SECTION 3

Understanding or 'reading' Schematic Representations

(Diagrams, organisational charts, maps, technical drawings)

24. In his long essay on communicating with illiterates, A. Fuglesang argues that certain concepts, on which the scientific approach to problem solving is based, do not exist among illiterates. He concludes from the tests carried out in Zambia that concepts of the conservation of mass, number and of area do not exist or are unstable, as are the concepts of a straight line, horizontality and verticality among illiterates. In general the determining factor for the development of such concepts is the educational stimulation of the environment and where the stimulation is lacking the basic symbol processes are lacking.

25. It may further be argued that some concepts do not exist in the language of the people. For example, there are in Lesotho, no concepts of area measurement and no generally used units of weights; while there are concepts of length and time these are based on units more situational than standard, varying according to what is measured, by whom and in what context. Sandra Wallman, the anthropologist who worked in Basutoland in 1963, reporting in Human Organization Fall 1965 Vol.24, No.3 on the communication of measurement in Basutoland (now Lesotho) where the problems of communicating with people whose conceptual framework is different from that of the person designing visual material, observes that "the tendency is to expect them to learn our way, to expect the illiterate peasant to adapt himself to the schooled man's thinking". Brian du Toit, of the Department of Anthropology at the University of Cape Town, argues strongly that language, itself a product of a culture, influences what the speaker perceives and the way in which he perceives it.

26. M.B. Goller working on programmed learning in Rhodesia, found that for African children the transition from the intuitive stage to the concrete operations stage as defined by Piaget, is unduly delayed, undoubtedly because they are compelled to live in surroundings which lack many experiences provided at home for children of the same age in other countries.* Thus if the type of concept formation that is necessary for scientific thinking and for the understanding of abstractions is lacking, the failure to understand a visual statement may be due not to a failure of perception but of thinking.

27. Professor P.A. Duminy points out in African Pupils and Teaching Them, published by J.L. van Schaik (Pretoria) in 1968 (page 70) "that the Bantu child, as the result of his being tied down to the concrete from his tenth year onward, does not readily develop more analytical and systematic thinking as is common with the European child. There is a handicap in the development of thought into the more abstract levels of consciousness. If this is so, the most important reasons will be the nature of the environmental influences, lack of sound didactical methods during early years at school, and language factors."

28. Studying the development of spatial concepts in Zulu children between five and twelve years of age, J.J. Cowley and M. Murray found that the

* Quoted by D.G. Hawkridge in Programmed Learning and Problems of Acculturation in Africa.

performance of the Zulu children was below that of the white children, though a similar sequence of development was present. Whether using cardboard models, pictures, questioning or drawing, the difference was marked. The authors accept that the language structure of the cultural group may influence and sometimes limit the ability of that group for logical thinking, but urge that by studying children's own representation of the environment the development of a culture can be followed and observations can be systematized. On closer study we find that the development of concept formation and understanding of spatial relationships are subtly interwoven with the effects of social environment as a whole, especially in the early years of childhood. Language is of course part of that environment. In an essay on Cultural Variations in Cognitive Skills published in Cross Cultural Studies edited by D.R. Price-Williams, (Penguin Books 1969) J.J. Goodnow concludes on page 256 that "one of the sharpest differences among cultural groups may lie in tasks where the child has to carry out some spatial shuffling or transforming, in his head, without the benefit of actually moving the stimulus material around. People with little formal schooling in the Western sense often make great use of action and direct manipulation of material and this may account for the well developed sense of spatial relationships among Eskimos." In his study Intelligence and Cultural Environment published by Methuen, in 1969, Professor P.E. Vernon concludes on p.217 that "certain types of visual discrimination are strengthened in environments where they are important for survival. Perceptual development seems to depend to a greater extent on social norms, education and acculturation. The deficiency which many African peoples have in interpreting three dimensional pictures and with analytic perception of figures is not found among quite backward groups of Eskimos. The explanation seems to lie in lack of visual kinaesthetic-experience and of encouragement of play and exploration throughout childhood, though it may be remediable by appropriate training."

29. As earlier, we may profitably note some general conclusions about visual aids put forward by M.D. Vernon. On pages 112 and 113 of Psychology of Perception (Penguin Books 1962), she points out that "it is customary to show children pictorial charts illustrating successions of historical events; or related geographical features; or technical processes in science or in manufacture. The meaning of these is not always obvious to the children. Many of the charts used in schools are too crowded and complicated for children to understand even after they have been explained."

30. Yet, accepting that teachers frequently misjudge the ability of children to understand either the concept or its schematic representation, Hawkridge finds that in addition Central African children have a particular disability relative to European children with respect to schematic presentations. In the course of empirical testing and revision of a linear programme on Simple Contours, designed to teach African pupils in the first year of secondary school to read simple contour maps, he found the verbal aspects of the programme were successful but that the visual aspects were significantly less so. The final objectives were to draw a cross section of simple vertical land forms, for example a conical hill, and to translate into words a two-dimensional contour representation of a three dimensional land form, (the conical hill). The majority of the African pupils could not identify the sketch nor could most of them draw a reasonably correct simple cross-section, but a significantly greater proportion of European pupils were able to deal successfully with these questions in the programme.

31. The indications are that through environmental factors operating from the earliest years, these pupils had not developed the capacity, required

in these schematic presentations, to translate the two-dimensional diagram into three-dimensional "pictures in the mind". Seeking experimental evidence in support of such an hypothesis, we find the seminal work of Dr. W. Hudson. In 1960 he completed the first of a series of studies on pictorial perception with the objective of examining the responses of various cultural groups in Africa to representational cues in depth. His findings were published in some detail in the Journal of Social Psychology in 1960 and discussed at the Scientific Council for Africa South of the Sahara conference in Lagos in May of the same year. The conference paper was published in Psychologia Africana in 1962, in an article entitled Pictorial Perception and Educational Adaptation in Africa. A later paper, The Study of the Problem of Pictorial Perception among Unacculturated Groups, published in International Journal of Psychology in 1967, draws on the same experimental data and correlates them with findings from some other studies. His evidence is conclusive and unequivocal - the perceptual determinants are cultural, not educational. Formal education has a contributive function, but is subordinate to other cultural factors in the environment. Dr. Hudson maintains that informal instruction in the home and habitual exposure to pictures play a much larger role in developing pictorial depth perception than schooling does.

32. Following Dr. Hudson's lead and using four of the pictorial depth perception tests devised by him, A.C. Mundy-Castle studied the problem among Ghanaian children aged between five and ten years and came to the same conclusion - that cultural stimulus is critical for the development of pictorial depth perception.

33. The readiness to 'see' three dimensionally is of great importance in many stages of "Western" learning and particularly so in applied arts, building trades, and all manner of technical crafts. As indicated above, attention has been paid since 1960 to the ability of African pupils to understand drawings intended to be seen three dimensionally. More recently, Jan B. Deregowski using the tests devised by Hudson and, in addition, a set of drawings from which his subjects were asked to construct little models of bamboo splints and plasticine, came to the conclusion that the inability of his Zambian school boys and house servants to construct correct three dimensional models could not easily be attributed to lack of manual dexterity. We would agree; after seeing the film Toy Making in Africa* (available from Professor L.J. Lewis, University of London Institute of Education) there can be no doubt that boys in Central Africa at any rate, have high manual dexterity. The Zambian pupils and adults recognized the three dimensionality of the drawing but distorted the relative arrangements of the diverse parts. "Hence it may well be that the subjects do not fail to see depth because they fail to recognize the depth cues as such, but rather because, whilst looking at the pictures, they restructure them by allocating lesser importance to depth cues than to other elements". Dr. Deregowski goes on to suggest that if these cues are given sufficient prominence in the drawing the learner pays attention to them and they are taken into account though the objects in question may be novel to the learner.

34. Two further indicators of the importance of this aspect of depth perception and the compensatory educational provision that can be made where it is desirable to develop the skill, come from the work of Schwartz and of Dawson. P.A. Schwartz developed aptitude tests for use in developing nations. In the course of his work he modified a test called Three-Dimensional Visualization test into the Boxes Test, described in a paper published in

* This shows models of trains and motor vehicles made by boys, out of bits of wire.

1964. The person being tested has to visualize cubes drawn flattened out, which is closely related to the reading of technical diagrams, and the evidence from the work Schwartz did in Malawi suggests that pictorial perception must be explicitly taught. In support of this notion we find the evidence submitted by J.L.M. Dawson in a doctoral thesis (Oxford University 1963) that pupils given a six month training period in three dimensional perception improved dramatically in their ability to 'read' pictures of this kind.

35. To sum up, it is generally accepted that environmental factors including language, operating from the earliest years, may retard conceptual development including spatial abilities, vis a vis Western 'norms'. For this reason, diagrams and three dimensional technical drawings are not understood. But special training in spatial perception, may remedy a situation which makes the adaptation to a technological society difficult.