Defining Behavior and Its Relationship to the Science of Psychology

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Abstract

Even though the concept of behavior is central to modern psychology, there is no consensus regarding what the term behavior means. The current paper focuses on disentangling two separate conceptions of the term that have added to the confusion. One meaning of the term behavior pertains to natural scientific epistemology, specifically the requirements of empirical methodology and its reliance on data that are measurable and available to public observation. The second meaning pertains to ontology and relates to the fact that at a descriptive level there are different kinds of behavioral patterns in the universe. Put simply, inanimate material objects behave differently from living organisms, which behave differently from animals, which behave differently from people. This paper introduces a "Periodic Table of Behavior" derived from Henriques' (2003; 2011) Tree of Knowledge System to map the different kinds of behaviors that are described and examined by different sciences. It concludes by using the formulation to clarify the relationship between the methodological and ontological description of behavior and argues how the basic science of psychology can be effectively defined as the science of mental behavior going forward.

Key words: Behavior, mind, ontology, definition of psychology, Tree of Knowledge System

Defining Behavior and Its Relationship to the Science of Psychology

Virtually all introductory textbooks define psychology either as the science of behavior and mental processes (e.g., Myers & DeWall, 2016) or simply as the science of behavior (e.g., Ettinger 2018). However, despite its centrality and periodic calls to renew the field's focus on behavior (Baumeister, Vohs, & Funder, 2007), there is little consensus regarding what the term means. To begin to appreciate some of the key problems and issues, consider the following: Do atoms or planets behave? Is there a fundamental difference between the behaviors of living and nonliving entities? Sometimes animals move in ways that do not seem well-described as behaviors, such as a cat falling out of a tree. Yet, conversely, we might be inclined to call events that involve the lack of movement a behavior, such as when a mouse freezes as it senses a cat. Are both (or neither) falling and freezing examples of behavior? Can or should we differentiate physical behavior relative to mental behavior? Are perceptions, feelings, and internal decisions behaviors? What about talking or inner dialogue?

In his call for a "descriptive psychology", Peter Ossorio (2006) emphasized the need for clarity in defining psychology's core concepts. Descriptive psychology gets its name because its primary focus is on developing pre-empirical analyses that set the stage for scientific investigations. Not surprisingly, the concept of behavior featured prominently in Ossorio's analyses (see Berger, 2011). As he dove into the meaning of the term, he tackled the ontological problem and made it clear that it is necessary to differentiate the behavior of persons from the behaviors of objects, organisms, or animals. In *The Behavior of Persons* (2006), he identifies the problem as such:

> Currently the terms "behavior" and "action" are used so variously and ambiguously that anything that moves or changes in any way can be said to behave or to act in one fashion or another. Particles, chemicals, material objects,

organisms, and persons all "act" or "behave," and it is not the same thing in each case.

In a series of articles on the concept of behavior, Uher (2013; 2016) analyzed the difficulties through a sophisticated metatheoretical perspective called the Transdisciplinary Philosophy-of-Science Paradigm for Research on Individuals (TPS-Paradigm). Uher made several key claims, including the fact that science is a human endeavor that inevitably has various anthropomorphic biases that need to be considered. Starting with human analyses of phenomena, she then turned her attention to behavior and proceeded to differentiate it from psychic and physiological phenomena. Uher (2016, p.490) defined behavior as "external changes or activities of living organisms that are functionally mediated by other external phenomena in the present moment".

Empirical research confirms that there is significant confusion about the meaning of the term behavior in the scientific literature. The behavioral biologists Levitis, Lidicker, and Freund (2009) explored how various textbooks have defined behavior, and they asked experts to characterize different kinds of events regarding the extent to which they were examples of behavior. The list they generated was as follows: (a) a person decides not to go to the movies if it is raining; (b) a beetle is swept away by the current in a river; (c) a spider spins a web; (d) a plant bends toward the sun; (e) geese fly in a V formation; (f) a person's heartbeat speeds up following a nightmare; (g) algae swim toward food; and (h) a rabbit's fur grows over the summer season. They found little agreement in either the textbook definitions of behavior or about which items on the list constituted clear examples of behavior.

Levitis et al. (2009) concluded that much work was needed to clarify the meaning of behavior, and they ended their article with the following definition, which overlaps some with Uher's (2016) conception: "The internally coordinated responses of whole living organisms (individuals or groups) to internal or external stimuli, excluding responses more easily understood as developmental changes." An important difference between the two definitions is that Uher's emphasizes the exterior domain between the organism and environment, whereas Levitis et al. include processes inside the organism. As we will see, this is a major point of contention. Another pertains to the kinds of entities that behave. According to Levitis et al., bacterial cells behave. This is a claim with which we readily agree, but a problem emerges if the focus moves to psychology. Indeed, the very notion of *behavioral biology* (the professional identity of Levitis and colleagues) raises an inconsistency for those who argue that psychology is *the* science of behavior. The behavior of bacteria does not fall under the purview of even the broadest conception of the subject matter of psychology. This suggests that psychologists who define psychology as *the* science of behavior are perhaps too narrow in their conception of the term. However, if we zoom out further, another problem becomes apparent. This time it is not psychologists who are too restrictive, but the behavioral biologists. Physicists, chemists, and geologists consider observable patterns and movements to be behaviors. Although the behaviors of particles, atoms, planets, and galaxies are not what a behavioral biologist means by behavior, it does *not* follow that these are *not* behaviors, any more than it follows that because psychologists are not interested in cells, then cells do not behave. This exclusionary claim is an unfortunate consequence of the Levitis et al. definition.

This paper employs Henriques' (2003) Tree of Knowledge System and unified theory of psychology (Henriques, 2008; 2011; 2017) to sort out the issues and offer a new perspective on the concept. The Tree of Knowledge (ToK) System (Figure 1) advocates for a "universal behaviorism" that characterizes the universe as an unfolding wave of behavior (for similar views, see Smolin; Whitehead). This unfolding wave is depicted as four different, hierarchically arranged dimensions of behavioral complexity—Matter, Life, Mind, and Culture—that correspond to the behavioral patterns of four different kinds of entities: 1) material objects (e.g., hydrogen atoms); 2) organisms (e.g., bacterial cells); 3) animals (e.g., dogs); and 4) people. These objects and the fields and relations in which they are embedded in across time are considered by the ToK System to be "ontic realities". These ontic realities are in turn are mapped by scientific ontology (i.e., theories or models about reality) developed and tested via scientific epistemology (i.e., rules and methods of justifying scientific knowledge). The ToK posits that science should be divided into four broad classes of investigation that correspond to the behavioral patterns of the four different kinds of object-field relations. These classes of science are the: 1) physical; 2) biological; 3) psychological; and 4) social/human science domains. Framed as such and consistent with current scientific language games, we claim that objects, organisms, animals, and people *all* behave. The key task of science consists of describing, explaining, and predicting the different kinds of patterns of behavior at the appropriate levels of analysis and dimensions of behavioral complexity.

(Insert Figure 1 about here)

This paper uses the novel vantage point afforded by the ToK System to disentangle two key meanings of the term behavior that have not been previously delineated. One meaning connects to the epistemological requirement that (natural) scientific knowledge be anchored to publicly observable data. We refer to this as the "methodological" meaning of the term to emphasize the point that it is framed by the methods of scientific investigation to measure change. Broadly speaking, science is system of understanding that adopts an objective, third person, exterior perspective on the world (see, e.g., Wilber, 1995), and works via developing models that describe and explain the changes in the world, which are then tested based on observation and measurement of data (Nagel 1961). Given this traditional framing of scientific inquiry, observing and analyzing "behavioral data" from a third person point of view becomes a basic ingredient for the scientific method and epistemology.

The second meaning of behavior is the "ontological" meaning. This refers to the idea that behaviors are real ontic phenomena and that there are different *kinds* of behavior in nature, which are mapped by our current scientific theories in different disciplines. We use the ToK System to be clear about this claim, as it posits that atoms, cells, animals, and people all exhibit radically different kinds of behavioral patterns (see also Cahoone, 2013), and corresponds those behaviors to the ontological descriptions and explanations found in the various scientific disciplines. The current paper puts the methodological and ontological meanings together and uses the ToK System to generate a "Periodic Table of Behavior" (PTB). The PTB provides a descriptive taxonomy of the different kinds of behaviors in the universe that line up with different branches of science. This allows for a more precise and detailed alignment between the methodological and ontological meanings of behavior in science in general, which in turn sets the stage for more clearly defining behavior in relation to the science of psychology (e.g., Henriques, 2011).

As scholars of the field know, there is a profound "problem of psychology" (Henriques, 2008) in that there is no shared definition nor subject matter, nor agreed upon set of values or epistemological frameworks that unite the discipline. Consider that the term psychology variously refers to behavior, mind, experiential consciousness, human self-consciousness, the human soul, and human behavior at the individual level of analysis. In *Psychology Defined*, Henriques (2004) employed the ToK System to point out that the field has historically and confusingly spanned two different planes of behavioral complexity, the Animal-Mind and Person-Culture dimensions. The ToK makes clear that if the field is to ever achieve conceptual clarity, psychologists must differentiate “basic psychology” from “human psychology”. The reason is that the Animal-Mental plane (the domain of basic psychology) is qualitatively different from the Culture-Person plane of complex adaptive behavior. This difference is apparent when we consider human development. When humans are born, they operate on the Animal-Mental plane of behavior, such that they see, feel, relate, and experience images and dreams and so on. However, they do not have language or self-reflective consciousness, nor can they justify their actions on the social stage. Such behavioral capacities emerge via development and socialization, such that humans *become* persons (Ossorio, 2006). As such, human psychology deals with the interface from the mental into the cultural planes of existence (Henriques, 2004).

By differentiating the Animal-Mental from the Person-Cultural planes, another crucial point is made, which is that the concept of behavior and its territory are different for these two dimensions of existence. Even the concept of science, the philosophy that informs it, and the appropriate epistemological frame is much discussed and debated when the move is made from the animal into the human, such that many scholars have argued that we need to differentiate natural science from the human sciences (see, e.g., Lamiell, 2017). This is a complicated issue worthy of much detailed analysis and careful critical reflection. The current work is grounded in a general conception of science in a traditional naturalistic framework; however, as will become clear, there are excellent reasons for why human science should be characterized and approached in a fundamentally different way than nonhuman science (see Henriques, 2011 for a discussion of some of the complications).

Our primary emphasis here is on developing conceptual clarity regarding the meaning of behavior in general and then placing that broad meaning in the context of a basic, comparative animal psychology, grounded in a natural science epistemology. As such, we will only briefly address the problem of defining and mapping human behavior, human phenomenology, and human science and how they relate to human values. The different dimensions of existence highlighted by the ToK System strongly suggests that it behooves scholars to separate out these issues. We contend that the ToK System and its extension into the Periodic Table of Behavior can advance a resolution in the form of a "mental behaviorism" (see Henriques, 2011). Such a resolution sets the stage for scholars to be in a better position to subsequently address the complicated epistemological, conceptual, and moral issues that emerge when the focus moves into the Person-Culture plane and the nature of the human sciences.

The Various Meanings of the Behavior and Mental Processes in Psychology

The term behavior emerged in scientific circles largely from the work of John Watson in the early 1900s. Watson (1913) advanced a vision for a behavioral psychology that eschewed all mentalistic concepts. Watson argued if psychology was to be a natural and experimental science it was necessary to change the focus of the discipline's subject matter from consciousness (which he argued could not be publicly observed or measured) to behavior (which could be). Although Watson's version of behaviorism is no longer considered valid, its influence was enormous, especially in the United States. Moore (2012) has argued that it ultimately gave rise to the two dominant approaches to scientific psychology in the U.S. today: Skinner's radical behaviorism (which generally defines psychology as the science of behavior), and methodological behaviorism anchored to a cognitive functionalism (which is the mainstream textbook view, especially prevalent in the United States, that defines psychology as the science of behavior and mental processes).

Skinner's radical behaviorism is best characterized as a philosophy that is defined against any form of mentalistic theorizing or conceptualizing any internal mediational processes as causing overt action. Given the current focus on defining behavior, it is worth noting that although Skinner shared with Watson a rejection of mentalism, his conception of what constitutes "behavior" was quite different from Watson's view. For example, unlike Watson, Skinner considered private, subjective experiences (such as a toothache) to be examples of behaviors. He referred to them as "covert" behaviors, which is something that would have been an oxymoron in Watson's system. This point whether internal processes are or are not behaviors highlights how nebulous the term can be. Although currently a minority perspective, there remains a vocal group of radical behaviorists who urge the field to follow Skinner's lead and reject any form of mentalism. Ed Wasserman (2018) recently reiterated the basic position:

> Will psychology ever "lose its mind"? From its inception, psychology has concerned itself with private experience, particularly with the ever-alluring yet obscure notion of consciousness. But natural science must study observables, whether they are the overt behaviors of organisms or the biological activities within organisms. We must at long last "lose our mind" and embrace the same basic paradigm that has proven so effective in physics, chemistry and biology. Only then can we escape from the obscurantism of mentalism and develop a truly scientific psychology. The tools of behavior analysis and neuroscience have matured to the point where this aim is attainable. Let's get going!

In contrast to radical behaviorism, mainstream psychology is mentalistic, in the broad sense that it largely adopts a cognitive functionalist view of the mind (Stam, 2015). That is, most mainstream academic psychologists view the nervous system as a kind of information processing system, whereby inputs are functionally related to outputs. Although the details vary greatly across the field's many paradigms, these processes are usually considered both mental and mediational and are framed as playing a causal role in producing overt behaviors. The cognitive functionalist paradigm is then combined with a scientific approach to data gathering, which requires data to be observable or measurable from an objective, third person point of view. George Mandler put the issue this way (cited in Moore, 2012, p. 146):

> [N]o cognitive psychologist worth his salt today thinks of subjective experience as a datum. It's a construct. . . .Your private experience is a theoretical construct to me. I have no direct access to your private experience. I do have direct access to your behavior. In that sense, I'm a behaviorist. In that sense, everybody is a behaviorist today. (Mandler in Baars, 1986, p. 256)

More recently, the consciousness researcher Stanislas Dehaene (2014) makes a similar point. In the following, he describes how he uses introspection as "behavioral data" to achieve the scientific understanding:

> In that sense, the behaviorists were right: as a method [for a pure, truth revealing procedure], introspection provides a shaky ground for a science of psychology, because no amount of introspection will tell us how the mind works. However, as a measure, introspection still constitutes … the only, platform on which to build a science of consciousness, because it supplies a crucial half of the equation—namely, how subjects feel about some experience (however wrong they are about the ground truth). To attain a scientific understanding of consciousness, we cognitive neuroscientists "just" have to determine the other half of the equation: Which objective neurobiological events systematically underlie a person's subjective experience?

In each of the prior quotes, one can note how scientific methodological considerations play a key role in framing the issues. Science is based on data collection and behavior is the frame that operationalizes that process. The difference between Wasserman and Mandler and Dehaene is that Wasserman rejects the concepts of cognition (broadly defined to include perception and emotion) and consciousness as playing a causal role in explaining behavior, whereas Mandler and Dehaene argue they are valid and necessary.

Ken Wilber's analysis of the epistemological quadrants as part of his Integral Theory can be helpful in the meaning of clarifying this point. Wilber (1995) offers a four-quadrant model of epistemology, framed by two axes. The first axis is the interior-exterior axis, which refers to whether one is considering knowledge from a first-person perspective (i.e., subjective or interior) or whether one is considering knowledge from a third person, objective perspective (i.e., objective or exterior). The second axis is whether one is situated at the level of the individual or at the level of the social or collective. The combination of the two axes gives rise to the four quadrants: interior-individual; exterior-individual; interior-collective; and exterior-collective. Focusing here on the interior-exterior dimension, the exterior is the position of that is external and behavioral. Consistent with the position taken here, Wilber (1995) argues this is the traditional natural science position. The interior subjective view is contained and cannot be publicly analyzed directly. However, introspective reports and other overt responses are data that can be analyzed from the objective, exterior view of the scientist.

Moore (2012) argued that, although they are rarely stated explicitly, the tenets of methodological behaviorism have permeated the mainstream approach in psychology. He characterized the situation as follows (p. 146):

> [Methodological behaviorism] underlies courses in research methods, experimental design, and statistics in most psychology departments at colleges and universities. It underlies such standardized tests in the discipline as the Graduate Record Examination. Research and psychological explanations that are not consistent with these features are given less weight, if any weight at all, in the scientific community, for example, as reflected in the editorial practices of journals and research support from granting agencies.

Despite its centrality, there are significant conceptual problems that emerge from adopting a methodological approach to defining the field. The reason becomes clear when we consider the ontological meaning of behavior; psychologists must also contend with defining the kinds of behaviors that they are interested in describing and explaining, especially because the field spans the Animal-Mental and Culture-Person planes of behavioral complexity.

Conceptual Problems Defining Behavior and Mental Processes

Our argument is that the ToK System allows for a new “zoomed out” view that can help sort out the methodological and ontological issues that have resulted in so much confusion. We can begin by considering how defining psychology as *the* science of behavior results in a logical contradiction (Henriques, 2003). Specifically, when the term behavior is used in the methodological scientific sense, it *connects* what psychologists study to what other scientists study, as “we are a real natural science because we study and measure behavior, as other sciences do.” Yet when the shift is made the ontological meaning adopted by radical behaviorists (i.e., psychology is *the* science of behavior because animals or humans behave and atoms do not), then behavior is used to *differentiate* the kinds of things psychologists study from the kinds of things other natural scientists study. Clearly, if the same term is used to justify antithetical conclusions, then there is a logical problem with it. The science of psychology cannot be *simultaneously connected to and differentiated from other natural sciences via the concept of behavior*.

Confusion is also apparent in the mainstream cognitive functionalist approach that divides psychology into “behaviors” on the one hand and “mental processes” on the other. Myers and DeWall (2016) define behavior as “anything an organism does—any action we can observe and record,” and mental processes as “the internal, subjective experiences we infer from behavior—sensations, perceptions, dreams, thoughts, beliefs and feelings.” As the “observe and record” makes clear, behavior is being defined in part as a function of the methodological requirement of science. A thought experiment can highlight key problems with this definitional framework. Consider that if the universe consisted of only two people, persons A and B, then the meaning of behavior and mental processes changes depending on whose perspective is adopted. From person A’s point of view, person B’s overt actions are behaviors and her mental processes must be inferred. However, from person B's standpoint the world looks very different. She does not observe her overt actions and then infer her own subjective mental processes. Rather her observations are synonymous with her conscious mental processes. Thus, in a two-person universe, what constitutes behavior and what constitutes mental processes are categorized completely different depending on the observer's point of view. This demonstrates that the concepts are murky.

A defender of the methodological behavioral view might retort that the natural scientific stance adopts a "general" independent third person view, which as Wilber (1995) and others have argued, can be defined as that which can be recorded with a video camera. Using this frame, it would seem the definitions of overt behaviors and inferred mental processes might hold. Indeed, a good argument can be made that such a differentiation would hold for nonhuman animals. Animal cognition does seem to be "locked" inside the nervous system (Henriques, 2011), with our access to it being via overt actions and studying the behavior of the nervous system. However, we should point out that the equation changes with the behavior of persons because of their capacity for language. Talking or verbal behavior is a different *kind* of behavior than the mental behavior of animals.

One key difference is that unlike subjective, phenomenological experiences, words move through the skin with no real boundary. Consider that although person A cannot share her private experience of redness directly with person B, if A chooses to do so, she can *directly* share her verbal narrative of redness and her thoughts about her favorite shade of red. This means that language-based mental processes need not be inferred but can be directly observed, which is why psychologists can rely on self-report as behavioral data. This means that talking breaks down the dualism of mental processes and overt behavior.

It is clear that there remains an enormous amount of confusion about the concept of behavior and how it relates to the methods of science, interior and exterior perspectives on the world, and the different kinds of behaviors exhibited by different kinds of entities in nature. In what follows, the Tree of Knowledge System is introduced. This macro-level view sets the stage for clearly delineating the different kinds of behavior in nature and the correspondence between the ontological and methodological meanings of the term. This in turn will set the stage for resolving key problems associated with defining psychology as the science of behavior and mental processes and will allow for the argument that the basic science of psychology should be defined as the science of mental behavior.

The Tree of Knowledge System:
A Map of the Four Dimensions of Behavioral Complexity and the Major Domains of Science

In this section, we argue that the Tree of Knowledge System (Henriques, 2003; 2011; 2017; 2019; Henriques, Michalski, Quackenbush, and Schmidt, in press) integrates both the ontological and epistemological/methodological meanings of behavior across different dimensions of ontic reality (i.e., Matter, Life, Mind, and Culture) and the different domains of scientific knowledge (the physical, biological, psychological, and social sciences). Although it was developed independently from Maturana and Varela’s (1987) proposal for a “Tree of Knowledge”, it shares the aspiration to be a framework that allows for a consilient (Wilson, 1998) understanding of the objective, subjective, and intersubjective ways of knowing. The ToK System characterizes the universe as an unfolding wave of four separable dimensions of behavioral complexity, which are mapped by different domains of science. The ToK System can be characterized as offering a map of a “scientific universal behaviorism” in the sense that everything is part of an unfolding wave of object-field change over time. As such, the ToK starts with the most basic conception of behavior as being akin to action, movement or change. However, with its different dimensions of complexity, the ToK sets the stage for differentiating behaviors that solely are a *function of* prior events from behaviors at the dimensions of Life, Mind, and Culture that also *function to* effect change. Put differently, the ToK System is an emergent naturalist model of various kinds of behavior, and it does not advocate for *reducing* all behaviors to physical and chemical processes. While everything is energy and matter unfolding on a grid of spacetime at one level, it is most definitively *not* the case that everything is *just* energy and matter. Instead, the ToK posits the existence of four different emergent dimensions of behavioral complexity, which are analyzed by different branches of science arranged in a hierarchical manner.

It is worth noting that the ToK System offers a vision that is highly congruent the philosophical analysis of emergent naturalism offered by Cahoone (2013) in *Orders of Nature*, a formulation he developed both independently of and subsequently to the ToK. Cahoone strongly criticizes modern philosophy for adopting a view of nature as fundamentally consisting of either matter (leading to a reductive physicalism) or mind (idealism) or a problematic substance dualism. He calls this the "dominant bipolar disorder of modern philosophy" and rejects it for a more empirically grounded view that entities operate at different orders of behavioral complexity. For example, he argues that cells operate at a different order of complexity (i.e. living) than atoms (material), and dogs operate at a different order (mental) from cells. Cahoone's (2013) orders of nature strongly correspond to the ToK's different dimensions of behavioral complexity.

Matter: The First Dimension of Behavioral Complexity

In physics, matter refers to any entity that has mass and takes up space. When capitalized and placed in the context of the ToK System, Matter refers to the first dimension of behavioral complexity and denotes the emergence of the energy-matter-space-time grid following the Big Bang. Consistent with modern cosmology, the ToK System characterizes the initial condition of the universe as a pure energy singularity (see, e.g., Das, 2017). Despite some uncertainty regarding the origins, nature, and substance of the singularity, there is considerable agreement about what emerged in the immediate aftermath of the Big Bang. Within the first moments, the singularity had divided into the four fundamental forces in nature (i.e., electromagnetism, gravity, strong nuclear, and weak nuclear forces) and the elementary subatomic particles (e.g., quarks and leptons) that are the fundamental constituents of matter.

As the early universe expanded some 400,000 years after the Big Bang, the temperature cooled to below a few thousand degrees Kelvin, which allowed protons and electrons to join and form hydrogen and helium atoms (Barkana, 2006). Large gas clouds eventually formed and collapsed in on themselves as a function of gravity, and this resulted in the formation of the first stars and then galaxies (Christian, 2018). As time progressed, atomic elements like carbon, nitrogen, oxygen, phosphorous, and sulfur formed in the bellies of stars. When the stars exploded, these heavier elements were launched out into the universe and chemically enriched the surrounding regions. Complex molecules could be found in planetary nebulae and the surfaces of newly formed planets, facilitating the chemical evolution that amplified the development of increasingly elaborate molecular structures and enhanced abiogenesis probabilities (Scharf & Cronin, 2016).

Central to our argument is that the above can be well-characterized in behavioral terms. The basic elements include objects (e.g., particles, atoms or stars), fields (the system or environment in which the objects reside), and the change processes that occur on the dimensions of space and time (Henriques, 2003). In addition to describing the physical change processes, foundational physical concepts, such as Newton's Laws of Motion, involve objects, fields, and change. The speed of light can be thought of in behavioral terms (i.e., velocity is the rate of change over time in relation to the field). Planck's famous constant, *h*, is a quantum of action, a mathematical-physical concept that is behavioral in nature.

Consistent with this argument, physics is often defined as the fundamental science that "explains how the universe behaves at every scale" (Wolfson, 2013). Particle physicists study the behavior of the very small (e.g., subatomic particles like electrons) using quantum theory, whereas cosmologists study the behavior of very large (e.g., galaxies) using Einstein's general theory of relativity. Similarly, chemists, geologists, and electrical engineers respectively speak of the behavior of molecules such as proteins (Breydo et al., 2015), plate tectonics (Kankanamge & Moore, 2016), and circuits (Nataf & Ciuti, 2010). The central point here is that the physical sciences develop scientific ontological descriptions and explanations for behaviors at the material dimension of complexity.

Life: The Second Dimension of Behavioral Complexity

Life is the second dimension of behavioral complexity on the ToK System. Although there is a significant probability that life may exist elsewhere in the universe (see, e.g., Frank & Sullivan, 2016), the ToK System maps our current knowledge of the empirically documented universe. The best scientific evidence suggests that planet earth formed approximately 4.5 billion years ago (Lunine, 2006). Life, in the form of simple single-celled organisms, was present on earth by 3.7 billion years ago, and possibly as early as 4 billion years ago (Dodd et al., 2017). The biological sciences are effectively defined as the Life sciences, with Life being capitalized here to specifically refer to the higher dimension of behavioral complexity.

Although the definition of life has long been debated, most concur that living entities nevertheless have many properties that inanimate objects do not. These include metabolism, homeostasis, adaptive responsiveness to the environment, growth, and reproduction. In his seminal book, *What is Life?*, Erwin Schrödinger (1967[1944]) pointed out that the truly remarkable facets of life include how it is organized, how it draws in and metabolizes energy to perform work and fend off entropy, and how it appears to be self-organizing. Stated in other terms, living entities are profoundly complex and work to maintain that complexity in response to increasingly diverse ecological niches and in fending off entropy. Descriptively, these are all key *behaviors* that make organisms fundamentally different from inanimate objects.

According to the ToK System, the central reason Life can be characterized as a separate, emergent dimension of behavioral complexity is because living processes are a function of information processing and communication network systems. Although physical entities and material behavioral changes can be described in information terms (Siegfried, 2000), there are no data being inputted nor anything akin to systematic computation, memory storage systems, or controlled outputs regulated by cybernetic feedback loops. A bouncing ball or a pendulum behaves as it does as a function of the physical forces that are acting in combination with their own internal, material compositions. No inputs are being computed or referenced against a store of information and followed by outputs, nor is there a communication network that is exchanging information between units in efforts to reduce variation and foster prediction of future vents. In contrast, Life exists as a collection of information processing systems that have stored data across the generations and engage in cell-to-cell communications functionally organized to enable prediction and control (Deacon, 2011). In addition to being part of the unfolding causal wave of behaviors, we can note that organism behaviors are not only a function of the past, but they function to affect future change in a way that is qualitatively different from the behaviors of atoms or planets (Kaufman, 2019).

Evidence for the centrality of information processing in understanding living behaviors (i.e., patterns and processes of organisms) is found in the language games of modern biology. Christian (2018, p. 79) argues that living organisms are "informavores" in that "they all consume information, the mechanisms they use for reading and responding" to their environments. Biologists speak of the language of genetics that involves genetic messages, genetic software, and so forth (e.g., Spradling 2006). Bray (2009) has argued how the DNA and RNA complexes function as computational systems that give life its complexity. Farnsworth, Nelson, and Gershenson (2013) assert that such information processing represents the defining feature of life. They extend their reasoning to claim that beyond the DNA and RNA molecular structure, functional information processing weaves together all levels and forms of life, from the genetic to the ecological.

Given this analysis, we are now in a place to return to Levitis et al.'s (2009) conception of behavior, given their professional identities as behavioral biologists. These kinds of scientists are interested in the behavior of whole organisms, which is separate from both physical behaviors like that of electrons or the behavior of parts of organisms, like the behavior of genes or proteins. This makes sense because the organism (and cell in particular) constitutes the whole unit of Life by providing the basic structure that allows component parts to engage in functional information processing and coordination required for metabolism, growth, and reproduction.

What Levitis et al. failed to recognize is that there are ontologically distinguishable behavioral patterns both “below” (atoms or genes) and “above” the behavior of cells or organisms. As Cahoone (2013) notes, the behavior of animals with a nervous system and centralized brain operates on a separate, mental order of nature. The ToK makes this important distinction explicit.

Mind: The Third Dimension of Behavioral Complexity

The ToK System jolts us out of the now well-documented Cartesian error (Damasio, 1994) of equating the concept of “mind” with human self-consciousness and rationality. Instead, the structure of the ToK highlights that the proper conception of the mental is to align it with the animal kingdom, most notably animals with brains and complex adaptive bodies (Cahoone, 2013). The defining feature of animals is that they are heterotrophic multicellular creatures that move around in their environments in response to immediate stimuli and toward functional outcomes. The elements of free movement, combined with the requirement of finding and eating other organisms, are the central forces that shaped the evolutionary structure and function of the nervous system and gave rise to the unique, emergent behavioral patterns seen in animals.

Available empirical evidence suggests that animals with the beginnings of a nervous system first appeared more than 540 million years ago. A remarkable transformation happened during the Cambrian explosion, as animals with brains emerged and started to dominate the landscape. These creatures likely evolved from tiny, low-energy budget animals during the Proterozoic era that had planktonic or benthic lifestyles (Wray, 2015). With the nervous system centralized in the form of a brain, animal behavior became coordinated by a new system of information processing. The primary task of the brain is to operate as a guidance control system that enables the animal to approach energy sources that enhance survival and reproduction (i.e., prey, mates, enriched territories) and avoid sources that are destructive (i.e., predators, toxins, degraded territories).

On the ToK, when capitalized “Mind” is the third dimension of behavioral complexity and refers to the set of *mental behaviors.* In Cahoone’s (2013) terminology, it corresponds to the mental order of nature that resides above the living and beneath the cultural orders. As delineated by Henriques (2003), mental behaviors correspond to the behavior of animals operating in and on their environment, mediated by the nervous system. If a cat falls out of a tree, it behaves in the physical sense as an object with mass and a shape. However, although both a dead cat and a living cat physically behave as falling objects, the latter also behaves very differently. That it lands on its feet and takes off is, of course, not simply a function of gravity, but represents an entirely different kind of behavior pattern. Similarly, when a cat freezes when startled, its body is being functionally coordinated by the nervous system. Both the freezing and running way are patterns characterized by the ToK as *mental behaviors*. Mental here is an adjective that describes the unique behavioral patterns seen in animals. The key organ associated with such behavior patterns is the brain, which is why it is so often referred to as ‘the organ of behavior’ (Ashby, 1952). In ToK parlance, the correct phrase is to refer to the brain as the organ of mental behavior, as mental is an adjective that clarifies the *kind* of behavior being referenced.

Whereas “Mind” refers to the set of mental behaviors and the third complex adaptive plane of existence, “the mind” refers to the information instantiated within and processed by the brain and nervous system (Henriques, 2011). This usage is consonant with research in cognitive ethology, and is seen in recent work on bee cognition (e.g., Chittka, 2017). Similarly, consider a book chapter titled: *In the Mind of a Hunter: The Visual World of Praying Mantis,* (Kral & Prete, 2004). When the authors discuss “the mind” the praying mantis, they are referring to the neuro-information processing mechanisms that are systematically coordinating and regulating the mantis' overt actions. The conceptual linkage between "the mind" and "mental behavior" can be made clear as follows: If one adopts the cognitive neuroscience maxim that "the mind is what the brain does" and it is agreed that the primary thing that a properly functioning brain does is to enable the coordination of the behavior of the animal as a whole, then it follows logically that we should refer to such behaviors as being mental (Henriques, 2003).

This framing of mental behavior allows us to examine how behavior has been used in confusing ways in various contexts. Consider, for example, that in 1938 Skinner published his landmark work, *The Behavior of Organisms*. Despite the title, the book said virtually nothing about the behaviors of bacteria, trees, or flowers, but instead centered on environmental influences that shaped the behavior of animals with brains, especially that of the rat in laboratory settings. If the views of behavioral biologists like Levitis et al. (2009) are considered, it becomes apparent that Skinner failed to take into consideration the concept of behavior "from below" (i.e., from the viewpoint of behavioral biology, including the behavior of cells). In this light, Skinner's title was a misnomer. He was not interested in the behavior of organisms per se (as behavioral biologists are), but rather the more specific behavior patterns of animals with brains.

A likely reason that Skinner's inexact language was glossed over was the reference point of his primary audience was coming from "above." That is, his readers were largely psychologists concerned with the behavior of persons. Although Skinner's emphasis was on a science of operant behavior, an important subtext was that such a science could largely account for the behaviors of humans. In his behavioral manifesto, Watson (1913) had famously argued that there was "no dividing line between man and brute." Skinner wanted to take this to its limit, commenting that the differences likely lay solely "in the field of verbal behavior" (1938, p. 442).

From the ToK System vantage point, Skinner's work on the function of the operant is fundamentally about Mind, the third dimension of behavioral complexity in nature. A much more semantically precise title for his work would have been *The Mental Behavior of Animals*. This rewording highlights the kinds of changes needed in order to solve psychology's language game problems.

The logic for differentiating the behaviors of animals (i.e., Mind) as a separate dimension mirrors the logic that distinguished the behavior of organisms (Life) from material objects (Matter). The brain and nervous system to an animal are akin to what DNA and RNA are to a cell: a centralized, information processing control system that plays a key role in coordinating and organizing the behavior of the whole entity. Just as genetic information processing links molecules to form proteins that structure cells that operate as wholes on a higher dimension of behavioral complexity, the nervous system links cells together to coordinate the animal-as-a-whole to behave as a singular unit. To see this clearly, consider that Skinner famously taught pigeons to play ping-pong (see Skinner Foundation, retrieved 2009). Of course, the idea of bacteria or flowers playing ping-pong is pure fantasy. The reason is simple: *animals behave very differently from cells or plants*. Of course, there is only one animal who has trained other animals to play games like ping-pong to make verbal arguments about the nature of behavior.

Culture: The Fourth Dimension of Behavioral Complexity

The behavior of people in socio-linguistic contexts is called Culture on the ToK. Like Life and Mind, Culture is capitalized here to refer to a specific dimension of behavioral complexity. It refers to the shared, socially constructed reality of human persons, and their systems of verbal communication and propositional meaning making. It is important to note that other animals have "culture" in the sense they have a sense of shared community, and some even have traditions and learned behavioral repertoires that are passed down. However, this is not what Culture with a capital "C" refers. It is the dimension of linguistic justification and self-conscious reflection coupled to narrative accounting, as well as large-scale systems of shared beliefs that are found only in humans. The logic of why Culture is a novel emergent dimension of behavioral complexity parallels the argument given for the emergence of Life and Mind. Just as genetic information processing was central to the emergence of Life and neuronal information processing was critical to the emergence of Mind, the emergence of Culture grew out of human language.

Although other animals have sophisticated systems of communication, human language represents a unique kind of information processing system. It is an open communication system, which includes learned symbols, grammatical syntax, and semantic information processing. The evolution of language in humans stems from the increased abilities for mental manipulation and simulations of probable outcomes. Humans also developed the capacity to translate images into symbolical-syntactical representations (Henriques, 2011). Objects are tagged as nouns and their transformations as verbs and differences as adjectives. As Christian (2018) has elaborated, the development of human language had a transformative impact on the behavior of our ancestors by giving rise to collective learning.

According to the ToK System, justification systems evolved as an inevitable, logical consequence of human language. Although human language created greatly enriched capacities for communicating, sharing ideas, and coordinating behaviors, it also created a fundamentally new adaptive problem that our pre-human ancestors had to solve: language allowed others a window into one's thought processes. For the first time in evolutionary history, therefore, our human ancestors had to explain *why* they behaved as they did. That is, they had to *justify* their actions to others (see, e.g., Mercier & Sperber, 2017). The ToK System frames the modern human speciation event as emerging as a function of a complexity-building feedback loop that stemmed from the problem of social justification (Henriques, 2003).

Although crucial, human language per se does not make Culture, but rather Culture emerges as a process by which symbolic systems are networked together into propositions and larger meaning-making systems. The ToK System specifically characterizes these networks as large-scale systems of justification (Shaffer, 2008). Justification systems refer to interlocking networks of linguistically represented beliefs and values that coordinate human action by intersubjectively framing both what is and what ought to be. Justification systems can range from the individual level (when a person talks privately to herself) to the dyadic level (a conversation or question-and-answer dialogue) to the group level (e.g., as when a preacher gives a Sunday sermon), and, finally, to the large-scale level of nations, political, or religious systems (e.g., the American legal system, a religion like Christianity, or the institution of science). These large-scale systems of justification are the essence of Culture in that they provide the macro-level contexts for processes of justification. This formulation of Culture lines up well with Ossorio's (2006) analysis regarding the essential difference between the behavior of persons and other animals. The difference stems from the former's capacity to function as an explicitly self-reflective entity who deliberatively navigates the world of linguistically mediated justification systems, both privately (to one's self) and publicly (to others).

The Periodic Table of Behavior:
A New Taxonomy of Behavioral Kinds and the Sciences that Map Them

The ToK System posits that the concept of behavior is foundational in all of science, and that objects, fields, and measurable change provide the conceptual ingredients that allow scientists to develop and test their maps of the world. The need to measure behavioral change captures the methodological meaning of *behavior.* ,The ontological meaning refers to both the fact that there are different kinds of behaviors in nature (i.e., the ontic reality of Matter, Life, Mind, and Culture) and the fact that different scientific knowledge systems have developed different ontological theories to map reality (i.e., the knowledge structure and content of the physical, biological, psychological and social sciences).

Other big picture systems, such as Big History (Christian, 2018), have made somewhat similar connections that align complexity in nature with the domains of science. However, virtually all other perspectives depict the evolution of complexity along a single axis, from particles to atoms to molecules to cells to multi-celled organisms and ultimately to human societies. In contrast, the ToK System characterizes nature as consisting of different dimensions of behavioral complexity (Henriques, Michalski, Quackenbush, & Schmidt, in press). The novelty and utility of the argument posed by the ToK becomes clearer when combined with the idea that the analysis of behavioral phenomena takes place at different levels of part-whole relationships (Wimsatt, 2007). When the dimensions of the ToK are combined with the idea of levels of analysis the realization emerges that behavioral complexity is best mapped on two axes, rather than standard, single axis approach.

The Periodic Table of the Elements was a wonderful advance in how scientists thought of the atomic elements because it shifted the categorization system to a formulation that included the now familiar groups (the columns) and periods (the rows). The Periodic Table of Behavior (PTB) draws its name from this inspiration. It divides what has traditionally been a single dimension of complexity into two separate axes, thus giving rise to a new way to objectively organize and classify behavior patterns in nature. One axis (the columns) consists of the four dimensions of behavioral complexity depicted by the ToK (i.e., Matter, Life, Mind, and Culture). The other axis (the rows) consists of the level of object-change relation (i.e., part, whole, or group) that is being analyzed. Dividing these two axes provides a much clearer picture of behavioral complexity in nature and the various domains of science that map them.

(Insert PTB Figure 2 Here)

Turning to the rows, the PTB differentiates a general level of "object-field relations" from primary units, with the former being listed above the latter. The general level refers to the various kinds of entities associated with that dimension of behavioral complexity (i.e., object, organism, animal, and person), and the fields in which such objects reside (i.e., field, ecology, environment, society). Consider that a physicist might track the behavior of either an apple or a cannonball traveling through the air. Both apples and cannonballs are general rather than primary units of matter. The PTB asserts that there are "primary" whole units that can be the formalized level of analysis. For example, atoms are the primary whole units that operate in the material dimension, with subatomic particles being the parts and molecular levels and above being groups or clusters. Cells are the primary units that operate in the living dimension, animals with brains are the primary units for the mental dimension, and human persons for the cultural dimension.

The primary unit for the Animal-Mental dimension is the "mindbrain" system, which refers to the brain-and-nervous system and the information instantiated within and processed by it. The Person-Culture primary unit is the self-reflective consciousness system or domain of personal self-awareness and control that enables individuals to justify their action on the social stage, and give accounts for them. Below the primary whole units are the "primary parts." Because of the focus on information processing on behaviors above the material dimension, the primary parts of the living, mental, and cultural dimensions are the fundamental units of information; that is, the gene, the neuronal network, and symbolic justification (i.e., propositions or the unit of linguistic meaning). Above the primary whole units are groups that could be potentially analyzed as functional wholes.

The PTB is proposed as taxonomy of different kinds of behavior in nature. As such, it should be effective at classifying different kinds of behavior. Levitis et al. (2009) empirically demonstrated that their examples generated significant confusion and disagreement among professionals. When referenced against the PTB, the argument is that the authors and experts they surveyed were confused because they were restricted in how they were thinking about behavior. Levitis and colleagues did not recognize that to be successful they needed to first define behavior in general first and then secondarily specify the specific *kind* of behavior in which they were interested (i.e., which in their case was the behavior of the living organism, as a whole). If these claims are justified, a clear prediction emerges for the PTB as a taxonomy of behavior, which is that it should lead to a much more reliable way to classify the descriptions offered by Levitis, et al. (2009).

Their first example was “a person decides not to go to the movies if it is raining,” which is a deliberate, reflective act, justified by a human person. This example can be categorized as operating in or on the fourth dimension of behavioral complexity, the cultural-person dimension, and it is readily placed at the level of the individual human person. Their second example was “a beetle is swept away by the current in a river.” The movement refers to physical forces (i.e., the fact that it is a beetle as opposed to a dust particle is not relevant for describing the change). This makes it a general object-level, material behavior. The third example, “a spider spins a web,” offers a straightforward case of a general animal-mental behavior. The fourth example is ‘a plant bends toward the sun.’ This describes the behavior of an organism-as-a-whole, which represents an example of the second dimension of complexity (biological-organic) behavior, at the level of the whole organism. The fifth example is “geese fly in a V formation,” which offers another clear example of mental behavior. However, this would be an animal group level, rather than the individual level.

The sixth example is “a person’s heartbeat speeds up following a nightmare,” which is a bit less clear because it potentially involves several different kinds of behaviors as mapped by the PTB. First, a nightmare would be a mental behavior—but not a cultural-person behavior--because it was not deliberative and linguistically legitimized by the self-consciousness system. In subsequent sections, will be map the various domains of human mental behavior. The increase in heartbeat is an organic behavior. There is also some part-whole fusion in the example, as the heart is only part of the bio-physiology of the whole human being. In short, this example is characterized by the PTB as being a conglomeration of several different kinds of behaviors that are operating across different levels and dimensions of behavioral complexity. The seventh example is “algae swim toward food,” which reflects a clear biological-organic behavior that could be at the individual or group level, depending on whether the reference is the coordinated group as a whole or a bunch of separate individual cells. Finally, “a rabbit’s fur grows over the summer season” is a biological-organic behavior (not mental, because it is not mediated by the brain/nervous system) and references one general part (the fur) of the whole organism. Although we find this classification compelling, we should note that this claim could be easily tested empirically. For example, researchers could essentially repeat the Levitis et al. (2009) study and then introduce and educate participants about how to place different categories and then give a similar set of examples and see if much greater rates of reliable classification would be achieved.

The PTB can also be thought of as a taxonomy of different classes and domains of science. Specifically, the argument is that all sciences are sciences of behavior broadly defined in terms of object-field change that can be measured. The ToK-into-PTB suggests that behaviors should be scientifically classified as taking place at different dimensions of complexity and levels of part-whole-group relations. If correct, then different kinds of scientific inquiry should be focused on the different domains highlighted by the PTB. The general assertion is that the physical, biological, psychological and social domains represent broad categories, and that within them, we should see more specific science homing in on different part-whole-group relations. This works especially well for the more advanced sciences. For example, particle physics studies the dimension from particles up into atoms, and thus directly corresponds to the box on the lowest corner on the left. In fact, the Standard Model, can be thought of as the map of the particles and forces of that box. The Periodic Table of the Elements maps the primary material level, that of the atom. Chemistry, geology, cosmology, and the material sciences analyze the behaviors of larger or more complex physical wholes.

The base of biology starts with molecular genetics, and that field represents base of the interface between biology and chemistry. Cytology is the study of cell behavior, and botany the science of plants (whole, multi-cellular organisms). Ecology and environmental science study eco-systems. Neuroscience bridges the biological/living and mental/psychological domains, and computational neural networks serve as a good example of that interface, residing at the base of the mental science in the current scheme (see Tryon, 2016).

The cognitive and behavioral neurosciences, along with ethology and comparative psychology study the behavior of animals in natural and experimental conditions. According to Henriques (2004), this should be referred to as either basic or formal psychology. Sociobiology and behavioral ecology provide analyses of animal groups, which highlights that animal social behavior should be considered above the operant analysis of individual animals. It is worth noting that this point was clearly made in a correspondence between B. F. Skinner and the famed sociobiologist, E. O. Wilson (Naour, 2009). Human cognitive science, including cognitive psychology, and linguistics serve the base of the Cultural-person dimension, representing the fundamental informational processes and structures that support this dimension of analysis. Human developmental and personality psychology represent the study of human individuals and represent the center of what Henriques (2004) called “human psychology”. Social into community and then cultural psychology, along with the other social sciences like anthropology, economics, political science, and sociology, are concerned with the behaviors of large human groups, cultures or societies.

As the preceding sections make clear, the ToK and PTB provide a new way to approach the concept of behavior. Specifically, provides a basic taxonomy for the ontological meaning of behavior across different dimensions of complexity and levels of analysis. The fact that the system effectively categorizes all the various examples from Levitis et al. (2009) demonstrates its potential utility in mapping the kinds of behaviors that exist in nature. In addition, the correspondence of the categories in the table with the various domains of science demonstrates that much of science can be characterized as mapping different domains of behavior in nature.

An Important Step Toward Solving the Problem of Psychology

Henriques (2011) argued that central to psychology’s tenuous status as a science is the fact that the field has never had a clear definition and delineation of its subject matter. The “problem of psychology” involves at least four different conceptual issues. The first pertains to the conceptual relationship between behavior and mental processes, and can be seen in the debate between radical behaviorists and cognitive functionalists. The second issue pertains to the difference between the behavior of animals (Mind) and persons (Culture). The third problem pertains to the distinction between a subjective-interior and objective-exterior view of the world, a problem that is especially relevant for human psychology and psychotherapy (see Kirchner, 2019). The fourth pertains to the identity relationship between the science and the profession, and the complicated issue of facts and values when one is describing events relative to when one is trying to design interventions to effect value-driven changes (Henriques & Sternberg, 2004).

The current work is centered primarily on the first conceptual problem, and the complicated relationship between science, behavior and mental processes. The conception of universal behaviorism derived from the ToK and PTB simultaneously addresses both the ontological and methodological aspects of behavior. This allows clarity about where the radical and methodological behavioral/cognitive functionalist views are both accurate and errant. According to this analysis, the radical behaviorists are correct when they assert that the universe is an unfolding wave of behavior. In addition, they are correct when they acknowledge that human behavior is the product of the “three tiers” of selection (i.e., natural-phylogenetic, behavioral-ontogenetic, and verbal-cultural, see Skinner, 1981). From a ToK System point of view, this “coelacanth” of an idea (see Stahlman & Leising, 2018) should have never been threatened with extinction.

Yet radical behaviorists err when they fail to acknowledge that neuronal, cognitive, and linguistic information processing play a central mediating role in such behaviors. They also err when they fail to distinguish the uniqueness of the behavior of animals relative to both organisms (from below) and people (from above). Radical behaviorists also err when they deny that “the mind” can be defined in scientific terms and that all mediational models of animal behavior are inherently unworkable. Anchored to an excessive materialist view of the universe, Skinner had a narrow and misleading conception of mentalism as some magical or supernatural force. In contrast, the ToK System and PTB formulation demonstrate clearly how to define mind in behavioral terms that line up well with Skinner's key insights (see Henriques, 2003). Consider, for example, Skinner's (1987, p. 784) argument that, "The mind is what the body does...In other words, it is behavior, and that is what behaviorists have been saying for more than half a century."

Mainstream psychology's cognitive functionalist view grounded in a methodological behaviorism also fails to define effectively the relationship between mind and behavior. By dividing the subject matter of psychology into behavior (which can be observed and measured) and mental processes (that must be inferred), mainstream academic psychology imposes an unnecessary and misguided ontological dualism on its subject matter. This is clearly a division that is driven by empirical epistemological requirements, rather than a clear ontological map that delineates the various kinds of behavior in nature. In contrast to mainstream psychology's unfortunate dualism, the ToK clearly identifies the domain of mental behavior as a specifiable order in nature. It also clarifies how and why mental processes that take place inside the nervous system are behaviors, and why overt actions of animals are readily conceived of as mental (cf. Rachlin, 1999), and how they are different from both the behaviors of organisms (Life) and self-conscious human persons (Culture).

The current analysis builds on previous arguments (Henriques, 2003; 2004; 2011) to show that basic science of psychology can now be defined effectively as the science of mental behavior. Contra Skinner, mental is not some magical or mystical cause of behavior. Rather, it is an adjective that characterizes the unique kind of behaviors that animals with brains and complex bodies exhibit. Mental behaviors occur both within the animal’s nervous system and between the animal and the environment. Paralleling the language of a radical behaviorist, the latter can be considered *overt mental* behaviors, whereas the former are *covert mental* behaviors. Hunting, mating, and defending a territory are overt mental behaviors. Perceptions, feelings, imaginings, and nonconscious cognitive processes are covert mental behaviors. Information processing and communication among neuronal networks provides the conceptual mechanism that moves the level of analysis from the bio-physiological dimension of neurons into the cognitive neuro-information processing of basic psychology (Tryon, 2016). In short, this paper delineates how to solve one of the field’s core conceptual problem, which is how to define the field’s subject matter in relationship to the concepts of behavior and mind. Behavior is a general scientific concept and mental behaviors are specific kinds of behaviors that take place on the third dimension of behavioral complexity.

The current analysis also highlights key features associated with the second conundrum associated with psychology’s subject matter, which is whether the science of psychology is concerned with animals, or people, or *both*. The current analysis demonstrates in no uncertain terms why the science of psychology needs to recognize the ontological difference between the behavior of animals and the behavior of persons. While we argue that both should be studied in terms of “mental” behavior, the fact remains that the behavior of persons is characterized by a linguistic and cultural dimension that the behavior of animals is not. This distinction should be clearly made and even institutionalize by differentiating basic from human psychology. Because human psychology is so central to the field, to solidify our analyses, we must clarify how to use the system to delineate the domains of human mental behavior.

Viewing the World Via the Lens of the ToK System

To achieve clarity on how the current model maps human mental behavior, we will use the ToK/PTB to delineate an everyday situation involving an individual at a furniture store looking to buy a table. The situation is such that the salesman has just made the pitch to buy the table and the shopper responds that he can “see the table”.

<<<<<<<<**Insert Figure 3 about here**>>>>>>>>>>>>>

Mapping this scene through the lens of scientific knowledge organized by the ToK/PTB, we can know that both the table and the person are made up of atoms. We know that the light consists of electromagnetic radiation that is being released from the lightbulb and bouncing off the table and entering the individual’s pupils. These behaviors are occurring in the Matter dimension of complexity. We know that the person consists of a collection of cells and organ systems that are constantly communicating, and that inside those cells are genes that provide the informational content that has guided and shaped his organismic development. This is the Cell-Life dimension of behavioral complexity.

We know that he has a nervous system that is processing information that is playing a key role in organizing his action. The nervous system into neuro-cognition represents the informational interface between the Cell-Life and Animal-Mental dimensions. The flow of information in his nervous system both allows him to behave as a coordinated unit so that he walks around and interacts with the table in a functional manner. We know that the flow of neuronal information is crucial in generating his subjective, interior experience of the table. From an exterior perspective, we can know that he has conscious access to this experience because he is reporting on it verbally. His perceptual experience of the table resides at the “mental order” of behavior. We know that linguistics is a particular kind of information processing system that connects human minds, and that English is a particular variant of human language. His comment that he can see the table perhaps suggests that he is thinking about his options, and he does not want to commit to a purchase under the pressure of the salesperson. The self-conscious action and shared, intersubjective dialogue takes place on the Person-Culture plane of existence. With regards to the table itself, it can be thought of as a hybrid between the Matter dimension and, because its form is a function of human behavior, Culture. Technology can be fruitfully considered “material culture”.

We can use this map to identify four different domains of human mental behavior. First, there is flow of neuronal information in the nervous system. This is the neuro-cognitive behaviors identified by the cognitive functionalist view of the mind, and would consist of all the subconscious processes of attention, memory, learning and so forth. Second, there is the first person “interior” view that corresponds to the shopper’s perceptual or phenomenological experience of the table. This would be the domain of experiential consciousness. Third, we have overt actions, the acting out in the world that involves neuro-muscular movements and results in physical changes between the individual and the environment (e.g., acting on the table, moving it into a desired position, which can be seen from an exterior view). Finally, we have explicit, language-based beliefs and values that emerges developmentally via talking and then writing and other forms of linguistic communication.

<<<<<<<<**Insert Figure 4 about here**>>>>>>>>>>>>>

Because language opens up a highway for direct communication between subjective experiential selves, it allows for us humans to be truly and explicitly “intersubjective” (other animals only have indirect action capacities to share their subjective experiences of being). This is what allows humans to “plug into” the dimension of Culture. There is much more to be said about this map and the details that can be added. Our point it to demonstrate that the model does clearly set the stage for mapping human psychology and its physiological, phenomenological, linguistic and overt action components. We believe that this map should be examined in relationship to other well-developed maps of behavior and psychology, such as Uher's (2013; 2016) model as part of her Transdisciplinary Philosophy-of-Science Paradigm for Research on Individuals (e.g., see Uher, 2013, diagram on p. 12).

Conclusion: Basic Psychology as a Mental Behaviorist Views It

As it emerged in its modern form near the end of the 19th Century, the science of psychology encountered a crisis that remains with us today. Simply put, there was no adequate philosophical language system that enabled the field's pioneers to delineate the complex relationships between the field's core concepts of behavior and mind and related processes, such as human self-consciousness. As Cahoone (2013) makes clear, this confusion was due in part to Western philosophy's bipolar disorder of defining ultimate reality in terms of either matter or mind. Absent a sufficient resolution to this core problem, different competing paradigms emerged with foundationally different vocabularies, and the field of psychology has remained in a state of fragmented pluralism ever since. What emerged over time, perhaps especially in the United States, is that modern academic psychology became predominantly defined by a cognitive functionalism anchored to a methodological behaviorism. The current work shows conclusively why this framing is inadequate.

The ToK System and its extension into the Periodic Table of Behavior allow us to sort out the difficulties and take an important step toward an effective solution for the problem of psychology. With its depiction of the universe as an unfolding wave of behavior, and its alignment of the various branches of sciences emerging out of Culture to map the different dimensions of behavioral complexity, the ToK enables us to clarify the ontological and methodological conceptions of behavior, both in the ontic reality of the world and across the various domains of science. In so doing, basic psychology can be readily defined as the science of mental behavior, characterized as the Animal-Mental plane of behavioral complexity. With this conceptual building block in place, the stage is set for future work toward a more complete solution to the problem of psychology that effectively deals with all the complexities associated with human psychology, human phenomenology, and the human sciences in general.

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Figure 1. The Tree of Knowledge System

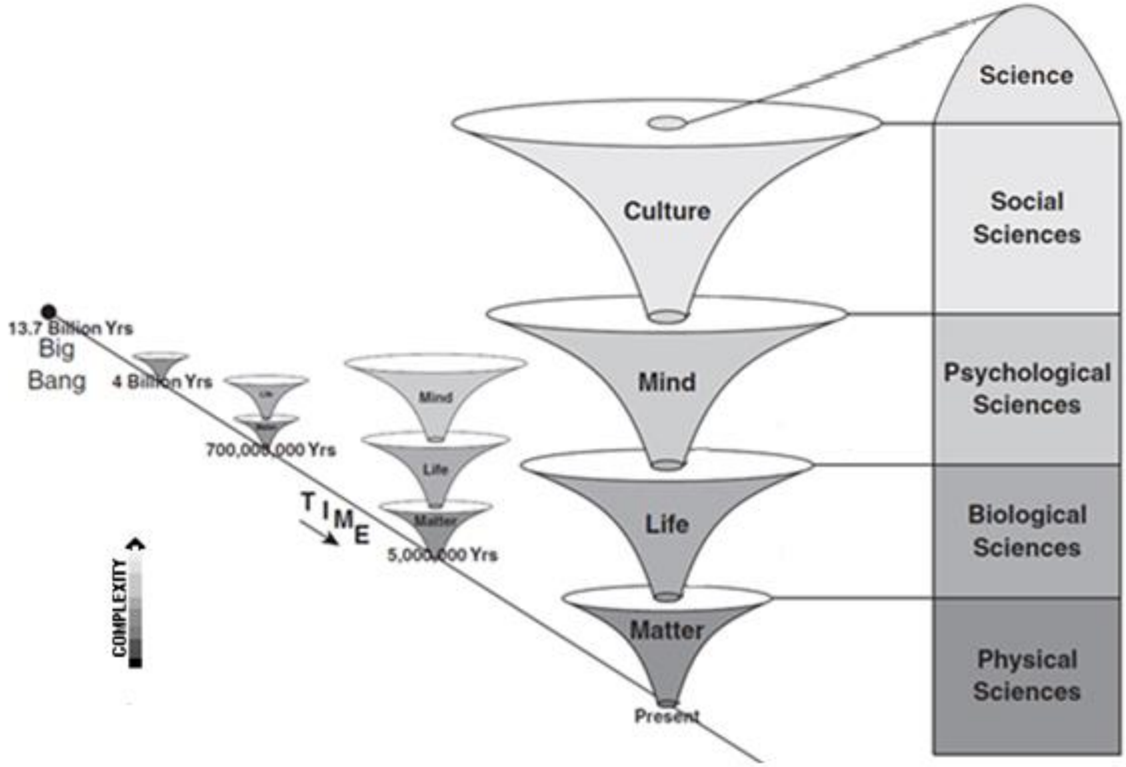

Figure 2. The Periodic Table of Behavior

The Periodic Table of Behavior

		Dimensions of Complexity			
		MATTER	**LIFE**	**MIND**	**CULTURE**
		Physical	**Biological**	**Psychological**	**Social**
Object-Field Relations	**Context of Behavior**	**Field**	**Ecology**	**Environment**	**Society**
	Behavioral Entity	**Object**	**Organism**	**Animal**	**Human Person**
Three Primary Levels of Object Complexity (Part, Whole, Group)	Groups of Wholes	Molecule	Multicell/Colony	Family-Group	Family-Community-Nation
	Fundamental Whole	Atom	Cell	Mind-Brain System	Self-Consciousness System
	Fundamental Part	Particle	Gene	Neural Network	Symbolic Justification

Figure 3. Viewing the World of Behaviors via a ToK Lens

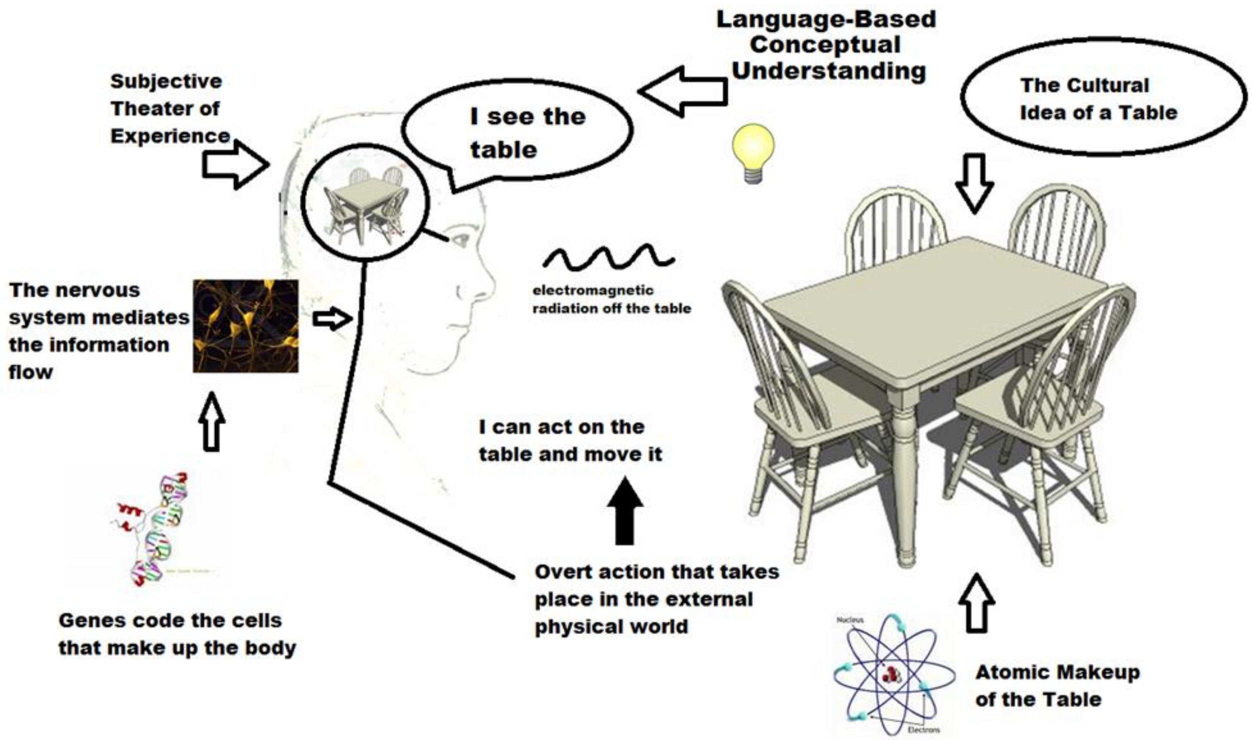

Figure 4. The Four Domains of Human Mental Behavior