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The Phenomenological Heart of Teaching and Learning

Theory, Research, and Practice in Higher Education

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Chapter 2
Getting DEEP

The Integrative Biology of Teaching and Learning

> The whole of science is built upon the world as directly experienced, and if we want to subject science to rigorous scrutiny and arrive at an assessment of its actual meaning and scope, we must begin by reawakening the basic experience of the world of which science is the second-order expression.
>
> (Merleau-Ponty 1945/1962, p. viii)

Introduction

We believe that all teaching can profit from a better understanding of the processes that enable learning, and this involves adopting a phenomenological attitude while remaining open to the biological factors that underlie teaching and learning. The biologist amongst our authors is confident the shared values of phenomenology and science is the opening through which fruitful collaboration will flow. This is, in part, because the *meaning* of his subject matter and what he learns about it is deeply enriched by first order insights, as is true of many scientists. Description, pursued as deeply as possible without bias, and particularly connections with more or less related topics, contributes significantly to this meaning. And as a teacher he is highly motivated to make comparable experiences available to students.

An examination of these processes is, however, a vast task, so in this chapter, we shall focus only on a few key examples of how biological considerations can speak to the phenomenologically inclined teacher. In particular, we focus on the ideas of the transformative learning experience and the teachable moment. Taken together, they also represent an eloquent expression of the reciprocity of internal and external phenomena, an idea valued in both phenomenology and ethology. We turn next to those ideas.

Transformative Learning

We begin with *transformative learning*, which is an internal phenomenon that can be understood in a variety of ways (Taylor, Cranton, & Associates, 2012). The meaning to which we subscribe was included in an article concerning some of our case study findings (Sohn et al., 2016, and see Chapter 7):

> While thoughtful teachers in higher education strive to help their students master course content, for many, a further goal is to help them transcend it—to help them go beyond transfer of content skills and knowledge—to a transformative understanding of the world and their place within it. . . . This transformation is manifest in students realizing the relevance of course content in their personal and professional lives—in the aesthetic sense of gratification that imparts confidence in one's understanding or insight—an intuitive sense of its truth and worth.
>
> (p. 179)

Learning goes on at every level of organization all the time. Cells learn, tissues and organs learn, connections within and between tissues and organs change as result of experience—we learn. It is an expression of the everyday ongoing processes of change and growth, but in its extreme expression, learning which imparts a distinctive sense that "everything is different" is transformative. Of course, connections are always being created, reconfigured, weakened, and strengthened, as we experience the world and ideas, but in its extremity, the transformative learning experience enables more clarity in our thinking about the circumstances that encourage and enable it. It shares attributes with epiphany ("an experience of sudden and striking realization") and resembles Piagetian "accommodation," the changing of a mental schema under the influence of new information (Piaget, 19947/2003).

In our view and in phenomenological terms, this is exemplified by students experiencing a paradigm shift from merely knowing course content to realizing its relevance in their personal and professional lives. This shift from *knowing* to *realizing* (Greenberg et al., 2015) can be compared to an act of creation (or discovery) that gives course content privileged personal meaning. This "bridge" from disciplinary generalities to an individual's particulars may have been gradually constructed, but often appears suddenly in a student's mind when there is a conscious awareness of energizing connections to other information or to intuitive and affective depths that are not usually available for connecting. The transformation is often (but not only) experienced as a cascade of ideas that has been "triggered" by an ecphoric thought or idea—a stimulus that acts as a trigger for a cascade of memories that can be organized into a coherent whole. The metaphoric implications are interesting: very small adjustments in this cascade can have massive consequences. The phenomenologically informed classroom can make the reservoir of a student's personal resources available for such connections. Students themselves may be unaware of the depth and richness of this reservoir. If we are going to put it in the service of learning, the best the teacher can do is create an enabling environment—potentially teachable moments—in which students feel ownership of canonical content that can create meaning and make the content available to other domains of life, often in highly creative ways.

The Teachable Moment

The environment in which transformative learning occurs emerges from the convergence of internal and external circumstances—biological, phenomenological, and environmental. It has been called the perfect storm of circumstances in which external factors in the moment converge with memory, awareness, and expectations, making a creative, transformative experience much more likely—this is the *teachable moment* (Greenberg et al., 2016).

Like the transformative learning experience, the teachable moment is at the end of a continuum of experiences and evokes unmistakable signs of phenomenological meaning. Teachable moments often appear unpredictable because the circumstances that converge to create them are not—probably *cannot*—be fully understood. It is, however, possible for teachers to reflect upon these circumstances as they plan learning activities. This is not a new insight; according to Plato, Socrates appreciated that one could learn the skill of delivering an appropriate comment at precisely the right moment.

Of course, such moments can occur spontaneously, but some (implicit or explicit) understanding of them—*the phenomenological attitude*—can enable the professor to maximize the possibilities for them. Our case study professor has done just that: with insight about each student's personal history, an expectation that in a specific place at a specific time they all have a measure of shared beliefs and values; in an environment he made "safe" for spontaneous discussion, he could guide students toward the moment. In his intuitive deployment of DEEP thinking (see DEEP ethology, below) in a phenomenologically inclined classroom, his understanding of

development and environment could guide students toward a teachable moment, much like "the pedagogical moment" of van Manen (1991), in which a teacher must act (or withhold acting) at a time that manifests both great sensitivity to the context and the life story and circumstances of the student (see Chapter 4).

Existential Phenomenology

Phenomenology emphasizes the perceptions of the individual and the description rather than the explanation of experience. This view, complemented by existentialism, informs the thinking of the authors of this volume, some of whom have implemented it in their qualitative research, some of which is summarized or reported here (see Chapter 1). It is helpful to distinguish this school of thought, with its emphasis on uniquely individual sources of authority and meaning, from its predecessors such as transcendental phenomenology, concerned principally with *essences*. This is an important distinction because the implicit points of view that inform transcendental philosophy still haunt teacher education and the classroom.

This is the problem Jean-Paul Sartren(1943/1956) sought to solve: the "*existence*" of his *existentialism* was ventured to contrast with the *essence* of his philosophical predecessors (the motto became, *l'existence précède l'essence*)—in other words, the real takes priority over the ideal, restoring authority (and responsibility) to the individual by emphasizing how things *are* rather than how they *should be*. This is most acutely manifest at times when, for example, a student experiences a transformative learning experience—for it is *the learner's* experience, not anyone else's.

Naturalizing Phenomenology

The distances between philosophy and science are significant and often contentious. For example, the claim in phenomenology that every experience is irreducible is difficult to reconcile with the scientific paradigm. Fortunately, there are significant efforts to *naturalize* phenomenology (Petitot, Varela, Pachoud, & Roy, 1999). Merleau-Ponty was stretching towards such an optimistic state in his emphasis on the "embodied mind" (Levin, 2016), a key topic we shall return to when discussing cognition. Naturalizing mental traits reflects efforts to increase confidence in an intuitive belief that there is a continuity between philosophy and science, and as such, it is an important step in avoiding the sterility of the ancient biases regarding dualism, epitomized for our era by Cartesian dualism. In Merleau-Ponty's (1945/1962) view, philosophy

> is not the reflection of a pre-existing truth, but, like art, the act of bringing truth into being. . . . We witness every minute the miracle of related experience, and yet nobody knows better than we do how this miracle is worked, for we *are ourselves* [emphasis added] this network of relationships.
>
> (p. xx)

Naturalizing the phenomenological perspectives makes them accessible to science at the same time as it infuses science with an appreciation for and implementation of the phenomenological attitude. Our view accepts that in teaching and learning, biological corollaries of consciousness (and in many cases its prerequisites) occur at all levels, from simply the evoking of attention to an internal or external stimulus to what it feels like to be one's self. This is a view encouraged by Merleau-Ponty's *Phenomenology of Perception* and the waves of subsequent works in philosophy and science (see Marconi, 2012), confirming and extending its insights (Carel & Meacham, 2013; cited in Petitot et al., 1999). The ways of thinking encouraged by these views involves an understanding of the forms of consciousness and cognition by means of which, and in which, all dimensions of the *lifeworld* are integrated (see Chapter 1).

Lifeworld

The idea of the *Lifeworld* (*Lebenswelt*) has been influential since introduced in the 1930s by Edmund Husserl, who conceptualized it as pre-reflective—that is, our focus is on *what* we are perceiving rather than *how* we are perceiving it (Brooks, 2015). As discussed in Chapter 1, the lifeworld is "the world of lived experience inhabited by us as conscious beings and incorporating the way in which phenomena (events, objects, emotions) appear to us in our conscious experience or everyday life" (Brooks 2015, p. 642). As such, "It is a social, historical, and

cultural world [that] includes individual, social, perceptual, and practical experiences" (from Alan Parsons's course notes on *Lebenswelt*, 2016). We can compare it to the *umwelt* proposed earlier by Jakob von Uexküll (1982) to describe the fact that each kind of organism lives in its own perceptual world and will interpret the same information in different ways (Eagleman 2011). For example, the sensory world is a combination of information from all senses, internal and external, and each has a unique trajectory through the nervous system, extracting different kinds of information from the aspect of the environment to which it is responsive. And it is the intertwining, integrative aspects that compose the lifeworld that leads us to consider existential phenomenology in relation to integrative biology.

Existential Phenomenology and Integrative Biology

Deploying all the study and scholarship resources of the several key biological disciplines that converge on behavior, we find an often neglected dynamic comes to the foreground: every aspect of an individual's cognitive processing is manifest as an outcome of the interactions that are part of the very definition of life. Arguably, these processes are not things that happen to people, they *are* people.

It is the unity of action which emerges from this multiplicity that encourages the holistic impulse. And a familiar theme in holistic thought is emergence, the idea that no whole can be defined by only its components (Humphreys, 2018). In this, phenomenology has an aesthetic quality, another aspect that is often neglected (Levin, 2016), but deeply appreciated by Merleau-Ponty (Crowther, 1982). Something unspecified (or unspecifiable) about the elements of which any distinctive entity is constituted enables the existence of that particular whole. We can take some philosophical heart, however, from Yoshimi's (2011) juxtaposition of two relevant comments:

> Every entity that is valid for me [is] . . . an index of its systematic multiplicities. Each one indicates an ideal general set of actual and possible experiential manners of givenness . . . every actual concrete experience brings out, from this total multiplicity, a harmonious flow.
>
> (Husserl, 1970, p. 166)

And

> human cognition involves . . . many hundreds, perhaps even thousands, of internal cognitive "spaces," each of which provides a proprietary canvas on which some aspect of human cognition is continually unfolding.
>
> (Churchland, 2002)

Yoshimi juxtaposes Husserl (the "transcendental idealist") and Churchland (the "reductive physicalist") to comfort us. Their thoughts enjoy a resonance that is also a tenet of aesthetics: "unity in multiplicity" (see Greenberg 2018b).

As mentioned earlier, the first task of the phenomenologist (and, as we will see, the ethologist) is to *describe*. Ethologists often begin by describing as much of their subject's repertoire as possible (creating an "ethogram") and then tend to emphasize a behavioral pattern of interest that might range from a muscle twitch to an entire constellation of closely related patterns (Greenberg 1978). The ultimate goal is further insight about the likely causes and consequences of what they are able to observe about the way individuals and groups (not least, teachers and students) acquire, organize, and act upon information. These phenomena are inevitable in the architecture of life—that is, the aggregate of traits that enable individuals to meet their biological needs in changing environments—both the environment within (physiological) and that outside the organism (environmental). This, in the spirit of true science, is a hypothesis, not an indubitable truth. Time has mitigated the rigidity attributed to science by researchers, who were persuaded by positivism and the seeking of a "true truth." Science has become progressively and more frequently viewed as a human endeavor (Greenberg 1986). Science, echoing the function of everyday thinking, must remain open to revision as new information is received and old information is reinterpreted or disqualified.

There is an empowering ambiguity [that] the egalitarian attitude Merleau-Ponty (1945/1962) espouses, not the least of which is creativity (see Chapter 1). Hence, phenomenologists describe, but in a different fashion. For they are looking for what stands out to the individual, in an unreflected manner, related to a particular phenomenon—in an effort to find the meaning held by the individual. Ethologists, on the other hand, assume (and this may be bias) that non-humans are necessarily unreflective and that meaning resides in the pursuit of evolutionary fitness. It is further assumed that in humans as well as non-humans, the deepest biases, those that

are constitutional parts of the brain's organization, have been selected by evolution because of their adaptive contribution to fitness. Certainly, meeting that essential need also motivates humans, when meaning, reflected upon, may contribute to the integration of an individual's self.

In other words, importantly and in great service to efforts to mitigate Cartesian dualism, all the discriminable components and processes of an organism have evolved over generations and developed over a lifetime as elements in each individual's environment:

> Parts and wholes evolve in consequence of their relationship, and the relationship itself evolves. These are the properties of things that we call dialectical: that one thing cannot exist without the other, that one acquires its properties from its relation to the other, that the properties of both evolve as a consequence of their interpenetration.
>
> (Levins & Lewontin, 1985, p. 3)

Gadamer's observation about the process of interpretation is significant for our view of interpretation within ethology and phenomenology:

> The anticipation of meaning in which the whole is envisaged becomes actual understanding when the parts that are determined by the whole themselves also determine this whole. . . . The movement of understanding is constantly from the whole to the part and back to the whole.
>
> (cited by Robinson & Robinson, 2013, p. 291)

In this sense, and in agreement with Merleau-Ponty's view, the "phenomenological method is a process of reconciliation rather than an instrument for restricted descriptive-analytic purposes. What needs reconciling are, at first approximation, the objective world and its subjective interpretation" (Natanson 1973, p. 28).

Both these ideas evoke concern about the tension between holism and reductionism, both enshrined in implicit bias as well as scholarly tradition. Gadamer (1960/2013) may have a satisfying solution, however: *the hermeneutic circle*, in which one treats a whole with reference to its parts, while simultaneously mindful that each part exists in the context of the whole. Gadamer envisioned the circle as a dynamic and progressive "conversation" with data that builds consensus and is more accessible to practical application. This process is at the heart of the research methodology utilized by most of our authors. But we briefly introduce now the field of ethology and its contributions to our understanding of individual behavior as it relates to the lifeworld of the classroom.

We believe that efforts to create such an empowering lifeworld in the classroom are facilitated by an understanding of ethology, an approach to the biology of behavior that integrates several key sibling disciplines within biology. These are developmental biology, ecology, evolutionary biology, and physiology, represented by the acronym DEEP. We will return to these after commenting on our understanding of embodiment and cognition/consciousness, key ideas in phenomenology that are also our best bridge from the philosophical views to biology.

Embodiment

Maurice Merleau-Ponty (1945/1962) states that "There is no inner man, man is in the world, and only in the world does he know himself" (p. xi). But knowledge, from the perspective of behavioral biology, involves cognition, and being in the world involves it in the context of that cognition. *Embodiment* refers to giving concrete form to an abstraction, to making an idea or feeling tangible. In phenomenology, as Merleau-Ponty (1945/1962) frames it, "a nexus of living meanings" (p. 151). Our engagement with the internal as well as the external world is fundamental to who we are as human-beings-in-the-world. Our feelings, imaginings, intuition, and many psychological and environmental influences are a part of us and, of course, influence teaching and learning.

Embodied cognition is the term adopted by scholars and researchers seeking to emphasize the extent to which cognitive processes in particular are intimately interwoven with the fabric of the body—a body that influences and is influenced by the environment into which it is born and hopefully prospers. This idea, derived from

existential phenomenology**,** informs and energizes our reports of the experiences discussed in this volume (see Chapter 1). It refers to the always present involvement of every cognitive function, and every level of consciousness, from intuition to epiphany, with the state and functions of the body. These are communicated by a large array of internal sensory receptors (interceptors and proprioceptors), as well as countless specific chemicals that have more or less access to the brain where they participated in organizing and initiating (or suppressing) specific actions, including learning (e.g., Laureys & Tononi, 2008; Merleau-Ponty 1945/1962) and the expression of what is learned, even by means of intuition, which involves access to cognitive resources of which an individual is unaware and typically precedes conscious reasoning (Haidt, 2012).

Whatever we know depends on our body that enables life and also builds on its constituent elements. Merleau-Ponty (1945/1962), from whom we have taken much direction, states that "The body is our general medium for having a world" (p. 146). The functions of body he includes in his conception of embodiment are those "necessary for the conservation of life," those that "elaborate upon primary actions" and those that "build itself an instrument, and it projects thereby around itself a cultural world" (p. 146).

We use the term embodied in the sense that cognition depends upon the "kinds of experience that come from having a body with various sensorimotor capacities, and second, that these individual sensorimotor capacities are themselves embedded in a more encompassing biological, psychological and cultural context" (Varela, Thompson, & Rosch, 1991/2016, p. 173). Further, as Brown (2017, p. 871, citing Greeno, 1998) observes, "if we are embodied selves then we are also always somewhere embedded in some situational context. Thus, the theory of embodied cognition can also entail what is known as situated cognition." This is a position that regards the social and cultural context both as formative and as a resource (Cobb, 2001). As in ethology, situated context is concerned with authenticity—real-life contexts, a point emphasized in teachers who find inspiration in this idea for their instructional design. Cognition is one of the most striking elements of embodiment, and we turn next to that.

Cognition and Consciousness

Cognition is sometimes thought of as everything that happens in the brain between input of sensory information and output of actions. But this neglects the extent to which these processes are affected by perception and action. A more useful view is that cognition refers to "the mechanisms by which animals acquire, process, store, and act on information from the environment. These include perception, learning, memory, and decision making" (Shettlesworth, 1998, p. 5). These are the processes that enable us to cope with vagaries and exigencies of the world from the most subtle to the most challenging. It is how we meet our needs as an organism. Perception is included as a participant in cognition because the processing of stimuli—its suppression or enhancement and the extraction of various kinds of information—begins at the instant of detection by a sensory receptor and also at every successive processing module along the path to awareness. Processing and the constructing, deconstructing, and reconstructing of connections is especially affected by past experience and contributes to future perceptions and their perceived meanings. The structures and processes of cognition, while almost impenetrably complex, manifest layers of organization of relative complexity, mostly by virtue of the more or less interconnected nature of its constituent elements. For example, cells, aggregates of functionally related cells, and interconnected systems of varying complexity, are each distinguishable components whose actions alone or in concert affect the state of mind.

Cognition is also wholly dependent on the processes of *perception*, in the foreground of phenomenological thinking. When a sense organ is stimulated, and information enters the nervous system, a percept is created. Before there is any conscious awareness, the information is analyzed, information extracted, and reconstructed within the brain. It is the active deconstruction and restructuring of percepts that allows us to regard perceptual experience as a cognitive process. In William James's (1911) view the supervenient phenomenon is a concept; as he put it,

> The intellectual life of man consists almost wholly in his substitution of a conceptual order for the perceptual order in which his experience originally comes. . . . Percepts and concepts interpenetrate and melt together, impregnate and fertilize each other. Neither, taken alone, knows reality in its

> completeness. . . . The world we practically live in is one in which it is impossible (except by theoretic retrospection) to disentangle the contributions of intellect from those of sense.
>
> (pp. 51–52)

Maintaining that "the *perceived* world is the always presupposed foundation of all rationality, all value and all existence" (p. 13), Merleau-Ponty (1964) sought to develop a descriptive philosophy of *perception*, our kinesthetic, prescientific, lived-bodily experience and cognition of the world—the unification. And as James (1911) reminds us,

> The deeper features of reality are found only in perceptual experience. Here alone do we acquaint ourselves with continuity, or the immersion of one thing in another, here alone with the self, with substance, with qualities, with activities in its various modes, with time, with cause, with change, with novelty, with tendency, and with freedom.
>
> (p. 97)

Perception, the critical bridge between the cognizing individual and their environment, includes other individuals in one's environment, indispensable to our ability to navigate and meet our needs in the world.

Amongst the many crucial processes that cognition entails, two of particular interest are memory and foresight. In one sense this is exactly what learning is about, but in our species, it goes much further. It is interesting that much of the neural basis of both memory and foresight—past and future—is shared in the brain (Schacter & Addis, 2007). Awareness of such a connection, played out in practice, could guide a teacher seeking student engagement with content. For example, both memory and creativity would be engaged when asking students where knowledge of some aspect of course content could lead in the future.

Consciousness is sometimes viewed as the inevitable consequences of our complexity or an unexpected irreducible *emergent* quality that could never have been predicted on the basis of a perfect knowledge of its subordinate processes. There is an abundance of reasonable paths within cognition which can compete as well as cooperate with each other to evoke an optimal response. Although at its best all processes function well together, there are nevertheless multiple functions, which, like all other traits described earlier, have each their own developmental and evolutionary histories. This is a principal contribution to our uniqueness.

The expressions of consciousness at different levels—from coma to the fullest measure of attention and thought—are tuned by intimate relations with the environment. Consciousness is often regarded as the most complex of human attributes, possibly emergent from cognition at its most complex. It is the embodiment of these processes that occupies many phenomenologists, and past and anticipated work of several highly productive research groups in cognitive neuroscience is gradually leading to a rapprochement between the fields. Traditional scientific methods integrating brain and behavior studies (neuroscience, cognitive science) have made remarkable progress but are at present stymied by a problem that would resonate with phenomenologists.

This is the "hard problem" of consciousness: how is subjective state derived from objective entities? How are feelings related to survival needs? Although a question that has deep roots in history, just the naming and framing of this problem by the distinguished philosopher of mind, David Chalmers (1995), has been the catalyst for an abundance of diverse studies. The richness of the methods developed and the analyses of consciousness in the last few generations of phenomenology would seem an invaluable resource for those approaching consciousness from a scientific viewpoint. Indeed, collaboration would, in Zahavi' s (2003) view, be highly beneficial to both. The study of these processes is plagued by an array of congenital and acquired biases, ranging from our competence to perceive and process selected aspects of our environment through those attributable to cultural traditions such as education and language. But, however they are viewed, their dependence on the environment throughout development and subsequent sensitivity to bodily functions energizes our confidence in embodiment. And it is helpful to consider embodiment and the teachable moment in relation to levels of organization.

Levels of Organization

Cultivating an appreciation for embodiment is highly desirable for the phenomenologically inclined teacher (Stolz, 2015). Placing a mental phenomenon within the brain, body, and environment also underscores the utility of thinking in terms of *levels of organization*, where the elements at given levels (for example, systems that serve

receptivity, attention, integration of information, and action) communicate with levels both above and below them in complexity. A few examples: access to information from the sensory world of the classroom or from memory, and acting on that information, may be at different levels of organization within an individual. Similarly, a raw stimulus and its meaning are at different levels of organization, achieved as its information is extracted and then integrated with other cognitive processes at more complex areas of the brain. And in a classroom, a student having an idea to express and actually articulating it, involves different levels of organization: First, she must retrieve and hold the thought in memory, but then when expressing that idea, she must move to a more complex level of controlling muscles involved in speaking while thinking. Also, an individual student's attention in the classroom could be affected by a subordinate level (say, the student is too cold or hungry) or a superordinate level (say, the classroom climate feels safe, or the teacher is particularly compelling).

The connections within and between these levels can easily be bewilderingly complex, but two general principles that appear to govern this complexity are deceptively simple. We accept easily that traits are the result of the actions of genes, activated or suppressed by their immediate environment. But most of these traits are affected by multiple genes—they are ***polygenic***. In concert with a complementary phenomenon: most genes have multiple functions—they are ***pleiotropic***. Taken together these attributes of traits and genes create an inseparable fabric of structures and functions that is deeply appealing: unimaginable complexity reduced to simple rules. As an analogy in the classroom, an idea or concept in mind may take its specific form from a multitude of variables, many unique to the student; the idea may then influence a multitude of other thoughts and ideas by a process recalling ecphory, the retrieval of a constellation of memories evoked by a new fragment of information. In some cases, this is highly creative if the memories recovered were not previously related but now present themselves to consciousness as a coherent whole.

We appreciate that there are layers above and beneath every specific phenomenological observation. Not least, how the environment and body collaborate with cognition and the cognitive processes that then interact with the body and through it, the environment. Of course, there are always more layers, and so the endpoint of our inquiries—where we choose to stop—involves a judgment about the usefulness of the layers of organization we emphasize versus the cost of looking further, either down to more fundamental, possibly enabling levels, or up to supervenient layers. The levels of organization we are mostly concerned with in the classroom emphasize perception and cognition at the center, and the immediate aspects of body just beneath (embodied cognition) and the immediate aspects of the environment just above—including intersubjectivity and sociocultural embeddedness (socially situated cognition)—all are incorporated in the lifeworld.

At the highest level of organization are the connections we can discover between knowledge and its place in our lifeworld—ability to meet our needs—that provides *meaning*: and, in Mark Johnson's (2007) incisive terms, "Meaning is more than words and deeper than concepts" (p. 1). The central thesis of Johnson's book is consistent with our operating assumptions about cognition. And they bring another dimension to this idea: not only is "what we call 'mind' and what we call 'body' not two things, but rather aspects of one organic process." Johnson (2007) goes on to emphasize that

> all our meaning, thought, and language emerge from the *aesthetic* [emphasis added] dimensions of this embodied activity. Chief among those aesthetic dimensions are qualities, images, patterns of sensorimotor processes, and emotions. . . . Coming to grips with your embodiment is one of the most profound philosophical tasks you will ever face. (p. 1)

And in pursuit of meaning we are presented with another optimality—cost versus benefit—problem, familiar to ecologists and economists (see below). But given the pleasures of participating in this book, the price is not so high. Eager for insights and pleased by surprise, we have observed (with Wilson & Foglia, 2017) that "Sometimes the nature of the dependence of cognition on the body is quite unexpected and suggests new ways of conceptualizing and exploring the mechanics of cognitive processing" (paragraph 2, online).

All connectedness at every level of biological organization exists by virtue of its communications within and between levels. Ultimately communication between organisms (as in the cultivation of intersubjectivity) occurs where the quality of communications is arguably more precise when organisms share aspects of their lifeworlds. And while never complete, we might expect that the quality of communications is precise to that extent. A phenomenological investigation that builds on first-person reports is only possible to the extent that we can

describe another person's subjective state while rigorously avoiding our acquired biases, a process emphasized in phenomenology as "*epoché*" or "bracketing" (Hut, 2001). Is this, as Churchill (2012) inquires, asking for empathy? Feeling what the subject feels about what they say? Or as one of our authors puts it, "walking in their shoes" (see Chapter 1). Learning is generally understood to represent adaptive change. That this change can occur at all levels of organization, each in their own way, is suggested by the observation that it is a property of all organisms, and even those without organized nervous systems (Tennenhouse, 2017).

To "walk in another's shoes" is the beginning of understanding of shared worlds (see Chapter 1 for a description of the experience of one of our authors who walked in the shoes of students and changed her teaching). In 1974, Nagel asked the question that still energizes consciousness studies:

"What is it like to be a bat?" He spoke of a host of related issues about how much we can share with the self-centered world of another organism. This is comparable to the lifeworld of Husserl, which we discuss below in relation to ecology.

Another dimension that helps coordinate levels of organization and ramifies through the disciplines integrated in ethology, as we shall see, is the meeting of biological needs, to which we now turn.

Biological Needs

A hierarchy reflecting relative priorities in meeting needs was designed originally by humanist psychologist Abraham Maslow (1943) as a theory of motivation. It effectively connects disciplines at different levels of organization. Needs must be met for organisms to survive and thrive in any given environment, and the body is finely attuned to (a) detect which biological needs at a given moment are not being met, and (b) their priorities for survival and self-actualization. At every point, mindfulness of a particular component of DEEP ethology must include at least an intuition of the biological need(s) of the individual. Needs are often understood as a linear hierarchy of biological urgency, but generally proceed also in parallel, sometimes competing: it is a familiar idea to sacrifice health or safety to more firmly secure self-actualization.

Meeting these needs—whether real or perceived—is the primary conscious or nonconscious aim of all individuals. It is important to note that real or perceived threats to being able to meet a need evoke more or less of a physiological stress response that is able to reconfigure one's conscious or nonconscious activities to better meet that need. The phenomenologically understood first-person experiences of students with unmet needs is a first step in enhancing the effectiveness of teaching (see Chapters 1 and 4 and studies we report in Chapter 8 that support this contention).

The most basic level is that of life itself. In Maslow's (1943) original hierarchy, this is best represented by the maintenance of a dynamic balance (homeostasis) of functions that enables health and welfare. The healthy individual next aims for safety, as in protection from elements or predators or competitors. But this is also manifest in a classroom where students feel personally safe to express themselves. We are a social species and require sociality for mutual safety and for reproduction. It is frequently argued that our remarkable progress as a species is attributable to our sociality (Henrich, 2017, citing Laland, 2017). For security within a social group and to identify and recruit a reproductive partner, esteem is sought, usually by excelling in a particular trait that might provide a recognizable reproductive advantage.

Finally, self-actualization is an expression of what the US Army called "being all you can be." Manifesting your most adaptive traits and transmitting as much as possible in genes or memes to future generations roughly approximates maximizing your biological fitness (see Greenberg, 2016).

With a sense of biological needs and their role in structuring behavior at every level, we can turn to integrative biology of behavior as expressed in ethology. In the spirit of "unity in diversity"—a kind of behavioral *e pluribus unum*—we undertake a focused survey of several principles in ethology that stand out to us by virtue of their heuristic potential in the phenomenologically informed classroom. Where ethological values are brought to bear in phenomenology, and phenomenological values contribute to ethology, the interdisciplinary synergy is manifest in ways that stand out by being applied to meeting fundamental human needs, and in this we could say they have meaning. So we turn now to DEEP ethology.

DEEP Ethology

The first explicit appeal for integrating biology in the service of more fully understanding behavior was that of one of the founders of ethology, Nico Tinbergen (1963), who identified four aims, each corresponding to a traditional discipline. Taken together, our contemporary restatement of Tinbergen's aims—development, ecology, evolutionary biology, and physiology—can characterize any behavioral pattern at any level of organization and in all contexts. As mentioned above, the coordinated consideration of these four disciplines applied to a question of behavior is called DEEP Ethology (Greenberg, 2018a). By history and ethos, ethology is the discipline that best organizes the abundance of variables embraced by the sibling disciplines and which also most fully appreciates the fact that the exclusion of inconvenient variables from a research model often leads to significant error (Greenberg, 1994). Movement toward embracing a phenomenological attitude has been suggested by Burghardt (1997).

Integrating the biological perspectives makes us mindful that *every definable behavioral event or pattern occurs at the intersection of development, ecology, evolution, and physiology*. A crossroads of time and space in which, for the purposes of study, phenomena, dynamic as they are, are necessarily seen as though static, frozen like a photograph. Like time and space, while intuitively obvious, these phenomena are at best inferred from patterns of perception of phenomena (Buzsáki & Llinás, 2017). In resonance with our intersection metaphor is Friesen, Henriksson, and Saevi's (2012)

suggestion for conceptualizing the critical shared experience aspect of phenomenological research. It is to "understand the life-world experience as extending or unfolding along four axes, dimensions or 'existentials'": lived space, lived time, lived body, lived relation (p. 43).

If we can visualize our biological traditions as four objective lenses on our microscope, each reveals something about the individual at a different level of organization and with differing degrees of resolution. At each magnification, fine focus can be sought by means of the process akin to the phenomenologist's collaborative hermeneutic circle.

After briefly characterizing the DEEP disciplines and identifying phenomenological constructs that resonate with them, we will also identify several themes at traverse levels of organization. These themes include the importance of pure description, the integration of "inner" and "outer" influences on behavior, and constraints on behavior.

Development

Development refers to both programs of change encoded in the genes inherited from the previous generation(s) as well as those attributable to individual experiences within one's lifespan. In recent years the field of genetics has given rise to *epigenetics,* providing dramatic new insights into how the environment can activate or suppress genetic activity, often in ways that can be transmitted across generations(Allis & Jenuwein, 2016). Thus, genes that unfold their program in a relatively fixed manner are complemented by changes that occur in a relatively environmentally sensitive manner. [Mayr's "open- and closed- genetic programs]

In other words, a core of evolutionarily ancient genetic programs guide the earliest stages of development. In response to their immediate intracellular environment, genes are activated (or suppressed) in the processes of tissue growth and organ formation. But also, the growing individual affects its environment establishing an intimate reciprocity that endures a lifetime. Throughout development both the organism and its environment are in constant change. They are partly fixed but also exquisitely sensitive to change attributable to the vagaries of the environment. Development is, of course, continuous from conception to demise with dramatic surges of responsiveness to the environment, particularly the social environment. We are thus socioculturally embedded—situated in the context of other people, from family to social media and involving countless linguistic and societal experiences to create a personal worldview (Bakewell, 2016; see Chapter 1).

With respect to learning, a once common view led many to believe that development is little influenced after early childhood, but Vygotsky and his followers demonstrated that mediated learning actually leads to further development. A large body of literature supports the idea that opportunities to learn how to learn in concert with high quality mediation are potent at any age (Feuerstein, 1985; Sternberg, 1997). While it may be difficult if not impossible for teachers to become knowledgeable about each student's development, higher education students reported transformational learning occurred when they were engaged in personal reflection (Franklin et al., 2014; Taylor et al., 2012). In other words, students, once they appreciate the role of private experiences in the learning process, can supply that variable on their own (see Owen-Smith, 2018; see Chapter 7). Further, research

demonstrates the feasibility of providing students with a repertoire of metastrategic knowledge from which they can develop and adapt personal learning strategies to overcome challenges in learning (Greenberg, 2014).

Habit is built into all organisms and certainly into perception. After the experiences of discriminating and categorizing our perceptions we can conserve or reallocate our energy and operate intuitively. All conditions of growth and change, such as the classroom, require us, however, to attend to new stimuli. An environment in which growth is sought—in line with basic ideas of optimality—trusts that the current cost is worth the future benefit.

Another important dimension of growth is creativity, enabled by ways of thinking that can be lost over time, but in an appropriately safe classroom, students are emboldened to shake off the previously mentioned "lethargy of custom." Considering even familiar ideas in new contexts, the opportunity for a teachable moment is more likely. Here, the uniqueness of the individual can manifest itself in creative insights and expression. As mentioned earlier, very small variations can have very large consequences in the complex cognitive working of problem solving. As Thoreau (1855) put it, under such circumstances, "It is only necessary to behold the least fact or phenomenon, however familiar, from a point a hair's breadth aside from our habitual path or routine, to be overcome, enchanted by its beauty and significance. . . . To perceive freshly, with fresh senses, is to be inspired" (p. 44).

Ecology

At every level of organization, every distinguishable element of life—from the multiplicity of organelles within a cell through the outermost boundaries of an organism—is embraced—embedded—in protean concentric spheres of the matrix of the world. The emphasis on any particular level of organization or the phenomena within it becomes interesting only when direct effects on us—such as health—are discovered. For example, in recent decades, ecology at its most vast has been found relevant to our thinking about ourselves (exobiology; NASA, 2018) as much as at its most minute (microbes). The familiar dimensions of our ecology with which we occupy ourselves is that which is most obviously relevant to our meeting of biological needs.

The environment includes the temporal and spatial physical and biotic contexts in which organisms must survive and thrive. It is also the source of all perceptions that organisms use to create their reality. In that regard, research indicates that the social environment is a particularly powerful variable, influencing our perception of interpersonal safety. This can be seen in the classroom as trust amongst students and with the teacher (Holley & Steiner, 2005). While it appears that most teachers in higher education pay attention to these factors, this is not always the case. We were amazed at the lack of safety and trust reported by African American students at a predominantly white university (Davis et al., 2004). In this study, for example, the student participants often felt hyper-visible or invisible—both of which stood out to them and reduced the availability of teachable moments. (see Chapter 8)

The lifeworld is the phenomenologically relevant dimension of ecology. The collaboration of multiple senses is highly adaptive, but also, it "can create unique experiences that emerge when signals from different sensory channels are bound together" (Stein, Stanford, & Rowland, 2014). Thus, the vast possibilities of the elements of our environment that we are able to perceive contributes in unpredictable ways to our lifeworld. The implication is that even at a basic level of processing this sensory synergy can fuel individual uniqueness. A shared lifeworld fosters intersubjectivity, and it is this uniqueness, once appreciated, that can enable particularly effective learning communities (see especially Chapter 6).

For the ecologically informed, phenomenologically inclined teacher, with respect to conspecifics, the intersubjectivity aspect stands out. The crucial nature of sociality to being "fully human" has been recognized since Aristotle, and other individuals in one's environment have long been recognized by phenomenologists as a critical element in fostering insight and cognition (Pollio, Henley, & Thompson, 1997; see Chapter 6).

One of the essential tensions of human development involves the continuing processes of individuation and socialization—whereby individuals learn the appropriate norms, values, behaviors, and interpersonal communicative skills. To the extent this tension is resolved, individuals can retain a sense of their own uniqueness while intersubjectivity is achieved. But in fact, it can never be fully resolved; there remains what is arguably a productive residue of ambiguity. Mutual understanding enables, more or less, unity of actions and can help the mutually involved individuals meet their individual biological needs. The pressure for sociality,

presumably to pool our cognitive resources, is manifest in the extraordinary growth of areas of the brain and their connections that form the "social brain," which is uniquely enlarged compared to other social species (summarized by Adolphs, 2009).

But as in every other domain of intersubjective interaction, the meaning of shared understanding depends on the interaction of both internal, implicit variables and those that are external and relatively explicit, in all parties to the interaction—teacher as well as taught. In other words, to echo a familiar mantra of behavioral science, what we study and the meaning of what we learn is the outcome of the interaction of internal and external processes. Together, these processes engender "the best story we can tell given our beliefs." But beliefs can change, and that is a key theme in our book.

Language is important but does not stand alone in interpersonal communications. While it involves the most advanced cognitive processing, other less clear modes of communication that are typically prereflective can be crucial: body language, touch, eyes meeting (his mouth says "yes" but his eyes say "no"). So lifeworlds are shared to a point, but there are important gaps creating another aspect of phenomenological thought: ambiguity (see Chapter 1).

What is shared and what is not or cannot be shared, "intersubjectivity and ambiguity," resonates with individuation and socialization. These processes are related to idiography and nomothetics in an older tradition. Because we appear to share more with each other than with other species, the importance of these differences between us is often lost. On the continuum from idiographic (individual, specific) to nomothetic (shared, general) traits, often seen in tension with each other, the particulars and uniqueness of individuals grades into the generalities and universally shared qualities of our species (Silverstein, 1988). Because these are often related to the antagonism of scientific worldview and that of the humanities, they are worth referencing because study of this tension can flush out implicit bias (Robinson, 2012).

Evolution

Evolutionary biology is concerned with the change in traits and organisms and societies across generations, from ancestors to the present moment, and forward to our direct and indirect descendants. Traits are understood to have their present form because of their preservation through the processes of natural selection of variations that are found adaptive—that is, able to compensate for environmental forces (often called "selection pressure") that impair their ability to meet needs. *Adaptations* are at the center of concern. There are several definitions of the term and all are unified by the idea of compensation for change, either short-term (such as a stimulus or life experience) or long-term adaptations (such as climate change).

Only recently has the expression of emotion, possibly the most ancient of these variables, been implicated in the circumstances of a teachable moment (van de Goor, Sools, Westerhof, & Bohlmeijer, 2017). There is a possible connection in that amongst the adaptive traits that have evolved in humans is a sometimes insatiable pursuit of information. Interestingly, when threads of information converge in specific areas of the brain they act to evoke a distinctively pleasurable response (Biederman & Vessel, 2006). It is likely that this response contributes to their coherence in narratives that enable them to be explored mindfully. This points to adaptive behavioral traits that engage and integrate the perceptual skills of experience and the conceptual skills of argument to establish the most coherent narrative possible with the facts at hand. The world we experience is one in which it is impossible (except by theoretic retrospection) to disentangle the contributions of intellect from those of sense, as described by William James (1911). Thus, in order to enable profound learning experiences, the teacher needs to allow space for shared descriptions of relevant information prior to any explanation of course content (Greenberg, Greenberg, Patterson, & Pollio, 2015). These can be guided by a sense of constraints—that is, the constitutional limits of competence for any definable trait, to be discussed below.

Physiology

Physiology, the fourth domain of DEEP, also provides insight into the teachable moment. Certainly, physiology provides the means by which acquisition of content and insight at a particular moment in time is framed and formed in conjunction with everything else the organism experiences (or may have experienced in the past). The processes within and between organ systems, including the many functionally specialized components of the

brain, are dynamic and in continual pursuit of balance (*homeostasis*) which, because of constant change, can never really be attained. These processes are especially tightly integrated with memory as well as anticipated outcomes of actions. Most of our actions are directly or indirectly necessary to enable these processes necessary to life to have the resources essential to meet their needs—from nutrients to energy. Many actions are, however, by constitution or custom, collateral and incidental to the main function. These actions, and the structures they utilize, contribute to confusion when we try to impute causal relationships. But they are also available for natural selection to utilize them in serving other, often unexpected functions if they contribute to fitness. This is complicated as well by the fact that these structures and functions evolved in environments very unlike anything we might feel familiar with today. As a result, there is often a mismatch between past utility and contemporary function.

Stress, as commented earlier, is evoked by a real or perceived challenge to our ability to meet our real or perceived needs. The physiology of stress and its capacity to balance or reconfigure the cognitive processes associated with motivation can be discussed in conjunction with a biological interpretation of Maslovian needs.

The awareness of a mismatch between circumstances and the prospect of meeting needs creates a dissonance that echoes what occurs at deeper levels of organization: in systems of neurons, detection of mismatches—errors—is absolutely essential to behavior. Most adjustments of posture, micromovements of muscle, and homeostasis are compensated with little or no conscious awareness. But there are important nonconscious signals detected by neurophysiologists,. For example, "error detection" is a compelling and growing field within behavioral neuroscience (Bach & Dolan, 2012). At another level of organization, error detection is important for teachers as they make intuitive decisions about what to say and do in a given moment in the classroom (see Chapter 9).

Although originally a generalized response to protect the body, stress, as mentioned above, can selectively energize motivational systems to meet needs. This is connected to Festinger's (1957) idea of *cognitive dissonance*—a tension evoked by a mismatch, however slight, between an internal working model of the world and the world as it is perceived, resulting in competing cognitive processes (Boring, 1964). The resulting motivation to restore consonance can range from unreflected through intense and preoccupying and is driven at least in part by the effects of stress on cognitive processes.

While stress energizes motivational systems associated with specific needs, for the most part, the vast detail of life is met by automatic, intuitive, unreflected responses of the body to changes in its environment. For example, when cold, our muscle tension might increase, the circulation of blood might be adjusted, or we might adjust our postures—all very effective and *not very expensive*. When these responses are insufficient, the failure to cope comfortably may emerge in consciousness, and the highest cognitive resources may be put into the service of solving the problem. Employing these resources may involve significant expense in time and energy and interfere with ongoing activities. A student in a classroom growing chill might even, after some thought, ask the instructor to adjust the thermostat. We are largely on "automatic pilot" until something out of the ordinary gets our attention. Something must, in Coleridge's (1817) now familiar poetic phrase, "awaken the mind's attention from the lethargy of custom."

For our purposes, the effect of stress on cognition is the most salient. Cognition is a complex protean concept as it has developed in scholarship over the generations, but its irreducible core has traditionally consisted of the processes of the nervous system involved in acquiring information from the environment (by means of senses and perception), storing it (several forms of memory), and acting as influenced by this information. Coping with change includes an extraordinary ability for error detection, mentioned earlier. This trait enables a crucial self-correcting mechanism for action that occurs in slightly different form at every level of organization.

The processes of cognition act in exquisite balance to address our real or perceived biological needs. That balance is highly sensitive to stress and can be reconfigured to help one cope. The expression of this response is evoked in modest or dramatic degree—by experiences ranging from an unexpected threat to life through a raised eyebrow, flushed cheek, or awareness that someone is staring at you. Any of these can reconfigure cognitive processes almost instantly (McEwen & Sapolsky, 1995; Greenberg, Carr, & Summers, 2002). Extreme or sustained stress can diminish the quality of life and be life-threatening. But in relation to our focus in this book, all aspects of DEEP ethology emphasize its relations to the existential phenomenological perspective on teaching and learning.

All Moments Are Teachable and All Experiences Are Transformative

We are perpetually challenged to look both above and below whatever level of organization occupies us—the ancient impulse to understand all causes and consequences, the congenital need to find connections, the search for simplicity we intuit lies beneath the complexity we experience. And we look for boundaries, the extremes of the everyday continua we experience. The transformative learning experience is such an extreme, but not really out of reach. And we look for uniqueness that we find in the teachable moment. But to study these we must be mindful of the integrative impulse.

Internal and External Integration

An implicit understanding of the unity of the organism and its environment is manifest in the ethologist's aversion to the study of organisms separated from the environments in which they naturally occur (Greenberg, 1994). Phenomenologists and other qualitative researchers often speak of the lack of focus in pedagogical studies on the lived experience of teacher and learner (see Chapter 1). When we explore how teachers can best create teachable moments and facilitate transformative learning, it makes no sense to look solely at teacher or student behaviors without also exploring their lived experience—the meaning they find in context.

Further, paths and processes are adaptive traits as much as morphology or behavioral patterns and, importantly, each path has its own evolutionary and developmental history. In ethology, an alternative path to an apparently identical behavior pattern may very well have followed a different evolutionary or developmental trajectory and have different relationships with all the systems with which it needs to be balanced in order to function. And this is no less true for teachers and students in the classroom than it is for mice or monkeys. In this spirit, perhaps, Merleau-Ponty, (1945/1962) famously stated that although always tethered to perception "there are several ways for consciousness to be conscious" (p. 124).

In pursuit of transformative learning, we should appreciate that these two processes of individuation and socialization, mentioned earlier, are often competitive with each other. At such times we may be acutely aware of our limits, the boundaries of our abilities, and the constraints on our behavior.

The biological boundaries of an organism—anatomical, physiological, cognitive—are commonly detected only when they are confronted or compromised, as they may be in the classroom. And in this, expectations are important. Our perceptions of the boundaries of specific traits are typically set by extraordinary individuals under extraordinary circumstances and are constantly being extended such that the most extreme capacity manifested by any one individual, no matter how extraordinary, represents the possibilities of all individuals, no matter how ordinary. An inventory of many specific constraints on behavior, such as those on stimuli and responses or the reinforcing effects of stimuli, have been tentatively identified by Hinde (1973).

Arguably, our lives are devoted to transcending our constraints. They are also a fact of life that haunts us. Even the most hardened logical positivist or existential phenomenologist might pause to ask with Dorothy as she entered the land of Oz, or with Israel "IZ" Kamakawiwo'ole (2010) as he sang, "Birds fly over the rainbow/Why then, oh why can't I?" This, of course, is sentimental, romantic, and an arrow to the heart of what it means to be human. Such questions, when aesthetically framed, highlight the profound influence, if not priority, of prereflective thought on more conscious cognition.

In summary, we hope you will consider the case we make in this chapter: that biology, particularly the integrative biology of ethology, is a valuable complement to phenomenology that can be brought to bear in understanding teaching and learning in the classroom. We characterized our general philosophy as existential phenomenology because in the shared emphasis on the world as we live it, and in the importance of rigorous description of our experience and reflections on its meaning, we find a deep resonance with our personal experiences in the classroom.

The teachable moment and its goal of transformative learning represent the crucial insight that behavior is the result of internal as well as external structures and processes. In traditional teaching we are too often and too easily satisfied by metrics of successful teaching. At such times, we may neglect the higher calling of our profession: to engender *meaning*. In this way, course content that is realized beyond mere knowing is owned by the student in ways that enable its creative applicability in other contexts. The difficulty is in the fact that meaning

for us and for each individual student are never exactly the same. But as teachers we can launch students into the world where they can grab hold of the abstract knowledge we want them to realize by finding, in their own depths, the ties that bind content to life and foster a life of creative connections. Enabling students to do this is our self-actualization; this is our greatest legacy.

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[i] **Greenberg, K., B. Sohn, Neil Greenberg, Howard Pollio, Sandra Thomas, John Smith** (2018/e-book 2019) *The Phenomenological Heart of Teaching and Learning: Theory, Research, and Practice in Higher Education*. New York: Routledge. 222 pages DOI https://doi.org/10.4324/9781351245906 eBook ISBN 9781351245906 Chapter 2 "Getting DEEP"