**PHENOMENOLOGY OF LIFE PRESENTATION**

**by Alex Hankey**

OVERVIEW: This presentation combines insights from Critical Phenomena and Quantum Field Theory to formulate a completely new kind of information theory applying at loci of control of biological systems, and yielding a completely new approach to phenomenology. The new theory can model direct mind-to-mind communication of ideas, for which considerable evidence is offered. I am honored to present it for the first time to information scientists.

**INTRODUCTION**

As we all know, there are currently three widely understood and accepted kinds of information, Fisher information in statistics, Shannon’s digital information, and the more powerful quantum information proposed by David Deutsch at Oxford. Here we present a new kind of information as different from the previous kinds of information, as they are different from each other. Since it is easy to justify it being used as the basis for experience, I am proposing that it should be named ‘Experience Information’, though I would naturally defer to experts in the field.

The completely new structure possessed by the new information leads to it being able to account for phenomena previously beyond the reach of scientific theory – and believed by many to be forever beyond its reach. This presentation is therefore in two parts: Part 1 presents the structure of the new information, and some of its proposed applications; Part 2 presents a particular class of evidence in support of its use, the no doubt shocking proposal that it can model direct mind-to-mind transmission of ideas/gestalts, for which there is now a considerable body of evidence. This application yields unexpected new input into the ‘Phenomenology of Life’.

PART 1: INFORMATION STRUCTURES AT ORGANISM LOCI OF CONTROL

Through the work of Kauffman (1), Holland (2) and others, the field of complexity (3) has wrought deep changes in the structure of biology. Loci of Control of most if not all organisms are now recognized to be preferentially located at critical instabilities. The main evidence for this comes from analysis of organism / physiological responses to fixed stimuli. Rather than fixed responses to fixed stimuli typical of mechanical systems, biosystems produce a distribution of responses obeying a fractal (1/f) power law: less frequent (smaller f) responses are larger, in a way that is inversely proportional to their frequency, f. (1)

Such patterns of response are characteristic of systems at critical instabilities, which may be understood in terms of the presence of feedback instabilities in system control structures (4). This implies that, at loci of control, system excitations, which carry information used in control are not quanta, but the vastly different critical instability fluctuations. Quanta would support information in the form of quantum information vectors, but critical point fluctuations do not (5). The information they support must be different. If anyone objects that they cannot support information, remember that critical systems possess entropy, and that information equates with negative entropy, so critical systems do support some form of information – albeit very different in structure from Shannon information. (4,5)

INFORMATION IN CRITICAL FLUCTUATIONS

Critical instability fluctuations possess entropy.

Negative entropy is information.

Information is therefore present.

Critical fluctuations possess an information measure.

For example, critical fluctuations possess long range correlations, which make it impossible to separate out individual basis states, as can be done for quantum systems. Hence the information is not separable, and cannot be digital. The long range correlations mean that the structure of the information must represent a form of integrated information, as proposed for the nature of information in consciousness (6).

The structure can be most briefly and easily analyzed by analogy with fluid systems. Here integrated structures occur in fluid flows at their Critical Reynolds number: vortices are trying to form, but cannot quite do so. Instead, many infinitesimally different fluid flow vectors are sewn together, as it were, by the presence of infinitesimal vortices that are trying to form, but lack the dissipative energy to become finite. Since fluid flow vectors represent information at each point in the fluid, analogous to quantum information vectors, the new structure at the critical Reynolds number (an instability) consists of a mixture of infinitesimally different vectors sewn together by an infinitesimal vortex loop. This may be represented as <===========**O**. where the arrow represents the *mixture* of fluid flow vectors, and **O**, the infinitesimal vortex flow loop (4,5).

In an information system where the gain **g** in a feedback loop has assumed its critical value **g** = 1, the situation is analogous. The information flow round the loop has become unstable and is subject to instability fluctuations analogous to critical instability fluctuations in ordinary kinds of physical system at criticality, the gas-liquid critical points described by Van Der Waals equation, or the Curie point in ferromagnets, as taught in high school physics (5). At such critical points, the information structure consists of an inseparable mixture of information vectors all sewn together by an infinitesimal **g** = 1 feedback loop, <===========**O**, as above. This form of information is also the kind present in biological systems at their loci of control (4,5). It is used in nervous systems, as evidenced by the numbers of scientific papers reporting observation of criticality and self-organized criticality in brain cortices of various kinds. (e.g. 7-9)

I propose that, *irrespective of any hypothesis concerning the application of such an information structure*, this constitutes a valid representation of information at all kinds of critical points including critical feedback instabilities, ordinary thermodynamic critical points, and complex critical points on neuronal nets, analyzed using the neural net / spin glass isomorphism. (5)

A NEW LAW OF PHYSICS

A recent paper (5) points out that a **g** = 1 critical feedback loop constitutes a *perfectly self-observing system*, and that, according to the laws of quantum theory, it therefore reduces wave packets / annihilates quantum fields. This yields a purely quantum reason for instability: at instability, stabilizing quantum fields have been annihilated by acts of (self) observation. By extension to other non-linear systems: *non-linearities annihilate quantum fields*, a law of physics not previously stated.

THE NEW INFORMATION STATES AND PHENOMENOLOGY

Most of mankind’s traditions report states of zero information content, where experiencers are not asleep, but fully awake within themselves. (10) In Yoga, such states are referred to as ‘*Samadhi*’ (11) or pure awareness. In such states, “The self knows itself by itself alone” (12). In other words, the nature of the self is to know itself – it is a process of self-knowing-itself. (13)

In the proposed <======**O** model, a state of zero information content can be represented as <**O**, where the arrow’s length has shrunk to zero, but the loop representing ‘self-knowing-itself’ remains. The model may therefore naturally be hypothesized to present a realistic picture of experience, where an inner sense of self accompanies all external, sensory awareness. In addition to being a process, such a ‘self’ would also experience a continuity of existence, a ‘sense of time passing’. The model possesses the relationship between ‘self’ and ‘sense of time passing’ noted in Husserl’s original analysis given in his book (14), ‘The Phenomenology of Internal Time Consciousness’. Hence, the relevance of <========**O**, Experience Information, as I suggest it be named, to phenomenology.

Also, the sense of time passing automatically becomes continuous. In contrast, neurological models based on digital information predict a discontinuous sense of the passing of time, jerking forward each time an information register is updated. But time’s passage ‘feels smooth’ supporting the kind of model suggested here. (5)

**KEY SUMMARY**

Understanding the new form of information relies on an image from fluid dynamics: 'Information' at each point is a fluid flow vector. At the critical Reynolds number onset of turbulence, infinitesimal vortices are trying to form at each point in the fluid, but cannot go all the way and manifest fully. The flow vectors become infinitesimally unstable at each point, as 'unmanifest' infinitesimal vortex loops bind together infinite numbers of vectors, into highly correlated vector bundles. The image portrays this in the form, <==========**O**, an arrow with an attached (unmanifest) vortex loop.

Transfer this analysis to information systems to analyze the structure of information states *within* a feedback loop at critical feedback instability, when feedback gain **g** has the value **g = 1**. Information states within the loop will have a similar structure. <==========**O**. Organisms prefer loci of control to be at feedback critical instability; they naturally use this form of information for control purposes – in their minds. This is used to explain the *structure* of experience.

PART 2: ENCODING OF THOUGHT AND SENSORY INFORMATION

Now consider how information pertaining to the external world may be encoded in the vector mixture <=======. This structure is a mathematical singularity containing one of Rene Thom’s catastrophes (15) i.e. a differential topology singularity. On neural networks, these can become arbitrarily complex. (16) We propose that they can encode information as gestalts. In support of this we analyze how thought arises in the mind, and show that much informal data suggests its encoding as gestalts. In particular, we use evidence that *encoding of ideas in animal minds is the same as our own*. This presents us with insights into the Phenomenology of Life.

Development of thought in the mind: Those who experience stable *Samadhi*, silent mind, report that words and speech develop in a distinct four level sequence. (17) Thoughts start from (a) the transcendental level, and (b) manifest as ideas, which transform into (c) word-thoughts in one’s language of choice, usually the mother tongue, and finally (d) into spoken words. Deeper levels of the human mind thus hold ideas, which are only later formed into sentential structures. Verbal thoughts and speech are only outward expressions of raw ideas generated. Academics may confirm this from the experience of giving lectures: while speaking out each sentence, one listens to the words of the next sentence forming in the mind, which are then spoken out, et cetera.

Similarly consider an idea for a book: the idea comes as a whole, integral concept; we then begin by partitioning it into chapters, which are subsequently split into sections and paragraphs. Although we may start at page 1 and write to the end, the *idea of the whole* drives the process. Mozart similarly described how an idea for a symphony would come to him, *arising as a whole* rather like a ball of string, which he would then unwind movement by movement and bar by bar. (18) Both these examples support the concept of ‘gestalt information’.

Here, the Experience Information arrow <=========== can be used to model such arising of ideas in the mind as gestalts, before being linearized into sentences or bars of music. Evidence for this comes from reports of communication of ideas directly from mind to mind, without intervening use of words or sense perception, as has particularly been reported between animals and humans. (19) The Experience Information model, <=========**O**, with its high levels of critical point correlations, need only be combined with the physics of ‘quantum teleportation’ (20) between correlated quantum systems to develop a scientific theory of such communication. Details of this will not be presented here, however.

HUMAN-ANIMAL COMMUNICATION

Study of cognition and mental abilities in animals is widespread. A December 2015 conference at India’s National Institute of Advanced Studies on Consciousness, Cognition and Culture commenced with a session: Cognition and Consciousness across Species. V.V. Binoy related how certain fishes are ‘Machiavellian’, while S. Iyengar told of problem-solving abilities in certain species of birds, particularly in the corvidae (crow) family. A. Sinha discussed primates and their ability to know their social position, something well-known in many other species e.g. canines. Primates can distinguish their own motives from others, and attribute beliefs to others, but whether they have ‘reflective access to their own minds’ remains unestablished. Matsuzawa showed how working memory in chimps can be better than in adult humans. However, this kind of psychological data pales into insignificance compared with that presented below, despite it only being narrative information.

Some people have reputations for communication with animals. Examples are Lawrence Anthony, ‘The Elephant Whisperer’ (21), and Anna Breytenbach (22), who teaches animal communication, a field in which I have had some small personal experience. In late 2014 a Yoga instructor here at S-VYASA who prides himself in being able to befriend wild snakes, pick them up, look after them and put them back, took me to our cowshed to pet the cows, as people do in India. To our surprise, one cow refused to be touched by either of us. Knowing his penchant for communication, I suggested that he focus on the cow’s heart and ask her what the problem was. He received a message that we were later able to verify. The cow had communicated that she liked to stray away from the herd and be alone, but the cowherd did not like that, so he beat her hard. She had decided she didn’t like humans. We brokered a peace deal for her!

Lawrence Anthony’s book, ‘The Elephant Whisperer’ (21), relates his work with elephants on the reservation where he worked in South Africa. Rather like the cow, a particular group of elephants had taken a dislike to humans and were creating havoc. Dissuading concerned persons from putting them down, Anthony relates how he communicated the situation to the elephants, accepted them on his reservation, and their behavior changed. Most movingly, when he died, the elephants, many miles away at the time, marched across the park to his home, and stood a silent vigil for two days just as they do when one of their own number passes on. The elephants’ mourned Anthony’s passing as one of their own, as if they had accepted him into their family.

Anna Breytenbach, also from South Africa, is highly skilled in this kind of work. The video of her work with the ‘Black Leopard’ (23) is particularly moving. The leopard had been transferred from a European zoo where he had had major problems, to a special home for large predators. But for six months he showed nothing but hostility. Anna was called in. She explained that, *because of its negative connotations*, the leopard did not like the name, ‘Diabolo’, which had been given him. It did not match his nobility and power; he requested its change. Also he wanted reassurance that nothing would be expected of him where he now was, he just wanted to be his natural self. Finally he was concerned for the two leopard cubs that had been in the cage next door to his own in the zoo. Were they safe and well? This last question, concerning a fact that Anna could not have otherwise known, brought complete acceptance of the validity of her communication by the reservation owner. The leopard’s name was changed to ‘Spirit’, and he was given reassurances on both questions. His behavior changed immediately, and he integrated into the community of large cats at the reservation. (23) The immediate change of behavior provides conclusive evidence for the validity of what had passed between Anna and the leopard.

Similarly moving accounts of the feeling lives of animals can be found in BBC documentaries portraying life at an elephant orphanage in Kenya, to which baby elephants are taken after their mothers have been shot by poachers. The sight of the understanding and comforting treatment given by the older female elephants who act as surrogate mothers for the newcomers is truly heart moving. It more than rivals the caring and compassion of humans, and tells us much about elephants’ qualities of heart. What do these things tell us about animal values and personalities? They are often deeply caring beings with similar natures to our own. In contact with humans they can show empathy, gratitude, trust and caring, and appreciate such values being reciprocated.

Humans living close to nature also communicate ideas directly. In his books about the Bushmen of the Kalahari (24,25), Laurens Van Der Post relates how, when a hunting group has caught its quarry many miles away, the family start preparing the fire to cook lunch. They know what has happened through the ‘bush telegraph’ – direct ‘heart to heart’ communication.

I have already argued that, in humans, ‘ideas’ precede speech (17), but evidence for direct communication has proved scientifically controversial. However, ‘Telephone Telepathy’, the phenomenon of having a thought about a person at the time that they call you, now has good quantitative evidence, for which statistical validation has become overwhelming (19). With a theoretical model of cognitive states that can support such communication, science should start to be more accepting of it, and hopefully investigate it more fully.

But how ancient is this encoding of ideas? How far back down our family tree, the ‘Tree of Life’ can it be traced? Sheldrake (19) relates the story of an African grey parrot called ’Nkosi with a vocabulary of over 1,500 words. ’Nkosi has been known to call out the names of objects in a picture book being looked at by her owner when she was out of sight in another room. On one occasion she even woke her owner out of a dream by shouting out the names of objects her owner was seeing in the dream so loudly that she woke her up.

This story has profound implications. It indicates that the encoding of gestalt information must be the same in the brains of birds as in those of humans, for *if the encoding were not the same, how could the information be directly communicated and understood*? Birds are descended from saurapsids, which evolved through reptilians into dinosaurs, whereas man comes from synapsids, which evolved through mammaliaformes into mammals. (26) The origin of the particular encoding of gestalts used in our brains must predate the time of the original amniotes, which are thought to have split into synapsids and saurapsids, some 380 million years ago. (26)

An important aspect of this work is that single cells of various kinds also optimize their integrated regulation hierarchy by self-organized criticality: Their loci of control are also at criticality. Experience Information must be as valid for them as for us: so when do consciousness and awareness arise? Some years ago a very interesting article on single cells by B.J. Ford appeared in New Scientist. (27) Under appropriate circumstances, certain kinds of paramecium and amoebae exhibit remarkable behavior: the former in reproduction, the latter in construction of protective shells against dehydration. Such behavior implies that both life forms possess considerable awareness of their space-time surroundings. Not to treat such feats anthropo-centrically is almost impossible: one senses that, *even in single cells*, self-awareness is an in-built aspect of regulation and organism control as the proposed theory of Experience Information suggests. Single cells appear to experience both the subjective senses of time passing, and of participation in an outer reality, in which they can perform functions appropriate to their needs.

To conclude on a personal note: Having come to this realization and reflected on it at length for some years, I no longer find it surprising. If an organism is to live in a challenging environment, it is less likely to function effectively as a behaviorist-style bunch of stimulus-response reflexes, than as an integral functioning intelligence with some kind of sense of subjective awareness. Only then can it control its functions in ways most appropriate to its needs and its surroundings.

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Alex Hankey is a theoretical physicist trained at M.I.T. in two disciplines: quantum field theory by Steven Weinberg, and critical phenomena by H.E. (Gene) Stanley, who incorporated some of their jointly developed ideas in his classic text on the subject. He currently works on the physics of biological control systems and health, at the S-VYASA Yoga University in Bangalore, India.