Light Signifying Form :
Peirce on creativity, responsiveness and emergence in quantum, biological and linguistic systems

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Abstract: Using Peirce as a guide, this paper explores the way in which light mediates finitude through the relational process of *semiosis*. Embodying the triadic logic of identity, difference and return, light *creates* space, time and matter. Attention is on simple bodily forms and the *meta*-physics of their relationality. The first section introduces the mathematical and metaphysical contours of Peirce's approach. The second section motivates Peirce's three categories as interwoven process. In the third section, Peirce's formalism of the sign is presented and applied to simple physical and biological bodies.

Prelude: In the beginning …

Lau Tzu once wrote that knowing the ancient beginning is the essence of the way [*Tao Te Ching*, Verse 14]. But what do we mean by beginning? And what kind of beginning should we seek? Temporal? Causal? Formal? Logical?

To seek the beginning is to embark on a journey of self-emptying and return to the source. Beginnings, like horizons, are elusive, always just beyond our grasp. The beginning is always already past. It is potentially significant to contrast *in the beginning* with the more common philosophical conception of foundation or *ground*. The ground, the earth, the land, is a *given structure* which supports or hosts beings in their relationship with one another. It is spatial, total, all at once. In the most abstract sense, the ground might be thought of as a *geo-metry* of space; a lawful, mathematical basis for the presence of individuals as individuals, be they particles or persons. The abstracted ground—space—sustains identity but it does not *grant* identity. In itself, it is not creative. The abstracted ground is the domain of the same, to use the terminology of Hegel [1977] or Levinas [2002]. If we seek to find the source of identity in the ground alone, *in the same*, we encounter the empty void.

Returning to the beginning draws us away from the emptiness. We encounter difference, asymmetry, that which has no equal:

> *And darkness was on the face of the deep.*
> *And the Spirit of God moved upon the face of the waters.* [Genesis 1.2]

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The earth, without form, might be said to be void, but beyond a found image of emptiness, beyond the geo-metry of space, is *in the beginning*. To cut ourselves off from the beginning is to make for ourselves a geometry of being which is cut off from the source. Without mediation, the transcendent becomes the excluded middle of a binary logic whose form is the empty reflection of what we take to be our *Self*. To draw away from the empty void is to understand ourselves differently and, in so doing, a new heaven and a new earth come into view.

> *And God said, Let there be light: and there was light.* [Genesis 1.3]

In this paper[2], using Peirce as a guide, I explore the way in which light mediates finitude through a process of *semiosis*. Here attention is on simple bodily forms and the meta-physics of their relationality. The first section introduces the mathematical and metaphysical contours of Peirce's approach. The second section motivates Peirce's three categories as interwoven process. In the third section, Peirce's formalism of the sign is presented and applied to simple physical and biological bodies. The final section is an abductive leap.

First Movement: Mathematics, metaphysics and music

In *Songs for Relinquishing the Earth*, Zwicky [1998] writes of how, in the end of mourning, we must pass through "that absence in ourselves". Awareness of absence becomes an opening whose sense, for Zwicky, is musical. A path of listening.

To listen is to enter into a place of open expectation. Listening is deeply temporal. It involves attention to what lies beneath, within, or beyond—what is passing through—the momentary present or current state. Listening dissolves the earth as brute fact by signifying something more or greater or yet to be. *The ear is a womb.* Let this metaphor sit uncomfortably in our minds for the time being.

Newton's *Philosophiae Naturalis Principia Mathematica* is said to unite heaven and earth in a calculus of difference. Let us take this as the ground for our exploration. The limiting form of the differential operator in Newton's theory becomes, for Peirce, a sign of the infinite as *infinitesimal*. Like "infinity", the infinitesimal is a tricky (non)-concept that perches on the edge of signification. Modern analysis, which provides the formal mathematical basis for differential calculus, involves the use of infinite series to limit, contain or perhaps even exclude the infinitesimal. Peirce questions the way modern analysis circumvents the infinitesimal [Herron 1977] through the use of convergent, infinite series whose limits are never reached: "… the doctrine of limits has been invented to evade the difficulty, or, as some say, to explain the significance of the word 'infinitesimal'" [*Law of Mind*, 537]. He is particularly critical of formal approaches to differential calculus (and the related treatment of limits or boundaries) in which

[2] Previous explorations focused on the way in which light becomes a sign of the absolute in modern theories of physics [Rogers, 1-11]. There light was found to be an irreducibly threefold operator invoking identity, difference and return. It creates time, space and matter through the principles of relativity theory such that the quantum ontology of the latter is consequent to the triadic form of light.

the infinitesimal becomes void—an excluded middle or symmetric cut that is assumed to define the relationship of proximity between Real numbers or points on a line, for example. With these approaches, each number or *point* is absolutely differentiated from its neighbour in the way that individual members in a class are separated from one another. But the cut itself, which is the limit where one number or point merges into its neighbour, is excluded[3]. Peirce claims that this is a false conception of continuity because *a continuum contains its limits* [*Law of Mind*, 544]. The absolute cut of analysis is a binary operation that results in a symmetric relationship between the two sides of the cut. Peirce questions whether this symmetry actually obtains, even for Real numbers.

Instead, Peirce argues for a different conception of continuity which he calls *synechism.* Unlike the continuum of modern analysis in which each element or member—each part—is a separate individual, in Peirce's continuum the individual parts blur into one another such that they do not have completely separate identity. He takes the flow of time as an archetype in which each moment flows out of a past moment and into a future moment. Whereas analysis assumes, as its ground, the independent identity of foundational elements (points in time, for example), Peirce argues that the identity of any part must derive from the whole to which it belongs. To introduce his concept of continuity, he turns his attention to the infinitesimal which he treats as an *interval*. For Peirce, however, the formal structure of the infinitesimal interval is *triadic*, containing a beginning, middle and end (in contrast to the *binary* cut of modern analysis and the *unitary* form of the point). And unlike modern analysis, successive intervals overlap such that the beginning of the next is the middle of the former and the middle of the next is the end of the former. The overlap, or redundancy, is what enables the finite objectivity of the world. However, this objectivity is a *mediated* process which always involves an interpreter. As we will explore further in the paper, Peire's infinitesimal results in the formation of finite, "whole" images within a diffuse background of potentiality. The mediation is intentional and based on a process of abstraction involving inferential relatedness (eg inferential comparison) and pattern recognition.

For Peirce, all objects or bodies can be considered interpreters in some sense. For example, an electron might be considered an interpreter of quantum spin[4]. To say that all bodies can be considered interpreters means that they possess an *interiority* that is in a mediated relationship with the world. However, this way of speaking can also be misleading because the classical concept of a body as a separable "object" does not hold in Peirce's approach. In a sense, Peirce's infinitesimal is a formal property of interiority that grounds, exteriorizes, *spatializes time*.

There is also an inherent uncertainty principle or randomness with Peirce's concept of continuity which he calls *tychism*. Tychism is a property of "being-with" that conditions relatedness. The indeterminate, resonant structure of the quantum vacuum might be taken as an example[5]. In a sense, tychism is a formal property of external localization or extension that animates, interiorizes, *temporalizes space*. Peirce critiques a classical conception of space as an empty, inert container for the localization of properties or qualities. According to Peirce, no quality can

[3] For an extended exploration of the breakdown of the differential operator in the non-Euclidean space of relativity theory, see Rogers, *The Proximity of Light: a deconstruction of space*.

[4] For a discussion of how an electron is an interpreter of spin, see Rogers, *Light as the Origin of Origins: How the ontological form of quantum mechanics is consequent to the principles of relativity theory*.

[5] For an extended discussion of the resonant structure of the quantum vacuum, see Rogers, *A Physicist's Guide to [Hegel's] Phenomenology of Spirit: Resonance, disambiguation and the genesis of spatial orientation*.

be unambiguously given or assigned to all "points" in a spatial domain. By way of illustration, he considers the example of a surface that is part red and part blue "so that every point on it is either red or blue, and, of course, no part can be both red and blue." "What, then," he asks, "is the colour of the boundary between the red and the blue?" [*Law of Mind*, 545]. Peirce concludes that the quality of colour cannot be assigned to an isolated point; rather, it is spread over the immediate neighbourhood of a point. Within extended domains of red or blue, this is not particularly problematic because the neighbourhoods of all points have the same quality. However, the boundary itself is half red and half blue. It is as if points on the boundary have an indeterminate potential to be either red or blue. Peirce likens this ambi-valent boundary to the nature of the temporal present, which is half past and half to come. The ambivalent, ambiguous, indeterminate nature of the boundary is an opening to interiority. In the simple example of trying to assign a binary quality to points on a surface, Peirce encounters the boundary as the potential for quality. It is an interior state of indeterminacy, but more than that the boundary is a window into a prior potentiality for quality (i.e. red and blue) which has been actualized by the spatial domains. Peirce calls this opening into an interior state *feeling*, although in this context feeling does not refer to emotion but rather to a holistic inner state that may obtain for any interpreting entity from photons to persons. Perhaps a less anthropocentric term would be *intentionality*.

The analytical notion that properties can be assigned to null, yet separate, Euclidean points of a spatial domain does not hold for Peirce. Instead, it would seem that space is always constituted by open domains whose interiorities resonantly interact with one another. The nature of the interaction depends, in part, on the scale. Space becomes an enabler of "objects" or bodies of varying degrees of complexity (such as electrons or organisms) which evolve in relationship with one another. Unlike the featureless inertness of the Euclidean point, the open kernel of spatial domains involves an inherent randomness or animation which is partly a consequence of the inseparability of "objects" or bodies. Randomness or tychism is a background quality of potentiality through which bodies are opened up to a mediated interiority or *responsivity*. For example, we might speculate that a massive body, conceptualized as a spatially localized entity, will always possess a resonant interior which is a consequence of its essential identity with and responsivity to other massive bodies. This is the way in which properties, like mass, might be embodied in space and time within Peirce's metaphysical framework.

Euclidean geometry, which is based on equality or *sameness* of all points, cannot accommodate ambiguous interiority or responsivity. In Euclidean geometry and its related differential calculus, the boundary is null or void—an excluded middle—and the infinitesimally extended domain or point is featureless or empty, lacking any potentiality. For Peirce, these assumptions involve a false image of relatedness. Since Newtonian physics is founded on a differential calculus of Euclidean geometry for both space and time, it results in a false determinism (or fatalism) which is void of novelty, creativity and, what Peirce calls, *mind*.

Peirce takes mathematical form as metaphor for metaphysical form. In *The Architecture of Theories*, he writes "metaphysics has always been the ape of mathematics" [p174]. In that paper he uses projective geometry—in which an "infinite" space is mapped back onto itself—to critique a crucial metaphysical conjecture that can be located in the formalism of Euclidean geometry (i.e. projective parabolic geometry)[6]. This conjecture privileges sameness and subverts

[6] For further discussion, See Raposa [1989].

inequality or otherness. The critique involves a comparison of the symmetry properties of parabolic (Euclidean) geometry versus hyperbolic geometry[7] under projective transformations and then using this comparison as a figure or trope for understanding the limitations of the Newtonian or deterministic worldview. Roughly stated, Peirce contrasts a metaphysics of strings and points within an inert continuum (Euclidean or parabolic geometry) with a metaphysics of open domains and relationally mediated growth formed from an indeterminate continuum of potentiality (hyperbolic geometry).

More specifically, in projective parabolic geometry, infinitely distant parts of any plane seen in perspective appear as a straight line or string. "Points", which form the *analytic foundation* of Euclidean worlds, mark the ends or limits of a straight line. If a straight line extends to infinity in both directions, the end points (under projection) coincide as a *single* fixed point, called the Absolute. This coincidence is one way of understanding the translational symmetry of space. However, such a formalism cannot support *asymmetry* which Peirce claims is a key property of time. In hyperbolic geometry, by contrast, the Absolute remains two distinct entities under projection—an alpha and an omega. Asymmetry is built into hyperbolic geometry such that the universe can be said to spring from a chaos in the infinitely distant past to tend toward *something different* in the infinitely distant future.

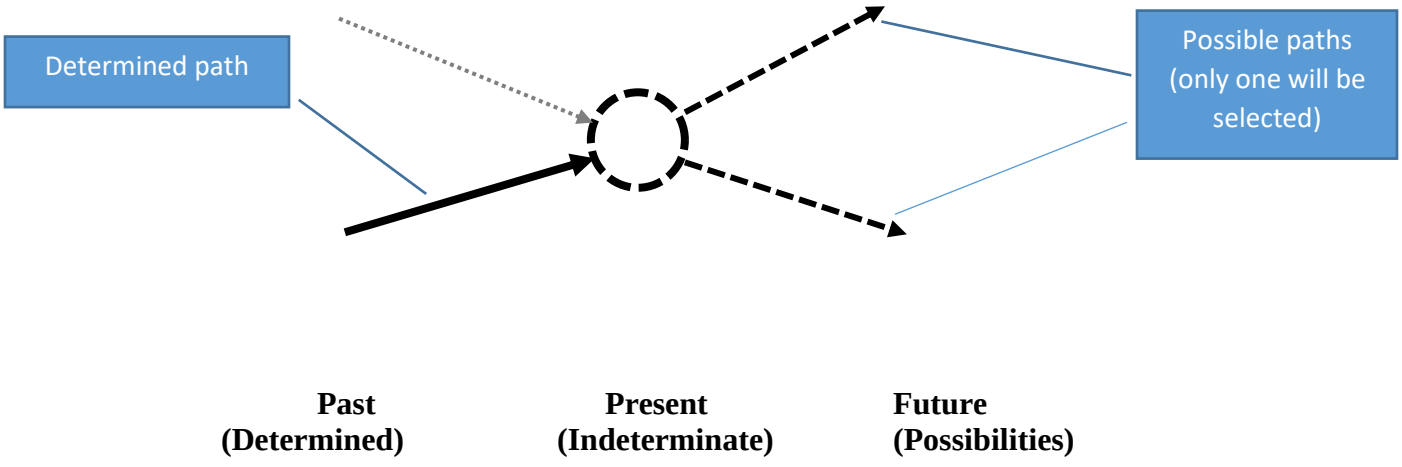
Additionally, in hyperbolic geometry, "the infinitely distant parts of any plane seen in perspective appear as a circle, beyond which all is blackness"[8] [Peirce, *Architecture of Theories*, 173]. The circle, which returns upon itself to form a mediating boundary for interior and exterior, is a central trope of Peirce's theory that will be explored in this paper. Based on his metaphysical insights, Peirce speculates that the world in which we live is hyperbolic and not parabolic (Euclidean). This speculation predates the development of relativity theory (which is based on hyperbolic geometry) and his metaphysical insights may still have an important role to play in the interpretation of relativity theory.

The theoretical form to be explored in this paper, which is guided by Peirce's writing and its interpreters, might be roughly introduced as follows. "Bodies"—be they electrons or biological organisms or persons—come into being or *emerge* through a process of mediation. Bodies possess *interiority* which involves an open process of synchronization with the exterior world through which a response or future path can be "selected" from a set of possible paths. Interiority involves *indeterminacy* or randomness or "freedom" as a key constitutive element. However, this indeterminacy is conditioned by a structural framework which is formed in time and is indexed to a particular "present state" of the body. The structural framework forms a *system* that constrains the relationship between particular bodies of the same kind (a whole) such that bodies follow spatio-temporal paths governed by general laws or *habits*. The laws are stochastic in nature which is to say that they possess inherent randomness and uncertainty.

The structural framework of general laws or habits limits the future possibilities or paths *for a particular body at a particular time* according to past determinations as illustrated in figure 1.

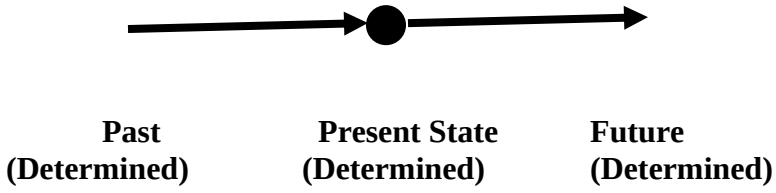
[7] Hyperbolic geometry is the geometry of Einstein's theory of relativity, although Peirce's article predates Einstein's work. Peirce also considers the third possibility of elliptical geometry which will not be discussed here.
[8] A trope that perhaps is not unlike a black hole.

Figure 1: Temporally embedded nature of "bodies" in Peirce's metaphysical framework[9]



This form of temporality can be contrasted with the mechanistic determination that characterizes Newtonian physics as shown in figure 2. In the Newtonian framework, the "present state" is ultimately reducible to a "null point", effectively erasing all trace of interiority, creativity and freedom.

Figure 2: "Timeless" nature of mechanistic determination in Newtonian physics



Bodies are formed by systems and systems are constituted by bodies. This is a progressive, evolutionary process that is mediated by "communication" or the flow of information. Bodies

[9] It should be noted that in this figurative treatment of time I have also partly borrowed from Wallace's formal logic of future contingents [Wallace, 2011].

may grow in complexity over time and higher order systems may emerge from lower order systems. Systems are ordered hierarchically such that the bodies at one level of order are formed into wholes which constitute the bodies of the next level. (For example, single cells at one level form into multicellular organisms at the next level of the hierarchy). Through this process there is a deepening of interior responsiveness and an expansion of capacity to process information from the external world to inform responses or re-*actions*.

The elementary formal unit for this theory is the *sign.* A sign involves an irreducibly threefold relation in which a *sign* (as a vehicle for representation) stands for an *object* to which a response may be made by an *interpretant*. Bodies are formed through signs. (This statement may seem counterintuitive at first—see section 3 for further discussion.) Bodies of an identical type form degenerate systems or groups. However, the constituents of a group are not individuated to the extent that members of a class would be (in the mathematical theory of classes, for example.) Bodies constituting a group obtain individual identity through a resonant relatedness with one another. A body cannot be fully abstracted as a separately enduring Self[10].

How are we to think about this formalism? A carefully chosen image, like a map, might be helpful. In this regard, the form of metaphysics to be explored in this paper is like the form of music, particularly as described by Zuckerkandl [1973]. Bodies are tones. But music is not made of tones in the way a house is made of bricks. Rather, each tone is a momentary locus, incomplete in itself, yet anticipating the whole to which it belongs. Music occurs not through the analytical stepping from one tone to another, but in the spontaneous dancing through intervals between tones. Music is a *system*.

> *A system in which the whole is present and operative in each individual locus, in which each individual locus knows, so to speak, its position in the whole, its relation to a centre, must be called a dynamic system. The dynamic qualities of tone can only be understood as manifestations of an orderly action of forces within a given system. The tones of our tonal system are events in a dynamical field, and each tone, as it sounds, gives expression to the exact constellation of force present at the point in the field at which the tone is situated. Musical tones are conveyors of forces. Hearing music means 'hearing an action of forces'* [Zuckerkandl 1973, 36].

The rest of this paper involves an exploration of the *irreducibly threefold* or "triadic" form of Peirce's metaphysical framework. Please bear in mind, however, that my prejudice is that the triadic form is greater than Peirce's treatment[11] and so, inevitably, other triadic formalisms are mixed into my interpretation of Peirce, including those of Levinas [2002], Hegel [1977], and, especially, Augustine [2012].

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[10] Although "bodies" are like objects in many respects, they lack self-contained identity. Rather the identity of a body comes from intentionality which involves mediation between interior and exterior. This is what makes Peirce's concept of spatiality radically different from Newton's concept. The featureless "point" is the Newtonian image of self-contained identity. For Peirce, the image of the point is a false image of the absolute.

[11] For further discussion, See Rogers, *Three Reflections on Return: Convergence of form with regard to light, life and word*.

Second Movement: The triadic form of gifting

Why is there something rather than nothing? Guided by Peirce, our exploration of differential calculus and Euclidean geometry seems to lead us into the void. Null points joined by null connectors to form an inert, empty space of nothingness. We might call this an *ontology of the same* because it is based on the assumption that all points (in space and time) are equal; it subverts or excludes Otherness[12]. This is not just a mathematical pre-miss, it is also a metaphysical presumption. For example, Newtonian metaphysics begins with the elimination of the Otherness of heaven in relation to earth. The Same, to which all becomes related, is taken as the measure of the observer. This assumption of universal sameness seems to have led us to a false image of unity (for example, a false image of the unity of the Absolute). Much of twentieth century continental philosophy is a critique of an ontology of the same. Although we will not explore this critique here, Levinas would be a good guide for such a journey.

There are two key insights that might help us move forward. The first comes from Aristotle. If we reflect on the things we find in the world, we might notice that they are organized in a hierarchy where species come from genera at increasingly higher levels of inclusiveness. For example, beagle from dog and dog from mammal and mammal from animal. Suppose, following this trail, we attempt to ascend to the highest genus or category, which we might call "being" or "essence". What Aristotle and others have argued [see for example, Somers-Hall 2012] is that, if we want to speak about the substance of reality at the highest, simplest or most original level as a genus or category—that is to say, if we want to ask what reality is made of or what it consists of; if we want to question the nature of "being" or "essence"—then will be confronted with a paradox. The paradox occurs because the highest genus or category cannot be a unity, it must be heterogeneous in order for the hierarchy to be differentiated. The highest category must include both identity and difference in order for our world to be differentiated into a variety of things. Unity, or the One, is not a thing among things and cannot be categorized as such[13]. Unity is like pure potential that is beyond conceptualization. One consequence of this is that we cannot define, describe, or contain unity, we can only speak *about* it and only indirectly at that.

The second insight comes from Augustine[14]. It is simply this: *nothing is not something*. What is challenging about the statement is that it appears to tell us something about nothing. This is misleading. The word "nothing" is not really a word like other words because *its referent does not exist*. Augustine says that what is really meant by the word "nothing" can be likened to a state of mind which seeks out something but fails to find it. This negating is purely temporal and implicitly binary. The problem with our exploration of mathematics so far is that we have rested on nothing as if it were something.

The continual process of putting forward a conception of the One and then negating that conception in order to move beyond its limitations is a traditional path of contemplation called *via negativa*. It may lead to a personal experience of enlightenment but, because the outcome is

[12] For further discussion of the ontology of the same in Newtonian metaphysics, see Rogers, *The Proximity of Light: A deconstruction of space*.
[13] For further discussion, see Rogers, *Beyond Space and Time: Unity and form in Augustine's Confessions*.
[14] For a discussion of Augustine's treatment of "nothing", see Rogers, *Beyond Space and Time: Unity and form in Augustine's Confessions*.

pure experience, it cannot be exposited or taught or systematized. Any attempt to conceptualize unity—as being or essence for example—puts forward something which must then be negated in order to stay the course towards unity. The movement itself eludes our understanding. "Dimly we apprehend this double movement—that turning away from the primal ground by virtue of which the universe preserves itself in its becoming, and that turning toward the primal ground by virtue of which the universe redeems itself in its being … our knowledge of duality is reduced to silence by the paradox of the primal mystery" [Buber 1970, 149].

These two insights suggest that a philosophical understanding of reality cannot be grounded in a single category—such as being—as some analytical thinkers might expect, nor can it be held fast in duality—such as différance—which is always deconstructing what is posited. Our reflection on these insights seems to lead us to three and to Peirce's metaphysics.

Peirce's theory is not foundational. He proposes three interwoven categories, called Firstness, Secondness and Thirdness. These categories animate and sustain a continuous evolutionary process that takes the form of growth or progressive *learning*. The process is both hierarchical (spatial) and emergent (temporal), such that higher levels of complexity are forged from lower levels. Each progressive level involves more intricate bodily forms with deeper interiority that grows in responsiveness and intentionality. The process is mediated by signs which also have a triadic structure.

Peirce's three categories are not fully individuated nor mutually exclusive. They flow in and through one another. They are not further reducible (for example, to a combination of unitary and/or binary categories). However, Peirce claims that any additional categories (for example, four or five categories) are reducible to three[15].

Because the three categories are not reducible, they cannot be individually defined *per se*. They relate as a whole such that their identities and their differences are brought into play at the same time. The more we speak about and work with the categories, the more clearly they might come into view[16]:

- *Firstness* is "that whose being is simply in itself, not referring to anything nor lying behind anything" [Peirce, *A Guess at the Riddle*, 248]. It is potential that is not yet actual—pure indeterminacy that is dynamic and self-othering. Firstness only appears in and through Secondness and Thirdness. It is fresh, spontaneous, whole. Peirce often refers to firstness as *quality*.
- *Secondness* is "that which is what it is by force of something to which it is second" [Peirce, *A Guess at the Riddle*, 248]. It is event, effect, otherness, compulsion. Secondness is constituted by things and facts which interact dyadically [Corrington 1993]. It is the domain of pure *experience* or "brute actuality".
- *Thirdness* is "that which is what it is owing to things between which it mediates and which it brings into relation to each other" [Peirce, *A Guess at the Riddle*, 248]. It is mediation, laws and habits, *generality*. The Third connects the First and the Second and weaves "a fabric of

[15] The special status of three might be like the special status of triangles in Euclidean geometry to which all other polygons can be reduced.

[16] For a slightly different take on this formal triadic form, see Rogers, *Beyond Space and Time: Unity and Form in Augustine's Confessions*.

concrete reasonableness in and through the world" [Corrington 1993]. The Third relates "things" to generalized "systems" from which Firstness re-emerges.

According to Raposa [1989], the forming logic of Peirce's three categories is like the irreducible triadic form of giving a gift or *gifting*. In the semantic structure: *A gives C to B*, relation can range over the three members of the triad as well as over different instances or sets of ordered triads. That is to say, there is a formal relationship of *interiority* between A, B and C, as well as a formal relationship of *exteriority* in the generalization of the instances of the fixed structure of A, B and C. Raposa contrasts the logic of gifting with the classical logic of exchange or equality which involves a binary semantical form: *A is B*. Interior and exterior are not differentiable with this latter form. Whereas the binary form operates through the concept of *classes*, Peirce's threefold logic operates through *systems*.

With binary or classical logic, individuals are members of a class (or set) which is, in some sense, eternally and simultaneously present as the collection of all members (i.e. it is *spatialized*, to use the terminology of geometry, or it is *totalized* to use Levinas' terminology of ontology). The class constitutes the general from the particular individual members. Induction in classical logic involves sampling individual members to infer general properties of the whole class. Generality is deterministic, fixed, fatalistic, without freedom or choice. With triadic or systemical logic, generality is constituted in space and time from the system of relations of individuals (both interior and exterior). The development of systemical logic involves sampling of fragments of a system to infer the complete system. This *process* involves a combination of abduction (abstracting a finite body as a whole through "recognition" or "guessing"), induction (inference from particular instances to the general case) and deduction (a law-like process of testing inferences and guesses against experience). Systemical logic results in generality as a possibility that is conditioned by intentionality and habit (or repetition).

Raposa [1989] calls systemical logic the logic of relatives. Classical logic can be seen as a degenerate form of systemical logic in which the totality of the system (i.e. as class) is given simultaneously or "totalized" all-at-once (eg. Structuralism). Classical logic is the logic of similitude in which members have a special relationship of identity [De Magalhaes, 1984]. The more expansive form of systemical logic is able to deal with systems that are not simultaneously synchronized, such as those encountered in the theory of relativity[17]. For such systems, members are not individuals in the classical sense—they are not completely distinguishable and their manifestation might be more aptly compared to the process of individuation encountered in quantum mechanics[18]. Systems are contingent, temporal, future-directed, emergent and compelled by final causes[19].

[17] Newton's concept of "Absolute Space" (i.e. Euclidean geometry) might be seen as an example of a degenerate system that is simultaneous or totalized. Einstein's theory of relativity, by contrast, takes light as a sign of the absolute through which synchronization happens as a process. For further discussion, see Rogers, *The Proximity of Light: A deconstruction of Space.*

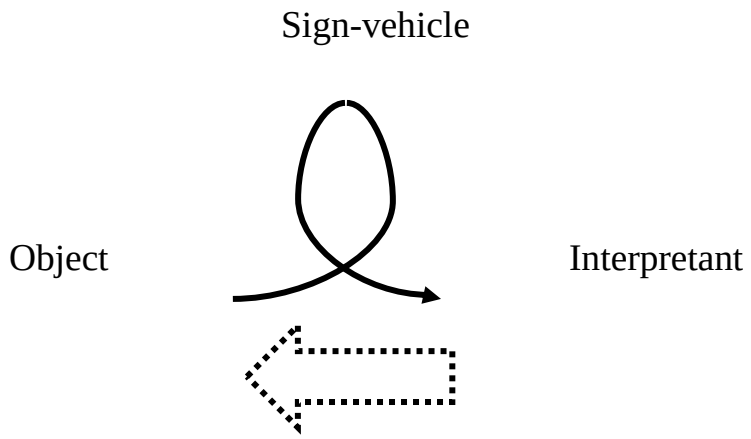
[18] For further discussion, see Rogers, *A Physicist's Guide to [Hegel's] Phenomenology of Spirit: Resonance, disambiguation and the genesis of spatial orientation*.

[19] For further discussion, see Rogers, *Towards the Case Against Reductionist Theories of Evolution*.

Third Movement: A theory of signs

The formal basis of Peirce's theory is the *sign*. Unlike the binary relationship between signifier and signified that characterizes many theories of signs, for Peirce a sign is triadic in form. The three elements of a sign are: the *sign*-vehicle (also called representamen or simply "sign") which stands for an *object* to which a response may be made by an *interpretant* [Robinson 2010]. The sign-vehicle does not signify anything in itself. Rather it is able to signify because it is affected or determined in some way by the object and, in turn, it is able to affect the interpretant. The interpretant is a change of state that allows the sign to mediate between the object and an interpreting entity. Often the interpretant will be a change in an interior state of an interpreting entity. For example, it may be an "image" or "thought" in someone's mind (i.e. what is signified to someone by the sign). However, the interpreting entity need not be a person, it could be any object or body whose state may be changed in response to the sign (such as an electron or an amoeba). The triadic form of a sign is shown diagrammatically in figure 3. The sign-vehicle mediates a relationship between the object and the interpretant (represented by the loop in figure 3) such that the interpretant may directly refer back to or re-present the object (represented by the dotted arrow).

Figure 3: Triadic Form of a Sign

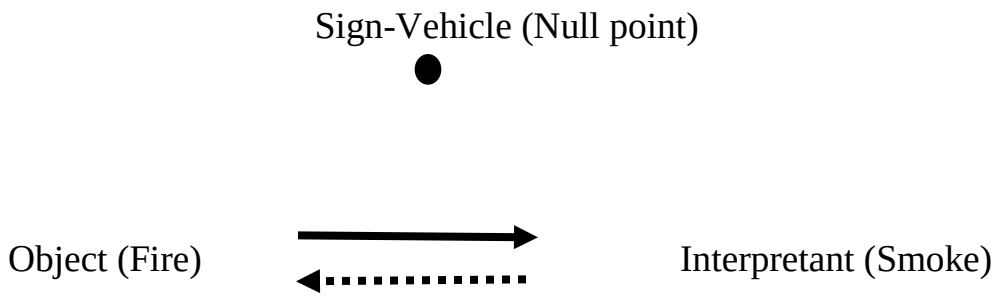


Through the sign, the relationship between the object and the interprent is *asymmetrical*. The sign-vehicle mediates (forward) a relationship between object and interpretant which then allows for a direct representational connection (backward) between interpretant and object. An interpretant may then serve as a sign for another interpretant and this process may continue indefinitely. Herein lies Peirce's notion of the continuum—the triadic form of the sign is similar to the triadic form of the infinitesimal discussed earlier.

Before going on to explore the formal properties of the sign, it might be helpful pause and reflect on how this form is related to the binary forms of classical logic and Newtonian mechanics. To that end, suppose there is a deterministic causal connection between the object and the interpretant. Then the change of state for the interpretant is caused by the object *directly*. For

example, smoke is caused by fire. In this instance, the sign-vehicle might be taken as null and the relationship might be seen as symmetric as shown in figure 4.

Figure 4: Determinism Reduces the Sign-Vehicle to a Null Point



A purely symmetric relationship between cause and effect cuts off the sign-vehicle and, therefore, eliminates the possibility of a semantical relationship of meaning. That smoke refers to fire becomes purely tautological in a deterministic world. Such a world cannot support interiority, freedom, novelty or change[20]. It also cannot support information, meaning or language[21]. The triadic form of the sign, however, opens up to the extra-ordinary event of possibility, significance and truth.

3.1 Creativity

The sign is *creative*. Creativity is related to firstness. Through the sign, objects are abstracted or foregrounded as finite entities from a diffuse background. Abstraction is a process which involves repetition, reflection, or comparison and the objects are abstracted *for* an interpreting entity. Peirce calls the type of sign that characterizes this process an *icon*. Icons refer through *likeness*: the sign resembles its referent object in some qualitative way. Iconicity is the forebear of information, images and concepts.

In human language, the creativity of the sign may be most apparent through the poetry—figurative language that works in the realm of images and concepts, for example. For illustrative purposes, consider the following thought experiment. Let's take "red" as an example of a simple concept and ask how it might come to have meaning for us. In its earliest inklings, the concept of red is embedded in the world as the possibility of quality—the particular *suchness* of that red

[20] For further discussion, see Wallace, *Richard Taylor's 'Fatalism' and the Semantics of Physical Modality*.
[21] For further discussion, see Rogers, *Is Dretske's Theory of Information Naturalistically Grounded? How emergent communication channels reference an abstracted ontic framework*.

apple on the tree. The redness can be foregrounded by the use of metaphor—*that apple is the setting sun*. The key property of metaphors is that they "contain the whisper *it is and it is not"* [Robinson 2010, 143]. This whisper is an echo of the double movement we encountered earlier in our discussion of negation. The apple *is* the setting sun (in some sense) and the apple *is not* the setting sun (in another sense). The tension or paradox between the "is" and the "is not" in the metaphor is a Second which is archetypal for icons. (Notice that a Third is also brought into play as the interpreter who is called to discover the sense.) The image of the red apple might now be used as iconic for other embedded instances of redness. This process will allow *redness* to begin to emerge as a distinct quality that appears repeatedly in the world. The process of abstraction is completed in the *naming* of this quality as "Red". Once named, "red" can be defined as a concept. This simple thought experiment suggests that the abstract concept— what is meant by the term "red"—might emerge organically from a diffuse background of feeling through the use of iconic images as signs[22].

The creativity of the sign form, however, is not limited to human language. Biological organisms can also be understood as sign-interpreting processes. (This theoretical framework is called *Biosemiotics* and the primary unit of biosemiotic research is signs, rather than molecules or a cells [Emmeche 2011; Kull 2011]).

Consider a single-celled amoeba as an example of a sign-interpreting body. The inner state of the amoeba is a potential *interpretant* that can respond to impinging forces from its environment. The impinging forces from the environment might be thought of as a diffuse background of random fluctuations for the amoeba that are reflected in an interior state of the amoeba that might be formally similar to Peirce's notion of "feeling" (although this need not imply sensation, emotion, awareness or any other higher-order inner state.) However, despite the randomness of the environment, it may be possible for the amoeba's inner state to synchronize with other "bodies" in the environment if there is a "communication channel" between the external body and the amoeba. The communication channel might be any causal pathway that causes a change of interior state in the amoeba as a result the exterior body. Based on Shannon's theory of information flow, the communication channel can establish a spatio-temporal scale of "coarse graining" or digitalization such that the interior state of the amoeba re-presents information about the state of the exterior body[23]. The communication channel is like a resonant structure through which a (whole) pattern can be transmitted and "recognized". The spatio-temporal scale of the pattern depends on the inter-relation between exterior body (transmitter), interpreter (receiver) and pathway of information flow (channel). In this way the exterior body may become a sign for the amoeba who may become an interpreter. The amoeba *represents* the external body as an interior state or "image" such that the interpretant emerges from a vague, diffuse background.

However, in order for the amoeba to be an interpreting entity, two other conditions must also be met as discussed by Robinson [2010]. First, the external body must have a purpose *for the amoeba*, such as food or energy. It is this intentionality that generalizes particular interpretants to a category that *makes sense* to the amoeba. Second, not all external bodies to which the amoeba

[22] For an exploration of this creative process, see Rogers, *danse sur glace: an experiment in language*.
[23] For a discussion of this process of abstraction and its relationship to communications theory, see Rogers, *Is Dretske's Theory of Information Naturalistically Grounded? How emergent communication channels reference an abstracted ontic framework?*

responds can serve the purpose. For example, if the purpose was food or energy, and the amoeba only responded to external bodies that served this purpose, then it would actually be a deterministic relationship rather than an interpretive one. For the inner state or interpretant to be a *sign* of food, it must be possible that sometimes the inner state obtains when the external body is not food. In other words, the external bodies to which the amoeba responds are sometimes food and sometimes not food. Again we encounter the mysterious whisper *it is and it is not*. Negation, which in this case might be called error, opens up for the amoeba the possibility of *learning* as the process for selecting true representations.

Ollner [2010] has coined the term True Narrative Representations or TNRs to characterize representations which correspond with the external world and to differentiate them from noise or error. TNRs might be related to the concept of error-free signal transmission in communications theory[24]. Ollner has argued that TNRs are unique in their logical properties and that they optimize the principle of "least effort by which a dynamically well-fitted representation is to be preferred over one that does not fit so well" [Ollner, 2010, p641]. In an evolutionary theory[25], it might be expected that TNRs would be selected because of their fitness. Creativity and abstraction might be seen as guided by truth.

3.2 Responsivity

The sign is *responsive*. Responsivity is related to secondness. Through the sign, abstracted bodies are brought into relation with one another and collectively they constitute a worldview. Responsivity is a process that involves action and reaction. It is the domain of *experience*. Peirce calls the type of sign that characterizes direct experiential encounter an *index*. Indices refer by a direct connection between the sign-vehicle and the object. This direct connection is governed by some form of law. For example, smoke can be taken as an index for fire because there is a causal law between fire and smoke. An index directly points to its object as significant or meaningful.

In human language, the archetypal index is a *name*. The name is a *direct pointer*[26] that forces attention on a particular object intended [De Magalhaes, 1984]. A name may point to a physical body or sensory constellation, such as that white horse in the field by the barn. It may also point to a mental image, such as the memory of the white horse or an imaginary white horse. Through repetition, the name becomes an identity operator for the interpreter that maps a single sign to multiple object-interpretant instances. In this way, an abstract concept can be formed as the intended unity among the instances. For example, "horse" may point to a particular horse as an object immediately present to the interpreter (a proper name). Through repetition, it may also point to different individual members of a group of horses such that the unifying object becomes

[24] For a discussion of this context for error and uncertainty in communication theory, see Rogers, *Is Dretske's Theory of Information Naturalistically Grounded? How emergent communication channels reference an abstracted ontic framework?*

[25] For further exploration of the relation between evolution and semiotics, see Rogers, *Towards the Case Against Reductionist Theories of Evolution.*

[26] The "law" of the name is that it is a direct pointer. The personal discovery of this "law" is brilliantly described by the deafblind women Helen Keller in her autobiography *The Story of My Life* http://digital.library.upenn.edu/women/keller/life/life.html

the interior quality or image that is similar to all instances. The name can then point to that image—for example, it can point to an imaginary horse as an invoked memory of the quality or image. Thus a name may bring a multiplicity of sensory and imaginative images into relationship as a single intended mental (i.e. interior) object—the *concept* of horse. The capacity of signs to abstract concepts for an interpreter obtains because an interpretant can itself be a sign for another interpretant.

The name *points* but in itself it does not define its object. With physical objects like horses, the connection between the sign and its object may be immediately present to the interpreter because the physical body can be defined independently of the name, through interaction with a horse (such as touching, riding, feeding etc.). However, for general terms, like "red", the connection between the sign and the object may only come fully into view through other signs. In our earlier thought experiment, metaphor opened up the possibility for the concept red and provided an indication of its sense. The name "red" provided an identity operator through which conceptual meaning could be formed progressively, although vaguely. However, the concept red only becomes defined as a concept when it is brought into relationship with other concepts. For example, a definition of red might include: red is a *colour;* and red is not *blue*. This process differentiates the ambiguous "is and is not" reference of metaphor into the logic of an excluded middle: "is" or "is not". The grammatical form of the proposition is the fundamental relational unit for conceptual definition and propositions form logical structures of law-like relatedness called classical logic.

Yet this picture of conceptual definition through logical structures cannot tell the full story. Conceptual definitions cannot be grounded in a single, coherent logical structure because if we take the structure of law-like relations between the terms of a language as the sole source of meaning for concepts then we encounter a paradox[27]. Suppose, for example, we take the structure of all (true) propositions to be the totality of what defines the set of all concepts. Then we are confronted by an infinite regress of signification because each term only signifies other terms which, in turn, signify more terms. How could any concept come to have its own, non-arbitrary meaning? How can concepts refer to a world outside of concepts? Notice that this is really the supposition of the excluded middle which we encountered earlier in our exploration—it is the assumption that concepts form a classical set. In part, Peirce's triadic form of the sign overcomes this impasse by allowing for the poetic working of language (through the ambiguous metaphor, for example) to burst through this assumed structure of propositional "calculus"[28]. Concepts remain open and responsive to poetic resonance as immediate experience of the world (firstness).

There is another important way in which concepts remain open and responsive. This responsivity arises because terms, as indexical signs, are used by *communities* of interpreters. What the term "red" comes to signify depends on the collective way in which the term is used over time. For example, the way that I use the term "red" may influence how you use that term. The meaning of a term—the concept—is negotiated *between* speakers and does not belong to any individual

[27] Goedel's First Incompleteness Theorem is an example of this paradox as it relates to the law-like logic of number theory: see Rogers, *Identity and Paradox in Habermas' Approach to Critical Reflection: Metaphor as necessary other to rational discourse*.
[28] For further exploration, see Rogers, *danse sur glace: an experiment in language*.

speaker as a completed or fixed totality. (This collective aspect of concepts may seem unimportant with a concrete concept like "red" but it may become very important with social concepts like "justice" or "homosexual".) Terms, as signs of concepts, draw speakers into mutual relationship. The fact that concepts are relational is what allows for the possibility of education and, ultimately, the possibility of mutual understanding[29]. As Levinas points out, the process of concept formation is an irreducibly three-person process [2002]. Alone[30], an individual could not parse abstract concepts from the world because there would be nothing to *fix* them as definite entities. Furthermore, two cannot resolve the issue of disagreement which is necessary to define the precise boundary where one concept ends and another begins (for example, when does "red" become "orange"). The third party brings the constitutional possibility of judgement [Levinas 2002]. The third party can adjudicate or decide the impasse of disagreement among two. In human language, this three-person form is reflected in the first person perspective ("*I"* or "*we"* which partakes in firstness), the second person perspective ("*you"* which partakes in secondness) and the third person or general perspective ("*they"* which partakes in thirdness).

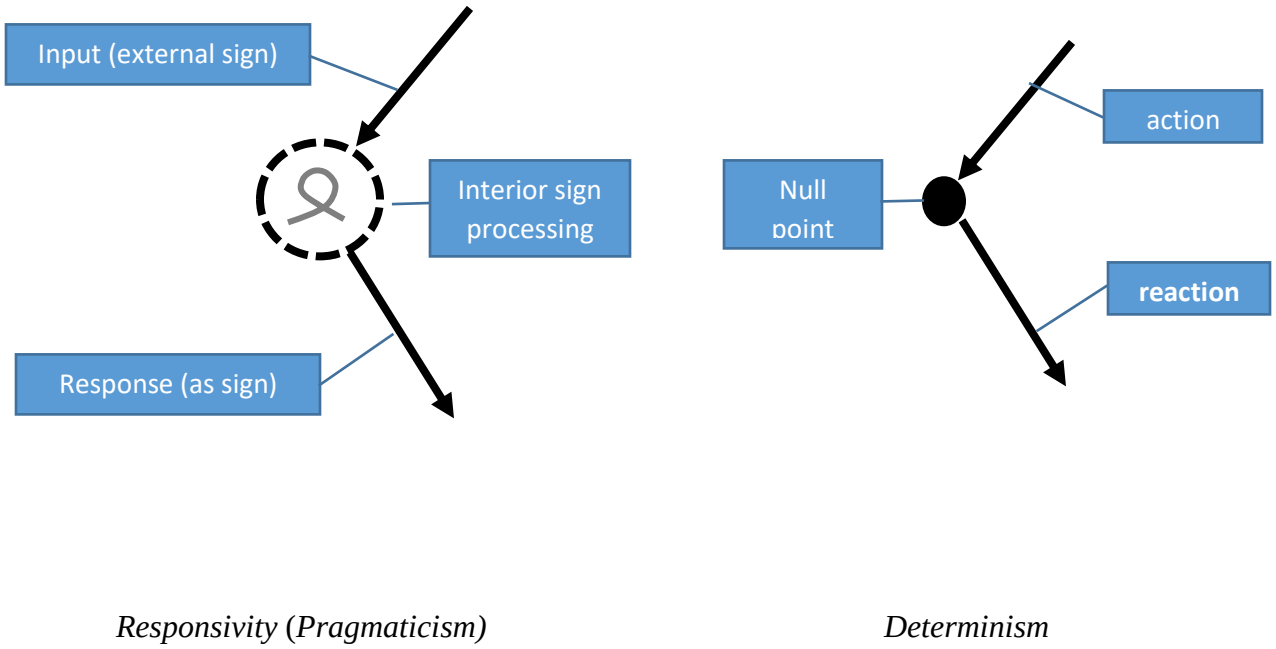
In Peirce's theoretical framework, a community develops or works out the meaning of a concept as an evolutionary process over time. This process might be guided by true narrative reports and tends toward the "ultimate logical interpretant" that is a *future* state of collective agreement. Peirce's theory might be seen to mediate between nominalism and realism. The term, as sign, mediates between an initial image (recall the metaphorical abstraction) and a final "ultimate logical interpretant" or *notion* through temporal repetition. Peirce's formal treatment of the sign is similar to Augustine's discussion of how a mental image is drawn to the notion through the word [Augustine 2012]. However, Augustine further provides an important critique of the assumption, implicit in Peirce's theoretical framework, that this process is purely temporal and that time is redemptive[31].

The responsivity of signs is not limited to human actors. Returning to the example of the single-celled amoeba, we might recognize that an individual amoeba is brought into relationship with other amoebas through signs. Recall that an individual amoeba can become an interpreter of external bodies as a result of communication channels. The interpretant is a change in inner state of the amoeba. But this interpretant may then become a sign for a succession of interpretants as changes in inner state of the amoeba, for example through interactions in a chemical pathway. As a result, the individual amoeba might *internally process* the original sign. Within Peirce's theoretical framework, interior processing of an exterior sign may involve spontaneous aspects of firstness (called abduction), comparative aspects of secondness (called induction) and law-like aspects of thirdness (called deduction). As a result of the interior processing of the external sign, the amoeba will respond in some form of action that impinges back on the exterior world (it may move in a particular way, for example, or it may express a particular chemical on its surface). After processing the original sign, the response or *action* of the amoeba can then serve as the object of a sign for another amoeba. That is to say, one amoeba can interpret the action of another amoeba. This form of interpretation Peirce calls pragmaticism. The "meaning" of the

[29] For further exploration of the way in which language is communal and relational, see Rogers, *Identity and Paradox in Habermas' Approach to Critical Reflection: Metaphor as necessary other to rational discourse*.
[30] Here I am not speaking about particular individuals, but rather a constitutional possibility. Adam could name the animals because God brought them to him; he could name himself because of Eve who was taken out of Man.
[31] For further discussion, see Rogers, *Beyond Space and Time: Unity and Form in Augustine's Confessions*.

sign for the amoeba rests in the action that it elicits. Figure 5 represents the responsive processing of signs and compares this process to mechanistic determinism.

Figure 5: Responsivity in comparison with determinism



Suppose an external entity in the environment is interpreted by a first amoeba as food or energy. The amoeba may process this sign and then act. But now a second amoeba can interpret the action of the first as a sign of food or energy. In this manner, internal interpretative states can be communicated and synchronized. The two amoebas are able to collectively begin to process the signs in the environment to learn about sources of food and energy. The results of this learning might become systematized by the "third" which refers to the ensemble of all amoebas who are mutually interacting. The systematization of learning (through laws and habits) is similar to what we usually mean by the term *text* in theories of language.

Unlike the determinism of Newtonian mechanics, with Peirce's theory of signs individuals are constituted by a community that compels their evolution and growth as an open, responsive process of learning. The generative force of evolution is love [Peirce, *Evolutionary Love*].

3.3. Emergence

The process of sign formation is *emergent*. Emergence is a spiral-like interweaving of the three categories. Through emergence, firstness bursts through the systemic text or body of thirdness as a new experiential form of secondness. The *symbol* is the archetypal sign of emergence because,

outside of the system in which a symbol normally resides, the relation between object and interpretant is arbitrary or pure potentiality.

Emergence results in a new level of sign processing. In our thought experiment on human language, we have already encountered the spiral form of emergence as the bursting forth of the concept from the level of images. Recall the juxtaposition of images led us to metaphor. Metaphor led to abstraction from the image-forming framework. Through naming, abstraction led to concept formation. Concepts replicated and became embedded in a concept-forming framework. This process resulted in a deeper interiority of sign processing. The sign at the higher level—the concept—includes and in some sense fulfills the sign at the lower level—the image.

Likewise, for the case of our community of amoeba's, we might understand emergence in the follow way. First, consider a single amoeba that is able to interpret an external object in its environment as food or energy by a change of internal state. Suppose there is a second amoeba who encounters the same external object but does not change its inner state; that is to say, it does not interpret the external body as food. (Recall that the possibility of error is necessary for a change in internal state to be an interpretant and the possibility of error comes from the underlying randomness of all processes). Now suppose there is a third amoeba who interprets the actions of the first two. (The third amoeba interprets the response of the first two amoebas rather than the external object). The third amoeba will encounter a paradox, because the two original amoebas have contradictory interpretations of the external body—one interprets it as food and one does not. The third amoeba may play the role of judge or adjudicator of the situation as we discussed earlier.

But now consider more closely the internal state of the third amoeba before the decision happens. Will it not be in an ambiguous resonant state of "yes" and "no"; a state which is informed by the contradictory signs from the two amoebas who are interpreting the external body directly? What is this resonant state? Is it not an interior state of *freedom to make a decision*? Is it not also a state of resonance? The potential for *pattern recognition*? The third amoeba recognizes the other two amoebas as potential bearers of signs. What is recognized in this moment? Is it not the *identity* of the amoebas as of the same kind as the third? The third recognizes itself in the ambiguous relatedness of the original two amoebas and this self-recognition is the recognition of amoebas as interpreters of the external world[32]. Through the third comes identity and self-recognition. This self is a state of expectancy, a state of potentiality for finding meaning in the world. And the self is only made possible by the whole community of individual amoebas. Without community, the self reduces to a null point. Moreover, in the threefold process of self-recognition, the possibility opens for naming of self, for forging of a collective body from the unicellular organisms, for the development of immune responses to stabilize that collective body, for the generation of a new level of order—a multicellular body.

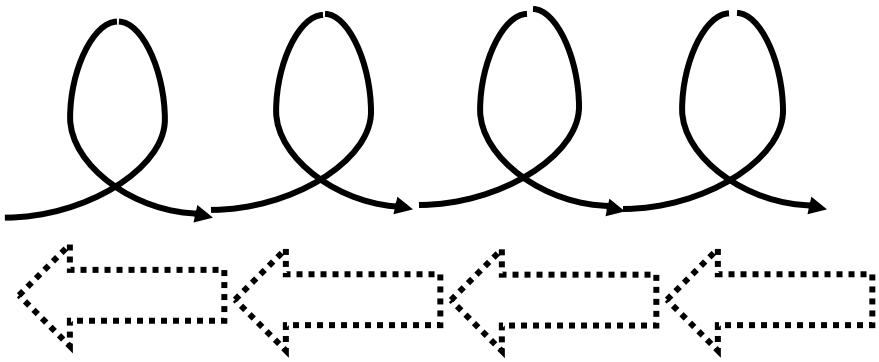
Yet it is not the self that is important here. What is important is the light that shines through the transitory self, that guides the self beyond itself and into the truth.

[32]Here I am suggesting that *mutual recognition* and identity come from an irreducibly threefold process. For further exploration, see Rogers, *A Cautionary Note Concerning Hegel's Approach to Absolute Knowing*.

Final Cadenza

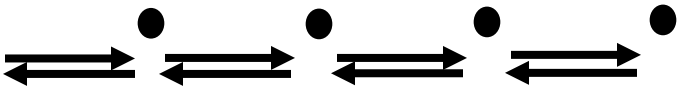
Let's return to the triadic form of the sign as an infinitesimal interval that mediates between finitude and infinity. As figure 6 illustrates, the sign mediates between an object and an interpretant, such that each interpretant may become a sign for a subsequent interpretant.

Figure 6: Successive infinitesimal intervals of the triadic sign (See also figure 3)



In the differential calculus of Newtonian mechanics, the process of sign formation might be taken as a linear chain of successive movements or intervals in time. The causal or deterministic relationship between each interval reduces the sign-vehicle to a null point and cuts off the flow of time as shown in figure 7. This reduction leads to time reversal symmetry or *the spatialization of time*.

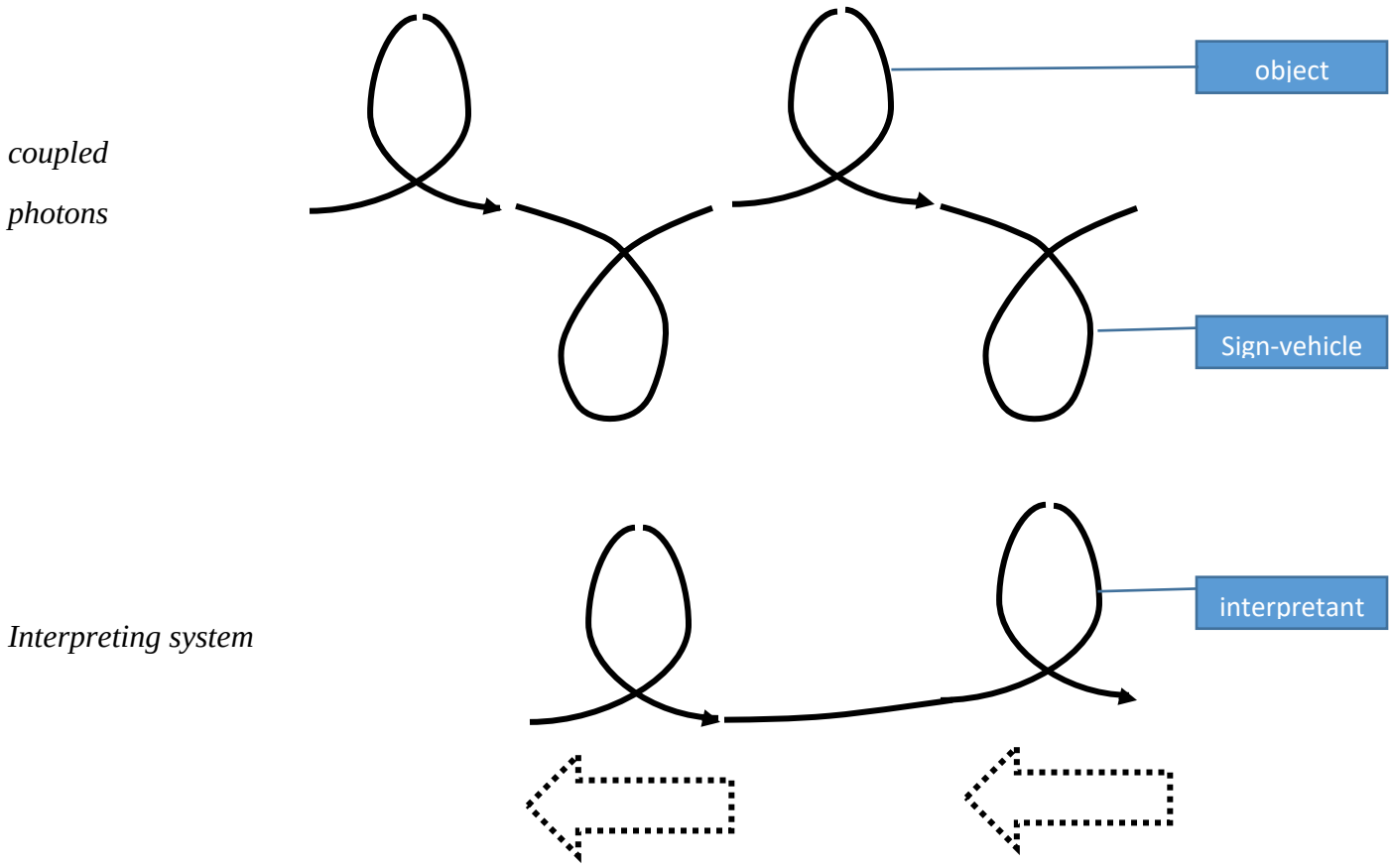
Figure 7: Successive time intervals in Newtonian Mechanics (See also figure 4)



The richer structure of the triadic interval in Peirce's theory of signs, however, opens up to the possibility of novelty and creativity. Each interval contains the potential for change. At a very simple level, we might imagine this as the creation of spacetime. As illustrated in figure 8, the sign bifurcates into a resonant structure that can then be interpreted by a third that is embedded in a system (or fame of reference). The resonant structure is like the quantum resonance of coupled photons. And the third that interprets this—by a process of synchronization—is like the

measuring system that determines or *collapses* the indeterminate potential of the coupled photons[33].

Figure 8: The collapse of coupled quantum spins



In this way, might we not see how a classical interpreting system becomes coupled to quantum fluctuations as a sign to its object and interpretant? And might we not see that the opening of emergence could move through ever increasing levels of complexity to generate the world in which we live as proposed in figures 9 and 10.

[33] For further exploration of this process, see Rogers, *A Physicist's Guide to [Hegel's] Phenomenology of Spirit: Resonance, disambiguation and the genesis of spatial orientation.*

Figure 9: Emergent Bodies or "Selves"

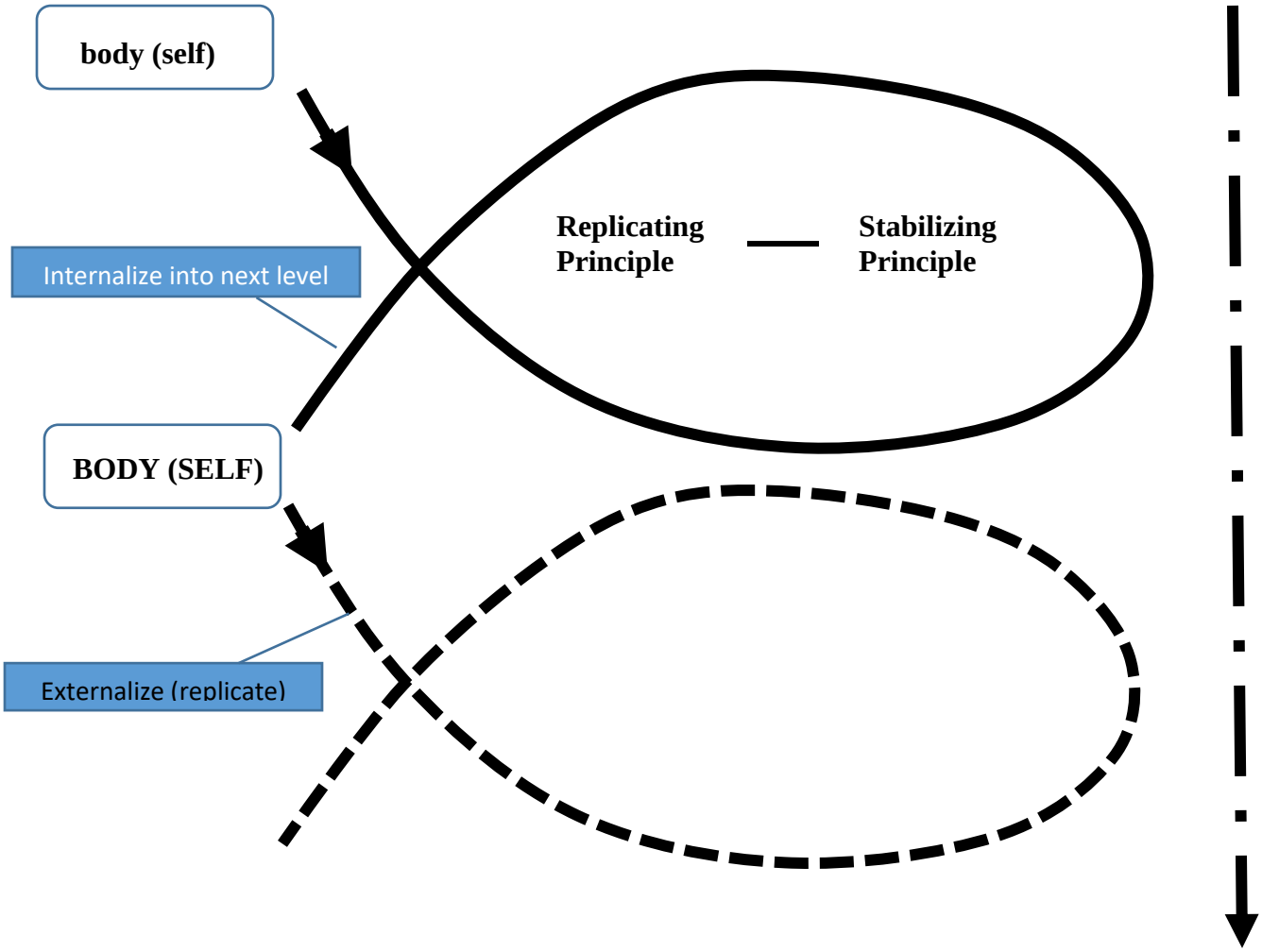
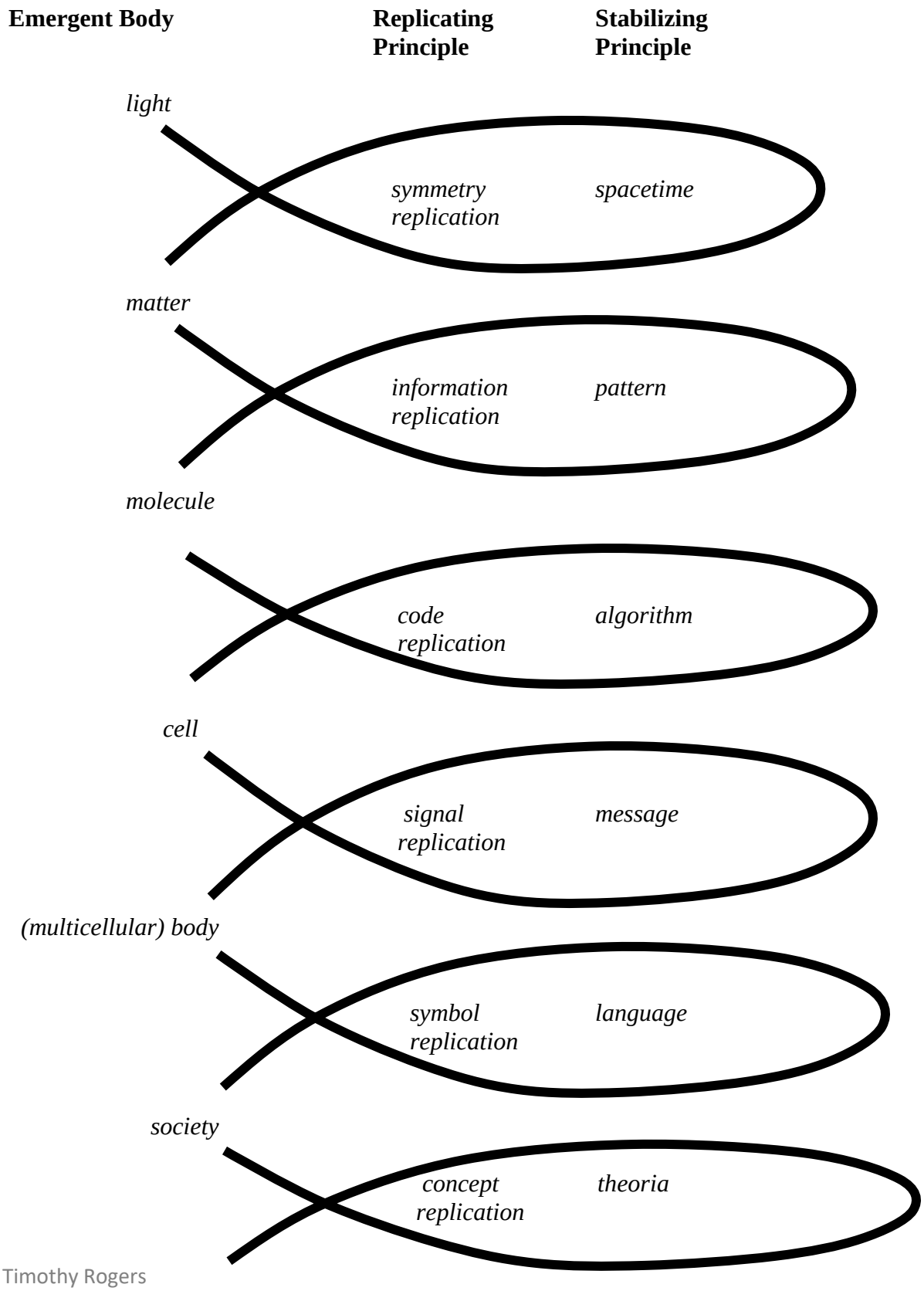


Figure 10: Process of Emergent Evolution



References

Augustine. *The Trinity*. Second Edition. Ed. John E Rotelle. Transl. Edmund Hill. New York: New York City Press, 2012.

Buber, Martin. *I and Thou*. Transl. Walter Kaufmann. New York: Touchstone, 1970.

Corrington, Robert S. *An Introduction to CS Peirce: Philosopher, semiotician and ecstatic naturalist*. Maryland: Rowman & Littlefield Publishers Inc., 1993.

De Magalhaes, Theresa Calvet. Un, Deux, Trois: Catégories Fondamentales (One, Two, Three: Fundamental Categories). *Acta Semiotica et Lingvistica* (São Paulo). 1984, 5:69-99.

Emmeche, Claus. Organism and Body: The semiotics of emergent levels of life. In *Towards a Semiotic Biology: Life is the action of signs*. Eds Claus Emmeche and Kalevi Kull, 91-111. London: Imperial College, 2011. [Available, January 8, 2015: http://www.academia.edu/727564/Towards_a_Semiotic_Biology_Life_is_the_Action_of_Signs]

Hegel, GWF. *Phenomenology of Spirit*. Trans. by AV Miller. Oxford: Oxford University Press, 1977.

Herron, Timothy. C.S. Peirce's Theories of Infinitesimals. *Transactions of the Charles S. Peirce Society*. 1997 Summer, 33(3):590-644.

Keller, Helen. *The Story of My Life*. Ed John Albert Macy. New York: Doubleday, Page and Company, 1905. [Available, February 14, 2015: http://digital.library.upenn.edu/women/keller/life/life.html].

Kull, Kalevi; Deacon, Terrence; Emmeche, Claus; Hoffmeyer, Jeffner and Stjernfelt, Frederik. Thesis on Biosemiotics: Prolegomena to a theoretical biology. In *Towards a Semiotic Biology: Life is the action of signs*. Eds Claus Emmeche and Kull Kalevi, 25-41. London: Imperial College, 2011. . [Available, January 8, 2015: http://www.academia.edu/727564/Towards_a_Semiotic_Biology_Life_is_the_Action_of_Signs]

Levinas, Emmanuel. *Otherwise than Being or Beyond Essence.* Trans. Alfonso Lingis. Pittsburgh: Duquesne University Press, 2002.

Oller, John W Jr. The Antithesis of Entropy: Biosemiotic communication from genetics to human language with special emphasis on the immune systems. *Entropy* 2010, 12:631-705. [Available January 8, 2015: http://www.academia.edu/7950655/The_Antithesis_of_Entropy_Biosemiotic_Communication_from_Genetics_to_Human_Language_with_Special_Emphasis_on_the_Immune_Systems]

Peirce, Charles Saunders:

1. *Evolutionary Love*, Monist III(1), 1892. [Available January 8, 2015: https://archive.org/stream/C.S.Peirces5FamousTheMonistPapers/5.EvolutionaryLove1893#page/n0/mode/2up]
2. *Law of Mind*, Monist II, 1891. [Available January 8, 2015: https://archive.org/stream/C.S.Peirces5FamousTheMonistPapers/3.TheLawOfMind1892#page/n0/mode/2up]
3. *The Architecture of Theories*, Monist I(2), 1891. [Available January 8, 2015: https://archive.org/stream/C.S.Peirces5FamousTheMonistPapers/1.TheArchitectureOfTheories1891#page/n0/mode/2up]
4. *A Guess at the Riddle*, 1887-8. [Available January 10, 2015: *http://www.iupui.edu/~arisbe/menu/library/bycsp/guess/guess.htm*]

Raposa, Michael. *Peirce's Philosophy of Religion*. Bloomington: Indiana University Press, 1989.

Robinson, Andrew. *God and the World of Signs: Trinity, evolution and the metaphysical semiotics of CS Peirce.* Leiden: Brill, 2010.

Rogers, Timothy [Available January 3, 2021: https://timothyrogers.academia.edu/]:

1. Beyond Space and Time: Unity and form in Augustine's *Confessions*.
2. Three Reflections on Return: Convergence of form with regard to light, life, word.
3. The Proximity of Light: a deconstruction of space.
4. A Physicists Guide to [Hegel's] *Phenomenology of Spirit*: Resonance, disambiguation and the genesis of spatial orientation.
5. A Thought Experiment with Light: How the ontological form of quantum mechanics is consequent to the principles of relativity theory.
6. Is Dretske's Theory of Information Naturalistically Grounded? How emergent communications channels reference an abstracted ontic framework.
7. Towards the Case Against Reductionist Theories of Evolution.
8. On the Relationship Between the Concept of Text in Gadamer's Theory of Hermeneutics and the Concept of Light in Einstein's Theory of Relativity.
9. Identity and Paradox in Habermas' Approach to Critical Reflection: Metaphor as necessary other to rational discourse.
10. danse sur glace: an experiment in language
11. A Cautionary Note Concerning Hegel's Approach to Absolute Knowing

Somers-Hall, Henry. *Hegel, Deleuze, and the Critique of Representation: Dialectics of negation and difference*. Albany: State University of New York, 2012.

Tzu, Lao. *Tao Te Ching*.

Wallace, David Foster. Richard Taylor's "Fatalism" and the Semantics of Physical Modality. In *Fate, Time, and Language: An essay on free will*, 142-216. Eds. Stephen Cahn and Maureen Eckert. Columbia University Press, 2011.

Zuckerkandl, Victor. *Sound and Symbol: Music and the external world.* New York, Princeton University Press, 1973.

Zwicky, Jan. *Songs for Relinquishing the Earth*. London, ON: Brick Books, 1998.