

The Use of Judgment Heuristics to Make Social and Object Decisions: A Developmental Perspective

Janis E. Jacobs and Maria Potenza

University of Nebraska

JACOBS, JANIS E., and POTENZA, MARIA. *The Use of Judgment Heuristics to Make Social and Object Decisions: A Developmental Perspective*. CHILD DEVELOPMENT, 1991, 62, 166–178. This study examined the development of children's use of 2 judgment strategies: (1) the use of baserates and (2) the use of the representativeness heuristic. Children in the first ($M = 6.85$), third ($M = 8.86$), and sixth grades ($M = 11.27$) and a comparison sample of college students ($M = 20.11$) made judgments about scenarios that varied by domain (social vs. object judgments) and by information provided (baserates only vs. baserates and individuating information). Results indicated that although the use of baserates and the representativeness heuristic increased with age, the use of individuating information to make social judgments developed quite early. Consistency between subjects' choices and rationales increased significantly with grade level, indicating that younger children use idiosyncratic strategies, such as personal preference or scenario embellishment, to make decisions. Developmental trends are discussed in light of previous research with adults.

Children make many decisions based on their beliefs concerning the likelihood of uncertain events, such as the chance of getting a part in the school play, the likelihood of being called on in class, or the probability of peer acceptance. How do children make such decisions? They may calculate the probability of a particular outcome, then make a decision based on the calculation; or they may rely on simpler judgment heuristics. For example, Sarah may figure that 12 people are trying out for the same part in the school play, so that her chances of getting the part are 1 in 12. A simpler strategy would be for Sarah to compare herself to the person who got the part last year and decide that she looks similar, so that her chances of getting the part are good. Research in social psychology suggests that adults are more likely to use judgment heuristics than calculate probabilities in such situations.

The impetus for much of the research with adults on this topic was work done by Tversky and Kahneman (1974), suggesting that “. . . people rely on a limited number of

heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations” (p. 1124). One of these is the “representativeness heuristic” (Kahneman & Tversky, 1973). According to their description of this heuristic, individuals make a simple similarity judgment instead of calculating baserates and probabilities, leading them to overrely on individuating information (specific information about a particular case) and underuse population baserates.

In one of their original studies, Kahneman and Tversky (1973) asked subjects to predict whether an individual was an engineer or a lawyer based on a brief personality sketch and information concerning the baserates of the professions in the sample. Subjects paid little attention to the information given about the baserates of the professions, but instead based their predictions on the extent to which the description represented the dominant features of the stereotype associated with each profession. A vast literature based on Kahneman and Tversky's original design and theory

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exists to document the specific situations in which adults are likely to use the representativeness heuristic (Ajzen, 1977; Ginosar & Trope, 1980; Kruglanski, Friedland, & Farkash, 1984; Zukier & Pepitone, 1984). It is clear from a number of studies that overreliance on judgment heuristics is limited to particular situations. Within-subject variation in noncausal base-rate information, judgments about a group of persons rather than a single person, and case-by-case presentation of category membership and individuating information are all changes in the problem scenario that will produce use of base-rates by subjects (Bernbaum & Mellers, 1983; Christensen-Szalanski & Beach, 1982; Fischhoff, Slovic, & Lichtenstein, 1979; Manis, Dovalina, Avis, & Cardoze, 1980).

Although it seems likely that children use a simplifying heuristic rather than calculating the odds before trying out for the school play, little is known about the developmental antecedents of adult use of judgment heuristics. Kahneman and Tversky's work has been discussed in the developmental literature (e.g., Fischbein, 1975; Kosslyn & Kagan, 1981; Ross, 1981; Ruble, Higgins, & Hartup, 1983), but little empirical evidence for the use of such heuristics has been gathered (an exception is found in Krouse, 1986). The goal of the present study was to begin to integrate these two bodies of literature by charting developmental trends in the use of base-rates and the representativeness heuristic under different conditions. Because it is possible that children are not using either one of these strategies, a secondary goal was to begin to identify what they *are* doing by describing the explanations children give for their judgments.

If the representativeness heuristic is a strategy of comparing information about a specific case to its representative category, as suggested by Kahneman and Tversky, then children would not be expected to use this heuristic until they are capable of using social categories. Based on previous research, we know that young children seldom use social categories such as traits to make inferences from behavior (Heller & Berndt, 1981; Rholes & Ruble, 1984), often relying on contextual information rather than utilizing the available individuating information (Higgins & Bryant, 1982; Martin, 1989; Ruble, Feldman, Higgins, & Karlovac, 1979). Although 5- and 7-year-olds may be able to use dispositional adjectives to describe others (Ferguson, Olthof, Luiten, & Rule, 1984), they cannot use the descriptions to predict stable dispositional

characteristics (Ferguson, van Roozendaal, & Rule, 1986; Rholes & Ruble, 1984). The use of social categories or stereotypes based on physical characteristics like gender has been documented for children as young as age 2.5 (Kuhn, Nash, & Brucken, 1978); however, similar understanding of trait- or activity-based social categories such as those used by Kahneman and Tversky has not been found until middle childhood. The shift from describing others in concrete, behavioral terms to descriptions based on abstract, psychological traits is typically reported between ages 7 and 8 (for review see Shantz, 1983).

Ross (1981) reports a study in which subjects ranging in age from 5 to 20 were presented with scenarios that provided both person and situation information. The findings indicated that all subjects knew how to make inferences using both the person and situation information, but that the youngest and oldest subjects gave the greatest weight to the situation and the least weight to the person. The author suggests that this quadratic relationship may be explained by accuracy due to ignorance of person schemas at the young age and accuracy due to a more mature understanding of the interplay between person and situation at the older age. Taken together, these studies suggest that children under the age of 7 have not developed the social categories or person schemas that the representativeness heuristic is said to rely on, leading us to predict that the use of the heuristic would increase through the elementary school years, since children's knowledge of social categories reportedly increases during that period. Based on Ross's findings, a slight decrease in the use of individuating information might be expected by college students.

When children do not use the representativeness heuristic, can they be expected to use base-rates as adults do? The work of Piaget and others indicates that although children do not reliably compute ratios to estimate probability until the development of formal operations (Goldberg, 1966; Hoemann & Ross, 1971; Piaget & Inhelder, 1951/1975; Yost, Siegel, & Andrews, 1962), they are capable of using relative frequency or subtraction to make comparisons between two quantities (see Surber & Haines, 1987, for review). Other studies investigating the ability to assess event covariation have found that before second grade, children are able to use frequency information even when they cannot use covariation information (Ferguson et al., 1986; Shaklee & Paszek, 1985). These studies indicate that even children in the early

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elementary grades are able to use the number of times something occurs or base-rate information as a basis for their judgments. Thus, we predicted that children of all ages in elementary school would be able to use base-rate information.

Two problems arise from using the adult models and the developmental literatures reviewed above as a basis for our predictions. First, the research on probability and covariation has focused on objects, and much of it has been done using random number devices, making its applicability to social situations uncertain. It seems likely that the use of base-rates is more difficult for social than object judgments because it is harder to quantify social events than to count objects. The ability to see discrete social events as belonging to the same category may depend on later-developing knowledge of social categories (reviewed above). Second, the adult research on estimations using the representativeness heuristic focuses primarily on social judgments,¹ confounding the domain with the judgment strategy. It is possible that, rather than a general judgment bias, the use of heuristics is reserved for social decisions. To address these two concerns, we designed our study to include both social judgments and judgments about objects.

The Present Study

We wanted to use judgment heuristic tasks similar to those used in research with adults to ensure measurement of the same phenomenon; the usual methodology, however, is limited because subjects' strategies must be inferred from their choices. Typically, subjects have read a scenario, then made a choice between two alternatives (one indicating the use of base-rates, the other indicating the use of individuating information). This may lead to overestimation of their use of a particular strategy. For example, the subject may choose a base-rate answer, but the choice may be based on personal preference rather than the numbers. We believed that this would be even more of a problem when studying children because their use of idiosyncratic strategies to make decisions has been documented in the probability judgment literature (Fischbein, 1975; Perner, 1979; Ross & Hoemann, 1975), and others have reported tasks on which younger children produce the same results as older children but do not use the same strategies (Baker-Ward, Ornstein, & Holden, 1984; Mil-

ler, Haynes, DeMarie-Dreblow, & Woody-Ramsey, 1986). To maintain comparability to the adult tasks while investigating children's use of other strategies, we modeled the judgment tasks after those used by Kahneman and Tversky (1972) but asked subjects to explain each of their choices. This allowed us to determine if they were using base-rates, the representativeness heuristic, or some other strategy.

Children made judgments about scenarios that varied by domain (social vs. object judgments) and by information provided (base-rates alone vs. base-rates and individuating information). Three specific research questions were addressed: (1) What is the ontogeny of the use of the representativeness heuristic? (2) Does the use of the representativeness heuristic differ for social judgments and judgments about objects? and (3) Do children's explanations of their judgments reveal strategies besides the use of base-rates or representativeness information? We predicted that children of all ages would use base-rate information if no other information was provided, but that a developmental trend would be found for the use of the representativeness heuristic, with older children more likely to use individuating information while younger children continued to rely on base-rates. We expected the base-rate information to be more salient for object judgments and individuating information to be more salient for social judgments.

Method

Subjects

The sample for this study consisted of 66 first graders (mean age = 6.85), 86 third graders (mean age = 8.86), and 82 sixth graders (mean age = 11.27). In addition, a comparison sample of 95 college students (mean age = 20.11) was obtained. Elementary school students attended two schools located in small Midwestern communities; the college students attended a large Midwestern university.

Experimenters solicited participation in elementary school classrooms by explaining the study to the class and sending home permission forms with each child. Children were given a token gift for returning the parental consent form to school. The participation rate was 70%. College students were volunteers from introductory psychology classes who re-

¹ The related task of assessing adults' judgments of posterior probabilities has been done with objects (Kahneman & Tversky, 1972).

TABLE 1
EXAMPLES OF SCENARIOS

Category	Example
BROBJ	Mike's dresser drawer contains three pairs of white socks and six pairs of colored socks. One morning he is late for school (work), ^a so he reaches in and grabs a pair of socks without looking. Which kind of socks do you think he got out of the drawer?
BRSOC	During summer vacation (from college), Julie and her friends decided they would take lessons to learn a new activity. Four of the girls took piano (scuba) lessons and two of the girls took swimming (tennis) lessons. Do you think Julie took piano or swimming?
INBROBJ . . .	Jim is buying a bicycle. Before buying it he gets information on different brands. A bicycle magazine says (reports) that most of their readers say the Zippo (Pathfinder) bike is best; however, he speaks to his neighbor and she says that the Whammo (Trailblazer) bike is best. Which bike should Jim buy?
INBRSOC . . .	In Juanita's class (residence hall) 10 girls are trying out to be cheerleaders and 20 are trying out for the band. Juanita is very popular and very pretty. She is always telling jokes and loves to be around people. Do you think Juanita is trying out to be a cheerleader or for the band?

^a Text in parentheses was presented to college students.

ceived course credit for their participation in the study.

Measures

Thirteen different scenarios were developed to model the Kahneman and Tversky (1972) judgment tasks. Each scenario first described a familiar situation, then asked for a choice between two alternatives. The stories varied by domain (judgments about objects or social situations) and by information given (baserates alone or baserates and individuating information). This resulted in judgments based on four types of scenarios: (1) baserate information alone for judgments in the object domain (BROBJ), (2) baserate information alone for judgments in the social domain (BRSOC), (3) individuating and baserate information for judgments in the object domain (INBROBJ), and (4) individuating and baserate information for judgments in the social domain (INBRSOC). An example of a scenario of each type is presented in Table 1. The ratio between the two baserates given in each problem was always one-to-two (e.g., five daisies, 10 sunflowers). This choice was made to keep the comparisons children were making constant so that differing ratios did not affect their responses. We also expected one-to-two to be a ratio that children might be more familiar with in everyday situations.

Others have found that this ratio is used to anchor judgments when making estimations (Ross & Hoemann, 1975; Siegler & Vago, 1978). After piloting a number of scenarios, three were retained in the BROBJ, BRSOC, and INBROBJ categories; four were retained in the INBRSOC category. The INBRSOC category was oversampled because it represents the true test of the development of judgment heuristics based on the adult research.

In addition to the choice data from the scenario tasks, verbal rationales for each choice were collected. Due to the new and exploratory nature of this project, verbal protocols were chosen in order to obtain qualitative descriptions of the actual strategies used by children. As suggested by Surber and Haines (1987), a verbal report of using a strategy that accompanies the appropriate choice is more convincing evidence of actual use of that strategy than the choice alone.

Procedure

This study was part of a larger project investigating the development of everyday statistical reasoning. Only the measure involving the use of judgment heuristics will be described here. Elementary school students were interviewed individually by trained experimenters. College students participated in groups of five to 10.

TABLE 2
 BASERATE SCORES FOR EACH GRADE BY DOMAIN AND TASK

GRADE	TASK							
	BR				INBR			
	OBJ		SOC		OBJ		SOC	
	M	SD	M	SD	M	SD	M	SD
First . . . . .	.70	.25	.53	.30	.60	.27	.31	.23
Third . . . . .	.68	.27	.59	.31	.59	.32	.23	.18
Sixth . . . . .	.78	.26	.74	.29	.65	.29	.21	.18
College . . . . .	.74	.24	.77	.24	.77	.23	.21	.19

A test booklet containing the 13 scenarios in random order was used for each participant. The children were told that the experimenter was interested in learning how people make choices when little information is available. The scenarios were read to the children, and the choices were depicted as pictures on index cards to insure that younger children had a clear understanding of what had been read to them. After children made a choice between the two cards, the experimenter asked them why they chose that card, then recorded their answers verbatim so that it was unnecessary for them to manipulate a test booklet or express themselves in writing.² The interview was completed by all subjects and took approximately 20–30 min.

Results

Three analysis strategies were used to investigate the development of children's use of judgment heuristics. First, we compared children's choices across grades, tasks, and domains to determine differential responding due to these variables. Second, we compared the frequency with which various open-ended rationales were used in order to document the strategies reported by children when they are not constrained by a forced-choice format. Third, we tested the consistency between children's choices and their rationales to see if children who made base-rate choices would report using a decision strategy involving baserates.

Task, Domain, and Grade Comparisons for Children's Choices

Construction of scores.—As indicated earlier, subjects either read or listened to each scenario and then made a choice between two

answers. One answer always corresponded to the baserates given in the problem. For example, if they were told that a garden contained 10 daisies and five sunflowers, the baserate response would be daisies. One point was assigned for each baserate answer. Subjects' points were totaled, then divided by the number of scenarios in each category (BROBJ, BRSOC, INBROBJ, INBRSOC) to produce a score indicating the percentage of baserate responses given for each category.

To compare the use of baserates in the social and object decision domains when children were given tasks with both baserates and individuating information versus only base-rate information, a mixed-model ANOVA was performed with grade (first, third, sixth, and college) as the between-subjects independent variable, domain, and task as the within-subjects independent variables, and the base-rate-use scores as the dependent variables.

Domain effects.—The within-subject comparison between domains revealed that baserate responses were given significantly less often for social judgments than for judgments about objects, $F(1,307) = 288.72$, $p < .00001$, at all grade levels (see Table 2).

Task effects.—Overall, subjects gave baserate responses significantly less often when they were given both baserate and individuating information to use than when baserate information alone was supplied, $F(1,307) = 322.70$, $p < .00001$. Because it was a forced-choice task, this means that they gave representativeness responses significantly more often when given the chance. In addition, a significant interaction between task and domain was found, $F(1,307) = 151.56$, $p < .00001$. Simple effects tests revealed that

² College students read each scenario, indicated their choice by circling the appropriate response, and then briefly explained the reason for their choice in writing. The language for the child scenarios was adjusted slightly to make it appropriate for college students (see Table 2).

TABLE 3
CODING CATEGORIES FOR JUDGMENT EXPLANATIONS

Category	Description
Use of baserate	Explicit use of numbers or reference to greatest number (e.g., There were more of them; There were six colored socks and only three white ones)
Use of representativeness heuristic	Explicit use of individuating information given in the scenario (e.g., Because he goofs around; Because she is popular)
Personal preference	Rationale based on own likes and dislikes (e.g., I always wear colored socks; I like to swim)
Creative fiction	Rationale based on inventing an extension to the story (e.g., She took piano because she took swimming last year; He went to the farm because airplanes make him dizzy)

baserate responses were given significantly less frequently for object than social scenarios in the baserate and individuating information condition,³ $F(1,307) = 459.80, p < .00001$. No significant differences were found in the baserate-only condition.

Grade effects.—Overall, the choice of baserate responses differed significantly by grade across the four scenario types, $F(3,307) = 9.06, p < .00001$. Although grade did not interact with domain, a significant interaction with task was found, $F(3,307) = 6.19, p < .001$. Planned comparisons indicated that the first and third graders were more likely to give similar answers in the two task conditions than were the sixth graders and college students, $F(1,307) = 14.92, p < .0001$. In addition, a significant triple interaction between grade, domain, and task was found, $F(3,307) = 12.08, p < .00001$. This effect was due primarily to the differences (reported above) in responses to social and object scenarios found in the baserate and individuating information condition but not found in the baserate-only condition. As can be seen in Table 2, the effect was more extreme in the older groups than in the younger groups. Simple effects tests were conducted to examine the pattern of grade differences in the use of baserates for each domain-by-task category. No significant grade differences were found for the use of baserate information to make

choices for the BROBJ scenarios (baserate-only task in the object decision domain). However, when individuating information was available in addition to the baserate information in the object domain (INBROBJ), the use of baserate information increased significantly with age, $F(3,307) = 6.95, p < .001$. A similar increase in the use of baserates was found for the baserate-only task in the social domain (BRSOC), $F(3,307) = 12.54, p < .00001$. The trend was reversed when both baserate and individuating information were given in the social domain (INBRSOC), $F(3,307) = 3.79, p < .05$, with baserate responses being chosen significantly less frequently with increasing age (see Table 2).

Rationales Given for Judgments

Coding.—After subjects made a choice in response to each scenario, they were asked why they had made that choice. Children's responses were coded into 14 categories. Overall, interrater agreement was 93%, ranging from 85% to 99% across scenarios.

Although some children gave responses in each category, most responses fell into four categories. The other coding categories each received less than 6% of the responses across all 13 scenarios (many received no responses by older children); therefore, only the four commonly used categories will be described and discussed at length. Examples of these coding categories are given in Table 3.

³ Correction for an inflated Type I error due to multiple tests was accomplished with the modified Bonferroni test ($p < .002$) in these and subsequent post-hoc analyses of significant effects (Keppel, 1982).

TABLE 4
PERCENTAGE OF EXPLANATIONS GIVEN BY GRADE AND SCENARIO TYPE

GRADE	CODING CATEGORY					TOTAL
	Baserate	Rep. Heur.	Per. Pref.	Creat. Fict.	Other ^a	
Baserate-only scenarios:						
First:						
Object	23.3	N.A.	19.9	27.8	29.0	100.0
Social	18.4	N.A.	57.3	14.1	10.3	100.0
Third:						
Object	36.5	N.A.	7.6	21.7	34.1	100.0
Social	19.8	N.A.	50.8	14.0	15.5	100.0
Sixth:						
Object	64.5	N.A.	3.7	7.6	24.2	100.0
Social	34.7	N.A.	30.2	11.6	23.6	100.0
College:						
Object	70.1	N.A.	1.8	3.9	24.2	100.0
Social	45.3	N.A.	14.6	17.2	22.8	100.0
Baserate/individuating information scenarios:						
First:						
Object	14.3	13.1	21.1	13.7	37.7	100.0
Social	7.3	41.1	23.0	12.5	16.1	100.0
Third:						
Object	20.2	16.7	10.1	9.7	43.4	100.0
Social	4.4	60.9	12.1	10.0	12.6	100.0
Sixth:						
Object	43.7	1.3	2.0	7.1	45.8	100.0
Social	2.8	77.0	1.9	5.4	12.9	100.0
College:						
Object	58.2	.4	3.6	2.9	34.9	100.0
Social	5.3	83.7	1.9	4.7	4.4	100.0

NOTE.—Rep. Heur. = representativeness heuristic; Per. Pref. = personal preference; Creat. Fict. = creative fiction.

^a Percentages in this column are for reasons falling into 10 other categories, none of which received more than 6% of the responses, some receiving no responses for particular grades.

Description of rationales.—The percentage of rationales falling into each coding category for the different types of scenarios described earlier (BROBJ, BRSOC, INBROBJ, INBRSOC) is presented in Table 4. It is clear from this summary of responses that although first and third graders reported the use of baserates and the representativeness heuristic, they were more likely than older respondents to use rationales based on personal preference and to create their own stories (creative fiction) to make judgments about objects and social situations. However, when both baserate and individuating information were provided, even the youngest children used the representativeness heuristic over 40% of the time when explaining social judg-

ments. As can be seen in Table 4, the use of explanations based on representativeness increased with age in the social domain while they decreased in the object domain.

Grade comparisons.—A score representing the use of each rationale was calculated by counting the number of times each subject gave a particular rationale for each type of scenario. This resulted in scores of 0 (never using that reason) to 3 (always using that reason) for the BROBJ, BRSOC, and INBROBJ scenarios, and 0 to 4 for the INBRSOC scenarios. To test the relation between grade and reason given for different types of scenarios, separate chi-square tests of independence were conducted.⁴ The factors

⁴ Although a MANOVA, using the design described earlier, would have been preferable for this analysis, the recalculation of usage scores as percentages resulted in a large number of valid zeroes. This violates the assumptions for MANOVA and precludes the use of transformations typically used on percentage data.

TABLE 5
RELATIONSHIP BETWEEN GRADE AND CODING CATEGORY
FOR JUDGMENT EXPLANATIONS

CODING CATEGORY	DECISION DOMAIN			
	Object		Social	
	Chi-Square ^a	Tau	Chi-Square	Tau
Baserate only:				
Baserate	102.74**	.41**	44.02**	.27**
Rep. heur.	N.A.	. . .	N.A.	. . .
Per. pref.	47.35**	-.19**	86.99**	-.42**
Creat. fict.	62.68**	-.27**	9.83	.01
Baserate and individuating information:				
Baserate	14.16	.43**	92.90**	-.02
Rep. heur.	97.21**	-.21**	83.26**	.41**
Per. pref.	98.73**	-.19**	47.07**	-.33**
Creat. fict.	24.04*	-.12*	18.35	-.15*

^a Degrees of freedom = 9 for all tests.
**p* < .001.
***p* < .00001.

were grade and usage scores (the number of times an individual used the rationale).

As can be seen in Table 5, the frequency of explanations was significantly related to grade for most types of scenarios (*p*'s < .00001). Exceptions were the use of creative fiction when making social judgments based on baserate information alone, and the use of baserates when making judgments about objects based on both baserate and individuating information. To determine the strength of association between grade and children's explanations for their choices, the Kendall rank correlation coefficient (τ) was calculated.⁵

The correlations indicate that use of baserate explanations was positively related to grade for judgments about objects and for social judgments on the baserate-only task (τ = .41, .27, respectively), but that the use of baserates was unrelated to social judgments when individuating information is available. As predicted, the use of the representativeness heuristic increased with age for social judgments (τ = .41). However, it decreased for judgments about objects (τ = -.21), suggesting that children learn that this strategy applies only to social judgments. The use of creative fiction and personal preference as judgment strategies decreased with age for

all types of scenarios. This negative correlation is particularly strong for the use of personal preference to make social judgments when baserates alone are available (τ = -.42).

Consistency between Choice and Rationale

Construction of scores.—To test whether subjects' rationales for their choices were consistent with the choices they had made, consistency scores were constructed. If subjects' choices and reasons were consistent (a baserate response was given with a baserate rationale or a nonbaserate response was given with an individuating rationale), subjects received a score of 1. All other combinations of response choices and rationales were assigned a score of 0. Consistency scores were created for each category following the same procedure used to create baserate response scores.

Domain and task effects.—A mixed-model ANOVA with grade (first, third, sixth, and college) as the between-subjects independent variable, domain and task as the within-subjects independent variables, and the consistency score as the dependent variable was performed. The interaction of task and domain was significant, $F(3,323) = 2.76$, $p < .05$. As can be seen in Figure 1, subjects'

⁵ Kendall's tau (τ) is a measure of correlation, suitable for ordinal data such as grade and explanation usage (number of times used) (Siegel, 1956).

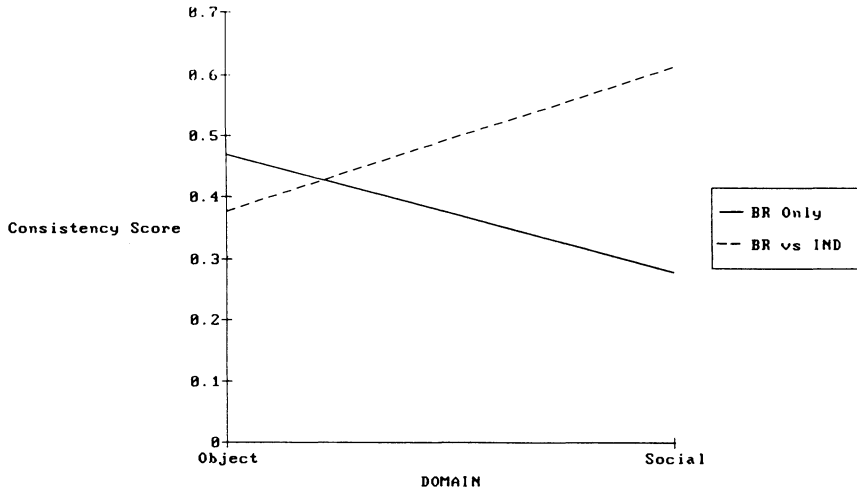


FIG. 1.—Comparison of consistency scores by task and domain

rationales were more consistent with their choices in the social domain than in the object domain when they were given individuating and baserate information but less consistent in the social than in the object domain when they were given only baserates. In addition, significant main effects for domain, $F(1,323) = 4.50, p < .05$, and task, $F(1,323) = 58.84, p < .0001$, were found.

Grade effects.—A significant triple interaction indicated that the effect depended on task and domain, $F(3,323) = 4.11, p < .01$. Simple effects tests indicated that consistency was greater with increasing grade level, $F(3,323) = 57.14, p < .00001$; it differed, however, depending on the task, $F(3,323) = 2.76, p < .05$, and domain, $F(3,323) = 3.73, p < .05$.

As can be seen in Figures 2 and 3, the effect of the information provided was reversed in the object and social domains. The increases in consistency across grades for the two types of information were parallel in the social domain, with baserate information alone resulting in *less* consistency at all ages. However, in the object domain, the consistency of responses did not depend on the information provided until the sixth grade, when it *increased* dramatically for baserate-only information.

Discussion

The goal of this study was to take a first step toward placing the judgment heuristic perspective in a developmental framework by

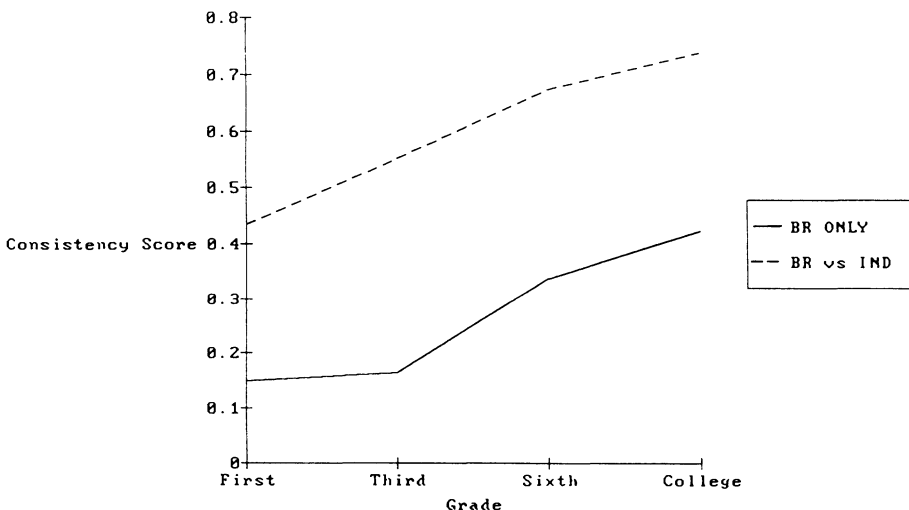


FIG. 2.—Differences in consistency scores for task and grade in the social domain

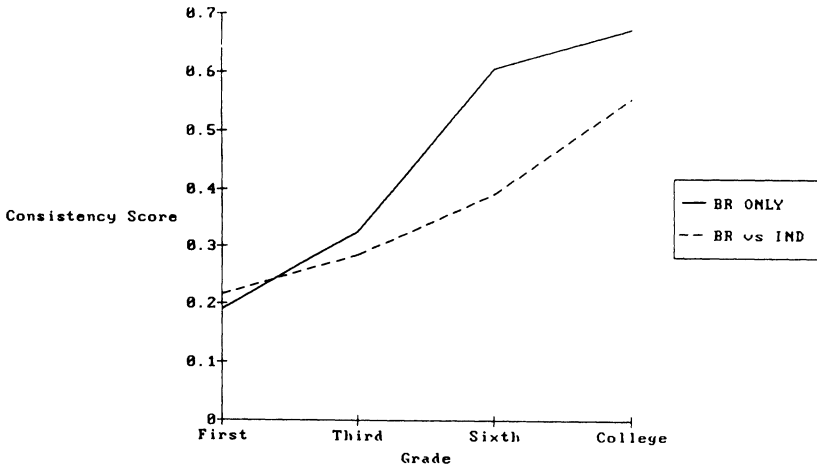


FIG. 3.—Differences in consistency scores for task and grade in the object domain

collecting empirical evidence on children's use of baserates and the representativeness heuristic. Based on related research and studies with adults, we predicted that the use of both baserates and the representativeness heuristic would increase with age, but that when both sources of information were available in the social domain, children would be more likely to rely on the judgment heuristic as they got older. We expected little change in the use of baserates in the object domain.

Based on the analysis of the choice task alone, it appears that the use of the representativeness heuristic in the social domain develops quite early and changes little. However, the explanations children give for their choices clearly indicate that the use of the representativeness heuristic to make social judgments increases throughout the elementary school years. Testing the consistency between the choice task and rationales allowed us to look at children's strategies a little more closely. The consistency analyses are important because they suggest a very different pattern of results for both children and adults than is found by relying solely on the choice-task data, as has been done previously. If strategies are inferred from choices, it appears that even first graders are using baserates much of the time in the object domain, and that the representativeness heuristic is used in the social domain with about equal frequency by all ages. However, the consistency data reveal that young children seldom give baserate rationales for their baserate choices in either domain, and that the use of consistent individuating rationales for nonbaserate choices increases with age.

These data suggest that what appears to be a decline in the use of baserates in the

social domain is in reality an increase in consistency between choices and rationales; first graders are using idiosyncratic strategies rather than a comparison of the numbers. The use of personal experiences and beliefs to make choices has previously been reported for probability judgments (Piaget & Inhelder, 1975) and for making causal attributions (Higgins & Bryant, 1982). As children get older, these idiosyncratic strategies decline and they apparently begin to realize the value of baserate information, using it to make decisions more often in the social domain when no other information is available, and in the object domain even when individuating information is available. At the same time, the use of the representativeness heuristic increases with age for social decisions. Our interpretation of this pattern of results is that the use of the representativeness heuristic is specific to social judgments, and that it is based on the development of social schemas that can be used to make judgments in social situations where baserate data are difficult to collect and integrate. If our interpretation is correct, the judgment biases reported in adults could be considered "smart errors." However, they are still errors and they may get in the way of optimal decision making when overused.

Although we followed the Kahneman and Tversky model of pitting the use of baserates and individuating information against each other, it is possible that the two strategies are dependent on each other as they develop. For example, social categories may be necessary as a basis both for using the representativeness heuristic and collecting baserate data in the social domain, but as baserate information is gathered it may change the content of the category. The development of

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stereotypes may be an example in which baserates are used to form stereotypes (see Eagly & Steffen, 1984, for a test of this relationship), and then the stereotypes become a social category that may be used as a representativeness heuristic under some conditions.

We view these data as the "tip of the iceberg" in an area of research that is relevant to a broad range of developmental topics. It has clear implications for questions concerning children's understanding and use of real-world baserates. For example, children's inability to collect or process the numbers or to see baserates as relevant may be related to the developmental trends found in the use of consensus information to make causal attributions about the behavior of others (DiVitto & McArthur, 1978; Hortacsu, 1987; Rholes & Walters, 1982). In these studies, the commonness or uncommonness of a particular response had little effect on causal assessments, particularly in children younger than age 9. To collect baserate information to make a social judgment in the real world one usually has to classify and aggregate across events, time, and individuals. This may lead young children to develop strategies for social decisions that do not rely on the numbers. Our data suggest that the strategy that they are most likely to use in this situation is to rely on their own personal preference.

This area of research is also related to the development of probability and problem-solving strategies. Our findings suggest that children and adults use a number of strategies besides reliance on individuating information to make their choices. It is possible that what we considered as the use of baserates may in reality represent a variety of different strategies used by children, such as a qualitative more-to-less comparison versus a subtraction or ratio approach. The development of intuitive strategies (Fischbein, 1975) in the real world is likely to be related to more formal rules that have been reported in the probability and problem-solving literature (see Surber & Haines, 1987).

Although we believe that there is great potential for important developmental work related to this area of research, the present data must be viewed as preliminary and interpreted with caution. A major limitation of this study is the reliance on verbal protocols to distinguish between the different types of decision strategies used by the subjects. The inconsistencies between young subjects' choices and rationales may have been related to their problems verbalizing intuitive strate-

gies. A rule-assessment approach, such as Siegler (1981) uses, or an information integration approach, such as Surber and Haines (1987) describe, would have allowed us to classify the types of strategies used by subjects without depending on their verbal abilities. However, due to the lack of existing information regarding children's patterns of responses when making judgments under uncertainty, we opted for a more descriptive approach. Future research should make use of the developmental trends reported here in order to devise a method that could be used by researchers to classify a child's strategy or rule within particular task parameters. Related to this is the possibility that children are actually calculating their own baserates based on prior experience and ignoring those provided in the scenario because they do not seem plausible. This is a problem shared by the studies in the adult literature, and one which an information integration approach would circumvent.

A second limitation is the selection of content for the scenarios. Systematically varying the subjects and domain in future research may yield different results that would be informative about the conditions under which children use judgment heuristics. A third limitation is the age range we chose. Because we modeled our tasks on the adult literature, we wanted children with good verbal skills, but the most interesting period of development in this area may be in children younger than 6. A different methodology would allow younger children to participate. A fourth limitation is the choice of a constant one-to-two ratio. The probability literature suggests that the size of the ratio is related to children's estimates so that different results may have been obtained by varying the ratios.

The data reported here indicate that the judgment heuristic biases displayed by adults are specific to the social domain, and that they develop over time. However, greater use of baserates develops at the same time in the object domain. This suggests that adults are capable of using baserates, but that they are considered less informative for social judgments. The task of future research is to look at the kinds of rules or strategies children are using, how they develop in different domains, and the ways in which they are related to the task demands.

References

- Ajzen, I. (1977). Intuitive theories of events and the effects of baserate information on prediction.

- Journal of Personality and Social Psychology*, 35, 303–314.
- Baker-Ward, L., Ornstein, P. A., & Holden, D. J. (1984). The expression of memorization in early childhood. *Journal of Experimental Child Psychology*, 22, 335–341.
- Bernbaum, M. H., & Mellers, B. A. (1983). Bayesian inference: Combining base rates with opinions of sources who vary in credibility. *Journal of Personality and Social Psychology*, 45, 792–804.
- Christensen-Szalanski, J. J. J., & Beach, L. R. (1982). Experience and the base rate effect. *Organizational Behavior and Human Performance*, 29, 270–278.
- DiVitto, R., & McArthur, L. Z. (1978). Developmental differences in the use of distinctiveness, consensus, and consistency information for making causal attributions. *Developmental Psychology*, 14, 474–482.
- Eagly, A. H., & Steffen, V. J. (1984). Gender stereotypes stem from the distribution of women and men into social roles. *Journal of Personality and Social Psychology*, 46, 735–754.
- Ferguson, T. J., Olthof, T., Luiten, A., & Rule, B. G. (1984). Children's use of observed behavioral frequency vs. behavioral covariation in ascribing dispositions to others. *Child Development*, 55, 2094–2105.
- Ferguson, T. J., van Roozendaal, J., & Rule, B. G. (1986). Informational basis for children's impressions of others. *Developmental Psychology*, 22, 335–341.
- Fischbein, E. (1975). *The intuitive sources of probabilistic thinking in children*. Boston: Riedel.
- Fischhoff, B., Slovic, P., & Lichtenstein, S. (1979). Subjective sensitivity analysis. *Organizational Behavior and Human Performance*, 23, 339–359.
- Ginosar, Z., & Trope, Y. (1980). The effects of base rates and individuating information on judgments about another person. *Journal of Experimental Social Psychology*, 16, 228–242.
- Goldberg, S. (1966). Probability judgments by preschool children: Task conditions and performance. *Child Development*, 37, 157–167.
- Heller, L. A., & Berndt, T. J. (1981). Developmental changes in the formation and organization of personality attributions. *Child Development*, 52, 683–691.
- Higgins, E. T., & Bryant, S. L. (1982). Consensus information and the fundamental attribution error: The role of development and in-group versus out-group knowledge. *Journal of Personality and Social Psychology*, 43, 899–900.
- Hoemann, H., & Ross, B. M. (1971). Children's understanding of probability concepts. *Child Development*, 42, 221–236.
- Hortacsu, N. (1987). Attributional focus and information selection in relation to chronological age. *Child Development*, 58, 225–233.
- Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. *Cognitive Psychology*, 3, 430–454.
- Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological Review*, 80, 237–251.
- Keppel, G. (1982). *Design and analysis: A researcher's handbook*. Englewood Cliffs, NJ: Prentice-Hall.
- Kosslyn, S. M., & Kagan, J. (1981). "Concrete thinking" and the development of social cognition. In J. H. Flavell & L. Ross (Eds.), *Social cognitive development: Frontiers and possible futures* (pp. 82–96). Cambridge: Cambridge University Press.
- Krouse, H. J. (1986). Use of decision frames by elementary school children. *Perceptual and Motor Skills*, 63, 1107–1112.
- Kruglanski, A. W., Friedland, N., & Farkash, E. (1984). Lay person's sensitivity to statistical information: The case of high perceived applicability. *Journal of Personality and Social Psychology*, 46, 503–518.
- Kuhn, D., Nash, S. C., & Brucken, L. (1978). Sex role concepts of two- and three-year-olds. *Child Development*, 49, 445–451.
- Manis, M., Dovalina, I., Avis, N. E., & Cardoze, S. (1980). Baserates can affect individual predictions. *Journal of Personality and Social Psychology*, 38, 231–248.
- Martin, C. L. (1989). Children's use of gender-related information in making social judgments. *Developmental Psychology*, 25, 80–88.
- Miller, P. H., Haynes, V. F., DeMarie-Dreblow, D., & Woody-Ramsey, J. (1986). Children's strategies for gathering information in the tasks. *Child Development*, 57, 1429–1439.
- Perner, J. (1979). Young children's bets in probabilistic tasks involving disjoint and part-whole related events. *Archives de Psychologie*, 47, 131–149.
- Piaget, J., & Inhelder, B. (1975). *The origin of the idea of chance in children*. New York: Norton. (Originally published in 1951)
- Rholes, W. S., & Ruble, D. L. (1984). Children's understanding dispositional characteristics of others. *Child Development*, 55, 550–560.
- Rholes, W. S., & Walters, J. (1982). Schematic patterns of causal evidence. *Child Development*, 53, 1046–1057.
- Ross, B. M., & Hoemann, H. W. (1975). The attainment of formal operations: A comparison of probability concepts in deaf and hearing adolescents. *Genetic Psychology Monographs*, 91, 61–119.
- Ross, L. (1981). The "intuitive scientist" formulation and its developmental implications. In J. H. Flavell & L. Ross (Eds.), *Social cognitive*

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- development: Frontiers and possible futures* (pp. 1–42). Cambridge: Cambridge University Press.
- Ruble, D. N., Feldman, N. S., Higgins, E. T., & Karlovac, M. (1979). Locus of causality in the use of information in the development of causal attributions. *Journal of Personality*, **47**, 595–614.
- Ruble, D. N., Higgins, E. T., & Hartup, W. W. (1983). What's social about social-cognitive development? In E. T. Higgins, D. N. Ruble, & W. W. Hartup (Eds.), *Social cognition and social development: A sociocultural perspective* (pp. 3–12). Cambridge: Cambridge University Press.
- Shaklee, H., & Paszek, D. (1985). Covariation judgment: Systematic rule use in middle childhood. *Child Development*, **56**, 1229–1240.
- Shantz, C. U. (1983). Social cognition. In J. H. Flavell & E. M. Markman (Eds.), P. H. Mussen (Series Ed.), *Handbook of child psychology: Vol. 3. Cognitive development* (pp. 35–87). New York: Wiley.
- Siegel, S. (1956). *Nonparametric statistics for the social sciences*. New York: McGraw-Hill.
- Siegler, R. S. (1981). Developmental sequences within and between concepts. *Monographs of the Society for Research in Child Development*, **46**(2, Serial No. 189).
- Siegler, R. S., & Vago, S. (1978). The development of a proportionality concept: Judging relative fullness. *Journal of Experimental Child Psychology*, **25**, 371–395.
- Surber, C. F., & Haines, B. A. (1987). The growth of proportional reasoning: Methodological issues. In R. Vasta (Ed.), *Annals of child development* (Vol. 4, pp. 35–87). Greenwich, CT: JAI.
- Tversky, A., & Kahneman, D. (1974). Judgments under uncertainty: Heuristics and biases. *Science*, **185**, 1124–1131.
- Yost, P., Siegel, A., & Andrews, L. (1962). Nonverbal probability judgments by young children. *Child Development*, **33**, 769–780.
- Zukier, H., & Pepitone, A. (1984). Social roles and strategies in prediction: Some determinants of base rate information. *Journal of Personality and Social Psychology*, **47**, 349–360.