Intersubjective Mental Behaviorism:

Mapping the Human Mind with the Tree of Knowledge System

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Abstract

Behavioral, mental, and social constructionist views represent three different philosophical positions in psychology that make different epistemological assumptions and emphasize different aspects of human behavior. Paralleling these different psychological positions, philosophers have long noted that considerations regarding human knowledge can be effectively captured by considering three broad angles or positions: 1) the objective (i.e., the world as it exists independent of subjective knowers); 2) the subjective (i.e., first person experience and knowledge of the world); and 3) the intersubjective (i.e., what groups of humans share as knowledge). This paper introduces Intersubjective Mental Behaviorism (ISMB) as an integrative new framework that is grounded in the Tree of Knowledge System (Henriques, 2003; 2017) that can effectively build bridges between these domains, both psychologically and philosophically. The current paper describes how ISMB maps the human mind into four domains connected via the concept of informational interface. It then uses the Tree of Knowledge System to make five key linkages that allows the domains to be coherent interconnected, giving rise to a new holistic position for understanding the human mind.

Keywords: intersubjective, mental, behaviorism, objective, Tree of Knowledge, emergent evolution, unified theory

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The Tree of Knowledge System has been proposed as a meta-theoretical framework that can solve psychology's philosophical woes (Henriques, 2011). In addition to offering up a "crisp" definition of the field (Henriques, 2004) and clarifying how the key insights from the major paradigms can be assimilated and integrated (Henriques, 2003), the system has been used to map the construct of human well-being (Henriques, Kleinman, & Asselin, 2014), and to build bridges between modern personality theory and integrative approaches to psychotherapy (Henriques, 2017). Here the framework is used to delineate an Intersubjective Mental Behaviorism (ISMB) that can map the domains of the human mind and use the ToK System's map of cosmic evolution to link them together in more effective ways than has been done previously. This paper starts with a brief philosophical review of three major domains of human knowledge, the objective, the subjective, and the intersubjective. The three domains are then linked to the behavioral, mentalistic, and social constructionist views in psychology as there are important parallels between them and the three domains of human knowing. Then, ISMB is introduced via mapping the domains of the human mind and the four domains of the human mind can be connected via the concept of informational interface. The paper concludes via a review of five key linkages that stem from the ToK System formulation set the stage for more effectively connecting these broad domains of the human mind.

The Objective, Subjective, and Intersubjective Domains in Philosophy

In his broad review of human history, Harari (2015) makes the point that considerations regarding human knowledge can be effectively captured by considering three broad domains: 1) the objective (i.e., the world as it exists independent of subjective knowers); 2) the subjective (i.e., first person experience and knowledge of the world); and 3) the intersubjective (i.e., what groups of humans share as knowledge). In everyday usage, knowledge refers to awareness of or familiarity with various objects, events, ideas, or ways of doing things. However, as philosophers have long noted, things get complicated quickly. For example, as I glance to the left of my computer, I see a coke bottle on my desk. The naïve commonsense view is that I simply perceive the actual coke bottle in front of me. Some reflection, however, reveals profound questions about the relationship between the “external” or “objective” reality and my perceptions of it. If one were to peer inside my head, for example, one would not find anything like a coke bottle, but rather the white and grey matter that make up my brain. My experience of the coke bottle is—somehow—a product of my brain, but the details remain mysterious in many ways. Thus, there are many philosophical questions that can be raised about the relationship between my brain activity and the actual reality of the coke bottle, independent of how I experience it.

These questions get at the potential distinction between the objective reality and the subjective experience of that reality. Philosophers such as John Locke invoked the concept of primary and secondary qualities to deal with this distinction. Primary qualities consisted of objective properties that really existed in the world (e.g., electromagnetic radiation coming off the bottle), whereas secondary qualities referred to the subjective experience that represented external qualities that did not necessarily exist in the external reality per se (e.g., the experience of the color red). Kant offered a famous distinction along these lines between the phenomenal world (our subjective, first person experience) and noumena, which are the “things in themselves.” Kant believed that we could never know things in themselves directly, but we needed to understand how the mind imposes categories on the world (e.g., quantity, quality, relation and modality) that give us our perception of things. In short, philosophers have long noted that, in many ways, the subjective experience of the world can be conceptually separated from the objective, knower-independent reality, and much philosophical writing has been done on the nature of this supposed dichotomy, including questions raised about the utility of the distinction.

The role that the intersubjective plays in shaping human knowledge can be readily added to current example by considering the 1980 film, *The Gods Must Be Crazy*, which tells the story of the dramatic impact a coke bottle, which accidentally fell from a passing airplane, had on an isolated tribe in the Kalahari Desert. The tribesmen interpreted the bottle as a gift from the gods, and the film tracked how that meaning permeated the tribe and influenced its members. Such a story highlights the central role that socially constructed (or intersubjective) narratives play in what humans experience as reality (i.e., the coke bottle meant something very different for the tribesmen than it did for the pilots in the plane). However, as soon as we start to conceive of human knowledge *simply* as a “construction” arising from processes of social exchange in local groups, we then find ourselves raising questions about the nature of objective knowledge. It surely is not the case that the mass of a proton is a function of social convention alone (see, Sokal).

In his collected works, *Subjective, Intersubjective, and Objective* (2001), the philosopher Donald Davidson summed up his analysis of the difficulty linking these three domains together as follows:

> I want, first of all, to stress the apparent oddity of the fact that we have three irreducibly different varieties of empirical knowledge [i.e., the subjective, the objective and the intersubjective]. We need an overall picture which not only accommodates all three modes of knowing, but makes sense of their relations to one another. Without such a general picture we should be deeply puzzled that the same world is known to us in three such different ways.

As one considers Davidson's reflections, it is worth keeping in mind that, in the practice of everyday life, these three domains are effortlessly coordinated. If, for example, a thirsty friend were to enter my office and asked for a sip of coke, my conscious experience would seamlessly align with my understanding of her subjectivity, and I would effortlessly reach out (presumably into the actual, physical world), and grab the bottle and hand it over to her. The problem from a philosophical point of view, as Donaldson notes, is that there is no comprehensive big picture system that seamlessly accounts for the three positions and their interrelations.

To understand the difficulty in integrating the objective, subjective, and intersubjective domains, it is useful to return to the picture of scientific knowledge that emerged during the Enlightenment. Following the tremendous success of Newtonian physics, a matter-in-motion physicalist picture of the universe emerged, and it was presumed by many Enlightenment intellectuals that the goal of science was to achieve an objective picture of reality, via analytic reasoning and experimentation, that would eliminate any influences of subjective or social biasing forces and yield ultimate objective truths. However, many modern philosophers of science have noted important problems that emerge with an overly objectivist conception of knowledge, and it is well-known that there is a "postmodern" movement that emphasizes the argument that human knowledge is inevitably tied to the subjective, social, and historical contexts and deeply influenced by those in power. Although some holistic philosophical systems have been proposed (see, e.g., Wilbur, 2000), no system to date has been widely accepted that provides a clear integrated vision that effectively frames the key issues.

The Behavioral, Mental, and Social Constructionist Views in Psychology

The complex philosophical issues associated with the objective, the subjective, and intersubjective domains of knowledge have significantly impacted debates regarding the philosophy of psychology. The official birth of the discipline is 1879, which corresponds to the opening of Wundt's scientific laboratory. Wundt defined psychology as the science of human consciousness, and he tried to study the structure of human perceptual experiences in the lab. However, scientifically studying subjective experience proved enormously complicated. Critics such as John Waston (1913) argued the problem was insoluble, and rejected the validity of any reference to consciousness. His behaviorist manifesto clearly spelled out the need for psychology to be based on objectively observable variables, and thus very much aligned with other natural sciences like physics.

Tensions between mentalist and behaviorist views have been at the center of psychology's longstanding epistemological woes (Uttal). Although there are a wide variety of behavioral positions, they all emphasize the need for a science to be focused on *objectively* observable facts—thus, behaviorism has always connected deeply to objectivist domains and conceptions of scientific knowledge. In contrast to behavioral commitments to observable entities, mentalists argue that "the mind" has legitimate ontological and epistemological status in science. This view gained significant ascendance via the "cognitive revolution," and most define the mind in terms of computation and information processing, which often includes subjective conscious experience. Perhaps the most influential mentalistic view is Albert Bandura's social cognitive theory, which posits that overt actions, mental processes (both conscious and nonconscious) and environments each reciprocally determine one another. Importantly, social cognitive theory does commit to a methodological behaviorism. It views psychology as a natural science that must be anchored, at least indirectly, to measured behaviors.

Since the middle of the 20th Century, another broad philosophical position has emerged, which can be termed the social constructionist view. This view is connected to a number of different streams of thought, including post modernism, feminism, critical theory, continental philosophy, and cultural or indigenous approaches. As with behaviorism and mentalism, there are a wide variety of different positions and emphases associated with social constructionist positions. However, the most basic claim is that human knowledge systems are embedded in socio-historical contexts and any full understanding of knowledge requires awareness of the role that history, power, and social movements play in what is regarded as knowledge. In addition, a key claim of the social constructionist angle is that the human mind is in part constituted by the cultural context in which it resides. This, of course, aligns significantly with the intersubjective domain. Moreover, many who adopt this philosophical position question the viability of natural science approaches to understanding the human condition and instead either argue that psychology must considered a human science or question the viability of objective knowledge about humans all together.

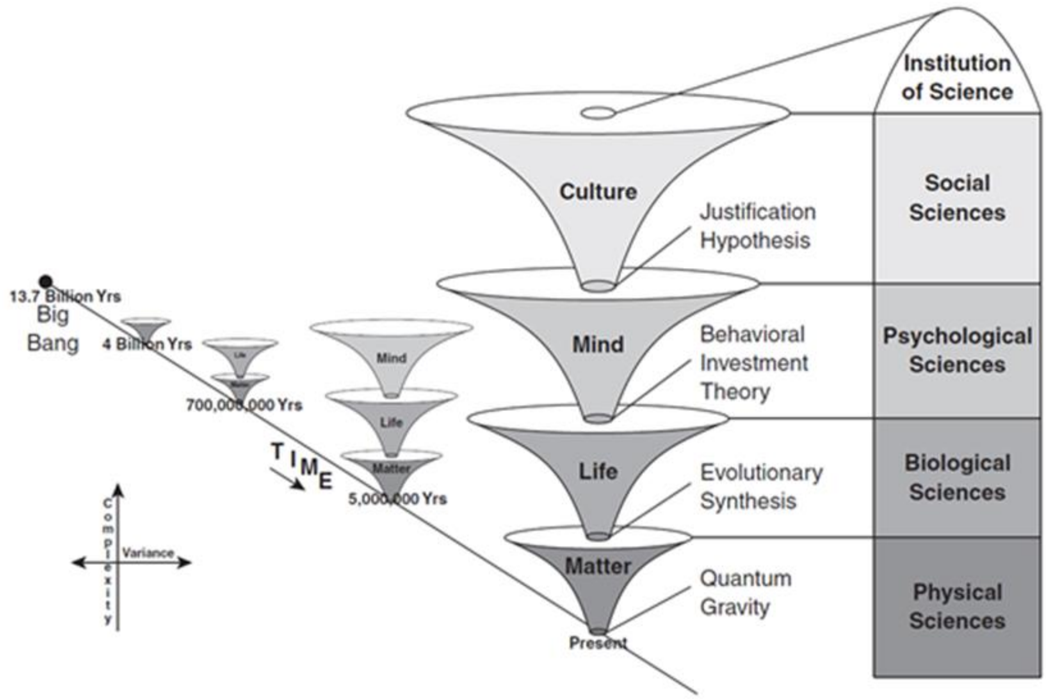
The philosophical tensions between these three broad positions in psychology can be highlighted by examining the vision of reality that Karl Popper (1978) delineated in his *Three Worlds* lecture, which he summed up as follows:

> There is the physical universe, World 1, with its most important sub-universe, that of the living organisms. World 2, the world of conscious experience, emerges as an evolutionary product from the world of organisms. World 3, the world of products from the human mind, emerges as a product from World 2. In each of these cases, the emerging product has a tremendous feedback effect upon the world from which it emerged.

Popper noted there are few good models for understanding the connections between these three worlds. From the perspective advanced here, what is missing for Popper is a scheme for understanding objective reality as mapped by science, the emergence of phenomenal consciousness, and the emergence of human culture in a way that also provides a framework for understanding how science and mathematics evolved out of culture as a human construction that effectively functions to map the physical and biological worlds. Popper's question relates deeply to psychology's philosophical woes and the differences between behaviorism, mentalism and social constructionism. Behaviorism attempted to eliminate consciousness or reduce it to brain activity (i.e., World 1). Mentalists attempt to account for subjectivity, often by information processing or phenomenological perspectives; however, they often do not consider of have good maps for the role culture plays in the development of human cognition. Social constructionists point out that all human knowledge systems are a product of humans developing shared meaning making systems (i.e., World 3), but they have trouble clarifying the truth claims of Worlds 1 or 2. Intersubjective Mental Behaviorism is grounded in the claim that a more wholistic, integrative approach can be achieved by looking at the human mind and human knowledge via the lens of the ToK System.

Mapping the Four Domains of the Human Mind

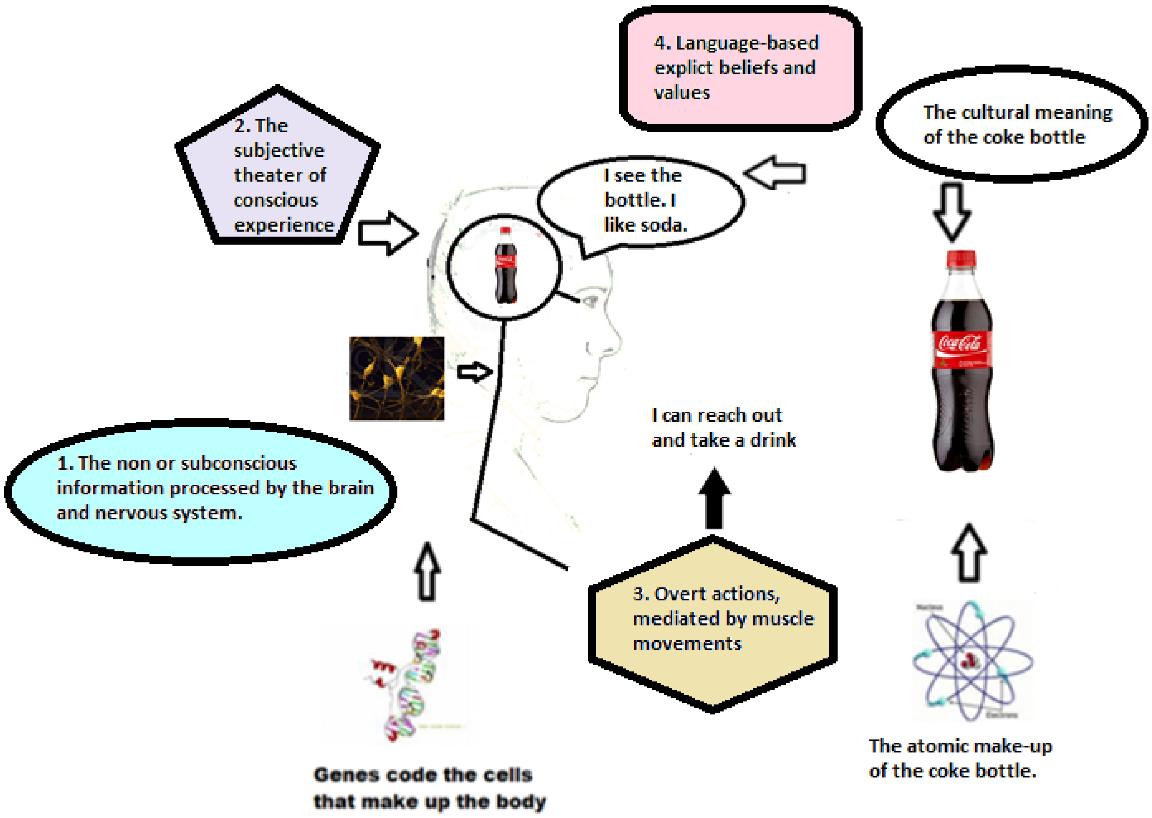
The Tree of Knowledge (ToK) System (Henriques, 2003; 2013) is a "Big History" (Christian, 2005) view of the universe that has been used to solve "the problem of psychology" (Henriques, 2008) and offer a "new unified theory of psychology" (Henriques, 2011) that defines the field and assimilates and integrates insights from the major paradigms in psychological science into a more coherent whole. The framework has compared favorably with other big picture views, such as E. O. Wilson's conception of "consilience" in its capacity to integrate human knowledge (e.g., Anchin, 2008; Quackenbush, 2008).



A focus of earlier writings has been on how the unified theory of psychology solves the traditionally contentious perspectives of behaviorism with cognitivism or mentalism (see, e.g., Henriques, 2004). The behaviorist view is the idea that what is referred to as "mind" is a kind of behavior that is in need of explanation by natural, mechanistic causes. The cognitivist view is the idea that overt behavior is caused by "the mind" and that the mind has legitimate ontological and epistemological status in science, usually framed in terms of computation and information processing. The unified framework, grounded in the Tree of Knowledge System, gives rise to a "mental behaviorism" that allows psychologists to understand both how "mind" can be thought of as a kind of behavior (the behaviorist view) in need of explanation, and how "the mind" can be thought of as a neuro-information processing system that causes observable behavior (the cognitivist view). More details on this conception are offered later in this paper. The current paper builds on the idea of mental behaviorism by adding the "explicit intersubjective" dimension. This refers to the capacity to share information about thoughts, feelings, and actions and the world in generally via language. The explicit intersubjective dimension gives rise to humans engaging in discourse, deliberatively justifying their actions on the social stage, and building large scale systems of justification that are the defining unique feature of human cultures.

A key feature of the unified framework is definitional in nature and the goal of this section is to clearly define and delineate the domains of the human mind from the vantage point of ISMB. To begin, it is useful to review four common definitions of the term *mind*. First, 'the mind' often refers to the self-conscious reasoning and deliberative reflection in persons. This is how Rene Descartes used the term when he separated the world into the dual domains of "mind" and "matter." Second, the mind also sometimes refers to the conscious experience of being-in-the-world, the "first person" world of felt perceptions, urges, emotional reactions, and imagined wonderings (e.g., the pain of a pin prick, or dreams of what might be). Third, the term mind also relates to what people are doing, ways of investing effort and attention. For example, if someone were to say, "Frank really put his mind to getting on varsity soccer," we would know that Frank was working hard to get on the team. Finally, there is the "behind the scenes" element or domain of mind; this refers to mental activity beneath or outside of conscious awareness. Freud became famous for introducing the idea of the "unconscious mind." Although he was misguided in many aspects of his formulation, modern psychology and neuroscience have conclusively demonstrated that consciousness represents only a small portion of mental activity.

The map of the human mind associated with the philosophy of ISMB delineates these four domains. The goal here is to be descriptive and develop a vocabulary for the human mind. As such, I will return to my example of perceiving and interacting with a coke bottle. Figure 1 offers a "map of reality" based on an ISMB formulation. In it, there are four different domains of the human mind which line up closely with the four common meanings of the term.



The first domain of mind in the diagram refers to the information instantiated and processed by the nervous system. This corresponds to the nonconscious, unconscious, or subconscious "behind the scenes" processes and messaging that takes between parts of the nervous system. Consistent with the basic framework that guides the cognitive neurosciences (broadly defined), ISMB operates from the position that the nervous system is an information processing system. That is, the functional organization of the nervous system is to bring in inputs via afferent nerves that monitor changes in both the external environment and the body, and reference those changes against various computational setpoints and coordinate outputs via efferent nerves.

The second domain of the human mind is the subjective theater of experience. This can also be call experiential or perceptual consciousness, and refers to the first-person (or first animal) integrated sensory experience of being in the world. In this case, it would refer to the consciously accessible sensory experience of how the coke bottle looked and felt. This view of experiential consciousness is consistent with the work of Bernie Baars. In *the Theater of Consciousness: The Workspace of the Mind*, Baars' notes the idea of consciousness being akin to a theater has a long history, dating at least back to Aristotle. The idea here is that "the lights come on the stage" when you wake up and go dim when you go to sleep and flicker on and off when you dream. Baars' combines this historical metaphor with his own approach to cognitive psychology and a "global workspace model" for consciousness, which argues that consciousness is deeply connected to working memory and provides a way to integrate, reference, and compare disparate streams of information. In the model, perceptual conscious awareness is akin to a "spotlight," and refers to what is the focus of conscious attention. In Baars' model this conscious spotlight operates within the context of working memory (which is the "stage"). Everything else (i.e., sensory input, the concept of self, long-term memories, rules of grammar, automatic behaviors, etc.) is considered back stage (the non- or subconscious information processing that is taking place in the nervous system).

The subjective, theater of consciousness can never be shared directly with others, only indirectly. That is one of the things that makes conscious experience so difficult to study empirically. However, much progress has been made over the past several decades. For example, in his ground breaking work, Consciousness and the Brain, Daheane has empirically examined what he calls the "conscious access point" and has demonstrated that conscious experience is closely associated with a "P3 wave," an oscillating wave of brain activity that emerges approximately 300 milliseconds following exposure to a stimulus.

Overt actions are the third domain of the human mind. It refers to engaging one's muscles to effect change in the environment. Acting and feeling are usually experienced as two sides of the same coin, especially when engaged in purposeful activity. However, they can be conceptually separated. Doing is dependent upon muscle activity, whereas feeling takes place completely as a function of brain activity. One can experience feelings without overt action at all, and overt actions can take place without feelings. Reflexes or physical shifts when one is unconscious (e.g., turning over in one's sleep) can be thought of as doing without feeling. In addition, while feeling is contained within the body, doing involves transacting with the world outside the body.

Finally, in humans there is the explicit, language-based beliefs and values that foster deliberative, reason-based thinking and can be directly shared with others. For example, consider the very different meaning the coke bottle had for the tribe than it does for me. Although we can never directly share the feeling portion of our consciousness, we can, of course, talk and explicitly share our verbal narratives. Symbolic language opened up an information highway between human minds. I am directly sharing my narrative for ISMB with the minds of readers. Other animals can only connect via doing and thus have a much weaker form of intersubjectivity. Talking is also inherently social and dialogical. We learn first to talk with others, and early in our child development we are essentially social actors (McAdams, 2013). However, over time, we learn to internalize our dialogue and talk to ourselves, giving rise to a private form of intersubjectivity.

Talking also opens up a new form of thinking, called explicit reasoning (Henriques, 2003). As social actors, we learn early in childhood how to give reasons for our actions and what are the kinds of reasons that are acceptable. As our reasoning capacities grow, we become able to shift from social reason-giving to being capable of more abstract reasoning. With schooling and introduction to mathematics and logic, we can become reasoning agents, and can move beyond just what is socially justifiable and ask deeper, more reflective questions about what is analytically true. That is, we can move from social justification to analytic justification and begin to reason about philosophical questions regarding the objective truth and theories of knowledge.

How are these domains of the human mind connected? ISMB employs the concept of “informational interface” can help clarify the links and relationships between them. Informational interface refers to the transfer of information across systems, and includes feedback loops and communication between different kinds of mediums. Examples of this phenomena abound, especially in the information age. Consider, for example, what occurs when two people are engaged in a conversation on the phone. In a phone conversation, an explicit, self-conscious thought is translated into motoric speech and the speech information flows as sound waves into the receiver in the phone. Those soundwaves are translated into electrical signals which are then beamed as radio waves to the nearest cellphone tower, where they are then sent to a satellite in space and beamed back into another cellphone tower, and then into the person’s cell phone. They are then retranslated into the speaker, which projects the information through the air via sound waves. These soundwaves are then translated into liquid waves via the ear drum and three small bones (i.e., hammer, anvil and stirrup), which cause vibrations in the cochlea which results in a pattern of fluid that is picked up by auditory receptors and then translated into words that can be processed and pulled together to form meanings. And the person responds, “I can’t believe she did that!”

The point here is that we can effectively frame the human mind by observing the informational interface occurring between the four domains of human mental behavior. Specifically, “the human mind” refers to how different parts of the nervous system communicate messages and store information (domain 1); how brain-based information processing gives rise to and is influenced by conscious experience (domain 2); how information flows from the nervous system into the muscles (and back again) to give rise to controlled, external movements and purposeful actions (domain 3); and, finally, how experiential consciousness and other neuro-information processes are translated into symbolic language, which can then be shared directly with others (domain 4). From this perspective, the human mind can be described as a *neuro-behavioral-experiential-linguistic informational interface system*.

ISMB offers this map of the human mind to provide a clear descriptive framework for the different domains and their interrelations. However, a descriptive framework by itself raises many questions and leaves us in a similar position to Karl Popper’s wonderings regarding the different Worlds. How did these domains come to be? What is their functional organization? How do we effectively link them together to form a coherent narrative? This is where the ToK System does much valuable work. It provides a new view of cosmic evolution that ties together many previously unseen linkages and gives rise to a new picture of the whole.

The Five Linkages that Tie the Map of the Human Mind Together

The Intersubjective Mental Behaviorist uses the ToK System as a map to link five key points that together explain how to connect the various domains of the human mind together in a clear cosmic evolutionary narrative of the universe and our place in it. These points are: 1)

Science is a way of objectively understanding the world, and behavior is the central concept for understanding and framing how science maps the material world; 2) Information processing is the key concept for Life (i.e., the behavior of living objects) and for differentiating the world of organisms from the inanimate world; 3) Behavioral Investment Theory and the philosophy of mental behaviorism provide a framework both for understanding Mind as a kind of behavior and for understanding the emergence of cognition and experiential consciousness; 4) the Justification Hypothesis provides a framework for understanding the emergence and subsequent evolution of human culture, self-consciousness, and explicit intersubjectivity; and, finally, 5) the evolution in human justification systems took a key turn when the early Greeks (i.e., Socrates, Plato, Aristotle) shifted the focus of justification from knowing *how* to do things toward reflecting on systematic questions about what "true" knowledge is and how one can be explicitly justified in knowing *that something is true*. This development in human justification systems was a foundational idea that eventually would lead to modern science, which added the final piece of the empirical method applied to behavior to decipher objective truths about nature. With these linkages made, we can view the map of the domains of the human mind in a new light and see how they are functionally organized into a coherent whole.

The First Link: Behavior as the Key Scientific Construct

The ToK System depicts the universe as an unfolding wave of energy, matter and information, and this unfolding can be characterized as a wave of behavior (a series of changes in object-field relationships). In contrast to how the term is used by behaviorists in psychology, here the most general definition of behavior is emphasized, which is change in an object–field relationship. Framed as such, behavior is the central construct in the sciences at large. That is, objects, fields, and change provide the conceptual bedrock for modern science. Physics can be described as the science of the behavior of objects in general, with particle physicists studying the behavior of very small objects (e.g., particles like fermions and bosons) using quantum theory, and cosmologists studying the behavior of very large objects (e.g., galaxies) using the general theory of relativity. In this view, it follows that the special sciences study the behavior of certain objects in particular. For example, chemists study the behavior of molecular objects and geologists the behavior of rock formations.

Importantly, although Watson generally gets credit for popularizing the term, physicists have adopted it and already use the term behavior in this way. For example, in the opening lectures of a course titled *Particle Physics for Nonphysicists*, the professor defines physics as the science of the behavior of matter and energy, and he goes on to characterize the course as being about the behavior of the fundamental particles that make up the material universe. This is commonplace. The Merriam Webster Dictionary offers the following as an example of this kind of usage: *The experiment tested the behavior of various metals under heat and pressure*.

Matter is the first dimension of behavioral complexity on the ToK System. Consistent with modern cosmology, the material dimension of the universe emerged at the Big Bang and has grown in space, time and complexity since. Despite some uncertainty regarding the ultimate substance of the singularity, there is much agreement about what emerged immediately after the Big Bang. Within the first second following the initiation of the Big Bang, the singularity had divided into the four fundamental forces in nature (i.e., the electromagnetic, gravitational, nuclear strong and nuclear weak forces) and the elementary particles (e.g., quarks and leptons). The Standard Model of Elementary Particle Physics provides a knowledge system for understanding these particles, and it forms the base of the dimension of Matter on the ToK.

This analysis gives rise to a “universal behaviorism” in the sense that everything is part of an unfolding wave of object-field change over time. This principle of a broad, universal behaviorism is crucial for ISMB. Everything is considered part of the unfolding wave of energy-information depicted by the ToK. However, in making this claim, ISMB does not advocate for reducing all behaviors to physical and chemical processes. Everything is energy and matter, but everything is not *just* energy and matter. Instead, as is clearly depicted by the ToK System, there are different dimensions of behavioral complexity.

The Second Link: Life and the Emergence of Information Processing

Life (Figure 3) is the second dimension of behavioral complexity on the ToK System. Although it is possible—perhaps even probable—that life exists elsewhere in the universe, 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. Life, in the form of simple single cells, was present on earth by 3.7 billion years ago and may have started as early as 4 billion years ago.

Exactly how life originated remains a bit of a mystery, although there are many clues and several plausible models. Biologists do have a basic framework for understanding how life evolved after it started. The modern evolutionary synthesis combines Darwin’s theory of natural selection with genetics. As depicted in Figure 3, Darwin’s theory refers to the idea that a cycle of variation, selection and retention was the key feedback loop that gave rise to the Tree of Life. Darwin did not know the mechanism of variation and retention at the time of proposing his theory. However, the needed elements were found in genetics and the DNA molecule. By the 1930s, biologists synthesized genetics with natural selection, providing a unified framework for understanding the evolution of life.

In 1944, Erwin Schrödinger authored a book asking the question *What is Life?* A physicist by training, Schrödinger pointed out that what is remarkable about life is how it is organized, how it takes in energy to perform work to fend off entropy, and how it appears to be self-organizing and self-perpetuating via reproduction. In chapter four of his book, Schrödinger states that "living matter, while not eluding the "laws of physics" as established up to date, is likely to involve "other laws of physics" hitherto unknown, which however, once they have been revealed, will form just as integral a part of science as the former." According to the ToK, these "other laws" are to be found the way in which information processing (Bray, 2009) gives rise to processes of self-organization (see, e.g., Kauffman, 1996). Central to this claim is the notion that there a fundamental distinction between life and inanimate matter (particles, atoms, molecules, chunks of rocks, stars, etc.) in that the latter do not engage in information processing in the way that animate matter does.

Support for this claim can be seen in the way biologist speak of "the language of genetics," genetic codes, genetic software, and so forth. DNA can be thought about as a memory/information storage system, and the various RNA types and relations (messenger, transfer, regulatory etc.) as "genetic information processing" systems that gives rise to self-organizing cellular structures.

In his book, *Wetware: A Computer in Every Living Cell*, Bray (2009) articulates how the DNA and RNA complexes function as computational systems that give life its complexity:

> Wetware, in this book, is the sum of all the information rich molecular processes inside a living cell. It has resonance with the rigid *hardware* of electronic devices and the symbolic *software* that encodes memories and operating instructions, but is distinct from both of these. Cells are built of molecules that interact in complex webs, or circuits. These circuits perform logical operations that are analogous in many ways to electronic devices but have unique properties. The computational units of life-the transistors, if you will-are its giant molecules, especially proteins. Acting like miniature switches, they guide the biochemical processes of a cell this

> way or that. Linked into huge networks they form the basis of all of the distinctive properties of living systems. Molecular computations underlie the sophisticated decision making of single-cell organisms such as bacteria and amoebae. Protein complexes associated with DNA act like microchips to switch genes on and off in different cells-executing "programs" of development.

Farnsworth, Nelson and Gershenson (2012) go farther and argue that the defining feature of life is information processing, and that it not only resides in the DNA and RNA molecular structure, but functional information processing is woven together at all levels of life, from the molecular to the ecological, and it is the central concept that allows biologist to understand the unique organized features and properties of living entities. The key point here is that animate matter behaves in a qualitatively different manner than inanimate matter and the root of this qualitative difference emerges from genetic and epigenetic information processing.

In thinking about life as a system coordinated by genetic or cellular or ecological information processing, a question arises regarding the subjectivity of organisms. That is, if organisms, from bacteria to trees, can process information, we can ask the question: *Do they have a subjective perspective on the world?* This question is debated (see, e.g., Wohlleben, 2016). The answer from a ToK System perspective is that they have a weak, implicit, or proto-subjectivity because they are self-organized, process incoming information, and respond to their surroundings via inputs and outputs. They can even be said to be goal-oriented in a cybernetic way, meaning they tend to systematically approach or avoid certain environments or stimuli (e.g., bacteria will swim to avoid toxins, and leaves will turn toward the sun for light). But lacking a nervous system, cells and plants do not have the full experiential subjectivity of animals; they are, in the words of Bray (2009), “robot(s) made of biological materials” (p. ix). Sentience or fully subjectivity emerges in the animal kingdom.

The Third Link: Behavioral Investment Theory, Mental Behaviorism, and Experiential Consciousness

The third dimension of complexity on the ToK System is Mind (Figure 4). Mind is a term that has many different meanings in common parlance, and it is crucial to be clear about what the term “Mind” means in the ToK System. As with Matter, Life, and Culture, when capitalized, Mind refers to the third dimension of behavioral complexity in nature. The logic for differentiating the behavior of animals from other organisms is the same as the logic differentiating organisms from inanimate objects. In the ToK formulation, the brain is to an animal what DNA is to a cell: a centralized, information processing control system that organizes the behavior of the whole entity. Just as genetic information processing links molecules together to form a qualitatively different dimension of complexity, brains link cells together to form animal whole that can behave as singular units that exist in a higher dimension of complexity.

As suggested earlier in referencing the concept of mental behaviorism, the ToK gives rise to a new vocabulary that helps resolve the tensions between behavioral and mentalistic approaches. Specifically, it explicitly differentiates between the concepts of Mind, mental behaviors, and ‘the mind.’ Mind on the ToK System is the third dimension of behavioral complexity. As with Matter, Life, and Culture, when capitalized, Mind refers to a distinct dimension of complexity in nature, and consists of the set of mental behaviors and corresponds to the behavior of animals. Animals are multicellular creatures that move around in their environments. They are heterotrophic, meaning that they rely on other organisms for their energy sources (i.e., they must consume other organisms because they cannot transform the sun’s energy directly into workable forms). The elements of free movement combined with the requirement of finding and eating other organisms are the central forces that shaped the structure and function of the nervous system—the centralized information processing system that allows for the coordination of the behavior of the animal-as-a-whole.

These behaviors are characterized by the ToK System as mental behaviors, with mental being an adjective that characterizes the unique kind of behaviors exhibited by animals. Mental behaviors take place both within the animal and between the animal the environment. The latter can be considered overt mental behaviors, whereas the former are covert. Hunting, mating, and defending a territory are exemplars of overt mental behaviors. Perceptions, drives, feelings, imaginings, and nonconscious cognitive processes are also considered mental behaviors; they simply take place within the animal and thus are covert. In slight contrast to ‘Mind’ (which is the entire set of mental behaviors), in the ToK framework ‘the mind’ refers to the architecture of the neuro-information processing system, as well as the information instantiated within and processed by that system. That is, the mind refers to the "covert" domain of mental behaviors.

We can move from this map to address long-standing issues associated with the mind, namely: *How does Mind and the mind relate to the brain and to what extent is it observable by others and to what extent is it not?* The earlier map of the human mind helps frame some of these issues. The flow of mental behavior can be observed following ways. First, scans of nervous system activity provide pictures of the electrical, chemical or metabolic activity, which are associated with the information being exchanged between different parts of the nervous system. Second, when an animal engages the environment, we are observing the overt mental behaviors associated with the activities of the information being processed by the nervous system. Third, there is a special kind of mental behavior in humans, called verbal or language-based behaviors. Finally, the thing we observe most directly of all is our own conscious experience of the world.

Although no one else can directly observe our conscious, subject experiences, we can observe our own consciousness. Indeed, one could argue it the only thing we can directly observe.

This analysis makes a couple of key points. With this analysis we can clearly see that mental behaviors exist both within and between individuals and the environment. Mental behaviors are mediated via the nervous system and thus are dependent upon nervous system activity. However, there is also a very clear distinction between the brain and mental behaviors. Mental behaviors (the subject matter of psychology) are a different kind of behavior than neuronal behaviors per se (the subject matter of neuroscience). Finally, we can use this map to be clear that there are some aspects of mental behaviors that are clearly observable by third persons (i.e., overt mental behaviors) and some are observable by first person observation (conscious experience) and some are only indirectly observable (the information instantiated within and processed by the nervous system).

The rise of mental behaviors is accounted for in the ToK System by Behavioral Investment Theory (BIT), which is the joint point between Life and Mind. Consistent with much work in the mind, brain and behavior sciences, BIT characterizes the nervous system as "the organ of behavior" and stipulates that it functions as an investment value system. Animal actions are framed in terms of invested work effort, specifically expenditures of time and energy calculated in terms of costs and benefits, relative to opportunity costs of other investment paths not taken. BIT delineates six foundational principles of animal behavior and nervous system functioning: 1) The Principle of Energy Economics; 2) The Evolutionary Principle; 3) The Principle of Behavioral Genetics; 4) The Computational Control Principle; 5) The Learning Principle; and 6) The Principle of Development.

Framed by BIT, the capacity for conscious experience emerges as a function of the evolution of layers of neuro-information processing. That is, increasingly complicated brains, modes of learning, and behavioral control gave rise to more extensive capacities for mental experience (first person subjective experience of being). Via the principle of computational control, BIT posits that experiential consciousness has the three primary domains, which are: 1) sensation and perception (e.g., seeing a red coke bottle, tasting a salty food); 2) motivation (e.g., hunger, sexual desire); and 3) emotion (e.g., sadness, joy, anger). Imagined sequences combine these elements into visions or simulations of events and actions (see Redish, 2015).

These three domains correspond to BIT's control theory formulation of mental experience. As noted by early cybernetic formulations, the basic equation for controlled feedback processes is: input – reference goal = output. There are a minimum of three components to such a system: 1) an input sensor; 2) a reference goal; and 3) an output mechanism. Behavioral Investment Theory uses the structure of the control theory framework to advance the P – M => E formulation (Henriques, 2011), where the "P" refers to perception, "M" to motivation, and "E" to emotion, and the formulation posits that claims what is perceived referenced against motivational templates of approach or avoid, which in turn activates emotion which energizes action, feeding back on changes in perception. Importantly, the P – M => E connects experiences, such as pleasure and pain, with Skinnerian models of reinforcement, giving rise to an "operant-experiential" view of animal behavior that includes both "feeling" and "doing" as parts of the overall equation.

Sociality was a crucial factor in the development of increasingly complex mental lives in animals, and many species have rich, complicated social lives (Safina, 2014). However, nonhuman animals are limited in the extent to which they can share their subjectivity, thus they only exhibit a weak, implicit or proto-intersubjectivity. The situation changes, however, with the emergence of human language because it opens up a direct informational highway for sharing subjective realities, thus giving rise to a strong, explicit intersubjectivity, which in turn opens up many opportunities for collective learning (see Christian, 2005).

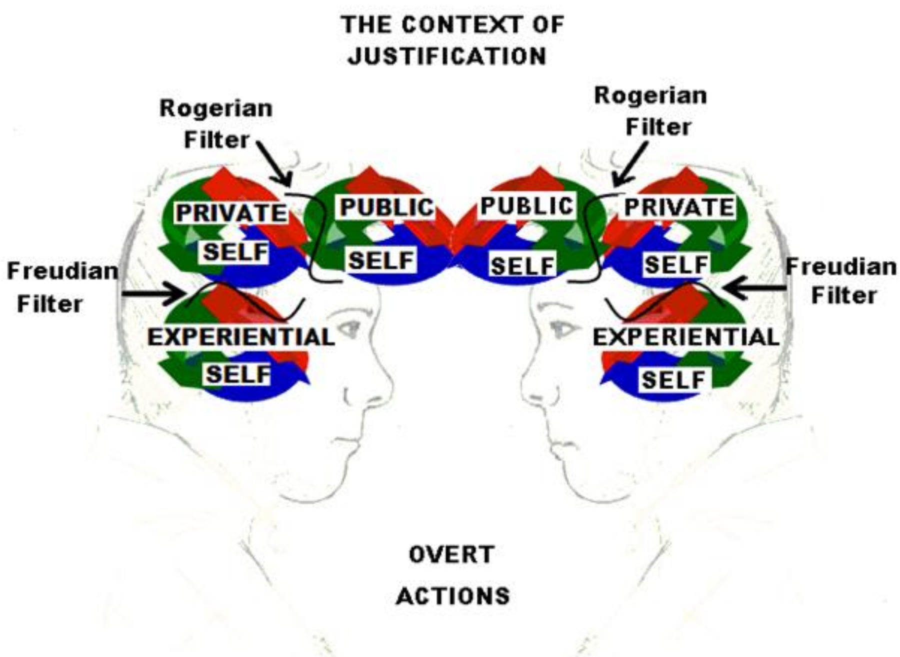
The Fourth Link in the ISMB chain: The Justification Hypothesis, the Tripartite Model of Human Consciousness, and the Rise of Explicit Intersubjectivity

The ToK System depicts "Culture" as the fourth dimension of behavioral complexity (Figure 5). Just as genetic information processing was identified as central to the emergence of Life, and neuronal information processing was identified as central to the emergence of Mind, the emergence of Culture is also associated with a new information processing system, human language. Although other animals have sophisticated systems of communication, human language is a unique kind of information processing system. It is an open communication system that includes learned symbols, grammatical syntax, and semantic information processing.

The ToK System weaves subjectivity with intersubjectivity via the Justification Hypothesis (JH), which is framed as the "joint point" between Mind and Culture. The JH effectively ties together the relationship between human language, self-consciousness, and the evolution of Culture. The JH consists of three separable ideas. First, the JH interprets both human self-consciousness and culture as *justification systems*. Justifications are the linguistic reasons we use to legitimize our claims and actions, and justification systems are interlocking networks of specific justifications that legitimize a particular version of reality. Second, the JH comes with an evolutionary hypothesis about the adaptive pressures that drove the origin and design features of the modern self-consciousness system. Finally, and especially relevant to the model of Intersubjective

Mental Behaviorism proposed, the JH, in combination with BIT and the ToK System, gives rise to an updated tripartite model of human consciousness (Figure X).

The Tripartite Model of Human Consciousness



This model of human consciousness (Henriques 2011) points to the presence of three distinct domains of human consciousness: 1) an experiential consciousness system; 2) a private self-consciousness system; and 3) a public self-consciousness system. The experiential consciousness system is the second domain in ISMB. As discussed above, it is a nonverbal, perceptual-motivational-emotional, parallel neuro-information processing behavioral guidance system that computes resource availability and organizes action. The JH divides the fourth domain of the human mind, the verbal-linguistic-talking-thinking portion into two separable domains of justification, namely private (justification to self) and public (justification to other). The private self is the center of self-reflective awareness in adult humans and is made up most immediately of the internal dialogue that weaves a narrative of what is happening and why. It is a second order awareness system, one that translates and feeds back onto the experiential system.

The public self is a mixture of how we want to be seen and how we imagine we are seen by others, although both may be quite different from how one's image is actually received by others. A number of seminal theorists have emphasized the importance of and dynamic tension between the public and private identity and researchers have demonstrated the validity of separating the private from public forms of self-consciousness. For example, the microsociology of Erving Goffman (1959) makes a strong case in favor of the importance of the public persona in a way that is very consistent with the JH. In *The Presentation of Self in Everyday Life,* Goffman describes face-to-face interactions and examined such processes through the lens of stage acting. He articulated how interpersonal interactions could be considered "performances" as actors learned to manage the impressions they present to others in both the structured and improvised roles of everyday life.

Above the two figures is labeled "The Context of Justification", which refers to the network of beliefs and values that provide the interacting members a shared frame of reference for their interaction. The religious, legal, and normative systems of social convention all provide the larger context in which the specific actions and scripts of local individuals are played out. Actions, the third domain of the human mind in ISMB, are also labeled in the figure and are the set of overt mental behaviors that individuals actively engage in the external world. Inside each of the individuals are two filters, labeled the Freudian and the Rogerian. The Freudian filter exists between the experiential self and the private self and refers to the process by which unjustifiable or painful images and impulses are filtered out and/or are reinterpreted to be consistent with the individual's conscious justification system. It is called the 'Freudian' filter because the dynamic relationship between self-conscious thoughts and subconscious feelings was (and still is) a central focus in both classical psychoanalysis and modern psychodynamic theory (McCullough Valliant, 1997). The filtering that takes place between the private and the public self is called the Rogerian filter because Rogers shifted the focus from deep and largely nonconscious intrapsychic processes to more conscious thought and experiences and here-and-now interpersonal processes.

Whereas BIT and Mental Behaviorism provide a link between objective behavioral conceptions and experiential subjectivity, the JH provides a framework for understanding the emergence of self-consciousness and explicit intersubjectivity. In linguistic communication, individuals must not only convey raw data, but they must also understand the explicit and implicit rules that legitimize action and investment and provide justifiable narratives for why they are doing what they are doing. The nature of conscious filtering, as elucidated by pioneering psychologists like Freud and Rogers, can be placed in the system and understood as structures that manage the adaptive problem of justification.

One of the central insights of the JH is that it links individual and micro-relational processes with group and large-scale social processes via the idea of justification systems. Laws, for example, are explicitly organized as systems that legitimize right and wrong. So too are political philosophies and religions (Shaffer, 2008). Even science can be characterized as a system of justification (Henriques, 2011). With this notion, we turn to the final link and explore the evolution of human Culture into the emergence of science as a particular kind of large scale justification system.

The Fifth Link: The Evolution of Culture, Philosophical Reasoning, and the Emergence of the Idea that there is an Objective Reality to be Systematically Investigated

Four of the five linkages are currently in place. To close the loop, we need to trace the trail of human cultural evolution to the emergence of modern philosophy and ultimately, natural science, which is a human invention that functions to develop mathematical and scientific maps of behavior in the universe. As noted in the previous section, Culture (with a capital "C") is the fourth dimension of complexity, and consists of symbolically mediated justification systems that linguistically frame human action. Culture, then, is theoretically separable from spheres of technology, acquired human behavioral investment patterns (i.e., learned procedures and skills), and the biophysical ecology in which humans live, although there are clearly complex interrelations between these various domains. With Culture so defined, we can then ask, "Where did Culture come from?", and "What is science?"

Archeologists have documented that by 50,000 years ago a pattern of cumulative growth had begun that would result in a creative, technological, and social explosion, and alter the face of this planet (Klein & Edgar, 2002). During the past 10,000 years, the pace of innovation has continued, including such achievements as agriculture, specialized division of labor, and systems of written language. The 19th and 20th Centuries saw a marked continuation of knowledge and technological growth, a pattern Piel (1972) characterized as "the acceleration of history", and one that is visually represented in the ToK System. The rate and character of such change makes it clear that explanations for it will not be found simply in terms of biological evolution through natural selection, but instead must be considered to be a consequence of socio-cultural and technological evolution.

Shaffer (1998) has articulated a conceptualization that links justification processes and transmission with the evolution of technology. He argued that cultural skills and technological developments are transmitted via packets of "recipe knowledge", which are justified by knowledgeable experts to novices. To envision how this process occurs, imagine a circumstance where novices observe an experienced toolmaker and form "why" questions: "Why do you strike the stone at this angle?" or "Why do you carve the bone this way?" A likely response given by an expert toolmaker would have been a justification: "I strike the rock this way to make it flake—if you strike it that way, the hammer will glance off the rock and you will end up striking your hand!" or "If you carve the bone this way, it will crack and the hook will be useless."

A second explanation for the accelerating rate of cultural evolution suggested by the JH is the fact that sociolinguistic exchanges between individuals give rise to complex systems of justification (Shaffer, 2005). This process was examined empirically in the influential work of Muzafer Sherif. Sherif realized that the apparent motion individuals see with the autokinetic effect represented a means to create a laboratory analog of events in early human history before the establishment of shared norms, which Sherif believed was the essence of culture. Sherif (1966) found that, when participants were asked to make judgments of the apparent motion by themselves, their initial judgments usually exhibited considerable variability. With repeated judgments, participants reduced the variability around a personal anchor termed a "personal norm." Others' evaluations, however, were typically very influential in the participants' subsequent judgments. Moreover, eventually groups would establish norms that would specify the legitimate perception of movement in a manner that carried moral overtones. According to this analysis, justification systems change, grow and evolve. And with this frame we can begin to trace the more recent histories of cultures, laws, governments and political processes and characterize them in terms of evolving justification systems.

Perhaps the most important event in the history of modern justification systems was the emergence of the insights of the early Greeks (i.e., Socrates, Plato, Aristotle), as these early philosophers offered a radical shift in how humans thought about knowledge in a way that would have dramatic implications for human culture (Goldman, 2007). Prior to the Greeks, knowledge was generally thought of in terms of local traditions, religious accounts of the world, and pragmatic or procedural know-how (i.e., knowing how to build a sword or pyramid). That is, there was not a systematic way to question the explicit relationship between subjective experiences of the world, human discussions about why things happened, and acting in the world with expected effects. However, the early Greeks changed that and turned their eye to more abstract problems in justification. Deeply influenced by the work of early mathematician-philosophers like Pythagoras, the Greek philosophers claimed that local, practical knowledge was not the stuff of true knowledge, and they sought a pathway that allowed them access to universal, absolute, deductive truths about the world. Mathematics provided them a model of what such knowledge might look like, and they thus began a quest to free humankind from the personally and socially constructed perceptual prison and reveal the universe's absolute truths.

Goldman (2007) traces the evolution of ideas and technologies from the ancient Greeks to the emergence of modern science in the Enlightenment period. He points out the technical developments that were central for modern science (e.g., writing and the printing press, central vanishing point perspective drawing), as well as conceptual developments (e.g., the view that nature is a closed system, calculus, Francis Bacon's articulation of the empirical method). What was happening was yet another shift in the nature of the systems of justification, from coherence and logic (the focus of the philosophers) to a focus on the correspondence theory of truth. Namely, whereas the Greeks emphasized attention to metaphysics and the logic of their philosophical systems, the pioneers of modern science emphasized that empirical evidence derived from one's conceptions must be gathered and analyzed and found to be in support of one's conjectures for the idea to be deemed scientifically justifiable.

Ultimately, the fifth and final linkage is the lineage of justification that evolved from everyday pragmatic know-how (which are processes of justification found in all cultures) to reflective and systematic justification processes about knowledge of truth (which was the birth of philosophy founded by the early Greeks) to empirical method-based investigations that are required to determine which truth claims were justifiable via correspondence with evidence (the birth of modern science in the Enlightenment).

This fifth link regarding the emergence of science as an objective knowledge system connects us back to the first link in the chain of insights that tie together ISMB, which is the claim that behavior is the key construct in science. The validity of this claim becomes clearer via the Periodic Table of Behavior (Henriques, blog). In the ToK System, Energy is the ultimate substance common denominator. The observable universe is "Energy" in all its different forms (Matter is chunked, frozen energy). The ToK further posits that universe evolves as an unfolding wave of Energy-Information, which can be placed on the dimensions of time and complexity. This connects to the "universal behaviorism" that grounds ISMB. That is, the ontological essence of the universe can be well-described as change in object-field relationships over time (also characterized as the flow of Energy-Information).

Via its dimensional view of the universe, the ToK System gives rise to a new taxonomy of behavior. Virtually all other perspectives depict complexity along a single continuous axis that advances as one moves up different levels of analysis, from particles to atoms to molecules to cells to organisms to animals and to ultimately human societies, as depicted in Figure X.

A common depiction of the single dimension of complexity

Rather than depicting nature on a single axis of complexity, the ToK System shows why it is necessary to think in terms of both levels and dimensions of complexity. These two axes must be differentiated if a clear picture of behavioral complexity is to emerge.

A level of analysis is defined here as the relationship between parts, wholes, and groups, relative to the field or environment in which the object resides. Dimensions of behavioral complexity are different. Dimensions of complexity refer to shifts in patterns of behavior and self-organization that emerge as a function of different, nested information processing systems. As discussed, the ToK System posits four distinct dimensions of complexity: Matter, Life, Mind, and Culture. These exist because, following the emergence of Matter from Energy, three separate information processing systems have evolved: 1) genetic information processing gave rise to Life; 2) neural information processing led to the development of Mind; and 3) symbolic information processing produced Culture. The levels and dimensions approach offered by ToK System generates a new way to think about categories in nature.

The ToK System provides a levels and dimensions approach to behavioral complexity to derive a taxonomy for classifying the fundamental kinds of behavior we describe as the ‘Periodic Table of Behavior’ (see Table 1). The rows categorize the levels of analysis, whereas the columns refer to the dimensions of complexity. The taxonomy can then be used to classify the sciences as a whole by the behavioral entities that they map. For example, the Standard Theory of Elementary Particles maps onto the ‘particle’ category in the material dimension. Similarly, the Periodic Table of the Elements maps onto the ‘atom’ category. The science of chemistry maps the behavior of molecules. Placements for genetics, cell theory, ecology, neuroscience, human psychology, and sociology are all clear. As such, the Periodic Table of Behavior provides good evidence that the concept of behavior does underlie science and its attempt to objectively describe and explain the world and our place in it.

The Periodic Table of Behavior					
		Dimensions of Complexity			
		Material/Physical	Living/Biological	Mental/Psychological	Cultural/Social
Object-Field Relations	Context of Behavior	Field	Ecology	Environment	Society
	Behavioral Entity	Object	Organism	Animal	Person
Three primary Levels of Object Complexity (Part, Whole, Group)	Groups of Wholes	Molecule	Group/Colony	Family-Group	Family-Community-Nation
	Fundamental Whole	Atom	Cell	Animal	Human
	Fundamental Part	Particle	Gene	Neural Network	Symbol

Summary and Conclusion

Intersubjective Mental Behaviorism affords both psychologists and philosophers a new map of the human mind and a new view of cosmic evolution that allows the necessary linkages to be tied together into a coherent whole. ISMB begins with a straightforward depiction of the human mind into four, clearly separable and identifiable domains. These domains correspond to the biophysical world of the nervous system (domain 1), the world of subjective experience (domain 2), the world of acting in the physical environment (domain 3), and sharing and narrating one's existence verbally, both to one's self or to others (domain 4). These domains have long been the focus of both philosophers and psychologists alike. The challenge has been, as noted by Popper, Donaldson and others, how do we link these domains together?

The Tree of Knowledge System is a new map of cosmic evolution that provides the necessary conceptual linkages. The ToK posits that the universe is an unfolding wave of energy-information that can be scientifically or objectively characterized as behavior, or the change in object-field relations. The system further posits that information processing was a major, emergent shift and one of the key ingredients that gave rise to Life, or the behavioral complexity of organisms. After 3 billion years or so of organic evolution, a second information processing system emerged, one that coordinated cells together and allowed animals to behave as whole units. Mind also gave rise to experiential consciousness and the subjective position in the world. Finally, a third kind of information processing emerged that connected mental subjects together. Language allowed humans an explicit intersubjectivity that gave rise to persons building Cultures and large-scale systems of justification. Science is a particular kind of justification system that attempts to objectively map how the universe behaves on the dimensions of complexity and change.

Grounded in the ToK System, ISMB both describes the human mind and provides a macro-level view that can tie together the key linkages. A such, it offers philosophers and psychologists how the objective and behavioral can be linked to the subjective and mental which can be linked to the intersubjective and socially constructed, finally giving rise to a grand narrative of the universe and our place in it.

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