Chapter 6
The Tree of Knowledge System

We have a surfeit of facts. What we do not have, and most of us in the quiet of our nights know it, is an overarching conception of context in which we can put these facts and, having done so, the truth then stands a chance of emerging.
—S. B. Sarason (1989, p. 279).

The fourth and final piece of the unified theory is the Tree of Knowledge (ToK) System, which attempts to provide a macro-level conception of context that gives us a way to place our hard-won scientific facts into an overarching conception of context that allows the truth to emerge. In the first chapter I introduced a basic representation of the ToK System. Figure 6.1 depicts the ToK System again, only this time there are some significant additions. One addition to this diagram is that now the four joint points are listed.

Joint points are the theories that link the dimensions. Quantum gravity is the first joint point and is theorized to be the link between Energy and Matter. It refers to the theoretical merger between the twin pillars in physics: quantum mechanics and Einstein's general theory of relativity. The modern evolutionary synthesis is the joint point between Matter and Life, and refers to the merger of Darwin's theory of natural selection with genetics. The modern synthesis can be thought of as the unified theory of biology because it provides the framework for understanding how complex, self-replicating organic molecules were ultimately transformed into organisms. Biology is a unified discipline precisely because it has a clear, well-established definition (the science of Life), an agreed upon subject matter (organisms), and a unified theoretical system that provides the causal explanatory framework for its emergence (the modern evolutionary synthesis). Some key elements of the modern synthesis will be explored later in the chapter, when we delve into Edward O. Wilson's work. Behavioral Investment Theory is the joint point between Life and Mind because it merges fundamental insights across the cognitive, behavioral, and neurosciences to provide a framework for understanding how Mind emerges out of Life. Finally, the Justification Hypothesis is the joint point between Mind and Culture because it provides a framework for understanding the changes in the human mind that resulted in the evolution of self-consciousness and human culture.

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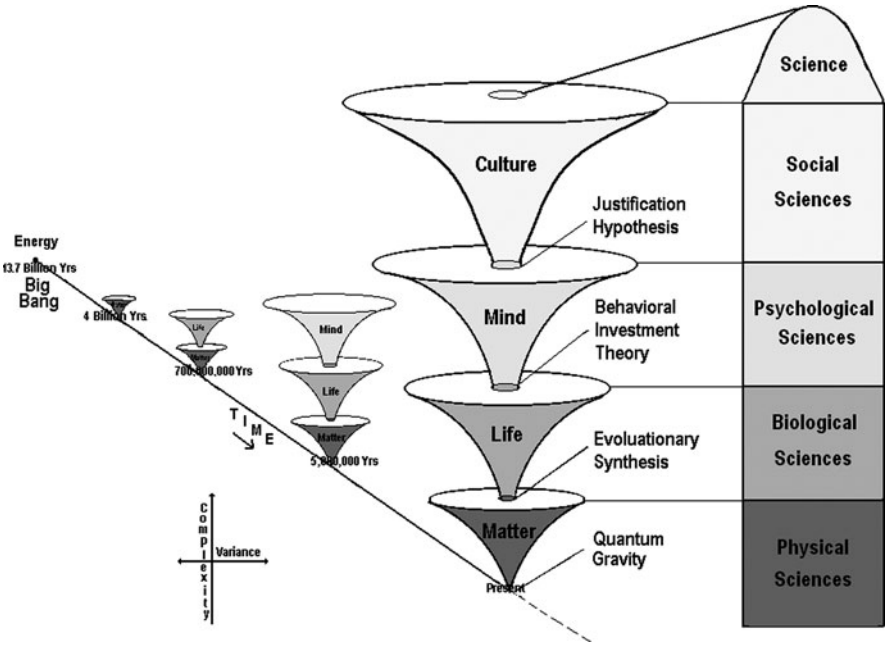

Fig. 6.1 The Tree of Knowledge System

Another notable feature of this diagram is the addition of science. From the unified theory perspective, science is a particular branch in the evolution of justification systems. In smaller and less complex societies, justification systems are initially undifferentiated, meaning that the shared narratives that coordinate the populations are global/religious/political narratives that explain how the world worked, how people should act, what was good and bad, and why. As societies grow in complexity, justification systems become more complicated and differentiated, and branch into various domains such as law, politics, mathematics, and religion. The ToK System suggests that science is a particular kind of justification system built on the value of accuracy and it depicts how science exists in the dimension of culture and functions to map the four dimensions of complexity. The reciprocal feedback loop of (1) systematic observation and measurement; (2) theoretical explanation; and (3) prediction and testing leading back to measurement provides the basic three-step process that underlies the scientific method and allows scientists to build increasingly accurate representations of the universe and the objects in it. The right side of the diagram depicts science as consisting of four broad, separable domains: (1) the physical; (2) the biological; (3) the psychological; and (4) the social. This correspondence between science and the dimensions of complexity is an important feature of the system. Philosophy is very much about knower–known relations, and the ToK System is the only system I know of that shows both the evolution of complexity, and where and how scientific knowledge about that complexity exists in relation.

Importantly, especially viewed in light of the problem of psychology, the correspondence between the dimensions of complexity and the domains of science provides a possible way for solving psychology's philosophical woes. Why? Because the gestalt offered by the diagram suggests that psychology can be as crisply defined as biology or physics. This fact, combined with the integrative conceptual frames offered by Behavioral Investment Theory, the Influence Matrix, and the Justification Hypothesis, provide a new pathway to solve the problem of psychology, an argument I give in detail in the next chapter.

But why is the Tree of Knowledge System so named? First, the metaphor of the tree illustrates how various branches of complexity are interconnected and emerge over time from more basic beginnings, thus placing us in the context of a cosmic evolutionary narrative. A tree also conveys a holistic, organic, and systemic view of knowledge (cf. Maturana & Varela, 1987). The primary reason it is named the Tree of Knowledge is because it serves as a reference to the Tree of Knowledge of Good and Evil in the book of Genesis in the Bible. I made this connection because I wanted to emphasize the tremendous need for a new mythology for modern times. In the traditional Genesis story the message is relatively clear: Obey God with blind faith and paradise will be delivered—challenge God's authority and all hell breaks loose. In contrast to this traditional message, I believe that humanity has matured to the point where it is clear that we should not be led by blind faith. Indeed, unquestioning obedience to traditional dogma is precisely the wrong starting point. We must instead take charge of our own destiny, and to do so we must be committed to asking questions about our nature, where we have come from and where we are going, and be committed to developing authentically justifiable answers. Thus, metaphorically speaking, we must eat heartily from the Tree of Knowledge if we are to flourish. Yes, eating from the Tree comes with some existential burdens. But it is our best hope. For it is only by acquiring such knowledge can we successfully and deliberately coordinate our actions and move humanity away from Evil toward Good.

Seeing the World Through the Prism of the ToK System

"Look, Daddy, I drew your work!" I looked down to see a picture that warmed my heart both as a father and as the developer of the unified theory. At the age of four, my daughter Sydney was presenting me with the picture in Fig. 6.2. "See," she said, "Rocks, plants, animals, people."

One of the grand hopes of the unified theory is that it will provide a scheme that can be comprehended by children in its broadest strokes but is nevertheless deeply informed by science. In this section I explore how the ToK System can function like a prism to organize our understanding of the world around us. The brightest and most complex thing in our world is the white light of human behavior, and to get a feel for how the ToK System works to organize nature's complex hierarchy, we will begin by applying it to human self-consciousness. First, though, think about what happens when white light shines through a prism. Out the other side comes a

Fig. 6.2 Rocks, plants, animals, people

rainbow of colors. Why? Each beam of light, with its own particular wavelength, is slowed differently by the glass. Since violet light has a shorter wavelength, it is slowed more than the longer wavelengths of red light. As a consequence, violet light is bent the most while red light is bent the least. The use of the prism reveals the separate beams that make up white light. As a prism can be used to see the colors that make up white light, the argument here is that human behavior is made up of processes that operate on different behavioral frequencies that can be separated according to the dimensions of informational complexity represented by the ToK System.

Let us apply the prism of the ToK System to the phenomenon of human consciousness because this is something with which you have intimate experience. Human self-consciousness is also a particularly interesting phenomenon because it is the one phenomenon where all four of the dimensions of complexity are simultaneously occurring. That is, during every reflective self- conscious moment, there is a layering of the physical, biological, psychological, and sociocultural dimensions of reality. We can start at the "top" of human consciousness and work our way down. The fourth dimension on the ToK System is called Culture, which is capitalized because it has a specific meaning, referring to the dimension of individual and collective justification systems. I am communicating with you now through the dimension of justification. Specifically, as you read this book and interpret its message, it is interacting with your pre-existing justification system(s), whereby you are trying to both derive the meaning of the message and match that meaning with your own semantic understanding (i.e., your verbal–conceptual systems for how

the world works). According to the ToK taxonomy, the meaning and dialogue that ensues about the content of the book—whether public or private—is taking place on the fourth dimension of reality, Culture.

Of course, the language-based dialogue is only part of your conscious experience. You are also likely to be able to identify images and feelings associated with the dialogue, along with other sensations. These elements make up your experiential self. If the message in the book is comprehendible and meshes well with your pre-existing beliefs (both verbal and nonverbal) you will likely feel positive, interested, and motivated to continue. If the meaning of the message is unclear or does not mesh well with or challenges your understanding, you are likely to feel irritated, uninterested or, if motivated at all, motivated to show why it is incorrect. There are many other elements of your experiential consciousness that exist mostly in the background but for a host of reasons could be brought into the forefront of awareness. For starters, there are the perceptual experiences that you can identify by looking and listening. Perhaps there is a noise outside or a flower on a table. Or perhaps there are internal urges or feeling states that you can identify. Maybe you have an ache somewhere in your body or feel some emotional distress due to a recent conflict with an important other. Obviously, then, there is much to our mental experience that is not verbal.

As described previously, sentience is the term used to describe nonverbal mental experience, and it is separable from language-based self-consciousness because it operates on a different dimension of information processing and thus on a different behavioral frequency. Sentience is an emergent consequence of neuro-information processing and occurs both phylogenetically and developmentally prior to language-based self-reflective thought. That is, animals were sentient before humans existed, and children are sentient prior to being able to talk. According to the taxonomy provided by the ToK System, the capacity for sentience emerges in the third dimension of complexity, Mind. That is not to say that Mind is synonymous with sentience—it is not. However, sentience emerges in the mental dimension of complexity, and nonverbal sentient experiences are third-dimensional phenomena. The mental dimension also includes the enormous number of nonconscious neurocognitive processes that are also occurring when you (or a sentient being like a dog) behave. When and how sentient experiences emerge from neurocognitive processes are very good questions for which we do not have clear answers, but the point I want to emphasize here is that according to the ToK System, your nonverbal experiences—that is, your perceptions, drives, feelings, and images—are third-dimensional phenomena. Thus in the frame offered by the ToK, you can rather simplistically but nonetheless justifiably think of your self-consciousness as your cultural mind, and your basic experiential self as your animal mind. Whereas words relate to the outside world through speaking and writing, your animal mind relates to the outside world via your overt actions.

If you are following me you can see that, according to the ToK System, your conscious experience is made up most immediately of behavioral frequencies operating at the third (mental) and fourth (cultural) dimensions of complexity. I should also

note that your self-consciousness can be seen "from above" as taking place within a macro-level cultural environment. That is, the largest, most complex "objects" on the ToK System are human societies, and the informational glue that holds human societies together are the collective systems of justification that coordinate human action (Culture). The ToK System posits that your language-based thought processes are significantly influenced by the large-scale cultural justification systems in which they are embedded.

From "below" your sensory experiences are taking place in a biological environment, consisting of neuron action potentials, neuron growth and metabolism, neurotransmitters, hormones, as well as the other organs and organ systems that keep you alive. Your experiential self is thus "embodied" in biology—cells, organs, and organ systems. These systems, as well as the plant on your desk or the trees outside your window, operate on the second dimension of complexity, which is the biological or organic dimension. According to the ToK System, psychological or mental behaviors operate at meta-level frequencies relative to specific brain processes. Although mental behaviors cannot be reduced to biological behaviors, biological processes do provide the conditions of possibility for mental behaviors emerging in animals. For example, if someone's brain was scrambled with, say, a bullet to the head, their mental behaviors and experience would quickly dissipate. Moving up a level of complexity for an analogy, the relationship between brain processes and mental behaviors is akin to the relationship between individual personalities and the behavior of a society as a whole. Just as we could never understand the behavior of the United States of America by analyzing the sum total of the individual personalities of its citizens, we will never understand mental behavior solely by analyzing the brain. Instead, we must also look at the behavior of the individual as a whole.

Understanding the relationship between wholes and parts is also crucial to have a good feel for the levels and dimensions of reality argument offered by the ToK System. The integrative theorist and philosopher Ken Wilber (2001) views nature as a holarchy, or a nested hierarchy, where wholes at one level are parts of wholes at another. For example, a molecule is a whole at the chemical level and is part of a cell, which is (or can be) a whole at the biological level. A cell is a whole at the biological level, but is only a part of an animal like a pigeon, which is a whole at the psychological level. A person is a whole at the level of human psychology, but is only a part at the level of society. Nelson (1996) offered the following example in the form of a sentence to help in thinking about the relationship between wholes and parts: "Thiss sentence has threee errors." To understand the point of the example, a consideration must be made at the object level (the individual words) and the meta-level (the meaning of the sentence as a whole). There are two errors at the object level (the two misspellings) and one error at the meta-level (the fact that there are two spelling errors instead of three). To extend the analogy, if we think of the behavior of a rat as akin to the whole sentence, a behavioral psychologist would focus on the sentence as a whole (behavior of the rat), a biologist would study the word level (organ systems, organs, and cells), and a molecular geneticist the particular letters (genes and molecules).

When we shift our attention to lower dimensions of complexity on the ToK System, we see that the relationship between higher and lower order phenomena remains analogous. Although it is impossible to reduce biology to chemistry, it is still the case that biological behaviors are populations of enormous complexes of chemical behaviors, which exist in the material dimension of complexity. Molecules are complex material objects and are made up of simpler objects called atoms. And atoms are, in turn, made up of even more basic material particles, such as electrons, protons, and neutrons. Although electrons are fundamental particles, remarkably it turns out that protons and neutrons are made up of particles called quarks. Quarks and leptons (electrons and another particle called neutrinos) are the simplest material particles and make up all the matter in the universe. Called fermions by physicists, they exist at the very bottom of the material cone on the ToK System. There is, however, one thing more fundamental than matter. That is energy. Matter is made up of frozen chunks of energy, and energy is the ultimate common denominator in the universe.

There is one other element about the taxonomy provided by the ToK System that I would like to mention. Once again, take a look around you. Sitting on a chair or a couch, holding this book or staring at a computer screen in your home or office, you are most likely surrounded by technology. Technology is an interesting category when viewed via the ToK prism. On the one hand, technology generally operates on the material dimension of complexity. On the other, it is the result of human intention and cultural evolution. That makes technology a "hybrid" between dimensions, and I characterize technology as material culture. Material culture, or technology, is obviously related to Culture (the dimension of language-based justification), but is, in the taxonomy provided by the ToK, separate from it. Indeed, by making the division between material culture and Culture, we can posit that the human societies are made up of the combination of four different domains as follows: (1) Culture (the large-scale justification systems that coordinate people's actions); (2) Material culture (the tools and technological innovations and inventions); (3) Overt patterns of behavioral investment (i.e., tacit knowledge, habits, and skills of individuals); and (4) the biophysical ecology in which the society exists (e.g., geography, natural resources, flora and fauna, climate, etc).

The taxonomy of behaviors provided by the ToK System hopefully feels both quite familiar and yet quite novel. What may be familiar is the notion that nature can be effectively parsed into different levels of complexity. That is, atoms exist at one level, molecules another, cells another, and so on. Seeing nature as consisting of different levels of complexity has been extremely common and is part and parcel to many broad systems of science and philosophy. The classification scheme of material objects, living objects, animals, and people should also have a familiar ring to it as this categorical system aligns with thousands of years of common sense. Since the beginnings of culture and including great thinkers like Aristotle, people have seen these four categories in nature. But despite these familiar components the ToK System is nonetheless a novel proposal that solves many longstanding philosophical problems. To understand why, it is helpful to locate the ToK System in relationship to previous proposals.

A New Approach to Emergent Evolution

I was perusing the library on a lazy Friday afternoon when I stumbled on a book written in 1958 by Oliver Reiser. Upon seeing the title, *The Integration of Human Knowledge*, I eagerly flipped through the pages. When I saw Reiser's proposal for a scientific humanism and his diagrams, which included the Temple of Knowledge (p. 51), Levels of Emergent Evolution (p. 271), and the Relations Between the Levels in a Spiral Action of Time (p. 85), an eerie sense of familiarity washed over me. So strong was the correspondence between his integrative vision and the ToK System that a Jungian might have labeled it a moment of synchronicity.

The similarity did not end with the overlap in the vision. In fact, Reiser (1958) began his book with a justification for his system that has strong parallels with the current work. He argued passionately that philosophy and science were producing oceans of information but were not generating a comprehensible, synthetic vision of knowledge in general. He wrote

> In this time of divisive tendencies within and between the nations, races, religions, sciences and humanities, synthesis must become the great magnet which orients us all. . .*[Yet] scientists have not done what is possible toward integrating bodies of knowledge created by science into a unified interpretation of man, his place in nature, and his potentialities for creating the good society. Instead, they are entombing us in dark and meaningless catacombs of learning*. (Reiser, 1958, pp. 2–3, italics in original).

Although I was not aware of it when I initially developed the ToK System, I have since learned that at the beginning of the twentieth century a group of scientists and philosophers argued for a conception of nature that was similar in form and spirit to the ToK System, and Oliver Reiser's work was part of that tradition.

The great comparative psychologist C. Lloyd Morgan was the primary scholar associated with the movement, and he coined the term emergent evolution to capture the new approach. Emergent evolution was described by Morgan as a third way, one that existed between the two dominant philosophies at the time. One dominant position was that of material reductionism. Advocates of this approach argued that life and mind were, at bottom, just complicated arrangements of energy and matter and, eventually, everything would be reduced to physics. The other position was vitalism, whose proponents argued that a supernatural life force had to be added to the physiochemical arrangements to explain phenomena of life and consciousness.

Emergent evolutionists argued a middle-ground position. Like the vitalists, they argued that biological and mental properties were genuinely and qualitatively novel and were not reducible to physics and chemistry in any meaningful way. However, in contrast to the vitalists, they argued that these properties emerged from evolutionary changes rather than supernatural forces. In reviewing the history of emergent evolution, Blitz (1992) captured the primary claims of the emergent evolutionists as follows:

> Emergent evolution combines three separate but related claims. . .: firstly, that evolution is a universal process of change, one which is productive of qualitative novelties; secondly, that qualitative novelty is the emergence in a system of a property not possessed by any

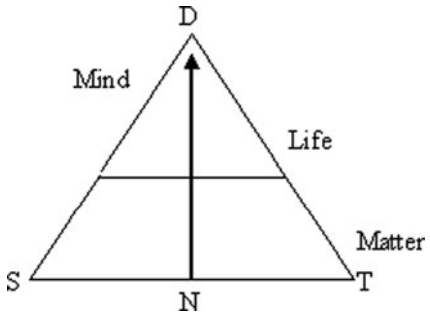

Fig. 6.3 Llyod Morgan's conception of emergent evolution

> of its parts; and thirdly, that reality can be analyzed into levels, each consisting of systems characterized by significant emergent properties (p. 1).

Importantly, Morgan (1923) and other emergent evolutionists saw the levels in nature in a manner that carries obvious parallels with the depiction of complexity offered by the ToK System. Building on aspects of Alexander's (1920) formulation, Morgan generated Fig. 6.3 to represent his conception of emergent evolution.

He described it as follows:

> At its base space–time (S & T) extends throughout all that is. At its apex, but within it no less than space time, is deity (D), an emergent quality that characterizes (sic) only certain persons at the highest and latest stage of evolution along a central line of advance (N). The narrowing which gives the pyramid its form expresses such a fact as that the range of occurrence of material events as such is more extensive than that of events which are also vital. . .[The diagram is] a synoptic expression, or composite graph, of a vast multitude of [objects and events—atoms] near the base, molecules a little higher up. . .higher still, plants (in which mind is not yet emergent), then animals (with consciousness), and, near the top, our human selves.

With the possible exception of the introduction of the concept of "Deity," this formulation should sound quite familiar because it carries clear parallels with the ToK System. It should be noted that although Morgan offered some theological musings in his proposal, his version of emergent evolution was a fully naturalistic approach, and "Deity" held a meaning closer to spirituality, values, and beauty as opposed to a supernatural God or force. That is why he makes the comment that some humans are closer to Deity than others; in Morgan's view as humans are striving for such things they are reaching the pinnacle of complexity.

There are also significant differences between Morgan's representation and the ToK graphic. The differences should not be underestimated because they hold the key to why the ToK System will succeed where previous proposals for emergent evolution failed. One important difference is the manner in which the ToK System represents time. When emergent evolution was being proposed, philosophers and theorists almost universally held a steady state theory of the universe. In contrast, the ToK's depiction is consistent with modern cosmology's theory of the Big Bang and cosmic evolution (Chaisson, 2001).

The second major difference is the ToK's depiction of different dimensions of complexity and associated joint points. Although emergent evolution attracted much attention during the 1920s and 1930s, a problem emerged because numerous proposals appeared and each offered a slightly different scheme for carving nature at its joints. For example, W. M. Wheeler (1928) argued for three levels: matter, life, and society. In contrast Broad (1926) argued for four levels, the physical, the chemical, the organic, and the mental. Sellars (1926) offered a vision of four levels that directly parallel the four domains of the ToK System: inanimate matter, animate nature, mind, and society/persons/civilization. These and other proposals followed in Morgan's tradition of emergent evolution. But in the mid 1930s the influence of emergent evolutionary perspectives waned because none of the proposals precisely defined the levels nor explained why or how they came into existence, and there was no clear way to determine which of the myriad proposals contained the most validity. With its proposed joint points and dimension of complexity argument, it is precisely these gaps in emergent evolutionary models that the ToK System fills in.

Another factor in the eclipse of emergent evolution was the rise of logical positivism. Logical positivism combined an emphasis on empiricism with a focus on logical coherence in an attempt to produce a purely scientific account of everything. Promoted by a group of philosophers known as the Vienna Circle, logical positivism became enormously influential. One of the leaders of this group, Rudolf Carnap, was a physical reductionist. His philosophy was an essential leveling down, so that chemistry, biology, and psychology would ultimately be reduced to physics. Carnap also argued strongly against building grand schemes of nature. Instead, he saw science as a cooperative, cumulative exercise of specialists. The logical positivists thus saw the grand schemes of the emergent evolutionists as incorrect both because such schemes seemed to argue against reductionism and because they were superfluous. Although now generally considered debunked, logical positivism was very influential from the 1940s through the 1970s.

To summarize, at the turn of the twentieth century a host of scholars led by Morgan offered a vision of nature that is quite similar in form and function to the ToK System. These emergent evolutionists argued, in contrast to the vitalists, that no supernatural force was necessary to explain phenomena like life and mind. However, in contrast to the physical reductionists, they argued these phenomena were not *just* energy and matter, and they could not, even in principle, be reduced to physics. Despite these insights, a proliferation of competing proposals and lack of agreement about what exactly the levels were, why there were levels, and how they emerged resulted in major stumbling blocks for the emergent evolutionary philosophy. A reductionist revival occurred in the mid 1930s, and grand knowledge schemes were relegated to the dustbin of history. But the reductionistic systems of the logical positivists have also generally failed as coherent philosophies, a point made strongly by philosophers like Oliver Reiser and others. Currently philosophers of science offer conceptions of nature that either lean toward reductionism or emergence, but there is little consensus, clarity, or agreement regarding these concepts.

One modern day theorist who clearly has philosophical roots in the tradition of Carnap and the logical positivists is Edward O. Wilson. Recognized as the father of

sociobiology and currently one of the most widely known and influential scientists, in the late 1990s he offered a new grand synthesis called *Consilience: The Unity of Knowledge*. Analyzing Wilson's career and his proposal provides a useful model to compare and contrast with the ToK System, and the next section of this chapter is devoted to this story.

The Modern Evolutionary Synthesis and the Emergence of Sociobiology

The modern evolutionary synthesis is the second joint point on the ToK System, providing the framework for understanding how biological complexity (Life) emerged out of material processes. The modern synthesis unified biology and is one of the great achievements of twentieth-century science. It refers to the merger of Darwin's theory of natural selection with genetics, such that current understanding is that biological complexity is ultimately a function of natural selection operating on genetic combinations across the generations. It is important to note that the modern synthesis was a hard fought intellectual struggle that emerged over decades of debate, dispute, and research.

In the 1920s and 1930s, biology was a fragmented science. Fundamentally incompatible versions of evolution were being advanced, and there was a vitriolic split between the "naturalists" and "experimental geneticists." The naturalists, who studied organisms in the wild, tended to advocate for a more holistic, gradual, organic view of evolution that was generally consistent with Darwin's natural selection but was often also infused with Lamarkian notions. In contrast, the early experimental geneticists tended to be saltationists who believed that change resulted from major genetic mutations and that natural selection played a minor role. Mayr and Provine (1998) provide a wonderfully rich and detailed history of how disputes in biology were ultimately resolved with the formation of a single, coherent paradigm. Mendelian genetics was finally recognized to fill major gaps in Darwin's theory; namely, it provided the mechanisms for inheritance and variation.

Importantly from the vantage point of the ToK System, the modern synthesis provided the theoretical framework to differentiate biology from chemistry. George Williams (1966) summed up the issues as follows:

> We are dealing with life when we are forced to invoke natural selection to achieve a complete explanation of an observed system. In this sense the principles of chemistry and physics are not enough. At the least one additional postulate of natural selection and its consequence, adaptation, are needed. (p. 5)

Richard Dawkins (1999, p. 113) similarly described how "living matter introduces a *whole new set of rungs to the ladder of complexity*" (emphasis added) via natural selection operating on genetic combinations across the generations. Although genes are coordinated populations of molecules, individual molecules are not "small" genes. Genes are irreducible points of complexity and can be conceptualized as digits of bio-chemical information. In this light, biology can be thought of as the

study of genetic information generated by the complexity building feedback loop of natural selection.

The modern synthesis provided the intellectual grounding for Edward O. Wilson, who emerged onto the international scene in 1975 with an influential and controversial text called *Sociobiology: The New Synthesis*. The strength of the book—its foundational organizing insight—resided in explicating the synthetic explanatory power that kin selection offered for understanding animal social behavior in general and explaining altruism in particular. It was William Hamilton, building on the work of R. A. Fischer and others, who was most responsible for elucidating the crucial relationship between kin selection and altruistic behavior. Altruism is sacrificing one's own resources, survival or reproductive capacity for the benefit of another, and there are many examples of altruism throughout the animal kingdom. This was a problem for traditional Darwinian models. If animals varied in their tendencies to be self-sacrificing, it followed that those who tended to be more self-sacrificing would leave fewer offspring behind and thus the tendency should decrease in frequency across the generations. And yet altruism, especially toward kin, is a fairly common behavioral tendency.

Hamilton took a gene's eye view on the issue and made a major breakthrough with an idea he called inclusive fitness. Inclusive fitness refers to the reproductive success of the individual and individual's kin, relative to their genetic relatedness. He made this insight by recognizing that natural selection operates on genetic material and that genes are shared among kin. We share 50% of our unique genetic makeup with our parents and siblings and children, 25% with our grandparents, uncles, aunts, nieces, and nephews, 12.5% with cousins, and so forth. Hamilton recognized that actions that benefit kin benefit one's genes, hence the term kin selection. In concrete terms, if I decide not to marry and have no children but instead I sacrifice to raise my brother's four children, in the currency of genes in the next generation, it is the equivalent of me having two children.

Thinking about this in terms of behavioral tendencies that would evolve, imagine that my brother and I are part of a tribe that has had difficulty hunting lately, and we are both extremely hungry. I am fortunate and spear a wild pig. I cook it up and eat my fill, but my brother returns empty handed. He is hungry and requests some meat. Should I give it to him? Speaking solely from a gene's eye view, the answer is probably. Because I have eaten my fill, the remaining meat is now less valuable to me. Let's give it an arbitrary energy value of three units. My brother, however, is famished and the same amount of food is worth a value of eight energy units to him. Hamilton realized that behavioral tendencies would be selected for in a manner that can be represented in the following simple equation $c<rb$, where "c" is the cost in fitness to the individual sacrificing, "b" is the benefit in fitness to the other individual and "r" is the degree of genetic relatedness. In the current example, giving away the meat costs me three, but it benefits my brother eight and since he shares 50% of my genetic material the overall benefit to my inclusive fitness is four and thus natural selection would result in animals that had the tendency to share under these circumstances. This conclusion is reached without even considering other factors, such as the impact of my sharing versus not sharing on his future behavior toward me.

Inclusive fitness theory provided an explanation of how selfish genes can build altruistic animals, and thus it represented a major advance in evolutionary theory in general and the understanding of animal social behavior in particular. One aspect of animal behavior that was particularly changed in light of Hamilton's inclusive fitness theory was that of the social, or more technically, eusocial insects. Eusocial insects (e.g., ants, bees, and wasps) form highly specialized colonies which, importantly for this discussion, involve the production of sterile members who carry out specialized tasks, engage in group defense including altruistic self-sacrifice, and provide care for the reproducing member or members of the colony.

Lacking knowledge of genetics in general and inclusive fitness theory in particular, the eusocial insects greatly troubled Darwin. After all, if adaptive evolution unfolds by the differential rates of survival and reproduction, how can a species succeed in which most individuals don't breed at all? Or, even more crucially, how could individuals evolve who suppressed their own reproductive capacity and instead worked in the service of someone else (i.e., the queen)? Since the workers do not breed, their fitness should be zero and any heritable factors contributing to this tendency should be eliminated from the population immediately. In *Origin of Species*, Darwin (1859/2008, p. 234) called this behavior the "one special difficulty, which at first appeared to me insuperable, and actually fatal to my theory."

Hamilton's inclusive fitness theory offered a brilliant solution. It turns out by the special mechanics of their reproductive process, technically termed haplodiploidy, workers who are all sisters in the colony theoretically share 75% of their genes instead of the more typical 50%. Because of this, Hamilton termed them "supersisters." Thus, sterile workers are more closely related to their supersisters than to any offspring they might have, meaning that from the point of view of inclusive fitness theory, it is more advantageous to help raise sisters than their own daughters! In short, inclusive fitness theory helped the behavior of the social insects to be transformed from one of the great enigmas in evolutionary theory to one of its greatest triumphs.

It is not accidental, then, that Wilson was making his mark as an entomologist specializing in ants at the time when Hamilton's ideas were being confirmed. The triumphant feelings associated with the power of inclusive fitness theory seeped through the pages of *Sociobiology*. For example, Wilson (1975, p. 416) reported how the "strange calculus" of haplodiploidy results in a "nonobvious" prediction regarding the behavioral tendencies of the few male drones in the colony:

> Consider for example the prediction that males should be consistently more selfish than females toward everyone else in the colony [because of their lesser genetic relatedness]...Not only is this prediction met in nature; its fulfillment seems explicable only by [inclusive fitness theory]. The selfishness of male behavior is well known but has never before been adequately explained—in our language, the word "drone" has come to designate any lazy, parasitic person.[1]

[1] Although this is true historically, it is important to note that further scientific analysis of haplodiploidy has significantly dampened the initially perceived brilliance of this explanation in accounting for the eusocial insects. As David Sloan Wilson and Edward O. Wilson (2007, p. 340)

Sociobiology was a weighty book that consisted of twenty-seven chapters on the latest research on animal social behavior through the lens of modern evolutionary theory. Of course, many previous texts had been compiled on the general topic of animal behavior, and many of the chapters in Wilson's book were quite technical. Thus, one would have expected the book to simply occupy the shelves of academics specializing in evolutionary approaches to animal behavior rather than launching a full-scale academic maelstrom that would result in Wilson being picketed, compared with Nazis, and having a glass of cold water dumped on him at a conference. What was it about *Sociobiology* that made it crackle with controversy in academic circles and beyond?

Without a doubt, it was the first and last chapters of Wilson's book that shifted the nature of its impact from an impressive scholarly tome to a text that touched off a firestorm of debate in the late 1970s and early 1980s. The first chapter, *The Morality of the Gene*, was only four pages long, but it connected sociobiology to ethical philosophy in a manner that raised the echo of Social Darwinism. It also depicted a rather imperialistic diagram where sociobiology, along with neuroscience, would replace ethology and comparative psychology as the primary explicators of animal behavior. Finally, it announced that sociobiology wasn't just about nonhuman animals. And, indeed, the last chapter of the book, *Man: From Sociobiology to Sociology*, outlined how the new view could biologize the social sciences and fold them into the explanatory network afforded by the modern synthesis.

As Wilson recounted it in his later book *Promethean Fire*, coauthored with Charles Lumsden (Lumsden & Wilson, 1983), there were two major aspects of the controversy that surrounded sociobiology, and both pertained to applying sociobiology to humans. The first major controversy became public on November 13, 1975, when a group of fifteen or so scholars, teachers, and students from the Boston area (most notably among them were Wilson's Harvard colleagues, Stephen J. Gould and Richard Lewontin) formed a group called Science for the People and published a letter in the *New York Review of Books* that said that any applications of sociobiology to humans were to be condemned because they were too politically dangerous. The letter linked examining biological bases of human behavior to Social Darwinism and Nazi Germany. Even hypotheses stemming from such ideas. . .

> consistently tend to provide a genetic justification of the status quo and of existing privileges for certain groups according to class, race or sex. Historically, powerful countries or ruling groups within them have drawn support for the maintenance or extension of their power from these products of the scientific community. . .These theories provided an important basis for the enactment of sterilization laws. . .and also the eugenics policies which led to the establishment of the gas chambers in Nazi Germany. (Cited in Lumsden & Wilson, 1983, p. 39)

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note in an article revisiting the theoretical and empirical foundations of sociobiology, "the haplodiploidy hypothesis has failed on empirical grounds. In addition to termites, numerous other diploid eusocial clades in insects and other taxa have been discovered since the 1960s, enough to render the association of haplodiploidy and eusociality statistically insignificant." The authors argue a more complete explanation requires an analysis of group level-selection.

Thus, the Science for the People opposed human sociobiology because its very pursuit implied a genetic basis for behavior that could be used to *justify* racism, sexism, and the status quo. This claim was designed to strike at Wilson's credibility and to raise questions about his motives, and it was very successful in spurring a highly public and politicized debate about sociobiology and its implications for humanity.

The second criticism was, according to Lumsden and Wilson, more intellectually substantial. It was the critique that the nature of human consciousness and culture had changed the equation so dramatically that although sociobiology might apply well to nonhuman animals, it could not have much relevance for the social sciences and humanities. The reason was because

> [W]hat is unique, richly structured, and most interesting in human existence is a product of the conscious mind permanently beyond the reach of biological investigation. The natural sciences can never be joined with the social sciences and humanities because the subject matter and whole intent are fundamentally different. (Lumsden & Wilson, 1983, p. 44)

Lumsden and Wilson (1983) agreed that this critique was largely correct. In fact, they opened their book speaking to the mystery surrounding this very issue:

> There is a missing link in human evolution about which few facts are known and little has been written. It is not any one of the intermediate forms connecting modern man to his primitive ape like ancestors. About the bodies and habits of these creatures we already know a great deal. . .The missing link is something more challenging—the early human mind. How did it come into existence? *Why* did it come into existence? (p. 1)

Wilson and Lumsden offered a proposal to address this mystery called gene-culture co-evolution, which attempted to provide a framework for human behavior that mixed the biological with the social. However, in the end most critics found that their formulation did little to explain social phenomena, link disparate social theories, or provide new avenues for research.

I hope it does not escape your attention that the Justification Hypothesis provides a clear framework for understanding and addressing the two primary criticisms that plagued Wilsons's sociobiology. As for the critiques offered by those in the Study Group and the like, Wilson repeatedly expressed surprise at the vitriolic nature of the criticism sociobiology encountered. It is likely that much of this surprise was because he overlooked the problem of the double hermeneutic. Recall from Chapter 1 that the double hermeneutic refers to the unique problem faced by those in the social sciences, which is that justification systems that are promoted to explain some facet of human behavior become used by humans and influence human behavior. Thus, the extent to which biological explanations for, say, male violence are promoted, there is a danger that such explanations become societal justifications legitimizing the status quo. And, of course, this is precisely why the Science for the People group objected to sociobiology applied to humans. Although this fact per se does not legitimize suppressing such biological explanations (a retort Wilson offered), it does leave social scientists with the conundrum regarding the much greater degree of confounded interdependence between facts and values for the social sciences as compared with natural sciences.

With respect to the second set of criticisms of sociobiology and the mystery of human consciousness, the Justification Hypothesis directly fills in Wilson's missing link between the human mind and the minds of other animals. Specifically, it offers a novel adaptive problem (the problem of social justification) to explain the form and function of the human self-consciousness system and to understand the evolution of human culture.

Wilson's Consilience: The Unity of Knowledge

In the 1980s Wilson became exhausted with the intense political battles that ensued following the introduction and promotion of sociobiology, and he redirected his attention elsewhere, most notably advocating the biophilia hypothesis, which is the notion that humans have an innate tendency to feel deeply affiliative toward nature (Wilson, 1984).[2] But in 1998 Wilson returned to the scene with perhaps his most ambitious scholarly work. In *Consilience: The Unity of Knowledge,* Wilson (1998) attempted a grand synthesis of the natural sciences, social sciences, and humanities. Because the unified theory is also a proposal for unifying human knowledge, an examination of *Consilience* is useful because it provides a way to understand the primary issues and core difficulties associated with any such proposal.

Wilson opened *Consilience* with an impassioned call for unified knowledge, although he acknowledged early that his quest was not currently based on science but instead was a "metaphysical world view, and a minority one at that" (Wilson, 1998, p. 9). He argued forcefully that if there could be a successful linkage of theory and facts that tied together the natural sciences with the social sciences and the humanities into a common framework of explanation, the potential payoff would be immense as it would allow our increasingly complex civilization a much needed common understanding from which to operate.

The logic underlying Wilson's consilience vision can be telescoped into essentially three steps. First, evolutionary biology is consilient with the physical sciences, which provides the foundational bedrock for all of science. Second, sociobiology allows for the understanding of animal social behavior via the lens of modern evolutionary biology. Third, because humans are animals, the social sciences must rest on a basic sociobiological foundation. To this formulation Wilson added the notion that because the humanities have radically different goals from science, they will remain as a separate great branch of learning. The social sciences are currently fragmented across the two great branches, and they will eventually split "with one part folding into or becoming continuous with biology, the other fusing with the humanities" (Wilson, 1998, p. 12). Finally, although the sciences and the humanities will remain separate, Wilson optimistically predicted that once consilience is achieved, the interconnections between the two great branches will be much more harmonious than is currently the case.

[2]Much of the content in this section and the next was published in Henriques (2008).

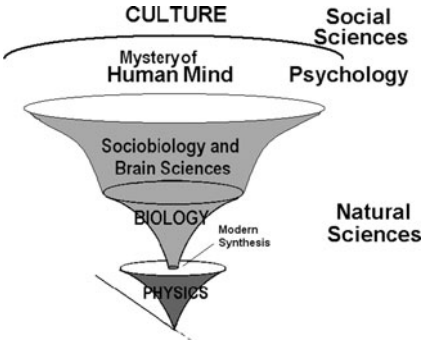

Fig. 6.4 A visual interpretation of Wilson's view of conslience

I attempt here to create a visual representation that is, to the best of my knowledge, a reasonable map of Wilson's vision of the sciences and their relations, constructed for comparison with the ToK System. Note that as with the ToK System there is a joint point between biology and physics, and that the modern synthesis provides the framework to explain biological complexity. However, from my reading of *Consilience*, Wilson does not perceive any fundamental dividing line between biology and animal behavior; nor does he seem to anticipate a "joint point" between biology and the social sciences. I make this conclusion from his argument that the science portion of the social sciences will fold into and become continuous with biology. At the same time he does acknowledge the leap from biology into human consciousness and culture to be a mystery, so I showed a break in the depiction (Fig. 6.4).

Consilience

Consilience received a huge amount of attention and has been hailed by many as bold, provocative and groundbreaking. However, it also received a substantial amount of criticism and resistance—so much so that Ceccarelli (2001) characterized it as failing in its goal to galvanize interdisciplinarity. In a powerful analysis of rhetorical inquiry, she compared and contrasted the response to *Consilience* to earlier interdisciplinary works by Dobzhansky (1937) and Schrödinger (1967), both of which were tremendously successful at building interdisciplinary bridges. By examining the difficulties Wilson encountered a clear picture emerges of the major problems any attempt at the unification of knowledge must address. Four major domains for which Wilson was criticized are the following: (1) Reductionism relative to emergence; (2) The relationship between the natural and social sciences; (3) The fact-value distinction and the relationship between the sciences and humanities; and (4) The need for unification and the nature of knowledge. After describing the criticisms levied against Wilson, I examined why the ToK System fares better than Consilience in its capacity to address these crucial philosophical issues.

Reductionism Versus Emergence

As was mentioned earlier, there remains in the philosophy of science conflicts between perspectives that emphasize emergence versus those that emphasize reductionism (e.g., Kim, 1999). This conflict is apparent and unresolved in Wilson's formulation. Todorov (1998) convincingly raises the critique that Wilson offered two versions of consilience, one "hard" and the other "soft." In the hard, reductionistic version, the world is essentially singular and material. Numerous times Wilson (1998) claimed that all of nature is organized by simple universal physical laws, to which all other principles can be reduced. This "hard" Wilson argued that there is only one class of explanation (p. 53); that nothing fundamentally separates human history from the course of physical history (p. 11); and that everything from "the birth of stars to the workings of social institutions, are based on material processes that are ultimately reducible, however long and tortuous the sequences to the laws of physics" (p. 266). By virtually all accounts, the hard version appears to be guilty of what Daniel Dennett (1995, p. 82) labeled "greedy reductionism," in which the boundaries between disciplines melt away and the vocabulary of physics becomes the one and only true explanatory framework because, after all, everything is energy and matter.

Yet there is also the "soft," more agreeable Wilson who claimed that we need more investigation into the emergent, holistic properties of the mind (p. 109); that virtually all human behavior is transmitted by culture (p. 126); that physics doesn't explain life (p. 68), and that biology doesn't explain culture (p. 127); and that "the ultimate goal of science" is synthesis rather than reduction (p. 211). Yet, by straddling reductionism and emergence, the picture offered by *Consilience* is not at all clear on this central issue.

The Relationship Between the Natural and Social Sciences

Wilson's ambiguous stance toward reductionism is paralleled in his articulation of the relationship between the natural and social sciences. On the one hand, he seems to call for bridge building efforts in which natural and social scientists can mutually benefit from less hostile exchanges—that is, if only social scientists would simply recognize that culture is in some ways connected to biology. This is, of course, a relatively soft claim. As Wilson (1998, p. 188) himself admits, there are far fewer "biophobic" adherents to the Standard Social Science Model than there were 20 years ago. In other places the hard version of Wilson shows up. Envisioning, as he does, the social sciences folding into biology echoes his earlier claims that sociobiology would cannibalize the social sciences. In addition to offering a picture of the sciences that Burnett (1998) characterized as "distressingly flat," Wilson at times also showed a brazen arrogance about the abilities of natural scientists relative to social scientists and those in the humanities. Rose (1999) expressed embarrassment at Wilson's apparent "contempt" of those in working other disciplines.

In a manner that clearly paralleled the ambiguous claims about emergence and reductionism, confusing questions remain about the hierarchical nature of the sciences in his version of consilience. For example, it remains unclear whether Wilson was arguing that the language, theories, and methodologies of the natural scientists will replace those of the social scientists (hard version), or will social scientists simply come to anchor their ideas more clearly to a natural science foundation (soft version)? Are there identifiable boundaries between the sciences or eventually will all sciences become physical sciences? Or will there be broad categories and boundaries between the physical and biological sciences or perhaps between the physical, biological, and social sciences? If there are to be boundaries, where are they and why will they be drawn at those junctures? For all its detail, *Consilience* does not answer these basic questions.

The Fact-Value Distinction and the Relationship Between the Sciences and Humanities

The fact-value distinction is one of the most important in all of philosophy, but Wilson brushes it aside, claiming that the naturalistic fallacy is itself a fallacy and that oughts are simply another form of is. "Ought is the product of a material process," (p. 251) the seemingly hard version of Wilson writes. Yet the obvious question that exposes the dark underbelly of the naturalistic fallacy is not dealt with at all: Is everything that is natural good? Numerous philosophical and empirical analyses have demonstrated that the answer is clearly no; yet Wilson's ethical analysis provides little information regarding which natural oughts we ought to adhere.

Although all justification systems are complicated mixtures of facts and values, nonetheless it remains clear that descriptive statements about what "is" the case can be analytically separated from prescriptive claims about what "ought to be" (Henriques, 2005). And it is generally well recognized that the sciences and the humanities have different charges with regards to these two types of claims. The basic sciences serve to generate the most general descriptive claims, whereas the expressive creativity embodied in the humanities carries with it the charge of illuminating how the world could be (Jones, 1965). Thus, Wilson achieves his connection between the sciences and the humanities by ineffectively blurring one of the most foundational distinctions in knowledge—the difference between facts and values.

The Need for Unification and the Nature of Knowledge

Numerous critics questioned the necessity and the reasonableness of Wilson's call for a more unified system of knowledge. For example, Rorty (1998b) questioned the need for consilience and instead argued that the various academic disciplines

are functioning just fine. Indeed, many reviewers with different epistemological leanings questioned the need for unity and others strongly objected to Wilson's derisive dismissal of any and all forms of postmodernism or relativism and his general denigration of philosophy (e.g., Quackenbush, 2005).

The problems associated with Wilson's philosophical stance are increased because careful examination of his position reveals significant confusions about the kind of thing he claims science to be. At one point he stated clearly that "science is neither a philosophy nor a belief system" (Wilson, 1998, p. 45) and supporters applauded Wilson for "debunking" the notion that science is a social construction (Kurtz, 1998). Yet, he also described science as "the boldest metaphysics of the age. . .a thoroughly human construct, driven by the faith that if we dream, press to discover, and dream again" (p. 12) understanding will be ours. At another point he described science as "religion liberated and writ large" (p. 6). Finally, in a statement that adds to the ambiguity, he acknowledged his belief in consilience to be metaphysical rather than scientific, although he asserted that consilience within the natural sciences can already be considered a scientific truth (p. 9) despite the fact that many scientists and philosophers would dispute such a claim.

While the above focus on criticisms is likely to leave a harsh impression of Wilson's attempt at unifying knowledge, it is important to temper this characterization for several reasons. First, the book was a monumental effort that surveyed a huge landscape of information. Second, it generated much productive discussion that provides a way of examining and framing many of the fundamental issues that arise when attempting to generate a scheme for unified knowledge. Third, I believe the hypothesis regarding the unity of knowledge is viable, and I share the notion that if it could be successfully achieved, it would be of tremendous benefit to humanity. Of course, even if one agrees in principle that a unified theory of knowledge would be extremely valuable, it does not follow that support should be thrown towards any such proposal. It is precisely because the implications of such a theory are so profound that the scrutiny and criticism of all potentially viable proposals should be intense. I am critical of Wilson here because it is clear to me that although his version of consilience has much going for it, it nevertheless is wrong in key aspects.

Achieving Consilience with the ToK System

Analyzing the critiques levied against Wilson allows us to ask how the ToK System deals with similar problems. Does the ToK System deal effectively with the problem of emergence and reductionism? Does it clearly specify the relationship between the natural and social sciences? Does it effectively deal with the fact-value distinction and the relationship between the sciences and humanities? And does it clarify the nature of scientific knowledge and its relation to human belief systems? I now turn to those issues.

Reductionism Versus Emergence

As already alluded to, with its pictographic representation, the ToK System offers a new vantage point to explore the relationship between reductionism and emergence. Consider, for example, how the ToK simultaneously captures both the essential truth of Wilson's basic claims *and* his critics' major complaints. As illustrated by the ToK and proclaimed by Wilson, the unity of scientific knowledge is a possibility, and energy and matter do indeed provide the physical basis out of which the higher dimensions grow. Furthermore, each emergent dimension of complexity incorporates and "must not violate" the dimension beneath it (see Tooby & Cosmides, 1992).

The extremely close correspondence between the ToK System and the natural science viewpoint is strikingly seen when compared to Chaisson's (2001) work in cosmic evolution. Chaisson offered a fascinating proposal for the quantification of complexity called the free energy rate density, expressed in units of energy per time per mass and denoted by the symbol Φ_m. Remarkably, this purely quantitative ratio yields a time by complexity hierarchical plot of rocks, plants, animals and human societies in an equidistant and sequential order (see Chaisson, 2001, p. 140) that directly overlaps with the map of complexity provided by the ToK System. In short the ToK is consistent with a "bottom up" perspective and should allay any concerns that the psychological and social sciences are not appropriately anchored to and consilient with their bio-physical base.

Yet at the same time there can be no doubt that the ToK System strongly rejects greedy reductionism of the kind offered by neuro-philosophers (e.g., Churchland, 1986; see Rand & Ilardi, 2005) or the "hard" Wilson. Consistent with the philosophy of emergent evolution and the primary concerns of psychologists and social scientists, with its depiction of dimensions of complexity and joint points, the system grants genuine ontological status to mental behaviors and justification systems. The unified theory also clearly allows for downward causation and a top down perspective. The large-scale justification systems that are the essence of society are seen to play a causal role in the formation of individual justification systems, which in turn influence the neuro-behavioral investment system, which plays a causal role in changing the biological and physical dimensions as well. For example, according to the ToK System, the events of September 11, 2001, can only be understood from the perspective of competing justification systems (Shealy, 2005). Although behaviors at the psychological, biological, and physical dimensions played a crucial role in how the events transpired, the events themselves could never be fully reduced to these dimensions of complexity without a huge loss of explanatory power. The physics of momentum, heat, and gravity can explain why the towers fell, but only a social science view that elucidates the dynamics between various micro and macro-level justification systems could possibly explain why the planes were flown into the towers in the first place.

As the preceding discussion suggests, much of the debate concerning reductionism and emergence can be framed by considering the concept from two opposing, perhaps even "fear driven" points of view. The first point of view, frequently

expressed by Wilson and his supporters, is the notion that all phenomena are material. The fear here is that failure to accept this point leads to an unworkable dualism. The second and opposing viewpoint protests that mental and social events are not "just" material processes and that a greedily reductionistic materialism is precisely that. The ToK System validates both perspectives and simultaneously debunks the fears of the Wilsonian natural scientists that the social sciences will exist in a free float, while at the same time it addresses the fears of psychologists and social scientists in that it preserves the integrity of their dimensions of analysis. In short the ToK System offers a consilient frame from which to view the world simultaneously from bottom-up and top-down perspectives.

The Boundaries Between the Natural and Social Sciences

One of the most salient aspects about the ToK System is the manner in which it aligns the evolved dimensions of complexity with broad domains of science. A preliminary examination of the ToK suggests that rather than two broad divisions of science (natural v. social) there, in actuality, should be four divisions: the physical, biological, psychological and social. However, once this initial observation is specified, it remains that the traditional distinction between the natural and social sciences can be readily understood via the ToK System. From the vantage point of the ToK, the physical, biological sciences and the disciplines that make up psychological formalism (e.g., the cognitive, behavioral, and neurosciences, see Henriques, 2004) would make up the natural sciences, whereas, human psychology (e.g., personality, social, human developmental psychology) would be merged with the rest of the human sciences (e.g., anthropology, sociology, economics) to make up the social sciences (see also Quackenbush, 2005). The reason for the division of these two domains of psychology is explained in detail in Chapter 7.

The Fact-Value Distinction and the Relationship Between the Sciences and Humanities

Wilson identified the relationship between the sciences and humanities as central and effectively argued that it should be at the very center of higher education, proclaiming that, "Every college student should be able to answer the following question: What is the relationship between science and the humanities, and how important is it for human welfare?" (p. 13). Yet, because Wilson offers an unsatisfactory resolution of the fact-value distinction, his linkage between the sciences and humanities is also dubious. Most in the sciences recognize that questions of "ought" are of a fundamentally different kind than questions of "is." Indeed, the purity *and* limitations of the scientific method become apparent as soon as one moves from basic descriptions to more prescriptive applications.

The ToK System is consistent with this basic understanding of facts and values, and with the Justification Hypothesis it becomes possible to explain why the

fact-value distinction exists in the first place. As Quackenbush (2008, p. 757) eloquently articulates it, the Justification Hypothesis allows for an understanding of the emergence of "the profound tension between *theoretical* analyses of the natural order and *practical* accounts of our experience as moral agents." But Quackenbush goes beyond merely articulating how the problem emerged. He also offers a compelling account of how facts and values are inter-related in all human knowledge systems and specifies in rich detail why the problem of value remains an unresolved issue at the very heart of the *basic* social sciences.

The distinction between facts and values *and* their inescapable interrelation in all knowledge systems is crucial to understanding the relation between the sciences and the humanities. The reason is because it resolves a major point of ambiguity, namely the question of whether and how the sciences and humanities are separated by a focus on facts relative to values. From the vantage point of the ToK System in general, and the Justification Hypothesis in particular, there is a fundamental difference between descriptive and prescriptive justification systems. That fundamental difference, to answer Wilson's question posed to college students, plays a crucial role in defining that which separates and organizes the sciences and humanities. The former have the charge of basic description and the latter the charge of expressing how the world could be, which in turn connects to how the world ought to be. However, because all knowledge systems are complicated admixtures of facts and values, it is far more accurate to conceive of the tensions between descriptive and prescriptive justifications as existing on a dialectical continuum rather than a dichotomy.

Interestingly, precisely this argument was made over four decades ago. In his outstanding work, *The Sciences and the Humanities*, Jones (1965) observes, "most philosophers either deny that there is any important difference between scientific and humanistic languages, or else, if they recognize a difference, they regard it as radical, a sharp difference in kind" (p. 155). Jones proceeded to demonstrate that questions of fact and questions of value, although separable, should not be conceived of in dichotomous terms when looking at systems of knowledge but instead should be seen as existing on a dialectical dimension (see Jones, 1965, p. 153 for a graphic representation of this dialectic). And Jones convincingly argues that the sciences represent descriptive–designative end of the dialectic, whereas the humanities represent the prescriptive–expressive end.

The Need for Unification and the Nature of Knowledge

I strongly agree with Wilson that if a coherent, unified vision of knowledge could be developed, it would be of tremendous benefit to humanity. As history seems to attest, the absence of a collective worldview ostensibly condemns humanity to an endless series of conflicts that inevitably stem from incompatible, partially correct, locally situated justification systems. Thus, there are good reasons for believing that if there was a shared general background of explanation, then humanity might be able to achieve much greater levels of harmonious relations.

One area that clearly could benefit from more mutual understanding is the split between the "naturalists" and the "social constructionists" concerning the nature of scientific knowledge. One of the most novel and unique features of the ToK System is the manner in which it depicts where scientific knowledge exists *and* how it emerges out of culture to provide a descriptive map of complexity and change (i.e., the shape of the knowable universe through time). Congruent with the primary claims of the social constructionists (and Wilson's comment that science is a "thoroughly human construct"), science is seen as a "particular branch in the evolution of justification systems" (Henriques, 2003a, p. 155). Thus, in a nod to the constructionist, it must be recognized that science is a cultural product and can and should be studied as such. However, the nature of science is that it is "built on the value of accuracy" (Henriques, 2003a, p. 155), which, in a nod to the naturalist, makes it a very different kind of justification system. In short I believe the depiction of scientific knowledge offered by the ToK System can go a long way toward mapping out the nature of science and resolving the acrimonious tensions between those who do science and those who focus on the cultural context in which science exists (Gieryn, 1999).

Aggression: A Concrete Example Contrasting the Two Approaches

Wilson won a Pulitzer Prize for his 1978 book *On Human Nature*, which outlined a sociobiological perspective on human behavior. The chapter on aggression opens with the proclamation that humans are clearly innately aggressive and that human aggressiveness is obviously a biologically adaptive behavioral response repertoire that reliably emerges in certain circumstances, a frame he briefly reiterated in *Consilience*. He specifically mentioned seven such circumstances where aggressive behavior reliably emerges: defense and conquest of territory, the assertion of dominance, sexual aggression, termination of weaning, aggression against prey, defensive counterattacks against predators, and moralistic aggression used by humans to enforce the rules of society.

Wilson provided examples of pacifist cultures that became aggressive when the circumstances changed and reported studies supporting the hypothesis that warfare evolved because aggressive traits increased the inclusive genetic fitness of human beings. Although the evolved adaptive nature of aggression was emphasized, Wilson did describe the genetic bases of aggression in terms of learned preparedness and mentioned the important role different cultural traditions play in the expression of aggressive behaviors. At one point Wilson explicitly proclaimed that, "only by considering the determinants of aggression at the three levels—the ultimate, biological predisposition; the requirements of the present environment; and the accidental details that contribute to cultural drift—can we fully comprehend its evolution in human societies" (1978, p. 116).

The chapter that follows aggression is on sex differences, and in it Wilson pointed out that as a group, males are more aggressive, more assertive, and more physically

venturesome. Much of the sex difference is explained in terms of sexual selection, with females representing a limiting resource around which males compete for access. Along with emphasizing the sex differences underlying tendencies toward aggression, Wilson also mentioned cultural and epigenetic factors, writing that he believed modest genetic differences are widened by learning and cultural factors.

Approaching aggression from the vantage point of the unified theory of psychology offered here reveals similarities and differences with Wilson's approach. First, Behavioral Investment Theory is directly consistent with Wilson's sociobiological viewpoint. Behavioral Investment Theory's core proposition is that the central nervous system computes the expenditure of energy on an investment value system build via evolution and learning. The following analysis from Wilson demonstrates the close correspondence between his perspective and Behavioral Investment Theory:

> Close studies by zoologists of the daily schedules, feeding behavior, and energy expenditures of individual animals have revealed that territorial [aggressive] behavior [occurs] only when the vital resource is economically defensible: the energy saved and the increase in survival and reproduction due to territorial defense outweigh the energy expended and the risk of injury and death (Wilson, 1978, p. 107).

A second similarity pertains to the analysis of levels of complexity. Both Wilson's view and the ToK System are consistent with the idea that the emergence of aggressive behavior in humans must be understood on three "levels": the biological, the environmental/ontogenetic, and the cultural, although the ToK System does appear to offer a clearer depiction of how those levels are defined and interrelated.

There are also important ways in which the unified theory is quite different from Wilson's view. The first major difference pertains to emphasis on and incorporation of various perspectives, which is greatly facilitated by the diagrammatic representation offered by the ToK System. For Wilson, the evolutionary view receives the vast majority of the attention and although he mentions developmental and cultural factors, the theoretical viewpoints are not well incorporated into his system. In contrast the theory of theories view afforded by the unified theory does not prioritize one piece of the puzzle over others but instead provides an integrative frame to hold a multitude of perspectives that exist at each dimension of analysis (physical, biological, psychological, and social). For example, Behavioral Investment Theory readily integrates theory and research from learning theory, as the consequences acts of aggression have during the course of an animal's lifetime are explicitly predicted to influence the likelihood such behaviors will be emitted. Furthermore, with its emphasis on computational processes, Behavioral Investment Theory incorporates social cognitive perspectives (e.g., vicarious learning) as well. In addition, the Influence Matrix provides a framework that can incorporate trait theory and psychodynamic factors to understand the individual difference variables associated with aggression and violence, an area that evolutionary approaches are notoriously weak in explaining.

The second major difference between Wilson's views and the unified theory is realized via the Justification Hypothesis which offers an explicit lens to view

individual and societal justification systems. For example, in *Prisoners of Hate*, Beck (1999b) analyzed the various ways individuals justify their violent actions, usually through beliefs that others are manipulative, controlling, ineffective or deceitful combined with beliefs legitimizing self-interest, power, and autonomy in a manner that is directly consistent with the Justification Hypothesis. The Justification Hypothesis also provides a clear lens to see how large-scale beliefs function to influence and coordinate human behaviors becomes clear. Consider that the central feminist concern is in the manner in which males in power create knowledge systems (scientific, legal, political, or otherwise) that function to justify the patriarchal status quo. Contrast this perspective with Wilson's characterization of the cultural level described above (i.e., "accidental details that contribute to cultural drift").

The third major area of difference is that the ToK System explicitly recognizes that the social sciences face the aforementioned problem of the double hermeneutic. Thus to the extent that biological explanations for male violence are promoted, there is a danger that such explanations become societal justifications. There are no simple solutions to this problem, but awareness of it via the picture afforded by the unified theory should result in avoiding some of the minefields that some of the pioneers of sociobiology unexpectedly wandered into by baldly proclaiming that aggression is innate and males are more aggressive than females.

Conclusion

The ToK System provides the overarching meta-theoretical frame that defines key concepts like Life, Mind, Culture and behavior and provides a diagrammatic representation that shows how they exist in relationship to one another. The ToK System thus represents a new attempt at consilience, one that avoids many of the problems and pitfalls associated with Wilson's proposal but one that retains the noble and hopeful aspects of the vision. It is a system that I believe can hold and honor the views of natural scientists, social scientists, and humanistic thinkers alike. And this meta-theoretical framework, with its new model of emergent evolution as consisting of four separable dimensions of complexity that evolve as a consequence of novel information processing systems, sets the stage for a new analysis solving the problem of psychology.