

The two principles that shape scientific research

Andrew Lohrey  and Bruce Boreham

ABSTRACT

This paper argues that all scientific research is framed by one of two organizing principles that underpin and shape almost every aspect of scientific research as well as nonscientific inquiry. The most commonly employed principle within mainstream science is content determines content. This is a closed, circular principle that is usually unstated within hypotheses but plays a major role in developing methodologies and arriving at conclusions. The second more open principle is context determines content. This principle represents the implied background embedded within hypotheses. The difference between these two principles revolves around the issue of context, with the first principle closing off contexts by ignoring, erasing, or devaluing them, while the second more holistic principle explicitly takes them into account. Each of these research principles has a focus on the explicit detailed nature of 'content' while differing in relation to the source and cause of such content. We argue that the more open and holistic principle of context determines that content is superior in producing reliable evidence, results and conclusions.

ARTICLE HISTORY

Received 14 March 2023

Revised 12 April 2023

Accepted 13 April 2023

KEYWORDS

Atomism; consciousness; content; context; holism; meaning; organization; paradigm; worldviews

Introduction

The two principles, *context determines content* and *content determines content* are at work in the application of all scientific research as well as in the presentation of scientific papers, yet at times there is confusion about the distinction between them. For example, concerning the presentation of scientific papers, G. Spencer-Brown writes that what happens is often 'the very reverse of what the investigator was in fact doing' [1]. Quoting P. B. Medawar, Spencer-Brown suggests that what the investigator in reality does is begin with a hypothesis, which then becomes the medium through which certain obscure, supporting facts are valued. This practice is an example of the principle that *content determines content* – the content of the hypothesis determines the value and type of supporting factual content. Spencer-Brown then suggests that the standard form of presenting a scientific paper gives the impression that such facts first suggested the hypothesis, which is the reverse order to what often actually occurs. More recently Milner [2] has lamented what he sees as an over-emphasis on hypothesis-driven research in the evaluation of applications for research funding. Milner reminds us that Charles Darwin did not start with a hypothesis of Natural Selection, but instead developed this hypothesis from observations of species during his voyage to the Galapagos.

Spencer-Brown goes on to argue that mathematicians reverse this hypothesis-driven process as they 'proceed by experiment, inventing and trying out hypotheses to see if they fit the facts of reasoning and computation'. In other words, according to Spencer-Brown mathematicians are

committed to the better practice of valuing the contexts of experience and experiments, which are always situations of uncertainty, and of testing out possibilities to arrive at a hypothesis that then fits the content of the computation with which the mathematician is presented. While Spencer-Brown, a mathematician gives a vote of confidence to mathematicians, we are less sanguine. We are less optimistic because, in Spencer-Brown's *Laws of Form*, the distinction between context and content is not at all clear. Rather, he suggests that the facts of mathematics should be considered to be the real data of experience, 'for only these appear to be, in the final analysis, inescapable' [1].

However, the facts of mathematics, in all their formations, proofs, and theorems in whatever way they are described, will always have the status of content. Mathematics has the status of content because mathematics constitutes a series of symbolic forms and all symbolic forms and signs, along with technology, data, tools, and discourses represent content. These are all content because they are the secondary effects of human actions. In his book *Relativity*, Einstein gives support for this contention with the example of geometry: 'geometry, however, is not concerned with the relation of ideas involved in it to objects of experience, but only with the logical connection of these ideas among themselves' [3]. Also, in the koans of Zen Buddhism, we find some simple examples of context-determining content: 'Where does the lap go when you stand up?'. These riddles are designed to develop greater awareness of how content is determined by context.

In contrast, within biological science the context for a cell is sometimes suggested to have three overlapping aspects, i) a compositional context; ii) a host context; and iii) an environmental context [4]. A compositional context involves the cell's structure and its internal functions, the host context refers to the host organism, and the environmental context involves such factors as temperature. These three so-called contexts are content as they represent biological discourses that have focused on the problems of designing commercial synthetic systems. This typical mainstream biological 'externalized' approach in which the biologists look out onto an independent world to understand the biology of cells has deleted the human mind from its considerations and, therefore, confuses the context of the human with its content products. This common misunderstanding alerts us to the need to define the character of both content and context.

Content always has a secondary nature and Manuel Morales in his paper 'Who Is Telling The Truth, Nature Or Man' [5] addresses the question that concerns us here, namely the most appropriate framing approach to take for scientific research. Morales' paper is a plea for a better understanding of the terms 'cause' and 'effect', which overlap the terms 'context' and 'content' that we employ. For example, context is always causal (determines) while content always represents the discursive effects of a context. While the distinction between cause and effect is mostly clear, (as it is between context and content), how they are applied in science and every day is often confusing. Morales cites instances when a cause is placed second to its effects. This is the case with Spencer-Brown who suggests that the real data of human experience is mathematics. Such a statement reverses the causal context with the secondary content.

Thus, the human mind that experiences the symbols of mathematics does not represent the formal and abstract content of mathematics, which is the derivative effect of the human mind, which in turn represents the context in which mathematics occurs. In a recently published paper, Morales uses the term 'domain causation' [6] to emphasize the difference between cause and effect. We use this phrase here in relation to context and content and as a consequence, the term 'context' relates directly to the domains of the human mind, to the mind of the mathematician, to the mind of the investigator, to the mind of the researcher and the individual. Human minds are the inescapable causal contexts in which the content of all technology, data, discourse, mathematics, and symbols of science, or those concerning everyday have arisen, have become experienced, and expressed as content. *It is the inescapable domain of the human mind that is always the context for all and every scientific research undertaking.*

Here then is the beginning of the architecture of these two framing principles that involve the issues of cause and effect, and the human mind. However, there is yet the issue of scope related to the causal contexts of the human mind that develops in the work of Henri Bortoft (1938–2012) [7]. Bortoft worked for a time in the 1980s with David Bohm and focussed on the relationship between the whole and the part to understand the world in a more interdisciplinary and holistic manner. Bortoft proposed that to understand the whole we must understand the parts, but to do that we must also understand the whole. As this seems to be a paradox, he suggested that to go beyond the paradox we must distinguish between the parts that are observed and the mind context that carries out the observation. In this manner, we not only begin to take appearances seriously but begin to recognize how parts always belong to and fit within the context of the whole mind.

Thus, there are several pairs of terms that overlap and come together at this point. These are: a context is causal, and it is holistic. On the other hand, content always represents the manifest and explicit effects and products of human endeavor. The question then arises, how does the human mind relate to the concept of the whole? To answer that is to change worldviews from mainstream atomism to the newer worldview of wholeness and with that change, many features will be redefined. For example, within the context of wholeness, the human mind becomes an embedded subdivision within the whole infinite field of consciousness. In our 2022 paper, we called this singularity Omni-local consciousness and in our 2020 paper suggested its essential implicit character was nonlocal [8] while its secondary character was local, which for humans is the local human mind. In other words, Omni-local consciousness represents an infinite field of relations that are not everywhere the same but have a predetermined structure that is simultaneously nonlocal and local, that is implicit and explicit. (The difference between these terms becomes clearer when meaning is included in this analysis).

Further, we suggested that the singularity of wholeness is constructed by an infinite domain of relationships. Hence, the anchor points of any study or inquiry framed by the singularity of wholeness will not be found in explicit material, formal, or biological objects, or abstract mathematical forms. Rather, the focal anchor points of any analysis will always be relationships, which we have argued are always the relations of meaning. This means that any scientific statement that does not include a conscious reflection on the relations of meaning and the organization within worldviews will be a statement that has ignored context, that is, it will be applying the principle: *content determines content.*

One of the immediate effects of changing worldviews is that any scientific analysis based upon the singularity of wholeness will erase the separating effects of binary, either/or modes of thinking and communication. For example, concerning the human mind from the context of wholeness, there is no subjective/objective divide and no internal world versus an external world. While these divisions have tended to be habitually promoted by mainstream scientific disciplines, they are nothing other than conventional ways of thinking, in other words, socially constructed mores that are observed within the culture of science. Therefore, such divisions can be modified and let go because even hardened mores have foundations of plasticity that come from the possibilities of re-learning new meanings.

The interconnecting force of wholeness transforms the binary meanings of either/or thinking, and as a result, the language of objectivity and subjectivity will change into a vocabulary that speaks about local and nonlocal meaning and consciousness. From the worldview of wholeness, the human mind is not the domain of private subjectivity but is located within the whole, infinite system of interconnecting relationships so that it is understood to be a local subdomain of Omni consciousness. Therefore, whenever we use the designation 'the human mind' in this paper it will always carry the implied meaning that it represents, not an isolated private entity but a local subdomain of Omni consciousness. Thus, the worldviews by which we choose to frame our understanding of reality represent the contexts for our communication. This is because worldviews have their implicit foundations within Omni consciousness. In terms of the language of 'objectivity', within the wholeness worldview, this term transforms from an illusionary viewpoint into the impersonal structured relationships of meaning (soon to be explored). It is these kinds of transformations that the singularity of wholeness brings to any analyses and which are significant for the development of biology as well as for the rest of science.

However, the difficulty with employing the wholeness worldview is that it is out of favor with mainstream science for two reasons. The first is the general tendency of mainstream science to exclude the human mind in favor of anchoring any analysis or experiment in the physical world. The second reason is the associated tendency to reduce the context of the human mind to the inferior side of the binary pair of objectivity versus subjectivity. When the human mind appears as 'subjectivity' it ceases to be a causal context and instead becomes some incidental and private content in an atomistic view that has an anchored focus within the physical world, such as the biological example

referred to above. Both these tendencies represent general features of an atomistic worldview in which explicit differences are habitually over-valued, so they result in separations and gaps in the fabric of the world. Such thinking has framed scientific research for most of the twentieth century, and has tended to produce a reliance upon the unqualified principle of *content determines content*. This was also the situation Spencer-Brown refers to concerning what an investigator does by beginning with a hypothesis and then looking for arguments and facts to support it.

The mainstream worldview of atomism assumes a non-participatory role in that the scientist's mind is located in a separate space from the subject matter of his study. This nonparticipating stance comes with the foundation belief that there is a gap or separation between the inner world of the scientist and the outer world of his biological subject matter. This approach presents inbuilt difficulties for the study of cell-to-cell communication. The situation is entirely different when a biological analysis of cell-to-cell communication is framed by the singularity of wholeness for then there is no inner/outer gap or separation between the mind of the scientist and the mind of the cell. Rather, such a view presents an infinite system of interconnecting relationships that provide meaning and communication to the cell as well as the scientist. While these meaningful communications of cell-to-cell and scientist-to-scientist will be different from each other, nevertheless both represent communication exchanges within the context of a participating worldview, a world in which biologists and cells share and exchange the same structures of meaning.

Like the athletic high-jumper who puts lead weights in their shoes, the biologist who attempts to investigate cell-to-cell communication by using the common terms of 'signals', 'messages', and 'information' their attempts will be severely handicapped. This is because these terms are employed to reinforce an atomistic, binary either/or world. This worldview assumes that cells along with signals, messages, and information are external, mechanical operations 'out there'. In addition, when used within the context of atomism these terms become reifications, that is, stand-alone linguistic entities lacking internal representational relations. In other words, they are no longer linguistic maps of a biological territory because they have been transformed from maps into the territory. In contrast, an analysis framed by the context of wholeness begins by understanding that communication is not the exchange of information, but rather an exchange of meaning and as such applies to both cell-to-cell and scientist-to-scientist communication. We suggest that such a definition of

communication presents the biologist with a new and fertile ground to begin resolving the difficult problems of cell-to-cell communication. This will be because the structure and function of meaning provide a learning model and organizational templates for every life form.

Returning to our definition of context and content, the causal nature of context is also not an either/or situation. Rather, this relationship represents a continuum in the sense that while contexts determine content, content can also have an ongoing influence and effects on other content. For example, the content of a mathematical formula will influence the content of related computations, or again, the initial conditions of iterative computer programs will lead to the shape and style of chaos images. This means that just because a billiard ball that hits other balls creates a scattering effect, this does not justify us to dismiss the overriding causality inherent within the context of the mind of the player who begins the process. Thus, the primary causal context represents the implicit wholeness of the Omni-local consciousness while the results of our communications represent the derivative expressions of artifacts, language and technologies. (It should be noted that this statement implies that every local mind has the same meaningful foundations grounded within the implicitness of Omni consciousness).

Bortoft has suggested we should try to understand the whole in terms of a holistic and integrated worldview. One pathway for doing that is to link David Bohm's notion of wholeness, ('an order of undivided wholeness') as described in *Wholeness and the Implicate Order* [9], to the context of Omni-local consciousness and then to strictly apply the principal *context determines content*. Wholeness has an arithmetic character in that its singular interconnected, undivided context is one. The singular character of the numeral One contains no explicit content, but its undivided wholeness does contain the implicit potentials of all other numbers. The same transformational characteristics apply to Omni consciousness for within this primary domain there is no explicit content, but this context does contain the potential for every kind of explicit content and that includes the contents of space and time.

An appreciation of the singular character of Omni consciousness is to recognize its dynamic, flowing nature. Bohm points to the dynamic nature of wholeness with the term 'the holomovement', by which he meant an interconnected flowing wholeness [10] In supporting that view, de Grosseon & Hiley [11] have stated that like the quantum vacuum, the holomovement 'is fundamental and gives rise to all physical phenomena. Objects such as particles, fields, and even space-time itself are to be abstracted from this underlying activity'.

These authors go on to describe the secondary and partial nature of material objects in the following manner: 'Things emerge as quasi-local, semi-autonomous invariant features of this flow. Without this flow, they cannot exist' [11]. Hence, the wholeness system of Omni-local consciousness does not represent a static state but has the character of a dynamic flowing life force that is the primary determining agent within every micro or macro-object and form.

As a summary, the term 'context', as applied here so far, has the following features: i) it is the primary causal domain; ii) it represents a universal, implicit wholeness; iii) it has the flowing dynamics of life; iv) it can be called Omni consciousness; and v) it represents the foundation in which every scientist lives, breathes and works, that is, this wholeness situates local scientists as context at the center of their work. However, the cultural difficulty with this view comes from mainstream cultural interpretations. Local human minds organize themselves based on learned habits involving an amalgamation of collective predispositions. Such cultural predispositions tend to be produced from patterns of identification involving interlocking assumptions that usually have a tacit, hidden, and implicit nature.

Sometimes these background assumptions are called paradigms but here we call them worldviews. The importance of such contextual predispositions for science is that they represent an inescapable tacit, communal agreement by which a scientific community collaborates in its investigations. Such predetermined background framing of the world creates a particular view of reality and represents the hidden architecture that shapes a scientist's actions and dictates what is hypothesized, observed, and measured, as well as how results are interpreted, what research is carried out, what is the appropriate equipment for experiments, what and how theories are developed and, finally, which of the two principles are applied.

Paradigms

The man who developed the concept of the scientific paradigm to the philosophy of science was Thomas Kuhn in his *The Structure of the Scientific Revolution* [12]. Kuhn's view of a paradigm was somewhat ambiguous in that at times he implies that a paradigm has the status of a scientific theory that is supported by experimental evidence. After his book was published Kuhn was accused by some scientists of making science akin to a subjective and irrational enterprise, mainly because he proposed periodic intellectual revolutions in science, and this was considered to be a too radical proposition. In a Postscript to the 1970 second edition, he attempts

to clarify his view of a paradigm: ‘On the one hand, it stands for the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community. On the other hand, it denotes one sort of element in that constellation’ [11]p, 175]. The distinction between a constellation and one element of the constellation was never satisfactorily resolved.

Later in his Postscript Kuhn suggested that a paradigm was a ‘disciplinary matrix’, a network of norms, values, and rules common to the practitioners of a particular discipline. He went on to describe a disciplinary matrix as involving generalizations, beliefs and values, and a group’s shared commitment to the matrix. This description of a disciplinary matrix appears closer to the set of predispositions that we refer to above while the term ‘paradigm’ tends to be somewhat more limited and has sometimes been used in ways that simply classify certain philosophical theories such as positivism, interpretivism, or realism. The ambiguity inherent in the use of the term ‘paradigm’ arises out of its lack of distinction between the content of theory on the one hand and something more contextual and experiential, such as that which is implied by a disciplinary matrix.

One way to resolve this confusion over what constitutes a paradigm is to take into account the two principles referred to above. This approach bypasses the issue of a theory versus a disciplinary matrix and at the same time, it enables us to take a broader interdisciplinary look at the contextual lens through which we apprehend the reality of the world. Hence, instead of the term ‘paradigm’ we prefer to use the holistic term ‘worldview’. Worldviews have a cross-disciplinary architecture that is built from a set of general and collective predispositions that are not tied to one discipline, and which in turn produce the kinds of interdisciplinary practices associated with the two research principles already referred to.

Worldviews certainly do not guarantee unbiased truth, quite the reverse. Worldviews differ not about how ‘objective’ they are but in terms of how open or closed they are. The worldview of atomism (often called local realism or reductive materialism) is much more closed than the interdisciplinary worldview of wholeness. For those scientists who are guided by the worldview of atomism their research will tend to be ordered by the circular principle of *content determines content*. Here are a few examples of atomism at work:

- (I) The first law of Aristotelian logic essentially declares identity as nothing but $A = A$. This formula represents the horizontal closure of

content in which the first ‘A’ determines the content of the second ‘A’. Both ‘A’s are symbolic, and both have the status of content. Such logic has historically been called rational.

- (II) The initial conditions for all computer programming begin with the content: 0/1. The symbols, 0/1 represent explicit content that then determines all the other explicit content of computer programming, along with what has been called artificial intelligence. This is also the case for text produced by ChatGPT, an AI language model that generates human-like text based on the inputs to which it has access.
- (III) John Archibald Wheeler (1911–2008) thought that information played a fundamental role in the universe and expressed this in his famous phrase, It from Bit. He thought that every particle, field force, and the spacetime continuum itself derives its function, meaning, and existence from, ‘the apparatus-elicited answers to yes or no questions, binary choices, bits’ [13]. Whether we agree with him, or the Claude E. Shannon mathematical brand of information, or Bohm and Hiley’s ‘active information’, the problems that the term ‘information’ imposes on us are the same as all reified terms and that is, they are the superficial, context-free entity that does not imply relations with human minds. A universe based upon ‘information’ is atomistic and fragmented one where the relations of meaning, mind, and consciousness are excluded.
- (IV) P.J. Stewart has written about the shrinking of the academic subject of ecology [14] What looked like an expanded view of the world in the 1960s and 1970s has shrunk into specializations because of the failure to include human behavior in its subject matter. Stewart writes, ‘By failing to address human culture and mentality, ecologists had renounced the study of most of the activity of the dominant organism on the planet’. This is the classic reductive effect of specialization driven by atomism. The interdisciplinary research of ecology is thus reduced in breadth and depth by excluding the human mind and by a forensic and exclusive focus on local explicit details, which then become the currency of highly acclaimed specializations. With this worldview, we produce large amounts of details but have trouble with their broader meaning, organization, and relevancy.

Meaning

To appreciate the depth and significance of all contexts and content it is necessary to discuss in some detail how meaning structures these two organizing principles.

The singular domain of Omni-local consciousness has three levels: the unseen, the seen, and the thought/expressed. Meaning's structure provides the architecture of these three domains. The first domain of consciousness – the unseen – represents the primary causal context or Host of the universe. The second subdomain of – the seen – represents the secondary context of the consciousness involving sense perceptions. The next subdomain of thought/expressed represents the third level of consciousness. Hence, in terms of causality, the primary domain of the unseen represents the primary causal source of everything; the subdomains of the seen represent a secondary causal domain; and the third level of consciousness, which is the subdomain of thought/expressed represents the derivative causality of the human mind.

The derivative level of the human mind possesses three organizing functions in the form of predispositions that make up three worldviews. The predispositions of these worldviews are formed by various cultural values that are generated from particular emphases being placed on meaning's differential structure. Each worldview in turn represents the context that produces different kinds of communication content. The three worldviews are the private self, atomism, and wholeness. Hence, the first and second domains of consciousness (the unseen and the seen) have organizing flows that function prior to any expression, while the three contexts of the three worldviews become manifest through their expressions. In this sense, the three worldview contexts of the human mind represent the implicit organizing potentials for all explicit, expressions, meanings, and communication.

The three levels of Omni-local consciousness are entirely integrated even though each has a different function. The integrated differences between these three domains are best understood through an appreciation of the structure and function of meaning. It is not necessary to repeat our theory of meaning here except to say that David Bohm's research and discussions of meaning have greatly influenced our understanding and analysis. In his book, *Unfolding Meaning: A Weekend of Dialogue with David Bohm* [15] Bohm connects meaning to cosmic and local consciousness, and that interconnection we have called Omni-local consciousness [8]. Amongst his many comments and statements on meaning Bohm maintains, 'We can say

that human meanings contribute to the cosmos, but we can also say that the cosmos may be ordered according to a kind of 'objective' meaning' [16]. And again, 'I think conscious awareness, its essential feature, is meaning.' ... 'The activity of consciousness is determined by meaning' [15]p. 102]. We have interpreted Bohm's many statements on meaning to imply that the *content* of consciousness in its local and nonlocal (cosmic) forms is always that of meaning.

In this respect, meaning represents the content of consciousness at each of the three levels of Omni-local consciousness and also for the contexts of the three worldviews. In addition, meaning's structures and functions (its content) represents the initial conditions of all content, no matter the communication form. Meaning is, therefore, entirely interdisciplinary in its scope for it represents the preconditions of all communications and that includes the communications of mathematics, the science of quantum physics, and mainstream mechanics, as well as the development of our birth, our body, our senses, our longings, and desires. Thus, for the wholeness of Omni-local consciousness, there is no independent and separate 'objective' physical universe devoid of the structures and functions of meaning and that also means, devoid of consciousness. Rather, there flows within every detail, feature, point, and form in the universe the life force of consciousness.

The life force of Omni-local consciousness is structured by a dynamic and complex flowing exchange between implicit and explicit meaning. These two conditions of meaning are the basis of Bohm's implicate and explicate orders. As these two conditions are dynamic rather than static there are four exchange combinations, which grow to five when their developmental aspect is taken into account. The fifth transformation comes about because the relations of meaning are also reflexive rather than linear, and hence these exchange patterns begin with the process of unfolding, then existing in that unfolded state for a time, and then enfold back into the unity of implicit-to-implicit meaning [8]. These five combinations are:

We use the term 'reflexivity' to mean self-referral. It can be applied as a conscious self-reflection or more broadly as it is used here, as an inherent self-referencing feature of any system or formation. In this latter use, it is a common feature of all meaning

| | | |
|---|---|-------------------------------------|
| 1 | implicit-to-implicit | - unseen |
| 2 | implicit-to-explicit | - seen |
| 3 | explicit-to-explicit - thought/ expression | - explicit - thought/ expression |
| 4 | explicit-to-implicit | - thought/expression |
| 5 | implicit-to-implicit | - unseen |

exchanges. In her book *Reflexivity*, Hilary Lawson positions self-referral as a function of language [17] while Arthur Young in his book, *The Reflexive Universe* argued that the universe itself is self-reflexive [18]. Reflexivity represents an inbuilt function of implicit meaning in that implicit relationships always imply a movement into more implicit relationships. As a consequence, reflexivity is an integral feature of Omni-local consciousness as well as of culture, society, communication, and the two principles of research we are discussing.

The three levels of consciousness – the unseen, the seen, and thought/expressed - (1, 2, 3, 4, and 5) provide the multi-leveled vertical hierarchy of the whole singularity of Omni-local consciousness. This vertical structure has an inbuilt hierarchy that can be seen reflected in de Grosseon & Hiley's [11] descriptions of Bohm's holomovement: the holomovement 'is fundamental and gives rise to all physical phenomena. Objects such as particles, fields, and even space-time itself are to be abstracted from this underlying activity'. This vertical hierarchy arises from the unseen source of Omni consciousness (1, and 5), which has a flowing wave-like wholeness that comes from continuous implicit-to-implicit exchanges that extend infinitely everywhere in the universe.

This primary Omni domain of consciousness has the character of symmetry because implicit-to-implicit exchanges represent a content description of symmetry. These exchanges are also nonlocal in that they are everywhere simultaneously interconnected. The space within Omni consciousness can be described as a pre-space (to use Bohm's term), that is, a space prior to the three dimensions of perceptual space. The infinity of pre-space is not empty, like a vacuum, but is filled with the life force of inter-exchanging, implicit, and hidden relationships. Such relations contain no divisions, distinctions, separations, or explicit meaning. Hence within this first infinite level of consciousness, the measurements and differences of spacetime do not exist, and as a consequence, it has an eternal pre-space quality.

The Omni domain of Omni-local consciousness has similarities with the meaning of emptiness rendered by the Buddhist Heart Sutra. However, it is only empty of explicit distinctions and differences but full of flowing implicit exchanges of meaning and memory. These flowing exchanges can be called mnemonic resonance. In a private correspondence to one of the authors (August 17, 2022) the biologist Rupert Sheldrake wrote, 'What you call mnemonic resonance is of course very similar to what I call morphic resonance, and Bohm and I explore this connection in a dialogue that is reprinted as an Appendix in my book *A New Science*

of Life (called *Morphic Resonance* in the US). This is, I believe, the first time he dealt with these implicit-explicit interrelations that you discuss in your paper'.

The reverberating implicit potentials within the domain of Omni consciousness are many, but here we focus on two special predetermined causes that are particularly relevant to the second subdomain of consciousness – the seen. The first of these relates to the creation of forms that Sheldrake has famously suggested arise from reverberating morphic fields. He describes such reverberations as having a morphic resonance that has a form-forming character. Among other examples, Sheldrake cites the development of crystals that are 'shaped by morphogenetic fields with an inherent memory of previous crystals of the same kind'. Form creation follows 'habits established through repetition' that produce a process of 'like upon like through space and time' [19]p. 89]. It's worth noting here that the phrase, 'implicit-to-implicit exchanges' is similar to Sheldrake's phrase of 'like upon like' in relation to memory. We would suggest that meaning potentials contain memory potentials, and their implicit reverberations at the level of the unseen determine the creation of forms across space and time within the second and third domains of consciousness – the seen and the thought/expressed.

The second set of predetermined causes associated with the unseen level of Omni consciousness is the light and intelligence of awareness. This is the awareness that local minds experience through the second level of consciousness in visual and other forms of perception, and also in thought, that is, the awareness of sight within the five senses, as well as the sight within insight. Awareness is the essential ingredient for the forms of the physical world to be born and to be registered as perceptual images. This is to argue that the mnemonic resonance within Omni consciousness is creative in that it produces both physical forms and their perceptual (seen) images. Hence, both physical forms and their images represent the explicit and derivative, yet manifest results of the unseen causality of Omni consciousness. This is saying no more than that forms and their images, along with the entire explicit manifest universe, represents Bohm's explicate order.

Perception

The second level of Omni-local consciousness – the seen – represents the three-dimensional spatial location in which all physical forms arise and move. In the worldview of atomism meaning, mind, and consciousness are mostly ignored in the consideration that the physical world of objects is primary and separate from what is thought of as the human mind. This fragmented belief is in direct opposition to the wholeness proposal

we make here, which is that physical forms and their registration within sense perception occur simultaneously within this second domain of Omni-local consciousness. One example of the confusion that can arise from atomism is the question of the stand-alone status of physical objects such as particles:

v) What is a particle? Within the atomistic worldview, the Standard Model of quantum physics assumes that a particle represents a minute portion of matter. Yet from within this worldview, other questions have arisen: is a particle a cloud that carries waves? do particles have bits? or again, is a particle just the mathematical abstract point singularity? Such questions and suggestions view particles as having the differential meaning of some small explicit something physical. Such interpretations are unsupported by any underlying mechanism that can explain the particle's existence or its functions. In other words, there is no background context able to be called upon that can explain the cause of the particle's existence or locate precisely in what context particles exist – out there, or in here. The puzzle of what is a particle comes directly from the Standard Model of Science that employs the principle of *content determines content*. This approach automatically excludes the context of Bohm's implicate order along with his holomovement, as well as the primary determining implicit causality within the domain of the unseen and the second domain of the seen.

The atomist's worldview has already predetermined that physical objects are primary. This predisposition is based upon little or no empirical evidence. Yet not all scientists agree with that view. For example, Erwin Schrödinger wrote, 'The world is given to me only once, not one existing and one perceived. Subject and object are only one. The barrier between them cannot be said to have broken down as a result of recent experience in the physical sciences, for this barrier does not exist' [20]. As we see from this quotation, Schrödinger calls on the empirical evidence of his own experience to disagree with the dualism of the atomist's worldview. We agree with Schrödinger's position, but there is a need to go further and ask what is the template mechanism for the unity of physical form and perceptual image. While that unity must come directly from the unifying source of Omni consciousness, what is the mechanism?

The unifying organization begins with the Omni domain of the unseen (Bohm's implicate order) which produces by unfolding Bohm's explicate order. The foundation structures of the human mind (and the physical universe) will always be those of the implicit meaning of Omni consciousness. This means

that the universe represents an infinite contextual field that is wholly interconnected by implicit-to-implicit relations of meaning. The worldview that awards primacy to infinite, implicit meaning over secondary, unfolded explicit distinctions differences and forms are exactly the order Bohm assumed to be operating within his implicate and explicate orders of the universe. We have already argued [8] for the extension of Bohm's implicate order so that it represents the universe-wide context of Omni consciousness from which every explicit object, form, distinction, difference, and image arises.

As a consequence of this extension, the explicate order of particles as well as the macro world of objects are constructed from the distinctions and differences (non and asymmetrical relationships) of meaning. This means that the prior causal mechanism that has created particles as well as macro-objects, together with their images and descriptions cannot then be ignored or compressed into a stand-alone physical reality. In addition, the meanings of differences and distinctions are unable to be separated from objects or images, for where there is a form there is automatically a set of distinctions and differences. For example, the visual images of perception are constructed from a synthesis of the distinctions of movement, shape, light intensities, colors, and the three dimensions of perceptual space.

All these explicit distinctions and differences along with those three dimensions of perceptual space arise through an unfolding from and have been determined by, the unseen contextual wholeness of Omni consciousness. Forms are never simply isolated or elementary self-created entities, and neither is space a place without a predetermined formative context. This means that explicit forms as well as space cannot represent the initial conditions of the universe. Rather, all explicit forms (objects and images) along with the three dimensions of space will always have a local and novel orientation arising as they do within the context of a local mind's perceptual processes.

The predetermined, self-perpetuating transformational mechanism within Omni-local consciousness means that particles along with macro-objects do not cease to exist when we close our eyes. These domain transformations within Omni-local consciousness continue whether our eyes are open or not, in other words, this background mechanism is not reliant on an individual closing her or his eyes. What does not cease to operate the moment we stop looking at the environment are the domain transformations (unfolding) of meaning that have already created the many features of the explicit environment.

Hence, physical objects and their perceptual images represent symmetrical twin features of the second domain of consciousness, that is, of Bohm's explicate order. In other words, in the absence of the second domain of Omni-local consciousness, that is, in the absence of the processes of sense perception the explicit world of space and moving forms would not exist for the individual. However, it should be noted that the supposed separation of objects from their perceptual images is impossible to empirically demonstrated locally for any individual. This inability affects every individual and it rests on the clear empirical fact that the core of all empirical evidence comes from acts of sense perception. Hence, concerning the seen, the general principle here is that the world arises for us when we perceive it. As Omni-local consciousness provides the principal context for all content, this principle becomes a general and absolute tenet.

Differences between physical forms and their perceptual images have indeed been argued for, but such rationality occurs within an atomistic worldview in the thought/expressed subdomain of mind. Such an argument normally describes the long history of the universe that contrasts with the shorter history of humankind. This kind of 'proof' is produced by an atomistic narrative and does not address the significant difference between the domain of the seen and the subdomain of thought/expressed. This lack usually means that the contextual experiences of sense perceptions are simply ignored. In addition, such proof comes from the research principle that assumes content determines content – the content of the narrative history determines the content of their separating differences. However, if there were actual and manifest separating differences between physical objects and their perceptual images, such differences would have to register contextually, and as a result, there would be a direct experience of this that every researcher could have within their sense perceptions.

Kuhn draws our attention to the tradition in science that regards perceptions as an interpretive process [12] p, 195]. This misunderstanding derives from a lack of distinction between the processes of perception and those of conception, that is, between the second and third domains of consciousness. Kuhn disagrees with the traditional misunderstandings and so do we. Along with Kuhn we hold that interpretation, which is all about thought and expression, begins where perceptions end [12]p, 198]. Kuhn writes that 'what perception leaves for interpretation to complete depends on the nature and amount of prior experience and training'. We agree for the essential features of any 'prior experience and training' usually concern an education

and training in the content of rules, theories, practices, and conceptual, instrumental, and methodological networks used by scientists.

While Kuhn does not describe in any detail the distinction between conceptual interpretations and sense perceptions his discussion does assert that demarcation. We agree with this delineation as the holistic worldview discerns an integrated difference between the seen and the thought/expressed. We suggest that interpretations express *content*, while sense perceptions and, in particular, visual perceptions represent situational *contexts*. Sense perceptions are always contextual because they provide us with an orientation to new and/or novel situational contexts. The situational contexts that are most relevant to modern science are those involving observations and experiments.

The processes of perception operate implicitly or, in terms of biology, within the body's autonomic system. As such they are beyond the conscious choice or control as individuals. Within the overall architecture of consciousness, perceptions represent the halfway stage between the infinite domain of nonlocal Omni consciousness on the one hand, and the local, individual's thoughts and expressions on the other. This halfway station of sense perceptions combines local and novel features, yet at the same time the domain operates beyond the individual's control [21]. The innate and healthy processes of sense perceptions come to us without being asked, and in visual perception, they come in the form of a series of moving forms across a three-dimensional space that includes a variety of light intensities and colors. As these events happen beyond our decision-making, we can therefore conclude that perceptions are not constructed by any content such as our discourses, interpretations, texts or computations, or even interpretations.

To conclude these comments on the second domain of consciousness: from the holistic worldview the first law of forms is not the distinction that Spencer-Brown suggests, ('We take as given the idea of distinction' [1] p, 1]). Rather, the background source from which all forms arise is the implicit primary domain of Omni consciousness, while the second law of forms will involve the seen: the perception of forms by local minds. Both processes are created by the primary background context of Omni consciousness. The third law of forms would then represent the conceptual level of the human mind, and what Spencer-Brown writes about as ideas: 'We take as given the idea of distinction'. The general point to be made here is that whenever scientific research is undertaken using the traditional atomistic worldview, then meaning, mind, and consciousness will tend to be deleted, devalued, or

erased altogether, and, as a consequence, such research will proceed under the framing principle of *content determines content*.

Thought/Expression

The third domain of Omni-local consciousness involves the processes of thought and their communication, which come in the form of content that is symbolic, textual, artistic, or technological and which can involve measurements, calculations, analyses, interpretations, narratives, artifacts, reports, and verbal discourses.

It is worth noting that within the vertical architecture of Omni-local consciousness, there are important meaning exchanges that have an asymmetrical order. This order proceeds from the primary flowing context of implicit-to-implicit exchanges through an unfolding involving implicit-to-explicit exchanges into the secondary domain of consciousness that produces the symmetry of space and moving forms and then to the third subdomain involving thought and expression. This third subdomain has a three-part horizontal structure and a set of organizing functions that emanate from the same transformations of meaning that operate vertically. Those relationships can be seen in the table below. Within this subdomain, the three horizontal meaning exchanges produce a range of dispositions, which in turn produce their respective worldviews. The following table indicates the three-part horizontal structure of thought, disposition, and worldview (in bold):

As can be seen, under the heading of ‘Meaning’ there is a five-part vertical structure that represents the key transformations of Omni-local consciousness, over which the local individual mind has no control. These five levels represent the levels that make up the vertical axis of causation of Omni-local consciousness, that is, the wholeness of context. In contrast, the dispositions that result in worldviews represent the horizontal structure of the local human mind. The three horizontal domains of the local mind are also learning dispositions that progress through the processes of identification to differentiation and then to integration. These three horizontal formations change and evolve in the same order as the vertical

axis, that is, by beginning and ending with implicit-to-implicit exchanges. The many implications of these evolving developments can only be touched on in this paper.

While the structure of the vertical axis of Omni-local consciousness is beyond the control of human minds, our local minds do have some choices regarding the learning changes that can occur within the horizontal formations of the mind. Such local control involves choosing to acknowledge and be open to the natural order and flow of these learning steps or deciding to resist this evolution by closing off to its inherent flow. Within science, the most common method of closing off this evolution of learning is to follow the principle that content determines content. In general, local minds can choose how much attention and communication is given to the creation, maintenance, and evolving changes related to the dispositions of identification, differentiation, or integration. In this regard, these three formations develop into syndromes of dispositions or worldviews that then become the contexts for all communication content.

Each of these three learning dispositions is common to every local mind and they are directly related to various situational contexts of the individual such as family, community, language, and culture. However, the overall weight and value that an adult gives to any one of these dispositions will create that individual’s worldview. The weight that is given to each of these learning dispositions may come from the identification patterns created by early childhood training or traumas. Alternatively, that weight may be formed from family predispositions about social or class inequalities and differences, and supported by most tertiary educational institutions which pursue specialization through an atomizing worldview. Finally, the individual who gives weight to integration will tend to be open to life-long learning and have a tendency to value compassion and reflexivity in the form of self-reflection. In terms of scientific research, the worldview of integration awards the central and key role of the human mind and its foundation within Omni consciousness in every aspect of science, from cosmology to physics, biology, and mathematics.

Hence, each of these three learning dispositions creates the three worldviews of the private self, atomism, and holism. There are no worldviews that arise from the implicit-to-implicit transformations of Omni consciousness because this is the causal source and primary domain where there are no explicit exchanges involving content or learning dispositions. Because meaning always implies other meanings, the entire five-level architecture of Omni-local consciousness functions reflexively. At this third subdomain of consciousness,

| Meaning | Disposition | Worldview |
|-----------------------------|------------------------|---------------------|
| Implicit-to-implicit | Omni | ----- |
| implicit-to-explicit | identification | private self |
| explicit-to-explicit | differentiation | atomism |
| explicit-to-implicit | integration | holism |
| implicit-to-implicit | Omni | ----- |

how reflexivity operates will be different with each learning disposition and consequently, for each worldview.

For example, the worldview of the private self comes with the kind of reflexivity that will be closed and centripetal, and which continually reinforces a sense of internal private identity or self. In his book, *On Dialogue*, Bohm suggests that we all tend to look ‘through our assumptions’ about the world [22]p. 79]. This is the case for each worldview. However, for the worldview of the private self, our identifications about the personal self severely restrict the world that is seen. In contrast, the worldview of atomism gives priority to a ‘real’ physical world that has been created by our predetermined assumptions about the necessity for separations and gaps in the universe. This view arises from the tendency to over-value explicit differences which makes them into separations and gaps. Over-valuing of differences occurs when we fail to locate content within its contexts of consciousness. Such over-valuing comes from dissociated cultural training that has a strong focus on explicit-to-explicit differentiations and a disinterest in language and culture. If we describe the world of the private self to be one of chaotic entanglement, then the world of atomism is one of fragmented disentanglement – fragmented because it denies context.

The subject matter of this paper has a major focus on the last two contexts of atomism and holism as these are the only worldviews that are open enough to the transformations of learning to represent a workable background framing for scientific research. The learning disposition of identification and the chaotic entanglements it produces simply tends to restrict learning ability to an almost exclusive small private world. Among the great variety of behavior that this worldview generates there is often a lack of interest in scientific research, and at times individuals can be actively anti-science, as is the case with the behavior of bigotry, racism, denial, and various forms of fundamentalism, each of which has a complex foundation within entangled layers of identification processes.

The worldview of atomism tends to declare a real but dead physical universe of parts and fragments along with a radical separation between the parts. The entrenched sightlines of this worldview tend to restrict perspective to content. These tendencies for separation and fragmentation have traditionally been employed by mainstream mechanical science and are often categorized as reductive materialism, and in some discussions may be labeled as local realism or pluralism. This kind of scientific research comes from the deletion of the central contextual role of the human mind as the local

feature of Omni consciousness. This principle is displayed most prominently within mainstream science as the assumption that dead matter of the universe has causality, rather than being the effect of Omni-local consciousness.

Communication

The predispositions that create our assumptions and mold our thought processes represent the pre-conditions of our communication. In other words, they are the organizing contexts of the local human mind and while all communications involve implicit and explicit meanings, the content of these exchanges will differ concerning our dominant worldview. As all content represents the results of human communication, the kind of content we exchange is determined by the habitual predispositions of the worldview we have privileged and mostly rely upon. The three-general worldviews (private self, atomism, and holism) are determined by a learned reliance on the dispositions of identification, differentiation, and integration, so also are there three general types of communication that reflect these three worldviews.

The communication model that reflects the worldview of a private self tends to identify the content of communication with the notions of self-interest and identity. In social exchanges, this can result in the habit of monologues or, with disagreements, a tendency to see them as criticisms of the self, rather than differences of viewpoint. Communications that are framed by the habits of identification tend toward literal, dogmatic, closed expressions that are assumed to have a single meaning (reification). The single meaning is characterized by an identification of the map of language with the territory it represents, hence, the phrase ‘the physical universe’ is a reality that is not considered to have a linguistic dimension.

The English poet and engraver, William Blake (1757–1827) called this kind of communication, ‘the sleep of the single vision’. In science, this form of communication is manifest through axiomatic, clear, and precise statements. In law, it manifests as an over-emphasis on legal precedent. In religion, it is expressed in discourses that are said to be the infallible word of God. Yet any attempt to achieve single, precise meaning through communication exchanges is only possible by ignoring the inherent structure of discourse, meaning, and consciousness.

The second communication model that exhibits the world view of the private self by relying upon the disposition of identification promotes a binary strategy of either/or, or ‘us and them’. Underlying this strategy

is Aristotelian logic that reinforces the assumption of the perfection of identity: as mine, my group, or my nation. Communications of this centripetal kind produce social disharmony, injustice, racism, and ultimately within communities, war. We would speculate that this template of disorder may well be found within the disorders associated with diseased cells.

Communications that reflect the worldview of atomism are those that place a strong emphasis on differentiation. This is the general tendency of mainstream science. These are the kinds of communication that over-value differences to the extent that they take overshadow similarities and connections while appearing to lack a context. These kinds of communications also value language that appears to provide immediate certainty that comes from a single axiomatic meaning. This happens when language ceases to be a provisional map of a territory and instead becomes reified into a territory, such as ‘information’, or ‘the physical world’.

The communication model that reflects wholeness should consciously foreground its worldview while taking implicit and explicit meaning into account. In other words, such communication addresses the vertical architecture of Omni-local consciousness. When this is done, we find that the uncertainties of implicit meaning are at the very heart of all communication exchanges. Hence, if uncertainty is a necessary and inherent feature of all communication, then every discourse will entail contradictory functions that simultaneously reveal and conceal meaning [23]. As a consequence of this, every expression, message, measurement, computation, symbol, discourse, text, artwork, or spoken exchange will reveal some explicit meaning while at the same time, there will be a large amount of accompanying contextual meaning that is hidden and consequently uncertain.

What often remains hidden from first sight is the social, linguistic, cultural, worldview, and implicate order contexts in which expressions are embedded [24]. As a consequence of this contradictory structuring of communication exchanges, it is impossible to express a concise, clear, logical, and certain statement devoid of ambiguity or uncertainty. In other words, every expression in science, law, and religion, as well as in all other fields, will always be provisional in that it will contain ambiguities and uncertainties. Hence, provisionality and open-ended uncertainty represent the inherent nature of all communication.

One example of this dynamic interweaving of concealing and revealing meaning within discourse is represented in the painting by the Belgium surrealist painter, René Magritte that shows an ordinary

European smoking pipe, and underneath which is written: “Ceci n’est pas une pipe” (“This is not a pipe”). The philosopher and social critic Michel Foucault was so fascinated by the contradictions in the painting that he wrote a small book about it [25]. Magritte’s painting tells us a great deal about the contradictory functions of communication by illustrating how context, as well as content, are implicitly operating, and how the two axes of discourse can, under certain circumstances, contradict each other.

Magritte’s painting plays with context and content in the following manner. This painting can be read vertically (context determining content) and at the same time horizontally (as content determining content). For example, the visual image of a pipe represents the context that would normally determine the content of the statement below. However, the statement specifically negates this contextual expectation with: *‘This is not a pipe’*. Hence, the vertical contextualizing habit associated with this image is undermined by the horizontal circularity of the content of the statement itself and we are forced into the joke by replying, *correct! “this” is a pronoun*. In Magritte’s painting, we can see a reflection of how mainstream scientists have tended to delete the vertical axis of causation (the context) and instead focus exclusively on the horizontal axis of word-to-word content.

The provisional worldview of wholeness produces open patterns of vertical and horizontal reflexivity that apply equally to all research and communication. Such patterns rest on the principle of *context determines content*. This principle is manifest in discourses that acknowledge that every content has its contextual cause, that every text has an author who has an active worldview and is associated with a date, a society, and a particular culture, while every computation is the effect of a local human mind. The worldview of wholeness establishes the reality of a single universe in which the vertical axis of causation (context) is primary while the horizontal axis of word-to-word, or sign-to-sign content communication is derivative. Within this holistic worldview, everything is interconnected and unified by the single agency of the relationships of meaning. Relations are always situated as relations of meaning and, as a consequence, all relations have meaning.

Within the provisional worldview of wholeness, the mysteries and uncertainties within the vertical contexts of Omni-local consciousness are accepted, not as problems to overcome but as stimulating possibilities that need to be explored. That could mean, for example, accepting the evidence that nonlocal connections are a feature of this universe rather than arguing that these

connections either do not exist or are super-luminary messages. It also means taking account of the uncertainties of mind and consciousness, and therefore accepting that uncertainty is at the very heart of all scientific research and communication. The provisional worldview of wholeness directly challenges Einstein's local realist worldview along with the de-contextual worlds of String and M theory and, in addition, Everett's Many Worlds Interpretation (MWI) which represents little more than a justification of the benefits of fragmented knowledge, the central effect of atomism.

A holistic worldview represents the communication bias of this paper and has provided the framework for most of David Bohm's theoretical work, along with Basil Hiley's later papers. The principle of context determines content has also been the frame for Rupert Sheldrake's analysis of biology and specifically his approach to morphogenesis, which is a highly controversial question for mainstream biologists. Another example that can be understood through the holistic worldview is the clustering of earthquakes occurring in a relatively short period and within a defined space. This is an acknowledged but a poorly understood feature of seismicity worldwide. These are synchronous events independent of one another, unlike aftershocks or swarms of earthquakes which are causally dependent on one another. A complete picture of the seismicity in this instance requires the inclusion of both synchronous events and linear causal events [26], suggesting that the unique and individual synchronistic and causal events are dual features of the same underlying universal order.

Many scientists other than Bohm and Sheldrake have embraced the implications of holism. To name just a few, Fritjof Capra, Larry Dossey, Dean Radin, Brenda Dunne, Robert Jahn, Ervin Laszlo, and Lynne McTaggart each has written in some manner about the singular source of the flow of the universe and how we are always a participating part of that larger whole. The signs are there that the provisional worldview of wholeness heralds the coming of a new scientific revolution that will eventually influence every aspect of science and everyday life. The only question is how many scientists will resist these inevitable changes by erasing, ignoring, or devaluing the vertical axis of causation (context) in relation to their work.

Kuhn wrote about the incommensurability of competing paradigms and by this, he meant the failure of scientists and philosophers to agree on precisely what a new paradigm means. This is also the case for worldviews, in particular for those scientists trained in the research principle of content determines content. Kuhn writes, 'Since new paradigms are borne from older

ones, they ordinarily incorporate much of the vocabulary and apparatus, both conceptual and manipulative, that the traditional paradigm had previously employed Within new paradigms, old terms, concepts, and experiments fall into new relationships one with another' [12]p, 149]. This is exactly the situation with the Cartesian materialistic worldview of atomism and the integrated world of wholeness.

It may be possible for scientists to view these two worldviews impartially to pick the most reliable one. However, along with Kuhn, we doubt that possibility. Kuhn quotes Max Planck to make his point: 'a new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grow up that is familiar with it' [12]p, 151]. We are inclined to agree with Kuhn's position on this question. By simply reading this paper we do not expect to convince any researcher trained in the Standard Models of mainstream science and/or who habitually employs the certainty principle that content determines content. Rather, the discourse of this paper is likely to be a more fertile ground for a younger group of researchers, or for those lifelong learners who are committed to changing their worldview from atomism to wholeness.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Andrew Lohrey  <http://orcid.org/0000-0002-4268-280X>

References

- [1] Spencer-Brown G. *Laws of form*. xxvi. New York: Dutton; 1977.
- [2] Milner S. Newton didn't frame hypothesis. Why should we? *Phys Today*. 2018 April 24. Commentary. <https://physicstoday.scitation.org/doi/10.1063/pt.6.3.20180424a/full/>
- [3] Einstein A. *Relativity the special and general theory*. London: The Folio Society of London; 2004. p. 6.
- [4] Cardinal S, Akin AP. Contextualising context for synthetic biology – identifying causes and failures of synthetic biology. *Biotechnol J*. 2012 July;7(7):856–866.
- [5] Morales MS. Who is telling the truth, nature or man. *News Biomed Sci*. 2016;13: 86–90.
- [6] https://www.academia.edu/s/34780cf563#comment_1319349
- [7] Seamon D. *The legacy of henri bortofoft (2022)*. Holistic Science Conference on the Legacy of Bortoft, Colquhoun and Goodwin; Feb 12–14. Gloucestershire, UK.

- [8] Lohrey A, Boreham B. The nonlocal universe. *Commun Integr Biol.* 2020;13(1):147–159. Lohrey A, Boreham B. ‘Lifting the veil on Bohm’s holomovement’. *Commun Integr Biol.* 2021;14(1):221–229; Lohrey A, Boreham B. ‘Omni-local consciousness’. *Commun Integr Biol.* 2022; 15 (1): 193–208. [10.1080/19420889.2020.1822583](https://doi.org/10.1080/19420889.2020.1822583).
- [9] Bohm D. *Wholeness and the implicate order*, London: Ark Paperbacks; 1983.
- [10] Bohm D. A new theory of the relationship of mind and matter. *Phil Psychol.* 1983;3(2–3):273. 17819902. [10.1080/09515089008573004](https://doi.org/10.1080/09515089008573004).
- [11] de Grosseon MA, Hiley BJ. Hamiltonian flows and the holomovement. *Mind and Matter.* 2013;11:2.
- [12] Kuhn T. *The structure of scientific revolutions*. Chicago: University of Chicago Press; 1970.
- [13] <https://www.themarginalian.org/2016/09/02/it-from-bit-wheeler/>
- [14] Stewart PJ. Eddies in the flow: towards an inclusive ecology. In: edit M. Updated chapter 18, *where next? Reflections on the human future*. Kew, UK: Royal Botanic Gardens; 2000. p. 291–327.
- [15] Bohm D. *Unfolding meaning: a weekend of dialogue with David Bohm*. London: Ark; 1984.
- [16] Nichol L. *The essential David Bohm*. London: Routledge; 2007.
- [17] Lawson H. *Reflexivity: the post-modern predicament*. La Salle, Illinois: Open Court; 1985.
- [18] Young A. *The reflexive universe*. Cambria: Anodos Publications; 1999.
- [19] Sheldrake R. *The rebirth of nature: the greening of science and god*. London: Rider; 1993.
- [20] Schrödinger E. *What is life?* Cambridge UK: Cambridge University Press; 1993. p. 127.
- [21] Lohrey A. *The evolution of consciousness: a new science*, princeton. New Jersey: ICRL Press; 2018. p. 101–147.
- [22] Bohm D. *On dialogue*. Lee Nichol, London: Routledge; 2006.
- [23] Lohrey A. Language maps. *Academic Letters*; 2022 May. <https://independent.academia.edu/AndrewLohrey>
- [24] Lohrey A. *Critical literacy: a professional development resource*. Melbourne: National Language and Literacy Institute of Australia; 1998.
- [25] Foucault M. *This is not a pipe*. In: Harkness J, translator; Berkeley: University of California Press; 1982.
- [26] McCue K. *Private conversation*. 2021.