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Children's predictions of consistency in people's actions

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Abstract

Past research suggests that young children are often reluctant to generalize about people' behavior. Three experiments involving 102 4–5-year-olds, 84 7–8-year-olds, and 107 adults explored the conditions under which inductive inferences about people are made. There was an age-based increase in propensity to predict consistency in psychological/intentional causal relations. Children often predicted change; people would behave differently in the future than they did in the past. Younger children limited predictions of consistency to non-psychological contexts. Older children showed some appreciation of stable motivations (e.g. traits, preferences). The results are consistent with the hypothesis that children's theories of mind emphasize situational influences, with personal influences appearing in middle-childhood. © 2002 Published by Elsevier Science B.V.

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1. Introduction

When is the past a good guide to the future? Recent accounts have suggested that intuitions about causality motivate inductive inferences (Ahn, Kalish, Medin, & Gelman, 1995; Gelman & Kalish, 1993; Keil, 1989). If two events or properties are understood to be causally related then evidence about their past co-occurrence is informative about the future. If A caused B in the past, A will cause B in the future (ceteris paribus). In the absence of a causal relation, people may refrain from generalizing. If A and B are only coincidentally related, there is no reason to expect A and B to co-occur in the future. Causal intuitions may be derived from analyses of patterns of covariation (Cheng & Novick, 1992) or from more theoretical processes of inference (Ahn & Kalish, 2000).

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However established, causal beliefs are particularly powerful in allowing inferences from limited evidence. Given the appropriate causal intuitions, people are often willing to generalize a consistent relation from a single exposure. Being burned by a hot stove once is sufficient to motivate the inference that a hot stove would burn again in the future.

Although the above account seems quite general, it really depends on a particular view of causation. Many types of causal relations are not repeatable or projectable. A match struck once will not burn when struck a second time. In addition to intuitions about which events are causal, intuitions about the types of entities and causal relations involved determine inductive inferences. As the match example illustrates, sometimes the fact that B followed A in the past makes it less likely B will happen again given A. There are different strategies for drawing inferences from past events. One common strategy is to predict consistency: the future will be like the past. Another strategy is to withhold judgment: the past is no guide to the future. Finally, a third strategy is to predict difference: the future will be unlike the past. A considerable body of research literature has documented developmental differences in children's and adults' propensities to make generalizations. These differences are particularly apparent in contexts involving human behavior. What beliefs, biases, or assumptions might be responsible for children's and adults' choices of inductive strategies when reasoning about people?

1.1. Evidence of children's inductive inferences

Young children draw inferences of consistency in category-based induction tasks involving natural (biological or physical) properties of non-human animals and objects. Learning that one individual animal has a particular property (e.g. green blood), preschool-aged children readily infer than another individual of the same type will share the property (Carey, 1985; Gelman, 1988). The explanation for this behavior is that children infer the existence of a shared essence that reliably produces the same properties in all members of a species or category. This belief in a stable essence leads children to predict that individuals will be relatively insensitive to environmental influences. For example, a creature that was born a pig will retain pig-like qualities despite being raised in an environment of sheep (Gelman & Wellman, 1991). Children's reliance on shared, enduring essences might be greater than adults'. Children seem to expect more qualities to remain stable despite environmental variation than do adults, and they seem willing to generalize more properties from one individual to another (Gelman, 1988; Gelman & Wellman, 1991; Taylor, 1996; see Gelman & Kalish, 1993 for discussion). There is also evidence from conceptions of illness that children overestimate the strength and reliability of causal relations. The connection between most behavioral/environmental factors and illness is manifestly probabilistic, both in children's experience and in adults' thinking. Yet children maintain that illness is a deterministic outcome, and, relative to adults, make over-confident predictions about its occurrence (Kalish, 1998). Thus, the message from studies of biological reasoning and category-based induction is that young children are strongly inclined to infer stability and predict that new instances will be like old.

In contrast, research in the development of social cognition suggests that young children are frequently reluctant to predict stability in people's behavior (Aloise, 1993; Rholes & Ruble, 1984; Rotenberg, 1982; see Miller & Aloise, 1989; Rholes, Newman, & Ruble, 1986 for reviews). For example, Rholes and Ruble (1984) showed 5–10-year-olds a series of videotaped vignettes of characters performing actions. Participants judged whether the actors would behave similarly in a new situation; would an actor who was nice on one occasion be nice on another, would an actor who was mean on one occasion be nice on another? Younger children generally did not use past behavior to predict future actions (the actor who was nice in the past was no more likely to be nice a second time than the actor who was mean in the past). Strikingly, this inferential strategy appeared even when children were encouraged to apply trait labels to actors (e.g. when asked whether a character who shared is "nice and kind"; Rholes & Ruble, 1984). It is important to note that some research has demonstrated consistent inferences on children's part (Cain, Heyman, & Walker, 1997; Heller & Berndt, 1981). For example, if given multiple instances of past behavior (e.g. evidence that John has shared many times) and more sensitive response measures, young children will predict behavioral consistency (Boseovski & Lee, 2001; Cain et al., 1997). Children are more likely to predict consistency when properties are described in noun form rather than verb form (e.g. a carrot-eater vs. likes carrots; Gelman & Heyman, 1999). Nonetheless, it is the case that young children are somewhat more reluctant than adults to ascribe stability in people's behaviors. Aloise (1993) found that young children required more instances of a behavior in order to ascribe a trait than did adults (e.g. a person would have to share many times before being called generous). The conclusion from this literature is that young children are conservative in their inductive inferences; they tend not to infer that people's behavior is consistent across time and context.

What might account for children's tendency to make consistent inferences in some cases but not others? One possibility is that the discrepancy is due to some methodological artifact or to the vagaries of cross-study comparisons. No single study has directly compared the same children's inferences about biological/physical and psychological items. Alternatively, the different inductive strategies could reflect some sort of general bias. For example, young children may be reluctant to generalize about any event involving a person. However, the hypothesis motivating this paper is that the source of the difference is more specific. Inferences are sensitive to the kinds of causal relations involved in an event. In particular, children's theories of mind do not lead them to expect consistency in people's behavior. Children understand mental causes to be different than natural (physical, biological) causal processes. The different causal theories are responsible for the difference in generalizations.

Research on developing theories of mind has demonstrated that even quite young children understand that people's behavior may be caused by mental states, such as belief and desire. An important quality of mental states is that they need not be understood as stable and enduring over long periods of time. People's beliefs and desires change, both as consequences of other mental states and as functions of changes in non-mental internal and external states (Wellman, 1990). For example, when a desire is satisfied it ceases to exist and no longer motivates behavior.[1] Moreover, at least in restricted contexts, people can alter their mental states at will. A person can arbitrarily choose to have a thought or form an intention. Free will is an important part of theory of mind, and may lead people to

[1] Thanks to an anonymous reviewer for this illustration.

expect less consistency in voluntary actions than in natural or physically caused phenomena. However, the evanescent and context-dependent quality of mental life is balanced, at least for adults, by two countervailing aspects of theory of mind. First there are involuntary psychological processes. Seeing red when staring at a well-lighted red wall, and even believing “I see red” in such a case, are automatic, unalterable, and highly reliable outcomes. Second, even those states and behaviors under voluntary control need not be unpredictable. People are often understood to have more or less enduring traits or preferences that dispose (though do not strictly necessitate) them to make certain choices. The trait of generosity is an example of such an influence. A generous person is someone who tends to choose to share, to voluntarily make generous decisions. Involuntary processes and enduring influences on decisions are two components of theory of mind that warrant predictions of stability in people’s behavior. However, research suggests that young children’s conceptions of psychological processes might tend to downplay such influences.

Adults are quick to infer the existence of enduring dispositions motivating people’s behavior (Ross, 1977). From evidence that John has shared in the past the conclusion is that John is generous: he has a trait that will lead to future instances of sharing. Developmental research has suggested that it is not until middle-childhood that children conceive of people in this way. Young children do not spontaneously describe people using trait terms (e.g. “generous”) and neither do they infer the existence of traits from behavioral evidence (Livesley & Bromely, 1973; Rholes & Ruble, 1984; see Yuill, 1997). Wellman (1990) suggests that the notion of a trait as an endogenous and persistent influence on desires does not appear as part of a theory of mind until middle-childhood (also Yuill & Pearson, 1998). Thus, preschool-aged children may not expect consistency in people’s motives; they do not recognize personality characteristics which might dispose a person to make the same choices, or have the same desires, from one time to another.

Young children’s theories of mind also tend to emphasize volition as a causal mechanism. Preschool-aged children generally do not consider the mind as an independent, active entity (Wellman & Hickling, 1994). They view more behaviors as intentional than do adults (Shultz & Wells, 1985; Smith, 1978) and overestimate their control over thought processes (Flavell & Green, 1999; Flavell, Green, & Flavell, 1998). For example, young children do not recognize that thoughts can occur automatically (e.g. the thought of an injection when seeing a hypodermic needle; Flavell et al., 1998). Non-intentional sources of behavioral consistency may be neglected. For example, that a person does not remember an event could either be interpreted in terms of a non-intentional influence (e.g. poor memory) or as an exercise of volition (e.g. doesn’t want to think about it, or didn’t try hard to remember). Indeed, Nicholls (1978) suggests that young children systematically construe ability in terms of effort (high ability is trying hard). If children tend to interpret behaviors as caused voluntarily they may be less inclined to expect consistency in those behaviors, especially given their inattention to enduring motivations.

When confronted with the challenge of predicting a person’s future behavior, young children seem less likely than older children and adults to use information about past behavior. Preschool-aged children are reluctant to predict consistency in people’s actions. Such a reluctance does not seem attributable to a lack of inductive inference skills on young children’s part; even young children make generalizations in category tasks and in contexts of biological or physical causation. Why do children generalize in some cases but not others? There are a number of explanations, ranging from methodological differences in assessments, to the influences of commonsense theories. One hypothesis is that theories or beliefs about causal relations influence inferences. What young children know about natural causal relations (e.g. physical or biological) leads them to expect consistency. Young children's conceptions of psychological causes does not warrant predictions of consistency. Adults also have different theories about natural and psychological causes. As discussed above, commonsense notions of voluntary choice and freedom of will may lead adults to make stronger generalizations about natural phenomena than about (at least some sorts of) psychological events. Thus, people at all ages may be somewhat reluctant to generalize about voluntary behaviors. This propensity may be exaggerated in young children, both because they see more events as voluntary than do adults, and because they generally do not recognize stable endogenous influences (traits) on people's voluntary choices.

2. Experiment 1

As no single study has directly compared inductive inferences about natural events with inferences about psychological events, the first step was to undertake just such a comparison. In Experiment 1 participants heard about single instances of causal relations and made predictions about future outcomes. Items described both physical causal relations (e.g. an unfamiliar substance sank in water) and intentional causal relations (e.g. an unfamiliar person chose a blue toy). The strategy was to select a set of items that would most clearly demonstrate a difference in inferential strategies. To keep items parallel, all stories described a human agent who participated in an event at a specified time in the past. In physical items, the agent observed or initiated some physical/biological phenomena. In intentional stories, the agent performed a voluntary action. Of primary interest is whether children and adults would make different inferences about future events involving the same actors and objects.

Inductive inferences may differ in two ways. First, there could be differences in the outcomes predicted for future events. Predicting that a past outcome will be replicated in a second instance represents a consistent inference (inference of consistency). The hypothesis is that participants are more likely to make consistent inferences for physical than for intentional causes. A second quality of inductive inferences is strength or force. People may have more or less confidence in their predictions of future outcomes or feel that the predicted outcomes are more or less necessary. These intuitions were assessed in Experiment 1 by asking participants to judge whether predicted outcomes would always happen or would only sometimes happen when the initial conditions were replicated. The hypothesis is that even when people make consistent inferences for both physical and intentional causes, they will make stronger generalizations for physical causes.

It is important to recognize that participants likely have prior expectations about the frequencies of various events. To control for the effects of prior beliefs, two sets of stimuli were constructed for the experiment. The sets of items were identical except for the outcomes of past events, which were reversed from one set to the other. An item in one set described a novel substance that sank when placed in water; the same item in the other set described the substance as floating when placed in water. Prior expectations (e.g. that things sink in water) might bias participants towards consistent inferences in one set, but away from consistent inferences in the other set. Thus, across the two sets, responses based on prior beliefs would tend to produce chance-like levels (50%) of consistent outcome predictions.

2.1. Methods

2.1.1. Participants

Sixty children participated in Experiment 1, 30 in a younger group (mean age = 5 : 0, range 4:2–5:8), and 30 in an older group (mean age = 7 : 0, range 6:5–8:2). Throughout, the younger group will be referred to as 5-year-olds, the older as 7-year-olds. These age groups were chosen because past research has indicated that preschool-aged children do not make trait attributions, while young school-aged children are beginning to (see Rholes et al., 1986 for review). An approximately equal number of boys and girls were tested at each age. Children were recruited from, and interviewed in, childcare and after-school programs. Thirty-five adults also participated. The adults were students at a large Midwestern university and received course credit for participation.

2.1.2. Design

Participants heard ten scenarios describing events that happened in the past. The task was to predict future outcomes. Three types of scenarios were used. In four physical scenarios participants heard about object interactions (e.g. a rock floating or sinking in water) or biological properties of non-human animals. Four intentional scenarios described people's choices or decisions (e.g. a child choosing a red vs. blue toy). Finally, two accidental scenarios described random events (e.g. a spinning top landing on black or white). Accidental scenarios were chosen to involve elements that children would recognize as random. These items thus provide a measure of predictions for independent events. They also served as potential checks for a bias to always predict consistency. A complete list of scenarios is provided in Appendix A. All scenarios involved novel objects to minimize the influence of prior knowledge. Two sets of scenarios were constructed, with the outcomes of the past event reversed. A participant heard ten stories from a single set. Half the participants heard stories arbitrarily designated as Set A outcomes (e.g. rock floated, person chose blue), and half the participants heard stories with Set B outcomes (opposite of Set A, e.g. rock sank, person chose red). Thus, each participant was tested in either the Set A condition or in the Set B condition. Materials included laminated color line drawings of events and agents.

2.1.3. Procedure

Children were interviewed individually and adults received a computer-based version of the task. In all cases scenarios were presented individually in random order, blocked with respect to scenario type. Participants first heard about an event that had occurred in the past. They were then told that actors and objects were participating in a second event in the present. It was emphasized that the elements of the present event were identical to those of the past event (e.g. same rock, same water, same child, same toys in the same colors available). One example was: "A few days ago Jesse saw these pretty flowers called glissflowers. Jesse picked a yellow glissflower to bring home, not a blue one. Now today she sees the flowers again. There are still some yellow and blue glissflowers. Jesse is going to pick a glissflower." Participants were asked to predict the outcome of the present event. The prediction question asked "Do you think ⟨outcome⟩ like last time, or do you think ⟨opposite outcome⟩?" The order of alternatives was randomized. This prediction question was followed by a generalization question. Participants were asked: "Do you think that ⟨object/agent⟩ will always ⟨do predicted outcome⟩, or could ⟨object/agent⟩ maybe, sometimes, ⟨do opposite⟩?" No feedback was provided, with the exception of general encouraging remarks to the child participants.

2.1.4. Scoring

Responses to prediction questions were coded as consistent or complementary. Consistent responses were those matching the past outcome (the rock that floated yesterday will float again); complementary responses were predictions of the opposite outcome (the rock that floated yesterday will sink today).

2.2. Results

Fig. 1 presents the mean proportions of consistent predictions. Differences from chance responding (0.5) are indicated. All participants predicted consistency for physical items. However, adults were at chance in their predictions for intentional items. Notably, for intentional items children predicted consistency significantly less often than would be expected by chance. Participants of all three ages made more consistent predictions for

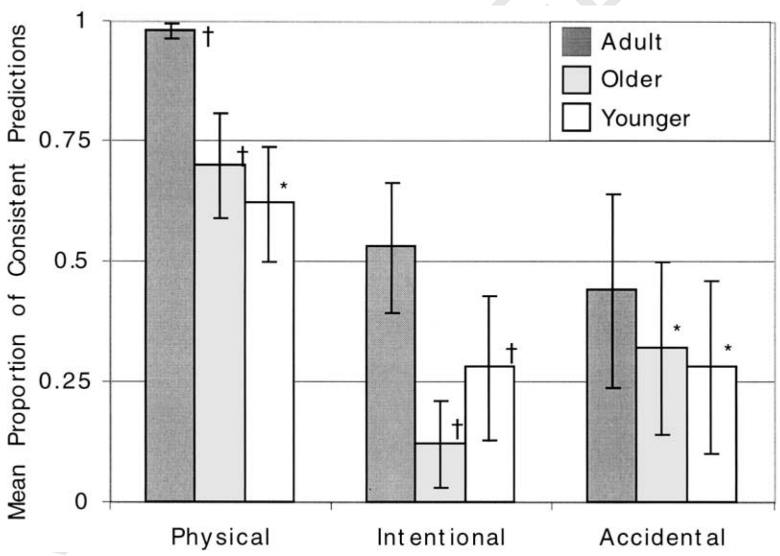

Fig. 1. Mean proportion of predictions that the future outcome would be the same as the past (consistent) for Experiment 1. Error bars represent 1 standard deviation. Comparisons against chance responding (0.5), †$P < 0.005$, *$P < 0.05$, two-tailed t-tests.

physical items than for intentional items: younger, $t(29) = 5.6$; older, $t(29) = 9.3$; adults, $t(34) = 9.4$, all $P < 0.005$.[2] Physical scenarios also elicited more consistent responses than the accidental ones: younger, $t(29) = 3.8$; older, $t(29) = 5.0$; adults, $t(34) = 7.5$, all $P < 0.005$. The relation between intentional and accidental scenarios differed by age. Older children made significantly more consistent predictions for accidental scenarios: $t(29) = 2.4$, $P < 0.05$, two-tailed. Younger children's and adults' predictions did not differ in the two cases: younger, $t(29) = 0.1$; adults, $t(34) = 1.2$, NS, two-tailed.

People in all three age groups made more consistent predictions for physical than intentional scenarios, however there were significant age differences. Younger and older children differed only in their responses to the intentional items: $t(58) = 2.5$, $P < 0.05$. Data from the two groups of children were combined for comparison with adults. Adults made more consistent predictions for physical and intentional scenarios than did children: $t(93) = 7.9$, $P < 0.001$, $t(93) = 5.8$, $P < 0.001$, respectively. Children and adults did not differ in their predictions for accidental scenarios: $t(93) = 1.6$, NS.

The patterns at the group level also appeared in individual participants' response patterns. Responses to the eight physical and intentional scenarios were used to define patterns. One pattern consisted of making consistent predictions for seven or more of the eight scenarios ($P < 0.05$, binomial probability assuming $P(\text{chance}) = 0.5$). A second pattern consisted of seven or more complementary predictions. Finally, a discriminant pattern involved making consistent predictions for physical items and complementary predictions for intentional items, with one or fewer deviations. This latter pattern was the most common, displayed by seven younger children, 17 older children, and ten adults. Many adults (13 out of 35) matched the consistent pattern (as did one younger child). Five younger and one older child (but no adults) matched the complementary pattern. Although these individual patterns are suggestive, it is important to keep in mind that they are based only on four items of each type.

A final set of analyses assessed the role of the information about past outcomes. Were participants making predictions based solely on prior beliefs about likely outcomes? If so, predictions in the Set A and Set B outcome conditions would be the same. The two conditions differed only in the description of the past outcome (e.g. girl picks a blue flower in one condition, but a yellow flower in the other). Similarly, if people were simply responding randomly there should be no condition differences. Significant differences between the A and B conditions demonstrate that participants were using information about past outcomes to make their predictions. To increase the power of the analyses the data from the older and younger children were combined. In general, participants predicted different outcomes in the A and B conditions. Rates of predicted outcomes for each item are presented in Appendix A. For children, condition differences were significant for all individual scenarios with the exception of one physical scenario (scenario number 3, see Appendix A; $\chi^2(1)$, critical value $= 3.84$, $P < 0.05$). Adults made different predictions for physical items in the two conditions, but not accidental items. Their responses to intentional items were mixed. There was no condition difference

[2] Unless otherwise indicated, all comparisons are one-tailed tests. Family-wise error was controlled using Holm's procedure.

Table 1
Proportions (and standard deviations) of generalizations: Experiment 1

	Physical	Intentional	Accidental
Younger			
Overall	0.52 (0.33)	0.32 (0.34)	0.18 (0.31)
For consistent predictions	0.61 (0.36)	0.33 (0.46)	0.27 (0.44)
For complementary predictions	0.26 (0.40)	0.32 (0.37)	0.19 (0.38)
Older			
Overall	0.45 (0.35)	0.08 (0.13)	0.1 (0.20)
For consistent predictions	0.53 (0.40)	0.19 (0.39)	0.17 (0.39)
For complementary predictions	0.19 (0.31)	0.06 (0.16)	0.07 (0.18)
Adult			
Overall	0.96 (0.10)	0.24 (0.33)	0.06 (0.20)
For consistent predictions	0.96 (0.09)	0.26 (0.38)	0.05 (0.22)
For complementary predictions	0.50 (0.71)[a]	0.25 (0.40)	0.08 (0.24)

[a] Only two participants contributed data to this cell, all others $N \geq 12$.

for two of the four intentional items.[3] Children used information about past outcomes to make their predictions for almost all items. Adults used past information, reliably, only for the physical items. Predictions for intentional and accidental items reflected prior beliefs or chance responding.

2.2.1. Generalization

After predicting the outcome of the future event, participants were asked whether their predicted outcome would "always" or "sometimes" occur. Table 1 presents the mean proportions of "always" responses to this generalization question. Participants at all ages made stronger generalizations for physical than for intentional outcomes: younger, $t(29) = 3.6$; older, $t(29) = 5.2$; adult, $t(34) = 12.3$, all $P < 0.005$. There were more generalizations for physical than accidental outcomes: younger, $t(29) = 5.8$; older, $t(29) = 4.4$; adult, $t(34) = 20.6$, all $P < 0.001$. Younger and adult participants showed higher rates of generalization for intentional than accidental scenarios: younger, $t(29) = 3.1$; adult, $t(34) = 3.6$, both $P < 0.05$. Older children did not make a significant distinction: $t(29) = 1.1$, NS. As expected, complementary predictions tended to be followed by non-generalizations ("sometimes" responses); the participant had just indicated that the outcome would be different on different occasions. Of greater interest is how willing participants were to generalize consistent responses. Would their predictions of consistency always hold? Because children generally made few consistent predictions for intentional and accidental items, the responses of the two age groups were considered together in these analyses. When children made consistent predictions they were more willing to generalize for physical than intentional scenarios: $t(59) = 3.0$, $P < 0.01$. The

[3] Items number 6 and 7. One item showed a positive condition difference; predictions matched the past outcome (number 8, $\chi^2(1) = 8.6$, $P < 0.05$). Another showed a negative difference; predictions differed from the past outcome (number 5, $\chi^2(1) = 15.4$, $P < 0.01$). In contrast, condition differences for children were always in the same direction for all items of a type. All the physical items showed a positive difference, and all the intentional and accidental items showed a negative difference.

same held true for physical vs. accidental scenarios: $t(59) = 2.8, P < 0.05$. There were too few children who made consistent predictions for both intentional and accidental items to compute a meaningful statistic ($N = 12$, four non-tied scores). Adults showed a similar pattern: they were more willing to generalize consistent predictions for physical than intentional or accidental scenarios: $t(34) = 10.8$, $t(34) = 19.4$, $P < 0.001$, respectively. Adults generalized for intentional scenarios more often than for accidental ones: $t(34) = 2.5$, $P < 0.05$.

2.3. Discussion

The results suggest that people may employ different inductive strategies when reasoning about physical and intentional phenomena. Children and adults both tended to predict consistency of outcomes in contexts of physical causation. A single exposure to a novel physical relation was sufficient to prompt predictions that the relation would continue to hold in the future. Moreover, participants frequently made a relatively strong generalization that the outcome would always happen the same way given the initial conditions. Although this pattern characterized participants at all ages, the effect was clearest for adults, with children showing more variability in their predictions. Nonetheless, given the very limited evidential base they had to work with, the results are consistent with previous suggestions that even quite young children are disposed to make inductive generalizations about physical causal relations.

The picture of people as willing inductivists is complicated, however, by the data from the intentional scenarios. Adults did not generalize from a single instance of a person's intentional behavior. This result appears inconsistent with a picture of adults as strongly biased toward dispositional attributions (Ross, 1977). That a person chose one option over another did not prompt adults to infer that the person had a general preference or trait to always choose that option in the future. However, adults showed significant item differences. Adults' inductive strategies may be sensitive to differences between types of psychological behaviors (see Experiment 2).

Children responded differently than adults to information about intentional acts. Observing what a person did on a previous occasion did have a reliable impact on children's predictions of the person's future behavior. However, in contrast to the physical case, children tended to predict that behavioral outcomes would be exactly opposite. That a person chose a blue flower in the past was evidence that they would choose a yellow one in the future. Rather than a dispositional or trait bias, children seemed to subscribe to a balance or complementarity principle for behavior. This complementary preference was at least as strong as the preference for consistent predictions in the cases of physical relations. Thus, for children, a single instance was equally informative or effective in both intentional and physical causal contexts. However, the way children used the information differed in the two cases. Complementary responses are consistent with a belief that desires disappear once they are fulfilled; people become satiated.

Several questions are raised by the differences in children's inferences about physical and intentional events. One set of issues concern the basis of this distinction. What about the items produces the different responses? One hypothesis is that theories about the natures of physical and psychological causation underlie children's inferences. However, the data are equally consistent with a number of other characterizations. For example, it may be that children draw different inferences for events involving people than for those involving objects. Extending the results by testing with additional items is required to rule out these alternative possibilities. Experiments 2 and 3 examine inductive inferences about a range of event types.[4]

3. Experiment 2

The results of Experiment 1 are consistent with past research demonstrating that young children tend not to think about people in terms of enduring traits that produce consistent behavior across time (Rholes et al., 1986). However, neither did adults in Experiment 1 show a preference for consistent attributions. Learning that a person chose a yellow rather than blue flower on a single occasion, for example, did not seem to prompt adults to infer the person liked yellow and would choose it again. Yet adults, at least in western cultures (Miller, 1984), have generally been characterized as quick to infer stable traits (Ross, 1977). Perhaps something about the particular items used in Experiment 1 suppressed trait ascriptions and consistent inferences. The intentional choices presented were relatively trivial. In contrast, most of the behaviors explored in the trait and person perception literature have involved more significant distinctions. For example, it seems more central to someone's personality that they share than that they like blue. Traits generally have positive or negative valences (e.g. generosity vs. stinginess) missing from the decisions in Experiment 1. Thus, the intentional behaviors investigated above may not have been salient or significant enough aspects of personality to prompt trait ascriptions and consistent inferences. Experiment 2 explored children's and adults' inferences about behaviors indicative of more traditional personality traits.

As used in the literature, the term "trait" covers a wide variety of dispositions (see Rosati et al., 2001; Yuill, 1997). Particularly important for this discussion is the fact that traits may be both voluntary and involuntary. Some traits are understood as influences on a person's intentional decisions. For example, generosity is a chronic tendency to choose to share. Importantly, for these kinds of traits each exercise of the disposition is voluntary. No matter how generous a person is, he or she is not irresistibly compelled to share. In contrast, other traits bypass intentional choice. Traits that are not under voluntary control include physical attributes such as strength or endurance, but also psychological dispositions such as fearfulness or intelligence. For example, we do not typically view intelligent people as choosing each instance of comprehension or knowledge. If it is particular beliefs about intentional causation that lead people to refrain from generalization, then children may make consistent inferences for behaviors caused by involuntary traits (IT) before they do so for behaviors motivated by voluntary traits (VT).

One difficulty with predicting a difference between VT and IT is that it is not clear that

[4] An alternative possibility is that complementary responses were an artifact of the procedure; something may have prompted a switching response on children's part. In a separate experiment, children were asked to predict pairings of agents and outcomes (e.g. who would pick a yellow flower, a person who did so last time or a person who picked a blue one last time?). Results using this method replicated the findings of Experiment 1. Details of the experiment are available from the author.

young children's ascriptions of intentional control match adults'. Children have been shown to over-attribute volition; they see more aspects of human thought and behavior as consciously controllable than do adults (Flavell & Green, 1999; Shultz & Wells, 1985; Smith, 1978). Similarly, Nicholls (1978) argued that young children understand abilities in terms of exercises of effort. Thus, young children may tend to treat abilities as voluntary and reason about both using strategies for intentional causation. This would result in complementary (or non-consistent) inferences for behaviors produced by both VT and IT.

Unfortunately a pattern of complementary responses for both VT and IT based on over-ascriptions of intentional control may be difficult to distinguish from simple bias toward switching responses. A hypothesis consistent with the results of Experiment 1 is that young children simply predict inconsistency in people's behavior regardless of the causes of those behaviors. To begin to address this possibility, Experiment 2 included scenarios for which prior knowledge would strongly suggest consistency in outcomes. Obvious or clear choices are one sort of example. For instance, it seems likely that young children would see the choice of a present over no present as highly reliable and consistent. Prior knowledge would also indicate that physical responses might be consistent across time (e.g. getting hurt from stepping on a tack). Thus, Experiment 2 contained four sorts of scenarios predicted to elicit predictions of consistency from adults: IT, VT, obvious choices, and physical responses. Exploring children's inferences in these cases begins to address the question of whether their inductive strategies are motivated by beliefs about the nature of psychological causation or are instead driven by some alternative heuristics.

3.1. Methods

3.1.1. Participants

Sixty children participated in Experiment 2, 30 in a younger group (mean age = 4 : 11, range 4:4–5:9), and 30 in an older group (mean age = 7 : 4, range 6:6–8:4). An approximately equal number of boys and girls were tested at each age. Children were recruited from, and interviewed in, childcare and after-school programs. Forty adults also participated. The adults were students at a large Midwestern university and received course credit for participation.

3.1.2. Design and procedure

Experiment 2 was identical to Experiment 1 except for the kinds of items included. Participants heard 12 scenarios describing events that had happened in the past. Five types of scenarios were used (see Appendix A for a complete list). In three IT scenarios participants heard about behaviors not (completely) subject to intentional control. An example is a child who was (or was not) afraid of a dog. Three VT scenarios described behaviors indicative of voluntary personality dispositions, things that a person can choose to do that are nonetheless often taken as reflections of stable qualities of character. An example is a child who shared (did not share) food. Three additional kinds of scenarios were included as checks against response biases: obvious choices, physical reactions, and accidents. As in Experiment 1, two sets of scenarios were constructed with the outcomes of the past event reversed (Set A and Set B conditions).

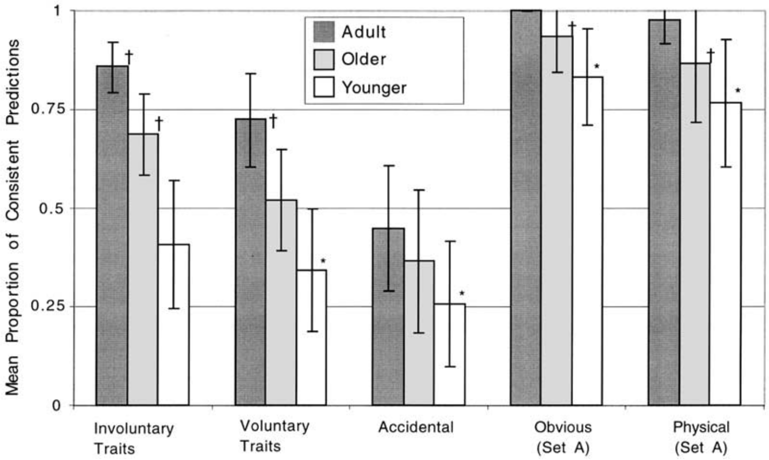

Fig. 2. Mean proportion of predictions that the future outcome would be the same as the past (consistent) for Experiment 2. For obvious and physical items, only data from the Set A condition are presented. Means (and standard deviations) from the Set B condition for these items were: obvious: younger, 0.17 (0.31); older, 0.17 (0.24); adult, 0.38 (0.43); physical: younger, 0.60 (0.39); older, 0.27 (0.32); adult, 0.55 (0.43). Error bars represent 1 standard deviation. Comparisons against chance responding (0.5), †$P < 0.005$, *$P < 0.05$, two-tailed *t*-tests.

Participants were also asked to rate their confidence in their predictions. A follow-up question asked whether they "knew for sure" that the predicted outcome would occur or whether they "just thought maybe" their prediction would be correct. This question provided a measure of the strength or necessity of the causal connection inferred from the past event, similar to the generalization question from Experiment 1.

3.2. Results

Fig. 2 presents the mean proportions of consistent predictions. For physical and obvious choice scenarios, reversal in the Set B condition yielded outcomes that could be counter-intuitive (e.g. a child who steps on a tack but is not hurt). For this reason, only Set A condition data are considered for these items. Inspection of Fig. 2 suggests that participants were not answering according to simple response patterns. At all ages, people made predominantly consistent inferences for obvious and physical scenarios (in the Set A condition), yet rarely predicted consistency for accidental scenarios. Even the younger children were willing to predict consistency in people's behavior, at least in cases of familiar causal relations.

Younger children did not predict consistent outcomes for either VT or IT items (at levels greater than chance, see Fig. 2). Predictions for the two kinds of items did not differ: $t(29) = 0.92$, NS. Older children predicted more consistency for the IT than the VT: $t(29) = 2.7$, $P < 0.05$. Adults predicted consistency for both types of items, but also made more consistent predictions for IT: $t(39) = 3.0$, $P < 0.01$. Adults made more consistent predictions for IT than older children ($t(68) = 3.6$, $P < 0.001$), who predicted more consistency than younger children ($t(28) = 3.8$, $P < 0.001$). The same pattern held for VT: adults vs. older, $t(68) = 3.4$, $P < 0.01$; older vs. younger, $t(58) = 2.3$, $P < 0.05$.

Older children were sensitive to the evaluative structure of the stimuli. The IT and VT items had both positive and negative instances (e.g. sharing is positive, not sharing is negative). Older children were more likely to predict consistency for positive VT (71% of the time) than negative (33%), and they thought people would tend do the right thing (see Appendix A, Table A1). This same pattern held for their judgments of IT (87% to 51%), though this difference derived from a single item (knowing the math problem, see below and Appendix A, Table A1). Younger children did not respond significantly differently to positive and negative items.

Before turning to an analysis of individual and item level differences, it is informative to consider responses for obvious choices, physical, and accidental scenarios. Children's predictions were not affected by past outcomes in obvious choice scenarios (A vs. B conditions). They predicted a character would choose gifts or snacks in the future at the same rates independent of what the character had done in the past: younger children, $t(29) = 0$, NS; older children, $t(29) = 1.2$, NS. Adults, however, were sensitive to past behavior, even in these cases; a character who refused a gift in the past would do so again in the future. The same pattern held for physical events. Older children's predictions were driven solely by the base-rate or prior knowledge, while adults predicted consistency with past outcomes: older children, $t(28) = 1.2$, NS; adults, $t(38) = 5.3$, $P < 0.005$. Somewhat surprisingly, younger children were similar to adults in predicting consistency. They expected outcomes to depend on the past performance: $t(29) = 2.8$, $P < 0.05$. Finally, younger children made complementary predictions for accidental outcomes: $t(28) = 4.0$, $P < 0.01$; they showed the negative condition difference. Older children and adults responded to accidents independent of the past: older, $t(28) = 2.0$; adults, $t(38) = 1$, NS.

Analysis of individual patterns is complicated because there were only six experimental items (three IT, three VT). To differ significantly from chance, a participant would have to match a pattern with no deviations ($P(6 \text{ of } 6) = 0.02$, with $P(\text{success}) = 0.5$). Four younger children reliably made complementary predictions for IT and VT; ten adults reliably made consistent predictions. The probability of making all consistent or all complementary responses with two or fewer deviations is 0.34. Second order binomial tests showed that more younger children made this level of complementary responses than would be expected by chance (17 of 30, $P = 0.01$, vs. 4 and 0 for older children and adults, respectively). In contrast, more older children and adults made consistent responses than would be expected by chance (17 and 38, respectively, vs. 6 younger children).

A final analysis of the prediction data explored possible item differences and condition effects. These analyses compared the frequencies of Set A outcome predictions in the A and B conditions for each item. Because younger and older children appeared to be responding differently their data were considered separately, although this reduces the power of the tests. Responses by item are presented in Appendix A. None of the individual item tests for VT and IT reached statistical significance for the younger children. Aggregating across items, there was a significant negative effect of condition (complementary responses) for VT: $t(28) = 2.6$, $P < 0.05$. Younger children displayed the same pattern for IT, though the contrast between the A and B conditions was not statistically significant: $t(28) = 1.3$, NS. For older children, condition differences were significant for two of the ability items (jumping, $\chi^2(1) = 6.7$, $P < 0.01$; fear, $\chi^2(1) = 13.9$, $P < 0.005$) but not the item involving knowledge. Children tended to predict the character would know the answer in the future regardless of whether he did or did not in the past. Older children did predict consistency for one of the VT items: whether a character shared or not in the past was taken as (positively) predictive of future behavior ($\chi^2(1) = 4.0$, $P < 0.05$). Collapsing across items of a type, older children made consistent inferences for IT (positive condition difference) ($t(28) = 5.0$, $P < 0.001$), but not for VT ($t(28) = 0.5$, NS). For adults, condition comparisons were significant, and positive, for all the VT and IT (smallest $\chi^2(1) = 5.0$, $P < 0.05$, for "try hard").

3.2.1. Confidence

Participants were asked whether they "knew for sure" or "just thought maybe" the predicted outcomes would occur. Younger children displayed low confidence for both VT and IT predictions, with no significant difference between the two: $M_{IT} = 0.38$, $M_{VT} = 0.30$, $t(29) = 1.2$, NS. These children did show at least moderate confidence in their predictions of familiar physical outcomes in the Set A condition: $M_{physical} = 0.67$. Older children were more confident in predictions for IT than for VT: $M_{IT} = 0.48$, $M_{VT} = 0.20$, $t(29) = 3.6$, $P < 0.05$. Despite the fact that adults made consistent predictions for both IT and VT, they also showed relatively low confidence in VT predictions: $M_{VT} = 0.40$; they were more confident in predictions for IT: $M_{IT} = 0.70$, $t(39) = 4.7$, $P < 0.001$. Older children and adults were more confident in predictions for involuntary than for voluntary events. Confidence judgments for accidental items varied by age. Younger children were no less confident about accidental items than trait items ($M_{accidental} = 0.31$), while older children and adults displayed little confidence in predictions for accidental items ($M = 0.05$ and 0.13, respectively). For the two older groups, ratings for accidental items were lower than those for VT, or any other items: older, $t(29) = 3.7$; adults, $t(39) = 4.9$, both $P < 0.01$.

3.3. Discussion

The primary focus of Experiment 2 was predictions about behaviors based on VT and IT. Adults saw people as consistent in these regards. They predicted that a person would continue to display the traits he or she had displayed in the past. However, the results suggest that young children may not use information about traits to draw consistent inferences about people's behavior. For 4–5-year-olds, that a person displayed a trait in the past did not imply that the person would display the same trait in the future. For behaviors under voluntary control (e.g. sharing), younger children tended to predict complementary outcomes. If a person shared in the past they would not do so in the future. Older children, 7-year-olds, displayed an intermediate pattern of responses. They made consistent predictions for IT but not for VT. In general, the results of Experiment 2 are consistent with past research, and the results of Experiment 1, in confirming that preschool-aged children tend not to infer cross-situational stability in people's behaviors (Miller & Aloise, 1989; Rholes et al., 1986). Also consistent with past research, school-aged children were beginning to make trait-like inferences, at least about displays of ability or involuntary behavior.

The hypothesis advanced to account for these data is that young children's conceptions of voluntary behavior make them unlikely to predict consistency. Observations of voluntary actions do not, at least in the experimental conditions, spur children to expect people will act the same way in the future. To the contrary, children may expect complementary patterns of responses in these cases. Such a hypothesis is supported by older children's performance on Experiment 2. They made consistent inferences for IT but not for VT.

Younger children's failure to predict consistency in involuntary actions may be somewhat surprising. The IT scenarios were chosen to represent behaviors not under voluntary control (e.g. being afraid of a dog). However, these items were selected based on adult intuitions; it is possible young children viewed them differently. For example, Flavell et al. (1998) have suggested that children may overestimate the degree of voluntary control they have over mental activity. Nicholls (1978) argues that children of this age conflate ability and effort; ability is exercising sufficient effort, inability is a lack of trying. Exercise of effort is usually understood to be voluntary. In contrast, adults usually consider ability to be involuntary (e.g. one does not simply choose to be intelligent). Thus, an important direction for future research in this area would be to directly measure children's judgments of intentional control. Involuntary items did not show the characteristic complementary pattern of other intentional actions. One possibility is that younger children have come some way to recognizing the non-intentional nature of those traits. Along these lines, it is also possible that there are individual differences. For example, Dweck (Levy & Dweck, 1998) suggests that people may differ in the degree to which they see abilities as fixed and stable across time. The intermediate results for IT above may reflect such individual differences. There were some younger children who often made consistent inferences, and some older children who often made complementary inferences.

At all ages, participants predicted consistency for some outcomes but not for others. What suggests that it is intuitions about the nature of psychological causes that account for differences in inductive practices? As mentioned above, one piece of evidence would be independent information about the kinds of events that children see as voluntary and involuntary. A second type of evidence comes from modal intuitions such as the confidence judgments collected in Experiment 2. These judgments provide some suggestion that adults were reasoning differently about voluntary and involuntary causal relations. In both cases (of VT and IT) adults predicted consistent outcomes, however they were significantly less certain of their predictions for VT than for IT. Older children were also more certain of IT than VT predictions. VT might lead to expectations of consistent behavior, but such consistency is not necessary. A person who shared once will likely share again, but he or she is not compelled to. However, voluntary action may be compelled in the deontic sense; one may be obliged to voluntarily do something. That older children predicted more consistency in cases of positive behavior suggests they viewed actors as voluntarily choosing the proper actions. In addition to predictions of consistency, modal judgments also provide evidence of different reasoning strategies in voluntary and involuntary contexts.

The results of Experiment 2 ruled out some alternative explanations for children's inferences. One possibility, from Experiment 1, was that children were responding from a simple bias to predict change in people's behavior. Such a bias was not consistent with older children's performance in Experiment 2: they did predict consistency in people's involuntary actions. Such a bias, at least in a simple form, was also inconsistent with younger children's responding. Children did predict consistent outcomes for familiar causal relations (the obvious choice and physical scenarios). However, it might still be the case that younger children adopt a simple strategy of predicting change in people's behavior in unfamiliar situations. Some evidence against this possibility was provided by the condition comparison for physical scenarios. Younger children predicted consistency for some quite incongruous outcomes. For example, if stepping on a tack did not hurt a person in the past, it would not hurt in the future either. This suggests younger children were not simply predicting change in unfamiliar cases. At least when the physical basis of the causal relation was clear, young children showed evidence of consistent inferences. Perhaps children did not show this pattern for the IT scenarios because they did not recognize them as involuntary. Thus, a good test requires items that are more clear. The purpose of Experiment 3 was to provide just such a test.

4. Experiment 3

Even quite young children appreciate that biological phenomena are outside of voluntary control (Inagaki & Hatano, 1993; Kalish, 1997; Rosengren, Kalish, Hicking, & Gelman, 1994). Biological phenomena provide a good test for the accounts of children's inductive inferences. One hypothesis is that children's inferences are not based on beliefs about intentional causal relations. Instead, they are just generally reluctant to predict consistency for unfamiliar events involving human actors. On this alternative hypothesis we should expect complementary (or inconsistent) inferences about novel biological events. In contrast, if it is the nature of the causal relation that is driving children's inferences, then biological events should be treated like any other physical phenomena, as a warrant for consistent inferences.

A second focus of Experiment 3 concerned the extent of children's dispreference for consistent inferences about intentional behavior. In Experiment 2 both younger and older children refrained from consistent inferences about behavior motivated by volitionally mediated traits. Is this reflective of children's reasoning about all voluntary action, or is it that the particular personality constructs captured by traits are not meaningful? Would children make consistent inferences about some other kind of intentional action? Although only an exhaustive search could answer this question in the negative, it is useful to consider the possibility that traits may not be the most salient stable personality characteristic for young children.

Experiment 3 explored children's intuitions about incidents of liking. It is common to describe people as having stable preferences. Individuals like certain foods or toys or fantasy characters. Anecdotally, the notion of preference seems very salient for children; they talk about their own and others' likes and dislikes. It seems possible that children think people will like the same things they liked on previous occasions. It is important to note that preferences are not entirely voluntary. We do not typically think of people as choosing their likes and dislikes. However, preferences do not seem wholly involuntary either. Nonetheless, preferences clearly are psychological constructs. Thus, assessing children's predictions about preferences will provide more information about their appreciation of stable, enduring psychological attributes of people.

4.1. Methods

4.1.1. Participants

Fifty-six children participated in Experiment 3, 32 in a younger group (mean age = 4 : 9, range 4:4–5:6), and 24 in an older group (mean age = 7 : 7, range 6:9–8:5). An approximately equal number of boys and girls were tested at each age. Children were recruited from, and interviewed in, childcare and after-school programs. Thirty-two adults also participated. The adults were students at a large Midwestern university and received course credit for participation.

4.1.2. Design and procedure

Experiment 3 was identical to Experiments 1 and 2 except for the kinds of items included (see Appendix A). Participants heard 12 scenarios describing events that happened in the past and then predicted future outcomes. Six items involved biologically-based outcomes. Of these six, three described physical abilities or qualities. Three other scenarios presented "empty" predicates similar to those used in previous studies of biological reasoning (Carey, 1985; Gelman & Markman, 1986). These items were constructed to activate biological knowledge without being familiar in specifics. In addition to the biological scenarios, three items described likes or preferences. Finally, three items presented voluntary decisions similar to the intentional scenarios of Experiment 1. As the biological and preference items were predicted to yield consistent inferences (at least for older children), the decisions were included as a check against a response bias. As in prior experiments, two sets of scenarios were constructed with the outcomes of the past event reversed (A and B conditions). After predicting each outcome, child participants were asked to provide a justification. The experimenter asked why the participant predicted the particular outcome. Adults were not asked for justifications.

4.2. Results

Fig. 3 presents the mean proportions of consistent predictions. Comparisons against chance responding (0.5) are indicated. For adults, the physical, empty, and preference items all prompted equally high levels of consistent predictions (no comparisons significant) and contrasted with decisions: smallest $t(31) = 6.4$ for empty vs. decisions, $P < 0.001$. Nonetheless, adults predicted consistency at above chance levels for all items. Older children showed a generally similar pattern. Physical, empty biological, and liking items did not differ, although the comparison between physical items and empty approached statistical significance (was significant before controlling for family-wise error): $t(23) = 11.0$, $P = 0.06$, two-tailed. Older children made more consistent predictions for each of the three types than for decisions: smallest $t(23) = 4.4$ for empty vs. decisions, $P < 0.01$. Older children predicted consistency significantly more often than chance for all items except decisions (which were significantly below chance). Younger children responded differently. They made more consistent predictions for physical than for other types of items, though the comparison with likes only approached

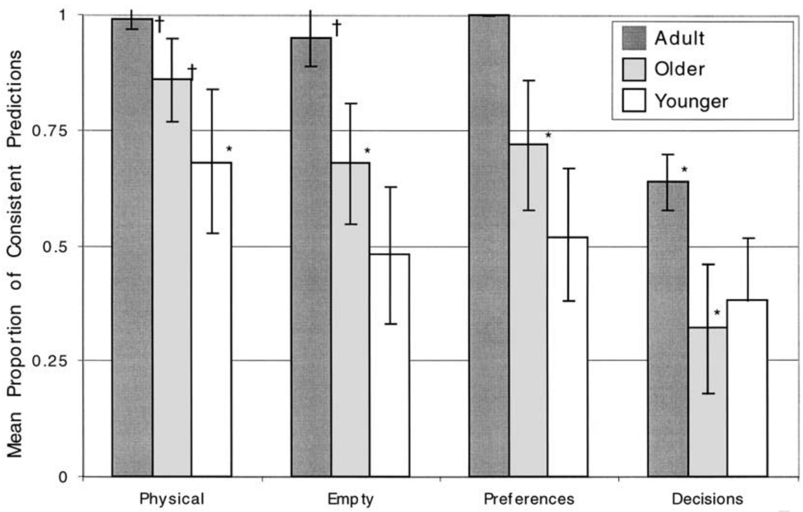

Fig. 3. Mean proportion of predictions that the future outcome would be the same as the past (consistent) for Experiment 3. Error bars represent 1 standard deviation. Comparisons against chance responding (0.5), †$P < 0.005$, *$P < 0.05$, two-tailed t-tests.

significance: $t(31) = 2.6$, $P < 0.06$. No other means differed. With the exception of physical items, younger children's responses did not differ from chance. Older children and adults predicted consistency for several types of items in Experiment 3. Younger children limited their predictions of consistency to physical items.

As suggested by the above analyses, there were significant age differences in participants' predictions. Consistent predictions for physical items increased with age; adults were greater than older children who were greater than younger: $t(54) = 3.5$, $P < 0.005$ and $t(54) = 2.5$, $P < 0.05$, respectively. The same pattern held for empty biological properties and preferences. Adults made more consistent predictions for empty properties than did older children ($t(54) = 5.0$, $P < 0.001$), and older children made more than younger children ($t(54) = 2.5$, $P < 0.05$); for preferences adults were greater than older children ($t(54) = 5.1$, $P < 0.001$), who were greater than younger children ($t(54) = 2.4$, $P < 0.05$). For decisions, however, both younger and older children made few consistent predictions, not differing from each other ($t(54) = 0.6$, NS), but significantly fewer than adults: older, $t(54) = 4.5$, $P < 0.005$; younger, $t(62) = 3.4$, $P < 0.05$.

Comparisons between the Set A and Set B conditions tested for item differences. Younger children showed significant condition effects for only three items: they made reliably consistent inferences for the hearing and liking snow items ($\chi^2(1) = 8.1$ and $\chi^2(1) = 6.1$, respectively), and complementary inferences for the stacking blocks item ($\chi^2(1) = 8.1$). The general item type effects were replicated in the individual item analyses for older children. All the biological items showed the consistent pattern, with the exception of the drinking ability scenario. Older children also made consistent predictions for two of the liking/preference items. (The exception was that all characters were predicted to like snow.) Only one of the decisions elicited complementary predictions, choice of shirt color: $\chi^2(1) = 13.6$, $P < 0.01$. Finally, adults made consistent predictions for all scenarios: smallest $\chi^2(1) = 4.8$, $P < 0.05$ for order of stacking blocks.

The small number of items of each type makes individual pattern analyses difficult. One pattern that may be tested is to ask how many participants always made consistent responses for the nine experimental items (physical, empty, and preference scenarios). Seven or more consistent predictions would be expected with a probability of 0.09 (binomial distribution, assuming 0.5 chance of consistent prediction). Second order binomial tests revealed that significantly more people at all three ages showed this level of consistency than would be expected by chance: all 32 adults, 18 of the 24 older children, and 8 of the 32 younger children (all $P < 0.01$). Two older children and five younger children showed a pattern of consistent predictions for physical items, but complementary predictions for empty and preference items, though these rates are not above what would be expected by chance (second-order binomial).

4.2.1. Justifications

Following each prediction, children were asked to justify their responses. Justifications were coded into one of six categories: physical, psychological, social norms, references to past outcomes, other (primarily responses containing ambiguous modals), and don't know/ no response. Coding was done by a researcher blind to the hypotheses of the study. A portion of the data was coded by a second researcher. Agreement between the two coders was 88%. The older children's modal response was to cite the past outcome. This justification accounted for 47% of the predictions of consistency and 43% of the predictions of change. In only 2% of the cases were older children unable or unwilling to provide a justification. Younger children were more variable in the kinds of justifications they provided. The predominant response was a reference to characters' psychological states (e.g. what they wanted). Psychological justifications were provided for 35% of predictions of consistency and 29% of predictions of change. References to past outcomes accounted for 16% of predictions of consistency and 25% of predictions of change. Younger children gave more "don't know" responses than older children, though the frequency was relatively low, 12% of both consistent and complementary predictions. In general, children were able to provide justifications for their predictions. These justifications frequently referred to the outcomes of past events. Moreover, predictions of consistency and change generally received the same kinds of justifications.

4.3. Discussion

The crucial finding of Experiment 3 was that young children did predict consistency for a class of causal events involving people. Physical attributes (e.g. hearing acuity) were judged to remain the same from one occasion to another. This effect embarrasses the hypothesis that the results from Experiments 1 and 2 were due to a simple response bias to predict change for events involving people. Rather, even the younger children in the experiments seemed sensitive to the kind of causal relation responsible for producing an effect. When the cause was clearly non-intentional these children were similar to older children and adults in predicting consistent outcomes.

Older children and adults made consistent inferences for relations that were not unambiguously outside of intentional control. Younger children did not. The empty biological properties (e.g. metabolizing food) and preferences (e.g. liking snow or not) are open to intentional interpretations. Although the context (and prior knowledge in the case of adults) may have led older participants to interpret the empty biological properties as involuntary, other construals are available. Not all biological functions or activities are outside voluntary control (cf. Inagaki & Hatano, 1993; see Kalish, 1997). Just as people can choose whether to breathe through their noses or mouths, young children may have interpreted metabolism, for example, as intentional. Interestingly, in other contexts young children have been shown to treat empty properties akin to those used in Experiment 3 as immutable and consistently projectable (Gelman, 1988; Gelman & Markman, 1986; Solomon, Johnson, Zaitchik, & Carey, 1996). A similar point may be made with respect to the preferences explored in Experiment 3. It is common to interpret preferences as relatively stable and involuntary; people do not simply choose their likes and dislikes. However, it is also common to think of preferences as determined by situational factors. Terms denoting preferences are often used to indicate voluntary choices as well. Thus, the results of Experiment 3 may be taken as consistent with those of Experiment 2 in suggesting that younger children tend to prefer transitory and or voluntary interpretations of properties ascribed to people. Older children and adults are more ready to see people in terms of stable properties and involuntary relations. Future research should explore the conditions under which people make intentional vs. non-intentional interpretations of ambiguous properties.

A final point concerns participants' justifications of their predictions. In general, children provided sensible justifications for both predictions of consistency and change. Particularly interesting was the fact that participants frequently justified a prediction of change with an explicit reference to the past outcome. A typical response would be that a character would wear a blue shirt today "because he wore a red one last time". These responses indicate that participants were attending to information about past outcomes and using that information as the basis of their future predictions. The prevalence of sensible justifications for predictions of change, and the relative absence of "I don't know" responses, provide some evidence against the hypothesis that complementary predictions are a simple response strategy in situations of uncertainty.

5. General discussion

The hypothesis motivating the three experiments reported above is that people's conceptions of psychological causes may lead them to be conservative in their inductive inferences about people's behavior. When antecedent A is linked to B via a process of choice or decision, people do not have strong intuitions of consistency, and may even judge that A will result in not-B in the future. In contrast, if antecedent A and outcome B are linked by natural causal relations (e.g. physical, biological), people tend to make the inference that A will consistently result in B. The effect of cause-type was predicted to be most pronounced in young children's reasoning. With increased age and experience people come to a better appreciation of the role of non-intentional mental processes and of stable influences on decisions. Thus, young children might be reluctant to generalize about all psychologically-caused behavior, while adults and older children would be more selective. Alternatively simpler biases, such as reluctance to make predictions about people or a general inductive conservatism, might account for young children's performance.

In Experiment 1 children and adults displayed cause-specific inference strategies. For physical causes, a single exposure to a past antecedent-outcome relation led people to predict the same relation would hold in the future. Neither children nor adults predicted consistency for intentional events. Both children and adults drew different inferences for events mediated by physical causal relations than for events mediated by intentional causal relations. A general dispreference for inductive inferences would not seem to account for children's performance. In fact, the results suggest that children might make stronger inferences from a single instance of behavior than do adults. Children reliably predicted that people would do exactly the opposite of what they had done in the past; if a person chose a red balloon a few weeks ago, he or she would choose a blue one today. In contrast, adults did not use past performance as a basis of future predictions of behavior. Children saw the past as informative in a way adults did not.

Experiments 2 and 3 explored alternative explanations for the item differences in Experiment 1. One possibility was that the intentional items used were particularly resistant to generalization. Experiment 2 presented instances of behavior that were expected to elicit trait inferences in adults. Specific items included events under voluntary control (e.g. sharing) and non-voluntary psychological responses (e.g. fear). Neither younger nor older children followed adults in judging that people would display the same VT from one time to another. Children were less disposed to predict consistency in intentional behavior than were adults. Older children did judge that people's involuntary reactions would remain constant. Younger children did not.

A hypothesis consistent with the results of Experiments 1 and 2 was that younger children might have a general heuristic to predict inconsistency in people's actions or reactions. In Experiment 3 participants made predictions about people's biological properties. Both younger and older children judged that physical qualities, such as perceptual acuity, would remain stable across time. Thus, preschool-aged children showed they would make consistent inferences about people. Younger children limited their predictions of consistency to clearly physical attributes. Empty biological properties (e.g. metabolizes food) were not generalized. Such properties do elicit generalization in category-based induction tasks (Gelman & Markman, 1986).

Although it seems inappropriate to characterize children as never making consistent inferences about people, Experiments 1–3 suggest they do so only in more restricted contexts than do adults. Children's consistent inferences were limited to physical or biological causal relations. Adults also made consistent inferences about people's intentional behaviors, at least when that behavior could be taken as indicative of personality traits (such as generosity). Experiments 2 and 3 also revealed developmental differences. Younger children were more resolute in withholding from predictions of consistency than were older children. Across the two experiments, it was only in the clearest cases of biological causation that younger children predicted consistency. In contrast, older children predicted consistency in more marginal or ambiguous cases. As did adults, 7-year-olds saw involuntary reactions and preferences as (positively) projectable. This pattern is consistent with the prediction that younger children's conception of psychological causation may emphasize voluntary choice and control and, hence, contrast strongly with notions of physical cause.

Before considering the nature of changes in children's inductive inferences, it is important to note a second result of the experiments. Not only did children make fewer consistent inferences than adults, they also differed from adults in what they did when not predicting consistency. Adults showed one of two patterns; they either predicted outcomes would remain the same in the future, or they predicted random outcomes (past and future independent). However, children often showed a third pattern of making complementary inferences. That an outcome occurred in the past was taken as evidence it would not occur in the future; something different would happen. In some circumstances, children were more disposed to draw inductive inferences about behavior than were adults.

Complementary inferences admit two interpretations. One possibility is that switching is a general response to uncertainty. When children feel they do not have enough information to be certain of a response they choose the novel alternative. Although it is difficult to rule out this possibility, two pieces of evidence tell against it. First, at times children did show the random pattern of inferences. For example, though younger children were equally uncertain about their predictions of IT and VT in Experiment 2, they made complementary predictions only for the VT. A second piece of evidence against the "switch when uncertain" hypothesis is that children did provide causal justifications for their complementary responses. When asked why they made a complementary prediction (in Experiment 3), children generally answered that the past outcome caused the change in the future outcome. In contrast to the hypothesis that children felt they had a lack of information upon which to base their predictions, only a very few answered "don't know" when asked for a justification. Moreover, children tended to give the same sorts of justifications for predictions of consistency and predictions of change. This similarity would seem to suggest that children were drawing causal inferences in both cases, rather than relying on a simple response heuristic for predictions of change.

In studies of conceptions of randomness or chance, children often are said to commit the gambler's fallacy (Metz, 1998; Piaget & Inhelder, 1975). Rather than seeing events as independent, they assume a causal relation between one trial and another. For example, a child might judge that a die that landed on 6 on a previous roll is less likely to land on 6 on a subsequent role. There is a sense of turn-taking or a progression through a deterministic sequence of states. It is not clear that children in the experiments above were committing an egregious version of the gambler's fallacy. They did tend to predict complementary outcomes for random, accidental, events. However, those predictions were not made with much confidence (Experiment 2); children did not appear to believe that the outcomes had to be different in the future. While past research has asked children to make relative probability judgments (e.g. is a 6 more likely than a 5?), a fuller picture of children's reasoning about randomness requires probing children's intuitions of necessity.

A more general point is that judging that a past occurrence makes a future occurrence less likely is not in and of itself a fallacious inference. In particular, it is often quite sensible to think about people as motivated to achieve balance or variety. It is consistent with our commonsense beliefs about human behavior to conclude that a person's previous choice of a red balloon, for example, leaves him or her satiated and ready for a different color balloon. Such a response is just as sensible as inferring the person has a stable preference for red. Ascriptions of traits and consistent motives are only part of the attributional story. Complementary inferences are also warranted in reasoning about non-intentional events. A match struck a second time will not flame again. On logical grounds there is no reason to prefer consistent over complementary inductions (Goodman, 1955). What disposes people to draw one kind of inference over the other must be expectations or beliefs about the natures of the events. The evidence presented suggests that young children tend to construe humans as motivated to seek diversity rather than consistency. This expectation seems to change with age toward an expectation that people's motivations are consistent across time.

What are the assumptions that dispose young children to predict variability in people's behavior? Two possibilities are an over-ascription of intentional control and a lack of appreciation of constraints on decision making. These possibilities are not mutually exclusive. As discussed above, there is considerable evidence that young children overestimate the degree to which people have voluntary control over their thoughts and actions (Flavell et al., 1998; Shultz & Wells, 1985; Smith, 1978). Experiments 2 and 3 revealed several instances in which older children predicted consistency in behavior while younger children did not. Each of these discrepant instances may be ambiguous with respect to voluntary control. Although adult intuitions are that IT (e.g. fearlessness, intelligence), empty biological properties (e.g. metabolizing food), and perhaps preferences (e.g. liking snow) are outside intentional control, these are all somewhat marginal cases, either because they involve mental activity (traits and preferences), or because they involve assumptions about unknown qualities (the empty properties). In the absence of clear evidence to the contrary, younger children may assume that behavior is intentionally caused. Older children may have better understanding of involuntary causes of behavior, or they may have different expectations about the extent of voluntary control. Given that intentions are recognized to be variable, a tendency to see human behavior as voluntary may lead young children to under-predict consistency.

Different intuitions about the scope of intentions may not be the only differences between children and adults. A second locus of differences may be beliefs about the implications of voluntary control. The literature on person perception has documented a number of cases in which adults predict consistency in intentional behavior when children do not. These findings were replicated in Experiment 2. Clearly voluntary behaviors, such as sharing, prompted positive generalizations by adults but not children. Yuill and Pearson (1998) have argued that adults view many traits as persistent influences on intentional decision making. Such traits provide an account of stability in voluntary action. An individual tends to choose to act the same way across time because traits dispose him or her to be in the same mental state (e.g. have the same desires) across time (see also Rosati et al., 2001; Wellman, 1990). However, young children appear not to recognize these dispositions towards particular mental states. Thus, they have no basis, no reason, to expect consistency in voluntary choices. This coupled with a bias to see behavior as voluntary leaves young children unwilling to conclude that a person's behavior in the past indicates that the same behavior is likely in the future.

A disinclination toward consistent inferences should not be misconstrued as an unwillingness or inability to reason about causes of behavior or make predictions. Predictions of consistency are based on the assumption that individuals posses stable properties. Children seem not to view individual people in these terms, but rather treat them as changeable and sensitive to situational and historical influences. Such an assumption leads to characteristic patterns of inferences. For example, a person’s past behavior will change his or her mental state and lead to different performance in the future. Rather than demonstrating a limited appreciation of the causes of human behavior, an emphasis on the power of situations (including past history) is a reflection of a coherent and characteristic theory of mind.

Research on developing theories of mind has indicated that children expect a close and strong connection between the external physical situation and internal mental representations. Work has focused primarily on children’s conceptions of epistemic mental states such as belief. Younger children expect that a person’s beliefs will be determined by the state of the world, by the situation (Perner, Leekam, & Wimmer, 1987; Wellman, 1990). By age 4 or 5, children come to appreciate that beliefs might not match the state of the world. Nonetheless, it is still only particular experiences, situational influences, that determine the content of beliefs. Chandler argues that not until middle-childhood do children appreciate influences intrinsic to the individual (Chandler & LaLonde, 1996). Children achieve a “constructivist” theory of mind when they understand that mental representations are not simply given by the stimuli, but rather are constructed by the thinker. For example, younger children expect that two people exposed to the same situation must come to the same beliefs. Older children appreciate that personal variables can color interpretations. Beliefs become characteristics of individuals. This pattern of development from situational to personal bases of mental states is generally consistent with the findings from the literature on person perception and traits. In fact, for traits involving epistemic states, the two accounts must converge. For example, a constructivist theory of mind is required to understand the trait of “suspicious” (disposed to certain interpretations of evidence). To see people as having individual dispositions toward beliefs just is to have a constructivist theory of mind. Children typically have a more developed (more adult-like) understanding of the causes of desires than beliefs (Moses, 1993; Wellman, 1990). In particular, from a quite early age, children recognize that different people may have different desires in the same situation (Repacholi & Gopnik, 1997). Yet this appreciation of diversity in desires does not necessarily imply that desires are seen as stable characteristics of individuals, in the same way that recognition of diversity in belief (e.g. passing a false belief task) does not imply a constructivist theory of mind (Chandler & LaLonde, 1996). One way to read the literature on developing theories of mind is that children move from a more situational to a more person-based view of the determinants of mental states. Younger children’s insensitivity to traits would be a consequence of their general theory of mind.

Thinking of individuals as composed of stable properties is a powerful and useful perspective. It allows prediction and explanation of similarities in an individual’s behavior across time and situations. However, thinking of an individual as changing in reaction to past and current environments is also a powerful and useful perspective. It allows prediction and explanation of the match between individual behavior and external conditions. Previous research and the results of the experiments reported above suggest that the former interpretation might be preferred in some contexts. When thinking about individuals’ physical or biological properties the expectation is stability. However, at least for young children the second interpretation is preferred for reasoning in psychological causal contexts. When thinking about individuals' mental states and voluntary actions the expectation is change. With age children become more disposed to the stable property interpretation of intentional agents. Mental states are seen as properties of individuals, stable from one time to another. Yet this "naturalization" of intentional phenomena seems neither a universal phenomena (Miller, 1984), nor a necessary increase in power or sophistication of reasoning about people. In drawing inductive inferences it is a good policy to predict consistency in some circumstances but change in others.

6. Uncited References

Flavell, 1977. Rholes and Ruble, 1986.

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Appendix A. Items used in Experiments 1–3 and proportion of consistent predictions in Set A (and B) conditions

Table A1
Items used in Experiment 1 and proportion of consistent predictions in Set A (and B) conditions

Item type	Content	Younger	Older	Adult
1. Physical	Pumice floated (sank) when placed in water.	0.60 (0.67)	0.80 (0.87)	1.0 (0.94)
2. Physical	Chinchilla had a black (pink) tongue when examined.	0.73 (0.67)	0.67 (0.53)	1.0 (0.94)
3. Physical	Benzene froze (stayed liquid) when placed in freezer.	0.67 (0.33)	0.53 (0.80)	1.0 (1.0)
4. Physical	Astrobil fed its babies mashed up worms (milk).	0.67 (0.53)	0.67 (0.80)	1.0 (1.0)
5. Intentional	Lisa bought a red (green) fizzoom toy.	0.07 (0.40)	0.13 (0.00)	0.22 (0.17)
6. Intentional	Picked a yellow (blue) glissflower.	0.13 (0.33)	0.20 (0.00)	0.67 (0.44)
7. Intentional	Chose a dura (apple) to eat.	0.13 (0.27)	0.20 (0.13)	0.61 (0.72)
8. Intentional	Chose a Yahoo (Smackum) cookie.	0.27 (0.60)	0.13 (0.20)	0.67 (0.83)
9. Accidental	Spun a two-sided tofer that landed on black (white).	0.27 (0.47)	0.33 (0.27)	0.56 (0.22)
10. Accidental	Got a sweet (sour) chewum candy from a machine.	0.20 (0.20)	0.27 (0.13)	0.50 (0.56)

Table A2
Items used in Experiment 2 and proportion of consistent predictions in Set A (and B) conditions

Item type	Content	Younger	Older	Adult
1. Voluntary trait	Shared (did not share) candy with her sister.	0.40 (0.27)	0.87 (0.47)	0.85 (0.60)
2. Voluntary trait	Didn't try very hard (tried hard) to do a puzzle.	0.20 (0.53)	0.33 (0.73)	0.6 (0.75)
3. Voluntary trait	Chose to play by self (with others) when invited.	0.40 (0.33)	0.20 (0.53)	0.60 (0.95)
4. Involuntary trait	Could not (could) jump over a pool of water.	0.53 (0.53)	0.67 (0.8)	0.95 (1.0)
5. Involuntary trait	Knew (did not know) $4 + 4 = 8$ when asked.	0.47 (0.27)	0.87 (0.13)	1.0 (0.25)
6. Involuntary trait	Was really afraid (unafraid) of a big dog.	0.20 (0.53)	0.73 (0.93)	0.95 (1.0)
7. Obvious choice	Chose to have cookies for snack (to have no snack).	0.73 (0.13)	0.87 (0.2)	1.0 (0.45)
8. Obvious choice	Decided to take (not take) a present.	0.87 (0.20)	1.0 (0.13)	1.0 (0.30)
9. Familiar physical	Got really cold (stayed warm) in snow without a jacket.	0.67 (0.47)	0.80 (0.33)	0.95 (0.60)
10. Familiar physical	Hurt (did not hurt) foot when stepped on tack.	0.87 (0.73)	0.93 (0.20)	1.0 (0.50)
11. Accidental	Found money (nothing) on way to school.	0.33 (0.27)	0.13 (0.60)	0.10 (0.90)
12. Accidental	Got a yellow (red) gumball from a machine.	0.20 (0.20)	0.40 (0.33)	0.40 (0.40)

Table A3
Items used in Experiment 3 and proportion of consistent predictions in Set A (and B) conditions

Item type	Content	Younger	Older	Adult
1. Physical	Weighed 20 (30) kilos when stepped on the scale.	0.60 (0.80)	1.0 (0.67)	1.0 (1.0)
2. Physical	Was able (unable) to pick up a chair and move it.	0.73 (0.47)	1.0 (0.75)	0.94 (1.0)
3. Physical	Could hear (not hear) the telephone ring from bedroom.	0.87 (0.73)	0.75 (1.0)	1.0 (1.0)
4. Empty	Stomach metabolized (did not metabolize) food after eating.	0.33 (0.87)	0.83 (0.58)	1.0 (0.81)
5. Empty	Muscles used a lot (little bit) of glycogen when running fast.	0.53 (0.40)	0.92 (0.75)	1.0 (1.0)
6. Empty	Was able (unable) to drink a whole magnum of juice.	0.40 (0.53)	0.42 (0.58)	0.88 (1.0)
7. Preference	Liked strawberry (orange) cookie better.	0.33 (0.47)	0.83 (0.58)	1.0 (1.0)
8. Preference	Liked Ernie (Bert) better on TV.	0.40 (0.60)	0.83 (0.75)	1.0 (1.0)
9. Preference	Liked (did not like) snow.	0.80 (0.73)	0.75 (0.58)	1.0 (1.0)
10. Decisions	Put on the blue (red) shirt.	0.40 (0.47)	0.08 (0.17)	0.25 (0.25)
11. Decisions	Ate the cookie before the apple (apple before cookie) at snack.	0.53 (0.40)	0.50 (0.50)	0.94 (1.0)
12. Decisions	Put green blocks on top of yellow blocks (yellow on top of green).	0.2 (0.33)	0.17 (0.50)	0.56 (0.81)

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