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ABSTRACT

Previous literature suggests that young children are relatively insensitive to viewpoint in drawing, only showing their view when the task demands it. In contrast, older children appear to become more sensitive to viewpoint, and it has been claimed that there is a developmental progression towards portrayal of viewpoint though linear perspective. This study investigated sensitivity to viewpoint by direct manipulation of the child's view. A total of 225 children of 6, 8, 10, 12, and 14 years of age were asked to draw an L-shaped array of three cubes from one of three views: frontal eye-level, frontal elevated, and corner elevated. Within each age group, 15 children were assigned to each of the three conditions. Each child performed only one viewing condition and produced only one drawing. At every age, children showed sensitivity to viewpoint. In the case of younger children, this involved showing the number of cubes visible, but did not lead to an accurate portrayal of either the children's view or the array relations. Older children portrayed their view and the array relations more accurately than did younger children, and their viewpoint had a strong effect on their choice of projection system. There was no evidence of a general progression toward use of linear perspective. (Author/RH)

The development of pictorial representation of objects and relations between objects: it depends on the child's view.

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ABSTRACT

Previous literature suggests that young children are relatively insensitive to viewpoint in drawing, only showing their view when the task demands it. In contrast, older children appear to become more sensitive to viewpoint and it has been claimed that there is a developmental progression towards portrayal of viewpoint through linear perspective. This study investigates sensitivity to viewpoint by direct manipulation of the child's view. Children between the ages of six and fourteen years were asked to draw an L-shaped array of three cubes from one of three views: *frontal eye-level*, *frontal elevated*, and *corner elevated*. At every age children showed sensitivity to viewpoint. In the case of younger children this involved showing the number of cubes visible, but did not lead to an accurate portrayal of either their view or the array relations. Older children portrayed their view and the array relations more accurately, and viewpoint had a strong effect on choice of projection system. There was no evidence of a general progression towards use of linear perspective.

INTRODUCTION

The issue of children's sensitivity to viewpoint in their drawings is central to most accounts of drawing development. Luquet's claim that young children are intellectual realists carried with it the notion that they make no effort to portray their particular view of a scene. More recently, work on children's portrayal of depth relations has indicated that under many circumstances depth, and hence viewpoint, is not indicated in young children's drawings (Cox, 1981; Freeman, Eiser & Sayers, 1977). Furthermore, it has been suggested that young children are more concerned to show relationships within the array than relationships between observer and array (Light & Humphreys, 1981).

It is also clear, however, that young children can be provoked into showing their own view, for instance, by stressing depth relationships before asking children to draw (Cox, 1978), or by making it important that the child communicate viewpoint information (Light & Simmons, 1983).

The issue of how children portray their view also crops up in the literature on the development of projection systems. Willats (1977) describes a developmental progression, beginning with the absence of any clear projection system around the age of 6 or 7 and proceeding through orthogonal and oblique projection to forms of linear perspective around 14 years. However, subsequent work indicates that choice of projection system is task dependent, even in adults. For instance, Lee (1989) showed that although Willats' sequence held when drawing from a model, there was little evidence that linear perspective was the end point of development when drawing from imagination. Instead, the majority of older subjects adopted oblique projection. From this, Lee concluded that viewpoint was an important determinant of the form of projection system used.

RATIONALE BEHIND THE STUDY

Oddly enough, viewpoint was rarely been directly manipulated. Although the child's view has differed between studies, being either eye-level (Light & Simmons, 1983), elevated (Bremner, 1985; Cox, 1978; Willats, 1977) or imaginary (Freeman, Eiser & Sayers, 1977; Lee, 1989) there have been few direct comparisons of drawings yielded from different viewpoints. Radkey & Enns (1987) compared end and side views of a two object array, but their study does not tackle the issue of how children's portrayal of depth relations is affected by viewpoint since their side view contained no relations in depth. To tackle this issue it is necessary to compare different viewing conditions in each of which there is a depth relationship to be portrayed.

The current study was carried out as a direct investigation of the effect on children's drawings of manipulating their view. In the case of younger children, it is particularly important to compare drawings produced from an eye-level view with those produced from an elevated view, since these viewpoints have been used singly in different studies but have never been compared in a single study. Eye-level viewing is, however, a rather special case in which further objects are often totally occluded. Thus it is also important to compare different viewing conditions in which all objects are at least partially visible. This should make it possible to assess children's sensitivity to which objects can be seen and also to how they appear from a particular viewpoint.

Over a wider age range, it is of interest to see whether different viewpoints prompt use of different projection systems. In addition, it is important to know whether children's projection system use is consistent within and between objects and whether changing the viewing angle has more effect on the system used to portray single objects than that used for relations between objects, or vice versa.

THE STUDY

Figure 1 illustrates the structure of the study. Children were asked to draw an L-shaped array of three cubes from one of three viewpoints, **eye-level frontal, elevated frontal**, or **elevated corner view**. In the **eye-level** condition children viewed the array horizontally and at right angles to the base of the "L", and so could only see the two nearer cubes. In the **elevated frontal** condition they also viewed at right angles to the base of the "L", but they looked down on the array so that a substantial part of the further cube was visible. In the **corner** view condition they looked down on the array and their viewing angle in the horizontal plane was 45 degrees to the left, so that the cubes appeared as a symmetrical V-shaped array.

Put Figure 1 about here

A total of 225 children took part, 45 in each of the age groups 6, 8, 10, 12 and 14 years. Within each age group 15 children were assigned to each of the three conditions. The number of boys and girls was approximately equal within each condition and age group.

Each child performed in only one viewing condition and produced only one drawing. In each

condition the instruction was as follows: "In front of you there are three blocks. Can you please draw what you can see of these blocks?".

CODING THE DRAWINGS

Each drawing was coded on the following criteria:

1. Number of cubes drawn (2 vs. 3)
2. Use of partial occlusion (yes/no)

In addition, several codings were made with respect to the projection system used. **Figure 2** illustrates the projection system classification, which follows that applied by Willats (1977) and Lee & Bremner (1987) with the addition of **horizontal oblique** and **isometric** projection. Firstly, drawings were coded in terms of the projection system used for single cubes and secondly they were coded in terms of the projection system used to show relations between cubes. In both cases, drawings did not have to embody the rules of one particular system in all their elements. In the case of construction of individual cubes, the most advanced system was identified even if it only appeared in one cube (a subsidiary analysis, not reported here, was performed looking at consistency of the system between cubes). In the analysis of systems used to show relations between cubes, the primary index was their relative placement on the page. However, the system used within cubes could also be informative. For instance, use of oblique projection for the two near cubes with the obliques in opposite directions so that they converged to a vanishing point was one indicator of an attempt at linear perspective to show relations between cubes (even though in this case linear perspective was not used within single cubes).

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put Figure 2 about here

RESULTS

Number of cubes drawn

Table 1 shows the number of children in each condition who drew three cubes. All children in the **frontal** and **corner** view conditions did so. However, an unexpected pattern emerged in the **eye-level** condition. The majority of 6-, 12- and 14-year-olds correctly showed only two cubes, whereas

the majority of 8- and 10-year-olds showed three cubes. This result may be best interpreted in light of the partial occlusion data.

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put Table 1 about here

Use of partial occlusion

Table 2 shows the number of children in each condition who used partial occlusion. In the **corner** view condition few used occlusion, not surprising since they viewed the array unoccluded from this position. In the **frontal** condition occlusion increased markedly at 8 years and continued to increase up to 14 years. In the **eye-level** condition the pattern matches that for number of cubes drawn - low partial occlusion at 6 and 14 years, but peaking to a high between at 10 years. Almost all children in this condition who showed three cubes used partial occlusion, very often only showing a very small part of the third cube. Possibly children around 10 use partial occlusion in this condition because this yields a relatively sophisticated drawing that is not too much of a violation of their actual view. Older children, it would appear, feel more constrained to showing their literal view.

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put Table 2 about here

Projection systems used to draw cubes

Table 3 shows the frequency of use of different projection systems in each condition and age. Only the major patterns indicated by the boxes are discussed here. Firstly, at 6 years the majority of children in each condition used orthographic projection. In the **eye-level** condition orthographic projection remains high at 8 years and is also high at 14 years, with a dip in between. This fits the pattern of earlier analyses for this condition, and the relatively high use of this system by the oldest children makes sense given that this is an appropriate system to use given the viewpoint. Drawings coded as oblique at this age usually included the inner side face of the right hand cube (see **Figure 3**) and thus produced an accurate representation of what the child could see. In the **frontal** view

condition oblique projection emerged strongly at 10 years and remained predominant from then on, whereas in the **corner** view condition isometric projection was the most frequent system from 10 years onwards.

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put Table 3 & Figure 3 about here

Projection systems used to show relations between cubes

The pattern of predominant systems in this case is very similar to that for within-cube systems, except that predominant use of horizontal oblique in the **frontal** condition and isometric projection in the **corner** condition comes in at 8 years rather than 10. Thus, at least in the case of the system to emerge as predominant, first use seems to be for portrayal of relations between cubes rather than for portrayal of the cube itself. This may be partly a matter of skill acquisition, since the application of a system within an object may be harder than its application to determine relative placement of different objects on the page.

Consistency of projection systems within and between cubes

Despite the similarity of the patterns between and within cubes, if we look within individual drawings we see that large numbers of children from 10 year onwards use a different system between and within cubes. Almost half of the 14-year-olds in the **eye-level** and **frontal** conditions used different systems between and within. Higher levels of consistency at 6 years may be put down to these children not possessing alternative systems. However, children were generally more consistent in the **corner** condition.

DISCUSSION

This study shows quite clearly that even the youngest children are sensitive to viewpoint. In the case of 6-year-olds this sensitivity appears at the basic level of number of items drawn, and it was only at later ages that viewpoint influenced the use of partial occlusion or choice of a particular projection system. As far as the latter is concerned there is clear evidence that older children use different

projection systems depending on their viewpoint, which supports Lee's (1989) argument.

The results in the **eye-level** condition are particularly interesting, with the peak in portrayal of three cubes and use of partial occlusion at 10 years and the fall off in both towards 14 years. This pattern can probably only be explained in terms of the child seeking a balance between portrayal of the array as it is and the array as it is seen, with developing skill as an added ingredient. Initially, children only draw two cubes, since that is what is seen. Cox (1986) suggests that young children draw what is seen without showing how it appears from their position, and it is possible that this happens partly because they lack the skill to produce a three cube drawing that would approximate to their view (although there is evidence that this age group can use partial occlusion, they may not be able to use it to produce a drawing that is at all close to their view). Later, increased skill in application of partial occlusion allows them to represent the array in a way that is not too great a violation of their actual view - using it to show only a small part of the further cube. Finally, older children appear to become constrained to their literal view, omitting the invisible further cube entirely.

Comparison of projection systems used within and between cubes indicates that within each viewing condition the predominant system is common both within and between cubes. However this conceals the fact that many children use a different system to portray relations between cubes from the system they use to construct individual cubes. So there is only limited evidence that even the older children are using a coherent system that applies to inter and intra cube relationships. The exception appears to be the **corner** condition in which consistency is high. This may have arisen because isometric projection produces a particularly good approximation to how the cubes appear and relate to each other from this viewpoint.

In conclusion, the strong evidence that viewpoint affected how children of all ages in the sample drew both single objects and relations between objects indicates the need to consider viewing angle more closely in future work. In addition, there is a need to investigate the relative contributions of viewing angle and degree of inter-object occlusion, factors that co-vary in real life and that were not separated in this study.

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TABLE 1

Number of children (out of 15) who drew three cubes

Age (years)	Condition		
	Eye-level	Frontal	Corner
6	3	15	15
8	9	15	15
10	14	15	15
12	9	15	15
14	4	15	15

TABLE 2

Number of children (out of 15) who used partial occlusion

Age (years)	Condition		
	Eye-level	Frontal	Corner
6	2	0	0
8	9	8	0
10	14	8	0
12	9	11	0
14	4	12	0

TABLE 3

Frequencies of different projection systems used within cubes. **Or = orthographic, Vob = vertical oblique, Hob = horizontal oblique, Ob = oblique, Iso = isometric, LP = linear perspective.**

	CONDITION																	
Age	EYE-LEVEL						FRONTAL						CORNER					
	Or	Vob	Hob	Ob	Iso	LP	Or	Vob	Hob	Ob	Iso	LP	Or	Vob	Hob	Ob	Iso	LP
6	13	0	1	0	0	1	15	0	0	0	0	0	15	0	0	0	0	0
8	9	0	2	3	0	1	6	7	0	2	0	0	4	2	0	6	3	0
10	4	0	3	1	0	7	0	4	0	11	0	0	0	0	0	4	11	0
12	6	0	0	2	0	7	0	6	0	8	0	1	0	0	0	1	14	0
14	9	0	0	6	0	0	0	1	0	11	0	3	0	0	0	0	15	0

FIGURE 1

The Three Viewpoints

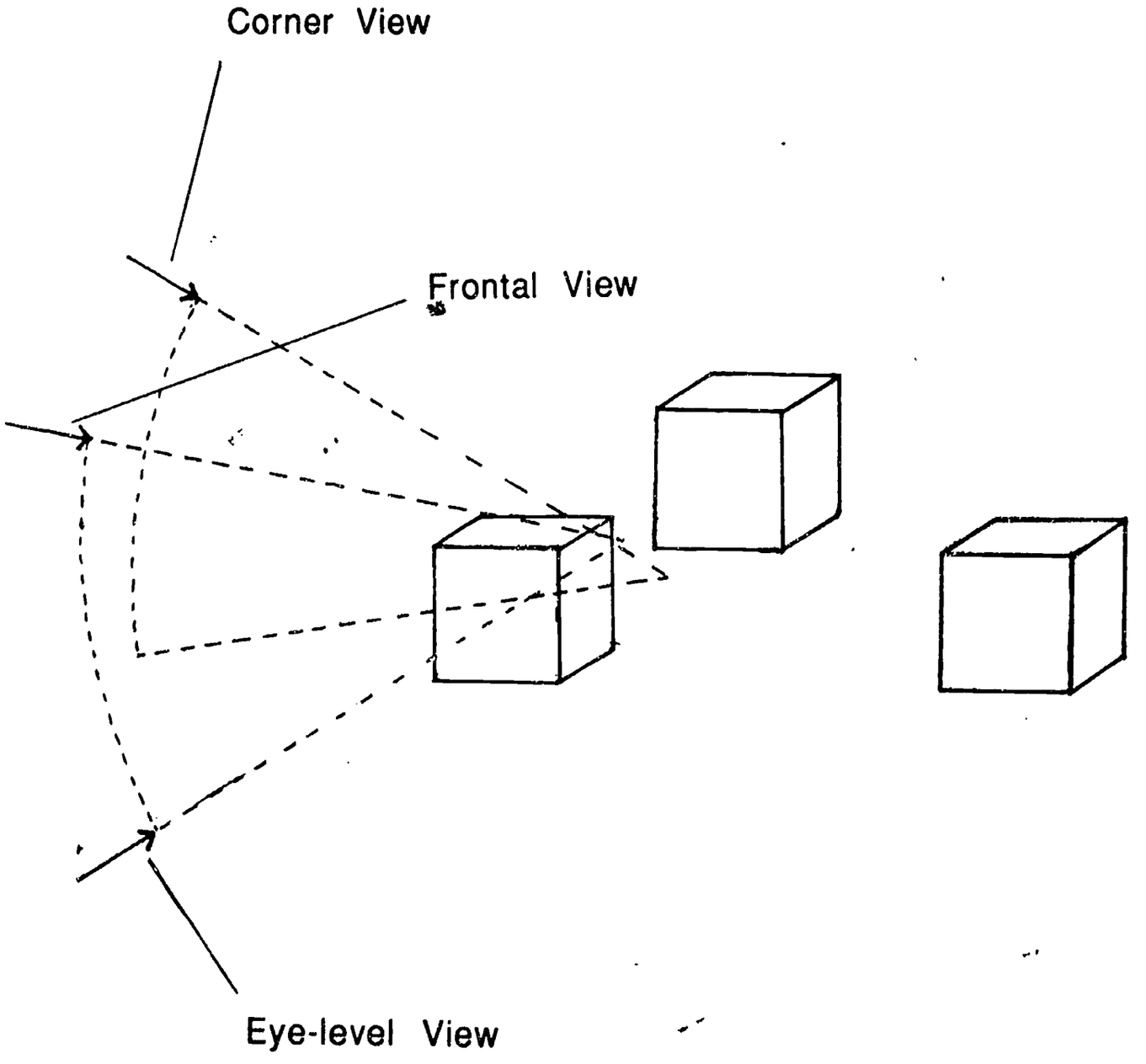
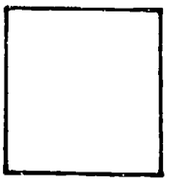


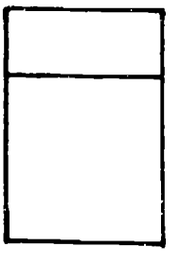
FIGURE 2

Projection Systems

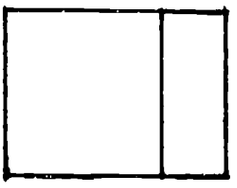
Orthographic



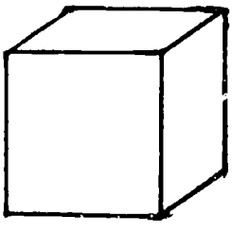
Veritcal Oblique



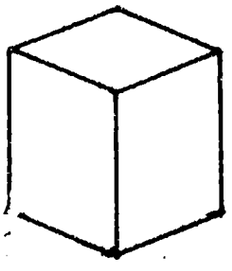
Horizontal Oblique



Oblique



Isometric



Linear Perspective

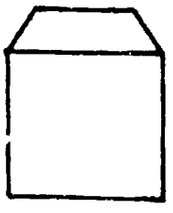
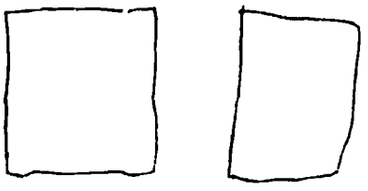


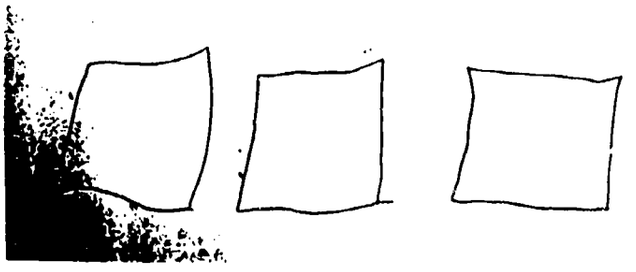
FIGURE 3

Some typical drawings

6-year old: eye-level

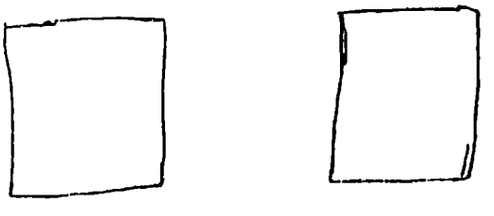


6-year-old: corner

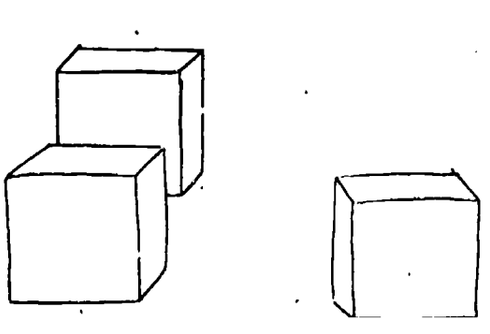


10-year-old: eye level

14-year-old: eye-level



14-year-old: frontal



14-year-old: corner