JOURNAL OF EXPERIMENTAL CHILD PSYCHOLOGY 35, 478–486 (1983)

Contextual Sensitivity in Young Children's Drawings

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Previous research has examined the characteristic errors made by young children when drawing from a three-dimensional array. The aim of the present research was to investigate the influence of context in copying tasks. In a series of three experiments children between the ages of 4 and 7 years were presented with contrasting models to copy. These included cups and sugar bowls in various combinations and orientations. In each experiment the children's copies were scored for inclusion or omission of the occluded handle on the model. The results showed that nearly one third of the children did not respond consistently by either copying accurately or by always including the occluded handle. Instead the findings pointed to a large group of children whose responses were directed by the type of context present within the arrays.

INTRODUCTION

Previous research has shown that young children make characteristic errors when copying from a three-dimensional array. One type of error is the children's tendency to include features of a model even when these features are not visible. For example Freeman and Janikoun (1972) noted that most 5–7 year old children when asked to copy a cup positioned with its handle out of view included the handle in their drawings. A similar type of error occurs when children are asked to draw two objects, one partially occluded by the other; below 7–8 years of age children tend to draw the two objects separately rather than using occlusion as a means of representing depth (Freeman, Eiser, & Sayers, 1977; Light & MacIntosh, 1980; Light & Humphreys, 1981).

In their 1980 study Light and MacIntosh presented children with the task of copying a model house when it was either inside or behind a

This research was supported by SERC Grant 81310392 and constitutes part of a Doctoral research program. My thanks go to Allayne Bridges for her enthusiastic support and assistance at all times. Finally, I wish to thank the staff and children of St. Alphage Infants School, Solihull, and Stanely Road Infants School in Teddington. Requests for reprints should be addressed to Alyson Davis, Department of Psychology, The University of Birmingham, P.O. Box 363, Birmingham B15 2TT ENGLAND.

0022-0965/83 $3.00

transparent glass. All the children represented the house within the outline of the glass on the "inside" task. However, half of these same children drew the house separately (either side by side or one above the other) in the "behind" condition. Thus even the younger children do not always draw two objects separately. They have the necessary graphic skills to produce a united representation as the results from the inside condition show but they may not always choose to depict an object array in this way.

The question is why? One possible explanation might be that young children are concerned to include in their drawings as much information as possible regarding the array presented. As Light and MacIntosh (1980) pointed out "partial occlusion inevitably involves some loss of information about the occluded object. The child knows that the further object is complete and yet cannot adequately represent its completeness." Light and MacIntosh go on to differentiate between "array specific" and "view specific" spatial relationships. "Array specific" refers to the actual relationships between objects within the array itself whereas "view specific" refers to the apparent relationship between the objects as seen from a particular viewpoint. Light and MacIntosh proposed that the responses of the younger children may result from a concern to depict array specific rather than view specific information in their drawings.

This hypothesis was tested in a further study by Light and Humphreys (1981) in which children between 5 and 8 years were asked to copy two-object arrays. The arrays consisted of either colored toy pigs or wooden blocks either side by side (lateral arrangements) or in front and behind (in depth). When the pigs or blocks were arranged laterally nearly all the subjects drew them side by side. However, the depth arrangements produced more disparate results. The occlusion drawings of the older children depicted what the children could see from their viewpoint. But only 17% of the 5-year-olds drew an end on pig or block and occluded the other object in their copies. The remaining children drew the two objects separately either horizontally or vertically. This is in keeping with previous findings (e.g., Freeman, Eiser, & Sayers, 1977; Light & MacIntosh, 1980). Of primary interest was the fact that the vast majority of these vertical and horizontal drawings preserved the internal relations of the array. Light and Humphreys took this as evidence supporting their original hypothesis "the young child is in fact simply unconcerned with or insensitive to perspective differences."

Occlusion in Freeman and Janikoun's (1972) experiment was achieved by the orientation of a *single* object. Here, a single cup was orientated with its handle turned away from the viewer so that it was not visible. Thus a complete feature of the object has to be omitted if the copy is to be view specific. Children under 7–8 years, Freeman and Janikoun found, included the occluded handle. Freeman and Janikoun proposed

that the children wanted to make their drawings recognizable as cups, which they achieved by drawing a canonical cup. Canonical refers to the fact that "there is always an optimal method of conveying basic structural information" (Freeman, 1980, p. 345).

In neither the Light experiments or the Freeman and Janikoun study is it possible to distinguish between drawings which are "array specific" and those which are simply canonical representations. The aim of the present study was to provide contextual contrast in arrays by presenting children with arrays constituting both an object with an occluded feature, and the same object in its canonical orientation. The objects chosen for the arrays were cups and sugar bowls in various combinations and orientations.

EXPERIMENT 1

Method

Subjects were 95 children all drawn from the same school. The children fell into three age groups: 4-year-olds (n = 32, mean age 4 years 6 months), 5-year-olds (n = 32, mean age 5 years 6 months), and 6-year-olds (n = 32, mean age 6 years 6 months). Each group comprised 16 girls and 16 boys.

The children were tested individually. The experiment was in two parts: A single cup task (SCT) and a paired cup task (PCT). Each subject was given both tasks but the order of task presentation was balanced. In the single cup task a plain white cup 7 cm high was placed on a table so that its handle was out of view from the subject. In the paired cup task two further identical cups were placed on the table. One cup was positioned so that its handle was clearly visible to the child and the other was positioned so that its handle was not visible from the child's viewpoint.

The task instructions were as follows: "I want you to look very carefully at this (these) cup(s)—can you draw it (them) just how it (they) look from where you are sitting, don't forget to keep looking at it (them) so that you can try your best to copy exactly."

Results

The resulting drawings were scored for inclusion of the occluded handle in each task. All the subjects included the visible handle in the PCT. The results are summarized in Table 1. Overall in the SCT nearly half of the subjects included the hidden handle. However, in the PCT less than one third included it. In all, 17 subjects changed their responses over the two tasks which is highly significant statistically (McNemar test for changes χ^2 = 13.07, $p < .001$).

The order of task presentation was a significant factor in determining the pattern of responses across tasks ($\chi^2(2)$ = 16.8, $p < .001$). Of those

TABLE 1
NUMBER OF SUBJECTS INCLUDING THE HIDDEN HANDLE IN EACH TASK

	Both tasks	Neither task	SCT only	PCT only
Order				
SCT followed by PCT				
4 yrs	8	4	4	0
5 yrs	3	4	9	0
6 yrs	3	11	2	0
	14	19	15	0
PCT followed by SCT				
4 yrs	6	9	1	0
5 yrs	1	15	0	0
6 yrs	2	13	1	0
	9	37	2	0

subjects receiving the SCT first 29% included the nonvisible handle on both tasks, 40% omitted it on both tasks, and 31% included the hidden handle in the SCT but not in the PCT. In striking contrast these results compare with 19, 77, and 4%, respectively, for subjects given the PCT first. Thus the vast majority of children copying accurately on both tasks were presented with the PCT initially. Furthermore of those children (17) who included the hidden handle on the SCT only, 15 were given the SCT before the PCT. Nine of these 15 children were in the 5-year age range. Younger subjects tended to consistently include occluded handles while the older children tended to copy accurately on both tasks.

Discussion

The major finding is that nearly one third of the children given the single cup initially drew the occluded handle on the SCT but then went on to omit it in the PCT. How can this behavior be explained? Clearly unlike the behavior of those children who responded consistently over two tasks these results cannot be accounted for simply in terms of veiw or array specific relationships, since they are apparently concerned with array specific relations only in the SCT. Neither can these findings be satisfactorily explained by supposing that the children are fluctuating randomly between being array specific and view specific, because all the children who change their response type do so in the same direction. None of the children included the hidden handle in the PCT only.

It is possible that children suppose that drawing the visible handle on the PCT is enough to define both objects as cups. Here the childs reasoning would be along the lines of "Because that cup has a handle and the other one is just the same I don't need to draw the hidden handle."

However, in the SCT the children have to draw the handle to show that it is a cup.

A further possible explanation is that the children find themselves with an insoluble problem—they may have omitted the handle in the PCT because to have included it would have meant wrongly specifying its orientation to the other cup. Light's hypothesis would allow for this if the children were concerned with not violating array specific relations.

The hypothesis to be put forward here is that those subjects who omitted the occluded handle on the PCT only, did not appreciate the deliberate noncanonical orientation of the single cup. But in the paired cup situation there is strong, visual contrast which signals that orientation is important. Thus the children include only the visible handle to preserve this contrast and thereby acknowledge their awareness of it. This argument can also be extended to account for the strong order or presentation effect. The context provided by the PCT has a carry-over effect into the SCT and as a result these children omit the occluded handle on *both* tasks.

In summary then children may be contextually sensitive for two reasons, either because the context of the PCT defines both the objects as cups or because the visual contrast signals the deliberate differing orientations of the two cups. Experiment 2 set out to investigate these possibilities by adding a further condition where a cup with its handle hidden was simultaneously presented next to a sugar bowl. Here there is no visual contrast but the child knows the two objects are different.

EXPERIMENT 2

Method

Thirty-six different children from the same school acted as subjects. The children were in the age range 5 years 0 months to 6 years 6 months (mean age = 5 years 7 months). This age range was selected since it yielded the highest proportion of children shown to be contextually sensitive in Experiment 1. There were 18 boys and 18 girls.

The children were tested individually. Each subject was given the SCT followed by the PCT. After completion of both these tasks the subjects were given a sugar bowl, identical to the cup, to examine. The sugar bowl was then placed on a table next to a cup. The cup was positioned so that its handle was not visible to the child. Thus the two objects looked identical from the child's viewpoint. The task instructions were modified appropriately from Experiment 1: "I want you to look very carefully at this cup and sugar bowl. Can you draw them for me just how they look from where you are sitting? Don't forget to keep looking at them so you can try your best to copy them exactly."

Results and Discussion

The results of the single and paired cup tasks were strikingly similar to those of the same age range in Experiment 1. As before, a significant proportion (McNemar test for changes $\chi^2(1) = 10.08$, $p < .01$) induced the hidden handle in the SCT but omitted it in the PCT and thereby showed themselves to be contextually sensitive.

As can be seen from Table 2 all of the subjects who omitted the handle on both the SCT and PCT then went on to omit it again in the cup vs bowl condition. Seven of the eight subjects who included the occluded handle in both the SCT and the PCT also went on to include it in the cup vs bowl condition. The responses on the cup vs bowl task of those children who were shown to be contextually sensitive on the PCT were divided. Seven of these twelve subjects included the handle in the cup vs bowl condition. Closer examination of the drawings of the other five subjects provided clues as to what was going on. One child drew a rim on the sugar bowl (but not on the cup) saying "That one's got a rim on it to show it's the sugar bowl." Another child made a vast adjustment of size so that the bowl appeared much larger than the cup. Therefore three quarters of the subjects who had been shown to be contextually sensitive on a single cup followed by a paired cup task made some attempt to indicate that the bowl and cup were different despite the fact that they looked the same.

Clearly, then, these children are not just concerned with representing orientation differences. The question is whether these children include the handle on the cup and bowl task to "say" this is a cup or do they simply wish to express that there is a difference between the two objects in the array. If it is just the difference which they wish to represent then the presence of a nondefining feature on the bowl could achieve this. On the other hand if they are concerned to mark the cup as a cup then they would still include the hidden handle.

Experiment 3 was designed as a test for this distinction by adding a black spot as a nondefining feature to the sugar bowl.

TABLE 2
NUMBER OF SUBJECTS INCLUDING THE HIDDEN HANDLE ON EACH TASK

SCT and PCT	Neither SCT nor PCT	SCT only	PCT only
8 (7)	16 (0)	12 (7)	9 (0)

Note. The numbers in parentheses denote the number of subjects who included the hidden handle in the cup and sugar bowl condition. $N = 36$.

EXPERIMENT 3

Method

Subjects were 36 children from a similar school. The children were in the age range 5 years 0 months to 6 years 6 months (mean age 5 years 7 months). There were equal numbers of boys and girls. All the subjects were given the SCT followed by the PCT. Following this subjects were divided randomly into two equal groups. One half of the subjects were given the cup and sugar bowl task as for Experiment 2. For the other half of subjects the sugar bowl had a large black spot clearly visible on the front of it. This black spot was the only difference between the two groups. The task instructions were identical to those given in Experiment 2.

Results and Discussion

The children's copies were scored for inclusion of handles and/or spot. There was only one subject whose drawing could not be scored due to ambiguity.

The results of the SCT and PCT were similar to Experiment 2 (see Table 3). Of those children who omitted the occluded handle in the SCT and PCT none included it in the cup vs bowl task, and only one child failed to include the spot. All but one of the children who included hidden handles in the single and PCT went on to include the handle in the cup vs bowl task and of these half included the spot. A significant number (16) of the children were contextually sensitive according to their performance on the SCT followed by the PCT (McNemar test for changes, $\chi^2(1) = 14.06$, $p < .001$). The responses of these children in the cup vs bowl condition were totally different depending on whether they were in "spot" group or the plain group: All the subjects given the plain bowl

TABLE 3
NUMBER OF SUBJECTS WHO INCLUDED THE HIDDEN HANDLE IN EACH TASK

	SCT and PCT	Neither SCT nor PCT	SCT only	PCT only
Plain group	7 (7)	3 (0)	8 (8)	0 (0)
Spot group	4 (3)	5 (0)	8 (0)	0 (0)
	11	8	16	0
Number of subjects including the spot	2	4	8	0

Note. The numbers in brackets denote the number of subjects including the hidden handle on the cup and bowl task. $N = 35$.

drew the occluded handle on the cup while all those given the bowl with the black spot omitted the handle and included the spot.

These children are trying, therefore to show a difference between two objects which they know to differ. The way in which they mark this difference is determined by the context. In the paired cup situation the objects in the array differ only in orientation, so the children mark this by omitting the occluded handle. If the two objects differ in "handleness" as in the cup and bowl task the children include the handle to show the difference. If they differ in "spottedness" and "handleness" the visible spot is used in preference to the hidden handle to mark the difference.

Conclusion

The three experiments reported here demonstrate that the context of a two-object array greatly influences the way in which young children represent the array in their copies. The evidence shows that children are aware of differences both in orientation and in the nature of the two objects and that they are concerned to mark these differences in their drawings. The manner in which they do this is influenced by the type of difference—for example, in Experiment 3 a visible spot was selected in preference to a nonvisible handle to mark the distinction between the cup and the sugar bowl.

Furthermore the context provided by a two-object array has a strong carry-over effect into subsequent tasks. This is shown by the extremely high number of children who, after being presented with the PCT, copied accurately in the SCT. Receiving the PCT first seems to cue children into what they are "supposed" to be doing if they are then given a SCT. However, being aware of what the task requires does not necessarily mean that the children will subsequently copy accurately in *any* task, as Experiments 2 and 3 have shown. (Further research is presently being carried out by the author into possible carry-over effects on Experiments 2 and 3).

The work of Light and his colleagues pointed to the fact that young children were more concerned with array specific spatial relations rather than view specific relations. The experiments reported here suggest that the extent to which children make view or array specific representations depends on whether or not the within array context is important.

The influence of context and contrast in the way differences are represented has been shown in other areas of research. For example Olson's (1972) work on language indicates that in a communication setting a speaker selects words or enlarges sentences to the extent required to "differentiate an object from the set of perceived *or* inferred alternatives." (Olson, p. 139). The parallels between this research and Olson's work alerts us to the fact that drawings are communicative and that the information they convey is specific to a given situation. Perhaps the strength

of this line of research is that it allows context effects to be examined systematically and thus has very clear implications for future empirical work.

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RECEIVED: January 22, 1982; REVISED: May 13, 1982, August 5, 1982.