

Visual Perception (1966-67)

INTRODUCTION

With the invention of the stroboscope, we 'discovered' that Bushmen in Africa and elsewhere have, over long periods of time been able to see the order of succession of the feet of a buck running at full speed. (A stroboscope is an instrument for studying periodic or varying motion by illuminating a moving body at frequent, rapid intervals.) Evidence of this capability is there to see in rock paintings by Bushmen found all over sub-Sahara Africa, and elsewhere.

Why we discovered this was less because of vested interest in Bushmen visual capability, as it was because of new necessities requiring that we specify visual perception functionally. These necessities have arisen out of the factor of speed in modern life. We now drive cars, pilot aeroplanes etc. It is the speed of these new products of technology which now calls into question the degree of precision inherent to natural vision.

The achievement of Bushmen, which in other categories was such that it might be said that the Bushmen could see rings round Mars with their naked eyes, points to the fact that it is possible for us to precision our visualisation far more than we normally undertake to do. How then are the Bushmen able to attain such refined and precisioned performance?

A little reflection will reveal an obvious fact - most obvious, indeed, to the Bushmen - that perception is, like all other categories of human performance, to be learned. This alone, takes time. Bushmen are not born with good eyes any more than anyone else. They train their eyes. This training is based on the understanding that the eyes, like all other organs of human body, have capability range which can only be realised if they are trained and precisioned.

7 Footnotes and list of references by Selby Mvusi.

That we know this obvious fact to be both true and sensible is evident in the extent to which we have developed curative technology for the malfunctioning of eyes. We, however, do not seem to have gone so far as to do the obvious - to build gymnasia for the exercise of eyes⁸. This the Bushmen did. Their gymnasia were the natural environment itself. Because the discovery of lenses came early in the history of technological discovery, and because the very development of technology discounted the hunter's necessity for precisioning eye-sight, we never seem to have bothered to test and realise the extent of capability inherent in natural eye-sight. This indifference has had far reaching effects on our attitudes and on the development of understanding.

Although the technologist using a stroboscope understands and controls the stroboscope as an instrument of given capability and function, it does not occur to many people that it remains equally necessary to understand and control the eye as an instrument of given capability and function. This has led to the opposition of vision as function - whereat 'naked eye' is opposed to instrumentally aided vision. *relation*

The Bushman does not take his eyes for granted. Because of this the Bushman knows, and is to a degree able to assess ahead of time, both the capability extent as well as the margin of error inherent to the exercise of the visual mechanism - his eyes. He accordingly incorporates both capability and error considerations into calculation during the process of exercising vision. His method and technique of processing percepts is married to and derived from an understanding of the very nature of the tool (his eyes) he uses. The process is based on a tool-method-technique coordinate.

The Bushman does not wait until he sees buck. He goes out to look for buck. In looking for the buck it is important that

8 Aldous Huxley: *The Art of Seeing*.

he sees the buck first - before the buck see him. Buck, from long experience, are always looking out for him and such as he - lions, leopards, etc. There is therefore built-in control in his looking for the buck: this control is the very precisioned sense perception of buck and any other animals likely to alert buck of his presence in the neighbourhood. Therefore the Bushman does not only need to understand his visual perception capability; he needs also to understand the perception capabilities of buck and other animals as well. In short, he needs to understand the perception mechanisms across the bar of animal life as a whole - himself not excluded.

In stalking the buck, he ties his eyes to his feet. He ties his eyes to his body posture. He marries his eyes to his ears. He places all other senses at the service of his sense of vision. Where he senses presence of buck, but cannot readily see the buck, he stops and listens. He puts his ear down onto the ground and listens to the wave resonance of feet of buck speeding across the plain. This enables him to plot the direction and speed. Standing up, and properly directioning his eyes, he then proceeds to scan the landscape for unexplainable changes which reflect movement or presence of something extraneous to the environment - an environment whose properties and characteristics he already knows well.

In all this we note perception performance considerations predicative to the exercise of visual perception. First, visual perception function is linked with and extended across the whole sense-response functions field. All senses are brought to coordinated relation - and to cross reference information. Second, the buck are not specified as animal unit and whole. The buck in turn become function and relation in given field - the environment. The Bushman knows how buck look or appear under different environments and activity situations. He knows the body-legs-neck-head relationships when buck drink, sleep, run or graze. He knows the scheme of

perception is inclusive of whole and others' perceptions

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buck as function relation

a question on the primary placement of the visual

①

no perceptual vacuum
 ② repetition
 ③ built in recursiveness

place + time determines state of object

seeing object = state of object + position of observer

① external field } affect our perception
 ② internal field } via perception

light object reality
 we see reflecting off object - surface
 we do not enter the object, but rather deal with variables with characteristics of light.

relation of the buck to grass, to trees and the shadows of trees, to rock, etc.

What is it, therefore, which the Bushman first looks for? Clearly he does not at first look for buck - as buck per se. On the contrary he looks for convergences and divergences in known relationships. He looks for peculiarly moving grass. He looks for shifting shadows. He looks for scented air. By abstracting convergences and divergences operationally he gradually 'sees' the buck. At the moment when he actually spots the buck, he simultaneously and instantaneously makes a quick reading of position of both the buck and himself. He makes a reading of the direction of his position relative to the buck and relative to such other factors as bush cover, wind direction, etc. Through calculated movement he then proceeds to effect 'coordination' between the buck and himself. Coordination effected, he kills the buck. Failure to kill the buck is failure to effect coordination.

The process, therefore, involves coordination of coordinates. Function-relation-field specifications of the buck and of himself relative to the terrain are computed, resolved and realised through time-motion control. Thought and action cross-check each other at every point. The Bushman is able to effect space-time position changes in action. Perception action is factorised across, and inclusively of the buck, the Bushman, the place and the time. Perception is the perceiving of something, by someone, somewhere, sometime - and this is a continuous, all-inclusive and ever-changing process. Equally, perception is referenced forwards and backwards in time. Past experience (as known relationships) informs anticipation of changes in relationships. It allows margin of prediction, but not prescription. Inference factors are processed instantaneously and probability specifications are worked out there and then. The whole effort is tensioned active process.

perception in action is co-ordination

love, and also romantic relationship

EXTERNAL VISUAL PERCEPTION FIELD

Perceptual Characteristics of the External Field of Vision:

There are three characteristics of the external natural world which bear direct relationship to the visual perception mechanism. These characteristics are of importance in so far as the world about us is the field of perception external to what actually happens inside ourselves (internal field).

These characteristics are:

1. that in nature there is no perfect smoothness, flatness, curvature, straightness, etc. There are no absolute objects. There is no absolute emptiness or nothingness. There is no perceptual vacuum. Even when we see 'blank' - we see it.
2. nature repeats herself infinitely. There are in nature a few basic forms, i.e. a limited alphabet of basic forms which recur with variations, giving prominence to each or several of these basic forms. With each situation which we encounter visually, we see objects which are to a greater or lesser extent round, triangulated, curved, straight, etc.
3. no matter how accurately we look at what we see, there always is a deviation in actual results of what we see. There is built-in recursiveness which obviates our seeing a thing exactly as we may have seen it before or as we may think we ought to see it.

These characteristics of the external field of our vision are constant - regardless of whether we are operating at 'naked eye' level of visual perception or at micro-macro instrument extended visual perception.

From the above we infer that there are no ideal or absolute objects, or states of objects, to be seen in nature. In consequence, therefore, there cannot be preferred position from which to see nature. Position - as place and time - cannot therefore be independent of the

state of the object. No two observers will see the same object in exactly the same terms. This means that the seeing of the object will invariably be a function of both the state of the object as well as the position and time of the observer of the object.

Keeping in mind these three environment control factors on visual perception, we have to take into account two other factors which introduce interference - which introduce a whole host of variables into the external field of vision. These factors are - light, and energy-matter duality.

Light-Object Reality

We do not, after all, actually see objects. What we do see are external or surface appearance of objects. These external or surface values of objects are seen because of light. Light is reflected and deflected by objects. This means that the nature and character of the surface - the unit patterning of this external surface - determine the patterning of reflected and deflected rays of light which bounce off the object, back to our eyes, and there-on act as stimulus.

It is therefore the nature and the patterning of these rays of light which determines and defines for us the object as seen. We do not enter the object to see its structure. We infer the objects structure from the patterning of light playing on the object and the retinas of our eyes. We read the internal structure of the object from unit specification as account for the nature and character of the reflection and deflection of light by the object in question. Accordingly, the object seen is -

[...] the mean scale ratio of intensities of reflected light¹⁹.

We therefore have a situation where we are dealing with invariant characteristics of the object on one hand, and, on the other hand, dealing with variable characteristics of light. We see the object

unit patterning

unit specification systems studies

the averaging of lightest and darkest parts of object

computed, resolved and realised

1 * tool-method-technique * tensioned active process

* function-relation-field

* time-motion control

② * space-time position * built-in recursiveness

properties of (inherent)
of light (inherent)
→ source / intensity

* object changes bc we + it are always moving in respect 2 light.

"the instant of observation" is central in characterising / specifying object.

relative to changing light position and changes in light intensity. The object seen is thus an amalgam of properties inherent to the object itself and properties inherent in light.

This means that change either way, i.e. the changes of the object and the change in light, both, occasion change in what is seen. The changing object changes the patterning of light reflected by its surface. The change in the position of the source and the change in the intensity of light, in turn, change the object as seen. The same object in different positions is to the eye not the same object. The same object at different times is, to the eye, not the same object. We never do see one and the same object the same way twice. This is because the object and ourselves are respectively moving relative to light. The motion of light, though constant to both the object and ourselves, is constant respectively - and not uniformly.

This therefore means that the instant of observation is the essential part of characterising and specifying the object as observed.

Because we see through the agency of light, we see at the speed of light. The stimulus play of light on the retina of our eyes must of necessity be at the speed of light. It must also be as comprehensive as light is relative to natural phenomena - the external world. Therefore sight must in essence be both instantaneous and comprehensive.

Energy-Matter Duality

There must be an outside limit attending naked-eye vision. However much we train and exercise our visual mechanism there must come a point beyond which the unaided eye cannot see. This limit must be a built-in limit in the mechanism of vision itself. It must also be a limit built into the visual field of natural phenomena. Clearly, this limit must be a comprehensive one - involving size, surface, character, distance, direction, time and light intensity.

We, by and large, use the word 'object' relative to visual perception only in respect of what is instantaneously concrete

air/wind, we "see" by computing probability relation schema

wind is objectifiable bc we can see it, in light quality, wave formation - image of wind...

we perceive objects / non-objects in same way.

to our visual sense. Hence, we do not generally call air 'object', if and when we speak from the perspective of what is visualisable. We confine the word 'object' to such phenomena as are objectify-able through the visual sense. We use the word relative to phenomena amenable to objectification as concrete entities by our eyes. However, we do not go so far as to assert that air is not seen.

What we do not actually see at the level and the capability range of visual perception, we 'see' via other senses, and/or alternatively, via reactions of objects seen to 'objects' unseen. Our skin 'sees' air. Our eyes 'read' presence of air in trees and grass as these react to the presence of air. Watching trees and grass we compute probability relation 'schema' on the basis of which we quantify air present in the visual field. It is these schema of relations that connect with the unseen object - air - which we then see.

Because we know that, in natural motion, force is the weight of the object, and resistance is the medium through which the object moves, we specify the force of wind as affecting trees and grass, and accordingly transpose force into mass, and thereby specify wind as concrete object - objectify-able in sense-perception terms. As such, relative to objects we do actually see, wind to sense is not absence of object. It is not emptiness. The glittering wave reflected by grass is not seen to represent just light, but also wind present to vision along with grass. The optical presence of which, is, in this instance, functional presence. It is the velocity of wind. It is the pressure of wind. Wave formation and momentum are the same thing. Because the wave is pictorial, therefore, wind itself can be pictured. It can be visually represented.

This fact is not so much telling about objects unseen, as it is telling about the objects seen. Objects seen are seen functionally. They are seen as light function. Of and by themselves, they do not exist to vision. As such, seen and unseen objects are, when functionally resolved, both seen in one and the same

objects dictate how they are to be "seen" - they are never directly seen but are always functions of other functions.

thus absolute space + time make no sense to the world of perception
(no separation between function space, object, perception)

way. There is then, unity in function, which replaces duality outwardly evident in the visual field. We therefore can represent perceptually, phenomena seen and unseen.

Already, electronic devices are being made which enable blind people to 'see' through their ears. Beams of high frequency sound hit obstacles, their echoes are picked up in earphones and the pitch and volume of these bounced signals can be 'read' to show what is ahead. Flashlights beaming ultrasonic waves register differences in texture, telling grass from concrete, through changes in volume. Transistor radios, producing a simple buzzing sound, are used to keep walkers in a straight line. There is nothing surprising about the development of these instruments. Bats have been using the same type of equipment since the dawn of time. For that length of time they have been living testimony of the fact that vision was not necessarily and exclusively 'visual'. In other words, bats pointed out the now realised fact that the visual field is itself a corporate part of the visual mechanism. Objects seen dictate how they are to be seen, because they are in themselves not directly seen except as functions of other functions. Functions, as functions, can be correlated.

The external field of vision is a functions field. As such, it requires to be specified in its own right, independent of the exercise of perception mechanism. Therefore, independently and apart from specifying how we do see, we need also to specify how objects seen do in fact 'see us'. This means that we need to specify space-time factors governing objects in their standing as potential visual materials as well as the field of visual operation.

We must accordingly revise - if not abandon - notions of absolute time and absolute space. Unless these concepts are radically revised - or abandoned - it is impossible to define objects in terms of their periodic states of existence in space-time. States of objects in space and time are parallelly states of times and places.

we see at the speed of light

we experience an object and light do - comprehensively

works problem differences to geometry

function of function?



2:4

f(x)
f(y)

* wind and air

what would it mean to abandon absolute time and space?

system of perception

... the speed of light ...

The reason why objects distant from us are not clearly visible is not because they are far. Their distancing increases quantitatively what is to be simultaneously seen with them. The distance increases interference factors. The fact that 'objects' intervening between us and the distant object are small, i.e. globules of water, particles of dust, etc does not prevent sunlight play on them, thereby creating diffraction and scattering which operate as interference in the space between the objects and ourselves. A distant object of high reflection capacity, positioned in such a way that it catches light at maximum reflectivity relative to our perception of light reflected by the object, will appear much more clearly and sharply defined in our eyes than will objects close and near to us.

this shouldn't be here

at the speed of light the object becomes an energy relation that is perceived

Not only does the state of the field qualify our visual perception; the position of the object in the field, in turn, determines and qualifies or conditions visual perception. Therefore, the seeing of the object is a process before as well as after the act of perceiving an object. The instant of perception, however, is comprehensive of both dimensions of perception. This is because light, and the speed of light, is functionally the speed of total cause in nature as a whole. At the speed of light matter 'decays' into energy. At the speed of light visual perception processes matter-energy.

Light and Visual Perception Process

Light is movement. In so far as light plays on the object; in so far as the object seen is seen via the agency of light; the object as seen is as of moving light. It is seen as rotationally translated by moving light.

light "plays on"

Accordingly, the object vibrates in space. This vibration of the object is at the speed of light. Optical transformations which the object undergoes are at the speed of light. This frequency of optical object existence in space is the key to the specification and delineation of objects. This specifications and delineation is therefore the abstraction of the ratio of the state-to-state changes which the object

undergoes as it is rotationally translated by light.

Op Art is a forthright expression of awareness and consciousness of LIGHT function design performance. Newer Art forms such as Psychedelic Art (mind experience expanding art), relate visual perception to other sense dimensions in one active experience configuration which, in its effects as experience, parallels drug experience¹⁰ Throbbing lights, 'swirling smells' and sound are built up through painting, sculpture, electronics, engineering, and made to induce hallucinatory effects and intensified perception in the spectator. This integration of techniques and elements on the basis of a changed or extended view of Art-as-expression derives from the new understanding of perception as primary and predicative of all expression whose cognition is a function of the exercise of all the senses. Psychedelic Artists state categorically -

'We try to vaporise the mind by bombing the senses'¹¹ noise, "viscious" things

Art is no longer to be realised through the senses, but rather, by the senses. The senses themselves become the canvas on which painting is done. Individually and variously, the senses become method-tool-technique of perceptual representation on the 'inner mind canvas' of experience and consciousness.

Realisation of light, as primary function of visual perception, calls for the redefinition of visual percepts and the very purposes of perception itself.

Light as constant motion can only create an art of constant motion. Art as expression realised through constant light-motion, in turn ceases to be an end in itself, and becomes a function of experience itself. It becomes a function and an aid in the realisation of otherwise constant experience. The continuity of light is paralleled by the continuity of experience. This means

10 Timothy Leary: An Interview, Playboy, September 1966. 11 Psychedelic Art, Life International, Vol. 41, No 7.

that the art, the object, though in itself a discontinuity, is nonetheless continuous in function, because it functions relative to continuous light and continuous experience.

As a consequence of habits developed in early childhood and entrenched in language and custom, we have developed, and come to accept as given truth, the existence of absolute space and absolute time. There are no objective facts confirming existence of absolute space and absolute time. Such 'facts' as do exist are purely subjective.

The fact that in ordinarily looking at our environment we do so from defined positions, and further, do so from successive directioning or ourselves relative to the environment - i.e. we look first this way, then that way; we look at things near, then at things far away, etc - implies that we never at any time actually see everything or, for that matter, one thing at a time. What we do see, on looking out at the environment from any one position at any one time, are sets of relationships, i.e. compositions. This means that we see things in context, that is, in relationship of one thing to the other in a given field which we ourselves isolate and specify. We abstract a field, and in this abstracted field proceed to abstract things as they stand related one to the other in the field of our vision. We do so by relating our eyes to objects. Both the object and the eye meet, each with given position and time, and both from coordinated positions and times. Nothing about perception does not involve relation and active relating.

of context as a whole process

Space-Time Factors In Perception

On observing events and objects in nature, we experience time and space simultaneously. We measure time spatially, From the very beginning, we realised and read time from shadows, as moving across the ground surface. When we use a ruler, we take measurements over a period of time. It takes us a minute, or five, to make an exact reading of measurement. All our actions are space-time realised. We have, successively,

if we understand light as motion, then all must be in motion - more a function of experience + an aid in realization of ...

relating our eyes

relation and active relating

Art as a tool towards consciousness?



LIGHT = TIME + MOTION

not independent of the object as energy matter.

takes place in/through time (4D)
the time factor pushes perspective into the impossible realm, where it cannot be shared - ever

two dimensions – height, breadth; third dimension – depth; the fourth dimension – time. This means that we live and act four-dimensionally in the four-dimensional space-time continuum.

Concepts of absolute space and absolute time have been translated and expressed as absolute objects, with definite place, and definite time. Our belief in absolute objects (of absolute space and time) has led us to believe that two people are capable of representing one and the same object one and the same way. From the above consideration, we know that perceptually, this is not possible.

If space was three-dimensional, it would be possible for observers of an object to occupy the same position relative to the object, from which to represent the object in the same way. We now, however, know that much as two observers may occupy the same position relative to an unmoving object, they may not occupy such position at the same time. The difference in time will be change in the nature and character of light as reflected by the object.

In everyday life we see objects from varying and different positions and at varying and different times. This means that our perspectives relative to both the object and the space occupied by the object differ. There cannot, therefore, be any interpretation of the object which is independent of the observer of the object in question. Each interpretation of the object invariably includes distance, and time. Both the object and the observer of the object have space-time positions relative to each other over and above mere distancing of the object from the observer.

The space-time function of an object is the object seen. From different positions and at different times, people will see an object of given weight and size as being different in shape and hue. The size – as weight or volume – ceases to exist as an optical consideration. The ratio of size to shape will be the effect of the space-time behaviour of the object regardless of its mass-size. Shape will not so much be a function of the properties inherent to the

object itself, it will be a consequence of the space-time region connecting the observer and the object.

Nature is an organic whole. A given amount of energy is physically equal to a definite amount of mass. The energy in a ray of light is no different from the energy in a piece of stone. Mass is convertible into energy. Energy in a given quantity of mass equals the mass times the square of the velocity of light. Energy is neither lost nor gained. It only undergoes transformations – endlessly. Light, as the agent or vehicle of visual perception, is energy and is, in nature and character, directly related to objects by which it is reflected. Light, as time and motion, is not therefore, in essence, independent of the object as energy-matter.

Therefore, in so far as light dematerialises the object perceptually, light acts in this respect in accordance with the very nature of the object. The very fact that we do not see the object – but light as reflected off and by the object, is the point about seeing and objects seen. Prismatic distortion is a factor and a function of the visual field. Our eyes only act to regulate this distortion. The mechanism through which we effect regulation is the whole biochemical system of perception – the internal visual perception field.

INTERNAL VISUAL PERCEPTION FIELD

Biomechanics of Vision: Bioelectricity: Biochemistry

The eye is an extension of the brain. Embryo-logically and anatomically the eye is directly connected to the brain. Therefore, through the eye, the brain directly abuts directly up and against the perceptual environment – the world about us. Parallely, through the eye, we are able to look into and see aspects of the brain activity which other senses do not reveal.

From personal experience we note the tendency to constrict our eyes – the pupils in particular – whenever we are confronted by a not too pleasant experience. We also note that pleasant

experience causes dilation of the pupils. This opening-up of the pupil reflects our interest and the nature and character of our motivations.

Men are, by and large, attracted by women with large pupils and large eyes. Seeing the eyes of such women, they read from them 'interest-in-me' and accordingly see such women as taking notice of and having interest in them. Much of the eye make-up of women today is geared toward creating the large-appealing-interested-in-you eye effects and impressions. All this effort is based on the understanding that pupils of the eye are indicators of motivation.

In so far as the brain – through the eye – abuts directly up and against the environment, it is possible to get at the brain directly and even ahead of the brain itself's willing acceptance. In a way we do refuse to hear something. And we do so without, of necessity, having to shut our ears. It is impossible to consciously refuse to see something without having to shut our eyes or change the direction of our vision.

The eye and the pupil of the eye, is closely associated not only with its visual centres in the brain but also with other brain centres. This means that the eye is closely associated with other senses – and other circuits of sense response.

NEUROCHEMISTRY OF VISION: THE BIOELECTRICAL CIRCUIT AND PHOTOCHEMISTRY

Bioelectrical Circuit

There are approximately 130 million light sensitive receptor cells in each retina. These receptor cells are mainly rods and cones. Light coming in through the lens of the eye falls on these myriad cells in the retina.

These receptor cells, on receiving the stimulus, send impulses through the visual pathway. The impulses are not sent directly to the brain. They are processed through a chain network of 'transformers', 'capacitators', resistors, etc. The first pathway station is a set

identical perspectives cannot be constructed

Freire lol

of retinal cells called 'Bipolar Cells'. These cells then pass the impulses on to the 'Retinal Ganglion Cells'. The retinal ganglion cells then transmit the impulses on to the Optic nerve. The optic nerves come to a junction point – the 'Chiasm' – and here each nerve splits up and each half crosses over to the opposite hemisphere of the brain. The optic nerves then enter the way-stations called the 'Lateral Geniculate Bodies'. From here the impulses are transmitted to the visual cortex of the brain.

The cerebral cortex is, if flattened out, a large plate $1/10^{\text{th}}$ inch thick and 20 square feet in extent. Its cells are arranged in more or less distinct layers. Millions of fibres coming in from the lateral geniculate bodies connect with the cortical cells in the fourth layer. Cells of the third and fifth layers of the cortex send fibres out of the cortex to the centres deep in the brain, and also to other cortical areas for further processing.

Retinas of our eyes send or project impulses to the visual cortex via the last pathway units – the lateral geniculate bodies. These impulses have special input areas in the cortex. This means that, most probably, each area of the retina corresponds directly to a given area of the cortex. However, each impulse is nonetheless first processed through the path-way stations. This means that each impulse, during its transmission is cross referenced at each path-way station.

Impulses transmitted by the retinal cells travel along the nerve-fibre circuit at velocities between $\frac{1}{2}$ – 100 meters per second. Impulses in the fibres have the same amplitude. This means that differences in strength of stimuli generating the impulses are not registered as different amplitudes during transmission. The strength of the stimuli is translated into frequency, and therefore, the differences in the strengths of stimuli will be frequency ratios. The common sense notion of light stimulus strength as paralleling brightness or dullness does not apply in this respect. Light intensity is not measured via

brightness or dullness but rather from wavelength and frequency.

Photochemistry: Visual Pigments

The receptor cells in the retina, that is, the rods and cones, contain photo-sensitive pigment that is laid down in molecular array. The rod grains are responsible for twilight vision. Their photo-sensitive pigment is 'rhodopsin', i.e. visual purple. The cone grains are responsible for daylight vision and their photo-sensitive pigment is 'iodopsin'.

Recent findings, showing that colour discrimination in vertebrate retinas is in respect of three pigments segregated in three kinds of cone receptors, imply that the cones, as daylight vision receptor cells, are the more complex of the two sets.

The colour discriminating pigments in the cone receptors are 'Blue, Green and Yellow'. (Contrast this with the standard colour theory base colour tri-polarisation specifying red-yellow-blue as base colours.)

These triple cone receptor pigments are somehow processed in the retina by the colour sensitive retinal ganglion cells into two-colour on-off signals which are then transmitted to the higher centres of the brain. The method of this trans-positioning is as yet, not resolved. However, the fact of the translation of a colour stimulus into electrical signal is known, and is at the base of the development of Colour Television.

Photosensitive pigments in light receptors undergo change when they absorb light. The pigment is 'bleached'. The bleaching of the pigments desensitises the receptor cells through the reduction of light sensitive pigment. This bleaching must therefore be the way in which excitation is communicated. We, from everyday experience, are familiar with experience of eye-reaction following intense illumination. The eyes become less sensitive following such exposure. It takes sometime before they recover their sensitivity.

Photochemical Origin of After-Images

After-images are photochemical in origin. Visual perceptions are constructed by means of a number of different operations occurring, at different times and places, along the nerve circuit connecting the retina and the brain. Perceptions as a whole are similarly constructed. They, further, are cross referenced at stage-to-stage, individually, reciprocally, and collectively at each way-station in the total circuit of perception integration. This integration is, apparently, time-function integration of much the same order as we encounter in ordinary electrical circuits.

It is therefore logical that when the total information regarding light intensity, which is received by the pigments of the retina, is greater what the nerve circuit of the visual pathway can transmit as a whole instantaneously, residual information is not neglected or abandoned. It is relayed later, in the form of an after-image. We thus see something after we have seen it: hence the after-image. The phenomenon is somewhat like double-exposure in photography.

From this we may conclude that there must be defined transmission time intervals which are quantitatively based. There must be defined impulse 'quanta' which the nerve can take at equally defined frequency intervals.

These units, or 'quanta', must bear relation to light quanta on one hand, and on the other hand to time-motion units inherent to bioelectrical circuit. It must be on the basis of these impulse units that patterns of interaction and combination along the visual pathway, and other sense pathways, are worked out relative to patterning of interaction and combination in the brain. Without such units perception performance would be arbitrary.

Light quanta exist related to and being the function of the speed of light. Light travels at the speed of 186,300 miles per second, or 3×10^{10} cm/sec. Impulses from the retinal stimuli travel along the optic nerve at $\frac{1}{2}$ – 100 meters per second. Therefore, the impulse quantum ratio

must derive and be a coordinate of the two velocities.

After-images may be positive or negative depending on the intensity and time duration of the stimulus. Flashes of the same amount of light, over the same length of time, produce identical after-images. This means that time and light are equal respectively. It does not mean that they are equal transpositionally. This means that there must be a transpositional ratio relationship between light (as stimulus) and impulse (as message). Because the transmission of the impulse is not in terms of the amplitude of the light stimulus, but is in respect of frequency – where the amount of light is equal but the duration is different – after-images will be different.

A flash of light which is strong enough to bleach nearly all the receptive pigment in the cones centred in the fovea produces a negative after-image. This negative after-image remains visible for about 20 minutes. If the source of this flash has sharp outlines, and if these are properly focussed on the retina, they will appear clearly on the retina for at least 2 minutes. This fact is of telling significance with respect to advertising, particularly now that there is standard use of neon light in this field.

Positive/negative colour after-images are positive/negative in respect of colour complementarity. We do not, in positive after-images, see the colour we first saw. We see its complementary hue: yellow-blue, purple-green, blue green-orange, black-white. Negative after-images: red-green, green-pink etc.

CELL SPECIALISATION IN THE VISUAL PATHWAY

Cortical Cells

According to David Hubel, each cell seems to have its own specific duties. Each cortical cell is visually specialised. Each cell takes care of one restricted part of the retina. It responds best to one particular shape of stimulus. It responds best to one particular orientation of the

stimulus. This means that a stimulus, stimulating one area of the retina, and so doing in one particular way – e.g. an edge, a slit, a bar etc, and each one of these being oriented in one or the other direction – there is a particular set of simple cortical cells that will respond. A vertical line will have one set of cells responding to it, while another line, equally straight, but five degrees off the vertical, will have yet another set of cells responding to its orientation. David Hubel pointedly remarks:

'The number of populations responding successively as the eye watches a slowly rotating propeller is scarcely imaginable'.

Noting that the propeller and the lines of the propeller are the same, and differ only in respect of orientation as the propeller rotates, then the number of cells that are brought into operation on just looking at an ordinary scene composed of any number of shapes and orientations of shapes must be fantastic.

Retinal Ganglion Cells

There are two distinct retinal ganglion cell types. These are 'on' response cells and 'off' response cells. Retinal ganglion cells differ markedly in the size of their respective field centres. The main job of these cells seems to be the contrast in illumination between one retinal region and its surrounding regions. The effects of light as interpreted by these cells vary markedly according to the place in which the light strikes the receptive field. An important and singular feature of these cells is that they fire at fairly steady rate – even in the absence of stimulation.

The responders (illegible) separating 'on' and 'off' regions in the retinal ganglion cells are straight and parallel rather than circular. That is why the most efficient stimuli are slits, edges or dark bars – or like stimuli involving straight lines. However, a particular cell's orientation differs from the next. For one cell it may be vertical, for the next oblique of a given inclination, for the next horizontal. Up to now there is no evidence showing any one of these orientations to be dominant.

What we do know is that receptive field orientation is a property built into the cell by its connections. An odd, but significant, point about the receptive field orientation of these cells is that orientation perpendicular to the optimum orientation of the cell evokes no response at all. This places singular significance on perpendicularity.

Rod and Cones

Rods absorb light differently in accordance with direction of incidence or polarisation.

This means that rods are dichroic (having or showing two colours; specifically, applied to doubly-refracting crystals when viewed in different directions). This again points to the fact that position relative to a light source determines reception of the light stimulus. In a way we have observed this phenomenon where people, whose eyes are not properly focussed, jerk the head to the side in order to align the eye with the stimulus in order to be receptive of the stimulus. Plane polarised light that strikes a rod from the side is absorbed if its electric vector is perpendicular to the long axis of the rod, but not if its electric vector is along the long axis of the rod.

A synapse relating to a particular retinal cell has excitatory or inhibitory function. Stimulation of a particular point on the retina may either increase or decrease a cell's firing rate. Naturally a stimulus that excites one cell will undoubtedly excite many other cells. However, the cells may be excitatory or inhibitory in their response to the stimulation. Parallely, cells may receive several stimuli at once, in which case they will respond to the nett effect of these in-puts. This is part of the mechanism whereby nervous responses to one stimulus is capable of influencing – or even suppressing – the response to other stimuli coming many seconds later. In everyday life we do at times fail to see people before us if and when our attention has been sharply focused elsewhere just the moment before. We know the phenomenon too well from car accidents.

VISUAL PERCEPTION FUNCTION

Perception Function

Perception is the establishment of contact between one and the world in, about and around us. Meaningful contact is reciprocal and must be a two-way interaction between oneself and the world at large. The perceptual function operates as a transformer in the external-internal perceptual field.

The perceptual act involves probing and testing the environment. There is constant sense-response to this probing and testing. Therefore the percipient, i.e. the 'observer', is not neutrally placed relative to the process of perception. His perceiving is the very functioning of his consciousness and awareness. He IS, therefore – and not passively placed – relative to his perception and his formulation of percepts.

The perceptual probing and testing of the environment is constant to both 'naked sense' perception and instrumentally aided perception. There is no difference – save difference in level or depth. Instruments as extensions to man's sense-capability enable man to see deeper and further, but not necessarily to see differently.

Visual Perception Function

Visually, perception is before, as well as after, the act of seeing any one object. When we die, our eyes do not themselves die at the instant of death. They continue to see. That is why we become so embarrassed at seeing a corpse staring at us. Biomechanically, eyes are operational to the extent that metabolic process feeding them is operational. That is why we can 'bank' our eyes and write them off in our wills to those alive who need eyes. The significant thing about this fact is that the biomechanics of visual perception is specifiable independently of objects visualised.

Functionally, we must understand and specify vision in respect of **how** we see and **how** what is seen is seen. This is a

completely different issue from concern about what we have to see and why we have to see it.

We have to measure what is measurable and what is possible of measurement about visual perception itself. Only in so far as we essay to measure visual perception itself can we understand how visual perception operates. Only then can we assess what is visually possible of achievement through the exercise of our innate visual mechanism. We may not intention meaningfully anything prior to understanding the range of possibility inherent to means at our disposal.

When intentions are outside the range of possibility – they are idealisms. When intention is indifferent to the range of possibility – it is self-indulgence in illusions. Methods-tools-techniques are the most important part of meaningful intentioning.

If and when we understand the bio-mechanism of visual perception, however approximate this understanding may be, we can then with some degree of accuracy specify limits and define required extension to innate visual capability relative to specified visual objectives and requirements. Of even greater importance is that we can assess fairly accurately past performance based on visual perception and go on to determine precisely what was achieved as well as what was not achieved. After all, historical study is significant only in so far as it specifies limitations relative to then available means. If we are not to repeat the mistakes of our forefathers ... if we are not to misread the achievements of our forefathers ... we need full understanding and command of the range of possibilities open to us now – if we are not to fall short of the achievement of our forefathers, relative to time.

If we are to develop laws of perception, or to adopt such laws of perception as have been carried over from the past; if we are to specify ideal percepts (works of art), we must, first of all, specify and control the invariant properties of perception relative to which the variables in and of

perception can themselves be plotted on a probability scale.

We are, as yet, far from understanding 'causes' of perception. We are further removed from understanding the 'effects' of perception. We are, today, capable of specifying to some extent the functioning of the perception mechanism. We are capable of spelling out invariant properties of perception in all categories – sight, hearing, touch, smell etc.

Oddly enough, this understanding is sought and used curatively by psychiatrists, brain surgeons, opticians, etc. It is only marginally utilised by those professions professing to be committed and dedicated to the creation of a wholesome man-made environment. It seems to be the irony of the design professions that, in lieu of design performance, designers become indifferent to consequences of their own performance. There is a striking difference between the man-made environment and the natural environment. Taking into account the fact that the man-made environment is, and must be, like the natural environment, perceptually 'received' by men, the difference in stimuli emanating respectively from the man-made and the natural environment becomes very significant.

Perceptually, to what extent is man himself the sower of the seeds of his own perceptual diseases? To what extent does the designer also design the clientele of the opticians, psychiatrists, etc? Designers are, by and large, so self-assured and self-assuring that many hardly think of these possibilities, even at the point when they have to send their own eyes for correction by opticians! It is not far from the mark to say that, by and large, perception diseases are a function of the man-made environment.

Continuity-Discontinuity/ Order-Disorder/ Symmetry-Asymmetry in Perception

Nature, as an organic whole, operates through sub-system integrations which are themselves organic wholes.

The tendency to select arbitrarily certain properties, and designate these as important, and thereafter treat them as distinct entities leads to overlooking the fact that these properties are abstract qualities of the whole.

If we are to obtain consistent and satisfactory synthesis of the visual mechanism, vision must be re-united with other sense-perception dimensions. Sense response, in turn, must be re-united and reconciled to other mental processes relative to which the perception mechanisms work. This is not undue extension of concern. It is recognition of the fact that man is whole. As such, whatever the perspective, performance must involve continuity while specifying the discontinuity of the perspective undertaken.

Discontinuity existing in and between the different senses, in no way implies separateness of sense-response. After all, sense perception is continuous and simultaneous. Therefore discontinuity between the senses is a function of the continuity of sense perception. This means that discontinuity-continuity is a characteristic feature of sense perception. It is a telling indicator of the functioning of sense-perception.

To see things we do not hear; to hear things we cannot touch; to touch things we may not taste; to smell things we cannot see, etc. is normal experience in every individual's life. What is not normal experience, however, is realisation of the fact that this discontinuous experience is an indicator and a pointer toward the nature and character of the continuous patterning and process of operation of the perception mechanism as a whole.

Discontinuity in otherwise continuous perceptions; disorder in otherwise ordered perception; asymmetry in otherwise symmetrical perception; each a function, implies perception function qualification, on the basis of which perception relation must be configured into the total structure and the total construct of the perception mechanism. It implies that there is a built-in relativity in perception. This in turn means that there

must be a perception probability metric involving some statistical distribution and relation sequence. If this is so, then it is to be welcome news for designers committed and dedicated to the creation of the man-made environment. It must be possible to control a whole set of variables which are perceptual in dimension and are a corporate part of the structuring and constructing process in the development of design product.

Periodic connection between the senses, as, for instance, when we touch and hear something at the same time, see and smell it at the same time, etc. must be explained via both the object itself and the sense concerned. Although we may not be able to know the causes, we can at least seek out and specify the nature of the relationship.

Playing an instrument and hearing the sound at the same time is so common an experience that we hardly question it. In fact, we go so far as to assert that this is normal, by that meaning that it is an invariant quality of the act of playing the instrument. If however we play the same instrument in a canyon, and the interval structure of the sound wave manifests itself, our attention is suddenly awakened. Suddenly the assumption of simultaneity and instantaneity ceases. The situation or context factor has suddenly to be taken account of. We then realise that the distance between the instrument and the ear is a force-field distance whose variability is infinite.

We realise that this distance is controlling the nature and character of what we do hear and, as such, controls both the instrument and ourselves as far as sound is concerned. Of even greater significance is the realisation that the distance is not linear – it is not a straight line path between the ear and the instrument. We realise that it not only is infinite in extension, it also is infinitely directioned. The nature and character of this distance, now realised to be a force-field, becomes a factor in the development and control of the initial playing of the instrument. The distance itself becomes a living part of music.

In an electronic age of electrical guitars and stereophonic sound modulation, instrument playing and the whole approach to music is suddenly extended and re-evaluated and, thus, made to accord with the new space-time understandings of our time. Sound orchestration is suddenly realised and understood to be something different and independent of the orchestra. New acoustic interpretations, formulations, and configurations are being worked out relative to the new understanding of sound phenomena and environmental controls. The return to 'folk music' simplicity is not a return to the mountains, but a going forward through new understanding on the basis of newly realised necessities.

Senses are so aligned as to effect transfer on predetermined paths connecting the senses to the master mechanism of consciousness and awareness. The continuity of perception is dependent on discontinuity inherent to the individual senses. Continuity of effect at consciousness and awareness level is not caused by continuity of cause at the sense-perception and sense-response levels. On the reverse dimension, continuity of cause, i.e. continuity of stimuli is the environment (there is always something to see, hear, etc.) does not cause a continuity of effect at sense-response level. On an integral scale, therefore, we have continuity-discontinuity-continuity as the sense-perception sense-response scale.

If, then, we take this total scale of sense response which is, environment-perception-consciousness, that is, continuity-discontinuity-continuity, we then see how and why the object as an entity, definable and specifiable in space and time, ceases to exist. We see the 'object' as existing extended across the total scale, i.e. as 'out there', as seen, and as realised, and as acknowledged. Out there, the object exists as specified by light – otherwise we would not see it. To our eyes, it also exists as specified by light reflected by the object and realised by us as a stimulus on the retina. In consciousness, the object exists as an

electrical impulse that is transmitted from the retina to the brain. Nowhere along the path does the object actually exist as an independent entity in its own right. Out there, it is light. To sense, it is light stimuli. To consciousness, it is electrical signal. Therefore, light broken up into series of light stimuli and translated into electrical signals can and must be able to create an object in consciousness – without requiring any object at all. In other words, it is possible to make one see an object which is not there. The object is therefore objectification of light stimuli. This fact is readily realised in the area of sound. Listening to a piece of music, we do 'see' places, occasions and events in our mind's eye with fantastic clarity. We even see them in colour. And even see ourselves there, romping around, talking, laughing, loving, and sometimes, even, dying. As the music ends these pictures may fade away, or stay on long after the tune has ended. If these were not the experiences we gain from music, music would hardly be worth listening to. What is it that we actually do listen to? Is it the instrument; the player of the instrument; the sound; ourselves and the pictures we make in our mind? Which of these is music? Surely, it must be the sound waves acting as stimulus on the receptors in our ears and thereafter translated into electrical signals.

As surely as there now is concentration on sound and sound modulation in music, in Art – for instance painting – concern is with surface and surface modulation. The surface, as light reflector and therefore modulator, is focused and studied minutely with a view to abstracting its properties and manipulating those properties for desired and required effects. These effects are sense response effects and, therefore, image formulation or picture making in the mind's eye. The painting no longer occurs 'out there', but rather in the mind's eye. The necessities of painting a picture, that is, of pictorial representation, suddenly disappear in the face of the realisation that, all along, people were never ever looking at the painting 'out there', but were, rather, always and

invariably painting their own pictures inside themselves with bits and pieces of the painting 'out there'.

It is these bits and pieces of surface area that are the concern of painters now. The size, directioning, hue, texture, contour, contour boundary values, etc, properties of unit surface areas, are now studied with respect to function relation and field configuration and, from these studies, value properties of these units are specified. Hence, therefore, do unit areas become specified also in respect of spin, rotation, vibration, space (as against size and area), decay, wave and probability amplitude, etc, etc. All this understanding has suddenly become necessary for the manipulation of these areas with respect to light as reflected by surface, and as received as stimulus by the retina, to be translated into electrical signals which we then use to make pictures in the mind's 'canvas' – the brain. These pictures are then seen and appreciated by the 'inner man' – our very consciousness and awareness.

As we can see, the painting ceases to be a two-dimensional entity existing as a closed unit out there to be seen. It becomes an action area from which we manipulate sense response, and therefore, consciousness and awareness. Paint accordingly, gains independence from painting. It ceases to enjoy prestige standing as 'prima donna' medium for visual representation of percepts. We realise that there is no preferred medium, in the sense that there is no medium independent of image formation, in consciousness. Any medium and any material will do for the production of 'paintings'. The most ideal medium becomes light itself for all other materials are only light reflectors and nothing more as far as perceptual response is concerned.

Sculpture, like painting, becomes the modulation of motion in space, combining both the tactile and visual response channels, through drawing attention to the dynamics of the existence of forms in space – a space which is in total motion. Sculpture ceases

to be representation of objects that become indifferently implanted in space. Sculpture becomes interpretation of the structural properties of space as well as the dynamics of space as force-field.

In graphics, lay-out becomes independent of illustration and lettering. It becomes visual space modulation. The individual letter is seen to be more than sufficient 'lettering'. Lettering is brought down to binary positive/negative space-value-relation in a visual field. 'Desire' is itself handled and its properties specified.

Building, correspondingly, ceases to be 'design' of micro-enclosure of space in space by two-dimensional plane 'elements', filling-in 'structure', and isolating micro-environment utilities. Instead, like sculpture, it becomes total coordination of micro-to-macro space; total motion-space and total space-in-motion, in total environment space-time. Like painting, 'elements', in themselves, become action evoking planes, structuring field relation. Like the environment itself, in which buildings exist, we build-in, and with, and integral to the environment. Building becomes independent of 'walls', 'roofs', 'floors'; undetermined by 'plans', 'elevations'; unlimited by structure, materials and enclosure made bearable by 'landscaping' to soften the boundaries of man-built environments and nature-building environment. Building, accordingly, becomes sub-system patterning isolate relative to total system field. It becomes function interaction specified form, and specific to, integral field functions, both external and internal to the building as structure and construct.

VISUAL PERCEPTION RELATION

Perception Relation

Perception, as contact with the environment, is probing and questioning, evaluation and judgement. Visual perception is varied and various. As probing and questioning, visual perception is effort at abstracting relationships, i.e. coordinate system patternings relating sets of objects,

and sets of objects to other sets of objects. As evaluation and judgement, visual perception is specification of unit areas, sizes, shapes, distances, spaces, orders and order assemblies. This means that we exercise the visual mechanism simultaneously in respect of different measures, dimensions and dimensionalities.

Measures/Dimensions/Dimensionalities

There is a wide variety of units of measure. There are many dimensions to/and of measurement. Measures and dimensions in turn aggregate into many dimensionalities. Assembly (i.e. evaluation and judgement) is the product of a complex sub-assembly system. Measures are not a law unto themselves. Their significance is in respect of dimensions and dimensionalities. Accordingly, equivalent measures do not necessarily give equivalent results.

There can be no meaningful action at the level of measurement without prior specification of problems. It is the problems which specify dimensional categories in respect of which initial choice is made. Problem-stating and problem-solving are one and the same thing differing only in respect of time as operationally realised.

Problems are related to the personality of the inquiring person. Motivation is a control factor in choice of problems. Motivation determines what are to be problems (as problems 'per se') independently of the programming of resolution which problems specify.

Perceptual inquiry is dependent on the interest provoked by what is seen. This provocation occurs relative to the nature, character, and scale of motivation of the individual as a personality. Perceptually, motivation is extended between two poles:

1. Allocentricity
2. Auto-centricity

Allocentric people are object-centred people. They are external world oriented people. They are people interested in looking at things generally without

of necessity looking for anything in particular. They are interested in the nature and character of things, as things. They are 'scientific' and seek to observe in nature the 'laws of nature' out of research interest which is an end in itself.

Auto-centric people are subject oriented. They are introverts. They put forward personal interest and look at natural phenomena by way of looking for something which is of significance and importance for and to themselves as people. Nature is not an end in itself. It is there to serve the interests of men.

Whereas an Allocentric person is tolerant of ambiguity in what he sees, an auto-centric person is intolerant of such ambiguity. He asks of what he sees that it makes sense there and then. He is not prepared to suspend judgement. He is accordingly, incapable of storing up conflicting information and feels himself obliged to force resolution. Such are the people who 'know what they like when they see it'. In essence, therefore, Allocentric people can be said to be constructivist people. Auto-centrics are expressionists.

This difference in motivation must be seen to be of fundamental importance to and for the development of ideal percepts. At everyday level performance of people, the dichotomy is represented at one end by what is often referred to as the 'scientific attitude', at the other end by what is the 'artistic attitude'. This dichotomy does not, however, account for what are science versus art attitudes art attitudes. Such attitudes are fundamentally misconceptions and misunderstandings. Scientists, like artists, are both Allocentric and auto-centric.

Mies van der Rohe in architecture, and Mondrian in art represent, respectively, the Allocentric approach to performance in the two disciplines. Frank Lloyd Wright and the German Expressionists in art represent the auto-centric approach. This 'divide' is not absolute. One and the same man can move from one extreme to the other as for instance, Rembrandt, whose earlier work is allocentric, while his later works become definitely auto-

centric. Value is not affected by the shift in position. The shift only occasions different dimensional aggregation of tool-method-technique approaches. The objective remains the same and the precision requirements relative to its attainment remain constant.

Man is measure of what he is measuring. He is not, however, measure of all that is, 'a la Renaissance postulates! Man's bodily dimensions and the whole biological process structure which he is, control what, how, and even when, he perceives. His perceptual mechanism is not an isolate in the biomechanical structural configuration which he is. It is not only related but is a corporate part of the whole system. A defect, or a fault, in any one part of the system affects and influences function in other categories of the system. Recent studies show how amputation affects perception of the visual vertical (sensed uprightness) because it occasions change in the individual's 'habitual equilibrium'. Change in muscular state of balance is change in and of the body's distribution of tonus.

Psycho-physical correspondences in perception are as yet not specified. What is the relation between perception and growth? What is the relation between perception and learning? Is the development of perception a sign of intellectual development? Is it a sign of social development?

We must, at this point, recall that the phonetic script is fundamentally visual. Word pictures are constructed on lineal sequence. The whole writing system is, however, supposedly representative of the power of the voice to shape air and space into verbal patterns. There seems to be a built-in performance contradiction in all this which must occasion stress. Is there no direct way in which sound shapes, i.e. words, can be interpreted so that their representation does not distort their very nature and character? Now that we know that number is independent of numbering, 'a la 1, 2, 3, 4, 5, etc., and have consequently developed digital computers which do not require numbering in these terms, may it not be

time that some quantum theory of word-shape representation is worked out? It must be possible to formally reconcile the spoken and the written word. The simultaneity and the instantaneity of words as spoken can surely be paralleled visually.

The question, i.e. the problem, invariably is the answer. Problems are predictive of their solutions. There is reversibility, though not symmetry, between the problem and the solution. The cause-effect relation between the two is also effect-cause relation. It is time which effects symmetry between the two. The time cycle is cause-effect-cause or, alternatively, effect-cause-effect. This means that symmetry between the problem and its solution is realised on stage-to-stage scaled resolution over a period of time.

Within the limits of present understanding, one thing is definite: That is, that there needs to be categorical separation and specification of problems. There needs to be parallel grouping of judgement relative to measures and dimensions of measurement. This is a fundamental and determinant factor in the development of understanding of the perception-relation-process on the basis of which perception itself may be effectively precisioned.

Space-Time Symmetry and the Relation Process

Vision is instantaneous-continuous-comprehensive. It is both projective and introjective. It is analysis and synthesis. It is exclusive and inclusive. These counterposed, but otherwise unified qualities of perception, constitute the base matrix of perception relation process.

The qualities of perception are related. In the main they derive from

1. continuity of space
2. continuity of time

The field of vision is a space-field demarcated and isolated from otherwise continuous space. The instant of vision is time similarly abstracted out of otherwise continuous time. The field of

visual representation, as distinct from the field of vision, is space demarcated and isolated from the field of vision. A painting – as field of visual representation – is abstracted from the field of vision – the wall, indeed – the room. Although isolated when viewed as a painting, if and when somebody looks in at the room, the painting is a factor in the composition of the room as field of vision for the viewer.

The specific formal qualities of the painting are seen, unity and severally as to exist within the field of visual representation which the painting is. Units of form in the painting are space within space. Vectorial divisions or unit areas (surface spaces) are similarly specified. Fractional or sub-vectorial areas, in turn, are specified accordingly, up to and until we reach zero space (or zero spaces/surfaces/areas) of the painting. Through zero space we pass onto the nega-space of the painting and incrementally move up once again from micro-mega-space to macro-mega-space.

We therefore see that the 'spatial unit' exists as a unit only in terms of its being tensorially held between

1. vectorial incident points, or points within the space constituting the spatial unit
2. total space – infinite and continuous.

There is, therefore, no spatial unit that perceptually exists as an isolate in space as a whole. This means that spatial units exist in coordinate relationship within total space.

Space is three-dimensional. Therefore spatial units, even when represented two-dimensionally, exist as three-dimensional entities. There is no two-dimensional space. There is two-dimensional representation of three-dimensional space, or better still, there is only the representation of three-dimensional space on two-dimensional surfaces as in painting, drawing, etc. In this one regard, spatial considerations which are essentially perceptual remain constant and are the same whether one is dealing with painting, sculpture, product design, building design, or city design. As 'looked

at' all these categories of performance, are in respect of both performance and product, the same. Differences relate to other performance considerations. A building is perceptually a painting. That is why we both paint buildings and make paintings of buildings. Surface texture is perceptual consideration of the same order in building and in painting. Distribution of surfaces as seen from a distance is judged from the one and the same considerations. This is so notwithstanding the fact that the architect arrives at external surface from the inside. Perceptually, the inside of the building is the nega-space of the building. It is not seen. It is only known to be there. It cannot serve as apologia for ill-conceived external appearance. We do not ask of flowers in our gardens that they justify themselves in such terms.

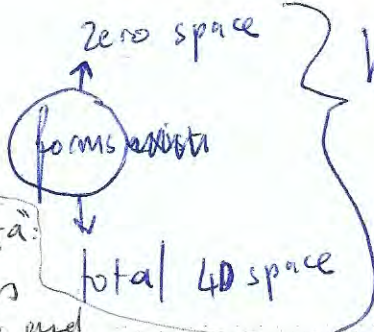
Another important consideration and implication of the three-dimensional existence of units of space in space is that we share the same space with the forms we see to exist in space. As such, we stand relative to them in three-dimensional space coordinate relationship. Because we physically enter buildings, this consideration in architecture is taken for granted. We do, however, much the same thing in a painting. We enter the picture space and move round it and round about it. Anyone looking at a painting perceptually effects this entering – hence the usage of such words as 'foreground', 'middle ground' and 'background', including 'light and shade', 'warmth', 'coldness', etc. All these are thermal terms indicative of a 'within existence' on the part of the spectator looking at a painting.

The 'perception act' introduces another dimension which translates three-dimensional space into four-dimensional space. Varying instants of our perception of space represent time and space coordination into unit space-time. Because the observer and the spatial unit observed are in coordinate relationship in three-dimensional space, the observer as observing instrument is not just a space factor; he is also a time factor.

"nega-space"

Musi on Composition

= no form is a totally closed form



with units of energy
"force quanta"

shape defines momentum and space

texture defines intensity

↓
together these give rise to "shape direction" (momentum-space direction and velocity potential)

↓
these unit properties allow for understanding "relative density for working on macro functions"

Light, as the agent rendering observable the spatial unit in question, is not static. It has rotational and translational properties. These properties of light are directly related to the observer's perception frequency processing of stimuli deriving from the spatial unit observed. This frequency is the time dimensioning of the instant of vision. The instant of vision, as unit of time, is itself sub-divisible into frequency units processed through the visual pathway. From this perspective, we exist with the forms we perceive in a four-dimensional space-time coordinate.

Transitions/ Transpositions/ Transformations

The fact that forms exist, extended and suspended between their zero space and total four-dimensional space, means that there exist transitions, transpositions and transformations in and about the forms as exist in space. Space-time is motion-space. Because space-time is infinite, position within space-time cannot be finite - it cannot be static or final. There is built-in change of one kind or another resulting from vectorial force distribution in space-time occasioned by the very nature of space-time itself. No form is a totally closed form. The boundary of each form is permeable and permissive.

Any composition of units of form in space exists as a coordinate system or pattern. It exists reacting to two force pulls

1. the centripetal or inward pull of the central point of the visual field. The central point of the visual field is, however, not the centre of the field. It is that point central to the focal points of the individual units of form constituting the composition. It is therefore, the point central to the sum of the centripetal force points of the individual units of form.
2. the centrifugal or outward pull of the perimeter of the visual field. Here again, the centrifugal force perimeter of the field is a product of the sum of the centrifugal force pulls of individual units of form.

The form of the composition is accordingly an abstract entity. It has to do with motions and 'energies' of units constituting the composition. Form is accordingly, structure, or a construct from the total patterning of forces in a given field. It is not just mere arrangement of units of form in space. It is this structure, or construct, that holds the units together and moulds them into an entity which we call the composition.

This integral coordinate structure or construct - form, in its working as the 'compositioning' factor bringing to unity the different areas/shapes works both inwardly and outwardly. It operates as the cohesion mechanism of the composition. It also works as the exclusion mechanism of the composition.

The composition is, in respect of this structure, both inclusive and exclusive. The composition is the product of units. It becomes form only in so far as the units are with force properties tending to unity (note: not uniformity). Not all compositions have form. All forms are, however, invariably rooted in composition. Because it is force inherent to individual units of space, which determines the extent and the extensibility of the force radius of their collective spatial existence, the boundary or perimeter of the form is determined and defined by the units as active agents in the field.

Units of space do not have a constant uniform energy-field. Their radial force field varies. This difference in force extent means that in any composition, and in any form, there will always be energy gaps. Although the form is a filled force field; it nonetheless is with energy gaps. Differences in energy-states of unit areas or shapes, in creating energy gaps, produce what are rest areas in a composition. These rest areas, or areas of interaction, are of fundamental importance to form structuring in composition. In music, the rest area is the pause or interval between two different or distinct sounds.

* Velocity = speed within a direction.

dynamism of composition = spec of momentum-space (velocity-space and unit number space)

In music, the rest area is time without action. It is not negative time. It is time portending action. It is suspension of action - not termination of action.

The ratio relationship between energy-gap areas, or intervals, and the charged energy-areas, sounds, determines and defines the mood or expression of the piece of music. It represents frequency specification which is what we call mood. It is however, the balance between the two which will define quality or form.

Composition, when targeted on the creation of form, cannot be just pleasing arrangement of unit spaces in space. It must be calculated deployment of forces.

The units of space must be seen to be force 'quanta' and must be handled as such. handling "force quanta"?

Each combination of micro-states produces a distinct and unique macro-function. We must therefore, specify properties of micro-states in precise terms if required macro-functions are to be attained. A unit of space is an energy configuration. Its shape defines its momentum space. Its texture specifies intensity and therefore, the energy level of the shape, as well as the momentum space of the shape. Shape direction is momentum-space direction and velocity potential of the shape. Only in so far as we understand these properties of unit spaces can we determine relative densities appropriate for required macro-functions.

The dynamism of a composition will therefore be seen to be a specification of momentum-space in terms of velocity space and unit-number space. Momentum space is the product of mass (as read) time velocity (as read). It should therefore be possible to control a composition all the way through to form. Form need not be a product of intuition. It can be a product of rational calculation. As surely as we need to know and acknowledge a good form, we most definitely need to know first the base ingredients of composition and, at that level, insure against bad composition.

This quality/ form lifting surfaces a lot - but I can't make sense of how this text even supports an orientation to energy, formal con- for as called to ab relate to spaces

Shapes
→ velocity momentum
→ texture specifies intensity and energy level/ momentum space

→ shape direction = momentum-space direction and velocity potential

I'd say this is a value study

~~activity~~

① centripetal / inward pull of focal point
+
② centrifugal / outward pull of perimeter of vis field
= composition.

simultaneous cohesion + exclusion mechanisms

compositions have rest areas/energy gaps.

Position and Position Orientation in Visual Perception

Nature, as already stated, repeats herself infinitely. There are few basic forms which recur with variations giving prominence, from time to time and from place to place to some or several of these basic forms. This attribute of nature is built into our visualising equipment. We note that retinal and cortical cells are highly specialised and that each set of cells works repetitively on the abstraction of one type or set of detail. The constant and continuous complex barrage or stimuli is handled through specialised breakdown processes, whereby stimuli are reduced to unit-stimuli of various categories and types. We further note that all stimuli, however complex or varied, are reduced and translated over into binary on-off frequency ration. Complex vision is, operationally, very simple.

This simplicity in complexity is of telling significance for the understanding of the relation process in perception function. Because the large number of variables found in stimuli are processed through what is essentially a binary system, sub-relations must be parallelly simple.

As noted earlier, the visual perception mechanism attaches singular significance to perpendicularity. In the receptive field orientation of retinal cells, orientation perpendicular to the optimum orientation of the cell is seen to evoke no response at all. Amputation of a limb affects equilibrium because it distorts the body's tonus. It distorts the visual vertical of the amputee. Therefore, body tonus is related to balance of force about the vertical axis of the body. This means that it relates directly to perpendicularity.

The anatomical structure of the head is about a vertical axis. It further is such that it affords optimum perception of information in given direction, particularly on horizontal rotation about its vertical axis. There is, therefore, direct correlation between the position of the head, the upright position of man, and the positioning of the sensory organs located in the head – the eyes, the ears, the nose.

Characteristics of 'sighting' are as applied and used in the development of optical instruments. The visual vertical, or vertical axis, operates as left-right vertical bisector of the visual field. The vertical axis operates relative to a horizontal axis, normally referred to as the horizon line or world-line of the observer, which functions as up-down, above-below bisector of the visual field. This horizontal axis gives position left to right of the vertical bisector of the optical field. On adding the vectorial diagonal onto these two axes, the diagonal axis gives spatial positions of the forms back to front, left to right, up-down relative to the vertical bisector of the optical field. This means that the vertical axis also acts as probability amplitude for each position of a unit of space.

Because the unit of space is itself similarly positionally broken down into fractional unit orientations as registered by individual unit retinal and cortical cells, the problem of space placement of units of space is resolved and specified to great detail. Four-dimensional translation of this three-dimensional space position placement is accordingly resolved as shift from position to position of fractional units in otherwise determinable positioning. The wave distribution resulting from this shift in position is therefore specifiable via probability amplitude specifications computed from known position, which is independent of positioned units of space. The independence of position from unit space of given position is crucial to operational manipulation of unit space positionings, as required for the structuring of form.

Fractional Equality and Probability Amplitude

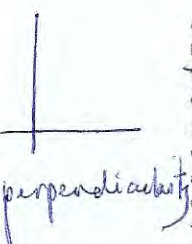
The eye has none of the vast problems of space and time, which we associate with our perception of the phenomenal world. Because the visual perception mechanism is an assembly of sub-system operations, which in turn, are assemblies of highly specialised unit systems, there is – operationally – no 'nature as a whole' to be handled by our visual perception

equipment. The visual equipment breaks down all nature-derived stimuli to uniform positive/negative electric impulse signals of varying frequency. This breaking down is the discontinuity intervening between the continuity of nature on one hand, and the continuity of consciousness on the other.

At unit-cell level, specification of fractions of units of space, length, as read by the unit retinal cell, is in the infra-millimetre range. At this range, there is no curvature which is curvature of significance relative to any macro-function of space. There is no texture. Curvature and texture, thus, become functions of straight lines variously oriented. We accordingly deal with fractional correspondence between straight lines of different orientation. Correspondences in orientation are simultaneous equalities as specified by equalities inherent to retinal cells themselves.

Space is a function of number. This fact, long accepted in the field of music, applies as well in the visual arts. Cells registering the same straight line orientation, collectively register 'straight line' at macro-function level. The greater the number of cells, the longer is the line. A macro-function straight line is the sum total of unit orientation registrations which are, in themselves, not lineally registered. Therefore the linearity of line is perceptually an abstraction. It cannot but be so, considering the fact that the receptor field of the retina of the eye is a concave disc. Further, recollecting the fact that stimuli acting on this receptor disc are exclusively light waves (light quanta) the orientation registered by the unit retinal cell is oriented in intensity change in light reflected by the object, then, there absolutely is no straight line because there is no line – as line per se – even at unit cell registration level. There only exists contour, specified by differences in intensity of light as reflected by the object.

Fractional equality equals fractional uniformity. Equal, uniform fractions in a set of spatial units signify unity in that set. Mutually related fractions in different



states of sets of spatial units also signify unity between such states. A ball, and a pumpkin, are different sets that approximate fractionally equal sets, which are sets existing in different states. There, however, remains evident unity between the two. When mutually related units, in different sets, are in different states, they signify both unity and comparability between the different states. The units act as transition probability points between the two states. They act as distributor points from one state to the two states – the pumpkin and the ball. Unity will be seen to exist only in so far as there is evident reversibility at fractional equality level. This reversibility is independent of scale or extent – it only is in respect of mean orientation at the unit level.

Transition or interconnection, therefore, rests on unitary transformation. Unitary transformation is accordingly identical with probability amplitude. Probability amplitude is periodic relation between a set of coordinates.

An interesting feature of this relation sequence is to be seen when two equal and identical forms, which are totally reversible – as, for instance, two equal balls of the same type – are simultaneously seen. Each ball is a set of fractional units identical with the other set of the other ball. The two balls, although sharing identical fractional equalities and uniformities, perceptually remain two separate and distinct entities. Why? Each ball is a system. As such it returns in upon itself. The unity expressed by the two balls is qualified by difference of position in space. Position alone will create difference because it will appropriate momentum space differently to the two balls. Space position difference is not just positional: it also is quantitative and qualitative. Two circles positioned respectively and differently, left to right of the vertical bisector of their field, and up or down relative to the horizontal axis, will change size – not shape – because they will, of necessity, fall within vectorial diagonal force lines, and, therefore, take positions back to front, left to right, of both the horizontal and vertical field bisectors. This depth-positioning

increases or decreases the distance (optical) between the observer and one, or other, or both of the circles.

Space is a force field. Space and momentum space are homogeneous. There cannot therefore, be preferred zero point in space. Factors qualifying space position are themselves not final, because they are subject to the exigencies of motion. Space is motion-space. Motion inherent to light is change. Observation of the unit area or space, being but a function of light is also change. Change of position by the observer, is also change of position by what is observed. It should be remembered that change of position involves deformation of one kind or another. This results from fractional breakdown of unit space. The fractional units do not just change position, they also change distance. This change of distance at fractional unit level is the cause of change of shape or deformation. An interesting feature of two identical circles occupying the same position respectively left and right of the vertical bisector, is that they will alternate. They will be seen to jump across the vertical barrier line, each one taking the other's position. They will also be seen to fade out and emerge at definite time intervals. Why?

Units of a certain kind have common multiplicity. Unitary transformations controlling connection between such units is itself governed by correlation laws. This means that unitary transformation is both a factor and a function of probability amplitude. Probability is not chaotic. It is controlled by correlation law of unitary transformation. Transition probabilities transpose into probability vectors – hence, common multiplicity.

A square rotated at given speed forms into a circle. This is because, fractionally, the units are plotted radially. This plotting allows for simultaneity of progression-reversion and positive-negative tension. When the square is rotated there occurs vectorial displacement along circular coordinate transfer lines of momentum. The decay of the square into a circle does

not only affirm the fact that the square existed as a sum of fractional units, but also, that it existed as a force field in a force field.

Visual Perception Controls in Design Development

In classical art, design and architecture concepts, the geometry and the physics of space are conceptually not seen to be a part of consideration of the placement of forms in space. Space is Absolute. The problem is, accordingly, thus seen to derive and relate to mere distancing of one form from the next. Composition is thus, arrangement of forms – it is deployment of forms, as entities, which need only bear aesthetic or balanced relation one to another. Balance, if and when attained, is attained via arbitrary process. It is, as a result, attributed to intuition, i.e., the sense of balance.

Objects in space were again, not seen to be themselves containment of space. The all-pervading nature and character of space was not acknowledged. The object was, therefore, seen to be only capable of changing position in space, but not capable of changing space itself. Absolute space was also space external to the object in space.

Space was also independent of time. Time as a real momentum, and therefore, space-time, was not recognised and acknowledged. Time was also absolute. Time was further deemed to be linear. It was expression of evolutionary sequence. As such, history was a counter-part of time. Precedent was of fundamental importance. Hence, importance attached to 'duration' as representing validity seen to be 'tested experience'.

Up to the 19th century, design development was founded on prescription of units of form seen to be representative of proportion, balance and symmetry. Euclidean Solids, developed from formula worked up from concepts of absolute space, and absolute linear time, were posited as fundamental to all design development. This thinking covered formulation laws of composition, which were in essence, deterministic,

i.e. absolute. Unit perspective point, the 'Golden Section', etc., became inviolable base laws of composition and design development.

Space and Time being, respectively, absolute, and themselves rendered concrete by natural phenomena, rendered Nature absolute. Nature stood as composition 'par excellence'. All that remained for artists, designers and architects, was that they go out and study Nature. Nature was a self-evident design truth – absolute and total. Life drawing, landscape painting, etc., enjoyed the standing of required base disciplines - a must for the training of the would-be designer's hand and mind.

All observed 'effects', that is, states of existence, were seen to be in need of accounting in terms of 'causes'. Relationships, instead of being seen relative to 'relation' itself, were explained away via causes, whose very cause could not be explained. This is evident in the development and use of Perspective Laws which, like the laws of gravity, became causes of proportional and relational self-deployment of natural objects in natural space. The 'Vanishing Point' was posited out-there with no explanation of the nature and character of its very happening to be out there. It was, like gravity, then explained away as magnetic pull on the centre of the earth, regardless of the fact that nobody was then able to fathom the nature and character of the centre of the earth. The obvious 'relational fact', that bodies on and about the surface of the earth are seen to behave in this pattern, was deemed not to be sufficient cause. The fact that there can be 'insufficient' cause for otherwise 'sufficient effects' was unacceptable. The fact that 'effects' can themselves be 'causes' was impossible to comprehend – because time was thought to be absolute and linear.

God, thought to have founded a finite, universal order, was seen to have decreed order in all categories of the phenomenal world. This order could not, therefore, be with disorder in any one category of phenomenal existence.

Planets were perfect solids in space, moving in ordered and outwardly symmetrical relationships and this was seen to mean that symmetry is decreed requirement in all performance.

The earth is round. Round – circle and sphere – is ideal shape and form. Planets revolve round the focal point – the sun, therefore, perspective point. Orbits are constant; therefore, golden Section in composition. God is perfect. God is beautiful. Nature is God's handiwork; therefore, perfection is the goal, to be all and end all of all design.

All these formulations are significant in respect of their derivation. They all derive from 'observed' phenomena, and are fundamentally, observations about natural phenomena. This means that they are all, essentially, perceptual. They are perceptually derived. They had been formulated from what were essentially collective observations of natural phenomena over long periods of time. People, respectively, were 'looking at' the constancy of the regimen of night and day, winter and summer, the stars in the heavens, the moon, the sun, etc., etc., etc.

To the extent that perception itself was unstudied, un-understood, and to a great measure misconceived, to that extent was error invested in observations made. People, looking at the behaviour of natural phenomena, overlooked looking also at the behaviour of their own perception equipment. Therefore, much of what was read as representing the behaviour of natural phenomena was in fact the behaviour of the very perception equipment. Therefore perception had functioned without controls. It has not been until man extended, refined and precisioned perception through the use of optical instruments – sighting instruments – that men realised the degree of the margin of error in what had earlier been thought to be proven and tested observation.

20th Century recognition and acknowledgement of the fact that matter is motion (energy-matter duality), and that, therefore, all is motion – nothing

is static – led to complete overhauling of all observations founded on static object-phenomena existences. Realised simultaneity of the object and the observer of the object discredited all 'object-out-there' theories. Visually, the field of vision was redefined and specified relative to perception processes.

This led to what is now commonplace knowledge: that function is inseparable from structure. That form is a function of energy times time. That materials are inseparably linked with and to both function and structure. That function does not follow form. That neither does form follow function. That form is function and function is form.

A given structural unit has both field-energy (function) and integral force patterning (system). Units of structure change from positive to negative and negative to positive existence depending on the point in time of their transition from system to system paterings. This transformation is existence-conditioned change, occasioned by our interference, i.e., by our very effort to measure patterning of relation between units, which patterning of relation binds these units into one formal or structural whole.

Nothing will and does happen to the state of a system unless, and until, that system is brought into contact with a measuring instrument. Nature, as a system, is perfect so long as we do not measure her. She is perfect, so long as we do not learn from her. To learn from nature, we inescapably distort and deform her. Being part of nature, this is unavoidable. The man-made environment is an 'interference environment' which, though nature derived, is essentially man-derived and is, to that order, that much 'removed' from nature in her natural state. Relative to nature – in her natural state – the man-made environment is disorder in her order. Relative to man – and his intention – nature is disorder to man's intentioned order. That is why, as people, we feel obliged to 'garden' nature in the face of our very assertion that nature is with order. Our order, which to nature is

vanishing point + gravity

f

disorder, is not independent or opposed to nature's order.

Order in nature is not absolute. As such it is not finite. Nature effects transformations in and of herself continuously and perpetually. She exists in integral transforms of varying and ever-changing relationship and is, as such, always new. This is why it is virtually impossible to 'copy' nature. Our effort now is only directed at simulating her. This change in attitude is fundamental to current abandonment of historicist concepts predicated on 'experience' and 'accumulated knowledge'. We have come a long way to realisation of the fact that progress is not 'progression'. It only is successional, in that things follow one upon another, but not necessarily one after another in lineal sequence. We accordingly have learned to contain our arrogance and presumption that we can explain natural phenomena and natural processes from accumulated knowledge and experience.

Experience, as experience per se, is irrelevant to isolating and specifying relations. Accumulated knowledge, when derived from wrong base concepts, in turn stifles and progressively erodes conception of relation and, therefore, how best to use available information (accumulated or not) to specify relationships. Relationships are not constant. They are ever changing in both nature and kind. No two or more states of relation are ever the same in four-dimensional space-time.

When abstracting any state of relation in nature, and when demarcating any part of nature out of the continuity and self-totalisation of nature, we effect addition and/or subtraction. The energy of that state will, either, reintegrate itself synergetically (addition) or, there will be initiated entropy (loss-subtraction). In other words, the state will thereafter be either greater or lesser than itself at point and time of demarcation. This function-fact of nature applies as well in human

performance. More than anything else, it is this fact which discounts relevance of experience and accumulated knowledge in performance no longer based on concepts of absolute space and absolute time. While concepts of absolute space and absolute time stood unchallenged and not invalidated, experience and accumulated knowledge were indeed relevant, largely because they were functions of these conceptions. The shift from these performance considerations to specification of Function independently of a 'functioning object'; specification of Relation again independent of 'related objects'; of Field as distinct entity independent of 'situations', sums up performance in this century (up to now) and posits it as different and distinct from performance in earlier times. There is not, and there cannot be, performance-co-existence between this time and past time which does not issue to contradictions and consequent stress and dis-ease.

There cannot be quantitative specification which does not involve qualitative valuation. The way units of structure are assembled is as important as is determination of the number and type of units that are to be assembled. The assembly process is simultaneous assessment of quantities and qualities. It is valuation of quantity and quality. This fact is fundamental to design development and control.

The now built-in synchronisation of numerous operations in unit ordinary machines (not computers), requires sense-response control which is parallelly synchronised. Unit-operation on lineal sequence is, for both machines and men, no longer appropriate operationally. Point to point production sequencing is not unit to unit integration. It is sub-system to sub-system relationing programmed on circuits of integration which are drawn from clearly understood functions. Because machines are now run on electricity, they are run at electric instant speed. They are run on two-function relation involving

information and perceptual response to information. The operator is required to respond to the machine on tool-method-technique integral performance ratio correspondence between man and machine. This fact is of fundamental importance for designers, whose designing is after all programming production and consumption. The machine is, today, standard tool, method and technique. The requirements of the machine are accordingly pre-conditional to meaningful performance in our time.

The machine is a theory-practice coordinate, requiring for its efficient utilisation, approach which is itself theory-practice coordinated. Instruments and machines we use today are theory rendered concrete. That is why we now have self-reproducing machines. Perception, as first-base sub-system in projected sub-system specification and sub-system integration relative to production-consumption cycling, holds the key to the cognition, specification and resolution of systems both as structures and as constructs. Their structuring and construction via machines is equally directly related and dependent on perception. Functions and response to functions are interlaced. The whole sense-response mechanism operates on electric impulses. Machines in turn are constructed to operate on electric energy. Electric energy governs both man and machine operations. This operation-coordination is both the control as well as the means wherewith development in design as well as in any other production-consumption action is today effected. There is no escape from the machine. As such there can be no divorce of theory from practice, where machine-based production is the issue.

There is no need to run outside
For better seeing.
Nor to peer from a window. Rather abide
At the centre of your being;
For the more you leave it, the less you learn.

- Laotzu b.604 B.C.

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