Design Education Research Note 5

An Introduction To Non-Verbal Aspects of Thought

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We cannot but suppose that the future developments of thinking are of primary importance to the development of the human species..... The possibilities open to thinking are the possibilities of recognising relationships and the discovery of techniques of operating with relationships on the mental and intellectual plane such as will in turn lead to ever wider and more penetrating significant systems of relationship.

Benjamin Lee Whorf (1956)

Recurring pleas in education for the recognition of a neglected aspect of human intelligence and communication have variously manifested themselves in a number of discipline areas. For example in Design (Archer, 1979), in Geography (Balchin, 1965), in Art (Read, 1943; Arnheim, 1970), and in Technology (Ferguson, 1977). The pleas are not a modern phenomenon. Froebel, Montessori, Dewey and Itten, amongst others, have attempted to structure educational experiences to provide for a balanced development of all aspects of intellectual activity in their students (See Cross, 1980). However, concern recurs increasingly in those areas where the intellectual processing of visual-spatial perceptions and the non-verbal communication of these perceptions occur. Many if not all of the subjects which fall under the 'Design' umbrella are concerned with teaching material associated with these aspects of human thought and communication.

The aim of this paper therefore is to review some important ideas which contribute to an understanding of these neglected modes of thought and communication. Hopefully these ideas will serve as a guide or basis for a restructuring of teaching/learning experiences in Design Education which will recognise and accommodate what appears to be an educationally neglected and fundamental aspect of human behaviour.

Graphicacy

'Graphicacy' is a term which refers to the educated counterpart of the visual-spatial aspect of human intelligence and communication. It is a word which was coined by two geographers, W.G.V. Balchin and Alice Coleman, who were attempting to draw attention to what they considered a neglected and basic area of education (Balchin and Coleman, 1965). Essential to their argument is the difference and distinction in education between 'Underpinning' or 'Foundation' and 'Superstructure.

"Underpinnings or foundations are that part of education on which the superstructure must rest. They involve teaching the individual child to communicate and receive communications; they are the media of communication that the child learns. The superstructure is the content that is taught through these media".

The underpinnings are therefore vehicles for that greater part of education - the superstructure-which is essentially a range of subjects, qualities and attitudes.

Within this context, therefore, Balchin and Coleman raise the question of whether the commonly accepted underpinnings of literacy, numeracy and verbal articulation, provide a wholly adequate foundation or set of media for communication. They decide that although emphasis in education is placed upon the acquisition of these particular learning media, they are inadequate. Their decision is based on the awareness that other, more suitable forms of communication are resorted to in particular situations. For example:

(a) the owner or designer of a house will use a plan to describe its layout.
(b) the mathematician will use a graph or diagram to describe an abstraction when numbers are inadequate.
(c) the historian may resort to a picture.
(d) the geographer will use a map or a photograph.

Balchin and Coleman therefore argue that skills in the communication of relationships - especially visual and spatial relationships - complement basic skills in literacy and numeracy as foundation media in education.

Calling this particular skill range 'Graphicacy' (since the syllable 'graph' is common to many of the names for visual aids, e.g. graphs, photographs, cartography, the graphic arts, etc.), they claim that, unlike the other basic media skills, graphicacy does not begin to have much encouragement in British schools until the age of seven or eight. This is despite evidence which suggests that graphical talent appears to be more spontaneous than writing or number. Young children, it is observed, draw spontaneously and accurately, essentially recording information in a symbolic manner. Bloomer (1976) supports this view that children demonstrate a natural tendency to record visual information by graphic means.

"They are strongly motivated to represent the most important characteristics of the object in question. In doing this, children usually draw objects from the viewpoint that gives the most information. A wagon for instance would be drawn from the side in order to show the wheels, hood and shape, whereas a house would be drawn from the front". (Bloomer, p.60).

Gardner (1980) shows how childrens drawings demonstrate shifts in perception, mood and skill levels and are therefore capable of communicating rather more non-verbal information than is often appreciated. Advocates of Graphicacy, however, appear to draw a line against this level of perceptual analysis. They maintain that Art as a subject does not seem to have risen to the challenge and accepted responsibility for the development of basic graphic skills. And they see its overwhelming emphasis to be upon encouraging the subjective, expressive development of the individual, at the subsequent expense of his/her technical ability (Coleman, 1968).

Balchin (1965) recognises a deficiency in basic educational provision which he acknowledges has repercussions in many discipline areas. As a geographer he sees the deficiency as it relates to his own particular field. He has suggested that as an undeveloped field of communication skills, graphicacy might embrace the following concepts and skills:

(a) appreciation of direction and distance
(b) appreciation of size, shape and area
(c) linear and angular measurement
(d) space relations and map forms
(e) appreciation of scale
(f) conventional signs
(g) colour distinctions, pattern recognition
(h) mathematical graphs and their interpretation
(i) use of co-ordinates
(j) map projection and art projection
(k) perspectives in field sketching and photography
(l) perspective in area reproduction
(m) map making and map interpretation
(n) photogrametry
(o) colour, radar and infra red photography
(p) computer graphics
(q) remote sensing devices

If, therefore, Graphicacy does embrace this list, it is clear that a pupil's acquisition of such skills is at present fortuitious rather than by any careful planning. Even the geographers do not attempt any early systematic coverage of the whole list presented here. However, the concept of Graphicacy in geography has influenced to some extent the nature of teaching geography to young children. Cole and Beynon (1969) in their 'New Ways in Geography', a series of school text books, attempt to introduce foundation work in the concepts of size, shape, direction, conventional signs, measurement, colour and pattern distinction, etc. (Also Kurt Rowland's books might be mentioned, although they relate to the art field.)

Coleman (1968) draws attention to the importance of the visual - spatial ability in the study of Geography and the extent to which its development in children is neglected by current educational practice. Maps, diagrams, pictures, patterns and models which enable the manipulation of information is, she says, an area of activity so vast in scope that it has hitherto been accommodated in a piecemeal fashion in education. Coleman distinguishes between the 'incoming' or reading aspect of graphic communication and the 'outgoing' or writing aspect of it in education. She maintains that whereas the visual aids movement has to some extent promoted some progress in the former, the writing aspect remains neglected, especially by present discovery methods of teaching.

The rest of her argument, whilst recognising that integration of the two aspects is necessary, proposes a reversal of what are commonly known as child centred approaches in teaching, and suggests a return to more formal techniques of training youngsters in graphic skills.

Clearly some consideration of method in teaching is necessary if the development of the visual-spatial mode of thought and graphical communication is to be encouraged in children. However the manner in which we attempt to formulate ways of proceeding in the classroom need not necessarily be so prescriptive. Classroom procedures ideally are informed by and depend upon a thorough examination of what is known of in this case, the nature of non-verbal thought processes and their many forms of expression.

The emphasis placed upon the achievement of technical competence in graphic skills advocated by proponents of Graphicacy may in effect be erecting undesirable and false barriers between the concept itself and its relationship with other fields, especially Art. The view of Balchin and Coleman (1965) is that:

"It can be said that Art is a form of self-expression, and communication a skill that involves both an expressor and an expressee. Great Art includes both. Graphicacy however includes only the skill aspect. It is the communication of relationships that cannot be successfully communicated by words or mathematical notation alone".

It would seem to be a simplistic notion that the skill aspect of communication can be taught independently. Such a notion may actually be inhibiting to the development of the concept in terms of education and teaching. After all, Technical Drawing for Geographers may in this instance fill the empty slot in education. If, however, emphasis were to be placed upon 'the communication of relationships that cannot be successfully communicated by words or mathematical notation', Graphicacy assumes a different complexion. It becomes to the educationist a concept wherein equal emphasis is placed upon the perception, understanding, intellectual manipulation and appropriate representation of non-verbal, non-numerate relationships and ideas.

Non-verbal Perception and Communication

Since the word 'Graphicacy' was coined in 1965 much research and written material has been produced which has helped to clarify and expand the concept and which clearly demonstrates the extent of its inter-disciplinary implications. Some of this work addresses itself to those areas in particular disciplines where educational deprivation manifests itself. Often this points to the necessity for the early cultivation of non-verbal thinking and communication skills. There is in fact a considerable body of ideas and research which forms the more generalised field of non-verbal thought, perception and communication. This work stems from a wide field, drawing in psychology, neurophysiology, art, education and linguistics.

Historian E.S. Ferguson (1977) has attempted to demonstrate and clarify the nature of non-verbal thought processes as evidenced by the practice of technologists and physical scientists since the Renaissance. He draws attention to the many drawings, pictures and books that have both recorded and stimulated technological developments. Also he reviews the many graphic inventions (such as perspective drawing) that have served to systematise, communicate and thereby exchange non-verbal information.

For example, Leonardo Da Vinci's sketch books and Franceso di Giorgio Martini's 'Trattato Di Architettura' contain whole series of drawings recording sequences of non-verbal reasoning in pictorial form. This mode of thinking Ferguson calls the 'non-scientific component of design' and he maintains that it is a primary component of any design

activity and that it has little educational status beyond the kindergarten.

Ferguson's primary sources are themselves essentially pictorial. His research project is aimed at learning more about the function of technical drawings and illustrations, how they were diffused, who used them, how, and with what results. His research method required and utilized many of the same non-verbal, visual skills and thought processes which produced the original source material.

Ability to read pictorial information, to understand, interpret, infer or deduce from visual cues is therefore a prerequisite for this kind of historical research and as such becomes a highly disciplined activity. Nor is this non-verbal activity confined to two-dimensional visual cues. Buildings, landscape vegetation, any aspect of the environment in fact, can reveal vast amounts of information associated with its past history and present nature.

The Art Theoretician Arnheim (1970) has focussed upon visual perception as a central and hitherto underrated function of thought and intelligent behaviour. Arnheim considers as erroneous the traditional views prevalent in art theory and aesthetics, which have repeatedly drawn sharp distinctions between the processes of intelligent thought and sensory perception. He maintains that the erroneous assumption is that thought begins where the work of the senses leaves off. He proposes instead that perception, in particular visual perception, is itself a cognitive activity, fully integrated with congitive processes of thought.

Cognitive Mapping

Almost in direct contrast to the rather limited interpretations and prescriptive evaluation of spatial thinking in the geographers' 'Graphicacy' concept. Stea and Blaut (1971) probe more deeply into its nature. Writing from what they term 'the benevolent wing of "the new Geography", ' they show that it is rather more complex than merely teaching children to draw maps and diagrams. Even traditional views of learning as developed within academic psychology throw little light upon the nature of the process, they maintain.

This work introduces the concept of cognitive maps (Stea, 1971). These are internal mental representations of geographical space which might be thought of as 'hologram models'. The mental hologram is constructed from the sensual and visual perception of information. The process of this construction Stea terms cognitive mapping. Stea writes of cognitive maps that "We have reason to believe that they are evolutionary, adaptive and therefore pervasive, featuring in the spatial orientation of all humans and highly mobile animals are learned but largely untaught, that they depend upon more than simple visual-motor co-ordination (since they also appear in the blind), that the capacity to utilize them develops with development of the organism, that they have a neurophysiological basis and that the neurophysiological basis is likely to be more strongly represented in one hemisphere of the brain than in the other."

The work of Stea et al, places the consideration of the visual/spatial ability in humans into a much wider field than subject disciplines such as Geography or Art can encompass, and puts the role of sensory perception into a prominent position.

Cerebral Lateralisation

Studies in neurophysiology cited by Edwards (1979) and McKim (1980) provide sound evidence for accepting the idea that'non-verbal ways of knowing' and communicating are as complex and productive as (possibly more so than) the more rational, systematic and deductive forms of thinking associated with 'scientific' procedures.

Brain research has, during the past fifteen years or so, revealed a duality of process in brain function. The cerebral hemispheres forming the brains of human beings are known to develop in an asymmetrical fashion in terms of function. The right or 'minor' hemisphere was until recently generally regarded as less advanced - less well evolved - than the left or 'major' hemisphere.

However, recent investigations involving 'split brain' patients (epileptics who have undergone surgery to sever the connecting cable of nerve fibres between the left and right cerebral hemispheres) have shown that both hemispheres are involved in higher cognitive functioning. The interesting thing to note is that each hemisphere appears to specialise in different modes of thinking, both of which involve equally complex processing procedures associated with distinctly different perceptions of reality. The mode of processing of the left hemisphere is known to be predominantly verbal and analytic, whereas that of the right hemisphere is believed to be more rapid, whole-patterned, spatial-perceptual, global and non-verbal. Further research has indicated that although the separate functions of the brain often complement each other, in many respects they can also interfere with each other. It is not possible to operate both distinct kinds of functioning processes simultaneously.

The suggestion has been made (Levy, 1974) that this interference factor may be an explanation for the evolutionary asymmetry in the development of the brain. (The most noticable behavioural manifestation being 'handedness' - 98% of people demonstrate 'left' hemispherical dominance by being 'right handed'.) Certainly the traditional emphasis in education has been upon the verbal and numerical aspects of thought, reasoning and communication, all of which are associated with left brain processing operations. The implications here are such that what has recently been described as a neglected area of education becomes almost the total neglect of one half of each individual's potential ability.

Verbal language: an inhibiting factor in Design?

Bruner (1971) indicates how language is often used to hint at a more mysterious aspect of human capability which historically has been shrouded with myth and superstition.

"I have been enchanted by the fact and the symbolism of the right hand and the left - the one the doer, the other the dreamer. The right is order and lawfulness, 'le droit'. Its beauties are those of geometry and taut implication.....it is adept at technique and artifice..... Of the left hand we say that it is awkward".

The left hand is associated with 'sentiment', intuition, and the sinister - left handed people are known as sinistrals. Bruner maintains that these classifications point to an artificial separation of two distinctly different modes of knowing which effectively cripples the contemporary intellect. Language itself can be seen to be instrumental in maintaining this separation or at least is inhibitive of their interaction.

As presented in Bruner's view, verbal language is the means whereby individuals are enabled to simplify the mass of complexity internally perceived. It enables them to externalise about events, thereby preventing isolation. He recognises that 'externalisation' can take place in many forms, e.g. embodiment, representation, symbol, metaphor and myth as well as sorting and classifying. But a benefit of verbal language is that it contains an inbuilt ordering or systematising component which provides a viewpoint from which to simplfiy complex perceptions.

Language studies by Whorf (1956) clarify this notion and provide insight into thought processes difficult to perceive outside our culturally influenced view point. A major hypothesis of Whorf's is that the structure of language one habitually uses influences the manner in which one understands or perceives the environment. He shows by analysis of American Indian languages and their comparison with other languages, e.g. English, French, how perceptions differ or shift between cultures according to the structure of the language used.

"Every language is a vast pattern system, different from others, in which are culturally ordained the forms and categories by which the

personality not only communicates, but also analyses nature, notices or neglects types of relationship and phenomena, channels his reasoning and builds the house of his consciousness." (Whorf, p. 252).

For example the word 'red' in English indicates a 'colour' and even covers a range of 'shades'within that colour band. The Hopi Indian word for 'red' also indicates the sensation of 'red' by including in its meaning an expression of the channel of perception which results in the consciousness of the individual to 'red'. Another example given by Whorf concerns the meaning we give to the English word 'wave' (water). The equivalent translation in English for the Hopi word 'wave' is 'slosh', which gives a more sensory description of the qualities of water movement in mass.

In this way Whorf's careful analyses show how the structure of the Hopi language permits simultaneous expression of perceptions from various aspects. It allows or directs a 'global' view of the environment in that the thoughts of a Hopi are seen to include and express both sensory and rational knowledge of form, space and time, since in his world view none are found in isolation.

Whorf comments

" Does the Hopi language show here a higher plane of thinking, a more rational analysis of situations than our vaunted English? Of course it does. In this field (time/space sensory perceptions) and in various others English compared to Hopi is like a bludgeon compared to a rapier."

In comparison to 'global' languages then, English emerges as a device for a formal systematisation of ideas and clearly is inadequate as a medium for many of the complex but ill-defined thought processes so far considered.

Some Implications for Design Education

It is beyond the scope of this paper to present 'patterns' of classroom procedure for Design Education, however necessary that may be. Such patterns would depend very much, for instance, upon the age range of the students involved. Also some consideration of the teaching content of other subjects within a school curriculum is necessary to prevent overlap. Since the range of non-verbal communicative devices extends from archaeology to ballet, some deeper thought is required as to exactly how much of the total range 'Design' is reponsible for within the school curriculum.

However, in infant and primary schools the interdisciplinary approaches to teaching would clearly favour the introduction of more non-verbal communication devices alongside present teaching demands . In the older age groups it may be necessary to be more selective about subject content in Design.

The points to be drawn from the ideas presented so far have many implications for the teaching of Design subjects in schools. Clearly if the nature of verbal language used by an individual can actually determine the nature of that individual's perception of the world (as Whorf suggests it does) then teachers of design ought seriously to consider the inhibiting effect which English must have upon the development of visual/spatial thought in children. Conscious and cautious use of verbal language, in conjunction with other 'modelling languages' may be needed of teachers who are sensitive to the need to encourage 'global' views in students.

Teaching procedures might consciously attempt to initiate 'right brain' cognitive functioning by the provision of direct experiences involving sensory perceptions, linking these directly with appropriate forms of representation

Without exploring the range of appropriate material for teaching too closely it would seem necessary that Design teachers should be proficient in a number of non-verbal communication skills, and competent in a good many more.

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