PART THREE

MOVEMENT AND SENSIBILITY: TOLERANCE AND CONSTRAINT

(Meaning from Movement)

By

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(UNFINISHED DRAFT)

CONTENTS

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.

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.

*My rationale for this course of action, which remains reflected in my assessments of children's abilities and difficulties of adaptation, will be discussed in the fifth essay 'General Understanding and Conventional Language', as will my views on terminology.

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.

In the first instance, I intend to do this in the form of five essays each of which, whilst being in some sense complete of itself, is meant to be read in conjunction with the others.

Years ago, following many attempts to explain my ideas to others, I became convinced that I had a personal communication problem which I should concentrate on meliorating; however, I subsequently realised that, whilst not denying my inadequacies in setting out novel notions simply and clearly, the very ideas I was attempting to communicate, were to do with the developing understanding. That is to say, the hypothesis is REFLEXIVE.

Since, as will be seen, the hypothesis claims that although the transmitter of information (the writer for example), can offer material, albeit more or less satisfactorily, the onus is entirely on the learner (the reader), who must ACTIVELY set out to understand, even though she can not yet appreciate what that understanding will consist in, and effortfully follow through, with the process indefinitely.

Emphasis will be laid on the CREATION OF EXPERIENCE and on the essentially much more active role of the receiver, the learner and the questioner, than that of the sender, teacher or 'answerer'.

The job of the writer is to facilitate the effortful strivings of the enquirer, much as a midwife eases the travails of childbirth.

I shall try to be clear; the difficulty of the subject matter is a function of the reader's interest.

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 ideas concern (i) the source of the sensory receptor activity patterns from which experience is ultimately created; (ii) the reinforcement and drive, caution and control, which powers and regulates the creation of experience; (iii) the essential role of movement, its ranges of tolerance and constraint, in this process; (iv) the self- creation, for each individual, of a functional bodily unit and an increasingly interesting and structured space within which to act and generate experience; (v) the form of the subsequent development of general understanding, including the need for a learned mechanism for creating and organising experience with increasing acceleration; and (vi) the relationships of this understanding to conventional language, etc.

The basic ideas, all of which first crystallised nearly twenty five years ago after a gestation of several years, have found their daily application in work with retarded and emotionally disturbed, as well as with normally adjusted, people. Now, having had such a prolonged period in which to mature, I intend that they should be set down in outline within five intimately integrated essays, having the provisional titles:

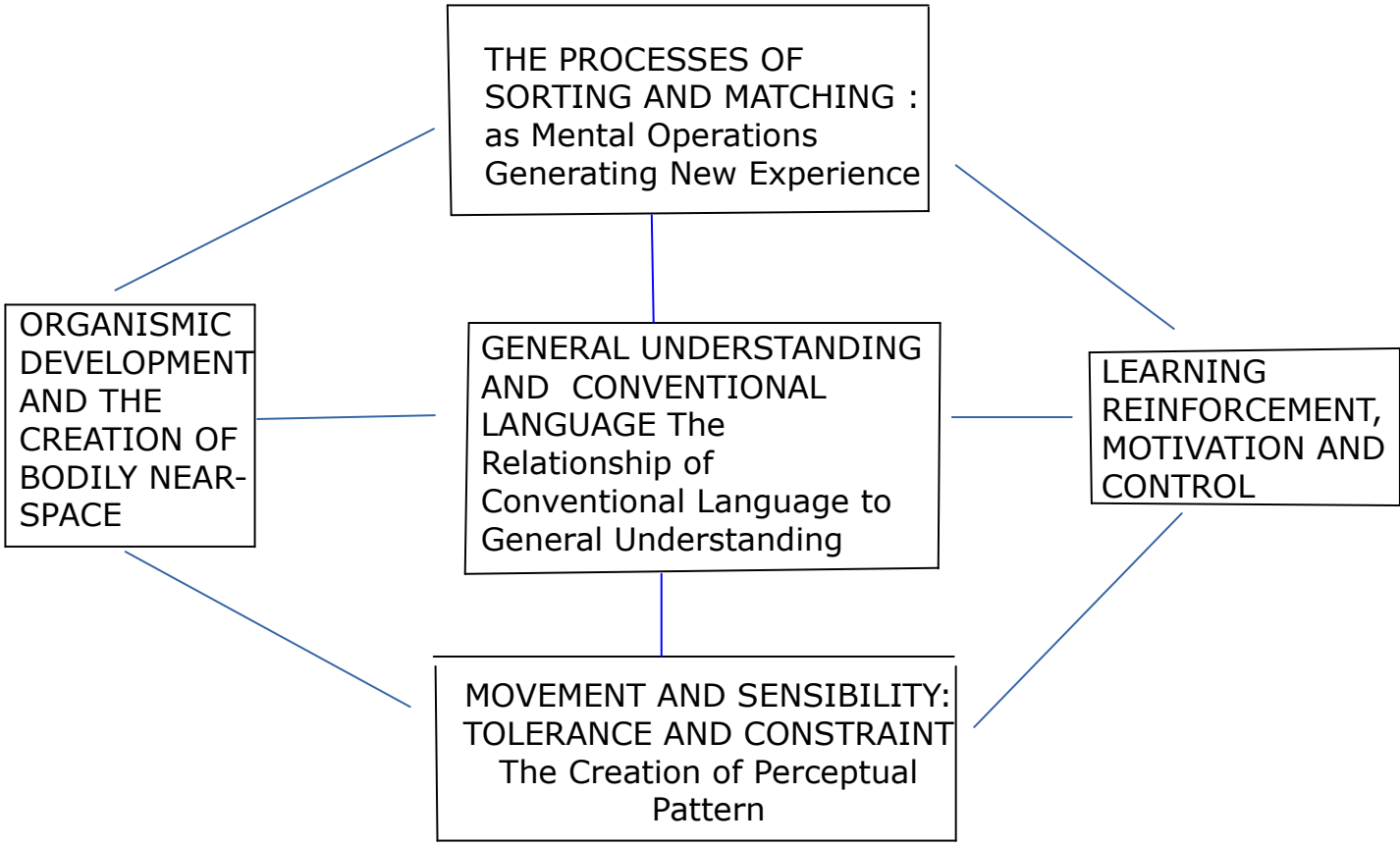
A) THE PROCESSES OF SORTING AND MATCHING as mental operations
Generating New Experience in Child Development

B) LEARNING, REINFORCEMENT, MOTIVATION AND CONTROL of the Generation of New Experience in Child Development and some of their consequences for the adult

C) MOVEMENT AND SENSIBILITY: TOLERANCE AND CONSTRAINT –
The Creation of Perceptual Pattern

D) ORGANISMIC DEVELOPMENT AND
THE CREATION OF BODILY NEAR-SPACE

E) GENERAL UNDERSTANDING AND CONVENTIONAL LANGUAGE
Relationship of Conventional Language to General Understanding.
Pathology of Learning and Development in ‘Retardation’ and 'Handicap’.


THE PROCESSES OF SORTING AND MATCHING : as Mental Operations Generating New Experience
ORGANISMIC DEVELOPMENT AND THE CREATION OF BODILY NEAR-SPACE
GENERAL UNDERSTANDING AND CONVENTIONAL LANGUAGE The Relationship of Conventional Language to General Understanding
LEARNING REINFORCEMENT, MOTIVATION AND CONTROL
MOVEMENT AND SENSIBILITY: TOLERANCE AND CONSTRAINT The Creation of Perceptual Pattern

There is, of course, no suggestion that the system being described is quinque-partite; however, a seemingly chance convenience allows the description to be dealt with in four parts, plus one which is concerned primarily with the product of the system as a whole and its reflection in everyday spoken and written language. This convenience more than compensates for the artificiality of the division.

Although the implications of the ideas for education and for the treatment of emotional disturbance will be obvious, discussion of the applications has already been dealt with in detail in 'Understanding UNDERSTANDING' Volumes 1 – 13 (unpublished).

I would like to heed the excellent advice of the King of Hearts: 'Begin at the beginning, and go on till you come to the end: then stop'; however our subject matter has no evident beginning and, even more certainly, no end, so that as with the chicken and egg problem, apart from moving so far as is possible from the simpler to the more complex and from origins to derivatives, our start must be more-or-less arbitrary.

I choose first to lay down a number of notions so that they can be taken up in discussion later when more definitive mechanisms are dealt with, much as a bowls player places woods beyond the jack to be available when the game moves further down the green. That was one of the aims of the paper on sorting and matching.

That first paper emphasised the paramount importance of pattern and introduced some ideas about similarities and differences, and the manner in which novel experience is created. It also introduced the notion of the *observation* as the functional unit of understanding.

The second paper was concerned with the driving force that powers both continuing existence and the creation of experience, and the aspects of this force which promote and regulate changes in behaviour.

The present paper is concerned with the forces which bring into being the highly improbable patterns from which the world of the human observer, indeed the identity of the observer himself, is created and which, despite their individual isolation, is nevertheless shared by all humans as the basis of understanding. Here we are to discuss the origin of the patterns of various degrees of significance from which the whole of human understanding is somehow created.

Since the understanding of the world, that is to say all that surrounds the one who understands, is assumed to be created from active observations or actions, generally directed towards or focussed upon particular locations within the personal space which is occupied by the physical

body, together with the range of physical behaviours engaged in by that individual creator of experience, we must first or at least simultaneously, account for the state and organisation of the observer himself.

Before attempting to examine the manner in which a child creates its own adaptive capacity – its general understanding – as is intended in Part Four, or attempting to follow in outline the sequence of the growth and 'evolution' of the essential core of this understanding (Part Five) it is first necessary to study the ways in which recurring patterns can take on significance or potential 'meaningfulness', giving rise to a state of self-knowing or learned organisation capable of making directed observations on its environment.

It might seem paradoxical that fragments of 'knowing', disembodied directionless understanding, should precede, in point of fact compose, coalesce and give rise to, the knower, the keeper of this knowing; however, it is difficult to see how it could be otherwise.*

Of course many creatures are from birth capable of a range of behaviours entirely sufficient to ensure a fair chance of survival. Some of these appear to be influenced by the outcomes of some of their behaviours so as to adjust these somewhat, but those which show a marked capacity for 'learning from experience' seem to require a pre-selfsufficient period of preparatory learning before being released from a need for parental protection.

There must be a preliminary *stage of becoming* in the would-be observer, in the generator of observations, who is to be capable of *creating* novel experience of an 'outside world', an ambient meaningful space within which things exist and behaviours occur.

Footnote

*Our question is: How do we know? What is the origin of our understanding?

This question presupposes that there is an entity – the 'knower', capable of knowing and that there is something which the knower 'knows'.

However, the knower comes into being simultaneously with the knowing, which is primarily the knowing of itself - at first the becoming aware of its own existence, establishing a familiarity with its own extent, range of movements, etc.

It seems perverse to separate the coming into being of the knower – the 'self' – from the coming into being of the knowledge, for the two seem not only inseparable but to be one and the same thing. The same processes which give rise to the individual as a self give rise to that individual's understanding.

1 ADAPTIVE SURVIVAL AND THE ENVIRONMENT

A) Environment: surroundings

The notion of a discrete creature separate from, surrounded by, and perhaps moving about within, a stuff of a different nature – its environment – is a fairly simple one; however, since many of the components of the environment such as air, water, minerals and states of matter such as solids, liquids and gases, and forms of energy such as radiation, heat, light, vibration etc. are also components and states of the creature and pass imperceptibly between creature and surroundings, the division between creature and environment is in reality none too clear.

Furthermore, since any attempt to locate the essential 'self' of the creature within its physical frame leads to paradox we need to identify an 'internal environment' whose physico-chemical balance of distributions determines the vitality or state of life of the creature and whose physical make-up of bones, muscles, ligaments conducting vessels and nerves form the basic components on which the life and existence and the means of individual adaptive survival of the creature, depend.

B) Survival

Individual adaptive survival -

- learning ways of recognising, meeting with and coping satisfactorily with the various sets of environmental conditions which arise ...
- producing appropriate behaviours ...
- learning to produce even more appropriate behaviours …
- having to temporarily modify local environmental conditions so as to facilitate survival…
- more permanent modification of the local environment …
- control and modification of environmental conditions ...
- fitting into the environment…
- adapting needs to the environment …
- making the environment suit the 'needs' of Man

As humans become technologically more powerful they more radically and extensively change the environment to suit their immediate desires thus creating more lasting changes in Nature … effecting disequilibrium ... and threatening their own lifelines to existence ... instead of the local, temporary and very limited changes within each necessarily adaptive niche with a subsequent return to a previous state of dynamic equilibrium/vital balance.

Even simple technologies, consisting of the felling axe assisted by ox-traction and combustion, when applied systematically and extensively and informed by the confidence of profound ignorance have been effective in significantly reducing photosynthesis and creating deserts.

C) Meaningfulness

In order to influence the external environment this feature or component of knowledge must first come into being and this creation is contingent on the development of a sentient and supposedly sapient organism of which the environment is a product.

In fact the environment as an 'interest compelling space' comes to be understood from a very early age so that normally the capacity for controlling or at least using the immediate environment adaptively is an inevitable consequence of the development of general understanding.

Now before investigating the structures and physiological processes which form the 'hardware' for this coming into being of self and understanding, let us follow some of the stages leading to meaningfulness:

Something from Nothing/Meaning from Void

Meaning as Change - Activity

Meaning as Pattern in Change - Traces of Change (Evidence of Change)

Meaning as Change of Pattern

Change as Movement Embodying Meaning

Traces of Movement – vestiges of meaning

Traces of movement reflected in the responsive activity of sensitive/irritable 'points'

Movement leaving temporary residual traces within sensitive/irritable 'points'

Temporo-spatial patterns encoding the movements exciting them ……

(Temporo-spatial patterns within which the essences of the movements inhere) ...

… assembling into collections which form designs capable somehow of giving rise to similar movements which not only manifest those designs

but also induce further traces which enhance, enrich, ‘envary’ and extend the ‘stored’ designs.

Activity and Change

So far in our investigations it has been possible to take ‘activity’ for granted; as given. Creatures, including human babies, evince behaviours which tend, on the one hand, to increase in amount and in the energy involved whilst becoming increasingly defined and predictable in regard to its general form. On the other hand, these behaviours also increase in complexity and variation and so become less readily analysed and interpreted, for, as the probability of any one of them diminishes, it becomes less predictable in regard to any particular manifestation.

We seem to proceed from one kind of unpredictability to another - from ‘chance’ to (the necessity of) inference.

We seem to proceed from nothingness or non-existence to increasing change (towards universal activity). From nothingness to change!

But change in what?

Contrary to intuitive feeling it seems that logically *change* comes first, the *what* being a product of the change!

Nothingness to change and to the necessary appearance of what can give definition to the change … matter, substance, substrate.

It seems to follow from this that the spatial and temporal characteristics of the matter etc. (including the 'identity' and identifying properties of any ‘object’) are themselves properties of the process of change.

If we now translate this notion into *activity,* active movement or change of location in space and time, it would seem that creation must lead to increasing randomness. And so we might expect a baby’s enlarging quantity and range of bodily movements to become increasingly chaotic; however, this is not the case. As has been said, it appears that increasing activity tends to lead to an *increasing order* which forms the basis of a hierarchy of organised complexity.

What is the origin of - what forces bring about - this increasing order in complexity in the face of increasing activity?

State of understanding

1 From ‘nothing’ to the ‘highest states’...

2 A ‘knower’ and that knower’s ‘knowing’ (understanding)

3 Knower must always be in harmony with its state of understanding

4 Existence of the knower must be essentially the same as the existence of the knower’s understanding and the raw materials, the stuff from which each is created, and the manner of creation must be essentially the same.

5 In reality there must be minimal structures and functioning which represent the ‘given’ or ‘innate’ knowledge (understanding) which develops through learning, in association with physiological changes, into progressively advanced understanding.

6 At first some sort of physiological change (maybe involving learning) leads to a ‘state of apprehension’, or readiness, (recognised by an outside observer as a responsiveness which increases with time and the exercise of activity).

7 Sensory receptors are the only viable candidates as sources of nervous activity directed towards the central nervous system (CNS).

8 Receptor activity is awakened by changes in the incident energy. *Changes* in the state of the incident receptor-activating energy and/or in the relationship of incident energy to the sensitive cells.

9 Patterns are created by receptor activity. (RAPs - Receptor Activity Patterns).

10 Unit RAPs (‘single’ patterns) arise, leading to established functional unit patterns.

11 To be apprehended a RAP must stand out against its background. Its degree of significance is determined by the contrast between signal (RAP) and background ‘channel noise’.

Instantaneous signal-to-noise ratio may vary in terms of

intensity	duration
definition	contrast
repetition	probability

12 Changes of state in incident energy

Changes in 'pattern in source'
Changes in source intensity (duration, rate of change)
Changes in direction and distance of energy source

Movement

13 Kinds of movement likely to produce definitive, consistent and frequently occurring patterns

14 Mechanisms necessary to the production of RAPs

A matrix consisting of several loosely connected parts (usually with a bony core) within which and on which the sensory receptors are distributed
The sensory receptor arrays within the parts, which can be moved relative to one another

The contractile muscles connecting the parts so that their shortening brings their points of connection closer together thus causing movement and changes of bodily posture

A communication system of nerve fibres and intermediate relays which conduct nerve impulses from one part to another by way of the CNS

15 Systems of Constraints and Tolerances engendering consistently recurring, potentially significant receptor activity patterns

a The physical characteristics of the body itself (- Reference back to and extension of matrix, pt.14)
b The 'postural reflexes'
c Learned Understanding

FROM NOTHINGNESS TO CHAOS, FROM CHAOS TO PATTERN

The subject of this paper is the origin of meaning. Not only the finding of significance and meaning in what is perceived by a human observer but the emergence of the observer itself as a meaningful pattern or system.

Meaningfulness as something compelling the directing of sustained interest clearly requires an observer capable of evincing and directing an interest, thus implying that the evolution of the observer and that of the act of observing can not be usefully distinguished.
The form of the emergence of the baby as an organism is the subject of Paper Four but the appearance of a meaningfulness within which this organised emergence can take place is our present concern.

Hence we need to consider the main requirements of an adaptive (or learning or experience-creating) system and what factors it must include (see also Learning, Reinforcement Motivation & Control, section four).

We are concerned here with the appearance within homogeneity or chaos or meaninglessness of what can be registered, recognised or recalled, recreated; with the emanation of pattern, something contrasting with the meaningless, the structureless, something discernible and capable of implying significance.

How can thousands of energy-sensitive sensory receptors become the source of significant signals? Receptors which are selectively susceptible to certain kinds and limited spectra of energies and tuned to be sensitive to limited ranges of intensity are capable only of two functional states: dormant and inert on the one hand and sufficiently active to initiate nerve-impulses in their associated sensory nerve-fibres.

The chaos or uncertainty to which I have referred is the absence of patterned activity, the background state of relatively homogeneous activity – structureless 'noise' which represents the condition of expectancy or readiness within the CNS.

The receptors are not of course either individually mobile or haphazardly distributed but are arranged about a supporting matrix which is the animal body.

The situation and sensitivity 'threshold' of each receptor renders it liable to be switched momentarily into an active state before becoming temporarily unresponsive. It is clear then that two kinds of pattern are possible: (i) sequences of discharges whose patterns lie in the temporal frequencies, and (ii) patterns due to the spatial separation of the receptors involved.

There is also of course, a further kind of pattern which is determined by the different kinds of receptors, that is to say the different sensory modalities: light sensitive, acoustic, tactile, thermal, etc.

It seems reasonable to assume that spatio-temporal patterns of sensory receptor activity (RAPs) represent the significant units from which all meaning (meaningfulness) originates.

How then do recurrent patterns of activity arise in the sensory receptors?

There appear to be three possible origins for the accesses of incident energy capable of eliciting repeatable patterns of activity within the batteries of receptors:

(a) sources of incident environmental energy moving relative to the body, as for example the baby's being stroked or stimulated by sights and sounds emitted from various directions,

(b) the baby's moving as a whole relative to its surroundings, as for example its being carried or nursed, or in due course its spontaneous locomotion; and

(c) segments of the body moving relative to both the general environment and to other parts of the body.

Since in practice from the earliest stages it is the baby's own spontaneous movements which are by far the most frequently occurring, the least reliant on chance, and the most subject to spontaneous movements and control, these are the most likely candidates as the producers of significant patterns of activity within the sensory receptors.

In order that observations (distinction between something and nothing) might be made it is necessary that part of the 'universe' separate off from the whole. If the manner in which this separation takes place involves the same processes as these by which the later understanding accrues there is no need to attempt to distinguish clearly between the child's 'becoming' and its 'knowing'.

How then does this increasing understanding come about?

Understanding can only be inferred from the behaviours a creature utters. In fact its understanding may be thought of as the behaviour-producing state of that creature.

With time those creatures referred to as adaptive may be observed to change the frequencies, forms and associations of the behaviours produced, from which we infer the creation of experience as a result of 'learning' having taken place. The creature's world, 'understood' through its own behaviours, becomes an increasingly more meaningful place; however as has already been implied, the origins of learned understanding antedate a discrete learner, since the earliest experience created through the process of learning goes to establish the existence of the potentially adaptive *organism* itself.

This is a stage of self-creation, self-discovery, organism formation.

Despite this there is no reason to suppose that the creation of experience leading to the emergence of the learner differs in any fundamental way from that from which an understanding of the environment is constructed.

If experience is the stuff that understanding is made on, what is the origin of this experience? What is the source of meaning?

2 MEANING FROM MOVEMENT

Before we can enter into a discussion of what we intend by the word 'meaning' we must surely accept the fact of a capacity for being aware of, of accepting the fact of the existence of what is to be meaningful.

But surely to recognise implies the prior existence of a pattern with which to compare that to be recognised, or putting it another way, it is necessary to have experienced 'something' in the first place in order to be able to 'recognise', to apprehend, or to be aware of the appearance or existence of another 'something'.

Presumably a 'something' must have features which characterise its 'somethingness'; which denote its very 'being there'; which 'draw our attention to' its existence? Already I am way ahead of myself in my speculation; however, one must start somewhere.

Our baby – our would-be learner and its inchoate understanding – has, *as a whole*, first to distinguish in some way between something and nothing before coming to relate separate somethings according to similarities and differences. Does she not? Since we, the speculators, already accept our own existence (to say nothing of an enormous burden of irrational prejudice) we have to start our investigation somewhere, and I have already suggested that we begin with the late foetus or with the neonate;

however, from the viewpoint of an onlooker, the little creature exhibits increasing amounts, varieties, durations and complexities of behaviours.

It is the increasing frequencies of recurrence and clarity of definition, which are initially the criteria of significance and the earliest forms of meaningfulness, or signs of 'meaning'.

But what are the bases for these claims?

Even if we accept, as I do not, that a newly born baby is a unified entity, an organism, quite distinct from the electro-magnetic and other energy fields about it, we seem driven inexorably to focus our attention on those sensible organelles which can detect change in the state or direction of incident energy and transduce this detected energy change into transient nervous impulses, namely the *sensory receptors.*

If we think beyond the *detection of presence*, to the recognition of similarity or difference, then we must introduce the notion of 'form of change', or *pattern.*

2.1 PATTERNS OF SENSORY ACTIVITY

Sensory receptors are of several kinds according as they are selectively susceptible to the changes of intensity in certain species of energy (mechanical compression, tension, vibration, heat, light), variously tuned to certain band widths of energy 'amount' and adjusted to certain thresholds of sensitivity. They are distributed about the body in various degrees of concentration and topographically according to pre-set biological rules, being sometimes found throughout the body and sometimes congregated locally into specialised 'organs', as with the organs of vision, hearing, olfaction and taste.

According to predetermined properties and/or prevailing chemico-physical conditions each receptor, whilst being sensitive to and momentarily changed by smaller amounts, is normally caused to suddenly undergo a change of state by a certain supra-threshold degree of energy change, taking place within certain time limits. The receptor cell is temporarily activated when, alone or in association with other simultaneously activated receptors, it is capable of initiating one or more action potentials (nerve impulses) in one or more nerve fibres by which route the effects of the sensory receptor activity is transmitted towards the CNS.

It is the nature of the sensory receptor that it requires a certain minimum of incident energy operating over a sufficiently brief period of time to cause it to 'fire'; however a single receptor is not differentially affected by

higher intensities. That is to say, it has only two states: 'prepared' and 'discharged'. Sensory receptors are said to obey an all-or-none principle. Following active discharge and the initiation of nerve impulses the receptor requires a short finite recovery period before regaining its normal sensitivity once more.

Since the sensory receptors are permanently fixed in their various locations, and behave in the manner just described, it is clear that when sensory receptor-containing tissues are suitably stimulated, large numbers of nerve impulses are sent travelling along the *afferent nerve fibres* towards the CNS, and since any particular nerve fibre conducts impulses discretely at a constant velocity, two varieties of patterns, originating in the activity of the peripheral sensory receptors and translated into patterns of nerve impulses, are available for registration and recognition by the receiving stations or 'centres' of the brain: namely patterns due to impulses originating in differing topographical locations - *spatial patterns* - and those due to the receptors firing at different rates at different times - *temporal patterns*.

Another kind of pattern arising from activity in more than one sensory modality more or less simultaneously (for example, 'heat' and 'touch', or light stimulation and eye muscle contraction during eye movements) is obviously another important source of potential information.

2.3 THE BASIS OF UNDERSTANDING IN MOVEMENT

The developing organism collects its experience through the agency of the sensory receptors which are susceptible to *change* in the energy state to which they are sensitive.

The creation of patterns of activity within the sensory receptors

Having recognised that spatial and temporal *patterns of change* within the states of activity of the sensory receptors appear to be the only sources from which experience can accrue, it is now necessary to identify the factors which induce these patterns of activity within the arrays of receptors.

Change in the state of the energy incident on a receptor can come about in several ways:

i) the energy source may vary in intensity or quality;
ii) the energy source may very its location relative to the receptor;
iii) the whole or parts of the organism may be moved passively in respect of the energy source;

iv) the organism may move its receptors relative to one another as well as relative to the energy sources;
v) the organism may move its receptors as a whole relative to an energy source.

It is these last two which are far and away the most important producers of change and therefore sources of experience for any organism since these are the sources of patterned receptor activity over which the growing creature/child has the most active control, thus making such patterns much more predictable than any of 'external' origin.

Furthermore it is the sensory receptors within the tendons, muscles and joints which, being sensitive to the changes in the apparatus of bodily postures and movement itself, provide the primary patterns from which an 'awareness' and subsequently an integration of the bodily parts into a functioning organismic unity are fashioned.

3 MOVEMENT AND SENSIBILITY: TOLERANCE AND CONSTRAINT – (Meaning from Movement)

Having concluded that patterns in the activity of the sensory receptors are the only viable candidates for the immediate source of experience and understanding, and having established a mechanism for reinforcing and regulating the acquisition and retention of some behaviours within the behavioural repertoire in virtue of the receptor activity patterns associated with them, it is necessary now to examine more closely the manner in which active movements create the receptor activity patterns from which experience and understanding is created.

Common sense has our organisms acting upon the environment to produce behaviours, which are recognisably affected by their interaction with the environment and the effects of these behaviours.

It is not at all difficult to envisage an animate entity distinct from its environment and evincing behaviours which form the origin of and basis for its learning, its creation of experience and consequent development of the understanding which is the source of its behaviours.

However, for the more highly adaptive organism – that capable of learning from experience, of modifying its later behaviours in consequence of the outcome of the earlier – there must be a transitional phase prior to which the learner is not yet an entity in its own right.

It is plain that in this process we seem to have *a knower* (one who understands) and *what is known* or understood by the knower in terms of its capacity for producing behaviours.

Since by definition the understanding is a state – the behaviour-producing state – of the knower and newly created experience modifies and expands the condition of the knower, we are driven to ask ourselves: what is the understanding of the knower in regard to itself?

In order to reach a state of understanding or state capable of initiating a number of behaviours which act upon the environment, a preliminary or prior period of activity must occur in which behaviours lead to the creation of experience from which the knower is itself constructed. That is to say, the earliest behaviours emanating from the foetus must first organise a changing behaviour-producing state which is ultimately the entity which subsequently acts centrifugally, ostensibly upon the surroundings, to create its own world of space and its contents.

As we shall see in Part Four, the first phase constitutes the formation of an organism, a unified whole, which subsequently observes or acts outwardly 'upon the environment' to construct an understanding.

Our purpose in this part of the theory is to examine the structures underlying and necessary to (controlled) movement and the manner in which a movement may be encoded within the patterns of nerve impulses within the peripheral nerves and nerve pathways within the central nervous system.

First of all we might review our list of the minimum structural and functional requirements for the creation and assimilation of the significant patterns from which an understanding might be constructed.

Discussed in Part Two (LRMC) were the minimum requirements for the human organism's creation and organisation of experience. These turned out to include the following:

1. RECEPTORS: Suitable sensory receptors, tuned to particular ranges of electromagnetic and mechanical energy (light, heat, vibration, etc). Change in frequency, intensity and quantity;

2. A CHASSIS: A fairly rigid framework about which the receptors are regularly and permanently distributed; but divided into a number of loosely connected segments which move relative to one another;

3. A MOTOR SYSTEM: Some means of moving and steering the receptor-arrays relative to the environment (the potentially incident energy changes), and to one another;

4. TOLERANCE: A sufficient range or 'space' within which the relative movements can take place. 'Freedom of movement' or tolerance;

5. CONSTRAINTS: (a) physical form and characteristics, (b) inherited reactive movement patterns – the 'postural reflexes' which together impose some limitation on the number or range of RAPs produced;

6. A SIGNIFICANCE DECIDING MECHANISM: A simple means of deciding which RAPs are significant and worth repeating;

7. A REINFORCING SYSTEM: A means of marking some receptor-activity patterns (RAPs) as '*significant*';

8. MOTIVATION: A source of motive power to set and keep the whole system in active motion;

9. RETENTION/MEMORY*: A means for storage and recovery of the significant patterns in such a way as to continually modify the steering and sensitivity components.

* The notion of 'memory' really applies only to associations between images etc. The learning of new skills in behaviour (and indirectly the objects acted upon) implies a retention of the ability to reiterate the behaviour, which is maintained by continual rehearsal of the behaviours or other more complex or extended behaviours which contain the earlier as foundational components.

It was further implied that all experience ultimately derives from the spatial and temporal patterns which occur within the activity of the sensory receptors which supposedly respond, in their characteristic on-off manner, to various 'outside' energies.

This essay is concerned with the apparatus and mechanisms which

- create those (sensory) receptor activity patterns (RAPs)
- decide *initially* which are the more or most significant of those patterns (or worthy of reproduction)
- and determine the potential range of freedom and the extent and flexibility of the constraining-rules for the form, variety and frequency of occurrence of the patterns.

It is concerned therefore with the sensibility transducers themselves; with their distribution, the form and characteristics of the framework upon

which the receptors are disposed; the power for movement; the devices for maintaining control between the parts – 'equilibrium'; the conditions which allow the scope of freedom for movement – 'tolerance'; the forces which impose the initial constraints – set the rules – which induce the RAPs from which the primary experience derives, as well as the manner of establishing the secondary constraints and the consequent creation of novel experience; also some of the ways in which the movement or motor-system can be disordered.

Tolerance and Constraint

That suitable recurring patterns within the activity of sensory receptors should be ensured, that these should occur, in sufficient amount and adequate contrast, that these should appear at the times and for the periods appropriate to their supplying the creature's/child's need for the raw materials of experience and that they should be similar in form and parallel in timing in all the individual members of the species, requires suitably patterned movements.

We have already discussed elsewhere (LRMC) the drive to action or motivation and the reinforcement of significant pattern. Here we are concerned with the forces imposing definition on the active movement.

Movement requires space within which it can take place and absence of excessive restriction on relative change of position between the bodily parts – notably at the joints.

This freedom to move I term *tolerance.*

At the same time for a movement to have sufficient definition to repeatedly induce similar receptor activity patterns there must be guiding or moulding forces which variously impose limitations (relative certainty) on the *range of tolerance* (or uncertainty).

These restricting or 'forming' forces I term *constraints.*

Generally speaking there are two means of imposing constraint, namely:

(i) that which keeps any displacements of the bodily parts contained within bounds by preventing or discouraging too wide excursions - repulsive, 'external' constraint; and
(ii) that which draws the movable/displaceable parts continually towards a central core – attractive, 'internal' constraint.

In the developing creature or child three species of constraint operate to induce the potentially meaningful patterns of movements and their

attendant receptor activity and nerve-impulse patterns. In order of their developmental priority these are:

Firstly, the structural characteristics of the body. The general form, differential dimensions, absolute and relative masses of the bodily parts, the characteristics of the joints, and the muscular strength and proneness to fatigue.

Secondly, the 'postural reflexes' and other related vestiges of instinctually imposed postural response tendencies; themselves brought about as automatic reactions to certain changes of posture during certain epochs of early growth and development.

The third major, increasingly dominant, and ultimately by far the most important source of constraint is the *learned behaviour.*

3.1 SENSORY RECEPTOR ACTIVITY PATTERNS

Clearly sensory receptors are 'activating' continually throughout the body to produce a continually changing but statistically predictable 'background state'. The total amount of activity (which may be high or low) will vary from time to time.

This background state may be related to the state of alertness.

* * *

When a 'local' increase in sensory activity occurs it may be organised spatially and/or temporally as well as varying in extent and intensity.

* * *

The source of such 'local' sensory activity (which provides the patterns for/is the origin of created experience) is primarily and mainly active bodily movement which of necessity imposes more-likely-to-be-expected patterns on the sensory receptor activity.

A certain amount of organised sensory receptor activity also derives directly from external environmental forces, which stimulate the receptors directly or by causing passive movement.

* * *

This sensory receptor activity occurs at the periphery of the nervous system, within the muscles, joints, skin and viscera. It takes place at the region of interaction with the forces of the surroundings. The receptors are in fact the only point of sensient contact with 'reality'. The world must be created entirely from the activity of the sensory receptors. Our occasional awareness of the activity of some receptors is only possible as a result of the activity of other receptors.

* * *

Temporal patterns of activity within the sensory receptors and spatial and temporal patterns within receptor arrays, in order to provide a basis for perceiving, must be translated, in the form of nervous impulses, to wherever they are to be collated.

* * *

The peripherally produced patterns in the activities of the several kinds of sensory receptor, which will be subsequently 'referred back' to the bodily parts where they initially occurred and, in due course, to some extent abstracted from bodily association, are transmitted through the peripheral nerves and pathways within the central nervous system to regions of structural and functional organisation where they can be 'processed' and 'stored' and with which such subjective sensations as 'awareness' and 'consciousness' are associated.

* * *

The Understanding or World is to be constructed or created from these receptor activity patterns (RAPs) from which therefore the more significant must be separated from the less significant, in some way, and 'marked' as such for retention and further processing.

* * *

The encoded temporo-spatial patterns, originating at the edge of organism or pre-organism, at the individual-environment interface, reach a 'level' at which they are available to and utilisable by the learning system, where they can be incorporated in the maintenance and growth of the understanding.

* * *

There must also be a 'level' at or above which the organism can attend to or direct 'interest' at or focus and concentrate interest on, RAPs. Post-organismic observations, that is to say observations made by the

complete or unified organism, are of this nature - to contemplate, examine, explore, and experiment with.

* * *

What the relationship of this is to what we call 'conscious awareness' I cannot say.

* * *

The observing, pattern generating, world-creating system of General Understanding (GU) requires (in addition to the tuned - to certain kinds and limits of energy - sensitivity threshold-adjusted, activity-frequency limited, on-off sensory receptors) a matrix or scaffolding upon or about which the receptors are permanently arranged.

3.2 RECEPTORS

Properties of receptors.

Kinds of receptors – energy sensitivity

Location and distribution.

Imagine a sensorium or place whose signals from the different kinds of sensory receptors are somehow distinguished as indicating light or sound or 'pressure' or vibration or whatever, also where patterns of any particular modality in space and their patterns in time are discriminated.

Our common sense and intuition[1] tend to have our imagining such sensory receptor activity patterns as the *source* of our awareness[2] and understanding; however whilst it seems likely that these do induce our awareness and are important to our understanding, such patterns are literally *disembodied.* By themselves they have no points, axes or planes of reference. They are likely to be experienced in a vague, formless, ill-localised, indeterminate, and even temporally imprecise way.

Neurology used to refer to such sensations, especially in relation to pain, as 'protopathic' in contradistinction to sensations which are closely localised, more precisely defined, and experienced as being determined by various characteristics. It is not surprising that sensations are vague until referred to specific parts and extents of bodily surface, associated with particular postures and regularly occasioned by distinct movements. Such definition of sensation then is not possible until the bodily parts are unified and form an organism, but thereafter becomes progressively

definitive as bodily organisation and the structuring of the space, mapped out by the movements of the body, advance.

In this essay we are concerned with the principles which govern the production of the temporo-spatial patterns of sensory receptor activity from which experience and understanding are created. The priority of oculo-motor understanding over vision and of oto-motor understanding over hearing will be dealt with in Part Four.

Primary understanding and experience lies in the form, range and integration of bodily movements which are, or have been, at the disposal of the individual and in their harmony with the bodily apparatus[3].

Each movement activates a large number of receptors some of which respond to the changes within the tissues which actually produce the movement itself. The sequences of receptor activity which signal the movement reflect back potential information to the CNS where the movement was initiated. It is these sequential patterns, those *which 'follow' the movements,* from which the understanding of the bodily interest in space is created and which form the basis for all other understanding.

Each movement, being initiated on the basis of a pre-existing design, excites receptor activity patterns which when fed back provide potential information about the closeness of the realised action to the design to which it approximates. That or those parts which coincide closely with the design characteristics potentiate or reinforce the design, whilst sufficiently close variants tend to expand the tolerance or 'loose-fit' of the design for the future.

Assuming an infusion of movement into the bodily parts[4] *what are the primary constraints determining the earliest and most fundamental movements or behaviours?* First of all the static properties of the tissues – the limb mass and dimensions and the gravitational influence on these; the resistance or obstruction due to the joints and muscle tone; the distribution of muscle tone due to postural reflexes[4] or to the subsequent learning (see 4.4)

Notes

1 Common sense, as the term implies, refers to the communally held beliefs and habits (by) which (we) govern our daily routine. It consists of a set of pragmatic notions or prejudices, especially those acquired during the early years. There is no necessary connection between them and reason or truth, their only justification being that they seem to work. Intuition refers to the feelings of consonance between any notion and our firmly held beliefs.

2. Awareness. The notion of awareness, like that of consciousness is very difficult to clarify; however, it is not necessary to invoke introspection for in our model we may equate awareness with some definite threshold of 'readiness', preparatory activity, background state of alertness, sensitivity (possibly, for example, akin to the raster of a television screen ready to be interrupted by patterns of signal) – which does not imply self-consciousness.

3. Harmony of bodily apparatus and the exploited movements is determined by the general control over *all the bodily parts.* That is to say, during development a dysplastic or phocomelic limb exercised vigorously and with control (or even an absent limb) will lead to more satisfactory understanding than a well-formed limb exercised inadequately.

4. See 'Notes on Movement' below.

4 NOTES ON MOVEMENT

The baby, so far as movement is concerned, consists of a mechanical system made up of a fairly small number of loosely connected rigid components. What kinds of relative movement are possible and how much freedom for movement the limb segments about a particular joint enjoy is determined for the most part by the mechanical factors constraining that joint. For example, the upper arm bone is connected to the upper trunk through a relatively unrestricted ball and socket joint which allows movement throughout at least a 100 degree angle cone, whilst the movements of the shoulder blade, by varying the positions of the upper arm joint relative to the trunk, further increase the range of movements of the upper arm positions.

The movement of the lower arm on the upper arm however, is restricted to hinge movement throughout perhaps 140 degrees. It is not necessary to pursue this is detail to understand the very great range of bodily movements and postures which are possible and the variety of permutations in compound movements which can be assembled from the movements possible about each individual joint.

It must be remembered that the kinds and ranges of freedom of the movements must vary with growth and physical development as well as with changes in limb size and relative proportion. The kinds and degrees of constraint influencing the forms and amplitudes of bodily movement vary not only progressively with time and physical growth but also at any one time according to the activity of the muscles acting around each joint.

It should be clear that according to the influence of these factors the parts acting about a joint will move in ways which are governed somewhere between a rigidly controlled form and/or amplitude or, at its extreme, no movement at all, and something approaching complete 'freedom'.

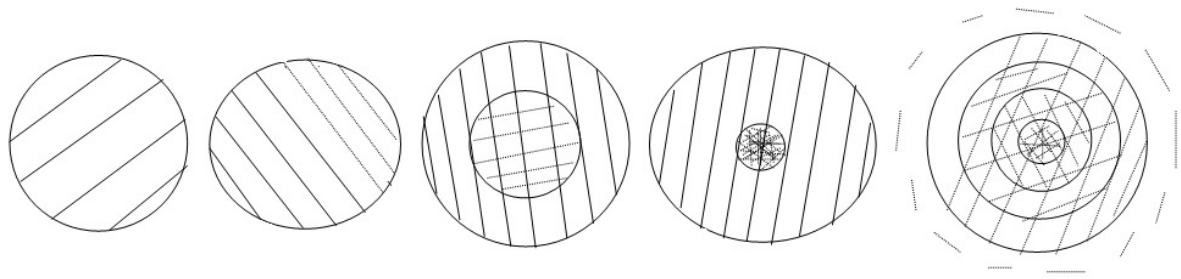
At one extreme there is no movement, or only stereotyped movement allowing no variations from which to construct novel experience, at the other such licence that there are no sufficiently fixed datum postures from which to estimate or register any particular variation. Between these extremes the natural constraints will normally determine the most probable (postures and) movements and the probability of any particular movement.

When we come to consider the movements of a complete limb acting from the base and 'chassis' structures of the trunk each movement of the whole limb will consist of the sum of all the component movements but similarly to/as with the individual components some movements, or rather movement ranges, will be more likely whilst others are relatively

rare. One would expect these movement patterns to fall into a number of discrete bundles of actions, each bundle centred about a core of highest probability within which a higher density of movement of that particular category occurs than it does elsewhere.

Each core and its associated bundle of closely similar actions although with practice capable of continuing variation and branching will tend to become progressively more specified or defined so as to represent what may be recognised as one of a relatively few basic actions from which all others arise by variation, branching and linking. These discrete bundles of actions I term *definers.*

A little thought will reveal that the definition of such a definer could vary not only according to the radius of integrity or the thickness of the bundle but also with the distribution of density within the bundle.



The greater the contrast between narrowly defined core and the remainder of the bundle the more rigidly performed the action; the more homogeneous the density within the bundle the less well defined the action.

Hence one extreme would occur if all component movements are very close to a very narrow central defining core, when actions performed from such experience will be stereotyped. This may be contrasted with the situation where the bundle is wide and the component actions have been distributed evenly within or to the periphery of the bundle, when actions performed on such experience will be vague and ill-defined.

Evidently clear core definition coupled with a reasonably wide range of component variants distributed with the density diminishing evenly in a centrifugal manner is necessary for clear-cut flexibility of action.

4.1 Active versus passive movement

Whereas it is possible to perceptually ‘follow’ one's own movements when effected by outside influences (passively-imposed movements), it is from movements spontaneously initiated and actively maintained and controlled that understanding, of the body itself and the space through and within which it acts, arises.

Reactive movements and postures are essentially the same as active movements, which in some ways might almost all be considered reactive.

Movements whose active ranges are passively restricted as by clothes or other external environmental constraints are essentially a special case of those, normally constrained by the bodily form itself, from which all ‘subjective’ understanding of the movements and posture are derived.

4.2 Notes on muscle tone and strength

Movements are effected and postures maintained by the selective contraction of muscles usually across one or more joints and the consequent change of position of one bone to other bony points.

Normally the state of activity within the anatomical muscle is something between quiet and very busy. Each of a fairly high proportion of fibres and bundles of muscle-fibres is in some state of contraction at all times so that when a muscle is required to do work to shorten (isotonic) or take a strain without shortening (isometric), more fibres, in attempting to contract rapidly, augment those already active fibres to bring about a brisk response.

The proportion of fibres active in a muscle at rest must however be sufficiently small to allow free but precisely reciprocal lengthening of the muscle (the agonist) when a muscle on the opposite side of the joint (an antagonist) shortens during movement.

The extent of this eutonic range of background or ‘platform’ muscular-expectancy varies to some degree not only between individuals but quite considerably from one to another muscle group in any one person and from moment to moment; however, ranging outside this normally adaptive condition are the pathological states of hypertonia or over-expectancy, and hypotonia, or under-expectancy.

Whether muscles feel over-hard or over-tight to an exploring hand depends to some extent on the action it is exercising and on the degree to which it is involved. Whereas an actively isometric 'contraction' can be readily palpitated in normal individuals, tight muscles felt during passively induced changes in (or attempts to change) posture usually imply hypertonia or spasticity or, if in transient episodes, spasm. The latter behaviour evidences the over-excitable condition of the 'resting' muscle and its response to sudden mechanical stretching.

When muscles feel soft and yielding to the examiner's hand, and the limb can be moved passively very freely, and a delay can be felt between the first signs of muscular response and the actual limb movement in active exercise, then those muscles may be said to be hypotonic, under-ready to do their job, or flaccid. Despite the flabbiness, the muscle, when it contracts, may be normally strong. Sudden accesses of raised muscle tone against a background of hypotonia, whether or not these result in limb movement, are referred to as 'dystonia' and are commonly associated with disequilibrium as in athetoid cerebral palsy.

Muscle strength

Anatomical muscles vary naturally from one group to another and from one person to another and although their strength can be modified by exercise, etc., each muscle varies from moment to moment according to the conditions.

The most important conditions from a practical point of view are the length of the fibres at the start of contraction and throughout the action. Within limits the longer the fibres are at the beginning of a movement the greater the power which can be raised. Furthermore, much greater strength can be shown when the length of the muscle fibres remains more or less constant. Clearly in such isometric actions there is little or no movement about the relevant joints and loads can not be moved directly; however, greater equivalent forces can be opposed than during isotonic activity when the internal state of the muscle, its tone, remains relatively constant, and not necessarily much higher than the resting tone, as the muscle shortens and the limb or other parts move (change relative positions).

When we examine the distribution of muscle tone throughout the body together with the relative strengths of the different muscle groups, it will be seen that in young normal and in movement-disordered children, any of a variety of bodily postures will be assumed according to the orientation in respect of gravity, the initial posture and other environmental influences.

For the normal child, these basic responsive distributions of muscle-tone, which may or may not be accompanied by movement or change of posture, can be considered as the vestiges of primitive adaptive but non-learned behaviours to be seen in other animals, but which for the human being ensures a minimum of organised and patterned movement to provide a foundation and simple mould for the development of personally acquired learned behaviours and experiences, without imposing too rigid constraints on variation and variety.

These 'postural reflexes' then give impetus and guidance to empirical gain of experience without dominating the character and extent of what is learned.

4.3 A note on Equilibrium in Posture and Movement

Direct experience, which is the stuff of general understanding, and the adaptive functioning, which is the exploitation of the understanding, is entirely dependent upon movement, on controlled movement.

The controlled or learned use of movement requires a physical basis to regularly initiate motion, to impose some limitation on its direction, extent and limits, as well as on its form, power and amplitude.

This physical basis is necessary at the beginning of understanding and continues to be essential throughout the development and use of general understanding. However, with time, the child gains increasing dominion over his physical body, his experience-gaining-and-utilising equipment, so that the basic physical mechanisms become progressively unobtrusive.

The steering of his bodily parts relative to one another and to the surroundings requires 'executive' control over certain very basic servo-mechanisms.

Control systems, in which changes are regulated in respect of some state, course or goal, by signals directly proportional to any deviation, which are transmitted back to the design-source of the activity, are apparent throughout Nature. Such control by error-actuated feedback is to be found at all levels of human activity.

In movement we need only concern ourselves with the equilibrium of the chassis and its movements, and with actions directed towards the surroundings by the 'limbs' from a more-or-less stable chassis.

That the ability to maintain sitting, standing, walking, etc. without toppling is highly remarkable, should be very clear as a result of contemplating the stability of an unsupported life-sized, human shaped model. Even slight changes in the weight-distribution of the body relative to its 'centre of gravity' must be, and normally are, compensated for immediately and constantly by changes in the muscle tone distribution, whether or not accompanied by change in position. Much is normally achieved without obvious movement or change of posture in virtue of cantilever action.

Impairment of this basic adjustment mechanism puts the whole onus for general postural or vertical equilibrium on the conscious compensatory movements of the individual guided by information fed back through his senses, and acted upon in awareness. Such compensatory movements and locking of muscle groups one would expect to be somewhat dilatory and very jerky. Furthermore the unstable and unpredictable state of the chassis associated with sudden exaggerated changes of posture must accentuate the effects of impairment of the other mechanism controlling the form, extent, pathway and speed of 'limb' movements.

In this case, the 'limb' movements normally acting from a sound and stable chassis are early 'controlled' by the conscious efforts of the individual designing, organising and carrying out a movement having an intended form and perhaps a particular goal. By monitoring the movement through position-sense, vision and touch, the individual uses fed-back information about the discrepancy between design and event to correct the behaviours.

Beneath this conscious control however, is a pre-conscious or automatic mechanism governing the smoothness and continuity of the changes of posture, which is functioning in the young baby before he could be said to have personal command of his bodily movements. Normally, this mechanism becomes integrated into 'intentional' movements and its constraining and lubricating influence in maintaining a satisfactory tonic balance about each joint is well seen in the child of 20-26 weeks where his 'error actuated feed-back control' in external goal seeking, is seen to be still raw or 'unfinished', but the underlying control of the movements themselves are quite smooth and untroubled.

Impairment of this mechanism, usually due to lesions in the cerebellum or hind-brain, results in delay in initiating this control response and the behaviour referred to as 'ataxic'.

4.4 A Note on Movement Strength and Weakness

How does a movement of a bodily part come about?

This sounds as if it might be a silly question and, in any event, I do not intend attempting to give a considered answer – only to note down a few observations, ideas and opinions.

I think it might be true to say that most people who think about it at all would tend to assume that when we 'will' a movement to happen, that is to say when we do something, we have a kind of model or plan of our body in mind much as the operator of a gas, water or electrically driven machine has.

We then 'cause' the necessary muscles to contract or relax and so 'move' the bodily part in more-or-less the way we had intended.

This simple picture comparing the animal body to a steam engine etc. is much as the Victorians seem to have visualised the phenomenon.

The control and guidance seems to travel out along with the power.

In many ways I consider the analogy closer than most would ever have had it but also tending to mislead. A steam engine requires a head source of steam under pressure. The engine responds when a main valve is opened so that steam is introduced to the movement system. Thereafter the engine performs to a fixed design according to which perhaps reciprocating piston action is translated to rotatory motion in driving a flywheel. The only variation possible would seem to be in respect of the total amount of power or work done per unit time and in the duration of working. These variations are effected by varying the steam pressure within the cylinder by means of the inlet valve. The power output of the engine may be variously set and maintained through the use of a Watt governor.

We might complicate the system by having several interrelated engines fed by the same head source of steam and regulated not only through the main valve but by means of subsidiary valves. The rate of one component engine could readily be made to influence the rate of another, etc; however, each part and the whole is always restricted to stereotyped forms of activity due to the constraints.

CONSTRAINTS

The power flow can effect change in any part but is itself goal-less and blind to when, where, how and to what.
When something is done, the choice of *what* is done, *where* and *when* it is done and *to what*, is determined finally by the restraints imposed on the flow of power which governs its access to the several parts.

Similarly motivation, the equivalent of motor power, is blind and the dynamic organisation of experience which I call general understanding ultimately decides the behaviours (movements) of the body through control in the release or use of that motive-force and the imposition of variable constraint on its free flow throughout the system.

Imagine blowing into an ordinary rubber balloon. As air is introduced the rubber casing first extends so that the whole takes on a form imposed by the unstretched rubber. Continuing to add air to the envelope in a free atmosphere leads to enlargement of the 'balloon', the contents being at or slightly above that of the atmosphere in pressure and the form determined by the thickness, rigidity and relative resistance to stretching of the various parts of the rubber. The inflated 'balloon' may be spherical, sausage shaped, pear shaped and so on, according to the design of the original mould, etc.

If we now deflate and re-inflate the balloon but this time constructing its expansion with e.g. splayed fingers, a loop of string, the walls of a containing box etc., the balloon must assume something of the form imposed by the constraining limits/limitations.

Inflated within a box, for example, it will assume a cuboid form or if partially confined by the spread fingers it will mould to the fingers but bulge between them in ways governed by the form and size of the gaps as well as the quantity of air affecting the internal pressure.

In this latter case, it is easy to endlessly modulate the form of the inflated envelope by varying the extent of inflation and by moving the hand and finger positions. In some ways this flexible model illustrates more clearly than the steam engine model the fact that the power source and medium is blind and stupid since it derives its meaning and sense from the control of the power source, and control of the power through the application of constraints to the movements/wanderings of the power itself.

RESONANCE

It may be seen that the form of movement derives from the form of the pathway of the least resistance throughout the system, the most facile resultant of all confining impediments or, as I have tended to call it for many years, the resonant (resonance) pathway.

TOLERANCE

Geoffrey Waldon's draft finishes here.

POSTSCRIPT

Writing to Chris Holland (‘Letter to colleague’), Geoffrey Waldon goes into more detail about his thoughts and feelings about the Five Essays -

http://www.waldonassociation.org.uk/pdfs/library-index/waldon-associates-book2gw.pdf

The first essay is listed on the Waldon Association (WA) website as Sorting and Matching (full title: *Sorting and Matching as Mental Operations Generating New Experience in Child Development*).

The second, *Learning, Reinforcement, Motivation and Control* and the third, *Movement and Sensibility: Tolerance and Constraint*, are in early draft form only.

We have left these substantially untouched, confining ourselves to 'tidying up' punctuation and other small textual details so as to allow the clearest possible expression of Geoffrey Waldon's meaning in his own words.

In addition, we have put in references to his other writings – all on the WA website – when it has seemed useful to add relevant detail.

Unfortunately, we have no drafts or even rough notes for the last two proposed essays -
Organismic Development and the Creation of Bodily Near-Space
and
General Understanding and Conventional Language
- but we have left in some references to them to add resonance and convey a sense of the full scope of his project.

In preparation for tackling the second and third essays you might find it helpful to read/re-read the essay Understanding 'Understanding', which prepares much of the ground which is covered in greater depth and detail in these two essays.

Terry Buchan
Marilyn Crook October 2016