FOLLOWING THE LUCAS ARGUMENT TO COMPLETION

J.R. LUCAS, 18 JUNE 1929 – 5 APRIL 2020, IN MEMORIAM

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ABSTRACT:

Background: In 1959, Oxford Philosopher J.R. Lucas proposed his Gödelian Argument, a consequence of Gödel's incompleteness theorem is that the human mind 'stands outside' the realm of mathematical logic possessing abilities no computer can emulate without purpose-built design. Douglas Hofstadter's book, Gödel Escher Bach, popularised Lucas's work, forming the launching point for the 20th century's defining achievement towards a western science-based theory of consciousness. With the assistance of philosopher, Jon Shear, David Chalmers, Hofstadter's student, produced highly discussed papers and a book naming four criteria that any theory of consciousness must satisfy for body and mind to couple. Most important is the requirement for a 'Double Aspect Information Theory of Consciousness'. Here we show that the Experience Information approach to body-mind coupling necessarily results in a form of mind with properties that no digital computer can emulate.

Methods: The Experience Information approach departs from previous theory by depending on complexity biology: specifically, its property that Loci of Control of all physiological functions are sited at criticality, i.e. critical instabilities. Previous work showed that excited states of critical instabilities cannot encode digital information, so they cannot be emulated by digital machines. Their lowest energy states have pure consciousness-like properties, while their excitations directly encode 'Forms' or 'Ideas'; something digital machines cannot do – a first indication that Lucas's Gödelian Argument is correct.

Main Result: Elementary excitations are encoded at effectively zero energy cost, meaning that they can be transmitted between correlated systems with space-like separation.

Discussion: That the human mind primarily encodes ideas is ancient wisdom in both East and West. In India's Vedic civilisation, the first *Vedanga* (Limb of the Veda), *Shiksha*, clearly shows that mind first encodes ideas, while digitisable forms like words in specific languages are secondary, agreeing with modern studies of stroke. *Shiksha* terms the stage at which encoding of ideas takes place, *Pashyanti*, at the level of the 'heart', second to the first stage, *Para*, that of pure consciousness. In the west, the idea mind encodes 'forms' can be traced back to Plato's Republic, then to Rene Descartes' *Discourse on Method*, to Immanuel Kant's reasoning that mind encodes 'wholes'; that gave rise to the cognitive theory of Gestalts, and then to Gestalt Psychology. The idea that mind's encoding is not digital has an impeccable history involving some of the finest minds in the history of mankind.

Experience Information achieves Lucas's conclusion far more decisively than even he could have anticipated. All psychic phenomena stand witness to this conclusion. A review of detailed evidence for such phenomena from Dean Radin and Rupert Sheldrake and other such scientists will be given in a second paper. Now that a good theory is available, all such material can be set on a proper scientific footing.

Summary: Lucas Gödelian Argument led to David Chalmers's criteria and then to Experience Information at criticality the first all-inclusive theory of experience: cognitive states consist of forms superimposed on self-awareness, encoded via Thomian catastrophes, which can be directly manipulated by the intellect – both properties fundamentally beyond the capacity of any digital machine. The icing on Lucas's cake, as it were, is that the new theory can explain the Direct Transfer of Ideas from Mind to Mind, for which an abundance of evidence exists.

KEYWORDS: Complexity; Optimal regulation; Critical instability; Experience information; Thomian cognitive states; Mind-to-mind transfer of ideas; Beyond digital machines

INTRODUCTION

In 1931, Kurt Gödel published his incompleteness theorem[1], showing that any mathematical system that includes arithmetic must be either inconsistent or incomplete. Inconsistency implies that anything can be proved, so the general assumption in mathematics has always been that mathematics is intrinsically consistent. Completeness of the functional calculus was of previous concern to Gödel. [2] Numbers have definite properties which are part of nature, and which cannot be denied. However, at that time the world's greatest mathematicians were of the view that it should be possible to flesh out known mathematics and bring it to a round completion. [3] Because of Gödel that is no longer true, and mathematics is now seen as an open structure where new definitions and new theorems can be introduced ad infinitum.

While this was very pertinent to mathematics itself, the structure of Gödel's proof was very provocative. It had tantalising implications for our understanding of the mind, suggesting that the intellect has abilities to reason about mathematics in ways different from just constructing logical proofs from axioms. Gödel used a new branch of mathematics to construct his proofs, known as 'metamathematics'.

[4,5] The construct was to number all mathematical statements in a unique way, and then to show that the numbering system itself could be used to construct proofs, some of which were not constructible within the system. [1]

Gödel's metamathematical construct made it clear that the human mind can reason about mathematics from outside mathematics itself, as it were. Rather than being limited to working within the confines of the intrinsic structure of mathematics, it seemed to be able break free and reason from outside it, similar to a third dimensional viewer looking at 'flatland'. This seemed to suggest that the human mind functions in a way inherently outside the confines of ordinary logic, and is not itself subject to purely mathematical laws. The aim of this paper is to use a recently introduced scientific approach to the study of mind[6] to demonstrate that this is indeed the case: the human mind possesses capabilities far beyond those of any digital computing machine.

In 1959, Oxford Philosopher J.R. Lucas read a paper, Minds, Machines and Gödel[7], to the Oxford Philosophical Society, proposing these implications of Gödel's incompleteness theorem. It subsequently became known as Lucas's 'Gödelian Argument'[8]: Gödel's mode of proving his incompleteness theorem implies that the human mind effectively 'stands outside' the realm of mathematical logic, and possesses abilities that no computer can emulate without purpose built design. Lucas[7] suggested that single properties might be identified, so that although a digital computing machine might be built, which could emulate the first property, it would still be incomplete, because further properties of the mind would be identifiable, each of which required a new development for the machine to emulate. Continuing incompleteness implied that a potentially infinite series of such properties exists. [7,8] Lucas's second article[8] contains such a precise description of his reasoning in his first paper[7]. that I felt to offer an edited version as an Appendix, especially in view of his recent passing.

A sequence of the kind proposed by Lucas was exemplified in the Deep Blue challenge to Garry Kasparov. [9] Kasparov's 1996 win led to improvements in Deep Blue. [10] To continue outwitting it, Kasparov developed new strategies. Although Deep Blue seemed to win the 1997 rematch, Kasparov[11] asserted that Grand Master input had been employed by the IBM team in one game. In another[12], Kasparov missed a draw by perpetual check, while in the final game, the Deep Blue team had anticipated Kasparov's tactic in the Caro-Kahn defence, inputting a variation into Deep Blue's database that very morning.[13] All this is consistent with Lucas's Gödelian Argument: ***in order to win, the computer had to be updated one fact at a time***, meaning that the claim that Garry Kasparov versus Deep Blue proves the superiority of machine over mind fails – it is merely an example of Lucas's Gödelian argument. .

HOFSTADTER, CHALMERS AND PENROSE

In 1979, a Pulitzer prize-winning book taking up Lucas's ideas was published: Gödel Escher Bach, an Eternal Golden Braid. [14] Author Douglas Hofstadter, son of Nobel laureate, Robert Hofstadter, had intellectual brilliance running through his veins. Later he took over Martin Gardner's famous mathematics column in Scientific American and ran it for years. Hofstadter stated that the aim of his book was to draw attention to the extraordinary nature of creativity in the visual arts and music, and to emphasize that such feats of originality could not proceed from a machine. It therefore had profound implications for consciousness studies. When we further observe that such creative cognitions would have to be programmed into a machine *one at a time*, the book's thesis is seen to be an expression of Lucas's Gödelian Argument. Hofstadter's second PhD student, David Chalmers took up the challenge of seeking a theory of conscious creative intelligence, and how it might be constructed.

Chalmers's work proved to be a critical turning point in the history of consciousness studies. Focusing on general requirements for a theory, rather than the theory itself[15], he drew up a closely reasoned list of conditions for any such theory to satisfy. [16] They provide a key to constructing a proper theory, forming the 20th century's defining achievement towards a western science-based theory of consciousness. Without Chalmers's points, little can be appreciated of subsequent details. His papers were published in the Journal of Consciousness Studies, founded by Dr Stuart Hameroff with managing editor, Jonathan Shear.

With Shear's help as reviewer, Chalmers produced excellent papers. [15,16] His first book, The Conscious Mind[17], identifies four criteria for theories of body-mind coupling to satisfy. Most important is the last: A 'Double Aspect Information Theory of Consciousness'. In view of its significance, the academic community contributed a book of responses edited by Jon Shear, Consciousness the Hard Problem[18], with Daniel Dennett as one of the dissemblers. [19]

Between Hofstadter and Chalmers came an attempt by British mathematician, Roger Penrose to prove that no computer however complex, i.e. no Turing machine[20], can emulate human consciousness. His 1989 book, The Emperor's New Mind[21], adopted a new approach, using the halting problem: no computer can determine whether or not it can achieve a final result for a given input. [22] While this added a new angle to the discussion, it did not solve the problem. Penrose's problem was that such ideas lack the lynch-pin needed to hold together a proof. He even explored how quantum physics might help prove the point, invoking the von Neumann – Wigner interpretation of quantum theory[23], 'Consciousness Collapses the Wave-Function'. To this, he devoted a second book[24], Shadows of the Mind. In a discussion at Cambridge, which included Stephen Hawking, the scientific community came down against the book's thesis[25], that consciousness cannot be modelled by a Turing machine.

Penrose's first book contained a twist of great fascination and originality. In the prologue, a little boy is allowed to ask the Emperor's new supercomputer 'Mind' a question; the epilogue reveals it to have been, 'What is it like to be a computer?' This question, originating in Thomas Nagel's much-referenced paper, 'What is it like to be a bat?'[26], is now regarded as a criterion for self-conscious experience. All of us 'know what it is like' to be ourselves. Here, we shall show that the Experience Information approach to mind-body coupling [6,27] offers a theory satisfying Chalmers's requirements that results in a form of mind with properties that no digital computer can emulate. It thus sheds light on Lucas's Gödelian Argument.

COMPLEXITY BIOLOGY AND EXPERIENCE INFORMATION

The Experience Information approach is based on Complexity Biology. [28] Complexity properties in biology result from optimisation of biological regulation. [29] The advantage of optimizing sensitivity of regulatory response is clear, it makes organisms more efficient in use of resources and more adaptable. [30] Sir Paul Nurse, a Nobel laureate and Past President of the Royal Society, has stated[31], "In future, Biology must come to terms with complexity." Complexity is important in the study of consciousness because of its fundamental result: Loci of Control of physiological functions must be at *critical instabilities*. [6] Being in command of thoughts and actions, consciousness must be located at Loci of Control of such functions. [32]

Since Loci of Control are at critical instability, known simply as 'çriticality', consciousness must couple to the body at critical instability. Any 'Double Aspect Information Theory of Consciousness'[16,17] must be the kind of information encoded at critical instabilities. Previously, no one had conceived that any kind of information can be encoded at an instability. Stability is an absolute requirement for encoding all known kinds of information. Every electronic machine depends on its stability as a basis for encoding information[6], any instability would lead to immediate information loss, making the device worthless practically speaking. How then can any kind of information possibly be encoded at critical instabilities?

The above observation makes it clear that, in consciousness, the information that is primarily encoded cannot be digital. Here is a primary result clearly distinguishing mind from machine, a first indication that Lucas[7] was right, and in a way far more fundamental than even he was able to anticipate. Various studies[6,27,32-34] have shown that information encoded at criticality in complex biological systems has a very special two-component structure. Firstly, the ground state, 'the state of least excitation of consciousness', is a perfectly self-observing information loop[32] – it provides a perfect description of the concept of *Atma*, the qualitiless pure self experienced in the state of pure consciousness. Any information encoded must then use any possibilities available in excited states of critical instabilities. As Gregory Bateson put it[35], "the elementary unit of information-is a *difference which makes a difference*." The internal structure of a critical point is a 'catastrophe', a mathematical entity of a kind identified by Fields medallist René Thom[36], the French mathematician. Different critical points control different functions, and can have widely differing catastrophe structures within them. Since all physiological function is ultimately under the control of a highest level of critical point[30], all the differing catastrophe structures are available in that highest level point. When differing catastrophe structures are selected for encoding, their differences allow them to encode different information. In this exceedingly novel way, critical points in biological systems form the basis for a completely new information theory.

Since the foundation is a state of perfect self-observation[6], all such states embody a sense of 'knowing themselves', of having self-knowledge. [6,27] That property used to be the defining property of consciousness, so it permits the self-awareness at the foundation of experience to be attributed to those states. That is why I chose to name this very unusual kind of information that exists at highly complex biological critical points, 'Experience Information'. [6]

And what kind of information can the different varieties of catastrophe encode? On this René Thom was absolutely clear. His book[36] was called, 'Structural Stability and Morphogenesis'. Each catastrophe governs the development of a different kind of structure. A structure that remains topologically the same structure while growing only does so when the structure is stable during the growth process. Growth extending into a new structure only occurs under conditions of *instability*. [36] Instability is thus the key to morphogenesis. Each catastrophe is like the 'seed of a form', which can direct the growth of that form under certain conditions, and can therefore be considered the means to 'encode' such a form. [32]

When we accept that criticality[37] provides an ideal condition for siting 'The Conscious Mind' in the physiology, it becomes clear that the natural class of information in the mind is this novel kind of information, 'Experience Information'. [33] Since this kind of encoding is not within the range of possibilities of a digital machine, it is clear that *Mind is **not** a Machine*. This argument, from criticality in complexity biology, is independent of Lucas's argument[7,8]; it can be taken as a first indication that Lucas's Gödelian Argument points to a valid property of the mind.

DISCUSSION

In complexity biology[28], control of physiological functions and their regulation centre on highly unusual states with equally unusual least excited states, those of system instabilities. [6] The ground states are degenerate, with lowest excitations having effectively zero excitation energy. [34] This means that the entropy cost of information transfer from one such state to another in a separate system will be zero. Being instabilities, they cannot encode Information digitally. [6] Rather, the states contain complex Catastrophes[6], the many choices of which are used to encode a 'language of forms', i.e. Ideas, in ways that should be familiar from study of great minds of East and West, including the Vedic Rishis[38], Plato[39], Descartes[40,41] and Kant. [42] These points led to the main result: the criticality model shows how elementary excitations encode 'forms' at zero energy cost. They can therefore be transmitted between correlated systems at space-like separations.

In more detail, the Vedic science of *Shiksha*[38], the first Vedanga, contains a first level of excitation, *Pashyanti* that encodes ideas. In Plato's Republic[39], Socrates fluently reasons that the mind encodes 'Forms', giving the Platonic Solids as examples. Descartes' early works[40,41] all imply that the mind's concern is with 'Ideas'; Immanuel Kant's Critique of Pure Reason[42] clearly says that the mind encodes 'Wholes'. In contrast, digital information is always in bits, i.e. parts, and cannot encode such wholes. Cognitive psychology further clarifies this in its theory of 'Gestalts'[43], used in many ways, e.g. the Rohrschach test[44], a test of associative thinking.

ACHIEVING LUCAS'S GOAL

These theories have considerable evidence behind them. They clearly demonstrate that there are some things that minds can do, which digital machines will never be able to. Particularly, they can directly transfer ideas from one mind to another at space-like separations. The laws of special relativity combined with those of thermodynamics guarantee that digital machines will never be able to accomplish that feat. [45]

Evidence for the psychic exchange of ideas between minds, not just human minds, is considerable. Here we shall only indicate sources of the evidence. In the author's opinion, the best is that assembled by Rupert Sheldrake and presented in recent editions of his book[46], Dogs that Know When their Owners are Coming Home. His best quantified evidence is that for 'Telephone Telepathy', where a person receives a phone call, and intuitively knows who is calling them before they answer. [47] The best anecdotal evidence in that collection concerned 'Nkosi, an African Gray parrot, with the largest recorded vocabulary of any African Gray, or any parrot for that matter. [46] 'Nkosi regularly called out the names of objects that her mistress was looking at in a picture book, when she was out of sight in another room, spectacular evidence for the transfer of information as visual 'forms' from her mistress's mind to that of 'Nkosi. Similarly, Sheldrake's book, 'The Sense of Being Stared At'[48], tells many stories of how various professions make use of this sensitivity. Its use in the animal kingdom protecting the predated from predators, demonstrates the same point.

Animal communicators[49] work on similar principles; much evidence is contained in their websites. In this context, the story of the Black Panther[50], and how he identified a cub in his previous environment, enquiring after its health, is very poignant, also how his name was changed from Diabolo to Spirit. Along the same lines, Lawrence Anthony's book, The Elephant Whisperer[51], sheds much light on the possibilities in human animal communication. All these examples, combined with the theory of the whole field, point to problems, even errors, in the field of psychic research. First. Communication takes place on the level of the heart – *Pashyanti*[38]; second, what is communicated is neither digital information, nor quantum information, but ideas, which constitute the natural excitations of Experience Information. [34] This immediately reveals the weaknesses in the experimental designs of such pioneering scientists as JB Rhine[52], whose great efforts suffered severe problems in acceptance, and were dismissed. The present theory shows that he would have done better to have used connections between people's hearts as the basis for his experimental designs. Failure to do so was probably the cause of his failing to obtain decisive evidence.

Similarly, Dean Radin's work[53] at the Institute of Noetic Sciences[54] (IONS) is based on a wrong assumption, namely that internal cognitive states of consciousness are quantum states. IONS experiments[53,54] then assume that consciousness naturally couples to external quantum systems, and can be used to bring about telekinesis via quantum interactions. The complexity based theory would rather suggest that atomic physics is not the best environment to seek evidence.

In no way is this paper meant to be a serious review of scientific evidence for telepathy or other psychic phenomena; that will be the topic of a later paper. Here we are only listing classes of available evidence, which should and will be reviewed in detail now that a proper theory is available for discussion and potential refutation[55] in light of such experiments.

SUMMARY

Hofstadter took up the challenge presented by Lucas's Gödelian Argument by focusing on human creativity. He passed on his inspiration to David Chalmers, who in turn identified four key criteria that any physical theory should satisfy. Popularised with the help of Jon Shear, the criteria guided the development of the Experience Information theory of the mind-body connection, the first

properly all-inclusive understanding of experience. Arising out of complexity biology, Experience Information shows how the foundation of awareness is a pure state of self-awareness, onto which a language of 'forms' is superimposed, encoded by Thomian 'catastrophes'. These the intellect habitually employs. The new theory of conscious mind also explains *Direct Transfer of Ideas from Mind to Mind*, the existence of which an abundance of evidence demonstrates. None of these abilities is possible for digital machines. The paper fully justifies Lucas's proposals, going beyond them to establish a new approach.

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APPENDIX: LUCAS'S ASSESSMENT OF HIS OWN WORK

(An edited version of Paragraph 2 of Reference 8 above, my divisions in separate paragraphs)

Godel … found a way round the problem (of metalanguage). He devised a scheme for coding logical and mathematical formulae into numbers, & relations between them into arithmetical relations between, or functions of, numbers. He … thus … circumvented the ban on self-reference, and (found) an arithmetical formula ascrib(ing) an .. arithmetical property to a certain number, which turned out to be a coded expression of that … formula's unprovability from …. Elementary Number Theory. .. He was (thus) able to construct a formula which … says of itself that it is unprovable from Peano's axioms (for arithmetic): but in that case it must be true, for if it were not, it would not be unprovable, and so would be both provable and false. Granted that no false formulae can be proved in Elementary Number Theory, it follows that ***the Godelian formula is both true and unprovable from Peano's axioms***.

I thought I could apply this to the mechanist hypothesis that the human mind (is, or can) … be represented by, a Turing machine. If that were so, I argued, it would be comparable to a formal system, and its output comparable to … theorems, that is to say the provable formulae of a formal system. And since we evidently are able to do elementary arithmetic, the formal system must include Elementary Number Theory, in which case there would be a Godelian formula which could not be proved in the formal system, but which was none the less true, and could be seen to be true by a competent mathematician who understood Godel's proof. Hence no representation of his mind by a Turing machine could be correct, since for any such representation there would be a Godelian formula which the Turing machine could not prove, and so could not produce as true, but which the mathematician could both see, and show, to be true.

This way … competent mathematician{s can) refute the claim that (they are) represent(able) by … Turing machine(s), Since this way (is) available to (them) whatever Turing machine (is held) to represent (them, they can) be confident of not being adequately represented by a Turing machine, and mechanism. ***The thesis that the mind (can) be represented by a Turing machine (is) false as far as (they are) concerned, and therefore false generally*** (my italics).