Responsiveness of Nigerian Students to Pictorial Depth Cues

G. S. Evans
G. M. Seddon

G. S. Evans is a chemistry teacher at Mpopoma Secondary School (P.O. Box 735), Bulawayo, Rhodesia, and G. M. Seddon is a lecturer in chemical education at the School of Chemical Sciences, University of East Anglia, Norwich, England. This study was conducted within a link scheme between the University of Lagos and the University of East Anglia. The authors thank the Inter-University Council for Higher Education Overseas, sponsor of the scheme, and the University of Lagos for their kind and generous assistance.

Because research has indicated that many students in the developing countries find it hard to understand depth portrayal in Western pictures, the authors tested three groups of Nigerian high school and college students for response to four pictorial depth cues. Their tests, which used ball-and-rod models originally devised for teaching chemistry, showed no one cue to be effective with all students. The students had more difficulty with cues concerning the relative size of objects and the foreshortening of straight lines than with cues involving overlap of lines and distortion of the angles between lines.

Pictorial and diagrammatic representation is very important in scientific and technical education. There are, therefore, serious implications to be drawn from a review by Miller (1973), who reports a number of investigations concluding that many people in developing countries have difficulty understanding the portrayal of depth in Western-style pictures. Research has indicated that Africans often see the spatial relationships pictured as two- rather than three-dimensional (e.g., Deregowski, 1968, 1969, 1971; Hudson, 1960, 1962a, 1962b; Mundy-Castle, 1966). While most of these studies involved primary school children or adults having little or no formal education, Nicholson and Seddon (1977) recently demonstrated that from 20 to 60% of very able children in Nigerian secondary schools had difficulty understanding diagrams similar to those used in textbooks to represent the spatial arrangement of atoms and molecules in crystals.

Figure 1 illustrates the use of four types of cues used to portray depth—an overlap cue, a relative-size cue, and two position cues (foreshortening of lines and distortion of angles between lines). Failure to understand the portrayal of depth implies difficulty with some or all of the cues. For example, a student may not understand the conventional significance of the cues or may not perceive that the cues are in operation. In either case it is important to determine which cue or cues are creating difficulty.

In 1963, Winter found that the overlap and relative-size cues used in accident-
FIGURE 1
Examples of Four Different Pictorial Depth Cues
(Failure to understand the portrayal of depth implies
difficulty with some or all cues.)

Relative size
cue

Overlap
cue

Foreshortened
line

Distortion
of angles

In the actual model being represented all the
spheres are the same size, all the rods are the
same length, and all the angles between adja-
cent rods are 90°.

prevention posters were not interpreted
correctly by Bantu industrial workers. Hudson (1962a) found that illiterate black
laborers had more difficulty than white
primary school children in South Africa in understanding foreshortening effects in
pictures of everyday scenes, whereas Holmes (1963) and Duncan, Gourlay, and
Hudson (1973) found that educated Ken-
yan adults and Bantu primary school
children, respectively, had no such diffi-
culty. In the latter case, however, the au-
thors admit that their testing procedure
failed to indicate clearly what the pictures
meant to the children (p. 176).

Duncan et al. (1973) also compared the
ability of European, Zulu, and Tsongan
primary school children to understand dif-
fferent combinations of depth cues. For one
set of pictures (Series A), which incorpo-
rated relative-size, position, and tone cues, they found that the proportion of Bantu
children who correctly understood the spa-
tial relationships portrayed was always
greater than the corresponding proportion
of European children. In the two cases in
which statistical analyses were reported,
the difference was significant at the .01
level. However, in another set of pictures
(Series B) that contained overlap as well as
relative-size, position, and tone cues, the
European children performed significantly
better than the Tsongan children. Duncan
et al. rationalize the apparent contradiction
in the two sets of results in terms of the
unsuitability of the pictures in Series A. For
example, in retrospect they consider the
Series A pictures atypical of those normally
found in educational textbooks (p. 177).
Kennedy (1977) is very critical of the man-
ner in which Duncan et al. scored the re-
sponses given by the Tsongan children to
the questions in Series B. In particular, he
considers that the responses interpreted by
Duncan et al. as showing a lack of pictorial
depth perception are actually the result of
too much pictorial depth perception.

The results of all these studies provide
very little clear or generalizable evidence
on which to plan remedial instruction at
secondary level and above. Hence the
present experiment attempted to deter-
mine which of the cues create difficulties
for students of different educational levels
in at least one African country, Nigeria. The cues of particular interest to the study
were the overlap, relative-size, and posi-
tion cues illustrated in Figure 1. Because
the position cue affects two essentially dif-
derent pictorial features—the foreshorten-
ing of lines and the representation of
angles—both these features were investi-
gated separately.

METHOD

We planned to construct four tests, one for
each of the four pictorial cues, so as to de-
terminate which cue was creating difficulty.

Subjects

We studied subjects from three different
student populations in Lagos, Nigeria. One sample comprised 85 first-year stu-
dents of an average age of 23, most of
whom were male, from the Faculty of Sci-
ence at the University of Lagos. The other
two samples comprised fourth-year stu-