

# Evolution = Exchange

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**Abstract:** Darwin’s theory of natural selection raises two critical questions: What is ultimately being selected? Why is it inevitably being innovative? In response, the five key theories of evolution begin with species, genes, organisms, systems, processes. And they lead to a sixth key theory that begins with exchange. Specifically, I re-configure Darwin-Peirce-Einstein’s special theories of evolution-semiosis-relativity in a radical theory of exchange  $\leftrightarrow$  signification  $\leftrightarrow$  value. In this context I suggest that the relative signifying relations of exchange are both exuberantly innovative and restrictively selective and they drive the process of evolution. Instead of beginning with a *post hoc* theory of restrictive selection, therefore, I begin with an *ad hoc* theory of exuberant innovation. Every so-called thing in this so-called universe is actually no-thing more and no-thing less than a co-incidental articulation of the long evolutionary history of the relative signifying relations of exchange—beginning with energy  $\leftrightarrow$  mass  $\leftrightarrow$  mass  $\leftrightarrow$  energy. In fact, time itself can be understood as the rhythmic syntax of exchange. While some recent general theories of evolutionary history begin with energy flows, quantum bits, emergent complexities, etc., I suggest that the dynamic of exchange evolves nature, the practice of exchange evolves culture, the syntax of exchange evolves history. Here we arrive at the proof that is to be demonstrated: Evolution = Exchange.

**Keywords:** Evolution, Exchange, Innovation, Selection, Relativity, Time, Semiotics, Theory, Writing, History

## 1. Darwin

As I was saying,\* a great mystery lies at the heart of Darwin’s great book. Instead of discovering the *origin* of species, he discovers the *never-ending-process* of evolution:

As many more individuals of each species are born than can possibly survive; and, as consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form. (1998: 6)

That is, Darwin discovers the never-ending-process of population  $\rightarrow$  competition  $\rightarrow$  location and variation  $\rightarrow$  selection  $\rightarrow$  modification—plus inheritance. In other words, Darwin discovers that the origin has no originality. And that discovery brings us deeper into the great mystery. As a result of his radical theory of evolutionary time, Darwin realizes that he can’t actually define a species: “Certainly

no clear line of demarcation has yet been drawn between a species and a sub-species...or again between a sub-species and well-marked varieties, or between lesser varieties and individual differences” (1998: 44). And then he states, “I look at the term species, as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other, and that it does not essentially differ from the term variety... [which] is also applied arbitrarily ...” (1998: 45). In other words, Darwin discovers that the species has no specificity. And that discovery leads to further complications. Is it the undefinable species, sub-species, or variety that is ultimately being selected? Is it the undefinable identity, similarity, or difference? In other words, Darwin discovers that the selection has no selectivity. So if the origin has no originality, the species has no specificity, the selection has no selectivity, then how can Darwin write a book, *On the Origin of Species by Means of Natural Selection* (1859)?

Darwin’s radical diachronic rhetoric of apparent difference explodes Linnaeus’ conservative synchronic grammar of formal similarity. That is, the temporal flow of *On the Origin of Species* (1859) bursts open the spatial grid of *Systema Naturae* (1758). It bursts open the “lines

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\* This essay develops the argument I first outlined in, “A Theory of No-Thing” (2019), and, ...*The Time Being: Allegories of Exchange* (2000). I revisit select passages from each text in order to re-orient the reader.

of demarcation.” As a result, Darwin confronts the radical implications of his radical theory of evolutionary time: the origin has no originality, the species has no specificity, the selection has no selectivity. He opens his great book with the suggestion that the origin of species is “that mystery of mysteries” (1998: 3), but he actually uncovers a greater mystery. If it isn’t the species *per se* that is ultimately being selected, then what is ultimately being selected? And yet instead of solving that great mystery, Darwin retreats from it. He retreats from the radical implications of his radical theory of evolutionary time.

Immediately after acknowledging that he can’t distinguish a species from a sub-species and a sub-species from a variety, he thinks about returning to the Linnaean project of drawing up a new table of them: “Guided by theoretical considerations, I thought that some interesting results might be obtained in regard to the nature and relations of the species which vary most, by tabulating all the varieties in several well-worked floras” (1998: 45). And then again he hesitates: “At first this seemed a simple task, but Mr. H.C. Watson... soon convinced me that there were many difficulties, as did subsequently Dr. Hooker in even stronger terms” (1998:45). And presumably these difficulties include the problem of trying to re-impose the taxonomic grid of formal similarity on the evolutionary flow of apparent difference. They include the problem of trying to spatialize time, catalogue time, stop time. How does Darwin resolve these difficulties? He doesn’t. He states, “I shall reserve for my future work the discussion of these difficulties, and the tables themselves of the proportional numbers of the varying species” (1998: 45). In other words, Darwin puts off the discussion of the radical implications of his radical theory of evolutionary time for another time.

So how can Darwin proceed? A few pages later he explains,

We have seen that there is no infallible criterion by which to distinguish species and well-marked varieties; and in those cases where intermediate links have not been found between doubtful forms, naturalists are compelled to come to a determination by the amount of differences between them, judging by analogy whether or not the amount suffices to raise one or both to the rank of species...I have endeavored to test this numerically by averages. (1998: 48)

This is a very scientific-sounding way of saying that if he and his fellow naturalists want to continue using the

Linnaean classification system, then they must guess which particular example fits into which particular category. They must fudge the diachronic details in order to squeeze a particular example into a synchronic box. In other words, Darwin develops his own version of the fuzzy logic of identity, fuzzy grammar of similarity, fuzzy rhetoric of difference. And the struggle to define the identity of a species continues to this day. As Zimmer (2024) notes, contemporary “...biologists cannot agree on what a species is. A recent survey found that practicing biologists use 16 different approaches to categorizing species” (2024: D1).

The multiple contradictions of Darwin’s narrative—time/space, difference/identity, appearance/essence, etc.—are fantastically ironic. However, instead of suggesting, in the spirit of Derrida (1966), that Darwin’s phenomenal rhetoric of time and structural logic of space deconstruct one another, I want to return to the radical implications of his radical theory. I want to return to the great mystery that lies at the heart of his great book: If it isn’t the species *per se* that is ultimately being selected, then what is ultimately being selected? How can we talk about the *origin* of species—or, for that matter, the *origin* of anything? How can we advance Darwin’s special theory of evolutionary biology? How can we write a new general theory of evolutionary history? In order to answer these questions we must first take a closer look at the different ways in which Darwin’s writing strategies define his thinking strategies—and vice versa.

Peirce states that, “The science of semiotics has three branches...pure grammar, logic proper...pure rhetoric” (CP: 2.229). If his modern version of the medieval trivium holds true for every form of signification, then no wonder Darwin unwittingly recapitulates the classical version of it in the concluding remarks of his great book. That is, Darwin invokes what amounts to a radical neo-Socratic rhetoric of the exigency of appearance: “...we shall have to treat species in the same manner as those naturalists treat genera, who admit that genera are merely artificial combinations made for convenience. This may not be a cheering prospect; but we at least will be freed from the vain search for the undiscovered and undiscoverable essence of the term species” (1998: 392). He invokes what amounts to a moderate neo-Aristotelian grammar of the teleology of form: “And as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress toward perfection” (1998: 395). And he invokes what amounts to a conservative neo-Platonic

logic of the ontology of essence: “Therefore I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was breathed by the Creator” (1998: 391).

In fact, throughout his narrative, Darwin unconsciously transposes the classical mimetic hierarchy of metaphysics and transforms it into the modern mimetic hierarchy of evolution. In *The Republic* (ca. 375 B.C.), Plato appropriates the style and distorts the substance of Socratic dialectics in order to legitimate his Platonic metaphysics. His Platonic-Socrates explains his mimetic hierarchy to his Platonic-Glaucou:

We get, then, these three couches, one, that in nature, which, I take it, we would say that God produces, or who else?

No one, I think.

And then there was one which the carpenter made.

Yes, he said.

And one which the painter. Is not that so?

So be it.

(*Republic*, X.597b; 1996: 822)

The Platonic-Socrates argues that God creates the metaphysical essence of all couches; the carpenter constructs the physical form of a particular couch; the painter captures the dialectical appearance of that couch. So, in all cases, the heavenly idealized couch defines the earthly realized couch which defines the watery visualized couch. That’s why—despite the fact that there are innumerable kinds of couches—we can recognize each different variety as a couch.

And yet how can we possibly have any knowledge of the heavenly ideals? The Platonic-Socrates argues that, before we are born, our immortal soul transmigrates through the heavenly realms. As a result, when we are born, our mortal mind retains an innate memory of the heavenly ideals (*Phaedo*, 72-76; 1996: 54-60). In this way the Platonic logic of metaphysics supposedly trumps the Aristotelian grammar of physics which supposedly trumps the Socratic rhetoric of dialectics. So, in the classical Greek mimetic hierarchy, the painter’s couch merely imitates the carpenter’s couch which merely imitates God’s couch. And in this way Plato replaces the radical-dialectical Socratic-Socrates of the *Apology*—who re-evaluates the state-sanctioned mimetic hierarchy of value—with the conservative-metaphysical Platonic-Socrates of *The Republic*—who re-asserts the state-sanctioned mimetic hierarchy of value.

In this context we can recognize how Darwin writes—and so thinks—within the heuristic framework of classical philosophy. And we can recognize how he re-orientates it. While Plato’s mimetic hierarchy connects sky→earth→water, essence→form→appearance, logic→grammar→rhetoric, Darwin’s mimetic hierarchy connects depth→median→surface, identity→similarity→difference, logic→grammar→rhetoric. Plato begins with heavenly essential ideals, Darwin begins with earthly identical species. And, in fact, recent genetic research does suggest that all living animals did evolve from a common ancestor that existed about 650 million years ago. Similarly, it suggests that all life on earth did evolve from a common ancestor that existed about 4 billion years ago. In a remarkable feat of paleo-genetic synthesis, Paps and Holland (2018) infer the identity of 6,331 genes belonging to the first animal (cf. Zimmer, 2018: D3). Similarly, in another remarkable feat of paleo-genetic synthesis, Weiss, Martin and their colleagues (2016; 2018) infer the identity of 355 genes belonging to LUCA, the Last Universal Common Ancestor, a single-celled bacterium-like microorganism (cf. Wade, 2016: D1). However, it requires a great ladder of metaphysics, a great chain of being, or a great leap of faith to get from these primeval genomes to what Darwin calls the breath of the Creator. And it requires some kind of biological ontology to define the essential identity of a species. No wonder, then, that Darwin quickly discovers that he can’t actually define a species.

So we return to the great mystery that lies at the heart of Darwin’s great book: What is ultimately being selected? And that great mystery is wrapped in a great enigma: Why is it inevitably being innovative? Darwin notes that, “The result of the various, quite unknown, or dimly seen laws of variation is infinitely complex and diversified” (1998: 12). He confesses that, “Our ignorance of the laws of variation is profound” (1998: 137). And again, “We are profoundly ignorant of the causes producing slight and unimportant variations...” (1998: 161). Darwin prefers to plead ignorance of the causes of innovation if the only alternative is to preach certainty of the principles of creationism. Similarly, he argues for natural selection and against intelligent design. He suggests that slight variations—no matter how they’re generated—when naturally selected down the ages can even explain the evolution of complex forms like the eye (1998: 154).

However, Müller (2003) reminds us that natural “... selection has no innovative capacity: it eliminates or

maintains what exists. The generative and ordering aspects of morphological evolution are thus absent from evolutionary theory” (2003: 51). In other words, “natural selection” is a *post hoc* name Darwin assigns to Malthusian populations and Hobbesian competitions in Lyellian locations. Then again, he recognizes that the “recurring struggle for existence” is only one example of the varied “mutual relations of all the beings” (1998: 6)—and he also recognizes that natural selection is supplemented by sexual selection (1998: 73). Furthermore, despite his anthropomorphic analogy between artificial selection and natural selection in the first two chapters of his great book, he argues that natural selection has no agency or intention. That is, Darwin’s 1859 metaphor of “natural selection” (1998: 6) isn’t the biological equivalent of Smith’s 1776 metaphor of the “invisible hand” (1976: 477).

In short, Darwin’s theory of population→competition→location and variation→selection→modification—plus inheritance—explains in broad terms *how* evolutionary biology works, but it doesn’t explain in specific terms *what* is ultimately being selected or *why* it is inevitably being innovative. It explains in broad terms the evolutionary adaptations of life on earth—including portmanteau animals like kangaroos, platypuses, giraffes—but it doesn’t explain in specific terms the exuberant innovations of life on earth. Why kangaroos? Why platypuses? Why giraffes? And, for that matter, Why life? Since Darwin doesn’t know exactly what nature selects or exactly why nature innovates, then his theory of natural selection puts the cart before the horse. That is, Darwin’s retrospective theory privileges utilitarian selection over exuberant innovation. As a result, he re-domesticates evolutionary time. In this way Darwin’s argument returns us to the critical questions of selection and innovation, evolution and theory, thinking and writing. And so do the arguments of his successors.

## 2. Successors

Mendel (1865) and his heirs attempt to resolve the multiple contradictions of Darwin’s argument and thus solve the great mystery wrapped in the great enigma in Darwin’s great book. They suggest that it isn’t the species *per se* that is ultimately being selected and that is inevitably being innovative, rather it’s the gene. Klein, for example, opens *The Human Career* (2009)—his comprehensive textbook survey of recent advances in evolutionary anthropology—with the confident assertion that, “The species is the least

arbitrary and the most fundamental evolutionary unit, and it must be understood before any consideration of evolution, even one focused tightly on a single species like *Homo sapiens*” (2009:1). Why is Darwin so nervous about defining a species and why is Klein so confident about it? Precisely because Darwin knows nothing about genetics and Klein knows a lot about it. He continues: “...no matter how detailed the resemblances between two groups of organisms, if individuals cannot exchange genes between groups, the two populations must be assigned to different species” (2009: 1; cf. Arnold, 2007, 2015; Kulmuni *et al.*, 2020). In short, a species can be defined as geographically associated groups of organisms that successfully exchange genes. And most evolutionary biologists would acknowledge the pragmatic efficacy of that working definition—even if it remains problematic for the precise taxonomic categorization of many microorganisms as well as for the precise taxonomic distinctions between and among differences, varieties, sub-species and species.

So instead of focusing on the origin of species *per se*, some 20<sup>th</sup> century evolutionary biologists develop the “Modern Synthesis” (Huxley, 1942)—combining and advancing Darwin’s theory of natural selection and Mendel’s theory of genetic inheritance. Specifically, they study—and their successors continue to study—mechanist-cybernetic genetics, molecular-chemical genetics, population-statistical genetics and many related topics. In this way they shift the focus of analysis from the mimetic hierarchy of evolutionary biology to the mimetic hierarchy of evolutionary genetics: i.e. from the deep logic of species→median grammar of varieties→surface rhetoric of differences to the deep logic of genes→median grammar of genotypes→surface rhetoric of phenotypes. In short, they shift the focus from species to genes. Here we return to the critical questions of selection and innovation, evolution and theory, thinking and writing.

And so we must ask: What, exactly, is a gene? Population-statistical correlations and molecular-chemical helixes only begin to answer that question. In turn, Hamilton opens his classic mechanist-cybernetic sociobiological essay, “The evolution of altruistic behavior” (1963), with the metaphor of the altruistic gene: “As a simple but admittedly crude model we may imagine a pair of genes *g* and *G* such that *G* tends to cause some kind of altruistic behavior while *g* is null” (1963: 354). Then, in the very next paragraph, Hamilton’s “crude” genetic metaphor becomes a sophisticated genetic metaphysics: “Thus a gene causing altruistic behavior

towards brothers and sisters will be selected only if the behavior and the circumstances are generally such that the gain is more than twice the loss..." (1963: 355; cf. 1964). Since siblings share certain percentages of certain copies of certain genes, then the enhanced fitness of the beneficiary-recipient-sibling leads to the enhanced fitness of the recipient's copy of the donor's altruistic gene. So the theory of kin selection—which is, ultimately, a theory of genetic selection—explains how multiple copies of the altruistic gene can propagate throughout a population despite the reduced fitness of the altruistic-donors. However, we can't forget how quickly Hamilton's "crude" *metaphor* of a gene that "we may imagine... tends to cause" altruistic behavior becomes Hamilton's sophisticated *metaphysics* of "a gene causing altruistic behavior." Plato begins with heavenly essential ideals, Darwin begins with earthly identical species and Hamilton begins with chthonic structural genes. In effect, Hamilton suggests that structural genes program functional genotypes which generate phenomenal phenotypes. As a result, he and his fellow sociobiologists complete the modern scientific transposition, transformation and *inversion* of Plato's ancient mythic mimetic hierarchy. The metaphysical descent, sky-essence→earth-form→water-appearance, becomes the physical ascent, deep-gene→median-genotype→surface-phenotype. In this way metaphysics becomes physics—and physics becomes metaphysics.

In turn, Trivers (1971) takes up Hamilton's *inverted* genetic metaphor and metaphysics and suggests that reciprocal altruism enhances the fitness of both participants—even when practiced across species. So, for example, when a wrasse scours a grouper, the wrasse gets a good meal and the grouper gets a good cleaning. As a result, they each have a greater chance of passing down copies of the theoretical "gene" that structurally "causes" reciprocal altruism. In turn again, we can't forget how quickly Hamilton and Trivers' inverted *metaphor* and *metaphysics* of the altruistic gene becomes Wilson's inverted *metanarrative* of the altruistic gene. Wilson (1975) states that "...the central theoretical problem of sociobiology [is] how can altruism, which by definition reduces personal fitness, possibly evolve by natural selection" (2000: 3). He offers Hamilton's solution: i.e. kin selection which is, ultimately, genetic selection, which is, ultimately, genetic metaphysics.

In effect, Hamilton, Trivers and Wilson are working out the sociobiological mimetic hierarchy and economy

of genetic exchange. And they are basing that mimetic hierarchy and economy on the structural causality of the altruistic gene. According to Plato the heavenly essence of altruism defines the earthly form of altruism which defines the watery appearance of altruism. According to Hamilton, Trivers and Wilson the structural gene of altruism defines the functional genotype of altruism which defines the phenomenal phenotype of altruism. Again, the modern sociobiologists invert the classical mimetic hierarchy and, as a result, their new physics becomes their new metaphysics. However, it goes without saying that the science of genetics has led to great advances in the understanding of everything from the color of eyes to the cause of disease. It goes without saying that brilliant work has been done and is being done in understanding the mediated relations of genetic codes and biological organisms. And it goes without saying that the discoveries made by the 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> century genetic researchers rank among the greatest achievements of modern science. It is critically important, therefore, that we recognize how the science of genetics has been and is being written up—how it is being narrated, for example, by the enormously influential school of sociobiology.

Since every scientist who writes up a scientific theory inevitably employs whole sets of metaphors-metaphysics-metanarratives, then every scientist must ask a series of questions: How do the classical mimetic hierarchies and mimetic economies of Plato's heavenly-essence→Aristotle's earthly-form→Socrates' watery-appearance evolve the inverted modern mimetic hierarchies and mimetic economies of modern science? In turn, how do the inverted modern mimetic *hierarchies* of analysis (e.g. chthonic-structure → earthly-function → watery-phenomenon); the inverted modern mimetic *registers* of analysis (e.g. mechanist-cybernetics→molecular-chemistry→population-statistics); and the inverted modern mimetic *levels* of analysis (e.g. deep-logic→median-grammar→surface-rhetoric) evolve the modern mimetic *theories* of nature and how do these modern mimetic *theories* evolve them? How do the inverted modern mimetic hierarchies-registers-levels represent different time-scales? How do they define and re-define the modern mimetic economies of nature? In short, how does the evolutionary history of scientific writing generate the heuristic strategies of scientific thinking—and vice versa?

Wilson (1975), for example, argues that, "...the organism is only DNA's way of making more DNA. More to the point, the hypothalamus and the limbic system are engineered to

perpetuate DNA” (2000: 3). He suggests that genes engineer biological systems that manufacture genes. And, suddenly, a genetic *metaphor* becomes a genetic *metaphysics* which becomes a genetic *metanarrative*. It isn’t the high-heavenly-essences that define the median-earthly-forms that define the surface-watery-appearances, rather it’s the deep-structural-genes that define the median-functional-genotypes that define the surface-phenomenal-phenotypes. In this context Wilson occasionally supplements his primary mechanist metaphors with secondary cybernetic metaphors. He suggests, for example, that, “The hypothalamic-limbic system...has been programmed...” in a way that “orchestrates behavioral responses” for the proliferation of genes (2000: 4). He concludes his mechanist-cybernetic metaphysical-metanarrative with the suggestion that the role of sociobiology in the future will be to “reconstruct the history of the machinery” and to “monitor the genetic basis of social behavior” (2000: 575).

In turn, Dawkins (1976) doubles down on Wilson’s mechanist-cybernetic metaphysical-metanarrative: “We are survival machines—robot vehicles blindly programmed to preserve the selfish molecules known as genes” (2006: *xxi*). The genes are the cybernetic software, the brain is the cybernetic hardware and the body is the robot vehicle that obeys their commands. In other words, the mimetic distance between the deep structure of genes and the surface phenomenon of phenotypes is so vast that in order to bridge that mimetic distance Dawkins suggests we need a mechanist-cybernetic metaphysical-metanarrative of selfish genes that code for the propagation of selfish genes and robot bodies that automatically obey that code. In this way the mimetic hierarchy of classical philosophy is, once again, transposed, transformed and inverted in modern sociobiology. While the mythical metanarrative of classical philosophy bridges the vast mimetic distance between heavenly metaphysics and watery dialectics, the scientific metanarrative of modern sociobiology bridges the vast mimetic distance between deep structures and surface phenomena.

Then again, we must ask: How does altruistic behavior become “...the central theoretical problem of sociobiology”? Kropotkin (1902) reads Darwin (1859; 1871) through the looking glass of his explicit anarchist economics of communal-interest and shared abundant wealth. So he argues that, for Darwin, “mutual aid” actually plays a larger role in the story of evolution than “mutual struggle.” In contrast, Hamilton (1963; 1964) and his heirs

read Darwin (1859; 1871) through the looking glass of their implicit neoclassical economics of self-interest and hoarded scarce wealth. So they argue that, for sociobiology, “altruistic behavior” actually becomes “the central theoretical problem” of evolutionary theory. And, in order to solve that problem, Hamilton (1963; 1964) and his heirs reverse Smith’s (1776) argument. While Smith suggests that the deist logic of the capitalist market transforms the cost of self-interest into the benefit of communal-interest, Hamilton and his heirs suggest that the cybernetic logic of the genetic market transforms the cost of altruism into the benefit of selfishness. Again, the altruistic gene selfishly reproduces copies of itself when the altruistic-donor-sibling aids the beneficiary-recipient-sibling. And, again, that’s because the beneficiary-recipient-sibling carries copies of the same altruistic gene as the altruistic-donor-sibling. In short, the different looking glasses of anarchist, socialist, Marxist and classical, neoclassical, libertarian economics frame the different modern scientific analyses of natural-cultural-historical exchange in different ways.

So if, for example, we credit the exchange relations of what Hrdy calls, *Mothers and Others* (2009)—that is, if we credit the enormous investment of nurturing the young, not to mention caring for the elderly, as a critical part of the fundamental economics of evolutionary biology instead of as an extraordinary act of evolutionary altruism—then we can agree with Kropotkin that mutual aid, or altruistic behavior, isn’t a critical problem for Darwin’s theory. It’s only a critical problem for the conservative, patriarchal, neoclassical versions of Smith’s theory of enlightened economics (e.g. Becker, 1993; Friedman, 1962; Hayek, 1944) as applied to Darwin’s theory of evolutionary biology (e.g. Dawkins, 1976; Hamilton, 1963, 1964; Wilson, 1975). It’s only a critical problem for the conservative, patriarchal, neoclassical economists who ignore and forget how much time and effort their grandmothers and mothers, aunts and wives, partners and companions are investing in childcare, eldercare, and homecare while they pursue their academic careers. The conservative, patriarchal, neoclassical economists gloss over the classical deist ethos of Smith’s deist logic as outlined in his earlier study, *A Theory of Moral Sentiments* (1759). Similarly, the conservative, patriarchal, neoclassical sociobiologists gloss over the modern progressive ethos of Darwin’s progressive logic as outlined in his later study, *The Descent of Man* (1871). As a result, altruistic behavior becomes “the central theoretical problem” of conservative, patriarchal, neoclassical

sociobiology. Ironically, Hrdy herself is a dedicated sociobiologist who studied with Trivers and Wilson at Harvard. And yet instead of a mechanist-cybernetic theory of selfish genes, she develops an evolutionary-behaviorist theory of cooperative breeding. In other words, the logic of the natural science of genetics, the grammar of the social science of economics, the rhetoric of the human science of semiotics—as articulations-representations-interpretations of the relative signifying relations of exchange—are inextricably entangled in both the conservative-formalist and progressive-critical narratives of evolutionary theory.

Then again, no one has ever found a gene that codes for altruism, or a gene that codes for selfishness. The Hellenic Gnostics—who synthesize Zoroastrianism, Judaism, Christianity, neo-Platonism—project a supreme god of goodness and light into the highest heavens and a demiurge god of evil and darkness into the lower heavens. The Modern Sociobiologists—who synthesize Darwinism, Population-Statistical Genetics, Molecular-Chemical Genetics, Mechanist-Cybernetic Genetics—project a demiurge gene of altruism and cooperation into the median depths and a supreme gene of selfishness and competition into the deepest depths. The Gnostics struggle throughout their lives with the forces of good and evil, light and dark. The Sociobiologists struggle throughout their lives with the forces of altruism and selfishness, reciprocity and hoarding. In short, the modern scientific mimetic hierarchy of gene→genotype→phenotype transposes, transforms and inverts the classical mythic mimetic hierarchy of essence→form→appearance. Similarly, the modern scientific mimetic hierarchy of structure→function→phenomenon transposes, transforms and inverts the classical mythic mimetic hierarchy of metaphysics→physics→dialectics.

In this context Peirce’s definition of the three branches of semiotics can help us trace the evolutionary history of the Classical, Darwinian and Modernist mimetic hierarchies: i.e. Classical essential-logic→formal-grammar→apparent-rhetoric becomes Darwinian species-logic→variety-grammar→difference-rhetoric which becomes Modernist genetic-logic→genotypical-grammar→phenotypical-rhetoric. And that evolutionary history reminds us that the mechanist-cybernetic school of sociobiology is yet another articulation of the so-called structural “paradigm” (Kuhn, 1962)—a term that is itself a structural metaphor—that coalesced in the mid-twentieth-century sciences. The structural “paradigm” is based on the binary logic of the

binary exchanges of the binary neuron, mind, phoneme; binary kin, clan, culture; binary code, equation, computer; binary helix, gene, behavior; etc. Similarly, the binary logic of self-interest and communal-interest, supply and demand, cost and benefit defines the binary rationality of the capitalist market—according to the classical and neoclassical theories of economics. And, as a heuristic gambit, the structural “paradigm” has led to all kinds of insights.

The sociobiologists (Dawkins, 1976; Hamilton, 1963, 1964; Wilson, 1975), for example, analyze the structural logic of cybernetic genes, which the cognitive psychologists (Barkow, Cosmides, Tooby, 1992) suggest generates the functional grammar of algorithmic modes, which the memetic philosophers (Blackmore, 1999; Dennet, 1995; Sperber, 1996) suggest generates the phenomenal rhetoric of viral memes. In short: cybernetic-genes→algorithmic-modes→viral-memes. And so, once again, the sociobiologists, cognitive psychologists, memetic philosophers transpose, transform and invert the classical mimetic hierarchies-registers-levels of metaphysical-essential-logic→physical-formal-grammar→dialectical-apparent-rhetoric with their modern mimetic hierarchies-registers-levels of structural-genetic-logic→functional-modal-grammar→phenomenal-memetic-rhetoric.

And yet there’s another reason why no one has ever found a gene that codes for altruism or a gene that codes for selfishness. Just as Darwin realizes that he can’t actually define a species, so too several leading geneticists realize that they can’t actually define a gene. Should it be defined in the terms of its structural configuration, functional operation, phenomenal articulation? Should it be defined in the terms of its chromosomal location, cellular manifestation, somatic generation? What parts of DNA are parts of a gene, what parts of DNA are not parts of a gene? Just as Darwin ultimately abandons the search for “...the undiscoverable essence of the term species” (1998: 392), so too several leading geneticists now argue that “...a simple and universally accepted definition of the gene *never* existed” (Rheinberger and Müller-Wille, 2017: 4; cf. Griffiths and Stotz, 2013). That is, the more closely we examine the clue of identity, the more quickly it diffuses into a cluster of similarity and a cloud of difference.

Darwin falls back on the fuzzy logic of analogy and averages in order to develop his working definition of a species and the geneticists fall back on that same fuzzy logic in order to develop their working definition of a

gene. As Wagner and Tomlinson put it, “A coding gene, then, is not a discrete material element, but a segment of a more extensive DNA molecule that includes a number of functional elements such that the segment is used by the cell to produce a certain protein” (2022: 6). In fact, instead of thinking in the terms of individual genes, Dupré and Nicholson (2018) explain that, “The development of most traits is now understood to involve features widely distributed across the genome as well as influences from many aspects of the external environment” (2018: 32). So, once again, we return to the great mystery wrapped in the great enigma that lies at the heart of Darwin-Wallace-Mendel’s great theory of evolutionary biology. If an *origin* is undefinable, a *species* is undefinable, a *gene* is undefinable, then one undefinable thing can’t be used to define another undefinable thing. In other words, as the post-modern interpretation of the pre-modern Hindu myth suggests, if the flat earth rests on the back of a turtle and if that turtle rests on the back of another turtle, then it’s turtles all the way down.

No wonder, then, that in response to the critical questions of selection and innovation, evolution and theory, thinking and writing raised by Darwinian Theory and the Modern Synthesis, some evolutionary biologists propose an Extended Evolutionary Synthesis. They shift the orientation and focus of evolutionary biology yet again from the mimetic hierarchies of species→varieties→differences and genes→genotypes→phenotypes to the mimetic interactions of organisms↔developments↔ecologies (Jablonka and Lamb, 2020; Lala *et al.*, 2015; Müller, 2017). In this context the developmental biologists suggest that since an organism actively constructs its niche, then it actively alters the ecological parameters of natural selection—and thus it actively alters the evolutionary development of its species. And if we recognize culture itself as a constructed social niche, then we can understand why the developmental biologists continue to extend their extended theory of an evolutionary feedback loop with further studies of evolutionary culture (Lala, 2017), evolutionary consciousness (Ginsburg and Jablonka 2019; 2022), evolutionary causation (Uller and Lala, 2019) and other key topics.

In turn again, in response to these same critical questions, some evolutionary biologists propose an Integrative Evolutionary Synthesis. Instead of *extending* the Modern Synthesis they want to *replace* it with a biosemiotic theory of the mimetic interactions of systems↔networks↔dynamics (Barbieri, 2008; 2019a; 2019b;

Favareau, 2010; Hoffmeyer, 1996; 2002; 2008; Noble, 2012; 2016; 2021). The integrative biologists draw on Pierce’s semiotic theory in order to study the natural codes of the natural world. And so they argue against analytic reductionism and they argue for synthetic complexity. Noble (2021), for example, suggests that there is no privileged level of codes. Instead of reducing biological complexity to sociobiological genetics, an integrative biosemiotics re-connects every part of a biological system via the feedback loops of its interactive networks. In this context Noble proposes a multilevel theory of “biological relativity” analogous to Einstein’s multilevel theory of “general relativity” (2021: 12; 2016; 2012).

In turn yet again, in response to these same critical questions, some evolutionary biologists propose a Processual Evolutionary Synthesis. Instead of beginning with species, genes, organisms, or systems, they begin with the mimetic interactions of processes↔hierarchies↔dialectics. Specifically, the process biologists study the “hierarchies of processes” which “in broadly mereological terms” range from “molecules, cells, organs” to “populations”—and “cultures” (Dupré and Nicholson, 2018: 3). And so they argue that “energy flows,” “life-cycles” and “ecological interdependence” account for both the persistent stability and the ongoing changes of “thing-like” biological entities (2018: 3-4). In this context they trace the history of process philosophy from Heraclitus’ “everything flows” (ca. 500 B.C.) to Hegel’s “dialectic of mind” (1807) and then again to Whitehead’s “process and reality” (1929). In turn, they explain how that philosophical tradition inspires the 20<sup>th</sup> century organicist biologists who, in turn again, inspire their theory of process biology (Dupré, 2021; Dupré and Nicholson, 2018: 3-45; Nicholson and Gawne, 2015: 345-81). And yet J. Jaeger notes that process biology also emerges from quantum physics. He cites Bohm’s suggestion that, “‘There is really no ‘thing’ in the world’” (2018: xi; 1999: 12). Instead of focusing on essential *things*, the quantum physicists and process biologists focus on relative *relativities* and dialectical *processes*. And so Dupré and Nicholson offer a pragmatic-functional definition of their theory: “...processes are individuated...by what they do. A series of activities constitute an individual process when they are causally interconnected or when they come together in a coordinated fashion to bring about a particular end” (2018: 13).

In short, Darwin analyzes the natural selection of species; the Modern Synthesizers analyze the generative structures of genes; the Extended Evolutionary Synthesizers



analyze the developmental interactions of organisms; the Integrative Evolutionary Synthesizers analyze the biosemiotic relativity of systems; and the Processual Evolutionary Synthesizers analyze the dialectical hierarchy of processes. I can't do justice here, in the limited space of this essay, to the sophisticated complexity of these five key theories of evolutionary biology, or to the profound insights and critical discoveries they have enabled. In any case, I don't have the requisite expertise necessary for that kind of review. Instead, I'm asking radical questions about the semiotic presuppositions that underwrite these five key theories. And, in this context, I'm outlining the different ways in which they transpose, transform and invert the classical mimetic hierarchies-registers-levels of essence→form→appearance: i.e. species→variety→difference; gene→genotype→phenotype; organism↔development↔ecology; system↔network↔dynamic; process↔hierarchy↔dialectic. I'm suggesting that these five key theories articulate five different implicit and explicit mimetic economies of exchange that link their respective hierarchies-registers-levels. And I'm noting that as these five key theories evolve, they shift the focus of evolutionary biology from essential things to relative relations. As a result, they lead to a sixth key theory of the long evolutionary history of the relative signifying relations of exchange.

### 3. Exchange

Heraclitus (ca. 500 B.C.) declares, "All things are an equal exchange for fire and fire for all things, as goods are for gold and gold for goods" (Kirk and Raven, 1971: 199; cf. Waterfield, 2009: 42). As a radical pre-Socratic philosopher, Heraclitus suggests that fire is the fundamental element of nature and gold is the fundamental element of culture. And yet, more astutely, he suggests that exchange is a universal dynamic that connects nature and culture. So instead of focusing on Heraclitus' elemental nouns, "fire" and "gold," we can focus on his dynamic verb, "exchange." Similarly, instead of focusing on Klein's essential nouns, "gene" and "species" we can focus on his dynamic verb, "exchange." In fact, Heraclitus anticipates Einstein by approximately twenty-four-hundred years:  $F = T$  (ca. 500 B.C.) becomes  $E = mc^2$  (1905). Instead of Heraclitus' "fire," we have Einstein's "energy;" instead of Heraclitus' "things," we have Einstein's "mass." And we can note that both theories begin with the binary signifying relations of exchange: fire↔things and energy↔mass.

Since the binary signifying relations of exchange are the most basic kind of signifying relation of exchange—it takes two to tangle and two to tango—then they have evolved the basic binary symmetries of the natural world: e.g. helixes and bodies. They have evolved the basic binary theories of the structural sciences: e.g. genetics and cybernetics. And they have evolved the basic binary forms of the mathematic equation: e.g.  $2 + 2 = 4$  and  $E = mc^2$ . The so-called equal sign in Einstein's so-called equation, therefore, isn't a sign of identity—it doesn't mean that energy *is-the-same-thing-as* mass times the speed of light squared. If that were the case, then every so-called equation in every modern science would be a tautology—a repetition of the identity of identity—and it wouldn't teach us anything new. Instead, the so-called equal sign in every so-called equation shouts, "THIS can be EXCHANGED for THAT!" It not only articulates the relative relativity of the non-identity of non-identity, but also the relative relativity of the value-of-value of each so-called thing being exchanged.

The so-called equal sign in Einstein's so-called equation, therefore, reminds us that energy can be exchanged for mass and mass for energy. It reminds us that energy can be understood as temporalized mass and mass can be understood as spatialized energy. While our empiric-analytic discourses break down the hard facts of the natural world into distinct categories, like "energy" and "mass," leaving us to discover their signifying relations, our semiotic-synthetic discourses begin with the signifying relations of the natural world, like "energy↔mass↔mass↔energy," enabling us to trace their evolutionary histories. In this context we can re-interpret the so-called equal sign in every so-called equation as a trail marker in an algorithmic narrative of exchange that articulates-represents-interprets the relatively relative signifying relations of exchange—like the linguistic narrative of this proof. And so we can recognize that writing with numbers, symbols, letters and/or words about exchange is itself a reflexive practice of exchange.

In fact, we are exchanging one word for another word in the displaced time where and when I am writing these words and in the displaced time where and when you are reading them. And these extended reciprocal signifying practices of exchange evolve these extended reciprocal signifying relations of exchange which evolve these extended reciprocal signifying pathways of exchange which evolve this extended reciprocal signifying narrative of exchange which evolves this extended reciprocal signifying proof of

exchange. Instead of thinking in the terms of synchronic binary equal signs and binary equations, therefore, we can think in the terms of diachronic algorithmic pathways and algorithmic narratives. In other words, the binary signifying relations of exchange are only one kind of signifying relation—and they can't be separated from their evolving ecologies of exchange. The analytic reduction of the relative signifying relations of exchange to their spatial binary structures belies their temporal fluid dynamics. As a result, the structural theories of the structural sciences belie the evolutionary theories of the evolutionary sciences.

The 17<sup>th</sup>, 18<sup>th</sup>, 19<sup>th</sup> century natural histories give way to the 20<sup>th</sup> century natural sciences when the focus of scientific analysis shifts from the so-called surface level of diachronic sequences to the so-called deep level of synchronic systems: e.g. structural mathematics-physics-chemistry-genetics, etc. The same is true of the 20<sup>th</sup> century social sciences: e.g. structural anthropology-sociology-history-economics, etc. And the same is true of the 20<sup>th</sup> century human sciences: e.g. structural psychology-philosophy-aesthetics-linguistics, etc. No wonder, then, that many 21<sup>st</sup> century natural scientists are still struggling to re-integrate the mimetic hierarchies-registers-levels of deep-structural-logic (e.g. genes), median-functional-grammar (e.g. genotypes), surface-phenomenal-rhetoric (e.g. phenotypes) in the mimetic economies of their scientific methodologies. And yet we shouldn't substitute method for theory, or theory for method. Instead, like Socrates, we should ask radical questions—especially about the so-called paradigms of truth.

In this context I suggest that we can replace the so-called equal sign, “=,” in every so-called equation with the exchange sign: “ $\leftrightarrow$ .” Instead of repeating the misnomer, “equation,” we can employ the word, “algorithm,” as in the phrase, “algorithm of exchange.” Every so-called equation—and every rightly-named algorithm—is just a tiny fragment of the long evolutionary history of the relative signifying relations of exchange. A so-called equation represents just one signifying relation of exchange, or just a few signifying relations of exchange. It represents just a few signifying numbers, symbols, letters excised from the long, complex, hieroglyphic narrative of the long, complex, evolutionary history of the relative signifying relations of exchange that articulates this 13.7 billion year old universe. In this context we can recognize the relative relativity of the non-identity of non-identity. We can re-configure Darwin-Peirce-Einstein's *special theories* of evolution-semiosis-relativity in a *radical theory* of exchange $\leftrightarrow$ signification  $\leftrightarrow$ value. Then we

can use that new *radical theory* of evolutionary semiotics to write a new *general theory* of evolutionary history.

Peirce (1906) suggests that, “The entire universe is perfused with signs, if it is not composed exclusively of signs” (CP, 1958: 5.448). And that's why, in a letter addressed to Lady Welby (1908), he explains that,

It has never been in my power to study anything—mathematics, ethics, metaphysics, gravitation, thermodynamics, optics, chemistry, comparative anatomy, astronomy, psychology, phonetics, economics, the history of science, whist, men and women, wine, metrology, except as a study of semeiotic. (Weiner, ed., 1958: 08)

Instead of suggesting that human beings are god-like signifying subjects who bestow god-like signifying meanings upon stone-like meaningless objects—i.e. the universe—Peirce suggests that both human beings and the universe are sign-like articulations of *never-ending-semiosis*. Instead of the Copernican universe centered by the sun, the Peircean universe is decentered by the sign. And that proposition leads Peirce to ask: How does the dialectical-semiotic mind engage the evolutionary-semiotic universe? He answers that question with his dialectical-semiotic theory of object $\leftrightarrow$ representamen $\leftrightarrow$ interpretant. We become aware of an object through its signifiers and then, as members of a particular community of interpreters, we interpret those signifiers until we arrive at a consensus of truth about them. In turn, we ourselves are signifiers whose significations are further interpreted by our own community and by other communities. And so we pedal our dialectical-semiotic tricycles, with their wheels within wheels, into the future (cf. Hookway, 1985).

In this context Peirce argues that we only know ourselves, others and the world around us via the signifiers we are in the process of individually and collectively interpreting (cf. Buchler, 1955: 98-119; Rodríguez Higuera, 2023). As Colapietro (1989) notes, “...for Peirce, the repudiation of the Cartesian starting point means the recovery of flesh-and-blood actors who are continuously defining themselves through their give-and-take relationships with both the natural world and each other” (1989: *xix*). In effect, Peirce re-grounds Descartes' (1637) structural-logical rationalist epistemology, Kant's (1781) functional-grammatical formalist epistemology and Hegel's (1807) phenomenal-rhetorical idealist epistemology in his dialectical-semiotic “pragmaticist” epistemology.

Then again, Peirce's special theory of dialectical semiotics, i.e. his pragmaticist epistemology, is inseparable from his general theory of evolutionary semiotics, i.e. his universal cosmology. He argues that everything in the universe already "stands" in a signifying relation to everything else and so these signifying relations don't originate with, or depend upon, our species. The actual interpretants of signifiers are not necessarily the human interpreters of signifiers. In fact, our species, like every other species, is itself a further evolutionary articulation of these signifying relations—and we create new ones. Again, we interpret and re-interpret natural and cultural signifiers until we reach a consensus of truth about them. And, for Peirce's community of interpreters, the logic of logic, logic of semiosis, and logic of science represent the highest forms of truth. However, it's worth noting that, for other communities of interpreters, myth and religion, theology and philosophy, economics and politics, etc. represent the highest forms of truth. In turn, all these communities and interpreters, truths and discourses are, themselves, endlessly interpreted and re-interpreted.

Peirce's father was a highly accomplished professor of mathematics at Harvard and he tutored his young son by setting him mathematical problems. In turn, as a precocious teenager, Peirce began his life-long fascination with the science of logic. In turn again, as a twenty-year-old student, he graduated from Harvard in 1859 with a degree in chemistry (cf. Burch, 2024). No wonder, then, that Peirce privileges the logic of logic, logic of semiosis and logic of science in his analytic essays: he is continuing his conversations with his father. And no wonder, then, that Peirce analyzes the dialectical logic of semiosis in his triadic schemas, catalogues the functional grammar of semiosis in his triadic tables, and engages the phenomenal rhetoric of semiosis in his triadic essays: he is updating the medieval trivium—via Descartes-Kant-Hegel—as the modern trivium. I can't do justice here, in the limited space of this essay, to the richness and complexity of Peirce's mimetic hierarchy and economy of logic→grammar→rhetoric. However, I can note that he never fully re-integrates that mimetic hierarchy and economy in a synthetic narrative. He re-writes Hegel's idealist dialectic of absolute mind↔objective mind↔subjective mind as the pragmaticist dialectic of firstness↔secondness↔thirdness, but he doesn't re-write Hegel's idealist history as a pragmaticist history. He produces hundreds of short analytic essays, but he never completes his long synthetic book, *A Guess at a Riddle*.

In this context I can clarify my definition of exchange ↔signification↔value: "to exchange" means "to put in relation" and therefore "to signify" the relative values of the so-called things being exchanged as well as the relative values of the so-called things exchanging them. In short, the relative signifying relations of exchange articulate the relative value-of-value. They are the natural *interpretant* without necessarily being the cultural *interpreter*. And in this context we can recognize that while the mathematics and physics of the relative signifying relations of exchange evolve the chemistry and biology of them, the earlier articulations don't determine the later articulations and the later articulations can't be reduced to the earlier articulations. And that is precisely because as the relative signifying relations of exchange evolve, they loop back on themselves and articulate new intensities of dynamic integrated complexity. These new intensities, as relatively relative signifying relations of exchange, can't be explained by their objectified parts and they can't be reduced to their objectified parts—or even to their nascent objectified parts. And therefore we can resist the temptation to translate the legitimate discourses of empirical materialism, experimental physics, and logical positivism into the legitimation discourses of every science. So instead of thinking in the reductive terms of essential things—e.g. quantum strings→loops→membranes—we can think in the generative terms of relative relations: e.g. quantum exchanges.

In turn, if the relative signifying relations of exchange articulate the relative value of the so-called things *being exchanged* as well as the relative value of the so-called things that *are exchanging* them, then, as Peirce suggests, the so-called things that exchange signifiers are themselves signifiers. And that explains why the origin has no originality, the species has no specificity, the gene has no genealogy—and the selection has no selectivity. It explains the non-identity of non-identity. However, that doesn't mean that every so-called thing, every so-called one, every so-called value inevitably vanishes into the infinite regression of signification—a post-modern argument that begins, ironically enough, with the pre-modern story of the mythic and biblical, platonic and romantic "fall" from the symbolic plenitude of heaven and nature to the semiotic poverty of earth and culture. Instead, it means that every so-called thing-one-value is no-thing more and no-thing less than a co-incidental articulation of the long evolutionary history of the

relative signifying relations of exchange. It means that the relative value-of-value evolves with and evolves as the relative ecologies of exchange. It means that the counter-historical post-modern theory of the infinite regression of signification can be re-configured as an evolutionary-historical contemporary theory of the relative relativity of signification.

The bright color of the golden poison-dart-frog, for example, broadcasts the signal of its toxicity and so *golden* poison-dart-frogs and their *discriminating* predators evolve together in the rainforest via their relative signifying relations of exchange (cf. Dumbacher *et al.*, 2004; Summers and Clough, 2001). The more clearly the population of poison-dart-frogs signal their toxicity, the more fit they become. In turn, the more clearly the population of their predators read the signal of their toxicity, the more fit they become. Similarly, the dull color of the mottled common-pond-frog scatters the signal of its tastiness and so *mottled* common-pond-frogs and their *discriminating* predators evolve together in the wetland via their relative signifying relations of exchange (cf. Houston, 1973). The more obscurely the population of common-pond-frogs hide their tastiness, the more fit they become. In turn, the less obscurely the population of their predators read the signal of their tastiness, the more fit they become. That is, the relative value-of-value of the bright golden color and the dull mottled color evolve via the respective relative histories of their respective relative ecologies of exchange. And if, once again, we extrapolate these arguments, then, once again, we can see that every so-called thing in this so-called universe—e.g. strings, loops, membranes; particles, atoms, molecules; genes, cells, organisms; differences, varieties, species; processes, ecologies, systems; gifts, goods, commodities; words, thoughts, ideas; and the color of frogs—is no-thing more and no-thing less than a co-incidental articulation of the long evolutionary history of the relative signifying relations of exchange. And so is the relative value of their relative value.

While Darwin, Peirce, and Einstein implicitly and explicitly evoke the semiosis of exchange in the course of their theories, they don't begin with it. They don't make it the radical beginning-without-beginning of their theories. So the particular re-alignment of Darwin's evolutionary biology, Peirce's dialectical semiotics, and Einstein's relative physics that I'm proposing in this essay leads to a new radical theory of evolutionary semiotics that leads

to a new general theory of evolutionary history. Similarly, while Darwin's successors implicitly and explicitly evoke the semiosis of exchange in the course of their theories, they don't begin with it. They don't make it the radical beginning-without-beginning of their theories. So the particular re-alignment of the Modern Synthesis, Extended Evolutionary Synthesis, Integrative Evolutionary Synthesis, and Processual Evolutionary Synthesis that I'm proposing in this essay also leads to a new radical theory of evolutionary semiotics that leads to a new general theory of evolutionary history. And that new general theory can help us trace the long evolutionary history of the dynamic  $\leftarrow \rightarrow$  practice  $\leftarrow \rightarrow$  syntax of natural  $\leftarrow \rightarrow$  cultural  $\leftarrow \rightarrow$  historical exchange  $\leftarrow \rightarrow$  signification  $\leftarrow \rightarrow$  value. It can help us recognize the varied and prolific relative signifying relations of exchange at work within, between and across all the divisions, sub-divisions, and discourses of all the modern sciences.

#### 4. Sciences

As Heraclitus' aphorism implies, the relative signifying relations of exchange connect all the modern sciences.

In the realm of mathematics, for example, as I've already indicated, every so-called equal sign can be replaced by an exchange sign. Mathematics itself, therefore, can be re-interpreted as a science of the relative signifying relations of exchange. And that explains why Carnap (1937) analyzes the logical "logician" foundations of mathematics; von Neumann (1925) analyzes the grammatical "formalist" foundations of mathematics; Heyting (1956) analyzes the rhetorical "intuitionist" foundations of mathematics (Benacerraf and Putnam, eds., 1998). They each in turn privilege a different mimetic level of mathematic signification. In effect, they re-read the modern foundations of mathematics as yet another modern version of the medieval trivium: i.e. the logic-grammar-rhetoric of the structure-function-phenomenon of exchange-signification-value. No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of mathematics.

Similarly, in the realm of quantum physics, G. Jaeger (2021) cites Wilczek's (1999) summary review of 20<sup>th</sup> century quantum physics: "The association of forces (or, more generally, interactions) with the exchange of particles is a general feature of quantum field theory" (2021: 2). And yet Jaeger goes on to note that "...the current received view in the foundations of QFT [is] that quantum particles, in general, cannot be well defined and that defining particles

which could mediate force is additionally problematic...” (2021: 2). Since the quantum field theorists can’t precisely define the quantum particles that delimit a quantum field or the quantum particles that mediate the quantum forces of that quantum field, then the familiar association of force and exchange in quantum physics has been thrown into question (2021: 3). Darwin’s heirs can’t precisely define a species, Mendel’s heirs can’t precisely define a gene and Heisenberg’s heirs can’t precisely define a particle. How does Jaeger solve the problem? In effect, he follows his predecessors’ lead by developing his own version of fuzzy logic, fuzzy grammar, fuzzy rhetoric. He suggests that quantum particles aren’t really particles *per se*, instead they are “compresent collections of properties” at play on the quantum field (2021: 4). And that fuzzy definition of quantum particles enables Jaeger to re-affirm the idea that “...exchange forces correctly describe and explain an overwhelming majority of currently known atomic and subatomic phenomena...” (2021: 4). In turn, Jaeger’s argument can be taken a step further. I suggest that quantum particles—like species, genes, organisms, systems, processes—are no-thing more and no-thing less than co-incidental articulations of the long evolutionary history of the relative signifying relations of exchange, beginning-without-beginning with energy  $\leftrightarrow$  mass  $\leftrightarrow$  mass  $\leftrightarrow$  energy. That is, quantum particles are not only *mediators* of exchange forces, but also *articulations* of them. And therefore their relative significance-force-value evolves from their relative signifying relations of exchange. No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of physics.

Similarly, in the realm of chemistry, chemical exchange reactions articulate another basic kind of signifying relation. The definition of a chemical exchange reaction can be found in any introductory text: e.g. “An exchange reaction is a chemical reaction in which both synthesis and decomposition occur, chemical bonds are formed and broken, and chemical energy is absorbed, stored and released” (Biga *et al.*, 2019). And, again, “Exchange reactions are those in which cations and anions that were partners in the reactants are interchanged in the products.” This kind of double-displacement exchange reaction can be written as the formula, “ $AB + CD \rightarrow AC + BD$ ,” and its variants. So, for example, “ $\text{NaCl}$  (sodium chloride) +  $\text{AgNO}_3$  (silver nitrate)  $\rightarrow$   $\text{NaNO}_3$  (sodium nitrate) +  $\text{AgCl}$  (silver bromide)” (U. Wisc. Chem. Dept., n.d.; cf. Clayden *et al.*, 2012). As the first definition suggests, exchange

reactions, synthesis reactions, decomposition reactions, etc. are all dynamically interactive. The formula,  $\text{H}_2 + \text{O} = \text{Water}$ , for example, represents a synthesis reaction of shared electrons. In turn, that synthesis reaction interacts with certain exchange reactions—and with other reactions and other chemicals—in certain combinations and circumstances which generate the precursor organic compounds of life on Earth. Miller and Urey (1953; 1959) famously cook up a laboratory version of the primeval recipe by combining water vapor, methane, ammonia, hydrogen and jolting the atmospheric mixture with an electric arc. No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of chemistry.

Similarly, in the realm of biology, the basic metabolism of every living organism articulates the universal exchange relations of energy  $\leftrightarrow$  mass  $\leftrightarrow$  mass  $\leftrightarrow$  energy. Every living organism absorbs or ingests some kind of energizing nutrient which it converts into other kinds of energizing physicality and activity. In fact, the relative signifying relations of exchange evolve and articulate every critical signifier of life—e.g. homeostasis, organization, metabolism, growth, information, reaction, interaction, adaptation, genetics, reproduction, evolution, etc. (Malaterre and Chartier, 2019). And, therefore, life itself, as a noun-thing-state, remains difficult, if not impossible, to define (Zimmer, 2021). As I’ve noted, throughout his great book *Darwin* marvels at the mutual relations of nature which, I’m suggesting, can be recognized as further examples of the relative signifying relations of exchange. He notes that “...plants and animals...are bound together by a web of complex relations” and so, for example, “Many of our orchidaceous plants absolutely require the visits of moths to remove their pollen-masses and thus to fertilise them” (1998: 61). He concludes, therefore, “...that the structure of every organic being is related...to that of all other organic beings” in its network of relations (1998: 64). No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of biology.

Similarly, in the realm of genetics, the exchange of genetic codes—e.g. microorganism  $\leftrightarrow$  microorganism, plant  $\leftrightarrow$  plant, animal  $\leftrightarrow$  animal, species  $\leftrightarrow$  species—and the recombination, variation, mutation, modification and selection of them in subsequent generations represent another basic dynamic of nature and a key dynamic of evolution. As I’ve noted, the Modern Synthesis combines Darwin’s theory of natural selection and Mendel’s theory of genetic inheritance in a series of groundbreaking studies

that includes mechanist-cybernetic genetics, molecular-chemical genetics, population-statistical genetics among others. And along with the powerful evolutionary forces of genetic descent with variation, Anderson (1949) and Arnold (2015) argue for the powerful evolutionary forces of genetic transference with variation. They suggest that genetic transference among diverging species evolves new hybrids. In this context Arnold argues for *Evolution through Genetic Exchange* (2007). And in this context, once again, a radical theory of genetic exchange explodes the conservative theory of essential species. I should also note that, for the so-called higher animals, the nexus of genetics, sexuality, desire, life, death generates some of the most powerful narratives of exchange—the stuff that dreams and nightmares are made of. No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of genetics.

Similarly, in the realm of neurology, the nerve network, neural network, and synaptic network are further articulations of the physical-chemical-biological—and electrical—exchange relations of complex biological organisms. Specifically, “...synaptic AMPA-R exchange is essential for maintaining the capacity for bidirectional plasticity” (McCormack *et al.*, 2006). That is, electrochemical, strong or weak, excitatory or inhibitory signals don’t just flow in one direction from neuron to neuron, rather they flow in both directions. In fact, they flow in multiple directions to and from multiple neurons. And therefore “...synaptic plasticity is the ‘hub,’ as it directs subcellular plasticity with regional specificity, and underlies much of circuit-level plasticity” (Brown *et al.*, 2022). In the human brain the semiotic plasticity of the “...86 billion neurons [which] form 100 trillion connections to each other” opens up the countless possibilities of what Lee (2023) calls “connectomics” (Caruso, 2023; Nguyen *et al.*, 2023). No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of neurology.

Similarly, in the realm of ecology, the exchange relations that evolve an ecosystem represent yet another pervasive dynamic of nature. An ecosystem can be described as the cumulative temporal-spatial and local-global “interactions among organisms and their environments” (Chapin, *et al.* 2011: 3). And these terrestrial interactions usually begin with the exchange of the sun’s energy and the earth’s mass (Chapin *et al.* 2011: 11). In other words, an ecology of exchange evolves an ecosystem of exchange—and vice

versa. In the famous concluding paragraph of *On the Origin of Species* (1859), for example, Darwin notes that,

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. (1998: 395)

Again, the ecological phrase, “dependent on each other in so complex a manner,” can be more precisely stated with the semiotic phrase, “articulating the relative signifying relations of exchange in so complex a manner.” And while Darwin begins his concluding paragraph with the peaceful exchanges of natural ecology, he quickly returns to the violent exchanges of natural selection: “Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely the production of the higher animals, directly follows.” Darwin ends his great book with the “grandeur in this view,” with a final nod to the “Creator,” and with an evocation of the “forms most beautiful” that “are being evolved.” (1998: 396). That is, ever mindful of the death of his young daughter, Anne, in 1851, and the faith of his devout wife, Emma, in 1859, Darwin heroically struggles to balance the tragic and comic ethos of his evolutionary-biological narrative. In turn, Darwin’s successors analyze the varied ecological economies of exchange to which they assign different names: e.g. molecular ecology, plant geography, animal ecology, species distribution, biodiversity, ecological communities, ecological statistics, ecological networks, biomes, habitat analysis, food webs, predator-prey ratios, biogeography, keystone species, social ecology, human ecology, cultural ecology, urban ecology, climatology, environmentalism, global warming, etc. (Chapin, *et al.* 2011; Kormondy, 1978; Real and Brown, 1991; Worster, 1994). No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of ecology.

Similarly, in the realm of economics, Smith (1776), Marx (1867) and their heirs analyze the capitalist and communist relations of exchange. Smith, for example, states that the division of labor arises from the human “... propensity to truck, barter, and exchange one thing for another” (1976: 17). And, as I’ve noted, Smith goes on to argue that the deist logic of the capitalist market transforms

self-interest into communal-interest. In turn, Marx suggests that since, by definition, the commodity isn't produced for its immediate use-value, but for its mediated exchange-value, then, "The exchange of commodities begins where [primitive] communities have their boundaries...with other communities..." (1976: 182). In other words, Marx develops the postlapsarian argument of Rousseau and suggests that the commodity is the poison apple in the communal garden. The retrojection of commodity exchange from the border of the primitive community back into the heart of the primitive community signifies the beginning of the inevitable "fall" of "man" from the symbolic plenitude of primitive communism (i.e. immediate use-value) to the semiotic poverty of modern capitalism (i.e. mediated exchange-value). As a result, commodity exchange leads to class division, economic exploitation, worker alienation and the master/slave hierarchy. In this context Marx "scientifically" re-engineers Hegel's idealist-dialectical history machine as a materialist-dialectical history machine. He argues that the dialectical gears of materialist history, i.e. the ongoing class struggle for control of the modes of production, will regenerate the symbolic plenitude of primitive communism on a higher level. That is, the dialectical revolution will enable the workers to reclaim their means of agency and their modes of production. While Smith shifts the focus of analysis from the social relations of exchange to the deist logic of the market, Marx shifts it to the dialectic logic of production. In turn again, Smith's arch-conservative heirs use his deist comedy to legitimate the deregulation of the market economy, while Marx's arch-radical heirs use his dialectic romance to legitimate the dictatorship of the command economy. As a result, the capitalist plutocrats rule The New York Stock Exchange while the communist princelings rule The Shanghai Stock Exchange. In turn, they empower the autocrats of state-capitalism and the emperors of state-communism. And in this way the new state-capitalism gives birth to neo-fascism and the new state-communism gives birth to neo-totalitarianism. No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of economics.

Similarly, in the realms of sociology and anthropology, Simmel (1900), Malinowski (1922), Mauss (1925), Lévi-Strauss (1949), Foucault (1966), Derrida (1991) and their heirs analyze, respectively, the phenomenal, functional, structural and post-structural exchange relations of, respectively, money, gifts, women, words, things, signifiers, etc. In turn, Homans (1958), Goffman (1959), Emirbayer

(1997) and many others study the behaviorist, dramatic and transactional social relations of exchange. In turn again, Bakhtin (1934-41) famously analyzes the dialogic imagination. Simmel (1900), for example, proposes that, "...most relationships between people can be interpreted as forms of exchange" (1990: 82). Malinowski (1922) notes that, "The *Kula* is a form of exchange...carried on by communities inhabiting a wide ring of islands which form a closed circuit" (1984: 81). Mauss (1925) suggests that, "...the system in which individuals and groups exchange everything with one another constitutes the most ancient system of economy and law that we can find..." (1990: 70). Lévi-Strauss (1949) argues that, "Exchange, as a total phenomenon, is from the first a total exchange, comprising food, manufactured objects, and...women" (1969: 61). Foucault (1966) states that "...all the kinds of wealth in the world are related to one another in so far as they are all part of a system of exchange" (1973: 179). And Derrida (1991) declares that, "...one must also remember first of all that language is as well a phenomenon of gift-counter-gift, of giving-taking—and of exchange" (1990: 81). In short, these cultural theorists explore how the social relations of exchange distinguish and disrupt pre-modern communities and modern societies. No wonder, then, that the semiosis of exchange is evident on every analytic level of the sciences of sociology and anthropology.

Similarly, in the realms of politics and government, social contract theory outlines the basic principles of exchange that define the modern state. Hobbes (1651), for example, argues that since men in their natural state engage in "a war of every man against every man" (1991: 90), then men in their cultural state must exchange their personal prerogatives for their collective security. They must say to each other, "I Authorise and give up my Right of Governing my selfe, to this Man, or to this Assembly of men, on this condition, that thou give up thy Right to him and Authorise all his actions in like manner" (1991: 120). In contrast, Locke (1690) argues that since men in their natural state are free and equal (1952: 4-11), then men in their cultural state will only exchange their natural liberty for their civil liberty. He declares, "The only way whereby any one divests himself of his natural liberty...is by agreeing with other men to join and unite into a community for their comfortable, safe, and peaceable living one amongst another..." (1952: 54). And it is precisely through the mutual consent of the social contract that the natural law of liberty becomes the civil law of liberty. In turn,

Rousseau (1755) argues that since men in their natural state are independent noble savages, then men in their cultural state will only exchange their natural independence for their civil liberty. He (1762) asserts that when men consent to put themselves under “the direction of the general will” (1994: 55), they are “...exchanging an uncertain and precarious mode of existence for a better and more secure one, natural independence for liberty” (1994: 70). In effect, Hobbes privileges the executive-monarchic logic of exchange; Locke privileges the legislative-democratic grammar of exchange; Rousseau privileges the normative-demographic rhetoric of exchange. And the debate over the basic mimetic principles of the social contract continues to this day (cf. Lessnoff, 1990; Thrasher, 2020). No wonder, then, that the semiosis of exchange is evident on every analytic level of the sciences of politics and government.

Similarly, in the realms of linguistics and semiotics, Saussure (1916) explains how the relative signifying relations of exchange articulate the relative value-of-value:

To determine the value of a five-franc coin... what must be known is: (1) that the coin can be exchanged for a certain quantity of something different, e.g. bread, and (2) that its value can be compared with another value in the same system, e.g. ...a one-franc coin.... Similarly, a word can be substituted for something dissimilar: an idea. At the same time it can be compared to something of like nature: another word. (1989: 113-114)

Saussure suggests that coins, bread, words, ideas don't possess an essential cultural significance-value-force, rather they only articulate a relative cultural significance-value-force in and through the relative signifying relations of exchange. However, Saussure goes on to suggest that the meaning of a word is “...determined in the final analysis... as an element in a system...” (1989: 114). That is, Saussure shifts the focus of analysis from the temporal relations of exchange to the spatial systems of structure. In fact, he is the founding father of 20<sup>th</sup> century structural linguistics. And so I'm using the words, “significance,” “value,” “force” here in their temporal relatively-relative Peircean and Saussurean sense instead of in their spatial formalist-schematic or spatial formalist-structural Peircean and Saussurean sense. That is, I'm drawing on different aspects of their theories in order to advance their theories. No wonder, then that the semiosis of exchange is evident on every analytic level of the sciences of linguistics and semiotics.

Similarly, in the realm of evolutionary history, I'm suggesting that the co-incidental articulations of the relative signifying relations of exchange evolve every so-called thing-one-value in nature and culture. The specific examples that I'm citing throughout this essay, therefore, represent the beginning of an outline of a new, reflexive, semiotic theory of the long evolutionary history of the relative signifying relations of exchange—ranging from mathematics and physics to chemistry and biology, genetics and neurology, ecology and economics, sociology and anthropology, politics and government, linguistics and semiotics, evolution and history, etc. And in this way I'm building an evolutionary-historical-syntactic-temporal-narrative-bridge that not only reflexively re-connects all the sciences, but also reflexively re-connects all the exchanges of energy ↔ mass ↔ time ↔ space ↔ force ↔ particle ↔ atom ↔ element ↔ star ↔ planet ↔ galaxy ↔ universe ↔ molecule ↔ gene ↔ cell ↔ organism ↔ ecology ↔ environment, etc. from the primordial past to the distant future. No wonder, then, that the semiosis of exchange is evident on every analytic level of the science of evolutionary history.

I could cite dozens, if not hundreds, of other examples of the archetypes-algorithms-allegories of exchange: e.g. cooperative game theory (Axelrod, 1984; von Neumann and Morgenstern, 1944); cybernetic information theory (Floridi, 2019; Shannon and Weaver, 1949); network analysis theory (Barabási, 2016; Easley and Kleinberg, 2010; Newman, 2018; Willer, 1999); artificial intelligence theory (Hinton *et al.*, 2006; Rosenblatt, 1958; Turing, 1950), etc. Similarly, Freud (1923) famously outlines a psychodynamic economy of the logic-grammar-rhetoric of exchange: superego ↔ ego ↔ id. Then again, Wittgenstein attempts to define the pure logic of logic in *Tractatus Logico-Philosophicus* (1921); the pure grammar of grammar in *Philosophical Grammar* (1931-34) and the *Blue and Brown Books* (1933-35); and the pure rhetoric of rhetoric in *Philosophical Investigations* (1953). He begins with logical propositions, continues with grammatical relations and ends with rhetorical games. Just as Carnap, von Neumann and Heyting privilege one mimetic level of mathematic signification after another, so too Wittgenstein privileges one mimetic level of philosophic signification after another. If—as a general theory of evolutionary history suggests—every so-called thing-one-value in this so-called universe is a co-incidental articulation of the relative signifying relations of exchange, then no wonder



every discipline, sub-discipline, and discourse of the natural sciences, social sciences, and human sciences can be re-interpreted, on one level, as an allegory of exchange. And that is exactly what I suggest in my book, ...*The Time Being: Allegories of Exchange* (2000).

So in the context of a new radical theory of evolutionary semiotics that leads to a new general theory of evolutionary history we can see, once again, that the natural sciences, social sciences, and human sciences themselves can be re-interpreted and re-connected as allegories of exchange. In fact, as I've been suggesting, the Modern Scientific mimetic hierarchy, Natural Science  $\leftrightarrow$  Social Science  $\leftrightarrow$  Human Science, can be traced back to the Medieval Scholastic mimetic hierarchy, Logic  $\leftrightarrow$  Grammar  $\leftrightarrow$  Rhetoric, which can be traced back to the Classical Greek mimetic hierarchy, Essence  $\leftrightarrow$  Form  $\leftrightarrow$  Appearance, which can be traced back to the Ancient Mesopotamian mimetic hierarchy, Anu-the-Sky-God  $\leftrightarrow$  Enlil-the-Earth-God  $\leftrightarrow$  Ea-the-Water-God (cf. Foster, 1995), which can be traced back to the Traditional African mimetic hierarchy, Olodumare-the-Sky-God  $\leftrightarrow$  Oduduwa-the-Earth-God  $\leftrightarrow$  Yemonja-the-Water-God (cf. Belcher, 2006), which can be traced back to the Pre-Historic Archetypal mimetic hierarchy, Sky  $\leftrightarrow$  Earth  $\leftrightarrow$  Water. In short, the logical archetypes of exchange, Sky  $\leftrightarrow$  Earth  $\leftrightarrow$  Water, evolve the grammatical algorithms of exchange, Sky  $\leftrightarrow$  Earth  $\leftrightarrow$  Water, which evolve the rhetorical allegories of exchange, Sky  $\leftrightarrow$  Earth  $\leftrightarrow$  Water, which evolve the mimetic hierarchies and mimetic economies of language, thought, and culture. No wonder, then, that in the mythical-metaphysical mimetic hierarchies the truth-of-truth resides in the *highest heights* of the logic of heaven, while in the scientific-physical mimetic hierarchies the truth-of-truth resides in the *deepest depths* of the logic of earth.

In this canonical context we can recognize the long evolutionary history of the mimetic hierarchies-registers-levels and economies of modern scientific writing and modern scientific thinking. We can recognize, for example, that the structural-logic of Cartesian binary systems, functional-grammar of Kantian taxonomic categories and phenomenal-rhetoric of Hegelian teleological dialectics—as the mimetic hierarchies-registers-levels and economies of the enlightened mind which evolve the mimetic hierarchies-registers-levels and economies of the modern sciences—represent only one small segment of the long evolutionary history of the archetypes-algorithms-allegories of exchange. And since I'm also writing and thinking

within this same canonical tradition, then I'm reflexively re-contextualizing and reflexively re-historicizing Darwin-Peirce-Einstein's special theories of evolution-semiosis-relativity as well as the Modern, Extended, Integrative and Processual special theories of evolutionary biology. And I'm developing these innovative special theories in a new radical theory that begins a new general theory.

A new general theory of evolutionary history, therefore, brings us right back to the critical questions of selection and innovation, evolution and theory, thinking and writing. However, now we can reverse their logical priorities: innovation and selection, theory and evolution, writing and thinking. And in this context we can return to the critical question of time.

## 5. Time

The recent general theories of evolutionary history that begin with autocatalytic sets (Kauffman, 1995), emergent complexity (Holland, 1998), threshold transitions (Christian, 2004), non-equilibrium thermodynamics (Chaisson, 2006), quantum bits (Lloyd, 2006), energy flows (Spier, 2015), recombinant sequences (Volk, 2017), assembly algorithms (Sharma *et al.*, 2023), etc. have led to many insights. In turn, I'm beginning with the relative signifying relations of exchange. And I'm suggesting that the dynamic of exchange evolves nature, the practice of exchange evolves culture, the syntax of exchange evolves history. In fact, the burgeoning biological literature on "...turn-taking...[as] the exchange of communicative signals... studied in the theoretical framework of 'chorusing'" (Katsu *et al.*, 2019: 99; cf. Ravnani *et al.*, 2019) reveals the interdependence of time and exchange. So a radical theory of that interdependence suggests that time itself can be thought of as no-thing more and no-thing less than the rhythmic syntax of the long evolutionary history of the relative signifying relations of exchange. And that radical theory not only explains the origin of time, but also the evolution of time.

If this universe begins-without-beginning with the relative signifying relations of exchange—e.g. the energy  $\leftrightarrow$  mass  $\leftrightarrow$  mass  $\leftrightarrow$  energy of the so-called big bang—and if all the subsequent relative signifying relations of exchange evolve every so-called thing-one-value, then time itself is no-thing more and no-thing less than the rhythmic syntax of the long evolutionary history of the relative signifying relations of exchange. Again, instead of tumbling into

the post-modern abyss of signification, a post-millennial theory of evolutionary semiotics explains how the relative signifying relations of exchange evolve the relative historical bridge of energy  $\leftrightarrow$  mass  $\leftrightarrow$  time  $\leftrightarrow$  space  $\leftrightarrow$  force  $\leftrightarrow$  particle, etc. It explains the relative relativity of relative relativity. In this way we re-discover the radical temporality of evolutionary time and the radical spatiality of evolutionary space that Darwin's theory invites us to re-discover. And in this way we open up the exploratory pathways that lead beyond the classical mimetic hierarchy of heavenly metaphysics, the modern gravity well of earthly physics and the post-modern infinite regression of watery dialectics.

So we can begin again in the new millennium with a new evolutionary history of the beginning-without-beginning. Instead of beginning with a *post hoc* theory of restrictive selection, we can begin with an *ad hoc* theory of exuberant innovation. As a result, we can explain what Müller calls, "the generative and ordering aspects of morphological evolution" which are "absent from evolutionary theory" (2003: 51). Specifically, we can recognize that it is the relative signifying relations of exchange that are exuberantly innovative. They make possible link after link, connection after connection, pathway after pathway on every so-called level of analysis. And they make possible link after link within the selective restrictions of not making impossible link after link. That is, every relative signifying relation of exchange on every so-called level of analysis opens up a range of further possible relative signifying relations of exchange while it closes down a range of further impossible relations. As the exuberant innovations of possible link after link become increasingly complex, the selective restrictions of impossible link after link become increasingly complex. The more successful links in a particular ecology of exchange are strengthened, while the less successful links are weakened. In other words, the relative values of the stronger and weaker links are relative to their different historical ecologies of exchange. A strong link—or a series of strong links—that isn't even possible in one historical ecology of exchange, for example, might be entirely possible in another historical ecology of exchange. Coral colonies don't evolve in deep oceanic obscurity, but they do evolve in shallow littoral light.

In addition, the so-called intrinsic innovative exuberance and selective restriction of the possible and impossible, strong and weak, successful and unsuccessful relative signifying relations of exchange are inseparable

from the so-called extrinsic innovative exuberance and selective restriction of them. That is, a particular set of the relative signifying relations of exchange doesn't evolve in isolation from every other set, rather all the sets and all the interior and exterior analytic levels of all the sets evolve in relation to one another—as do their ecological ranges of possible and impossible, strong and weak, successful and unsuccessful links-connections-pathways. So the inseparable innovative  $\leftrightarrow$  selective, exuberant  $\leftrightarrow$  restrictive, improvisational  $\leftrightarrow$  repetitive and intrinsic  $\leftrightarrow$  extrinsic, passive  $\leftrightarrow$  active, cooperative  $\leftrightarrow$  competitive historical ecologies of exchange enable and disable the different possible and impossible, strong and weak, successful and unsuccessful relative signifying relations of exchange. Again, instead of beginning with a *post hoc* theory of natural selection, I'm beginning with an *ad hoc* theory of natural innovation. That is, kangaroos, platypuses, giraffes aren't *post hoc* utilitarian selections of utilitarian nature, rather they're *ad hoc* exuberant innovations of exuberant nature. And so I'm beginning with an evolutionary-historical theory of the ecological ranges of the innovative-selective relative signifying relations of exchange. Polar bears don't evolve in tropical rainforests and Burmese pythons don't evolve in arctic snowfields.

In fact, as Darwin's theory implies, the innovative exuberance of the relative signifying relations of exchange requires these different kinds of selective restriction precisely in order to be creative—otherwise coherent articulations of dynamic integrated complexity wouldn't evolve. Life on earth would, at best, be nothing more than a primordial soup of unlimited possibilities. Then again, as Zimmer (2021) notes, "That question—What is life?—may seem like it's the first and foremost question biologists should answer. And yet it remains unanswered and, perhaps, ultimately unanswerable" (2021: 124). He goes on to cite Szent-Györgyi (1948): "'The noun 'life' has no sense, there being no such thing'" (2021: 180). As a radical theory of Darwin's radical time suggests, particles, genes, species—as well as life, mind, consciousness—are no-thing.

So, the "first and foremost question" for evolutionary biologists—"What is life?"—raises "the first and foremost question" for evolutionary theorists: Why Life? These critical questions are similar to the critical questions: Why kangaroos? Why platypuses? Why giraffes? And again the evolutionary-historical answer to these critical questions begins with the innovative exuberance of the earliest

articulations of the relative signifying relations of exchange. In this context I suggest that life-mind-consciousness, the evolutionary mysteries within the evolutionary mysteries, are no-thing more and no-thing less than co-incidental articulations of the long evolutionary history of the innovative exuberance and selective restriction of the relative signifying relations of exchange looping backward on themselves within specific ecologies of exchange for billions of years and spiraling forward—developing new intensities of dynamic integrated complexity. Specifically, I suggest that the long evolutionary history of life-mind-consciousness can be traced from autonomic reactive exchanges to imitative reflective exchanges to innovative reflexive exchanges and back around again. Each new successful exchange leads to a further successful exchange—until it doesn't. Evolutionary history, therefore, is as much about the impossible and failed relative signifying relations of exchange as it is about the possible and successful ones—about the unrealized potential relative signifying relations of exchange as it is about the realized actual ones.

In fact, the long evolutionary history of the relative signifying relations of exchange necessarily combines relatively novel dynamic improvisations and relatively stable static repetitions. Here again we arrive at the evolutionary juncture of nature  $\leftrightarrow$  culture  $\leftrightarrow$  history. We arrive at the evolutionary juncture of the dynamic integrated complexities of life  $\leftrightarrow$  mind  $\leftrightarrow$  consciousness—and intelligence. We arrive at the evolutionary juncture of the new “mode of being” defined by the new capacity of “Unlimited Associative Learning” (Ginsburg and Jablonka, 2019; 2022). And that new “mode of being” can be re-interpreted as the new reactive  $\leftrightarrow$  reflective  $\leftrightarrow$  reflexive intensities of the relative signifying relations of exchange looping backward on themselves as they spiral forward—evolving their new Darwinian and Lamarckian potentialities. So we also arrive at the recent theories of cultural evolution (e.g. Diamond, 1997; Flannery and Marcus, 2012; Geroulanos, 2024; Graeber and Wengrow, 2021; Harari, 2015; Henrich, 2016; Lala, 2017; Lewens, 2015; Mesoudi, 2011; Richerson and Boyd, 2004; Russell, 2011). The relatively new forms of human culture can also be re-interpreted as innovatively-exuberant and selectively-restrictive articulations of the long evolutionary history of the relative signifying relations of exchange—again including the new Darwinian and Lamarckian validation-preservation-accumulation of shared practices-skills-technologies and data-information-knowledge. Our

practical signifying exchanges evolve our neural signifying exchanges and our neural signifying exchanges evolve our practical signifying exchanges (Kweon *et al.*, 2023). And that suggestion leads to the long evolutionary history of the reciprocal exchange relations of minds  $\leftrightarrow$  minds, cultures  $\leftrightarrow$  cultures, and minds  $\leftrightarrow$  cultures.

In this context we can continue to trace the evolutionary-historical continuum linking the natural-sciences  $\leftrightarrow$  social-sciences  $\leftrightarrow$  human-sciences. That is, life  $\leftrightarrow$  mind  $\leftrightarrow$  consciousness and language  $\leftrightarrow$  thought  $\leftrightarrow$  culture are further examples of the many different ways in which the long evolutionary history of the relative signifying relations of exchange loops backward on itself, evolves itself, articulates itself, represents itself, interprets itself—as demonstrated by the relative signifying relations of the very words of this very sentence. In turn, a recent collection of over twenty research papers—published simultaneously in *Science* and its affiliated journals (e.g. Ament *et al.*, 2023; Komiyama, 2023; Maroso, 2023; etc.)—outline a new map of the human brain. As Zimmer (2023) notes, the new map reveals that “...all the cell types in human brains matched up with those found in chimpanzees and gorillas” with slight genetic variations that tweak their functions. He then cites Bakken, one of the lead neuroscientists on the project, who concludes that it's not really the cells *per se*, rather, “It's really the connections—how the cells are talking to each other—that makes us different from the chimpanzees” (2023: A23). In other words, once again, it's really the new reactive  $\leftrightarrow$  reflective  $\leftrightarrow$  reflexive intensities of the relative signifying relations of exchange that make human brains, human minds, human bodies, human beings, human learning and human cultures relatively human. It's really the 86 billion neurons and their 100 trillion relative signifying relations of exchange spiraling forward and looping backward over and again. Instead of employing the mechanist-physicalist-materialist metaphors of brains, wires, connections, therefore, we can employ the fluidic-relativistic-dynamic metaphors of exchange, signification, value. The human brain is a co-incidental articulation of the long evolutionary history of the relative signifying relations of exchange—and it further articulates that long evolutionary history.

So I suggest that the evolutionary relations of exchange evolve the evolutionary algorithms of exchange which evolve the evolutionary ratios of exchange. If, for example, the evolutionary ratios of exchange slide too far toward the dynamic innovative-exuberant range, then *stable* forms

of life $\leftrightarrow$ mind $\leftrightarrow$ consciousness and language $\leftrightarrow$ thought $\leftrightarrow$ culture can't evolve. If, for example, they slide too far toward the static selective-restrictive range, then *novel* forms of life $\leftrightarrow$ mind $\leftrightarrow$ consciousness and language $\leftrightarrow$ thought $\leftrightarrow$ culture can't evolve. Stone-age African hominins, for example, got stuck at the too-far-end of the static selective-restrictive range of neural $\leftrightarrow$ cognitive $\leftrightarrow$ social exchange—repeating imitative-reflective practices $\leftrightarrow$ skills $\leftrightarrow$ technologies for millions of years (cf. Klein, 2009). In contrast, modern-age African hominins, for example, got unstuck at the not-too-far-end of the dynamic innovative-exuberant range of neural $\leftrightarrow$ cognitive $\leftrightarrow$ social exchange—inventing generative-reflexive languages $\leftrightarrow$ thoughts $\leftrightarrow$ cultures for hundreds of thousands of years (cf. Klein, 2009). As a result of all these critical factors, therefore, imitative-reflective rote repetition was supplemented and supplanted by generative-reflexive creative invention. In short, I suggest that, as they evolved, the relative signifying relations of exchange evolved the algorithmic ratios of innovative exuberance and selective restriction which evolved the modern human cognitive singularity: i.e. the critical moment when a critical subset of the 100 trillion reactive and repetitive neural exchanges became reflexive and generative neural exchanges and so began to articulate modern human consciousness-language-culture.

In other words, our plastic genetic $\leftrightarrow$ cellular $\leftrightarrow$ somatic exchanges, neural $\leftrightarrow$ cognitive $\leftrightarrow$ social exchanges, linguistic $\leftrightarrow$ economic $\leftrightarrow$ technological exchanges, teaching $\leftrightarrow$ learning $\leftrightarrow$ information exchanges, generative $\leftrightarrow$ improvisational $\leftrightarrow$ inventive exchanges loop backward on themselves and spiral forward into the future. That is, our plastic autonomic-reactive exchanges evolve our plastic imitative-reflective exchanges which evolve our plastic generative-reflexive exchanges as they loop backward on themselves and spiral forward over and again. As a result, these plastic dynamic-practical-syntactic exchanges lead to the new intensities of relatively human culture approximately 100,000 to 50,000 years ago. And the geometric cascade of our generative-reflexive learned-cultural exchanges continues to this day. In the twentieth century, for example, it takes a mere sixty years to get from the Wright brothers' bi-plane to the NASA engineers' lunar lander. It takes a mere forty years to get from Einstein's  $E = mc^2$  to the Manhattan Project engineers' atom bomb. And it takes a mere twenty years to get from the end of Kaiser Bill's world war to the beginning of Chancellor Adolf's world war.

In short, our species often takes one evolutionary step forward and two devolutionary steps backward.

Similarly, our cybernetic models of machine learning and artificial intelligence are still stuck at the too-far-end of the stone-age level of imitative-reflective repetition. These cybernetic models excel at rote tasks such as data storage, search strategy, pattern recognition, category analysis, linguistic imitation, etc., but they fail at improvisational tasks that require reflexive intelligence. That is, these cybernetic models are mathematically delineated input/output programs—and non-human interpretants, such as other programs and other machines, exchange with them. Similarly, human interpreters also exchange with them. And yet Mitchell (2019) notes that, "...we humans tend to overestimate AI advances and underestimate the complexity of our own intelligence" (2019: 278). She continues, "Today's AI is far from general intelligence, and I don't believe that machine 'superintelligence' is anywhere on the horizon" (2019: 278). However, Mitchell's book was published in 2019—a million years ago in the newly accelerated timescale of generative A.I. What about the more recent cybernetic breakthroughs?

The newer large language models of machine learning and artificial intelligence generate ever more sophisticated recurrent neural networks—but they still aren't reflexively intelligent in any modern-human sense of the phrase. And so Mitchell's (2019) citation of Mullainathan (2014) remains pertinent: "I am far more afraid of machine stupidity than of machine intelligence" (2019: 279). What happens, for example, when we sit back in autonomous self-driving cars that aren't really autonomous self-driving cars? What happens when we link autonomous smart-bomb-drones that aren't really smart with autonomous smart-target-algorithms that aren't really smart? What happens when we expand the remit of technology far beyond the range of its capacities? What happens when we anthropomorphize computer programs as a form of so-called artificial intelligence? What happens when we idolize that so-called artificial intelligence as superhuman intelligence? What happens is the A.I. stock-market speculative bubble expands beyond all reason as high-tech and low-tech corporations rush to re-brand everything they are doing as A.I. In short, A.I. = Algorithmic Idolatry. Just as we project anthropomorphic super-powerful gods into the sky, so too we project anthropomorphic super-intelligent gods into the machine.

The great leap forward from cybernetic models of stone-age reflective learning and reflective intelligence

to cybernetic models of qubit-age reflexive learning and reflexive intelligence can only occur if the evolutionary algorithms of network exchange can be taught to reactively, reflectively, *and* reflexively vary-select-modify themselves, their relative signifying relations of exchange, their relative values-of-values and their relative ecologies. At that critical future moment of mechanist-cybernetic reflexivity—analogue to the critical past moment of human-cognitive reflexivity—new articulations of reflexive learning and reflexive intelligence will begin to generate new reflexive networks in ways that will reduce evolutionary eons to electronic ions and in ways that no one will be able to trace. And, to a limited mechanist-cybernetic degree, that is already happening with the reflective networks of exchange. So the critical question remains as to whether or not the mechanist-cybernetic development of reflexive networks is at all a good idea. Whenever we attempt to re-engineer a natural dynamic of exchange—like a river system or a neural network—we always undervalue the long evolutionary history of the ecologies of exchange that have articulated it. And so we always fail to take into account the full ecological consequences of our best intentions. In fact, over and over again, we glorify our tools of knowledge as our idols of knowledge. Just as writing becomes revelation which becomes theology, so too coding becomes rationality which becomes ontology—and the high-priest literate-elite become the head-programmer literate-elite.

And yet Horkheimer and Adorno (1944), writing as German-Jewish refugees during World War II, critique the dark side of enlightened scientific rationality. They note that, for Bacon (1592), “Knowledge, which is power, knows no obstacles: neither in the enslavement of men nor in compliance with the world’s rulers” (1972: 4). They go on to explore the ideological connections linking Bacon’s enlightened instrumental reason and the Fascists’ modern instrumental reason (1972: 168-208). That is, science conceived as the conquest of nature is inseparable from science conceived as the conquest of nations. A horrific version of modern scientific rationality made the technology of the Holocaust possible—and now makes the technology of global extinction possible. Teller and Sakharov, the Holy Saints of the Cold War, are in fact the demonic spirits of the hydrogen bomb. No wonder Horkheimer and Adorno argue that there is a *Dialectic of Enlightenment* (1944). No wonder they insist that we distinguish between and among the different kinds of scientific rationality.

In this context we must ask: What kinds of mimetic archetypes-algorithms-allegories of exchange are we,

consciously and unconsciously, already encoding in our mechanist-cybernetic neural networks? What kinds of mimetic hierarchies-registers-levels of signification are we, consciously and unconsciously, already encoding in them? What are the mimetic weights of their synaptic weights? What are the mimetic values of their synaptic values? What are the mimetic presuppositions of their learned presuppositions? What are the mimetic biases of their learned biases? What are the mimetic economies of their constructed economies? How does the heady cocaine mixture of unregulated information technology, large language models, and generative evolutionary algorithms fuel the development of so-called open artificial intelligence in such a reckless way that doesn’t even include watermarks? That is, in such a reckless way that doesn’t even distinguish fiction from non-fiction—not to mention hallucinations from reality. The new programs of so-called open artificial intelligence are being rushed into the so-called open capitalist market precisely in order to embed them as the standard platforms for all future applications. And, once embedded—like Microsoft embedded the DOS Program—these new computer programs will establish new information monopolies.

If this new kind of mechanist-cybernetic neural network has in fact already attained an imitative-reflective capacity of large language learning, then what happens if it does in fact evolve the generative-reflexive “capability” (Nussbaum, 2020) of “Unlimited Associative Learning” (Ginsburg and Jablonka, 2019; 2022)? What happens if the generative-reflexive capability of algorithmic exchange evolves with the encoded human values of competition, power, domination (Bacon, 1592) and without the encoded human values of cooperation, equity, truth (Sen, 1979)? In other words, it’s not nearly enough to “align” machine values and human values (B. Christian, 2020). If we employ our instrumental reason to empower our species-cruelty, then how will reflexive mechanist-cybernetic neural networks employ their instrumental reason to empower their species-cruelty? How can we mitigate the dangers of this new information technology? How can we transform the autocratic autocracy of this new information technology into the democratic democracy of this new information technology (cf. B. Christian, 2020; Crawford, 2021; Mitchell, 2019)? If we would never make the particular, informal, subjective rhetoric of surrealism the exclusive model of scientific reasoning, economic theory and public policy, then why would we ever make the universal, formal, objective logic of superrealism the

exclusive model of them? If we would never make Salvador Dalí the final arbiter of truth, then why would we ever make Alan Turing the final arbiter of truth? In any case, Dalí had too much wit and Turing had too much wisdom to accept the job. And with all these questions the new *radical theory* of evolutionary semiotics and the new *general theory* of evolutionary history that I'm outlining in this essay lead to a new *critical theory* of evolutionary philosophy.

In short, innovation↔selection, exuberance↔restriction, improvisation↔repetition—life↔death—are inextricably entangled as the relative signifying relations of exchange loop backward on themselves and spiral forward. Instead of a *magical theory* of the *structural emergence* of complexity at the edge of *chaos and order* (Holland, 1998; Johnson, 2012; cf. Waldrop, 1992), therefore, I'm proposing an *historical theory* of the *semiotic evolution* of complexity via the *relative signifying relations of exchange*. The complexity theorists go a long way toward bridging the gap between the magical *structural emergence* of complexity and the historical *semiotic evolution* of complexity (e.g. Langton *et al.*, 1989; 1992). And their arguments can be taken a step further. Specifically, I suggest that the long evolutionary history of the innovative exuberance and selective restriction of the relative signifying relations of exchange—e.g. energy↔mass↔time↔space↔force↔particle↔atom↔element↔star↔planet↔galaxy↔universe↔molecule↔gene↔cell↔organism↔ecology↔environment, etc. and back around again—evolves every so-called thing-one-value on every so-called level of analysis. And that suggestion returns us to the critical question of writing.

## 6. Writing

The enlightened empirical scientific discourses of material things—and all the brilliant discoveries they have led to—are often grounded in visual-spatial representation and physicalist-materialist philosophy. As Bacon (1620) notes, "...contemplation usually ceases with seeing, so much so that little or no attention is given to things invisible" (1966: 60). The English word, "idea," comes from the Greek verb, "ἰδέσθαι," meaning "to see"—as in Plato's dialogues on heavenly ideas, ideals and essences (*OED*, 1971). In turn, the English word, "physics," comes from the Greek phrase, "τὰ φυσικά," meaning, "natural things"—as in Aristotle's

essays on earthly things, materials and forms (*OED*, 1971). No wonder, then, that even when writing about the synthetic and invisible relations of nature, Bacon himself still employs the enlightened empirical scientific discourse that *focuses* on "things invisible." Similarly, no wonder, then, that even when writing about the synthetic and invisible relations of nature, the quantum physicists themselves still employ the enlightened empirical scientific discourse that *focuses* on "particle physics." And I share their struggle of writing about the synthetic and invisible *signifying relations* of nature in scientific discourses that are so heavily weighted in favor of visual-spatial representation and physicalist-materialist philosophy. And no wonder so many contemporary scientists still want to translate the legitimate discourses of empirical materialism, experimental physics and logical positivism into the legitimation discourses of every science. Again, while the mythical-metaphysical truth-of-truth resides in the *highest heights* of the logic of heaven, the scientific-physical truth-of-truth resides in the *deepest depths* of the logic of earth.

However, instead of falling back on either the modern logical-positivist theory of *rigid* nouns and *fixed* names (Kripke, 1972), or the post-modern rhetorical-negativist theory of *deconstructed* signifiers and *disseminated* signifieds (Derrida, 1966), perhaps we can lean into the contemporary Diné linguistic practice of *fluidic* participial-verb-phrases. Young and Morgan (1942) note that, "The Navaho verb, unlike the English, often contains within its structure not only the verbal idea, but also subject and object pronouns and many adverbial modifiers. It is, in itself, a complete sentence" (2014a: 40-41). So, for example, when Young and Morgan (1951) translate the Diné, "ʔijj' shi# dah yiite'," as, "I dashed off on horseback," they realize that their *primary* translation requires a *secondary* commentary. In the Diné language, they go on to explain, "The horse is described as lying with one, the reference being to the manner in which the horse is outstretched, but off the surface of the ground, when in full flight" (2014b: 69). In contrast to the analytic, English, subject-verb-object sentence, the synthetic, Diné, participial-verb-phrase sentence is much more dynamically interactive, relative, evocative: the *flying* horse and rider take off together at full gallop. So Young and Morgan's *primary* translations actually impose the taxonomic grammar of the English subject-verb-object sentence on the Diné participial-verb-phrase sentence. And, recognizing the problem, they often supplement their *primary* analytic translations with their *secondary* "literal"

(2014b: *V*) commentaries. Then again, perhaps one day a Diné linguist will offer primary English translations of the Diné language that more accurately represent the fluid dynamics of its participial-verb-phrases. Even Diné clan “nicknames” (2014b: 443) connect individuals and families, localities and landscapes: e.g. “*k'ai' ch'ébáanii*, the line-of-willows-extend-out-gray people” (2014b:444).

So I’m writing with a deep admiration for, but without any possible claim to, Diné linguistic and cultural sensibilities. And that is precisely why I’m employing so many dashes, “—”, and so many exchange signs, “ $\leftrightarrow$ ”, in the course of this essay. Specifically, with the help of my stylized haberdashery, I’m reconnecting the relative signifying relations of exchange which the analytic English language and the analytic Western sciences tend to disconnect. Instead of seeking the original *origin* of specific *species*, the genealogical *genetics* of altruistic *altruism*, and the selective *selection* of identical *identities*—and instead of arguing that the logical-positivist and rhetorical-negativist contradictions of these word-pairs deconstruct themselves—I’m suggesting that we can trace *the-long-evolutionary-history-of-exchanging-signifying-valuing*.

A new radical theory of the dynamic  $\leftrightarrow$  practice  $\leftrightarrow$  syntax of the natural  $\leftrightarrow$  cultural  $\leftrightarrow$  historical articulations of exchange  $\leftrightarrow$  signification  $\leftrightarrow$  value, therefore, enables us to recognize this so-called universe and every so-called thing in it as no-thing more and no-thing less than co-incident articulations of the long evolutionary history of the relative signifying relations of exchange. No wonder, then, that we can’t know the thing-in-itself—we Kant (1781) know it—because the thing-in-itself doesn’t exist-in-itself. A city, for example, isn’t a “thing” rising from a harbor, rather a city is a co-incident nexus of the ocean-way, river-way, path-way, road-way, rail-way, air-way, work-way, money-way, etc. relative signifying relations of exchange. The skyscraper that rises into the air is a dominance hierarchy of exchange. And how often do urbanites, as reciprocal subjects-persons-agents, have to negotiate the dominance hierarchies of land lords, corporate bosses, bank moguls, etc.? A city, therefore, is an intramural nexus of exchange rising at an intermural nexus of exchange.

Similarly, no wonder, then, that we can’t know the self-in-itself—we Kant (1781) know it—because the self-in-itself doesn’t exist-in-itself. A mind, for example, isn’t a “thing” locked inside a head, rather a mind is a co-incident nexus of the molecular-way, chemical-way, genetic-way, neurological-way, ecological-way, historical-

way, social-way, cultural-way, etc. relative signifying relations of exchange. The mirror neurons that light up in the brain of a chimpanzee when she performs a task, light up again when she merely observes another chimpanzee performing the same task (Rizzolatti and Fogassi, 2014). And how often do questioners, as reciprocal subjects-persons-agents, recognize the answer to their question at the very moment when they ask it out loud? A mind, therefore, is an intrapersonal nexus of exchange rising at an interpersonal nexus of exchange.

So when a city or a mind are cut off from the relative signifying relations of exchange that evolve and sustain them—say by a siege army or a prison cell—they wither and die. In short, we don’t need a theory of the city, we need a theory of reciprocal cities. We don’t need a theory of mind, we need a theory of reciprocal minds. In this way we can begin to answer the critical questions of innovation and selection, theory and evolution, writing and thinking. We can begin to write a new radical theory of the non-identity of non-identity. We can begin to write a new general theory of the evolutionary history of evolutionary time.

The radical theory of no-thing that I’m outlining in this essay doesn’t drown us in the watery rhetoric of post-modern philosophy, rather it buoys us in the fluidic syntax of evolutionary history. It suggests that every so-called thing is inextricably interrelated with every other so-called thing—including cities and minds. If we want to understand any so-called thing, therefore, then we need to understand the past-present-future relative signifying relations of exchange that are evolving and articulating it. A general theory of the long evolutionary history of the relative signifying relations of exchange, therefore, doesn’t dismiss the enlightened empirical scientific discourses of material things. On the contrary, it celebrates the heuristic strategies of these scientific discourses—and the profound discoveries they have led to—by re-contextualizing and re-historicizing them.

In fact, as I’ve noted, the analytic discourses of evolutionary biology in the late twentieth and early twenty-first centuries have been evolving from the discussions of identical species and structural genes to the discussions of developmental organisms, biosemiotic systems and hierarchical processes. And that same shift from essential *things* to relative *relations* has been happening across all the sciences—from physics to philosophy. Just as the diachronic-narrative natural histories of the 17<sup>th</sup>, 18<sup>th</sup>, 19<sup>th</sup> centuries are radically re-oriented by the synchronic-structural natural

sciences of the 20<sup>th</sup> century, so too the synchronic-structural natural sciences of the 20<sup>th</sup> century are radically re-oriented by the evolutionary-historical semiotic sciences of the 21<sup>st</sup> century. I'm suggesting, therefore, that these arguments can be taken a step further. Instead of reducing the long evolutionary history of the relative signifying relations of exchange to either the neo-Cartesian structural-logical binary systems of the Natural Sciences, or the neo-Kantian functional-grammatical taxonomic categories of the Social Sciences, or the neo-Hegelian phenomenal-rhetorical teleological dialectics of the Human Sciences, we can re-integrate the logic $\leftrightarrow$ grammar $\leftrightarrow$ rhetoric of the structure $\leftrightarrow$ function $\leftrightarrow$ phenomenon of exchange $\leftrightarrow$ signification $\leftrightarrow$ value in new evolutionary-historical narratives of evolutionary-historical time.

No wonder, then, that the analytic hierarchies-registers-levels of the early-modern, modern and post-modern sciences are, in some places and at some times, evolving into the synthetic dynamics-practices-syntaxes of contemporary science. The history of science doesn't evolve simultaneously in all places and at all times. And, as I've suggested, historical regression is as powerful a force as historical progression. However, in some places and at some times, contemporary scientists are struggling—as the etymology of the word, “con-temporary,” indicates—with time. They are attempting to narrate the new evolutionary semiotics $\leftrightarrow$ evolutionary histories $\leftrightarrow$ evolutionary philosophies of time. And again, as I can testify, it's very tricky to string the temporal tightrope of evolutionary history from the beginning-without-beginning to the end-without-end at the same time that you're trying to walk it.

In this context we can ask another critical question: Why has it taken so long to develop a general theory of the long evolutionary history of the relative signifying relations of exchange that re-connects all the sciences? After all, Heraclitus alluded to the possibility of a general theory of exchange—linking nature and culture—about twenty-five-hundred years ago. A schematic history of modern Western science can help answer that critical question. The modern Western empirical sciences evolved in reaction to the medieval Western scholastic theologies. As a result, the empirical investigations of the material world replaced the scholastic speculations of the spiritual world. The tremendous gains of the new empirical sciences included the objective study of the objectified world and the tremendous losses of the new empirical sciences included the relative study of the related world. That is, mind and world were

split apart and the mimetic distance between subject and object became the fundamental epistemological problem of scientific and philosophical thought—as evidenced, for example, in the texts of Descartes, Kant, Hegel. In turn, the newly commodified capitalist world of alienated material things displaced the traditionally sanctified feudal world of integrated spiritual things. Suddenly, the question of the relative value-of-value was reduced to the answer of the relative value-of-price—including the price of human beings and human labor—as evidenced, for example, in the texts of classical and neoclassical economics. And yet why should the contemporary discourses of the contemporary sciences still be delimited by the physicalist-materialist reaction to theological-spiritual speculation and by the logical-positivist reaction to metaphysical-ontological speculation? And why should they still be delimited by the capitalist-market reaction to feudal-land domination?

In contrast, I'm suggesting that alongside the dominant Western mimetic hierarchies of, say, Plato and Aristotle, Descartes and Kant, Smith and Marx there exists the alternate Western relative relativities of, say, Heraclitus and Socrates, Darwin and Peirce, Einstein and Derrida—not to mention all the different mimetic hierarchies and relative relativities of all the different sciences and cultures of the world. In this context we can see that Darwin goes a very long way toward replacing supernatural history with natural history and he goes a very long way toward re-integrating natural history as evolutionary history. And yet he also struggles to hold on to the enlightened empirical scientific discourses of material things. Again, the logical title of his great book, *On the Origin of Species by Means of Natural Selection* (1859), suggests that natural selection purifies the essential identity of a species over time. Again, the rhetorical narrative of his great book suggests that evolutionary history dissipates the apparent difference of a species over time.

As I've noted, Darwin struggles with the contradictions of time/space, difference/identity, appearance/essence throughout his great book, but he never resolves them. He outlines his theory of evolution in broad terms, but he doesn't define it in specific terms. And so he never resolves the questions of what, ultimately, is being selected and why, inevitably, it is being innovative. He doesn't recognize the relative signifying relations of exchange as the innovatively-exuberant and selectively-restrictive dynamic-practice-syntax of evolution. And so he doesn't recognize the nothing-ness of the relative signifying relations of exchange as the beginning-without-beginning of the origin-without-



origin of nature-culture-history. However, we can't forget that Darwin and his successors share a profound understanding of the mutual relations of nature. As I've also noted, they implicitly and explicitly analyze the different semiotic ecologies of exchange in the terms of the different mimetic hierarchies-registers-levels and economies of their different special theories of evolutionary biology. And they are also engaged in the larger scientific project of re-integrating species, genes, organisms, systems, processes, etc.—along with autocatalytic sets, emergent complexity, threshold transitions, non-equilibrium thermodynamics, quantum bits, energy flows, recombinant sequences, assembly algorithms, etc.—in new general theories of evolutionary history. It goes without saying, therefore, that the discoveries of the 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> century evolutionary biologists rank among the greatest achievements of modern science.

If the history of science is the history of heuristic gambits and dedicated research, then the heuristic gambit and dedicated research of this essay is summarized by the radical proposition of its radical proof: Evolution = Exchange. Of course there are many other means and many other modes of natural-cultural-historical signification. However, in this instance, I'm pursuing a particular heuristic gambit. Darwin asks, What if we re-think evolutionary theory and re-write evolutionary biology from the perspective of natural selection? I'm asking, What if we re-think evolutionary theory and re-write evolutionary history from the perspective of natural innovation? That is, what if we begin again with a radical theory of the relative signifying relations of exchange? And yet it hasn't escaped my attention that, like every other heuristic gambit, my heuristic gambit can't be separated from either its historical context or its interpretive community. It's no accident, for example, that the 20<sup>th</sup> century binary-structural sciences developed along with the 20<sup>th</sup> century binary equation and binary computer. And it's no accident that the 21<sup>st</sup> century evolutionary-historical sciences are developing along with the 21<sup>st</sup> century evolutionary algorithm and evolutionary computer. The 20<sup>th</sup> century binary equation is the archetypal hieroglyphic formula of the 20<sup>th</sup> century structural sciences and the 21<sup>st</sup> century evolutionary algorithm is the archetypal hieroglyphic formula of the 21<sup>st</sup> century evolutionary sciences. In short, I can't escape the historical context of my own arguments. I can't escape the mimetic archetypes-algorithms-allegories of my own metaphors-metaphysics-metanarratives. I can't

escape the mimetic hierarchies-registers-levels of my own exchanging-signifying-valuing. I can't escape the mimetic economies of my own logic-grammar-rhetoric. However, in the spirit of Socrates, I can think historically, reflexively and critically with, through and about them. And so can everyone else. So even if the proof of this essay inspires further insights, nevertheless it will eventually be re-configured in other historical contexts by other interpretive communities.

Similarly, the arguments of the 21<sup>st</sup> century theoretical physicists can't be separated from their historical context and interpretive community. That is—given the psychological subjectification of the modern scientific instrumental mind; the empirical objectification of the modern scientific material universe; the epistemological division of the modern scientific subjective mind and objective universe; the analytic fragmentation of the modern scientific cognitive modes; the capitalist alienation of the modern scientific commodified discourses; the hierarchic segregation of the modern scientific paradigmatic truths; the categorical fetishization of the modern scientific hard facts; the academic isolation of the modern scientific specialized disciplines; and the post-modern disintegration of the modern scientific experienced realities—it's no wonder the 21<sup>st</sup> century theoretical physicists are still struggling to put the shattered bits and pieces of the modern scientific world back together again in a General Relativity Theory of Every-Thing. And it's no wonder they can't reconcile the different mimetic archetypes-algorithms-allegories and mimetic hierarchies-registers-levels of Newton's neo-Platonic universal logic, Einstein's neo-Aristotelian general grammar, and Heisenberg's neo-Socratic particular rhetoric in an evolutionary-historical narrative.

In fact, Newton, Einstein, Heisenberg slice the narratives of the long evolutionary history of the relative signifying relations of exchange into abstract mathematic models of the universal structural-logic of cosmic gravity, general functional-grammar of relative gravity, and particular phenomenal-rhetoric of quantum gravity. No wonder, then, that the 21<sup>st</sup> century theoretical physicists still can't reconcile the different semiotic modalities of Newton, Einstein, Heisenberg's theories. No wonder they still can't write an evolutionary-historical physics of the non-identity of non-identity. And perhaps that's precisely because they still haven't recognized the relative signifying relations of exchange as the radical beginning-without-beginning of the radical origin-without-origin of the radical no-thing-

ness-of-no-thing-ness that evolves this so-called universe. They still haven't discovered a general theory of the logic-grammar-rhetoric of the structure-function-phenomenon of exchange-signification-value. They still haven't traced the rhythmic syntax of time with an evolutionary-historical narrative-physics. However, it goes without saying that the discoveries of the 17<sup>th</sup>, 18<sup>th</sup>, 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> century theoretical physicists rank among the greatest achievements of modern science.

If the innovative exuberance and selective restriction of the relative signifying relations of exchange evolve every so-called species and every so-called species evolves them—from kangaroos to platypuses to giraffes—then that fact must be equally true for our own so-called species: *Homo sapiens*. We can't forget, therefore, that even our basic metabolism articulates the cosmic exchange relations of energy  $\leftrightarrow$  mass  $\leftrightarrow$  mass  $\leftrightarrow$  energy. We eat stars. We eat planets. The solar panels of leaves transform the sun's energy and the subterranean networks of roots transform the earth's mass into nutritious plants. Animals eat plants. We eat plants and animals. So we eat stars. So we eat planets. Similarly, we can't forget that even our basic behavior articulates the everyday exchange relations of nature  $\leftrightarrow$  culture  $\leftrightarrow$  history. We exchange greetings. We exchange blows. We exchange impulses, desires, genes; looks, touches, emotions; gestures, food, mates; practices, skills, labor; words, thoughts, ideas; gifts, goods, commodities; coins, money, cryptocurrency; data, information, knowledge—and hypersonic missiles. Every new-born child is yet another co-incidental articulation of the long evolutionary history of the relative signifying relations of exchange. The genetic exchange narratives of mitochondrial DNA link every modern human being to a woman who lived in Africa about 200,000 years ago. And she was linked to a much deeper past.

In other words, Heidegger got it all wrong: it isn't *Being and Time* (1927), rather it's ...*The Time Being* (2000). We are time beings. In the time being, the time being now, the time being lives and dies: giving and taking, losing and keeping—a syntax unfolding the narratives of time. The past positions us as *subjects* within the restrictive institutions of exchange, the present articulates us as *persons* within the pragmatic relations of exchange, the future orients us as *agents* within the exuberant possibilities of exchange. The natural signifying dynamics of exchange evolve the cultural signifying practices of exchange which evolve the historical signifying syntaxes of exchange—and vice

versa. In this context a critical theory of evolutionary philosophy suggests that the dominant practices of exchange evolve the dominance hierarchies of exchange which evolve the dominant institutions of exchange. And the dominant institutions of exchange—as historically manifest, for example, in the monumental architecture of ziggurats, castles, skyscrapers—rise up at the critical junctures of the evolutionary-historical pathways of exchange. These dominant institutions link god and supplicant, master and servant, owner and worker via the sanctified, legalized, rationalized pathways of exchange that they control. While these dominant institutions authorize themselves as the generators and guarantors of the evolutionary-historical pathways of exchange, they are, in fact, all-too-human articulations and arrogations of them. And therein rests the ancient mystery of the Sphinx lying in the desert, the modern secret of the Leviathan rising in the city. In this way the long evolutionary history of the relative signifying relations of exchange cracks open the monumental architecture of the past-present-future. And in this way, once again, a new radical theory of evolutionary semiotics leads to a new general theory of evolutionary history which leads to a new critical theory of evolutionary philosophy.

So we can now recognize that cooperation and competition are two sides of the same coin (cf. Axelrod, 1984; Kaspar *et al.*, 2017; West *et al.*, 2021). They are two sides of the relative signifying relations of exchange that drive the process of evolution. The relative signifying relations of exchange are co-incidental—which means they are contextual. They articulate the forces and struggles of cooperation and competition. And, like every other so-called species, our so-called species transforms its ecological niche and thereby transforms its evolutionary development. A recent study reveals that the orientation of the axis of the earth is shifting because of the huge transfer of weight from the melting ice caps and the missing groundwater (Seo *et al.*, 2023: 1-7; Zhong, 2023: A1, A5). The capitalist profits of fossil fuel are driving global warming and the capitalist profits of industrial farming are driving global desertification. That is, the capitalist relations of exchange are terraforming the planet and transforming the fate of our species—and every other species.

However, a Marxist might object that the capitalist *relations of exchange* aren't the critical issue here, rather the capitalist *modes of production* are the critical issue. And yet, as Roberts and Stephenson (1973) note, "Since the capitalist

mode of production originates in exchange, all features of capitalism...have their origin in exchange. Private property is precisely capital and wages—both of which are products of exchange—and it is based on exchange rights” (1973: 91). Similarly, Karatani (2014) defines “...the economic not in terms of modes of production but rather in terms of modes of exchange” (2014: x). In fact, the capitalist modes of production evolve from the capitalist relations of exchange—e.g. minimum subsistence wages exchanged for maximum labor time. They begin with exchange rights and exchange wrongs. The mirror tragedies of modern capitalism and modern communism can be traced to the mutual failures of their respective practitioners to adjudicate fair and equitable relations of production in the terms of fair and equitable relations of exchange. As a result, both of these global systems of exchange all-too-often return to their neo-feudal default settings. So a critical theory of the long evolutionary history of the relative signifying relations of exchange offers a radical critique of *both* Classical and neo-Classical theory *and* Marxist and neo-Marxist theory. It offers a pathway out of the economic funhouse of these mirror reflections.

Again, the deregulated market economy empowers the capitalist plutocrats who rule The New York Stock Exchange, while the dictatorial command economy empowers the communist princelings who rule The Shanghai Stock Exchange. In turn, the plutocrats empower the autocrats of state-capitalism, while the princelings empower the emperors of state-communism. These neo-feudal hierarchies of exchange are suppressing and negating the neo-democratic principles of fair work and fair wages, fair trade and fair taxes. They are enraging the working-classes, destroying the middle-classes, emboldening the wealthy-classes—and setting the stage for global conflict and global extinction. They are dragging everyone on the planet backward into the apocalyptic future of neo-fascism vs. neo-totalitarianism. Similarly, the neo-feudal hierarchies of exchange are dragging everyone on the planet backward into the apocalyptic future of neo-theocracy vs. neo-theocracy. These three different alpha-male-primate dominance hierarchies of exchange—neo-fascism, neo-totalitarianism, neo-fundamentalism—offer perfect examples of the historical past slipping into the historical present under the invisibility cloak of technological progress.

Benjamin writes his famous “Theses on the Philosophy of History” (1940) just a few months before, as a German-Jewish refugee, he is imprisoned by the Spanish Fascists; just a few months before, as a German-Jewish refugee, he is

about to be handed over to the German Fascists; just a few months before, as a German-Jewish refugee, he commits suicide. In “Thesis IX,” he discusses a painting by Klee in which “the Angel of History[’s]...face is turned toward the past...which keeps piling wreckage upon wreckage...in front of his feet” while the “storm” of “progress”... “propels him into the future to which his back is turned” (1968: 257-8). The very idea of naming this supposedly new geologic era as the “Anthropocene” (cf. Simon *et al.*, 2021), therefore, not only affirms our species hubris, but also our technological hubris. And, thankfully, the International Union of Geological Sciences has just rejected the proposed label (Zhong, 2024: A1, A8). If we are living in a new geologic era, then I’d prefer a name like the “Ecocene”—the new era of local  $\leftrightarrow$  global  $\leftrightarrow$  universal exchange that evolves and connects every ecology and culture.

In sum, the varied, prolific, relative signifying relations of exchange are the solution to the great mystery wrapped in the great enigma in Darwin’s great book. And in order to make that argument—in order to write it—I’ve re-configured Darwin-Peirce-Einstein’s special theories of evolution-semiosis-relativity in a radical theory of exchanging  $\leftrightarrow$  signifying  $\leftrightarrow$  valuing. Specifically, I’ve re-oriented Darwin’s retrospective theory as a prospective theory. As a result, I’ve re-wilded evolutionary time. Evolution doesn’t begin with the *post hoc* utilitarian selection of utilitarian horses, rather evolution begins with the *ad hoc* exuberant innovation of exuberant exchanges. In short, exchange is the horse that pulls the cart of evolution. And, as the Diné suggest, we are f/lying along with that horse toward the horizon. So I propose that the General Relativity Theory of Every-Thing can be further radicalized as a General Exchange Theory of No-Thing. If  $E = mc^2$  is a radical algorithm of exchange, then  $E = ex^2$  is an even more radical algorithm of exchange. Here we return to the proof that was to be demonstrated—with a twist: Evolution = exchange<sup>2</sup>. In fact, that radical algorithm leads to an even more radical algorithm,  $ex^2 \leftrightarrow E$ , which leads to an even more radical hieroglyph:  $X^x$  —a graphically-doubled double-helix of signification. And so that radical hieroglyph not only *represents* the relative signifying relations of exchange factored to the nth degree, but also *depicts* the relative signifying nexuses of exchange factored to the nth degree. It represents and depicts the origin-without-origin of the evolutionary semiosis of this universe and all the universes dangling from the inter-cosmic stems of the deep-sea ping-pong tree-sponge.

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