

*The mind is inherently embodied.
Thought is mostly unconscious.
Abstract concepts are largely metaphorical.
These are three major findings of cognitive science.*

George Lakoff and Mark Johnson (1999, 1)

Our body is the ultimate instrument of all our external knowledge, whether intellectual or practical.

Michael Polanyi (TD 15).

Tacit knowing joins together three co-efficients. This triad is akin to the triad of Peirce: 'A means B to C'. But I shall prefer to write instead: A person A may make the word B mean the object C. Or else, A person A may integrate the word B into a bearing on C.

Michael Polanyi (KB 181)

Polanyi, Lakoff and Johnson, and Embodied Knowing

Richard W. Moodey

Abstract: *According to the meaning I create and attribute to Michael Polanyi's essay "Sense-Giving and Sense-Reading," each person creates the meaning, concept, or idea he, she, or they (singular) attributes to any of his, her, or their experiences. This is accomplished by integrating tacit subsidiaries into a focal object, a process Polanyi described as being analogous to the creation of a visual Gestalt. I explore the way second generation cognitive science, as articulated by George Lakoff and Mark Johnson, might provide a way of building on Polanyi's semantic theory. I also explore the way Polanyi's semantic theory might provide a way of building on Lakoff and Johnson's philosophy of embodied realism. I focus on the from-to structure of metaphors, radial categories, and prototype theory. I contrast Polanyi's and Charles Sanders Peirce's explanations of the triadic structure of the process of creating and attributing meanings, concepts, and ideas to experiences. I argue that Peirce's formulation is useful for a Polanyian interpretation of biosemiotics.*

Keywords: Polanyi, Lakoff, Johnson, Peirce, person, create, attribute, metaphor, prototype, radial category, semantics, semiotics, biosemiotics, communication, transforming, meaning, concept, idea, focal object, integration, tacit, explicit, *from-via-to*.

My objective in this essay is to report on two of the ways I've been trying to expand on the meanings I create and attribute to Michael Polanyi's "Sense-Giving and Sense-Reading" (KB 181-207). Polanyi said that sense-givers (speakers and writers) and sense-readers (listeners and readers) create meanings by integrating tacit subsidiaries into the focal objects that *are* the meanings each of us attributes to things we experience. One of the ways I expand on this is by using second-generation cognitive science, the cognitive science of the embodied mind. I don't use first-generation cognitive science, the cognitive science of the disembodied mind (Lakoff and Johnson 1999; Takaki 2009-2010). The other way is by using Charles Sanders Peirce's *impersonal* formulation of semiosis. (Colapietro 1989, 6). This provides a path from Polanyi's *personal*

semantics and theory of communication to thinking, talking, and writing about the non-human communication that's important in biosemiotics (Gulick 2012-2013; Mullins 2017; Leiff 2020). I begin by apologizing for three aspects of my writing that I worry about, because I think some of you might be irritated by them: (1) my tiresome repetition of the phrase "I create and attribute to," and (2) my persistent use of "I," "me," and "my," and (3) my use of "they," "them," and "their" as *both* a plural *and* a singular pronoun.

Apologies

Repetition of "I create and attribute to." I need to remind myself, as well as you, that I agree with the meaning I create and attribute to "Sense-Giving and Sense-Reading." I need these reminders because in the idiom of my everyday conversations I use language that suggests that I believe that the following three metaphors are true declarative sentences, rather than a way of *naming* metaphors:

IDEAS (OR MEANINGS) ARE OBJECTS,

LINGUISTIC EXPRESSIONS ARE CONTAINERS (Lakoff and Johnson, 1980, 10), and

VERBAL MESSAGES ARE PACKAGES.

I put these three metaphors into the category of metaphors Lakoff and Johnson (1980, 25) called "ontological metaphors," the kind of metaphors that enable each of us to understand selected parts of his, her, or their (singular) experiences as "discrete entities or substances of a uniform kind." In the context of everyday conversations I think, talk, and write as if I believe in the truth of the *folk semantics* expressed by these three metaphors. It's only in the context of theoretical discourse, talking and writing in the context of *slow thinking* (Kahneman 2011), that I explicitly recognize these metaphors as metaphors. In this paper, I'm trying to engage in theoretical discourse.

Persistent use of "I." I justify writing in the first-person singular by appealing to two authorities: William Poteat and Douglas Hofstadter.

When James Stines had been a graduate student, he had studied with Poteat. In "Personhood and the Problematic of Christianity" (2016, 103), he quoted from a letter he received from Poteat in January of 1988 in which Poteat explained he struggled with the first person singular pronoun:

From "Faith and Existence" to POLANYIAN MEDITATIONS I am struggling to found, formulate and argue my thesis within the first person singular. Of course the whole philosophic tradition militates against this preferring, as it does, the third person. Therefore, my efforts--never wittingly made until POLANYIAN MEDITATIONS-- are compromised over and over again as I try to follow my instincts and stay in the first person at the same time that I try to speak to the tradition. 'Incarnate' is an interesting stage. There at the heart of the argument I have the courage of my convictions but then capitulate to Immanuel Kant in the first critique third person thinker par excellence.

I use "I" persistently as a way of trying to "have the courage of my convictions," but I worry that this makes me appear hopelessly egocentric. Douglas Hofstadter (2007, xiii) described "the tradition's" preference for third person rhetoric as a "formidable bastion from which self-reference had been strictly banished by its audacious architects."

Singular "They." In recent years, a growing number of people have been asking others to refer to them as "they" rather than "he," or "she." Mary and I had to take this very seriously when our former daughter, Claire, declared that *they* no longer wanted to *present herself* as female, and asked to be called "Clay" and to be referred to as "they." I accepted this intellectually, but was also saddened that they was no longer the daughter I had loved for over thirty years. I still love them very much, but my *emotional* acceptance of changes in my own family hasn't caught up with

my *intellectual* acceptance of the LGBTQ+ movement in general. Repeating “he, she, or they” in my writing is one of my ways of trying to accept this change emotionally.

Realisms: Polanyi’s and Polanyians,’ Peirce’s and Peircians,’ etc.

Alan Gross (1996, 193) added “realism” to Walter Gallie’s (1956) examples of “Essentially Contested Concepts,” “Christian doctrine,” “work of art,” and “democracy.” Contrary to both Gallie and Gross, I say that these are *terms*, rather than concepts. They are contested terms because different people create and attribute different concepts, meanings and ideas to them. Using a term from contemporary linguistics, I describe these terms as *polysemantic*, and, using a term Polanyi used (PK 251), I say that these terms exemplify *semantic indeterminacy*.

Even among Polanyians, “Polanyi’s realism” is an essentially contested term. In his contribution to a special issue of *Tradition & Discovery* devoted to Polanyi’s realism, Gulick (1999-2000, 35). said that the diversity of the seven essays in that issue made him “wonder if Polanyians truly do represent a community of inquiry.” He offered a brief explanation of that diversity: it was “sufficient to underscore how many factors feed into our personal Backgrounds to contribute to strikingly different interpretations of the same body of work.” I say that *Polanyi’s* realism has only been expressed in texts *he* wrote. When *he* was writing those texts, *he* was the *sense-giver*, creating and attributing *his* meanings, concepts, and ideas to *his* words and sentences. He was doing this by integrating tacit subsidiaries from *his* personal background. When a Polanyian is reading a text written by Polanyi, *he, she, or they* (*singular*) is a *sense-reader*, creating the meanings *he, she, or they* is attributing to Polanyi’s words and sentences by integrating tacit subsidiaries from *his, her, or their* personal background. Then, when the scholar attempts to communicate the meanings, concepts, and ideas *he, she, or they* has created and attributed to *Polanyi’s* texts, *he, she, or they* becomes a *sense-giver*, creating and attributing meanings to *his, her, or their* words and sentences. I read that special issue of *TAD* as containing seven distinctly different *Polanyian* realisms, the Polanyian realisms of Sanders, Jha, Gulick, Mullins, Cannon, Puddefoot, and Meek.

But when I reflect on what I’ve just written, it seems too extreme. I turn again to Poteat to explain my discomfort. In the prologue to *Polanyian Meditations* he reported on his experience of reading Polanyi after his “Orphic dismemberment,” a dramatic change in his thinking that resulted from his encounters with the Greek sculptor Evangelos Moustakis. He wrote (1985,8):

Returning to Polanyi, I discovered equivocations, complexities -- and profundities -- I had not hitherto noticed. He was more difficult, more radical than I had been able to see or say when, in 1967, I had sat down to write the introduction to *Intellect and Hope*, . . . (Poteat 1985, 8).

I think that “Sense-Giving and Sense-Reading” is one of Polanyi’s most radical texts, and this is why I’m uncomfortable with the results of trying to expand upon the meanings I create and attribute to it. I don’t feel comfortable saying that each of the contributors to that special issue of *TAD* was presenting his or her *Polanyian* realism, rather than *Polanyi’s* realism. The subtitle of Esther Meek’s *Contact with Reality* (2017) is *Michael Polanyi’s Realism and Why It Matters*. I don’t think either she or her publisher would have liked the following subtitle: *My Polanyian Realism and Why It Matters*. The different names Polanyians have given to their Polanyian realisms are suggestive: Richard Gelwick (1977), “heuristic realism;” Phil Mullins, “participative realism;” Dale Cannon, “post-critical realism;” John Puddefoot, “resonance realism;” and Kyle Takaki (2009-2010), “enactive realism.”

Despite my discomfort, I want to take a few more steps along this path. I don’t have a name for *my Polanyian* realism, but I do have a maxim: “The map is not the territory” (Korzybski 1933).

The maps are *real* and the territories are *real*, but even the best map is never *identical* to the territory that the map-maker tried to represent. Polanyians draw metaphorical maps of two different territories: (1) mind-independent realities, and (2) what *Polanyi* was thinking and feeling *at the time* when he was drawing a metaphorical map of some mind-independent reality. Polanyians, however, aren't unique in our struggles to draw metaphorical maps of these two kinds of territories. Scholars devoted to the study of any great thinker draw metaphorical maps of two different territories. Scholars who compare two great thinkers, Polanyi and Peirce for example, draw metaphorical maps of *three* different territories:

1. mind-independent reality,
2. what *Polanyi* was thinking and feeling *at the time* when he drew a metaphorical map of some mind-independent reality, and
3. what *Peirce* was thinking and feeling *at the time* when he drew a metaphorical map of a *similar* mind-independent reality.

Colapietro's (2011-2012, 52) reflections on comparative studies reduces my discomfort. He said, "From a Peircian perspective, nothing could be easier than identifying similarities between even the most apparently disparate things."

In comparing what Peirce and Polanyi claim regarding inquiry, for example, one should aim at enhancing our understanding of this process itself. The comparison should be itself a step in the inquiry into the nature of inquiry.

In terms of the map metaphor, drawing a map of what Peirce claimed about inquiry, drawing a map of what Polanyi claimed about inquiry, then comparing the two maps, should be a step towards drawing a map of the *nature of inquiry*.

Second-Generation Cognitive Science

My objective here isn't to point out similarities between things Polanyi said and things that second-generation cognitive scientists have said. It is, rather, to use the meanings I create and attribute to things that second-generation cognitive scientists have said to develop or build upon the meanings I create and attribute to "Sense-Giving and Sense-Reading. What am *I doing* when *I'm* creating and attributing meanings to my experiences, *beyond* just saying that I'm integrating tacit subsidiaries from my personal background to create focal objects?

In "Operational Principles of Language," section 3 of "Articulation," Polanyi articulated the linguistic Laws of Poverty, Grammar, Iteration, and Consistency. A language must have a limited number of words to refer to an unlimited variety of human experiences, and verbal messages must contain a grammatical ordering of words if they are to be intelligible. Competent users of a language use the same limited number of words repeatedly and consistently. To learn to become a competent user of a language is to learn an *art*. There are linguistic laws, but competence in following those rules is a tacit skill (*PK* 77-82).

Maps were the source domain of two of Polanyi's favorite metaphors. In the first chapter of *Personal Knowledge*, "Objectivity," it was A THEORY IS A MAP (*PK* 4). In section 4 of "Articulation," "The Powers of Articulate Thought," it was A SYMBOLIC REPRESENTATION OF REALITY IS A MAP. After providing a number of examples, Polanyi concluded said:

We have now before us the following sequence of sciences relying decreasingly on the first [poverty] and increasingly on the second [grammar] operational principle of language: (1) the descriptive sciences, (2) the exact sciences, (3) the deductive sciences. It is a sequence of increasing formalization and symbolic manipulation, combined with decreasing contact with experience. Higher degrees of formalization make the statements of science more precise, its inferences more impersonal and correspondingly more

‘reversible’, but every step towards this ideal is achieved by a progressive sacrifice of content. The immense wealth of living shapes governed by the descriptive sciences is narrowed down to bare pointer-readings for the purposes of the exact sciences, and experience vanishes altogether from our direct sight as we pass on to pure mathematics.

There is a corresponding variation in the tacit coefficient of speech. In order to describe experience more fully language must get less precise. But greater imprecision brings more effectively into play the powers of inarticulate judgment required to resolve the ensuing indeterminacy of speech. So it is our personal participation that governs the richness of concrete experience to which our speech can refer. Only by the aid of this tacit coefficient could we ever say anything at all about experience — a conclusion I have reached already by showing that the process of denotation is itself unformalizable (PK 86-87).

I’ve quoted Polanyi at some length because I want you to create and attribute meanings to the words and sentences *he* wrote, rather than to the words and sentences *I* would write as an attempt to paraphrase what he had written. But I take personal responsibility for saying that maps were the source domains for two of his favorite metaphors. He *used* those metaphors, but never explicitly acknowledged that they were metaphors.

This findings of second-generation cognitive science about the pervasive presence of metaphors in all of our thinking, talking, and writing help me to connect the meanings I create and attribute to things Polanyi wrote about language in *Personal Knowledge* to the meanings I create and attribute to “Sense-Giving and Sense-Reading.” In their Preface to *Metaphors We Live By*, Lakoff and Johnson (1980, ix) say:

Mark had found that most traditional philosophical views permit metaphor little, if any, role in understanding our world and ourselves. George had discovered linguistic evidence showing that metaphor is pervasive in everyday language and thought — evidence that did not fit any contemporary Anglo-American theory of meaning within either linguistics or philosophy. Metaphor has traditionally been viewed in both fields as a matter of peripheral interest. We shared the intuition that it is, instead, a matter of central concern, perhaps the key to giving an adequate account of understanding.

On the first page of chapter 1, “Concepts We Live By,” they state the core message of their book: “Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature” (1980, 3). I connect this to the personal backgrounds of each sense-giver and sense-reader. Memories of metaphors are pervasive among the tacit subsidiaries we integrate to create focal objects — meanings, concepts, and ideas.

Although Polanyi and Prosch wrote a chapter titled “From Perception to Metaphor” (M 66-81), they focused on the power of metaphors to move us emotionally rather than the degree to which metaphors structure even our scientific and philosophical thinking, talking, and writing. In *Making Truth: Metaphor in Science* (2003), Theodore Brown cited Polanyi and Lakoff and Johnson, and in *Society and its Metaphors: Language, Social Theory and Social Structure* (2003), José López cited Lakoff and Johnson but not Polanyi. One of the metaphors López focused on was SOCIETY IS AN ORGANISM. Polanyi used this metaphor in many of the things he wrote about social things, but never acknowledged that it was a metaphor. In his critical exposition of Polanyi’s philosophy, Prosch said: “Our study will show that Polanyi in his role as a physician-philosopher was mainly concerned with trying to cure the modern mind of what ails it” (1986 7). Even though he included a chapter on metaphor, Prosch never pointed out that Polanyi, and he, were using the metaphor THE MODERN MIND IS AN ORGANISM.

The source domains of many of our metaphors are bodily experiences. This is the case with the container metaphor and the associated *in-out* image schema.

Each of us is a container, with a bounding surface and an in-out orientation. We project our own in-out orientation onto other physical objects that are bounded by surfaces. Thus we also view them as containers with an inside and an outside (Lakoff and Johnson 1980, 29). I've already written about the container metaphor as used in folk semantics. According to folk semantics, we "put" meanings "into" words in a way that's analogous to the way we put food into our bodies. And I've argued that in the context of theoretical discourse, as opposed to everyday conversations, I judge this to be a seriously misleading metaphor, because it contradicts the meaning I create and attribute to Polanyi's argument that sense-givers and sense-readers *create* the meanings we attribute to words. In the light of second-generation cognitive science, I add that a centrally important aspect of the process of creating meanings is metaphorical.

Another important finding of second-generation cognitive science is that most of our conceptual *categories* are *radial categories*. In *Women, Fire, and Dangerous Things: What Categories Reveal about the Mind* (1987), Lakoff built upon Eleanor Rosch's (1978) study of the relation between radial categories and prototypes. There's no contradiction between saying that most of our conceptual categories are radial categories and saying that our conceptual schemes are pervasively metaphorical. They are complementary heuristics for thinking, talking, and writing about what's going on when we are creating meanings, concepts, and ideas. Radial categories and prototypes are other ways by which I connect "Sense-Giving and Sense-Reading" to Polanyi's chapter on articulation.

Polanyi's Law of Poverty, for example, implies the necessity of categorizing our experiences. We have to use a limited number of words to signify a virtually unlimited diversity of experiences. What prototype theory adds to "Sense-Giving and Sense-Reading" is that one aspect of the process by which I create meanings ideas is that I put an experience into a category based on *my* personal, and tacit, judgment that the experience is *similar enough* to one of *my* prototypes for that category. I can assert that in the language of universal intent by saying that each person puts an experience into one of that person's radial categories if he, she, or they (singular) tacitly judge it to be *similar enough* to one of that person's prototypes for that category.

One aspect of what I'm doing when I'm creating meanings is that I'm making tacit judgments about which category I shall put *this* experience into. This brings the container metaphor back into my Polanyian semantics, but in a way that's different from the way the container metaphor enters into folk semantics. According to folk semantics, words are containers for already existing, object-like meanings, concepts, and ideas. According to my Polanyian semantics, radial categories are containers for personal experiences. It's true that words serve as labels for the categories, but the words are metaphorical *pointers* (KB 181) rather than metaphorical containers.

Prototype theory also helps to make some of those tacit subsidiaries explicit by specifying a list of categories of prototypes: "central subcategory," "typical case prototype," "ideal case prototype," "anti-ideal prototype," "social stereotype," "salient exemplar," and "essential prototype" (Lakoff 2002, 10-12). The process by which I judge a specific case to be similar enough to one of my prototypes for the radial category to which a word or term points is tacit.

I'm excited by the process of using second-generation cognitive science to connect things Polanyi said in "Sense-Giving and Sense-Reading" to things he had said earlier in *Personal Knowledge*. Engaging in this process opens up many interesting paths to explore, only a few of which I've reported on here. Rather than going down more of those paths here, I want to report on a path that's opened up by connecting "Sense-Giving and Sense-Reading" to Peirce's semiotics.

Polanyi and Peirce

The path that's opened up by comparing Polanyi and Peirce has already been taken by Gulick, "Polanyian Biosemiotics and the From-Via-To Dimensions of Meaning" (2012-2013); "A Polanyian Semiotic: Toward a Comprehensive Theory of Meaning" (2022) and Mullins, "Michael Polanyi's Approach to Biological Systems and Contemporary Biosemiotics" (2017). And there was an issue of *TAD* (38, 3: 2011-2012) in which Mullins, Davi Alger, Robert Innis, and Vincent Colapietro reported on ways they developed *their* philosophies — their metaphorical maps of reality — by comparing (1) meanings they created and attributed to things Polanyi had written to (2) meanings they created and attributed to things Charles Sanders Peirce had written.

I realize that Mullins, Alger, Innis, and Colapietro would probably want to express what they were doing in that issue of *TAD* differently from the way I just did. I used the language I did because I want, again, to remind you, as well as myself, that each of these men had been *creating* the meanings they were attributing to their words and sentences as they were writing them. Important among the tacit subsidiaries each was integrating to create those meanings were their *memories* of having previously created the meanings they had attributed to texts written by Polanyi and Peirce. Their later acts of *sense-giving* were articulations of their memories of previous acts of *sense-reading*.

Mullins reported that there are two slightly different versions of "Sense-Giving and Sense-Reading," but that the differences don't make a difference in the core message of the essay. In one version Polanyi attributed the formula "A means B to C" to Stoic logic while in the other version he attributed it to the "triad of Peirce." That seems to be the only difference between the two versions. In both versions, Polanyi added "But I shall prefer to write instead: A person A may make the word B mean the object C. Or else, A person A may integrate the word B into a bearing on C" (*KB* 181). I think what Polanyi rather mildly expressed as a preference was, in the Preface to *Personal Knowledge*, expressed as a *rejection*. Polanyi said "I start by rejecting the ideal of scientific detachment," and "I want to establish an alternative ideal, quite generally" (*PK* vii). One of the meanings I create and attribute to Peirce's "A means B to C" is that he formulated it inspired by the ideal of scientific detachment. But I also argue that, *in some contexts*, Polanyi *didn't* reject the ideal of scientific detachment, which he often called "objectivism."

Much of the following is based on the meanings I've created and attributed to chapter 1 of Colapietro's *Peirce's Approach to the Self* (1989), "Is Peirce's Theory of Signs Truly General?" Peirce began with a personal formulation, but subsequently removed any reference to a person as the way to make it more general. Colapietro said: "In 1873, Peirce claimed: 'A sign is something which stands for another to a mind' (MS 380)." Colapietro added that "the Peircian definition adds a dimension the classical formulation lacks, namely, reference to mind: A sign not only stands *for* something, it stands *to* someone — to some mind" (Colapietro 1989, 4; Colapietro's italics). But Peirce dropped the reference to the mind of a person in the interest of greater generality. Colapietro said (1989, 5):

Around 1897, Peirce formulated what is almost assuredly his most frequently quoted definition: "A sign, or *representamen*, is something which stands to somebody in some respect or capacity" (2.228). . . .

Even before formulating the definition in 2.228, Peirce had already generalized the idea of a sign in such a way as to strip that idea of all reference to the mind.

After contrasting Peirce's semiotics with that of Josiah Royce, Colapietro said:

Peirce's purely *formal* definition of semiosis manifests the truly general aspiration of his semiotic investigations. For, in it, neither the source nor the outcome of semiosis is

necessarily mental. This definition exhibits the *form* of a process without specifying the nature of the participants in that process. In this completely formal definition, a sign “is an object which is in relation to its object on the one hand and to an interpretant on the other, in such a way as to bring the interpretant into a relation to the object, corresponding to its own relation to that object” (1989, 6; Colapietro’s italics).

I’ve already quoted, at some length, a passage from *Personal Knowledge* (PK 86-87) that I interpret as allowing for the *Polanyian* legitimacy of Peirce’s purely *formal* definition of semiosis. In moving from the descriptive to purely formal sciences, such as pure mathematics, there’s “a sequence of increasing formalization and symbolic manipulation, combined with decreasing contact with experience.” The meaning I create and attribute to “decreasing contact with experience” is very similar to the meaning I create to Colapietro’s description of Peirce’s definition as exhibiting “the *form* of a process without specifying the nature of the participants in that process.” By substituting the impersonal “interpretant” for the personal “interpreter,” Peirce opened up a path for exploring the kinds of non-verbal, even non-symbolic, communication that’s the object of inquiry in biosemiotics. Even though that formulation “detaches” persons from the process, and can legitimately be called “objectivist,” Polanyi’s characterization of the purely formal sciences allows me to include Peirce’s formulation within my radial category of statements I label “Polanyian.”

The knowing processes of those who practice biosemiotics are just as *personal* as the knowing processes of social scientists. But social scientists focus mostly on the personal knowing processes of other people. Biosemioticians, in contrast, are studying the kinds of communication that Jon Lieff described in *The Secret Language of Cells* (2020). Lieff was using “language” in a highly metaphorical way: cells *don’t* use language to communicate, but they *do* communicate.

I’ve formulated a speculative hypothesis: *cells communicate by transformations of dynamic information*. I interpret Colapietro as saying that for Peirce, signs are agents. Their agency is real, even though it’s a much simpler kind of agency than the agency we attribute to people or even to the non-human animals to which we attribute intentions and decisions. The information that constitutes the *form* of a sign is *dynamic*. It’s a *cause* that produces *effects*. From this, the meaning I create and attribute to Peirce’s purely formal definition is that the relation of a sign to its object is a dynamic transformation of the form of the sign into the form of its object “on the one hand,” and into the form of its interpretant, “on the other, in such a way as to bring the interpretant into a relation to the object,” a transformation of the form of the sign into the form of the interpretant, “corresponding to its own relation to that object,” a transformation of the form of the sign into the form of the object.” What I have done, in other words, is to translate the less dynamic term “relation” into the more dynamic term “transformation.”

Sean Carroll (2005) reported on the communication of “toolbox genes,” genes that don’t code for any trait, to genes that do code for traits. In the development of an embryo, genetic information that controls for traits has to be released both at the right time in the process, and sent to the right place in the increasingly complex “landscape” of differentiated cells and tissues. This strikes me as an almost incredible communication of complex messages from toolbox genes to trait genes. We speak of the gradual “unfolding” of genetic information in the development of a viable infant from a one-celled zygote, but the term “unfolding” can obscure the complex communication processes that have to take place for a normal and viable infant to develop.

Conclusion

I have taken just a few steps down just a few of the many paths that second-generation cognitive science and Peirce’s semiotics open up as ways to expand on the meanings I create and

attribute to “Sense-Giving and Sense-Reading.” Second-Generation cognitive science, the cognitive science of the embodied mind, points to paths for thinking, talking, and writing about what’s going on when I’m creating meanings as a sense-giver and sense-reader. Because I follow Polanyi in asserting with universal intent what I assert about my own knowing and doing, those paths are also ways of thinking, talking, and writing about what everyone is doing when they are knowing. Peirce’s purely formal definition of the semiotic process points to a path that’s going in a very different direction, not towards what we humans are doing when we are knowing and communicating, but towards a better understanding of non-human communication, especially for communication that takes place “below” the level of the non-human animals to which we attribute intentions and decisions similar to human intentions and decisions. I said some things about communication at the level of cells and genes, but nothing about the discovery of the way trees communicate by networks of fungi.

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