

The Processes of Sorting and Matching:

as Mental Operations Generating New Experience

in Child Development

by

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A Personal Note

My attempt to describe the essential constituents of early human learning and development, as a dynamic and inevitable pattern of growth, began in about 1960 as a resolve to learn something about the development of young children by direct observation.

Although I was aware of the existence of a literature on this topic, and had read a little of it, I decided to make my own observations first, then reflect on them and only much later to read what other people had said.

After several years of casual but careful looking at children in public and private places, on buses and trains, in parks and waiting-rooms, nursery and infant schools and the houses of friends, I was able to work with two hundred or so backward and 'brain-damaged' children in whom variations on the more usual patterns of development could be studied during my everyday work as a doctor.

In this way, by observing normal and anomalous behaviour, and by speculating on possible learning and behavioural growth mechanisms, I inevitably began to build and test hypotheses.

It is, of course, more usual to approach a subject by first critically studying the work of others; however, there are advantages to be gained, especially when one's concern is with the origins of understanding, in collecting and collating first-hand information.

On the other hand, a disadvantage of developing ideas in isolation, and the source of some vexation to me, is the accompanying need to develop a suitable terminology, a satisfactory means of communication, for the notions are unlikely to be directly comparable with those of others. In due course I hope that my ideas will be compared and contrasted, by myself or others, with those of workers such as Gesell and Piaget.

These ideas have been developed in association with the practical teaching of normally and abnormally developing children. The initial ideas immediately suggested how the growth of understanding might be actively encouraged and the early experiments soon gave rise to an approach to teaching differing considerably from current practices.

Almost inevitably, or so it seems, the focus of my professional interest moved from the neurological problems of children to the educational needs of such children, and then further to those of all children and young people.

For twenty years the ideas have been developed in association with my daily work with children with all kinds of learning difficulties. This has provided a living laboratory for observation and experimentation. However, I now feel the time has come for me to set them down as a scientific theory, stating my definitions and axioms, and formulating testable hypotheses.

Geoffrey Waldon, 1985.

Abstract

This paper represents part of an ongoing study to prepare an interpretative description of the learning and development of general understanding in the child.

The aim here is to introduce two components of the experience gathering process, essential to the development of general understanding.

Sorting and matching, as here defined, are forms of observation by means of which general understanding interacts with its surroundings, either to:-

- (i) Generate experience which adds to and increases the effectiveness of the general understanding through its observations; or to
- (ii) Promote immediate survival. To this end sorting and matching take the form of simple or complex behaviours, designed to take care of everyday needs - finding and eating food; getting or making and donning garments; and using tools.

Before defining and discussing sorting and matching, the immediate context is extended somewhat to introduce the notions of individual survival and biological specialisation.

Having treated of sorting and matching and their particular roles in the creation of experience, an attempt is made to locate their place in the wider field of understanding, and to outline the way in which the state of understanding changes as new experience is created.

1. Introduction

Childhood is a period of preparation for survival as an independent and interdependent member of society.

During this time the child gathers experience of the world and stores it in such a manner that it can be used thereafter to obtain fresh experience, to acquire food, covering and shelter, and to communicate with, make use of and protect other people.

This whole programme is directed and carried out by the developing general understanding which acts on the outside world through the direct links here called observations.

1.1 The Question of Terminology

"The question is", said Humpty Dumpty, "which is to be master - that's all".

Lewis Carroll.

Words can mean all sorts of things, and they often mean rather different things to different people. A language derives flexibility from consisting of elements each with a range of possible variants of meaning; however, it is sometimes necessary to pin down a rather more precise definition for some particular purposes, even at the risk of this definition's being somewhat at variance with the experience of some people.

It is sometimes necessary to 'label', so as to help to draw attention to ideas or behaviours which have hitherto most probably been taken for granted. For this purpose one might use a simple code name, coin a neologism, or re-define a word in common use, which coincides more-or-less with the intended definition.

This latter option is the one I have adopted in calling two closely related human behaviours by very familiar names: sorting and matching.

'Sort' and 'sorting' are words which commonly imply a bringing together of things into separate classes or 'sorts', or the imposition of order on a state of confusion ('sorting out'), by arranging things and behaviours according to some system of classification. It is the former use that my primary definition is related to but, as will be seen, the other uses are corollary to the first.

'Match' and 'matching' in everyday use are words somehow implying equality or balance. Sometimes it is equality in similarity, so that, so as to merit the label 'match', their similarities must correspond in every way. They must be equally alike, exactly similar. The words are also used to imply a balance of dis-similar, but somehow equivalent or complementary, things.

Here it is the former use which I am basing my definition on, but since identical or exactly similar implies that every component, point or aspect of one pattern has been put into equivalence with its counterpart in the other(s), (a contingency rarely to be met with in practice), it would be difficult to distinguish the 'almost identical' from the 'identical' without continual reference to possible difference.

One practice looks for similarities, any points or patterns of correspondence; whilst the other looks for differences, any points or patterns of non-correspondence. The two processes, sorting and matching, are therefore operating in opposite senses, and it seems to me rational to define one process in positive and the other in negative terms.

Other key words used in this essay were chosen in this way to be in keeping with at least one standard usage. All such words are defined within the text and/or the glossary. The everyday meaning of most words is, however, entirely adequate to my purpose. 'Assimilate', for example, meaning 'to convert into one's own substance', or 'to transform into one's own likeness', precisely describes the enrichment of the understanding by the conversion of raw experience into itself or its own substance.

1.2 Survival

However we interpret the fact of human existence, the recognition that we share an in-built tendency with all other living things to perpetuate our existence, is inescapable. Within the behaviours of animals, especially those animals which are sufficiently like ourselves for us to identify with them, we seem to discern a deliberate striving, not only to survive, but also to seek after pleasure and to avoid pain.

These seem to be the guiding principles in the life of the higher animals; constant struggle for existence by satisfaction of the appetites and the pursuit of pleasure.

Highly specialised organisms such as the malarial parasite, the honey bee, the frog, the spiny anteater and the wildebeest are, as individuals, extremely vulnerable to change. Such species survive successfully by relying on small size and/or relatively unchanging environmental conditions, and on very large numbers within which each member is equally important.

Relatively unchanging environments clearly favour the specialised creatures as does the related factor of small size. As an animal gets bigger its internal environment (see glossary) inevitably becomes distinct from, and partially independent of, the external one. Ways have evolved of maintaining equilibrium within the animal's body, well insulated from the exterior by a skin barrier; however, slow change in the environment, such as might occur in the marine world, which allows time for adjustment, remains an advantage.

Survival in the face of rapidly changing conditions requires such aptitudes as, foresight and flexibility, enterprise seasoned with caution and an ability to learn from experience, which are characteristics of the less specialised organism.

The animal which has opportunity and time to learn these aptitudes, and can learn quickly, can adapt to unexpected situations and conditions. Such an animal has much greater potential for individual survival, within varied surroundings, than one which exactly and comfortably fits a particular, relatively unchanging, environment.

Man differs from all other animals, including his closest relatives, primarily in his extremely low degree of bodily specialisation. His understanding, which I am attempting to show is the product of his bodily activity, is equally unspecialised, or 'general' as I prefer to call it.

The unspecialised activity of the unspecialised human body creates from experience an understanding associated with a high level of self-awareness, the ability to consciously co-

operate with others and a capacity for constructing conventional languages as means of facilitating interpersonal communication. Man, as an individual, has consequently come to possess by far the most successful means of survival on earth.*

This general understanding is in form, genetic sequence and function, common to all humans. The ways in which it grows and develops is the central topic of the interpretative description being framed and of the present essay. In this essay our concern is the part played by the operations of sorting and matching in the generation of experience and the way in which the child proceeds from 'not understanding' to 'understanding' a notion.

1.3 Man as Creator of Experience

A living organism is guided and controlled in its actions by its general understanding, which might be thought of as the centrally organised abstraction of, and as containing a set of blue-prints for, all its currently possible behaviours. This general understanding is itself subject to change, as the range or balance of currently possible behaviours changes.

Each component behaviour or observation, each organised act directed towards the environment, in acting within this surrounding space, stirs up forces of change, within both the organism and the environment. Evidence of the forms of these forces may be detected as activity-patterns within the sensory receptors of the organism. These are compared and contrasted with those 'stored' from previous encounters as experience organised dynamically as a source of observations - the general understanding.

To survive, an organism must be an experience-generating machine. The experience need not be new. It may consist merely of the feedback of the information that the observation did occur and that the expected effects on the environment did actually take place.

The primary function of such seemingly stale experience may be little more than the signalling to the organism that it does continue to exist, but by recapitulating - or rehearsing the essential basis of the current understanding it also excites and maintains a sufficient background of preparedness for new learning, whilst preventing the fading anamnesis of the already established understanding. Such information I call confirmatory experience.

* The success of a species may turn on frequent mutation among copious numbers or on the adaptive qualities of each individual member.

This continual rehearsal of the basic understanding is particularly important in keeping the physically-based understanding in step with the changes in bodily size, shape and strength during normal growth. Novel or creative experience, on the other hand, also being 'fed-back' to be assimilated into the understanding, not only performs these functions (constant preparation and continual reminding), but also tends to change the very nature of that understanding and consequently that of the observations which specify it.

The essence of spontaneously persisting existence, that is to say survival, is the continual generation of experience which confirms that existence. When the experience is novel its incorporation into the understanding results in changes which are manifest in the subsequent behaviours. Put another way, learning is 'gaining' novel experience and novel experience is that which modifies behaviour.

Thus survival is signalled by the generation of experience which either (i) merely confirms existence or, (ii) changes the survival status, that is to say, the ability to survive, by modifying the form of the general understanding and consequently the form of some of the observations which generate or create experience.

Observations may vary considerably in form, complexity and purpose but all involve essential operations which determine the kinds of experience created. In this essay we are concerned principally with those operations which I call 'sorting' and 'matching'.

2. The Nature of Sorting and Matching

2.1 Descriptions and Preliminary Definitions

General understanding or the capacity for individual survival, largely fashioned during the first decade-and-a-half of life, grows by feeding from interactions with the environment. The experience which accrues from these 'ingestive' and 'digestive' processes, being 'metabolised' ('anabolised') into new general understanding and into more robust forms of that already established.¹ (reference 1)

Observation This experience-generating and organising mechanism operates through the process of observation, which may be looked upon as the functional unit of general understanding. An observation may support immediate survival, as in carrying out tasks or solving practical problems, or may exercise and expand the understanding, solely for the pleasure and satisfaction that this affords.² (reference 2)

Observation is directed perception. Observation is always an active process and necessarily involves interpretation. The quality of an observation may vary, for whatever reason; but there is no such thing as passive observation. An observation might consist in manual reaching, active looking, listening, smelling or tasting, to examine and explore a substantial, visual, acoustic, etc., pattern. It might mean following and analysing a movement, or causing something to move or to change in some way.

Observation is deliberate acting-on the environment, including one's own body, to excite receptor activity. The observation process makes use of one or more, of a very small number of mental operations which I call 'learning-how-to-learn' tools. Sorting and matching are two of these, usually performing together as a complementary 'duet'.

Sorting is actively recognising resemblances or similarities between images or patterns, during the process of perceiving. These images or patterns may be of any kind. They may be patterns discovered within the modality(s) or patterns abstracted from reference to any sensory modality. (reference 3)

Matching is the process of actively recognising discrepancies or differences, between images or patterns within perceptions. It entails the comparison of a 'chosen' model with all available 'known' or knowable patterns, to discover that candidate which is the least unlike the model, thereby drawing attention to the minimal differences. Since one can never consider more than a small proportion of the candidates that could possibly be compared with the model, it follows that any 'match' must always be provisional and the process can never be final. (reference 4)

Matching focuses attention on differences. If it focused on similarities it would be no different from sorting. Sorting seeks to find similarity or points of agreement in two or more patterns. To find the pattern that is 'the most like' the model it is necessary to check all the accordances. In order to recognise that two patterns are unlike one needs to find only one discordance.

Sorting is an activity of accepting. Matching has to do with rejecting. These similarities and differences will be made more clear by a comparison of the main features of each process and by reference to some everyday examples.

Comparison of Sorting and Matching. Behaviours which group sets of characteristics together in virtue of similarities or differences, however minimal, tend eventually to draw attention to the features which constitute the similarities and differences. In due course this leads to their being 'understood', that is to say, capable of being consciously considered and assimilated into the general understanding.³ (reference 5)

Since sorting seems to provide the substrate for matching, it may be thought to have a slight priority in function over matching. One might, for example argue that, since sorting seems to stem from an additive or incremental process, whilst matching is subtractive or decremental, and since one can hardly subtract before providing something from which to subtract, sorting must be an earlier process than matching. Sorting and matching are however fully complementary operations; the former drawing attention to what two or more images or patterns hold in common; whilst the latter discriminates between them by pointing up the disagreements.

2.2 Examples of Sorting and Matching

Examples of the secondary exploitation of the operations of sorting and matching are not difficult to find.

Sorting may be seen in the everyday recognition of a pattern as belonging to the same class as another. For example when we say:

"Doesn't that chap remind you of Charlie?"

or

"How she resembles her mother!"

we are pointing out features that the present image of the indicated individual has in common with the remembered image of the one referred to. And when I say:

"That chap reminds me of someone".

I imply that I have perceived, in the appearance of someone I do not know, some features or expression which I normally associate with someone familiar, and that I am now trying to identify those features.

Another way in which sorting plays an everyday role is in categorising or deliberately attributing something to a class or set. For example:-

'The square is a special case of the class of rectangles',

or

'Since X works it is likely that Y will be even more effective'.

Such classification so dominates the organisation of our thinking, as well as the expression of our thinking in day-to-day living, that it is not possible to conceive of existence above a fairly simple level without it.

Matching, on the other hand may allow us to notice a difference before recognising its nature, for example:

"There is something different about you - your hairstyle perhaps?"

That is to say my attention has been arrested by some discrepancy between your present appearance and that which I recollect. I am now trying to pinpoint the difference.

Or we may use a feature to demarcate between patterns, for example:

"This reptile has moving eyelids and a long tail: distinguishing it from the true snakes."

or we may employ the systematic comparison of patterns;

"Check your answer before handing your paper in",

meaning 'compare what you have written with the pattern of what you intended to write and facilitate this by making a 'one-to-one' correspondence between each point of the plan with each point in the event'. Many such examples could be given.

It is, however, virtually impossible to give explicit examples of the functions of sorting and matching in their primary role as generators of experience and understanding since it is not possible to specify an as yet uncreated idea.

Whereas we perpetually utilise these operations to draw attention to similarities and differences in day-to-day living, virtually all this activity leads to more-or-less predictable results, and the features to which one's attention is drawn are fully familiar. On the other hand, new patterns can, by definition, be at best only partially recognised since any new pattern will only be partially congruent with models in the accumulated experience. A consideration of the behaviour of young children ought to shed light on these notions.

The old saying, 'It is the exception which proves the rule' refers to the process of matching. 'Proves' here refers to 'asserting the existence of a 'rule'. The apprehension of 'something odd' draws attention to the existence of an hitherto unremarked pattern. The freshly discovered pattern to which our interest was directed by an anomaly emerges by processes of sorting.

The 'prepared' mind which attends to slight discordances in everyday life and the 'unusual mind' which questions the obvious, rare among grown-ups but commonplace among children, seem to me to be characterised by a willingness to be arrested by the slightly unusual.

3. The Beginning of Conscious Sorting and Matching

Clear signs of an awareness of associating things by similarities are not seen in children until about two-and-a-half years; and of their recognising a distinction between sorting and matching, until about 3½ - 4 years.

In order to illustrate these processes, let us examine the behaviours of a child during the period in which he is beginning to exhibit gross signs of his or her distinguishing between sorting and matching.

Should one actually set out to observe a child engaged in such activities, it is most important not to talk or otherwise pass comment on the proceedings, for much of what a child does when in the presence of an adult is conditioned by what the child thinks the grown-up expects of him, and by the labels grown-ups impatiently feel obliged to hang on things.⁴

3.1 Separating

Let us consider an easily contrived situation in which a normal, that is to say well-motivated⁵ child, of about 3 years,⁶ is allocating a mixture of several clearly differentiated objects to several, already 'seeded' dishes. For example, the mixture might be a half dozen or so of each of the following: similarly sized pine cones, spark plugs, cockleshells, (blue) plastic cubes, dessert spoons etc.

The child is playing by herself; no verbal instruction has been given.

The child selects each object randomly and puts it where, she feels, it is best suited. Soon all the objects are lodged and are seen to be separated out into pine cones, spark plugs, cubes and cockleshells etc.

The observing grown-up will not be surprised and perhaps not even particularly impressed. But how did the child make her choices?

Was it, as most people would assume, because a blue plastic cube asks to be put with others of its like; or was it because they did not 'go' with pine cones or cockleshells etc., so they had better be put into a dish or their own? Or was it a bit of each? In this case there is probably no satisfactory way of knowing.

Suppose we pursue our study of this child and, during a re-run of the activity, add some other objects to the mixture: two whelk shells, two differently coloured plastic cubes, a fork and a table knife, some beech-mast and a conker, and a couple of metal nuts and bolts. This time, especially if she is young and social and a talkative sort of child, she may well first allocate the objects as before, deliberately avoiding the 'foreign' objects until the end; when she might, rather tentatively, add the forks and then the knives to the spoons. After a little indecision the other plastic cubes are dealt with, as is the beech-mast. Some external 'encouragement' may be necessary to prevent her leaving some of the objects, unallocated.

There seems to be an ambivalence in her attitude toward some of the objects. Is an object similar enough to be considered? Or is it just not part of that game?

Over the following months, if not interfered with our child will associate cubes of different colours, irrespective of the materials of which they are made, spoons and forks with metal keys, as well as with cups and cruets etc. Somehow she will tend to associate things according to some particular features, whilst ignoring others. So long as they are related in some way they may be put together in the same dish, and, what is more, at different times they will be allocated differently.

3.2 Pairing

Now, returning to our 3 years old child, let us have her pair objects; and at first those objects which appear to be the 'same'. For example; two sherry bottle corks, two torch batteries, two cockleshells, two bottletops, two spoons, two cotton reels etc. It is a good idea to choose objects which are not easily labelled verbally, such as pieces of packing material, 'leftovers' from a manufacturing process etc. The members of each pair seem so very different from one another, that there is little chance of confusion.

In this game the grown-up spreads all the pairs about the table and by picking up one object invites the child, non-verbally, to look for its mate. The question now arises: is the child looking for the one 'like the model', as is commonly supposed, or is here rejection of those which are unlike the model, which steadily reduces the number of candidates for consideration, playing an active role in the process?

If we now introduce extra pairs, which closely resemble the others but which, nevertheless, are distinctly different in some ways, these will add to the visual 'noise', tending to deflect the child's interest; and she may have actively to attend to these 'possibles' before rejecting them, in order to continue her search. Eventually, large numbers of the candidate objects, perhaps all, closely resemble the model(s) and must be scrutinised actively and carefully.

We begin to see that, following a decision that an element is sufficiently similar to the model to merit attention (sorting), it is the differences which are attended to (matching). These processes can be seen to throw up and expose all sorts of similarities and differences for consideration and classification.

It is not a very big step to an awakening suspicion that such mechanisms are those by means of which a child draws here own attention to novel evidence, that is to say, creates experience.

But how does a state of 'not knowing', or pre-awareness of an experience, become 'knowing' or awareness? How do observations utilising sorting and matching serve to induce experience, that is to say novel understanding? Patently, we cannot describe the ineffable until it has become expressible! Nevertheless an analogy might help to make the mechanism a little clearer, as follows:

Suppose that one tenth of a quantity of gold coins in common use were progressively and surreptitiously adulterated with lead, the other nine tenths remaining pure gold. Each of the affected coins would periodically have a small proportion of its gold removed and replaced by lead. Since most coins would remain unaffected a considerable change could take place in the variant tenth before increasing softness and weight, a tendency to leave black smudges or to tarnish etc., forced their being noticed and then recognised to be both classifiable variants on the original as well as independent non-genuine (largely) lead coins.

In a similar way, spontaneously growing variants on established behaviours tend not to be noticed until they are sufficiently established to have acquired contrast in definition, from which time they may be recognised to be independent alternative variants, or the varying parts of the original behaviours may be recognised to have become primary behaviours in their own right (See also section 5).

4. Further Definition and Examination of Sorting and Matching as Generators of Experience

In order to understand the processes of sorting and matching better we must examine a little more closely: the processes themselves and the means by which experience is generated (4.1); the kinds of patterns which are subject to this processing (4.2); and the two basic ways in which we perceive patterns (4.3).

4.1 Sorting and Matching as Dynamic Aspects of Comparison (leading through recognition and interpretation to classification during observation)

The fundamental unit of understanding is the observation which takes origin in an active scanning of the environment by a 'prepared' state of understanding hunting for familiar patterns.* Recognition of a familiar pattern is followed by attempts to establish that pattern as being alike in every way to some pattern which has been met with previously.

This active attempting to 'place' the discovered pattern satisfactorily is the primary source of all novel experience. The struggle to abstract it from concrete associations, to extricate it, if necessary, from enmeshment in irrelevant 'noise', to complete it if seemingly unfinished or to continue it to recurrence if 'open'⁷ entails the active re-examination of previously encountered patterns.

Such activity may mean the focusing of attention on innumerable similarities and differences, and the formulation of many tentative solutions, before one (or perhaps more than one) is accepted as a satisfactory option or choice. All the patterns turned over during this process, including those rejected, add to the richness of experience engendered.

Such attempts to close or complete a partial pattern and to assign it a place in the understanding are accompanied by emotional unease. These feelings of disquiet continue to cause a varying degree of emotional discomfiture until the indeterminacy is resolved, either as moral certainty or as an equilibrium with an acceptable range of tolerance. (See Appendix B: Some Thoughts on Observation and Communication).

It will be seen that the comparative process I have called sorting culminates in the recognition that two or more sets of characteristics overlap or intersect in virtue of certain characteristics held in common. Attention is thus focused upon the defining properties of the intersecting subset. (Figure I).

Figure I. Similarity

* Compare this with the utterance as the fundamental unit of conventional language.

For example: 'green things' and 'cube-shaped things' are collections which overlap in the set of things which are both cube-shaped and green, ie., green cubes. (Figure II)

Human beings form a particular set of the class mammals and grown-up female human beings form a set which completely overlaps with humans as a whole. (Figure III).

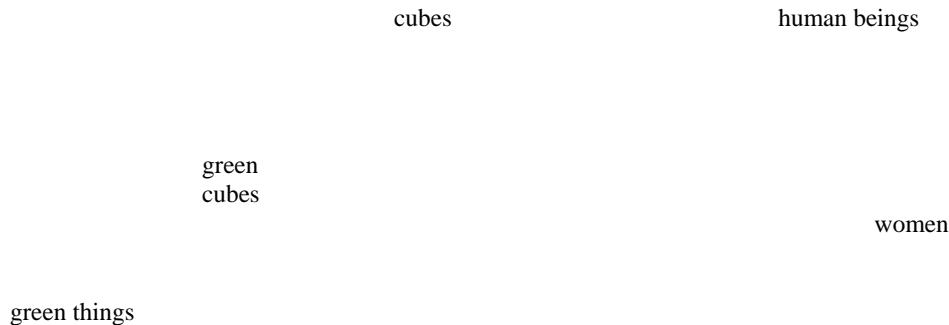


Figure II.

Figure III.

In matching it is the disjunction which focuses attention on the defining properties of those segments of related sets which do not intersect. (Figure IV).

Figure IV. Difference

For example: 'green things' and 'cube-shaped things' are most clearly separated into the groups: (i) things that are green but not cubical and (ii) those things which are cubes but not green. (Figure V).

Subtracting grown-up female humans from the class human beings clearly leaves those humans who are not women, that is, men, boys, and girls. (Figure VI).

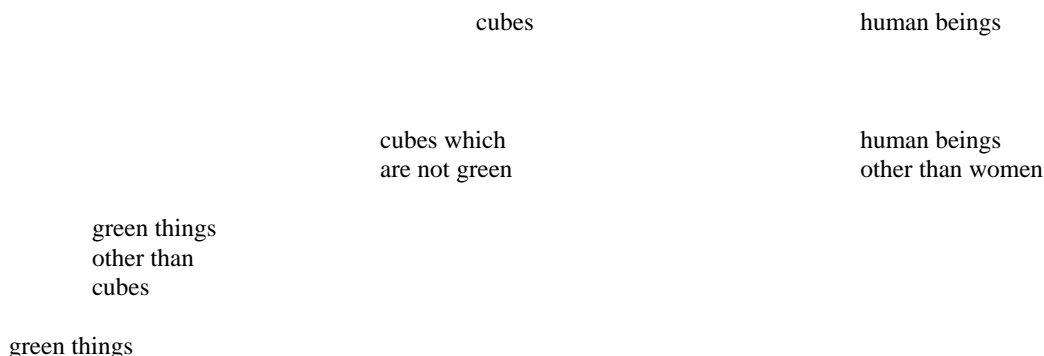


Figure V.

Figure VI.

Patterns are continually compared, sometimes for similarities (figure I), sometimes for differences (figure IV). By deliberately bringing together apparently very different patterns unlikely similarities are discovered, whilst the critical and systematic comparison (or the

point-to-point correspondence) of seemingly identical patterns bring to light previously unnoticed discrepancies.

It is only possible to consciously or unconsciously plan behaviours which are well-established within the general understanding and normally it is only possible to attend to those of our behaviours whose basic structures have been admitted to the general understanding. Hence it is only possible to contemplate with anticipation what is already well-practised in contemplating the behaviour or event itself. During the regular practice of an activity, whether 'physical' or 'mental', a novel variant may appear and subsequently come to appear regularly and consistently.

The new variant behaviour is by definition a member of the class of which it is a variant and, however greatly it changes and in whatever ways it changes, it can remain a member of that class by the simple 'sorting' expedient of expansion of the set characteristics (See Appendix A).

Once the pattern of variant behaviours or variants has, through practice, acquired sufficient definition it is susceptible to becoming the focus of attention by the general understanding. This process is itself the first phase of matching, which tends to delineate the differences, between the now more-or-less autonomous variant, and that part of the original pattern of which it is a variant.

Subsequent point-to-point analysis of the variant pattern, in the light of past experience employs the matching principle whilst attempts to recognise resemblances, between the whole or parts of the variant and other patterns previously not noticed to be related to the parent, is sorting. Both processes lead to the creation of new experience. It should not be assumed however, that the ability to make associations between contrived patterns necessarily implies that either of the processes is occurring, for the satisfaction of associating patterns can be and often is exaggerated by reinforcement of the association per se rather than the process which underlies it.*

Reinforcing the end product, by rewarding a child for 'correctly' associating patterns which, for example 'belong to the same set', is more likely to discourage the finding of elements common to obviously different things; whilst similar rewarding in supposedly 'matching' activities reinforces the discriminating between artificially selected patterns, without encouraging the actively sceptical searching. True matching seeks for an ultimate match never to be attained in practice. It is therefore ideally a never ending quest.

The active and effortful processes of sorting and matching, on the other hand, go further than simply finding the similarities and differences which actually exist in the materials

* Learning by simple association can lead to behaviours which superficially resemble those originating from primary sorting and matching. Extrinsically reinforced training procedures frequently bring about association of similarity or relationship without reference to the underlying principles, thus by-passing the processes which create new experience.

under scrutiny. By tentatively fabricating or suggesting possible features, and possible groupings of features, for trial comparison with patterns being examined, these processes actually create experience without reference to simultaneous empirical observation.⁸

The primary observational operations, of sorting and matching, are able to draw attention to patterns which are only partially assimilable to the current state of understanding. However, the active striving to satisfactorily digest a 'noticed but unrecognised' element, by construing any possibly relevant pattern in an increasingly wide range of permutations for comparison with the maverick fragment of pattern, is itself creative of experience which is not of directly empirical origin.

4.2 What Kinds of Patterns or Images are Subject to Sorting and Matching?

If we consider a thing to be a bundle of properties organised according to a characteristic pattern, then the definition of a thing is the definition of the set containing these properties arranged in that pattern, and any or all of the properties and parts of the pattern are available elements for sorting and matching, constituting realised or realisable experience.

For example: identity, substance (metal, glass, wood, etc.) shape, size or quantity (volume, surface area, length, weight, density, power, etc), physical state (solid, liquid or gas), consistency (such as hardness, malleability, ductility), other substantial characteristics (such as strength and elasticity), colour and other light-reflecting properties, surface properties (smoothness, thermal characteristics), number, etc., (also acoustic, olfactory etc., also verbal, mathematical, musical patterns and elements).

In addition to these fairly constant intrinsic properties are those concerned with predictable change, that is to say, the behaviours. These range from features such as volatility, flammability, solubility, to complex behaviours such as those associated with life (such as unexpectedness, relative unpredictability, spontaneous change of form, fugitiveness, capacity to withstand trauma (ultra-stability), reproducibility etc. On the other hand extrinsic properties include association by; location (such as household things, zoo animals, etc.) by ownership (such as - yours, Ann's, belongs to the estate, etc.) by use (such as clothes, food, for cutting, washing, etc).

4.3 The Relevance of the Two Basic Ways in which we Perceive Images and Patterns

A more fundamental distinction between patterns than those distinctions already discussed, obtains at the perceptual level.

During perception an image or pattern is viewed as either a complete object having attributes and associations but no origin, growth or manufacture, or as a structure, an assemblage of parts, all of which have grown spontaneously or been made and which have either grown or been put together.

All patterns can be viewed in the second or 'praxic' way, and some images can only be satisfactorily understood by means of some sort of praxic analysis-synthesis; however, much if not most everyday perception is probably of the former constant-image or sustained pattern kind.

Sustained-image perception. An image may be perceived as persisting through time, an enduring pattern whose totality or fragment of whose totality is apprehended as a whole. A

motor car or tree, a drawn triangle or circle, a written phrase, may each be seen, recognised and interpreted at a glance and subsequent glances will induce perceptions very similar to the first, even if new aspects are now noticed or the balance of priorities as to what is important has changed.

Praxic perception (Perception of change). Changes in a pattern and active behaviours may be recognised and interpreted instantaneously in one sense but only in the comparison of the pattern as it is now with what it was previously and with what it is becoming. This means that comparison of a series of such images is required for the perception of change.

In this sense the comparison of behaviours is a comparison of comparisons, or a sorting and matching of sortings and matchings; however it is not only that some images are viewed in one way and some in the other but that all images can be viewed in the second or praxic manner whether changes are taking place spontaneously at the time or not. In fact some static patterns can only be satisfactorily interpreted by mentally re-living how they came or might have come into being and/or how they might have changed had they not gelled to immobility at some moment.

A pattern is often a frozen-image of action, a still or snap-shot embodying and encoding the effects of the forces and actions which led to its creation.

Under these conditions an interpretative analysis is essential to an adequate description of the pattern. A chair may be viewed as the product of its parts coming together to form the whole, as well as in terms of the order of assembly, the essential versus the inessential components, the alternative means of fixing together the parts etc. Even the phrase 'pile of bricks' implies the manner of its creation.

Clearly an interpretative analysis of an already complete image is rarely able to re-create the exact manner of its original formation. What is produced by such praxic perception is a range of probabilities and a suggestion as to the most likely of the available hypotheses.

In practice it matters little in praxic 'analysynthesis' whether the perceptual re-creation actually closely resembles the original production. In such perception 'might have been thus' is as good as or better than 'was thus', especially if the former consists of a collection of alternative hypotheses.

This praxic capacity for analysynthesising complete images arises from praxic perception or the interpreting of the changes of form and location which we term behaviour. In this form of perception whole series of instantaneous images are recognised and synthesised subsequently into complete behavioural events. (reference 6)

It will be seen that the integrity of a sequence of events as constituting a behaviour must depend on each event's being recognised as belonging to the same class in virtue of certain resemblances - that is to say it involves sorting, whilst the perception of change itself and the discernment of the pattern of that change rely on the recognition of discrepancies between the adjacent images - which is the function of matching.

5. Sorting and Matching and Understanding

When sorting and matching are operating to create novel experience the new evidence for agreeing that patterns have common characteristics or that one differs from the other in some way, will not be apparent. That is to say we recognise that there are similarities and differences but we do not as yet know what these are. Sorting and matching at this level indicate but can not specify.

Nevertheless, having apprehended, that is to say become aware of, new 'evidence', our behaviour is changed. The comparisons which steadily focus our attention more precisely on the new 'evidence' lead to increasing definition of the changes in our behaviour until these become sufficiently discrete to awaken our conscious interest which soon leads to a more stable state of increased knowing.

Experience is enduring change in behaviour, neither more nor less.

During the latter part of the transition period we may have an increased awareness without as yet an equivalent understanding. Our normal behaviour at this time may seem to belie this fact in that we may act as if we understood what, in reality, is still beyond our understanding.

How then is experience created? How does unplanned change in behaviour come about? How does general understanding expand and extend by the addition and assimilation of new experience?

Novel experience arises when (suitable) new behaviours appear adventitiously⁹ as variants on already established behaviours. Unrecognised at first¹⁰ by the child, they continue to grow unnoticed until so well demarcated that they represent truly alternative behaviours from which time they become obtrusive and a focus for the child's attention.

When practised under conditions of awareness (for a sufficient period of time) they come to form part of the child's developing understanding and so are subject to being imagined, consciously designed and anticipated.

From this it will be seen that new understanding accrues according to the following paradigm:

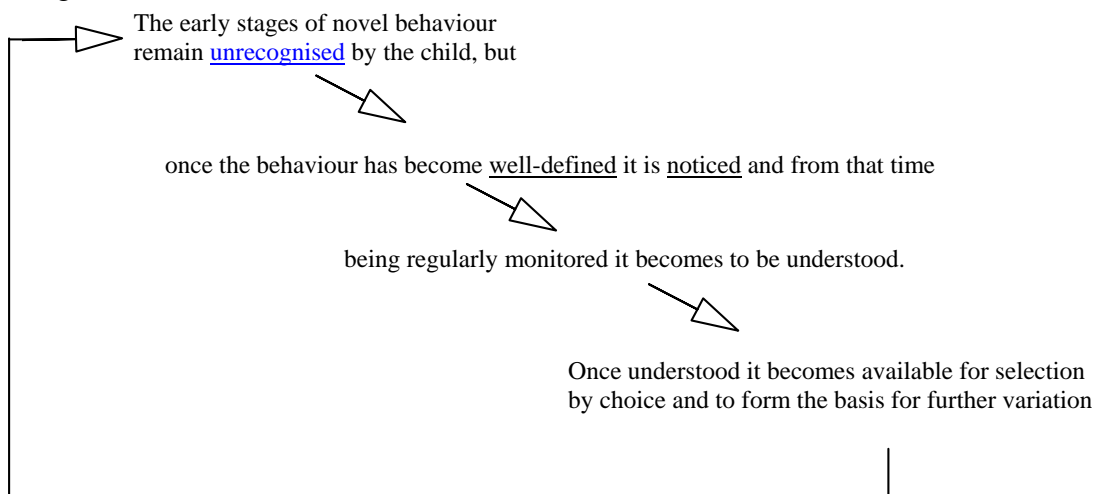


Figure VII.

This implies that a child can not wish to do something which is truly novel, so far as general understanding is concerned. Therefore he can not directly add to his general understanding by observing the activities of others; neither can he directly gain new understanding from being given a 'new' principle followed by the repeated practice examples illustrating that principle.¹¹

A child ¹² can contemplate only what is already established within his experience.¹³ He can contemplate with emotional equanimity only stable notions.¹⁴

How then does he progress from being unaware of an idea to the stage when he is able to consciously think about that notion? How do notions that he can think about arise from a state of unawareness?

6. Understanding: From Not-knowing to Knowing

'Knowledge is the perception of the agreement or disagreement of two ideas.'

John Locke.

An individual who at some stage of his development is able to understand in a way that he previously could not, has undergone a vital change. He has extended or otherwise enlarged his understanding.

A growing child or actively enquiring adult will understand later what earlier was incomprehensible to her. Between such moments in that individual's existence some fundamental change has taken place which has radically altered the way in which the stuff of perception is examined, analysed, interpreted, and acted upon. This change in the understanding is referred to as experience or gain of knowledge.

Prior to 'knowing' (knowing that is to say this particular form of behaviour, manner of observing, of determining what is apprehended and how it is to be arranged and made use of), it is not possible even to entertain thoughts about the 'knowing' state. It is quite impossible for the learner to contemplate what is to be learned - the novel experience - until that learning has been accomplished and the experience has been realised.

I am, of course, not talking about the learning of the rules of how a game is played or a factory organised and run, or about simple permutations on well-understood themes, although all of these are based on understanding which was once novel and the learning of such straight forward applications of well-recognised kinds of understanding can, and often does, lead to truly new understanding.

Between not-knowing and knowing is a phase or period of flux which might be inadequately described as 'half-knowing', during which is awareness without full understanding, which may last for seconds or for many years.

In the young child this is evidenced by her doing more 'clever' things, making 'clever' decisions, producing more advanced-looking physical behaviours, with increasing frequency but against a background of her generally not doing these things. In due course the consistency with which the behaviours occur diminishes their appearances of fresh behaviours signal that other changes in understanding are taking place.

The older child or grown-up may feel and be able to report a feeling of 'almost understanding' or 'nearly-knowing', akin perhaps to the feeling of having a name or word 'on the tip of one's tongue'. In the case of half-knowing however, it is not merely a question of remembering a well-established word but of making increasingly more clear and definite an idea not previously recognised consciously.

Here I should refer briefly to the emotional concomitant of the transition from not-knowing to knowing. Small children are driven to behaviours which are sometimes described as a 'thirst for knowledge'. Pleasure in doing is spiced by a strong and niggling need to see more clearly the vague, to fix the uncertain, to pin down the fugitive, to understand.

Under satisfactory conditions basic general understanding develops apace. In strengthening, enriching and extending the established understanding, so the total realm of awareness enlarges.

Although I have specified 'small children', this insatiable appetite ('satiabile curiosity') for furthering one's understanding, associated with a gnawing need to see a little clearer, to seek to know why, need never leave us and in some individuals leads to discovery, invention or to artistic creation welcomed by other members of society.

The growth of truly novel understanding in a child is thus identical to scientific advance, for science consist in seeking after general understanding well beyond that which is essential for ordinary survival. It has to do with new ideas and new ways of thinking.

The discrepancy between the realm of awareness and the limits of the adequately understood is the region of half-knowing and is associated, as has been said, by a feeling of need for release from uncertainty and a drive to bring about this end.

Apprehension without full comprehension, especially when excessive demands are made on the understanding, can lead to emotional discomfort amounting to anxiety or even fear, which may account for the other common meaning of the words, apprehension and apprehensiveness.

This is why a child during the phase of half-knowing who may be assumed by those about her to be fully aware and comprehending of what she is doing, simply because she behaves sometimes as if she did, will show obvious confusion if her attention is drawn to the half-understood act she is performing.*

* Impatience on the part of the teacher, which gives too little time to establish an awareness of a change of behaviour, can, and in my experience frequently does, delay or prevent a proper understanding from developing.

7. Summary

Individual survival requires 'adaptive flexibility' or the power to learn from 'experience'. Man's extreme degree of unspecialisation renders him singularly able in this respect. It is the accumulated experience which, when arranged in the manner that the bodily apparatus dictates,¹⁵ controls the organism. The experience is organised as the general understanding.

General understanding, which motivates and directs our heuristic, inventive, problem-solving or just plain necessary interactions with the environment, operates as continual successions of observations, which invariably involve recognition and comparison. Whatever the images or patterns compared, whether they are intrinsic or extrinsic to the objects, whether they are appearances or behaviours and in whichever way these images or patterns are perceived, the basic operations of sorting and matching play an essential role.

At various levels of complexity in day-to-day living the operations of sorting and matching help us to find things quickly, to recognise what we need for a purpose, to arrange our surroundings in convenient ways, to fit together things which are appropriate, to help us to order and to notice and generally organise our everyday living.

Sorting and matching of a somewhat higher order are paramount in the analysis of complex systems, such as the reductive processes which enable us to become aware that the patterns underlying ostensibly very different problems may in fact be quite similar, and susceptible to simpler treatment once shorn of the more obvious particulars.

Since it is the current understanding which decides and designs the observations, new understanding, accruing from the creation of novel experience, must dawn slowly. Between 'not-knowing' and 'knowing' is a transitional phase during which the child appears, from her behaviour, more and more to understand without herself actually being aware of the change.

Throughout childhood, and ideally throughout life, these same observational operations lead to the creation of new experience, to the illumination and apprehension of previously unknown or unfamiliar evidence of the ways of the world.

Appendices

A. Some thoughts on the expansion and contraction of sets and indirect intersection.

A collection of 1p and 10p pieces might be thought of in various ways. For example as artifacts, as metal things, as tokens, as circular discs etc. If we were to take this collection of objects to be a set of 1p and 10p pieces, a £1 coin and a 2p piece might be added to the collection making it 1p, 2p, 10p, £1 without disturbing any of the above set definitions.

If however we add £1 notes or tiddly-winks, the range of possible set definitions is restricted in some ways but enlarged in others. The addition of a £1 note allows artifacts, tokens, money, etc., but eliminates metal things and circular discs as essential characteristics. It also reminds us that cheques, I.O.U's and other monetary tokens including those of other cultures, such as beads, cattle, etc., would be possible members of the set and the non-essential features of those things further introduce more possibilities.

Tiddly-winks as additions, on the other hand, seem to limit us to circular discs but release us from the constraint of monetary value or metal as necessary properties. Forms of 'roundness' other than circulatory - cylindrical surfaces, ellipses, sphericity etc., become possible, so a glass marble, a saucepan, a pebble, an helix, etc., become possible additional elements. Thus one can follow a kind of continuity through these changing - expanding and contracting - sets.

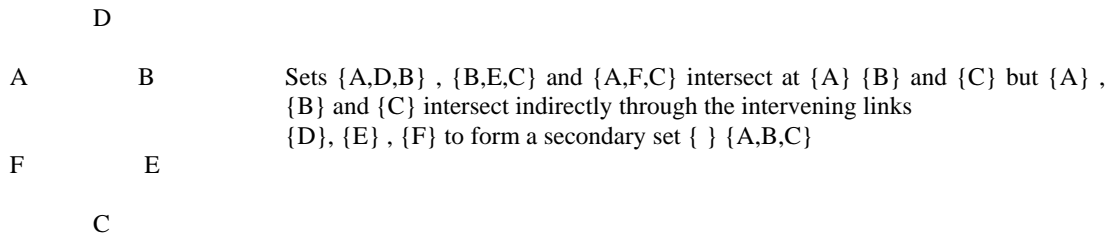
If the changes maintain some measures of intersection with the original set all the subsequent sets can be viewed as variants of that original or mother set; however even without actual overlapping of the contents of sets it is possible to maintain links between them (the sets) by a device which I call secondary, or indirect, intersection.

Secondary Intersection

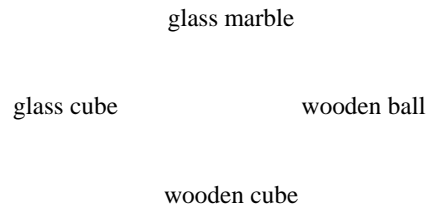
A thing may be considered to be defined by its essential characteristics arranged according to its essential structural pattern.

During the process of generating new experience there is a continual recognition of the defining characteristics of the sets. Comparison of primary sets with their subsets and with unlike sets leads to the recognition of the defining properties of the intersecting and of the disjunctive sets. The associations between characteristics form new primary sets.

Secondary sets may be defined as collections of characters indirectly-linked by way of intervening sets, so giving indirect associations between sets which do not intersect directly but do connect through one or more intervening intersections:



For example: Although a glass marble and a wooden cube may together form a set, the defining characteristics of these two objects as individual sets do not intersect in respect of form and material substance. However, the introduction of either a wooden sphere, or a glass cube, or both, links the two sets in a kind of secondary intersection or indirect intersection.



B. Some thoughts on observation and communication.

An observer observes, that is to say, acts upon his environment. Observing is an active effortful process in which the observer attempts to 'make sense of' (- to find pattern in -) what is available to his senses (- the patterns of activity within his sensory receptors -) at this time.

The reception by one individual (the 'receiver') of signals (apprehensible patterns) transmitted (that is to say, actively brought about) by another individual (the sender), is referred to as interpersonal communication.

It will be noticed that both 'sender' and 'receiver' make observations. The former acts (intentionally) to set up or bring about changes in the environment and actively monitors these in order to ensure their integrity (that event matches design). The latter (receiver) acts to intercept the signal to seek pattern or change of pattern within background 'noise' (irrelevant or 'meaningless' or very low probability pattern).

This sender-receiver set-up is clearly a special case of the experience-gathering observation process. I consider that the basic component of a communication event is the observation process, and that therefore the study of communication is a sub-topic of that of experience-creation and the development of understanding.

Communications theorists equate the degree of unexpectedness of a signal with the amount of information it 'carries' and the completion of a communication act with the resolution of uncertainty. These notions are pertinent also to the process of observation and the creation of experience. In this way the basic process in communication is seen to be identical to observation, and observation itself a state associated with a measure of uncertainty whose intensity is related to the amount of novel experience being generated and whose resolution coincides with cessation of the act of observation.

Adequate observation requires:

Organismic completeness; a growing child may normally be considered to become an organism, or a functionally unified and integrated unit, from about twenty weeks although the process requires many months for completion. A child whose development has been delayed and distorted from an early age may never reach anything like satisfactory unification and the form and quality of his observations will be correspondingly impaired;

Equilibrium between bodily size, shape, strength, etc., and the general understanding; it is essential that the understanding and the body which must express that understanding, are matched. Normally such a reasonably harmonious relationship is virtually inevitable but early distortion of development and inappropriate cultural demands often result in disequilibrium, when impairment of the quality of observation results.

High state of motivation; adequate tendency to be doing; active seeking after the pleasures which accompany sensory-receptor activity, is necessary to continual scanning and an active state of expectancy.

Competent general understanding; an established integrity of the understanding, sufficient to withstand physical distractions, tiredness and emotional upset, ensures an all-day-round high level of understanding.

State of balanced preparedness; echoing the equilibrium mentioned above, the several main areas of general understanding and their various subdivisions need to be more-or-less equally developed.

Adequate repertoire of background experience (as information and exploitative skills).

The design for an observation must be drawn from or based on well-established general understanding patterns. The realisation of an observation may be seen as occurring as temporary changes in a background state of, more-or-less, active expectancy. These disturbances subside quickly or slowly, completely or incompletely according to such factors as the qualities, levels and competence of the understanding, and the observation is superseded by another. (Figure VIII).

ACTIVE SCANNING (Motivation) STATE OF ACTIVE EXPECTANCY (Pre-awareness)	This coincides with the state of active searching for fragments of pattern - any pattern in any modality - through a process of scanning.
ENCOUNTER WITH PATTERN (Awareness) STATE OF UNCERTAINTY	Once a pattern is found the dynamic equilibrium is unsettled.
APPLICATION OF GENERAL UNDERSTANDING and a STATE OF STRIVING FOR RESOLUTION OF UNCERTAINTY	This coincides with a, now directed, drive towards discovering the most satisfying ways of arranging etc. the fragments of pattern apprehended.
RECOGNITION OF PATTERN STATE OF RESOLUTION OF UNCERTAINTY (complete or partial)	Recognition or 'placing' of the pattern implies resolution which coincides with some degree of subsidence of the need and a tendency to return once again to the background state of active expectancy.

Figure VIII. The Process Of Observation

The form of an observation, or behaviour directed towards the environment, will be determined to some extent by the current expectations of what is to be perceived and, if the understanding is not competent, may colour the experience even when it is not in keeping with the expectations.* This expectation, and the current state of understanding which gives rise to it, will be modified subsequently by the realisation of these perceptions in relation to what is being observed.

Such an arrangement ensures an ever widening range of variant perceptions, necessarily including the continual appearance of previously unknown or novel behaviours.

Those which are sufficiently like established behaviours will seem familiar enough to be accepted as such whilst those very unlike any already known will have such a low familiarity content as to make them hardly noticeable.

It is the variants of the recognisable behaviours which, one established within the active observational repertoire are eventually noticed and, when they have been explored by the attention, are assimilated into the understanding as new experience.

* We commonly 'see' what we expect to see so that unless sufficiently alert we are prone to miss less obtrusive forms or changes of pattern. This 'expectation' is so potent an influence that it often affects us retrospectively, allowing us to remember what we have subsequently come to believe happened. Such retrospective creation of experience is associated with a felt 'need' to complete or resolve unfinished perceptions.

NOTES

1. (page 10) The growth of experience; the organisation of this experience into general understanding, and the exercise of this in application to particular cases resulting in further experience gain, is the subject of the interpretative description of child development being alluded to.

The access of additional experience in consolidating, enriching and strengthening the integrity of the established understanding tends to lead to its further extension and expansion.

The build-up of experience of particular applications of general understanding facilitates interactions with the environment and leads to the formation of a range of prefabricated and commonly used behaviours which obviate the need to approach each situation as if it were completely new in everyday survival. A variant of the underlying learning-mechanism, utilising 'spillage' from the normal reinforcing-system, allows for the occurrence of an adventitious learning of skills built up or trimmed down from raw materials supplied by the fundamental general understanding.

Usually, however, these particular skills occur as the result of more-or-less conscious selection by other members of the culture and although outwardly resembling the particular applications of general understanding are not necessarily appropriate to the child's needs.

It is suggested that it is this manner of building understanding which is the purpose and intention of present day schooling, including special education, with a consequent neglect of the conditions necessary to the free and satisfactory growth of basic general understanding.

2. (page 10) All basic learning is reinforced by the pleasure taken in the activity, pleasure which is specific to the activity itself. The use of non-specific rewards (eg. praise, applause, attention, sweets, etc.) is not only not necessary to learning but actually tends to restrict spontaneous experience seeking. A child clearly benefits from being approved of and may need some overt praise. He does not however need selective approval or praise to learn what is basic to general understanding.

These comments are at variance with the implicit assumptions of some of the common teaching practices and with the notion that children 'learn by imitation'.

3. (page 11) Understanding is the capacity which determines and governs the occurrence, form, quality and appropriateness of those observations on the environment, which constitute existence or survival.

General Understanding is that simplification by which most basic components of stored experience are abstracted towards their application in observation, whether this leads to novel gain or simply to restatement of established experience.

The more frequently repeated observations tend to be stored as ready made behaviours continually available for use (in much the same way as common phrases and sentences are used in every day speech). These individually learned, pre-packed skills which facilitate everyday living, make up what we may call particular or personal particular understanding.

Of the total stored experience at any time, which we might term the fundamental understanding, that which has been digested and assimilated to some degree into the basic structure of the organisation, forms the general understanding.

All the actively acquired experience is the result of the action of general understanding, but any of this experience can become the raw material for the production of a kind of casual or extrinsic (non-observational) gain of 'experience', which makes use of excesses of redundant reinforcant and results in the acquisition of simple behaviours brought about by external factors; usually the deliberate actions of other members of the culture to which the learning organism belongs.

These specialised 'add on' behaviours constitute a 'cultural understanding' or, since they superficially resemble the particular skills realised by the exercise of general understanding in response to cultural needs, a cultural particular understanding.

4. (page 13) Our observations are here directed at the child's growing general understanding. Her decision, therefore, should be independent of cultural influences, including conventional language.

5. (page 13) Motivation is the power and tendency to institute and maintain activity. It is analogous to motive power in engineering; for example, the pressure and quantity of available steam in a steam-engine, and, like motive-power, it is blind and requires control and direction.

6. (page 13) '...child of three years...' This age is deliberately chosen for the illustration for, although most children can learn to separate and pair objects by the second half of the third year, consistent behaviours which can be definitely identified as 'sorting' and 'matching' are usually not apparent until after the third birthday.

7. (page 16) Some patterns are not 'closed' or complete units but repeat endlessly or change indefinitely according to more-or-less predictable rules. For example, a succession of pulses, a sine wave, or a mathematical progression.

8. (page 19) Indirectly empirical experience. All understanding is here considered to derive ultimately from direct observation; however it is possible to imagine things based upon direct experience but which cannot be experienced directly. I have never seen a green horse with blue blood which lives exclusively on powdered glass but I can imagine such a prodigy since I do have direct experience of horses, greenness, blueness, blood, eating, glass and power.

During perceiving, when an attempt is being made to identify a pattern, model patterns may not only be summoned up from the 'memory' but may also be created from combinations of notions which themselves do rest on direct observations of the past.

9. (page 22) Adventitious variations. Under normal conditions the repetition of a familiar behaviour is guided and defined by various limiting factors, or constraints, which tend to ensure that the activity is recognisably that which was intended; however the design of an action represents not one precise movement sequence but a set of similar behaviours any one of which is defined by the design. Within the overall bundle of actions, represented

by the design (definer), there is much room for spontaneous variation (tolerance or uncertainty) according to the conditions prevailing at the time.

10. (page 22) 'Unrecognised at first...' Slow unintended change in behaviour is automatically adjusted to and unconsciously accepted until such time as it 'disagrees' with the established patterns, when it excites attention and demands explanation.

11. (page 23) Practices deriving from the ideas underlying these comments are at variance with some of the common teaching practices. For example, (i) learning through the agency of conventional language: it is commonly, but quite erroneously, taken for granted that it is possible to use verbal description and discussion etc., as a means of introducing a novel notion. The practical application of this view means either that the teaching practices are invariably unsuccessful or, alternatively, that no truly new idea is broached deliberately but only discovered accidentally by the student: or (ii) the notion that children 'learn by imitation'. That children are spurred into activity as a result of watching others at play, and sometimes increase their experience in areas of understanding related to that governing the model behaviours, is not, of course, denied. Neither is disputed the fact that children do expand their understanding to some extent from being given a scheme for recognising certain kinds of problems and a formula for 'solving' these problems. It is just that children do not learn directly in the manner that this approach seems to assume, so that the gains are really more in spite of than because of the approach. A rational re-organisation of these learning conditions would make more effective learning possible.

12. (page 23) 'Child' - any learning organism - baby or scientist.

13. (page 23) The general understanding, which we are discussing, governs the child's acting on his surroundings. A child can not make an observation if his understanding is lacking in some necessary experience. Hence truly novel experience can not be recognised until it has become an integral part of his understanding.

14. (page 23) The 'viable completeness' and stability of a notion determines whether the child is prepared to attend to it. Inadvertent attention to a still incomplete or unstable notion will result in (a) inability to 'comprehend' it sufficiently to act upon it and (b) access of unpleasure (anxiety) due to the low familiarity ratio. The child will thus be emotionally 'disturbed' and confused.

15. (page 26) '...bodily apparatus dictates...' In the creation of experience constraints are necessary to impose pattern and order on what is being perceived. The nature and form of these constraints determine the nature and form of the understanding being constructed. The understanding of any particular organism, at least during the growth period, must reflect the physical characteristics of the experience-producing apparatus of that organism. In some sense human general understanding is Human-shaped.

Glossary of Terms

CONSTRAINT That which imposes restriction upon the extent, direction and form of behaving.

ENVIRONMENT The environment implies all the possible and available forces with which an organism can interact. Usually this refers to those forces originating beyond the limits of the body; however the body itself, its metabolic state, temperature etc., also represents an internal environment - a 'milieu interieur'.

EXPERIENCE An observation consists of an action (the definer) directed towards some focus or 'target' (the director) within the surroundings. Such an action actualises a design (drawn from or synthesised from the organised experience or understanding) and may anticipate or hypothesise (also from understanding) the possible or probable effects of the action. 'Information' is 'fed back' from the event and from the realised effects of the action, to be compared with the action-design and effects-hypothesis. The results of these comparisons constitute the experience, the discrepancies representing novel or created experience.

MATCHING See pages 6,7,10,11,16 et seq.

OBSERVATION/OBSERVING See pages 5,6,8,9,10,30-32. Action directed to the environment. Directed perception. The functional unit of understanding. Roughly equivalent to active perception.

ORGANISM An animal whose parts function together as a whole. In the theory alluded to here the early stages of development in a human being are concerned with motivation, early bodily definition and spatial awareness, with getting it all together, with unification. The formation of the true organism capable of acting as a unit requires a distinct period of learning, unless highly specialised. The less specialised the animal the longer the period of unification or organisation.

PAIRING AND SEPARATING See pages 13-15. Sorting and matching are mental processes which may be pursued in any number of different ways, and utilising a variety of techniques. 'Separating' and 'pairing' are merely techniques which specify what can be seen by an outside observer at a time when there is no way, that I can fathom, of deciding whether a child is putting things together because they 'belong' (sorting) or because they 'do not belong elsewhere' (matching). I labelled them specifically (even though merely techniques) because it seemed to me (1) that children reinforced their recognition of similarity by repeated intersection, the entities remaining together so to speak, whilst their noticing differences seemed to be associated with sequences of individual disjunctions leading to rejection of each until the least unacceptable is found. Sorting seemed to have to do with associating whilst matching had to do with dissociating. But at 27/30 months, who knows at any moment which mental process is dominant?, and (2) in practice the two techniques of 'pairing' and 'separating' (not a happy choice of name I am afraid) seemed to mimic and encourage the two mental processes at that early stage of development, although it is clear that either technique will work perfectly well for both sorting and matching.

PERCEPTION, PERCEIVING Difficult to define but for my purposes are virtually the same as observation/observing. Directed interest.

PRAXIC See pages 19-20. Understanding based on movement or change.

SEPARATING See 'pairing' and 'separating'.

SORTING See pages 6,7,10,11,16 et seq.

SPECIALISED/UNSPECIALISED The more precisely fitted an animal is to a particular environment the more dependent it is on that environment and the less able it is to adapt to change. For example animals which are able to digest grass are not usually able to cope with meat; a cat's feet are equipped with soft pads and sharp retractable claws for climbing and holding prey (a leopard) or with hard pads and non-retracted dog-like claws for running (cheetah).

UNDERSTANDING See pages 5,8,10,24-26, and note 3 (page 34).

UNSPECIALISED See 'Specialised/Unspecialised'.

REFERENCES

CARROLL Lewis, 'Through the Looking-Glass'.

LOCKE John, 'Essay Concerning Human Understanding'.

1. WALDON Geoffrey, 'Understanding UNDERSTANDING', Collected Papers 1964-1980 Volume 1 (Film Script and Session 1).
2. WALDON Geoffrey, 'Understanding UNDERSTANDING', Collected Papers 1964-1980 Volume 3 (Session 9).
3. WALDON Geoffrey, 'Understanding UNDERSTANDING', Collected Papers 1964-1980, Volume 5 (Sessions 1 and 2 of 'Educational Approach to the Handicapped Child in the Classroom' (1976).
4. WALDON Geoffrey, Course Notes, Session 7 'Matching' of 'Educational Approach to the Handicapped Child in the Classroom' (1976).
5. WALDON Geoffrey, 'Understanding UNDERSTANDING', Collected Papers 1964-1980, Volume 5 (Rough notes on Sorting, and Volume 13 'Learning-how-to-learn to understand').
6. WALDON Geoffrey, 'Understanding UNDERSTANDING', Collected Papers 1964-1980, Volume 4 (Session 5 - 'Brickbuilding').