

10. Circuits and Closure

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Everything the Power of the World does is done in a circle. The sky is round, and I have heard that the earth is round like a ball, and so are all the stars. The wind in its greatest power whirls. Birds make their nests in circles, for theirs is the same religion as ours. The sun comes forth and goes down again in a circle. The moon does the same, and both are round. Even the seasons form a great circle in their changing, and always come back again to where they were. The life of a man is a circle from childhood to childhood, and so it is in everything where power moves.

— Black Elk (Neihardt 1932, 150)

Every plant and animal is constructed upon the premise of its cyclic nature.

— Gregory Bateson (1972, 345)

The world is inseparable from the subject, but from a subject which is nothing but a project of the world, and the subject is inseparable from the world, but from a world which the subject itself projects.

— Merleau-Ponty (1945, 499-500)

Big Current

The ancient Greeks of Homeric times imagined the earth as a flat surface surrounded by the river Okeanos, the source of all waters – also described, in a few passages, as the source of all the gods, and even of all things. It is not difficult to see why the Greeks, with their experience of the sea, would imagine the whole world as encircled by water; but it is not so obvious why that water took the form of a river, with a *current* flowing around the circle.

With the meaning cycle in mind, we can now read this cosmology as an intuitive reflection of the cyclic nature of life itself. The difference between a circle and a cycle is the dimension of *time*. Just as the dimension of depth cannot be directly represented on a flat surface like a page, the dimension of time cannot be represented in a static diagram – except by some directional symbol, such as the arrows in the gnoxic diagram. Models (and diagrams) are always simpler than the systems they model; the simplifying process may discard not only details but also dimensions. We reconstitute or recreate the dimension of time by projecting the idea of *flow* onto the circle we see in the diagram, so that it becomes a recursive path. Perhaps a similar motivation led the Greeks to read a one-way flow into Okeanos; for this adds a whole new dimension to its *closure*. While the circle represents (en-)closure of space, the cycle represents closure in time by returning to itself.

As it turns out, both kinds of closure are essential to self-organization, autopoiesis and the evolution of life forms. And as the concept evolves, its meanings proliferate. If we can say that the life of a cognitive system is its operational closure (as we did in Chapter 9), we can also say that death is the closure of life. ‘The meaning of life is that it stops’ (Kafka); our little life is rounded with a sleep. The sense of finality is also crucial to psychological ‘closure,’ such as we hope for when we mark the completion of someone’s life with a funeral or wake, or try to close the gap in the social fabric left by their departure. The achievement of consensus which marks the end of an inquiry is another kind of social closure. All of these are entangled with *teleology* and other derivatives of the Greek verb *τελέω*, which means *to complete, fulfill, accomplish* – and *to bring to an end* (LSG).

The poet John Donne, during a life-threatening illness in 1623, heard the tolling of a passing-bell from a nearby church, and

wondered who had ‘passed.’ That experience led to his famous meditation:

No man is an *Iland*, intire of it selfe; every man is a peece of the Continent, a part of the maine; if a *Clod* bee washed away by the *Sea*, *Europe* is the lesse, as well as if a *Promontorie* were, as well as if a *Mannor* of thy *friends* or of *thine owne* were; any mans *death* diminishes *me*, because I am involved in *Mankinde*; And therefore never send to know for whom the *bell* tolls; It tolls for *thee*.

— Donne (1623, 98)

But Donne is telling only half the story here. Due to the operational closure of autopoiesis and the autonomous agency, every human *is* an island. Yet human selfhood develops only through dialogue with others, and is necessarily grounded in the organic selfhood common to all animals, who live and grow by developing complex relationships with their environment. You and i and everyone are involved in humankind, and beyond that, in the biosphere – and even beyond the planet Earth, in the whole physical universe, since the heavier elements essential to our lives were forged in supernovae, those massive explosions which typically occur when a very large star reaches the end of its life cycle. A little current flows through every life because a big current flows through all, embracing all as Okeanos does in the Greek myth. Indeed, to mix a few religious metaphors, it’s wheels within wheels all the way up and down every dharma.

We can say that no man is an island because he is part of a community, yet the community itself is an island. Just as a cell defines itself by enclosing itself in a membrane, each species population in an ecosystem ‘is isolated by its behavior or chemistry so that its food and mineral flows are not entangled with those of other species’ (Odum 2007, 163). Likewise a social group can develop a cultural ‘membrane’ which insulates it from other groups. A dialect or *cant* can often serve as such a membrane, distinguishing the group from others even in the act of communication; for instance, the jargon of any specialized discipline is vital to its identity and authority. David Sloan Wilson,

for one, argues that a social group can be considered as an organism if it has such a membrane. A scientific community is an island, to the extent that it is specialized; science then is not so much a continent as 'an archipelago of disciplines' (Wilson 2002, 151).

Cultures prescribe norms, evolve goals, build beliefs to help us tackle the challenges of existence. In so doing they must rule out many alternative goals and beliefs, and thereby limit possibilities; but this channeling of attention to a limited set of goals and means is what allows effortless action within self-created boundaries.

— Mihaly Csikszentmihalyi (1990, 81)

Some such limitations or constraints appear to be necessary conditions for the state of creative engagement which Csikszentmihalyi calls *optimal experience* or simply *flow*. This often calls for acting into the world, dancing with the macrocosm; but it also calls for *close* attention, i.e. limiting or narrowing the magic circle of one's focus. Indeed the *privacy* of experience – the fact that nobody else has *your* experience – reflects the operational closure of living systems. Insofar as a community or culture is a self-organizing, self-defined entity, it too must reflect this operational closure; we do not experience it directly, yet it is made of our actions, and it returns the favor by creating the conditions which make human experience meaningful.

A community which distinguishes itself from other communities does bear some resemblance to a geographical island, like the one inhabited by Donne himself – or like the one which is home to the author of this essay. That island is called Manitoulin, which means something like 'land of spirits' (or 'of spirit') in the Ojibwe tongue of its first human settlers. This island is separated from the 'main' (the north shore of Lake Huron) by the North Channel, which narrows to a mere hundred metres or so at the northeast end of the island. Through this narrow channel, from west to east, flows a current strong enough to keep it ice-free through many a winter; this perhaps explains the name of the town on the island side of this channel, Little Current. From there, it's not difficult to picture this island as a separate little world with its own

Okeanos.

But Manitoulin Island also communicates with the mainland, via a one-lane bridge across that channel. Once an hour during the summer, this bridge rotates on its giant bearing to allow passage of tall-masted boats through the channel. Motorists who arrive at that time wait 15 minutes or more for the bridge to slowly swing open and then, after the boats have passed through, to swing ponderously closed again. But which state you call 'open' and which 'closed' depends on your point of view. When it's open to road traffic, it's closed to big-boat traffic, and vice versa. If you think of the road as analogous to an electrical circuit, and the bridge to a switch, then the current stops flowing when the bridge is *open* and starts again when the bridge *closes*. Such an ambiguity lies behind the paradoxes of *closure* whenever some kind of *circulation* is involved.

There can be no communication without a gap between the communicants. What makes us human is the gap between us, *and* the closing of the gap. More generally, closure can only happen to an open system, and opening can only happen to a closed system. The gaps between beings are formed by one kind of closure and bridged by another. We *close* the gap between us to reach for intimacy, which allows us to communicate more *openly*. The heart of intimacy is that little current of feeling flowing through your bodymind, which is both a small part and a complete microcosm of the big current you sense as time and history, the Okeanic flow which forms and dissolves us all.

The same principle applies to our dialog with nature, and to all the interactions at every scale which make up a mental life. The act of perception closes the gap between subject and object, as an electrical circuit is closed by a switch. Bateson (1979, 120) pointed out that from the circuit's point of view, a switch *does not exist* when closed – just as from the motorist's point of view, a swing bridge is just another part of the road, unless it has swung open. On the other hand, when the switch is open the *circuit* does not exist as such because the current is not flowing.

Little Current

Every living system is a *whole* which provides the context in which the interaction of its parts can be meaningful; it is also *part* of a larger-scale whole, which it helps to constitute by interacting with other parts. So it is with the nervous system, which works to maintain the integrity and autonomy of the system it inhabits (the organism) by modeling that larger system's relations with its environment. That means maintaining its own operational closure even as it monitors the current state of its bodily environment, which includes news of the body's environment. Wherever movement is essential to the mode of life of a multicellular organism, there is the corresponding development of a nervous system. A nervous system links sensory surfaces (sense organs and nerve endings) and effectors (muscles, glands) within the body, and thereby integrates the organism, holding it together as a mobile unity, an autonomous sensorimotor agent (Thompson 2007, Chapter 3). The fundamental logic of the nervous system is to couple movement and a stream of sensory activity in a continuous circular fashion (Maturana and Varela 1987, 142-176).

An observer of the human organism equipped to monitor the activity of brain regions, or even the firing of single neurons, could say that the state of the brain at any given time is 'perturbed' by sensory 'input' from the world, or that 'output' from the brain causes 'behavior' of the organism. But if we focus on the internal dynamics of the brain rather than its functions in the body, what we see will consist mostly of events in one part of the brain triggering events in other parts; and often these trains of events form loops or 'global reentrant circuits,' as Gerald Edelman calls them. It is 'a general principle of brain organization,' according to Walter Freeman (2000, 224), that 'the larger fraction of the output of each module goes back directly or indirectly to the module from which it gets its input, and only a smaller fraction goes onward.' This looping structure is essential to the functional closure of the brain.

At the microscopic scale of neurodynamics, the gap which makes closure possible is the *synaptic cleft* across which neurons transmit their signals from cell to cell, generally axon to dendrite. Like other cells, neurons must keep their distance in order to exist, but they specialize in propagating a wave of electrochemical energy from their bodies along their axons to the synaptic cleft,

thus causing closure of the gap between cells. During development, they send out ('project') their axons in search of a suitable destination for their signals, and if they fail to find one, they die. Like us, they are not so much isolated as *insulated* (from the Latin *insula*, 'island'): long axons develop a myelin sheath in order to insulate their currents and thus communicate more effectively. Populations of neurons (cell assemblies) also insulate themselves by chemical means, inhibiting the activity of neighboring neurons which are not included in the population, and thus forming temporarily closed *circuits* in the brain.

Only a small minority of neural cell assemblies deal directly with sensory input to, or motor output from, the brain. Most are engaged in a reciprocal dialogue among themselves. For Edelman, this biological fact correlates with our psychological need to keep the cognitive bubble closed even when this closure is dysfunctional.

What is particularly striking about the operations of the conscious human brain is the necessity for integration, for a unitary picture, for construction, and for closure. This is manifested by the obliviousness we have to our blind spot, by various visual, somatosensory, and auditory illusions, and most strikingly, by neuropsychological syndromes. The patient with anosognosia and hemineglect who denies ownership of a paralyzed left hand and arm, the patient with somatoparaphrenia who insists that a touch on an anesthetic and paralyzed left hand is a touch on her sister's hand not on hers, or the patient with alien hand syndrome—none of these individuals is psychotic even if, in certain respects, each fails the test of veridicality. The conscious brain in health and disease will integrate what can be integrated and resists a fractured or shattered view of 'reality'. I believe that these phenomena are reflections of the necessity for global reentrant circuits to form closed cycles with whatever brain areas and maps are left to be integrated.

Recognition of these functional cycles in the brain also reveals the limitations of any linear model of the causal relationship between brain events and consciousness. As Freeman (1999b) says, 'complex material systems with distributed nonlinear feedback, such as brains and their neural and behavioral activities, cannot be explained by linear causality.' Freeman therefore adopts a model of *circular causality* which maps directly onto the 'meaning cycle' explained in Chapter 9.

Circular causality explains intentionality in terms of 'action-perception cycles' (Merleau-Ponty, 1945) and affordances (Gibson, 1979), in which each perception concomitantly is the outcome of a preceding action and the condition for a following action. Dewey (1914) phrased the same idea in different words; an organism does not react to a stimulus but acts into it and incorporates it. That which is perceived already exists in the perceiver, because it is posited by the action of search and is actualized in the fulfillment of expectation. The unity of the cycle is reflected in the impossibility of defining a moving instant of 'now' in subjective time, as an object is conceived under linear causality. The Cartesian distinction between subject and object does not appear, because they are joined by assimilation in a seamless flow.

— Freeman (1999b, 147)

Another aspect of this circularity is the mutually causal relationship between levels in the hierarchy of brain function: 'a top-down macroscopic state simultaneously influences microscopic particles that bottom-up create and sustain the macroscopic state' (Freeman (1999b, 145). Mental patterns are self-organizing in that they arise from the 'grassroots' of neural interactions – but a pattern, once formed, guides the lower-level neural interactions which will in turn shape the next higher-level pattern. Like the Rosen diagram described in Chapter 9, this gives us a loop within a loop, the outer loop being the macroscopic interaction of the organism with its milieu, which maps onto the whole meaning cycle.

In the process of organizing itself into reiterating loops, the microscopic neural activity leaves its mark on the system by subtly altering the physical and chemical *connectivity* of the neural networks: any connection which has recently been active in the brain is a little easier to reactivate than it was before. This, along with the general brain structure which develops as prescribed by the genome, ensures that the brain carries its own history forward, not as inert 'data' but as a more or less vague propensity, a palimpsest continually overwritten by current experience. (See LeDoux 2002 for microscopic details, and Schacter 1996 for psychological ramifications of this.) We humans, of course, have also developed vast *external* resources (such as you are now using) to supplement, scaffold and anchor our 'wetware' memories.

The pattern of circular causality appears again at a still higher time scale, in the form of co-evolution. An extended 'event' like the emergence of language would have involved the co-evolution of brain and culture 'in an iterative loop of selection pressure originating at the cultural level' (Donald 1991, 237; Deacon 1997 gives a more detailed account of language/brain co-evolution). Language development was powered by the need of individuals to communicate, but its formation was guided by a selection process similar to that which feeds back to the genotype in the next biological generation.

Complementary closures

Cells enclose themselves in membranes in order to insulate internal processes, but must import energy and selected materials across the boundary in order to maintain those processes. This raises the question of how they could have organized themselves in the first place: how did biological systems emerge from the inorganic? Stuart Kauffman identified one crucial step as *catalytic closure*, in which the product of one spontaneous reaction acted as a catalyst for another reaction, which in turn produced materials vital to the first reaction. Such an autocatalytic loop can involve many more than two separate reactions, but it can sustain itself and grow as long as it produces its own catalysts – provided that it has a steady supply of raw materials which it can 'eat' or transform

into the molecular forms which constitute it.

Catalytic closure means that every molecule in the system either is supplied from the outside as 'food' or is itself synthesized by reactions catalyzed by molecular species within the autocatalytic system.

Catalytic closure is not mysterious. But it is not a property of any single molecule; it is a property of a system of molecules. It is an emergent property.

— Kauffman (1995, 275)

However, Thompson (2007, 105) points out that autocatalytic systems do not qualify as autonomous agents if they do not produce their own boundary: 'the form or pattern of the autopoietic organization is that of a peculiar circular interdependency between an interconnected web of self-regenerating processes and the self-production of a boundary, such that the whole system persists in continuous self-production as a spatially distinct individual' (Thompson 2007, 101).

This *interdependency of closures* is also noted by Terrence Deacon in his comprehensive study of emergence (Deacon 2011). He argues that catalytic closure alone is not enough to bring about *autogenesis*, the emergent stage which he proposes as precursor to life. Self-enclosure is equally necessary, because without it, the autocatalytic process would exhaust the substrate it needs, or its products would dissipate into the surrounding medium; in either case the process would stop. The process would also stop if the 'autogen' sealed itself off from its environment, but it would spontaneously start up again if its enclosure were broken open by reactions with the substrate molecules needed by the process – and it would be the *same* process which spontaneously restarted itself, not just any autocatalytic cycle, because the same key molecules were kept together in close proximity while the self-enclosed unit was floating around in an inert state. It's the reciprocal relation between topological closure and autocatalytic closure that constitutes the level of emergence called *autogenesis*. Both kinds of closure can arise spontaneously, under the right conditions, but each would need the other in order to develop the proto-selfhood which leads to life and thence to sentience.

However, ‘the right conditions’ include several prior stages of self-organization, each with its own dynamic emerging from the one before. *Morphodynamic* organization emerges from thermodynamics, and on that basis emerges the stage of *teleodynamics*, which Deacon defines as:

A form of dynamical organization exhibiting end-directedness and consequence-oriented features that is constituted by the co-creation, complementary constraint, and reciprocal synergy of two or more strongly coupled morphodynamic processes.

— Deacon 2011, 352

Once we have teleodynamics, we can have organisms with *teleogenic* properties, which are

constituted by a higher-order form of teleodynamic process, specifically where that teleodynamic process involves a self-referential loop of causality such that the causal properties of the individuated teleodynamic unit are re-presented in some form in the generation of teleodynamic processes

— Deacon 2011, 352

– in other words, the kind of process which enables anticipatory systems to incorporate models of their own agency as internal guidance systems. Thus the closure of self-referential causal loops is essential to sentient life.

Yet another kind of closure is essential to the *evolution* of life forms. Howard Pattee identified it as *semantic closure*, and later as *semiotic closure* (Rocha 2001, Pattee 2004). The basic idea is that any system capable of evolving or learning must *include* both static and dynamic aspects, and *closure* refers to the co-operation of these complementary aspects. You can’t do any reading without a stable text, and the text can’t *actually* mean anything if nobody reads it. The genome is like a stable text which a cell reads and also replicates in the process of reproducing itself, and thus the whole system is capable of what Pattee calls *self-reference*. The DNA “text” retains the same form through generations of individual embodiments, as it must in order for the lineage to continue, but it

must also be capable of some variation (and variable expression) in order for the line to evolve.

To state my position as briefly as possible, self-reference that has open-ended evolutionary potential is an autonomous closure between the dynamics (physical laws) of the material aspects and the constraints (syntactic rules) of the symbolic aspects of a physical organization. I have called this self-referent relation *semantic closure* (Pattee, 1982) because only by virtue of the freely selected symbolic aspects of matter do the law-determined physical aspects of matter become functional (i.e., have survival value, goals, significance, meaning, self-awareness, etc.). Semantic closure requires complementary models of the material and symbolic aspects of the organism.

— Pattee (1995a)

Pattee's distinction between the 'material' ('law-determined' and dynamic) and the 'symbolic' (constraining and unchanging) aspects of a system resembles the distinction in linguistics between semantics and syntax, as we will see in the next section. His usage of 'symbolic' is quite different from the Peircean usage. For Pattee it would make no sense to say that 'symbols grow' and have a life of their own, as Peirce does; for Peirce, on the other hand, it would make little sense to speak of 'freely selected symbolic aspects of matter.' But this is just another example of polyversity. At any rate, Pattee, Peirce and Deacon could probably all agree that evolvability, sentience and meaning are deeply intertwined; indeed, as Deacon says (2011, 502), 'the experience of sentience is what it feels like to *be* evolution.'

Languages and other symbolic systems

As the nascent science of biosemiotics was emerging toward the end of the 20th century, Pattee came to prefer the term *semiotic closure* to his original term 'semantic closure.' Rocha (2001) explains 'semiotic closure' in terms that bring out the similarities

between linguistic and living systems. According to this analysis, a functional language must be a symbol *system* with three characteristic aspects: *syntax*, internal rules which stabilize the manipulation and recombination of word elements; *semantics*, regular relationships between words in the language and things external to it; and *pragmatics*, aspects of meaning which relate usage to its practical context.

Syntax requires a strictly limited set of 'inert structures' like an alphabet, such as the set of phonemes (elementary sound patterns) which can be combined to form meaningful units (morphemes, words). Of the possible sounds that humans can emit, only a limited set form the universe of phonemes that can be combined into meaningful utterances in a given language. 'Part of what makes learning language difficult is that language carves up sounds and different languages carve them up differently' (Gopnik et al. 1999, 102). At the morphemic level, some words and phrases (such as *the*, *and* or *to*) furnish structure to a sentence instead of denoting or describing what it refers to. This set of inert structure words is always relatively small and closed – unlike the sets of reference words (such as nouns, verbs and adjectives) which are much larger and open to the inclusion of new members. Syntactic closure allows the open-class words to be creatively organized into sentences which can mean something new even though (or *because*) their parts are familiar. In the genetic 'language' which informs the biological development process, the inert structures are DNA and RNA; the four-letter 'alphabet' consists of the nucleotide bases (G, C, A, and T); the three-letter 'words' are the nucleotides or *codons*; the 'sentences' are genes, such as sections of DNA that will be interpreted as specific proteins or regulatory functions; the whole genome is the text that provides the template for growing an organism of a specific type.

The 'reading' of that text is semiotic in that it 'interprets' each gene to produce a protein or a functional constraint. The genome provides the stable, transferable basis for the act of meaning achieved by the dynamics of development. The complementary relationship of dynamics and stability, reading and text, is semiotic closure. As the embryo develops, it begins to interact *pragmatically* with its environment, while the proteins become building blocks for the next level of self-organizing process, and so on. Evolution

depends on the success of that developmental process, as indicated by the survival and reproduction of the organism: over the long-term life of its species, the natural selection of those who reproduce feeds back to the genotype which provides the text for the next generation of readers. The reading is self-referential in that the object of the genome as sign is the organism as reader, the phenotype.

'Semiotic closure' requires the collusion of all three elements – syntax, semantics and pragmatics – in order for languages or living beings to develop and evolve. Syntax, the most *internal* (to the language system) of the three, must also have its own closure in order to open up space for interaction with the other two. This syntactic closure is deeply entangled with *semantics*, defined above in terms of the language's relations to the external world, because the world is inside out (recalling Chapter 5). *Meaning* then is neither internal nor external, involving as it does the pragmatic closure of the action-perception loop. Mutual relations among these forms of closure enable the system to be semantically open, because it has one foot in external reality and one in intentionality, so to speak.

The syntactic structure of the genetic system, shared by all organisms on Earth, justifies calling it a *symbolic* system. A 'word' or other symbol can refer generally to a *dynamic object outside* the system because it plays a specific part *inside* the system, which governs how it can be combined with other system components to designate an *immediate object*. Terrence Deacon relates this to the acquisition and use of human natural languages:

... symbols cannot be understood as an unstructured collection of tokens that map to a collection of referents because symbols don't just represent things in the world, they also represent each other. Because symbols do not directly refer to things in the world, but indirectly refer to them by virtue of referring to other symbols, they are implicitly combinatorial entities whose referential powers are derived by virtue of occupying determinate positions in an organized system of other symbols. Both their initial acquisition and their later use requires a combinatorial analysis.

The structure of the whole system has a definite semantic topology that determines the way symbols modify each other's referential functions in different combinations. Because of this systematic relational basis of symbolic reference, no collection of signs can function symbolically unless the entire collection conforms to certain overall principles of organization.

— Deacon (1997, 99)

We will look further into those 'principles of organization' in Chapter 13. The closure of the 'semantic topology' which limits what you *can* mean, or know, also enables you to have an open mind, so that the actual flow through the meaning circuit can realize those possibilities. When we consider the meaning cycle synchronically, it is clear that the *difference* and the *connection* between its two poles (**Model** and **World**) together constitute, for each of us, the formal cause of the semiotic flow we experience. But when we consider it diachronically, in terms of the **Practice-Perception** loop, it should be equally clear that the flow from **M** to **W** is *simultaneous* with the flow from **W** to **M**. There is only one flow, not two taking turns, despite the difference between the two things (whatever we call them) forming its poles – and this enables final and efficient causes to work together in the formation of *habits*. We might call this a causal/logical meta-closure, but we can see it more clearly as *semiosis* if we consider it in the terms pioneered by Peirce. This will take us to the heart of *Thirdness*, that element of the phaneron without which *meaning* cannot take place. But first we need to refine the concept of *symbol*.

As defined by Peirce, a *symbol* 'is constituted a sign merely or mainly by the fact that it is used and understood as such, whether the habit is natural or conventional, and without regard to the motives which originally governed its selection' (BD). The base-level unit which fits that definition is called the *proposition* in logic, and the *sentence* in linguistics, as smaller units (phonemes, letters of the alphabet, isolated words) are not normally capable of meaning anything much by themselves. The *meaning* of a symbol is the marriage of *reference* (to the World inhabited by the users of the symbol) and *signification* (the symbol's role in the habit-system shared by that community of users). Reference is basically

indexical, while signification is *iconic*.

The significations of symbols have various grades of directness up to the limit of being themselves their own significations. An icon is significant with absolute directness of a character which it embodies; and every symbol refers more or less indirectly to an icon.

An index is directly denotative of a real object with which it is in reaction. Every symbol refers more or less indirectly to a real object through an index.

— Peirce, EP2:320

The ideally genuine symbol would embody a high grade of directness in both respects. All symbols aim to advance the dialogue toward the ultimate closure of the meaning cycle, the *entelechy* in which Model and World are one; but in actual dialogical use, all symbols are incomplete and vague to some degree.

All consensus being a network of intertwined symbols, any real relation between a symbol and its object may get lost in the jungle of implications. Thus you can speak quite reasonably without really knowing what you are talking about; and even the most authentically grounded symbol can be misread if the interpreter's attention is misdirected. How can symbolic utterance direct attention beyond the cognitive bubble sustained by habitual consensus, when its very meaning depends on that consensus? This would be impossible if that consensus were not *continually co-evolving* with a reality prior to it and independent of it. This co-evolution is embodied in the functional coupling of Umwelt and Innenwelt.

Thirdness and Thought

A symbol such as a book is a *text*, itself a network of intertwined symbols. For the individual reader, the cognitive process of *understanding* a text, or understanding anything, follows a recursive path forward, on a time scale midway between the microscopic scale of neural circuits and the macroscopic scale of

scientific inquiry and cultural dialogue. This recursive path is commonly called *the hermeneutic circle*, which Gadamer aptly delineates as the ‘rule that we must understand the whole in terms of the detail and the detail in terms of the whole.’

This principle stems from ancient rhetoric, and modern hermeneutics has transferred it to the art of understanding. It is a circular relationship in both cases. The anticipation of meaning in which the whole is envisaged becomes actual understanding when the parts that are determined by the whole themselves determine this whole.

— Gadamer (1986, 291)

Søren Brier (2008, 12) observes that ‘hermeneutic circles evolve into a spiral movement in understanding,’ and John Deely (2001, 726) likewise refers to the ‘semiotic spiral.’ At every scale, the cognitive current flows not only around but forward in time: each new interpretant of a genuine symbol represents not only a reiteration of the semiotic cycle but also a *growth* of understanding. For instance, the *taxonomy* or classification system in biology evolves by means of hermeneutic circles: ‘organisms are first ordered into seemingly natural groups (through a consideration of numerous characters and character combinations) and then those characters are given the greatest weight which seem to be correlated with the most natural groups’ (Mayr 1982, 224). In other words, the ‘reader’ of biodiversity first develops a working notion of the *taxon* as a whole by looking at its parts (the characters, traits, properties, attributes,, of its members), then reconsiders each part in the light of its correlations with other parts in making up the whole.

The closure of the meaning circuit, which enables the current to flow in/around the hermeneutic circle through the reciprocity of practice and perception, also enables the spiralling growth of what we call *cognition* or *thought*. Since *all thought is in signs*, as Peirce affirmed (EP1:24), a cognitive process is a semiotic process. But Peirce’s concept of *thought* is both broader and deeper than the common usage of the word.

Peirce wrote to William James in 1902 that ‘one must not take

a nominalistic view of Thought as if it were something that a man had in his consciousness. Consciousness may mean any one of the three categories. But if it is to mean Thought it is more without us than within. It is we that are in it, rather than it in any of us' (CP 8.256; we will look further into 'nominalism' in Chapter 12). *Thought* is thus the formal component of the Big Current, not merely the little current of someone's private stream of consciousness. We often call that inner stream 'thinking,' and sometimes call it 'thought,' in the sense defined by the *Century Dictionary* as the 'subjective element of intellectual activity.' But the specifically Peircean sense (often marked by his capitalization of the word) is defined in the CD as 'the objective element of the intellectual product' of thinking. To illustrate this exact sense of the word in the CD, Peirce cited the following quotation:

Thought is, in every case, the cognition of an object, which really, actually, existentially out of thought, is ideally, intellectually, intelligibly within it; and just because within in the latter sense, is it known as actually without in the former.

— G.J. Stokes, *The Objectivity of Truth* (1884), p. 53

Here 'cognition' appears as a self-bounding process, so that it has an inside and an outside. Indeed we can take Stokes' sentence as equivalent to the proposition that the world is inside out. The causal reciprocity between the intelligence and the reality external to it, considered as different things, is essential to cognition as a teleodynamic process (defined above). Deacon emphasizes this by contrasting cognition with *computation* (the italics are his):

computation only transfers extrinsically imposed constraints from substrate to substrate, while cognition (semiosis) generates intrinsic constraints that have a capacity to propagate and self-organize. The difference between computation and mind is a difference in the source of these formal properties. In computation, the critical formal properties are descriptive distinctions based on the selected features of a given mechanism. In cognition, they are distinctive regularities which are

generated by recursive dynamics, and which progressively amplify and propagate constraints to other regions of the nervous system.

— Deacon 2011, 498

This of course refers to the dialogue within the brain, which for a symbolic species like ourselves is continuously informed (constrained) by participation in the dialogue which constitutes the community of minds. Thoughts uttered and interpreted in that dialogue also propagate constraints (information) from mind to mind, body to body and brain to brain through the circular causality of the meaning cycle. This is possible because thought has generality: the same thought can be shared by many people in many situations, just as a single law of nature governs (*regulates*) a whole range of events.

By thought is meant something like the meaning of a word, which may be “embodied in,” that is, may govern, this or that, but is not confined to any existent. Thought is often supposed to be something in consciousness; but on the contrary, it is impossible ever actually to be directly conscious of thought. It is something to which consciousness may conform, as a writing may conform to it. Thought is rather of the nature of a habit, which determines the suchness of that which may come into existence, when it does come into existence. Of such a habit one may be conscious of a symptom; but to speak of being directly conscious of a habit, as such, is nonsense.

— Peirce, EP2:269

‘In a still fuller sense,’ Peirce went on to say, ‘Thirdness consists in the formation of a habit.’ The *formation* of a habit is brought about by *information* in the Peircean sense of that word, formally defined as the *logical product* of *breadth* and *depth*. The *breadth* of a symbolic term or proposition is the range of things to which it refers, while its *depth* is its connectedness with the rest of the network of symbols which constitute the language or other symbol system. As explained above, the symbol system is syntactically closed but semantically open by virtue of its capacity for reference

to previously unnoticed events, acts and facts, which broadens the universe of discourse. Thus the original *recognition* of a fact or event as an instance of a general form or type represents an increase of information. (Fuhrman 2010 gives a fuller explanation of this).

Semiosis and information

It is also possible for information to increase by growth in the *depth* factor, when new conceptual connections are formed within the **Model** or Innenwelt with no change in the breadth of reference involved in the symbol. This could also form or modify a habit, but would be experienced as the *object* of the symbol becoming more significant (since it is the object, and not semiosis itself, to which we pay attention when informed through semiosis). This is why 'it is impossible ever actually to be directly conscious of thought,' or of habit, although we do directly experience the *changes* in its immediate object as the "train of thought" rolls on. Thus we are aware of the continuous current of time, punctuated by surprises but also governed by regularities which turn occurrences into recurrences. We also experience the continuing flow of *practice* which is informed by our habits, but subjectively driven by 'will.' Consciousness rides on the surface of this circular current, while experience itself runs deeper.

Thus continuity, regularity, and significance are essentially the same idea with merely subsidiary differences. That this element is found in experience is shown by the fact that all experience involves time. Now the flow of time is conceived as continuous. No matter whether this continuity is a datum of sense, or a quasi-hypothesis imported by the mind into experience, or even an illusion; in any case it remains a direct experience. For experience is not what analysis discovers but the raw material upon which analysis works. This element then is an element of direct experience.

Phaneroscopy, as the analysis of the phaneron into its ever-present elements, identifies this element as Thirdness – which is quite distinct from Firstness and Secondness, although none of the three can appear in a pure form in the absence of the other two. These are what Peirce called ‘the *formal* elements of the phaneron’ (CP 1.284), and in this respect they are entirely different from the chemical ‘elements’ (or from any set of categories into which things can be sorted by type). Thirdness as Thought or habit-formation involves the presence of past and future in the closure of potentiality with actuality. As soon as you realize that something has happened *again*, you must have some kind of *concept* which presently embraces a number of past events, recognizing them as all of a kind, and anticipates their possible recurrence in the future. The same applies to your intention to carry out any conceivable course of action. Indeed, seeing a *connection* of any kind between two *different* acts or events brings us into the universe of Thirdness (continuity, regularity, generality, significance,).

Semiosis takes *time* because the connection between a sign and its object *continues* with the interpretant, which in turn propagates the connection to generate another interpretant sign with the same power of propagation. The sign-object relation is meaningless without the interpretant; there can be no sign-interpretant relation without the object; the object-interpretant relation is inconceivable without the sign. Thus a sign embodies Thirdness as a triadic relationship which cannot be decomposed into a set of one-to-one relations. Semiosis as Thirdness brings the two poles of the meaning cycle into the kind of relation represented diagrammatically as a closed loop. When we see (through many observations) that certain regularities in the causal relations between phenomena remain consistent over time, we call them ‘laws of nature.’ If the brain carries a stream of consciousness, it is also *carried by* the river of Thought, the Big Current running through Big Mind.

Thought is not necessarily connected with a brain. It appears in the work of bees, of crystals, and throughout the purely physical world; and one can no more deny that it is really there, than that the colors, the shapes, etc., of objects are really there.

Peirce's attempt to generalize *thought* and *mind* beyond human psychology led to his most thoughtful and mindful characterizations of semiosis and Thirdness – such as the following, from the 'Syllabus' which he wrote to accompany his Lowell Lectures of 1903. Here he also stipulates that a Sign must have 'a mental interpretant' – which, as we have seen, does not restrict its provenance to human consciousness – and then poses the question of whether representation could take place without signs, i.e. mindlessly. His answer to that question virtually asserts that not only is all thought in signs, but also *all signs are in thought*.

A Sign, or Representamen, is a First which stands in such a genuine triadic relation to a Second, called its Object, as to be capable of determining a Third, called its Interpretant, to assume the same triadic relation to its Object in which it stands itself to the same Object. The triadic relation is genuine, that is its three members are bound together by it in a way that does not consist in any complexus of dyadic relations. That is the reason the Interpretant, or Third, cannot stand in a mere dyadic relation to the Object, but must stand in such a relation to it as the Representamen itself does. Nor can the triadic relation in which the Third stands be merely similar to that in which the First stands, for this would make the relation of the Third to the First a degenerate Secondness merely. The Third must indeed stand in such a relation, and thus must be capable of determining a Third of its own; but besides that, it must have a second triadic relation in which the Representamen, or rather the relation thereof to its Object, shall be its own (the Third's) Object, and must be capable of determining a Third to this relation. All this must equally be true of the Third's Thirds and so on endlessly; and this, and more, is involved in the familiar idea of a Sign; and as the term Representamen is here used, nothing more is implied.

The *second triadic relation* which the Interpretant must have can be seen as another iteration of the loop we have diagrammed as the meaning cycle. Yet it is separated from the first triadic relation only by abstraction from the process, i.e. from the current flowing through the semiotic circuit. These relations all take place *simultaneously* even as they take time, and this (like the presence of past and future) characterizes the continuity of time itself as an element of direct experience. Peirce continues:

A Sign is a Representamen with a mental Interpretant. Possibly there may be Representamens that are not Signs. Thus, if a sunflower, in turning towards the sun, becomes by that very act fully capable, without further condition, of reproducing a sunflower which turns in precisely corresponding ways toward the sun, and of doing so with the same reproductive power, the sunflower would become a Representamen of the sun. But *thought* is the chief, if not the only, mode of representation.

As Peirce's example of the sunflower shows, it is very difficult to imagine how this could take place without *thought* in the Peircean sense of that word, which does not depend on the *thinking* of human subjects – for human language depends on semiosis rather than the other way round – but does involve the direct experience of *time as continuous transformation*.

Closing time

In any process of inquiry or cognition, every 'stage' in the meaning cycle may be going on simultaneously with others; but we cannot observe them all at once, except by abstracting from the process a 'skeleton diagram' like the meaning cycle. We use this circular image to simplify what is really an 'inextricable causal web of perception, action and cognition' (Thelen and Smith 1994, xxii). While we do so, this simplified image occupies the narrow beam of our conscious attention, displacing whatever *percepts* are represented by the perceptual side of the diagram. Percepts are the

points of contact between dynamic and immediate objects, between the realms external and internal to the perceiving. When we *recognize* a percept – that is, make a *perceptual judgment* as to what it is – this constitutes a reiteration of the cognitive cycle; but of course, while we are *in* that loop, we don't see the whole of it as if we were outside of it. To do that, we have to leap into another semiotic loop, for 'every concept and every thought beyond immediate perception is a sign' (EP2:402).

Neither percepts nor perceptual judgments, which are determined by the interaction of our cognitive habits with percepts, are subject to conscious control. But out of those recognitions, which are 'the first premisses of all our reasonings' (EP2:191), cognitive processes grow by inference toward the self-control of the guidance system. This growth is the growth of *symbols*, which according to Peirce are 'the only things in the universe that have any importance' (EP2:269) – since nothing else can make real connections between general patterns on the one hand, and particular percepts or individual actions on the other. But what we gain in connectivity from the mediation of symbols may entail a loss of directness.

We have a direct knowledge of real objects in every experiential reaction, whether of *Perception* or of *Exertion* (the one theoretical, the other practical).

Peirce, EP2:304

But as we have seen above, symbols can manifest this knowledge only by referring *more or less indirectly* to an icon, and to a real object *through* an index. The closure of the symbol *system* entails that 'Symbols are particularly remote from the Truth itself. They are abstracted. They neither exhibit the very characters signified as icons do, nor assure us of the reality of their objects, as indices do' (EP2:307). The abstractedness characteristic of symbols is a natural result of the loops within loops which characterize a self-guidance system. The internalization of thought-loops can cause the decay of a sign's relation to its object into a degenerate Secondness – a short circuit, as it were, leaving reality out of the loop.

Once we are aware of this, however, we can embark on cycles of *logical* (meaning *self-critical*) thought. Each cycle of logical

thought, or reasoning, takes control of its course at the advent of the perceptual judgment and releases it into action (which, once taken, cannot be redirected or “taken back.” This is the course followed by every meaningful concept.

The elements of every concept enter into logical thought at the gate of perception and make their exit at the gate of purposive action; and whatever cannot show its passports at both those two gates is to be arrested as unauthorized by reason.

— Peirce (EP2:241)

Perceptual elements (i.e. percepts) ‘show their passports’ to reason by means of common-sense reality checks. As *conceptual* elements, they must show their passports as pragmatically relevant to a reasonable course of *conduct*, i.e. ‘purposive action.’ The *purpose* is the final cause of the reasoning process – in science, the quest for Truth. Natural science aims to formulate the laws of nature as the final causes of whatever happens in the observable world, for as Peirce put it, ‘the truth of the formula, that is, the law, is, in the strictest sense, the defining cause of the real individual facts’ (Peirce, EP2:316).

On the personal level, a perceptual judgment takes on meaning by filling a niche in your internal semantic space or Innenwelt. Aspects of this inner model find their meaning in the difference they make to your practice by functioning as *precepts*. Thus we have a closed causal loop or cycle which, taken as a whole process, is a final cause for any act of meaning; ‘final causation is that kind of causation whereby the whole calls out its parts’ (Peirce, EP2:124). The ‘two great tasks of humanity, *Theory* and *Practice*,’ are essential parts of the cycle. Our actions in the world of external things must be guided by perception of them in order to realize our intentions; and our perceptual faculties in turn have evolved to serve the purpose of guiding our actions. The optimization of our biological guidance systems has played a key role in determining the form of our perceptual organs, and these in turn determine what kinds of things we are able to act upon and interact with. Physical and biological forms of closure are specialized forms of semiotic or logical closure.

Semiosis synchronizes direct perception with direct practice in a circular process like the one envisioned by Peirce in 'Evolutionary Love':

The movement of love is circular, at one and the same impulse projecting creations into independency and drawing them into harmony.

— EP1:353 (1893)

How does the movement of love achieve creation and closure at *one and the same impulse*?

A quick person needs only a single word, a swift horse only needs one stroke of the crop. Ten thousand years are one moment, one moment is ten thousand years. If you want to become acquainted with direct perception, it is before mention is made. But tell me, before any mention is made, how can you search for it?

— *The Blue Cliff Record*, Case 70 (Cleary 2002, 236)