

Evolution of consciousness

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Abstract

The evolution of codification within the increasing complexity and diversity of relations is examined within a triadic architectural frame of filiated hierarchical levels of both material organization and consciousness. Inertia and entropy are understood as basic forces within codal organization, and evolution is examined as a force of mediation between these two forces, operating to move energy to more complex and diverse codal relations. © 1999 Elsevier Science Ireland Ltd. All rights reserved.

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1. Evolution of consciousness

“Ideas produce material effects. A whisper in the ear may cause motions on the earth’s surface sufficient to attract the attention of the inhabitants of the planet Venus” (Peirce, 1931–1935 CP.7.369).

This paper is focused around the nature of and the relationship between consciousness and evolution.

2. Concept of energy

I begin with the metaphysical assertion that the basic reality of our cosmos is its nature as energy, with energy understood as a force of potentiality for the actualization of this energy in spatiotem-

poral terms. I don’t think one can initially describe energy in any more detail than that, because energy, by itself, cannot and does not exist as that force of potentiality. When we start to be more exact and specific in a scientific definition of energy, we bring in such terms as ‘erg’, ‘joule’, and ‘work’; that is, we must bring in other forms of reality that provide stable terms of reference to measure this energy force. The means of measurement then becomes part of the reality of energy. Here, energy exists only when it is measured by something else. Measurement is another term for codification. Codification is a logical organization, and when applied to energy, it permits that free and infinite potentiality to exist as a finite actuality. Energy exists as, not the energy to be an atom; it exists as an actual atom, a molecule, a set of molecules, bacteria, all the plants and animals of our world, human beings and their societies.

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This basic force of our cosmos exists only if codified or measured, i.e. extensionally and intentionally ordered by means of a secondary system of referentiality. Then, we are able to interact with energy in its nature as ‘matter’. In this spatiotemporal state of codification, energy is information. Information is a codified microstate of energy; it is energy in a state of ‘informing’ by means of measurement, which is to say, by means of a referential system whose logical properties of ordering that energy provides for the establishment of relationships with other forms of matter. Measurement or referentiality organizes energy such that it operates within systemic relationships with other orders of energy. This means that the transformation of energy into information requires separate levels for processing. Uncoded or free energy must somehow be differentiated from the referential codes in order for the two to even interact with each other. That is, metalevels are a basic necessity for coupling or relationships of referentiality to occur, such that energy can exist as matter, as information.

Therefore, the transformation of energy into information takes place within networks of interactional processes that operate within a hierarchical or multiresolutional architecture. We will consider, in this architecture three basic levels or domains of codification, namely, the physico-chemical, biological and conceptual. These three form the architecture of our cosmos. The basic axioms of this architecture are that each of these metalevels are self-referential and coherent codal systems, that they are contextually dependent on a coherence of codification, but that they are all filiated each with the other, and that none is separate from, or, by virtue of history or content, authoritative over, the other. We will also consider that the codification processes within these three tropic levels is of two types: dynamic and thermodynamic or inert and entropic. And finally, we will consider the evolution of this architecture of codification, within the three Peircean categories of Firstness, Secondness and Thirdness. These are the axiomatic components of our architecture of consciousness and evolution, which operates within the idea that the formation of complex systems, of hierarchies and new emergent properties, is a natural process.

3. Three types of codification

What is codification? It is a referential system that measures energy. In this action of measurement, it organizes energy within patterns that correspond to its referential logic and thus orders energy within a discrete and locally operational phase of reality, a sign. Is the code separate from the energy? There is disagreement on this. Platonism organizes the code as a Form, and sets it apart as an ideal reality. The everyday version of this pure Form can be a mimetic clone, a dialectical analogy, or even, a crafted symbol. But, the original Formal Cause remains separate from the Material Cause; the code is separate from matter. However, Aristotle says that “to reduce all things thus to Forms and to eliminate the matter is useless” (Aristotle, 1941 *Meta.* 1036b20). The Aristotelian understanding of codes and energy merges them, for “matter... is something that can never exist without quality and without form” (*De gen.* 320b15)¹. Weiss (1970) has pointed out “that a sequence of DNA has no intrinsic meaning. Take a gene out of an organism and it has no more meaning that a particular set of cards has outside the context of a game of poker or bridge. Both information value and function are context dependent” (in Root-Bernstein and Dillon, 1997: 449). Aristotle is quite specific that “since nature means two things, the matter and the form, of which the latter is the end, and since all the rest is for the sake of the end, the form must be the cause in the sense of ‘that for the sake of which’” (*Phy.* 199a30). The codes, the systems of measurement, are the means of organizing energy. But

¹ Aristotle’s term ‘form’ and ‘formula’ can be understood as ‘codification’, within my definition of codification as “a referential system that measures energy”, based on such Aristotelian references as “a definition is a formula, and every formula has parts” (*Meta.* 1034b20); and “‘part’ is used in several senses. One of these is ‘that which measures another thing in respect of quantity’” (1034b35). Aristotle refers repeatedly to “the formula of the form” (*Meta.* Bk.VII.). The formula is a means of ‘measured definition’ of matter, for “one kind of substance is the formula taken with the matter, while another kind is the formula in its generality” (*Meta.* 1039b20), and “the definition is the formula which contains the differentiae” (*Meta.* 1038a30); it is “the type according to which they are produced” (*Meta.* 1032a20) and the ‘figure’ or ‘form’ is “the formula expressing the essential nature” (*De gen.* 335b10).

energy can only exist when it is coded, therefore, “what desires the form is the matter” (*Phy.* 192a20). Energy as potentiality, desires and requires measurement, so that it can be actual.

Energy can be codified or measured by means of three basic systems of measurement: the physico-chemical as found within atomic and chemical processes; the biological as found within organic processes; and the conceptual, as found within human symbolic processes. It is an axiom of this paper that there are basic similarities and relationships between the processes of the physico-chemical, biological and conceptual. Information cannot be understood only as anthropomorphic interpretations of the lower codal orders. We must ask, for example, “what natural process(es) does the selecting in a chemical universe so that, at some point, the chemicals stop being a mixture and become a system?” (Root-Bernstein and Dillon, 1997: 449). Is not this systemic logic of interaction—‘information’? And then, when does this chemical system begin to operate also, within biological codification, and when does this begin to also operate within conceptual codification?

4. Two codifications of energy

There are two basic forces in this process of codal measurement and energy transformation which can be described under the two laws of thermodynamics that govern the conversion of energy from one state to another. These laws refer to the direction (reversible or irreversible) of that energy flow, and the availability of that energy for work, by establishing relations, as information. Peirce called them, succinctly, law and chance, and stated that “Law begets law; and chance begets chance; and these elements in the phenomena of nature must of their very nature be primordial and radically distinct stocks” (7.521). Other terms used to describe these two processes have been—for the first—symmetry, universalization or generalization; this process is considered to extend the breadth of coverage of a codal order and deplete its depth or resolutive specificity. Terms used for the second process have been asymmetry, particularization, specification; this process increases the depth or specificity of

definition, and restricts, or decreases breadth of expansion in both time and space. We know them scientifically as the laws of the conservation of energy and the entropic dissipation of energy.

The first law of the conservation of mass-energy establishes the functional integration of energy within homeostatic buffers within systems, which retain and store codal descriptions and thereby provide stability of relationships. This domain of reality sets up a so-called ‘universal’ definition, within iterative referential codes, such as a chemical formula, or the DNA, or a linguistic grammar, or rules of law within societies. It should be clarified that these homeostatic definitions are universal within a domain, such as a normative physico-chemical molecular combination or a biological species or a linguistic genre or a society, but they operate within finite reality, “for definitory formulae are not infinite” (Aristotle, 1941 *Meta.* 1043b35) and must be understood as relevant to that domain. The ‘fact’ that there are homeostatic codes which insert a process of symmetry is universal but their specific codal properties are linked to an existential domain. In contrast, the second law of thermodynamics, implying the existence of irreversibility, operates within the entropic destabilization of that integrated order. Energy, understood as the basic force of potentiality, operates within two contradictory forces integration and disintegration, stasis and entropy. Matsuno clearly differentiates their natures within temporal values, for “energy dissipation takes place in locally asynchronous time, while energy conservation is observed in globally synchronous time” (Matsuno, 1988: 67). Elsewhere, we read that “evolution therefore requires that living systems have redundant or non-integrated functional parts on which variations can occur without threat to the functional integrity of the system. New systems are therefore most likely to evolve from uncoupled, weakly coupled, or redundant components” (Root-Bernstein and Dillon, 1997: 463)². These components,

² The ‘redundant’ components referred to by Root-Bernstein and Dillon are ‘introns’, or so-called ‘junk DNA’, and they claim that “redundant components or introns...non-coding or inessential, redundant DNA” can be considered a site where “semi-random mutations can accumulate without threat to the functional viability of the system” (1997:463).

I suggest, are operative within the second law of asymmetry. These two laws are deeply interrelated. Matsuno, for example, states that “the cohesion between the measuring and the measured energy flows thus turns out to be a principal characteristic of energy dissipation and conservation” (Matsuno, 1988: 67). In other words, energy, to exist, requires these two basic processes but how do they relate to each other? Is energy necessarily forced into actions of evolution to strengthen its capacity to perform either one and then the other of these two basic forces? Can evolution be understood as a covalent mediation of these dyadic forces?

We must begin by examining the separate identities of these two codal processes. What is the nature of each, and how do they relate and, importantly—are these the only two powers? As noted by Swenson (1997), it is clear that “the experiments of Joule and every other experiment designed to demonstrate the first law...demonstrated the second law as well”. Matsuno points out that “ontologically, the second law on irreversibility is a derivative of the first law of conservation” (Matsuno, 1989). Prigogine states that “we have inherited two conflicting views of nature from the nineteenth century: the time-reversible view based on the laws of dynamics and the evolutionary view based on entropy. How can these conflicting views be reconciled” (Prigogine, 1997: 19).

Briefly, inertia is a codal process that organizes energy within actions that are repetitive and reversible, and therefore, within a domain, sets up universal codal rules that are, internally, atemporal and aspatial, in that they are unaffected by internal stimuli. This provides inert or stable processes of information generation. Prigogine and Stenger’s outline of dynamic codification is that “any single state is sufficient to define the system completely, not only its future, but also its past” for, “at each instant, therefore, everything is given” (Prigogine and Stengers, 1984: 60). Newtonian time, absolute in its external measurement “defines all states as equivalent” (Prigogine and Stengers, 1984: 60), for it implies “the equivalence of past and future” (Prigogine, 1997: 2). This process, based on a universal or non-contextual

inertia of codification is ideologically the basis for a deterministic and globally homogenous world, where “the future is always completely fixed by the past” (Penrose, 1990: 94). As such, it provides for an understanding of knowledge that considers a possible final state to that knowledge, and that denigrates variation, with variations understood as deviant or inadequate and based on ignorance or fallibility. The key factor in this type of codification is the formation and use of necessary rules-of-measurement that resist change and are based around an ‘ideal’ or steady-state mode of reality.

The other type of codification process, the thermodynamic, deals with the once-only or irreversible action of measurement³ and provides for unique and diverse forms of reality. Peirce notes that “there is probably in nature some agency by which the complexity and diversity of things can be increased; and that consequently the rule of mechanical necessity meets in some way with interference” (6.58). Prigogine and Stengers state that “irreversibility plays an essential role in nature and lies at the origin of most processes of self-organization” (Prigogine and Stengers, 1984: 8). Thermodynamic codification, random and spurious, ‘picks up’ free or peripheral entropic energy. It measures or semiosically encodes energy in exactly the opposite manner of dynamic codification and permits variant fluctuations which relate to other forms in entirely new ways.

How does one acknowledge the operational validity of these two basic laws of energy-inertia and entropy-within dynamic and thermodynamic codification, or stasis and chance events? Ideologies throughout history have privileged one or the other process, within the framework of design versus randomness, modernism versus postmodernism, mechanism versus phenomenology, realism versus nominalism. I maintain that rather than one or the other process, both are necessary for the transformation of energy to information. This still leaves us with the question of how they

³ Measurement should be understood in the semiotic sense of codification, which is to say, the differentiation of experience into parameters according to referential systems. These referential systems or codes can be both natural and artificial (physico-chemical, biological and conceptual).

interact. “Until we understand how to link thermodynamics, systems theory and molecular biology, these questions will remain unanswerable” (Root-Bernstein and Dillon, 1997: 450). However, I think we know enough to ask them. What type of world does measurement, as operative within the three genres of codification and the two tropic forms of codification produce?

5. Concept of multiple levels of energy concentration and interaction

I am taking as an axiom that life, which is to say, the processing of energy into information, can only operate within a state of complexity. This process must operate within different states of organization, which actualize as different levels of energy capacities for both inertia and freedom. The system must have the capacity to keep these levels separate, with their codes of organization and their energy content insulated from each other, and yet be capable of conducting energy from organizational level to level. We consider that there are, at a minimum and even as a maximum, three processes within energy codification or measurement. “Every cybernetic system must consist of at least three hierarchically distinct (though strongly coupled) parts: a process, a means of measuring the process, a means of controlling the process” (Root-Bernstein and Dillon, 1997: 450). There is energy as intentionality of the process, there is the specific contextual action of measurement of that process—and, there are other forms, generalizing forms, of codal reality that limit the expansion of that process. Therefore, reality can only operate within three different operational realities. I am stating that complexity exists, not as an accidental, but as a necessary process.

The idea of multiple processes or forces is ancient and they are most frequently triadic. We can see this in the Egyptian Isis/Osiris/Horus; Plato’s triads of the soul, the intellect and the city-state (for example, the appetites/spirit/reason; the worker/bureaucrat/ruler). We can see also Plato’s three means of developing knowledge: by mimesis via anamnesis, by methexis and dialektike, and

via a questioning mediation of a demiourgos/eristic process. There are the three Aristotelian archai or principles of immanent form (eidos); privation (steresis) and substratum (hypokeimenon); and Aristotle’s three active causes based on the immanent material cause, of efficient cause/formal cause/final cause. There is the triad of Plotinus of hen/nous/psyche; and Augustine’s god/history/utopian redemptive phases and his soul, made up of love/existence/ knowledge. There is Vico’s mute era of the gods, the confrontational heroic era, and the mediative rational era. In modern philosophy, we have the Hegelian triad, Peirce’s Three Categories, Popper’s Three Worlds, etc. We can compare these metaphysical levels with the three major ‘realms’ or domains of codification—the physico-chemical, the biological and the conceptual. In addition to this basic triadic architecture, hierarchical metalevels of codal organization will operate within each domain to increase the energy-codification abilities. The domains are sharply defined; each level permits a vast number of possibilities of codal operations of measurement, as, for example, the wide range of existential possibilities within the physico-chemical world—but there is a finite horizon to the amount of energy each domain can organize or encode. A ‘higher’ or more complex level, with a codification process that is more refined and with a higher resolution of codifying or measuring capacities will have a higher energy processing ability than a lower level. A ‘lower’ or more simple level, with a looser, low resolution of codification, has a lower or less complex energy processing ability.

Because of the discrete and self-coherent nature of each level, the movement of energy from band to band, particularly in a unidirectional temporality, cannot be via an essentialist or progressive flow, an intentionalist and teleological focus on the future. I will postulate, working from the theories of energy flow, that these levels do not flow seamlessly the one into the other, that there is a borderline ‘forbidden band’ acting as an insulating membrane between them, and that energy, in this ‘forbidden band’ between two levels is in a state of high far-from-equilibrium excitation. This state of excitation has been described,

in many cases, as operative within a heightened state of otherness⁴, which works within a direct confrontation between two closures, a state of struggle and competition between two entities. This interaction transforms energy processing from a homeostatic and iterative state to an entropic high-attractor state of openness to interaction. This dyadic differentiation is exemplified in the Heraclitean Love and Strife, the Darwinian Struggle, the Augustinian good and evil, and its result is the adrenaline excitation of games and war, science and discovery.

If, however, this interaction were the only process in this membrane-phase, then a large proportion of energy could be lost within this binary confrontation. Such decodified energy could be picked up by a lower level of codification—but this dissipative action, if continuous, would eventually, following the third law of thermodynamics, lead to the heat-death of the planet where all parts are at the same temperature and where energy is no longer available. To prevent this dispersion of energy within this dyadic struggle, the two entities could isolate themselves from each other, but such an action would have a similar result, for it would end in a frozen and energy-unavailable world of symmetrical and non-interactive units. Instead, this far-from-equilibrium state of conflict, operating within the ‘fuzzy’ phases of the high excitation of sensorial-emotive attractor states, provides for the mediative action of evolution. I will define evolution as an exploratory expansion of micro/macro interfaces followed by the development of new codal logics or codal patterns, which provide for unpredicted and strategic coupling actions which permit the development of new information and new knowledge properties. I consider that evolution provides a mediative triadic force within this con-

frontation to enable a higher and more complex rather than lower resolution of codification for this free energy. That is, evolution is a mediative or relational process that provides a means of developing unpredicted and emergent referential codification processes for higher and more complex energy levels of organization of energy. However, this means that the higher level of codal processing are also the most detailed, the most fine-grained, the most specialized, with a great deal of energy compartmentalized into highly specialized and closed modules of codification—as for example, in the biological domain where a species will isolate itself to a particular and limited ecological niche, or in the conceptual domains, where an ideology will articulate itself into rigid and inflexible closures of definition. This could result in another form of heat-death or energy-unavailability, by the movement of codification into isolate and reified ultra-specialized definitions. We will explore how conceptual codification deals with this problem by its reintroduction of a high entropy level within the deliberate ambiguity of symbolic or figurative codification. I would like to examine the nature of these levels within the Peircean triad of categories of Firstness, Secondness and Thirdness.

6. Firstness as sensation

I am defining the first and most basic level of consciousness, which I will term primary or pre-consciousness, as a state of Peircean Firstness. Peirce defines it as ‘feeling’, and feeling is “the consciousness of a moment as it is in its singleness, without regard to its relations whether to its own elements or to anything else” (7.540). In contradiction to Kant, this feeling is not limited to pleasure and pain (7.540), which inserts an evaluative codification, but to all sensation regardless of its value. “The idea of First is predominant in the ideas of freshness, life, freedom. The free is that which has not another behind it, determining its actions...freedom can only manifest itself in unlimited and uncontrolled variety and multiplicity; and thus the first becomes pre-

⁴Otherness is understood as operative within the basic dyadic differentiation of the self versus the not-self. The closure of matter/energy into an asymmetrical phase of discrete forms of organization (self as differentiated from not-self) permits interaction, relations, and motion. Without such differentiation, the world would be a ‘homogenous frozen unity’.

dominant in the ideas of measureless variety and multiplicity” (1.302).

The codification processes of this level of energy are elementary rather than complex, with properties that are homogeneous, unspecialized and operative within simple and unreferenced coupling bonds that set up reversible and symmetrical links that tend to maintain an equilibrium of codal modalities. What is its nature as consciousness? It would be unconscious consciousness. It is a “chaos of unpersonalized feeling” (Peirce, 1931–1935: 6.33). A feeling, as Peirce noted, is without parts; you cannot separate its nature into different parts, because to do so, you must alienate yourself, even slightly, from this feeling and act as an observer with a measurement. “By a feeling, I mean an instance of that kind of consciousness which involves no analysis, comparison or any process whatsoever, nor consists in whole or in part of any act by which one stretch of consciousness is distinguished from another” (1.306). As Godel points out, a formal system cannot prove its own consistency but requires a metareference. This level, which I also consider the level of physico-chemical codification, is pre-consciousness, (if there can be such a term) and operates within an experience of, a sense of, a contact with otherness, and yet, without any awareness of that contact, because the referential system cannot encode the separation between the self and the other (the not-self) and therefore, cannot provide any means of codifying that awareness of the real nature of this contact. Primary Consciousness, then, is a state of being-in-relationship—but without the regard for, the awareness of, such a relationship. It operates, as Prigogine has implied, with an indifference to time. I will maintain, however, that it operates within a particular mode of time—Cosmic Time—a referential measurement that encodes by millenia rather than seconds.

Before we examine the next step of consciousness, which brings in the codal capacity for reflection, a level of energy-processing which I will term self-consciousness, we should first consider the nature of a reality operating only within primary consciousness.

7. Monadic typology

What kind of world operates within this basic consciousness? This would be an experience without any sense of its finiteness either in space or time, without, therefore, any capacity for comparison, for separation of the self from that sensation. In the physico-chemical world, these monadic experiences would be the operative world of molecules, where an aggregation of atoms is held together within the rigid patterns of valence forces. The same atoms can combine in different but definite proportions to form different molecules, as, for a basic example, two atoms of hydrogen bonded with one atom of oxygen yield a water molecule, while two atoms of hydrogen bonded with two atoms of oxygen yield a hydrogen peroxide molecule. These structural rules of bonding are so tightly embedded in the action that there is, normally, no possibility of separating the code from action or action from code. The result of such a tight bonding, which I will refer to as a nuclear binding force, following the formula for the binding energy of nuclei (MeV or million electron volts) means that there is little flexibility of variation for either codal rule or action. This level is the world of mimesis, where objects are iconic iterations of each other, and as such symmetrical forms, have a limited set of relations and therefore, a low information capacity (until, of course, that binding energy is broken). A chemical molecule has a limited repertoire of composition and bonding properties and has no capacity to change these rules. In the biological codal world, we find prokaryotic bacteria, those one-celled microscopic organisms that lack a membrane-bounded nucleus and organelles, and, with their small size, simple design and broad metabolic capacities, are the dominant living creatures on earth. Their referential means of encoding or organizing energy is more advanced than that of the molecule, but their metabolism of interaction and of reproduction, which maintains their capacity to extend themselves in time and space, is, although extensive, permitting a broad expansion of energy processing across the planet, limited in energy-codification properties. Therefore, like the molecule, they have a limited capacity to vary

their typology of reproduction—most reproduce by binary transverse fission—and a limited capacity to adjust the nature of their relationships. This is a world without consciousness of itself, a seething mass of undifferentiated interaction. This level, however, is basic and important. It operates as the ‘substratum’, and as the most widespread form of energy processing, establishes the primary basis of energy-as-coded into information. It therefore, has an important role to play in preventing either entropic or inert heat-death. It is largely operative within the decay and decomposition of higher forms of energy organization; that is, this level of codification operates not merely to stabilize energy processes at a basic ground level, but also, to free energy for further codification, by means of the decomposition of higher forms. This level acts as an operational reservoir of energy for higher level codification processes⁵.

On its own, this world would be a silent and relatively stable and slow-moving era—as it was for the millennia of the infinitesimal developments of the precambrian and cambrian. This type of world exists in a state of haecceity, or ‘now-ness’, without the capacity to reference otherness, and therefore, without an awareness of history or time. These are the ideal steady-state worlds which we find eulogized in utopias. This is Vico’s era of the silence of the gods, it is the aboriginal Dreamtime, it is the Christian Eden. Could the universe have survived with only this type of codification, based so heavily around the first law of thermodynamics and therefore, with a limited ability to abstract and store its codal laws from current mimetic bonds, and to insert the sense of time and irreversibility, and therefore, ‘reflect on’ (and divert from) the nature of those laws? The reality of the second law, restricted as its applications were at this early stage of the universe, meant that entropic disorder would certainly have

existed, even if on a minute scale, and, given the limited storage or conservational capacities of the existent codal systems, would have eventually so lowered the energy operations of the world to a universal ‘third law reality’ of homeostasis that the functional heat-death of the universe would have been an inevitable result. To retain the work-capacity of energy, its power to be material information, it must operate within a non-homoeostatic state that permits a more complex asymmetrical differentiation than provided within the molecular and the prokaryotic forms of organization of matter. It must, therefore, have higher or more complex codification processes that both preserve energy and increase its capacity for diverse relations.

What is the next hierarchy of energy evolution?

8. Secondness or self-consciousness

Consider the monadic state of consciousness, where “all that is immediately present to a man is what is in his mind in the present instant. His whole life is in the present. But when he asks what is the content of the present instant, his question always comes too late” (Peirce, 1931–1935: 1.310). That is because referentiality or “reflection cannot be performed instantaneously” (Peirce, 1931–1935: 7.540). In order to know anything about this conscious feeling, and I do not mean conceptual knowledge but merely awareness of that feeling as a discrete reality, you must separate your self from, so to speak, your self. You must move into a state of Secondness, which is a state of “mutual action between two things regardless of any sort of third or medium, and in particular regardless of any law of action” (Peirce, 1931–1935: 1.322). In this state, we have what Peirce referred to as a ‘double consciousness’ (1.324), for “we become aware of ourself in becoming aware of the not-self. The waking state is a consciousness of reaction; and as the consciousness itself is two-sided, so it has also two varieties;...this notion, of being such as other things make us” (1.324). The state of Secondness supplies a referential process, that reference to ‘such as other things make us’, by means of another level of

⁵ It is interesting to speculate whether sporulation, which produces dormant forms of bacteria, could be considered an evolved tactic to both counter the relative inability of reproductive variation within bacteria and to insert a capacity for flexibility over time; i.e. to insert the capacity for historical change, even if that ‘change’ is only non-reaction until better environmental conditions reappear.

codification, which permits one level to observe, to refer to, to measure, the other level. This is the level, not of analytic, but of descriptive consciousness, which I will refer to as self-consciousness.

What is the nature of this phase of observation? You cannot observe or relate to or describe something else without first separating yourself from it and then, by some organizational means, establishing a relationship between yourself and it. Therefore, you may observe ‘it’ as rain, as a tree, as clouds. This action ‘selects’, focuses on, both your own closure and the other closure and inserts a measurement as a relation between the two. Within the heightened electromagnetic excitation of a dyadic interaction, this level of codification produces a high resolution or organization of energy, a fine-grained description of both self and other. As the resolution increases within even further codal bonds, the flexibility of meaning decreases and the specificity of information increases. As an example, consider your noticing something in the trees at the edge of the field. Because of its motion, you describe it as living. Then, as you continue to observe, your description becomes more specific. It is, rather than a bird, an animal. It then becomes a cat, but rather than a cat, it becomes a Persian cat; and then, it becomes your particular Persian cat with its specific name. All of these specialized codifications provide a more fine-grained and buffered or anti-entropic state of energy organization. In the second level of codification, we have a sense of volition, of force, where the referential processes force energy into specific codal paths. As Peirce notes, “the second is precisely that which cannot be without the first. It meets us in such facts as another, relation, compulsion, effect, dependence, independence, negation, occurrence, reality, result” (1.358). There are two categories of Secondness. The most basic and easily observable is the dyadic asymmetry between the self and the not-self, which permits an interactional relation to develop between these two units, such that each can be ‘identified’ or ‘referred to’, within this interaction. That is, in this formation of energy, we now have a membrane or closure between self and not-self, such that the self can maintain “homeostasis within a non-equilibrium thermody-

amic environment” (Dillon and Root-Bernstein, 1997: 483); the two are in an asymmetrical relationship to each other. The other category of Secondness, less easily observed, is the internal asymmetry of energy levels, where one level or order of the mass provides for continuity of process—as in the cell nucleus, while the other level or order provides for the activation of that referential blueprint—as in the cytoplasm. Without this separate zone of stable referentiality, the energy-processes of the entire mass would collapse within its own gravitational forces and dissipate to the lowest possible ground state. For the sake of energy, and its continued existence on this planet, a more complex and separate level of codification developed about 570 million years ago⁶.

9. Dyadic typology

Again, what type of world would operate that has only two phases or levels of codification? First, on the positive side, it would introduce history, it would provide the capacity to ‘refer to’ the other, both the external other and the internal other-as-history. It would thus permit a consciousness of both past and future and a capacity to interact with and influence the environment. Such a world is focussed around the sense of

⁶ These levels can also be compared to energy states. In a dyadic world, with two states of energy, the referential or stable (nuclear forces) level acts as a ground state, with a longer referential lifetime than the excited states of relations (electromagnetic forces). As in quantum mechanics, transitions between these states/levels may be allowed or forbidden. A genetic code, the referential level, that is protected from interaction within a nucleus, protects its codal references within a forbidden transitional state—its properties do not, themselves, move out of this nucleus. In this manner, for example, the eukaryotic cells, with the polynucleotides in their nucleus providing reproductive iteration, and the proteins in the cytoplasm providing catalytic actions, function as a partnership, and achieve a highly efficient ‘best of both’ actions of continuity and flexibility. In addition, this necessity for both ‘forbidden’ and ‘allowed’ alterations may be the reason not only for the dyadic frame, but also why some of the ground referential codal actions (forbidden transitions) of the cell also take place within the cytoplasm (see Root-Bernstein and Dillon, 1997).

struggle, of electromagnetic attraction towards and rejection of, the self and the other—both within that external dyadic interaction and the internal conflict. This is the mythic era as narrated within the Homeric epics, the Arthurian romances, the legend of Gilgamesh; it is the epoch, in every people's stories, of the conflicts between the gods and the heroes.

The iterative or iconic code of the physico-chemical or preconscious level has by its very nature as a reproduction by mimesis, a low capacity for asymmetry and therefore, for diversity of interaction. As a means of codifying energy, it provides a stable general and coarse grained reality, operative over a wide range of space and within a synchronic or global and ahistorical time where relations are either rigidly bonded and incapable of supplying information (as available energy) or, only a limited amount of information/available energy. The second phase of codification, by its introduction of otherness, provides for a more detailed and finer grained codification. The relations are therefore not iconic and mimetic, but differential, permitting indexical and relational interactions. An indexical semiosis produces a discrete secondary sign which is asymmetrically differentiated, by virtue of space, time, and/or codal form, from the 'primary' sign. An index "marks the junction between two portions of experience" (Peirce, 1931–1935: 2.285). Therefore, this codification operates within an asynchronous time, with a differential rather than iconic sense of past as well as future realities. As Aristotle pointed out, "time is the measure of motion" (*Phy.*221b5), and therefore, if motion or interaction exists, by virtue of differentiation of one entity from another, then historical or irreversible, locally asynchronous time also exists as a codifying force. This phase inserts the second law of thermodynamics, with its directional architecture, that permits a reference to 'that which is not'. Time becomes 'unidirectional' and energy processes become based around the maintenance not merely of uniformity and continuity, but also diversity and differentiation. We can therefore ask "how does one explain the shift from random chemical interactions to directional processes—from scalar to vector? Stated another way, what produces the unidirectional 'time's arrow' that characterizes all biological pro-

cesses as they become more complex?" (Root-Bernstein and Dillon, 1997: 450).

This level of evolutionary consciousness is the world of biological or self-conscious codification. It is within this phase that, for example, the eukaryotic cell develops, with its long-term reproductive code stored within the membrane-bound nucleus and shielded against the disturbances of short-term excitations from differential interactions. Here, we see the two processes of energy operating in a dyadic frame of relations, based on opposite interactions—force and reaction. What would our world be like if we were to establish a socioconceptual world within this dyadic codal architecture? It could operate only within an infrastructure of struggle, a permanent state of active or immanent warfare. This is the Manichean, Heraclitean, Augustinian, Darwinian, Freudian and Marxist ideological world, which all, despite their empirical and theoretical differences, operate within an architecture based on a conflict between polarities—with also, in some cases, an eventual reduction to an ideal steady-state world. This world of energy, as organized within differentiation and therefore, necessarily active only within differentiation, works within the fundamental force of electromagnetic opposition. A dyadic world, based as it is on distinct boundaries, must now include local asynchronous rather than only global or universal synchronic time. This means that codifications, both generic and individual, move into finite temporality and operate with discrete origins and deaths, as Adam and Eve discovered, after the ideal eternity of Eden. However, I maintain that, despite the capacity for self-replication that developed within this introduction of referentiality, the dyadic architecture is an 'imperfect' architecture for the maintenance of energy processes, and will dissolve, due to the inherent variable found within the second law of thermodynamics, which is to say, the reality of entropy and its irreversible tendency towards disorder. The world will lose its organized hierarchies, its rulers and ruled, and will dissolve into a single level equality of the monadic ground state, the ideal utopian worlds of our origins. The fact that this event of homogenization is actually the heat-death of the universe is another story.

With this in mind, we should be cautious lest we view evolution as it was in the nineteenth

century sociological ideologies, as a progressive movement, via struggle, away from simple or primitive codal modalities towards a ‘better fit’ and a better world. Rather, these hierarchical networks of energy should be understood to operate as an intermeshed architecture of increasing complexity, whose sole goal is to maintain the viability of codification of energy on this planet. It is energy that requires evolution, that requires a triadic architecture, and there is no evaluative judgment on this architectural goal other than its pragmatic functionality.

Let us now consider the third level.

10. Thirdness as knowledge

“It seems, then, that the true categories of consciousness are: first, feeling, the consciousness which can be included with an instant of time, passive consciousness of quality, without recognition or analysis; second, consciousness of an interruption into the field of consciousness, sense of resistance, of an external fact, of another something; third, synthetic consciousness, binding time together, sense of learning, thought” (Peirce, 1931–1935: 1.377).

The most complex level of codification, with the foremost potential to organize energy, is the socio-conceptual. The socioconceptual, within its use of logic and organization, has the capacity for highly complex and stable codal resolutions or organizations of energy, but, at the same time, within its use of ambiguity, the fuzziness of its metaphors and rhetoric, and their short or weak life-spans, it also has an astonishing potential for non-equilibrium disorder. It is the level with the highest usage of the second law of thermodynamics. Therefore, of all three levels of codification, this level has the greatest capacity to transform energy into information. How did it develop? Is it a linear result of the first two? Does energy organize itself, so to speak, at the simplest level of physico-chemical codification; then, for some reason—whether accidentally which

I do not accept, or externally which I also do not accept⁷, or by virtue of the requirements of both laws of energy, the conflict between inertia and entropy develop a more mediate and complex system of codification? A further question is whether these levels operate, as the sociological evolutionists claim⁸, as an increasingly hierarchical codal complexity, with each level unique and separate, and operating as an advancement from a temporally prior level? This is, or was, the understanding of, for instance, bacteria, which were formerly understood as primitive cells or precursors to ‘higher’ organisms. They are now viewed as, not merely the dominant living creatures on earth, but as necessary organisms. Therefore, can we conclude that these levels are necessarily filiated in their operations, such that all are part of the operation of consciousness? The answer is, in my estimation, that energy itself self-organizes this hierarchical structure, including this most complex level of conceptual codification, and maintains each as separate, each within a different state of energy excitation (from a low to a high) and yet, operative within a constant filiation of all hierarchies. Nature is not separate from culture; culture is a development of nature.

I define this third level within the Peircean analysis of Thirdness. “By the third, I mean the medium or connecting bond between the absolute first and last” (1.337); that is, this level acts as a system of mediation between the two extremes of the basic laws of thermodynamics, the processes of inertia and entropy, to both permit their interaction and prevent either dominance. Again, we may compare the three levels. “The dream itself has no prominent thirdness; it is, on the contrary, utterly irresponsible; it is whatever it pleases. The object of experience as a reality is a second. But the desire in seeking to attach the one to the other is a third, or medium” (Peirce, 1931–1935: 1.342). Thirdness is the action of establishing relations. Relations

⁷ Accidental or completely random evolutionary processes have been thoroughly critiqued as problematic (see, e.g. Brooks and Wiley 1988; Kauffman, 1993; Salthe, 1985, 1993; Depew and Weber, 1995) and external causality, with its vitalistic teleology, is beyond rational analysis.

⁸ I refer here to the evolutionary blueprints of societies, which saw human development as linear, developmental and progressive, moving from, e.g. the ‘primitive savage’ to the ‘barbarian’ to the ‘civilized’—with the latter exemplified by western man. See, e.g. Spencer, 1851, 1885, 1967; Tylor, 1871; Morgan, 1877).

establish intentional bonds and in those interactions, affect not only that which is currently related, but also, as actions of relational bonding, establish networks affecting future realities. How is this done?

11. Consciousness as three-levelled

This level of establishing relations is a mediative or analytic process that works within the other two levels. As an analytic or logical process, it has the capacity to abstract commonalities of behaviour, generalize their processes and their causal relationships and then, develop and cultivate these relations as stable networks or filiated rules of law. This heightened level of mediative consciousness is the dominant means by which the two oppositional thermodynamic forces of inertia and variation both lessen the energy loss which would result from their continuous unmediated conflict and also, prevent the rigidity of codification which would result from a domination of either force. I repeat the roles of each trophic level of the triadic architecture. Firstness or the physico-chemical operates within a pre-consciousness, within an immediacy of the sensate and a nuclear bonding of its energy force; Secondness or the biological operates within an electromagnetic referential duality that provides for a descriptive awareness of self-other; and Thirdness or the socioconceptual operates within a mediative or symbolic referential processing of the relations between this self-other that operates within the weakest relational force, the gravitational. As such, this third level is a vital and indeed integral force in the cosmic processing of energy⁹. Is this action of both analyzing and establishing networks of relations, this generalizing mediative construction and deconstruction of

relations by ‘conceptualization’, only operative within that logical process which we consider as mind, that is, the human mind? Peirce states that “it so happens that biological organisms, and especially a nervous system are favorably conditioned for exhibiting the phenomena of mind also; and therefore it is not surprising that mind and feeling should be confounded” (7.364). What we normally call ‘mind’ is merely the third level of symbolic consciousness. However, my understanding of mind is not solely this phenomenon of reflexive symbolic consciousness (within Thirdness) or even the phenomenon of descriptive self-consciousness (within Secondness). Mind is rather, a hierarchical process of increasing complexity of codal organization, and as such a holistic and complex force, its operations are as readily found among the decompositional actions of bacteria as among the dialogues of philosophers.

12. Time and evolution

How does time operate within this architecture? Energy operates within the reality that “the passing-away of this is a coming-to-be of something else, and the coming-to-be of this a passing-away of something else” (Aristotle, 1941: *De gen.*318a25). Therefore, “consciousness occupies time, and...we have no consciousness in an instant” (Peirce, 1931–1935: 7.355). However, time, as a means of codification or measurement, is not uniform within the hierarchical levels of this architecture. Multiresolutional evolution or consciousness operates within different codifications of time—the global, the ecological and the conceptual. Matsuno states that “time and information are intimately related between themselves...Newtonian absolute time is exceptional in having no relation to anything external as expressed...there would be no information in Newtonian absolute time...[This means] that time in relation to information cannot be globally synchronous as its Newtonian counterpart is. It must be locally asynchronous” (1998: 57). As Matsuno outlines, synchronic or global codification is in a ‘past progressive’ time, as differentiated from the asynchronous present progressive and present per-

⁹I am suggesting that a cosmos operating within only a dyadic codification of Firstness and Secondness (the first and second thermodynamic laws) lacks the ability to generate new rules, and would therefore, by virtue of the third law, collapse to a ‘frozen’ ground state. To prevent this, energy has to insert a permanent level/phase of ‘ordered excitation’ or ‘dissipative equilibrium’ (Prigogine, 1997), ‘diffuse rationality’ (Cottam et al., 1998), ‘self-organized criticality’ (Kauffman, 1993)—which is Thirdness.

fect local codifications of time (1998). In contrast to Newtonian time, which disregarded hierarchical levels and, as an abstract code, worked only globally, each level of the multiresolutional architecture has a unique ontological reality.

In the lowest level, the physico-chemical pre-conscious, the nature of time, as a measurement of the production of information within asymmetrical interactions, is extremely slow¹⁰. The pre-cambrian era began, in our conceptual temporal codes, about 4600 million years ago and was dominant until the Cambrian period, 570 million years ago. As noted, interactions within this state of energy formation are elementary and stable and can be considered operative at energy levels that are at borderline stationary or ground states. However, the reality of irreversibility, derived from either the expansion of matter or its continuous creation, even if at an infinitesimal rate, had to be dealt with by strengthening the world's capacity for codification of that 'free' energy. Therefore, the next phase, that of the biological self-consciousness, was more complex, divided into several subphases, and lasting until the Paleocene. In this phase, as we have seen, there is an increased capacity for both processes of thermodynamics—the reversible and the irreversible. The resultant expanded capacity for heterogeneous interactions, operating within a heightened flexibility-of-organization, resulted in an explosion of diverse energy-organizing life-forms and processes. This phase, with its requirement for asymmetry and non-homeostatic processing meant that energy moved into independent units, which operated within "a local energy minimum that is higher than the surrounding global energy minimum" (Dillon and Root-Bernstein, 1997: 486). As such, these discrete units also, each of them, be-

came finite states. Time became measurable in terms of the finite beginning and end of the individual unit as both a 'fact' of information and a unique information-processing system (e.g. the particular butterfly)—rather than the informational operations of the class or generic experience (e.g. carbon monoxide or CO). How is this closure dealt with? The third phase, that of conceptual or symbolic consciousness, began about 65 million years ago, and provides the fastest and most complex means of energy processing, in terms of the ambiguity and volatility of its constantly generative inventiveness and the flexibility of its metaphors of identity. In this third level, we have two types of time. Time, when understood as a means of measuring any actual differentiation of processes and therefore, the actual information content, is, in the individual or discrete unit perspective, moving faster in this architecture of consciousness. However, time, understood as the generative or potential continuity of this information production, is experienced as infinite—whether that power is vested in god or 'our future'. Time, therefore, is a factor of the measurement of the information producing capacities of energy, and as information production differs, so does time. As Prigogine has said, "we are actually the children of the arrow of time, of evolution, not its progenitors" (Prigogine, 1997: 3).

These three levels of hierarchical codification—the macroscopic or physico-chemical, the living organisms or biological, and the socioconceptual or human—are necessary metastates of energy. Therefore, this multiresolutional outline of consciousness is an argument against the autonomy or hierarchical dominance of any level, against the autonomy or dominance of the physico-chemical world, of the biological world, and most certainly against the autonomy or dominance of the socioconceptual world. I emphasize the filiated or functional interconnection of these levels, where the most complex level can be understood within the sense of an Aristotelian final cause—which is, "an end, and that sort of end which is not for the sake of something else, but for whose sake everything else is...[and] the end is a limit" (*Meta.* 904b10). This is not the world as operative within

¹⁰ Whether these relations operate within the continuous creation of matter as explained within the steady-state theory (Bondi, 1960; Hoyle, 1960; Gold, 1967) or the expanding universe theory (Hubble, 1937; Friedmann, 1990), the point is, that time is not independent of matter and the interactions of matter. Therefore, an energy level with a higher rate of asymmetry, will produce more information and will therefore 'move faster' than an energy level operating within a more symmetrical state and therefore a lower rate of relational interactions and information production.

the self-interested or selfish gene teleology, which is focused on the survival of that particular codal formula (an action viable only within the Secondness of the self-conscious world). As Aristotle said of this final cause, “the active power is a ‘cause’ in the sense of that from which the process originates; but the end, for the sake of which it takes place; is not ‘active’ (*De gen.* 324b15). The end is for the sake of the codification and therefore, retention, of energy/matter in our cosmos. There is no agential or teleological goal to this action. There are no individual agendas in nature. The ‘goal’ is merely, to maintain the existence of energy, within its ability to ‘relate to’ and ‘work for’ itself, in the transformation of itself, to information.

13. Concept of the evolution of mind

I have a number of conclusions about evolution. The first is that evolution, by which I mean an increase in the existence of information, as evidenced in an increase in the diversity of discrete particles and an increase in the complexity of rule-based organization of the relations of these particles, is a necessary and yet chance-driven process.

Some may say that the universe is, as it is, and is not increasing in diversity or complexity. We are merely, in our ignorance, discovering more of its basic identity. Others may say that it is either moving away from or towards uniformity or purity. Others may concur with both diversity and complexity but deny both the irreversibility of process and the spontaneity of formation. What I am suggesting in this paper, is, as Aristotle pointed out, that each step “in the series is for the sake of the next; and generally art partly completes what nature cannot bring to a finish” (*Phy* 199a15). The causal force or intentionality of each level or phase-state of energy lies in the next or more complex level. And art, the conceptual codification, “completes what nature cannot bring to a finish” (*Phy.* 199a15). The intentionality of energy-processing is focussed on the pragmatics of the future and the collective network of relations of all energy phase-states.

When we think of mind, should it be the individual mind, the mind that we commonly associate with our human identity? Or is it rather, as Peirce said, “It is we who float upon its surface and belong to it more than it belongs to us” (7.558). Can we sustain any longer the dualism between matter and mind? The mechanist perspective denies consciousness and feeling to anything without the means of that third energy level of symbolic codification. Is mind only conceptual or symbolic consciousness, with its overtones of individual goals? But “it is absurd to suppose that purpose is not present because we do not observe the agent deliberating. Art does not deliberate...if, therefore, purpose is present in art, it is present in nature” (Aristotle, 1941: *Phy.* 199b30). Therefore, as soon as evolution begins, which is to say, as soon as time begins as a process of codification or referential differentiation, then, consciousness, or mind or knowledge, begins. “All flow of time involves learning; and all learning involves the flow of time” (Peirce, 1931–1935: 7.536). Therefore, the socioconceptual consciousness is a necessary level for the existence of the descriptive self-consciousness of the biological level and the sensate primary consciousness of the physico-chemical level. All are part of the ‘mind’, of time, of evolution.

Evolution is the means by which energy, moving from basic atomic particles to chemical molecules to prokaryotic cells to more complex eukaryotic cells to complex organic modules and to social organizations of these organic modules transforms itself into information and, in this transformation, increases its operational processing of the two basic laws of thermodynamics and thereby increases its capacity for both continuity and flexibility of that information. By means of evolution, energy develops referential systems that can functionally cluster its codes such that their codal actions become insulated against degeneration or dispersion. It then develops stable referential systems that differentiate relations such that codification becomes increasingly indexical rather than mimetic, and can thereby generate irreversible new properties, such that the ground state of the functional cluster does not degenerate into maximum entropy. It then differentiates its energy

states and their properties such that an entropic reconfiguration of one code does not harm other codes; it hierarchically separates these phase states, and these codes such that each level is relatively immune to either the restrictive closures or dispersive releases of other levels. It develops extensive networks that mediate and relate these codes and levels with each other, such that energy maintains its ability to reflexively transform energy into information. Consciousness is a hierarchical and differential process by which energy has evolved its capacities for both the stability of functional integration and the flexibility of diversification, without, importantly, a concomitant requirement for a lower level or physico-chemical and biological recodification.

That is, an evolutionary consciousness is a unique means by which energy, using stable physico-chemical and biological codal processes, develops a means of increasing the pragmatics of both laws of thermodynamics by the development of hierarchical levels of metareferential code systems. The introduction of metaphoric codification within the actions of *fantasia*, the *erotesis* or *dubitando* of questioning, of hypothesizing, is an extraordinary power that enables energy (not humans)¹¹ to develop the telescope rather than undergo the slow evolution of the eye; develop the jet plane rather than the chance evolution of turbo-wings; develop artificial intelligence rather than *Homo ultrasapiens*. Maintaining energy-processes within the relatively stable continuity of a physico-chemical and biological codal metanarrative while permitting increased entropic diversification within the higher biological and the conceptual-aesthetic codal metanarratives provides energy with a highly efficient capacity for rapid pragmatic strategies of adaptation. *Homo sapiens* as the bearer of this unique property must consider that consciousness is not for the sake of our, or any particular, species but for the sake of energy as the substratum of our world, and must

accept that the true force of consciousness as an aesthetic and ethical ‘force majeure’, requires a concomitant humility and responsibility.

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¹¹ Although we are indeed the inventors and manufacturers of these expansions of both our own and our world’s capacities for relations, I maintain that we should consider ourselves the ‘handmaidens’ or agents of energy and energy-processes, rather than the other way around.

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