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AUTHOR Blevins-Knabe, Belinda
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ABSTRACT

Examined were preschoolers' spontaneous use of correspondence strategies. A total of 40 children 4 and 5 years of age were asked to divide a pile of cookies into two equal groups. The cookies were two sizes, halves and wholes, so even though there were trials with an odd number of cookies, it was possible to divide the cookies evenly. When children's division strategies and accuracy in dividing the cookies were examined, data indicated that subjects frequently used correspondence strategies to divide the cookies, but they did not do so uniformly across all trial types. Both 4- and 5-year-olds consistently used correspondence strategies on small numerosity trials, but only 5-year-olds consistently used these strategies on large numerosity, even number trials. Children of both ages had difficulty on the large numerosity, odd number trials. These results suggest that young children's use of correspondence strategies may not be quantitative on the type of division tasks used in this investigation. (RH)

Preschoolers' Use of Correspondence: Ineffective and Infrequent?

Belinda Blevins-Knabe
Department of Psychology
University of Arkansas at Little Rock
Little Rock, AR 72204

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ABSTRACT

Research examining children's spontaneous use of one-to-one correspondence often finds such use is infrequent and ineffective. In this study I examined preschoolers' spontaneous use of correspondence strategies to determine the accuracy of such claims. Forty 4- and 5-year-olds were asked to divide a pile of cookies into two equal groups. The cookies were two sizes, halves and wholes, so even though there were trials with an odd number of cookies it was possible to divide the cookies evenly.

Children's division strategies and accuracy in dividing the cookies were examined. Although 4- and 5-year-olds frequently used correspondence strategies to divide the cookies they did not do so uniformly across all trial types. Both 4- and 5-year-olds consistently used correspondence strategies on small numerosity trials, but only 5-year-olds consistently used these strategies on large numerosity even number trials. Children of both ages had difficulty on the large numerosity odd number trials. These results suggest that while young children frequently use correspondence strategies such use may not be quantitative.

Preschoolers' Use of Correspondence: Ineffective and Infrequent?

In 1983 Fuson, Secada, & Hall claimed that the available evidence on young children's spontaneous use of one-to-one correspondence showed that such use was infrequent and ineffective. Many of the tasks used by researchers up to that point had employed conservation or conservation-like tasks. Since then Miller (1984) & Frydman & Bryant (1988) have found that young children can divide objects into equivalent groups using one-to-one correspondence. Both of these studies used tasks with no conflicting length cues.

My research focuses on several unresolved issues concerning young children's use of one-to-correspondence: Is the frequency of children's use of one-to-one correspondence influenced by numerosity or size of objects?, Do children use one-to-one correspondence consistently within and between trials?, Is children's use of one-to-one correspondence associated with accuracy in dividing objects into equivalent groups?, and Are there developmental changes in children's use of one-to-one correspondence?

Method

Subjects

Twenty four-year-olds ($\overline{X}$ = 4-6) and twenty five-year-olds ($\overline{X}$ = 5-4) participated in the study. An equal number of males and females were included in each age group.

Procedure

Each child was given a number conservation task, an addition and subtraction task, and a division task. Only the division task will be discussed.

The division task was composed of the trials listed in Table 1. On each trial children were shown two cookie monsters and a pile of round cardboard cookies, randomly arranged. The cookies were two sizes, halves and wholes. Children were shown that two halves were equal to one whole and then asked to give both cookie monsters the same amount of cookies to eat. The cookies were placed on round cardboard "plates". When the children finished they were asked whether the two cookie monsters had the same amount to eat. Children were videotaped while performing the task.

Results

Before I examined how children divided the cookies I examined their success in dividing the cookies. Trials were scored as correct when children used all the cookies and had the same amount of cookies on each plate. A repeated measures analysis of variance revealed a main effect for trial, F, (5, 175) = 22.33, $p < .001$. Post hoc analyses found that children were most successful in dividing the cookies on both of the whole cookie trials, and least successful on the large numerosity, odd number trials. These results are described in Table 2.

Next I examined how frequently children used a correspondence strategy. In these analyses only children who correctly divided the cookies were included.

Because so few children correctly divided the cookies on the 3 whole/ 8 half trials, those trials were excluded from the analyses. Children's strategies for dividing the cookies were classified into the following categories: a. correspondence strategies--put one or more cookies on 1 plate and put the same amount on the other plate, b. number based strategies--put one or more halves or wholes on one plate and put the same number on the other plate, c. alternating distribution--put one or more cookies on one plate and then put a different number and amount on the other plate, d. Other strategies--transfer of cookies between plates, subtraction, or addition (addition was defined as placing a cookie on 1 plate, but no cookies on the other plate).

Frequency of strategy use was examined by comparing the number of times different strategies were used. The number of children using a particular strategy at least once was tabulated using only the trials on which children were correct. As can be seen in Table 3 most children used a correspondence strategy. There were no significant effects for numerosity or size of cookies in these analyses. Very few children overtly counted or mentioned number names on these trials.

The next issue examined was how consistently children used a correspondence strategy. Only children who were correct were included in these analyses, so the whole/8 half trials were excluded. The number of trials on which children used only one type of strategy was tabulated. Although none of the children used a correspondence strategy consistently between trials, many

children used correspondence strategies consistently within a trial. These data are presented in Table 4.

Whether children are more accurate in dividing the cookies when they use a correspondence strategy was examined next. Children did accurately and consistently used a correspondence strategy on all trials, except the 3 whole/ 8 half trials. In the analysis of these trials both frequency and consistency of correspondence use was examined. Very few children used correspondence strategies consistently and consistent use was not associated with accuracy. Few children counted or mentioned number names on these trials. When children were given credit for use of correspondence if they used it at least once per trial, the analyses revealed that children who used a correspondence strategy were more likely to be incorrect than correct (see Table 5).

The final issue examined was whether there were developmental changes in children's use of one-to-one correspondence strategies. One clear developmental trend was in the consistency of strategy use. Both 4- and 5-year-olds consistently used correspondence strategies on small numerosity trials, but 5-year-olds had a significantly greater tendency to use correspondence strategies consistently on large numerosity even number trials.

Discussion

The results indicate that 4- and 5-year-old children frequently use correspondence strategies when asked to divide a group of objects in half. However, whether the use of a correspondence strategy is effective depends on the particular problem children are given to solve. Children used

correspondence strategies to correctly divide the cookies on all but the 3 whole/8 half trials. It is clear from their success on the other trials that preschool children have the motor skills to carry out correspondence strategies, that 5-year-olds can use correspondence strategies with large numerosities, and that they can cope with having two sizes of objects. However, the finding that these same children have difficulty applying these skills to the 3 whole/ 8 half trials raises the issue of whether children's use of correspondence on any of the trials was quantitative.

Children may be dividing the cookies using what looks to adults like a correspondence strategy without realizing that the strategy correctly applied guarantees success or realizing that the procedure provides quantitative information. They could have solved all of the trials, except the 3 whole/8 half trials, correctly without having either of these understandings. On all of the small numerosity trials it is possible that children were using the strategy of subitizing the number of cookies and using that quantitative information to guide their division. On the 10 whole and 2 whole/ 8 half trials children could be correct using a strategy of alternating back and forth between the plates. To be correct on the 2 whole/8 half trials they did have to match the 2 whole cookies. The 3 whole/8 half trials then are the only trials which require that children use some quantitative strategy, such as counting or correspondence, to be correct. The results suggest that young children's use of correspondence may not be quantitative on the type of division task used in this investigation.

Table 1
Trials Used in the Division Task

NUMBER OF PRESENTATIONS	TRIAL DESCRIPTION
1	4 W*
1	10 W
2	2 W/2 H**
2	1 W/2 H
2	2 W/8 H
2	3 W/8 H

*W = whole cookie
**H = half cookie

Table 2
Mean Percent Correct by Trial Type

Trial Type					
4 w	10 w	2 w/8 h	2 w/2 h	1 w/2 h	3 w/8 h
100	89.5	76.5	70	66.9	26.75

4 w ⟷ 10 w
10 w ⟷ 2 w/ 8 h
2 w/ 8 h ↔ 2 w/2 h ↔ 1 w/2 h

Trials connected by arrows are not significantly different.
Trials not connected by arrows are significantly different, $p < .05$, Newman Keuls tests.

Table 3
Mean Percent of Children Using a Correspondence Strategy

4 w	2 w/2 h	1 w/2 h	10 w	2 w/8 h
100	85	73	84	89

Table 4
Mean Percent of Children using Correspondence Consistently Within a Trial

	Trial Type				
Age	4 w	2 w/2 h	1 w/2 h	10 w	2 w/8 h
4	100	76	65	50*	77**
5	100	71	86	77*	91**

*a significant increase, $p < .05$, Binomial tests
** a significant increase, $p < .05$, Binomial tests

Table 5
Frequency of Strategy Use on 3 Whole/8 Half Trials

	TRIAL 1		TRIAL 2	
	CORRECT	INCORRECT	CORRECT	INCORRECT
4- AND 5-YEAR-OLDS USING A CORRESPONDENCE STRATEGY	8	26	11	26
	$\chi^2 = 9.53$, $p < .01$		$\chi^2 = 6.25$, $p < .02$	

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