Worldviews: A Darwinian View of Human Decision-Making

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Introduction

Perhaps the most important event in our evolutionary history, as measured by its implications for our future, is the evolution of our cognition. How did the way we think evolve, and what are the important legacies of that evolutionary history? How we see the world around us is one of these important legacies and may well turn out to be the crucial one in determining our fate. But where do we start in an attempt to makes sense of the diversity of worldviews and belief systems that human beings have? Modern naturalistic philosophy provides such an entry point and, in this case, proceeds our biological understanding of human cognition.

A Mediated World

> Naive Realism—"...the dogged assumption that the human sensory apparatus accurately records the one and only real world, of which the human brain can make but one accurate model."—Ferris, 1992

Modern naturalistic philosophy rejects "naive realism." This, however, doesn't mean that naturalism rejects the existence of a concrete reality apart from our mental existence. Instead, the position that naturalism takes can best be call "qualified" realism. The "qualification" is that we experience external reality only through the mediation of our mental images of that reality. This is the basic epistemological assumption that makes the concept of worldviews important. For worldviews are the working collection of beliefs and theories that mediate our interactions with the external world. As Larry Laudan puts it: "we find ourselves in a situation where our only contact with the world is mediated by our concepts. We posit certain beliefs or theories to make sense of that mediated world. If those beliefs or theories were entirely free-floating and reflected nothing whatever about the world itself, then it world be unthinkable that they would enable us to manipulate the world as effectively as we can." (Laudan, 1990, 165-166)

But given this mediated world, how do we decide which course of action to follow out of all possible courses of action? How do we decide which behavior is "right" and which is "wrong"? There is more to this question. We have no choice, conscious or otherwise, in whether we respond to the external world. We must respond or die. Think no further than our need to find enough food or water. So when I discuss worldviews I am not concerned with lofty issues of ethics and moral behavior. Rather, I am concerned with the processes that mediate our most basic behavioral responses to external stimuli.

Jerison provides this portrait of a mediated world:

> "Reality is a creation of the nervous system, ..." "The 'true' or 'real' world is specific to a species and is dependent on how the brain of the species works. This is as true for our own world—the world as we know it—as it is for the world of any species." "What the brain produces, therefore, is a kind of mental model of the world, a system for handling the information that flows from sense organs and for generating the appropriate responses. The integration of the sensory data, one with another, is central to monitoring the 'out there' and to creating a model of it 'in here.' The 'in here' becomes the real world as an individual animal experiences it."—in Leakey, 1992

What is crucial in Jerison's passage is what he means by appropriate in the phase "for generating the appropriate responses". Appropriate in what sense? Appropriate in the Darwinian sense of appropriate for successful survival and reproduction or appropriate in the ethical sense of "proper" conduct? Appropriate response has a subtler meaning if viewed from the phase "tracking external reality", or in Jerison's words "monitoring the 'out there'." In that a behavioral response is "appropriate" if the behavior closely tracks external reality. Please note, however, that an appropriate behavioral response does not mean that our view of the world is a true reflection of external reality. It is very possible to develop an appropriate response to a given situation without having a true picture of the reality of that situation. It is possible to do the right thing for the wrong reasons.

A Formal Definition of Worldview

The idea of a worldview has a long and distinguished philosophical ancestry, dating back at least as far as Voltaire, who used the notion to characterize the difference between Cartesian and Newtonian science (Laudan, 1996). What follows is a formal definition that incorporates this philosophical precedence with what we have learned of the neurobiology of the brain.

A worldview is the environmentally determined state of the cognitive neural structure (or structures) in the human brain that is organized by "computational rules" to provide for adaptive decision-making in human behavioral responses to the external environment (Real, 1991). This mental model of external reality consists of intuitive theories about the processes that operate in the external world or how the world works; theories as to the historical state of external reality or how the world is; theories of self-identity that are derived from our mental model of the world; and a set of values derived from our self-identity that assigns priorities in decision-making. From these elements we build an image of how the world came to be and our place in that world. This image of our personal identity, in turn, determines what we hold to be of importance —our values.

Griffiths gives this picture of what a worldview is and does.

> "Our view of the universe is built up slowly from input acquired since the beginning of consciousness. This viewpoint represents our identity as individuals. It drives our attitudes and our actions and, as such, determines the kind of people we are and ultimately the kind of society we have."
> —Griffiths, 1991

The Cognitive Elements that Comprise a Worldview

There are five elements that comprise the cognitive structure of a worldview.

1. *"Theories" of Initial States* or "how the world is". This is what we believe about the historical context of our existence.

2. *"Theories" of Process* or theories about "how the world works". Theories of process are theories of causality.

3. *"Theories" of Self* are derived from our beliefs about initial states and our theories of process. Who and what we think we are is determined by our cosmology, our theories of human origins, and our theories of human nature.

4. *"Theories" of Value* or values are self-referential and are derived from our theories of self. What we value is determined by who and what we think we are.

5. *Desired Future States*—What we want for the future is determined by our valves. This is the link between ethical principles—how we modify our behavior to achieve a desired future—and the characteristics of a desired future as determined by our values.

The use of the term "theories", as used here, needs explanation. In this definition, theory may correspond to intuitive or generic hypothesises in the case where no formal indoctrination has occurred. Or conversely, "theory" may relate to dogma in the case of an individual who has been indoctrinated into a formal belief system such as a theistic religion. But it is also possible that "theory" as used above refers to an individual who is educated in and accepts the scientific theoretical accounts of both initial states and process.

Tracking External Reality

How do we tell if our view of the world corresponds to external reality, if we must always view the world through the lens of our mediating beliefs and theories? The problem can be described as tracking external reality or the effort to track the degree of match between what we think and what actually is. Objectivity is the traditional term used to describe the achievement of a match between our perception and reality. But it lacks the recognition that we must always view external reality through our worldview, and that our worldview is always a parody. By this definition we can never achieve complete objectivity. The goal we must settle for is getting as close a match as our beliefs will allow, a contingent correspondence. This view points up the necessity of changing our beliefs if experience shows they give us a poor match to the external world. That this is much more easily said than done is accepted folk wisdom.

To see how we attempt to track external reality, but must do so through the mediation of our beliefs, imagine if you were to wake up one morning in a strange place surrounded by a dense, gray fog. You can see nothing that would tell you where you are. All you can see is a dim light that filters through the fog and tells you that it is day. At first, as you are waking, you are aware only of yourself. Then suddenly you awake and your senses are flooded with information about your surroundings. It is cold and it's damp. The fog seems to cut right through you. You realize how you are dressed, too lightly it would appear for these cold, damp conditions. You suddenly understand how it is that you know you're outdoors—the light is from above and you can see blue sky occasionally through the fog. Then you become aware of sounds around you. A light breeze is blowing and there is the sound of it blowing through the grass at your feet. Suddenly you realize that you're standing in a field even though you can't see it. All you can see is a grassy circular area within a few feet of where you stand. Slowly you build up a mental image of where you are—in a grassy field in the country. But where? Your mind is trying to expand the limits of what you know about your world, trying to piece together where you are from the meager information of your senses. But before you can use that information your mind must create an image of what your senses are telling you. That mental image is not real nor is it complete. This mental image corresponds to our worldview. As we learn more about the world we see through the fog of our ignorance, we change our view of the world to correspond to that knowledge. If we do not change our beliefs, we put ourselves at risk of making decisions that could threaten our survival. We become, therefore, prisoners not only of the limited knowledge we have of the external world obtained through our senses, but also to the beliefs we hold about that world. The only comfort is that, if we are wrong, reality always finds a way to remind us. The rub, of course, is that we may not like how it's done.

Now imagine what it would be like for a newborn child in the same situation. What would it have to draw on in building up a mental image of its world? It would have no experience of grassy fields. A newborn has only memories of the womb. So where do we get our first mental images of the world, and how do we make sense of this first awareness?

We are, of course, taught our first mental images of the world. From the beginning we take in an image of reality that is given to us by our parents. In the very words they teach us are the structure and form of our developing view of the world. Slowly this image of reality is built and elaborated upon, all the while, we continue to sort through the information received by our senses. Slowly, we begin to see around us as if a fog were disappearing. First we see those near us, our parents, our siblings. As time passes we continue to learn about and experience the world around us, and our world grows larger. We become aware of new dimensions to our world, of new people and new things, but always through the lens given to us by our parents. While this is happening our mental image of the world helps us to give meaning to what we experience. We build up the context of our lives through this process. It is in this context, largely given to us, that we add new information about our world.

Preconceptions, Intuitive Theories and The Development of Worldviews

The idea of "preconceptions" found in modern learning theory (also known as intuitive theories, misconceptions, naive theories, children's science, and alternative frameworks) plays a central role in understanding the cognitive development of worldviews (NRC, 2000). This model of worldview development assumes that there is a cognitive structure in the brain that is involved in decision-making, and that this structure requires causal theories about the processes of the external world before it can be fully functional. The implication which follows from this is that the need for theories about the world is so great at some crucial developmental stage, that our minds take whatever theories are available and imprints them into the cognitive decision-making structure of the brain. This happens without regard to whether the theories in question are rational. And it occurs because, at some critical point in our cognitive development, we must become functional decision-makers.

It is reasonable to hypothesize that this crucial point in development has been set by natural selection at just prior to sexual maturity. The rationale for this hypothesis is that a fully functional decision-making faculty should be strongly selected for in child-rearing. The fact that we may make faulty decisions using intuitive theories does not offset the developmental need to be able to make decisions no matter what their outcome. Not making a decision creates a default situation where a decision is made for us by circumstances. Probability allows that any decision we make has a better, if not equal, chance of a positive outcome when compared to no decision at all.

There is a second, equally important implication that is also supported by what is known about preconceptions and intuitive theories. This comes from the observation of how difficult it is to change preconceptions once they become established. If the hypothesis is correct, that there is a crucial stage of development in the formation of worldviews, it lends support to the idea that once this stage is passed, it should be very difficult to change preconceptions about the external world.

Imprinting and The Cultural Transmission of Worldviews

Understanding the mechanisms of cultural transmission, such as imprinting, that produce the tenacious long-term conservation of irrational beliefs from one generation to the next may explain what we see as "intuitive theories" in our students.

> "Our parents' teachings are naturally subject to review as a result of subsequent cultural influences. There is, however, a mechanism that renders some areas of parental teaching particularly effective: humans' greater sensitivity to certain influences during the early years of life. There are critical periods in psychological development during which cultural influences leave indelible traces; if this influence is missing at the crucial moment, an individual may never develop correctly in the way determined during that phase. This mechanism, known as imprinting, is especially strong in animals."—Cavalli-Sforza, 1995, 210

> "Possibly we are born, not with any specific social norms, but with a learning agenda that tells us which information to imbibe and how to organize it." "In a sense, we are imprinted upon a particular moral system through a process that, though hundreds of times more complicated that the imprinting of birds, may be just as effective and lasting."—de Waal, 1996, 36

Although de Waal is talking about social norms, he could just as well be talking about the elements that comprise a worldview.

> "...transmission from parents to children, and from an entire social group to its components, are the cultural mechanisms that make innovation hardest to accept. This explains the extremely powerful trend toward cultural conservation." —Cavalli-Sforza, 1995, 210

Innovation in the case above is scientific knowledge of our world. What we see in science education is that young children are imprinting the irrational beliefs of their parents. They then come to the science classroom with an impenetrable fog of irrational beliefs and negative values toward learning that cannot be easily dislodged.

The Evolution of Human Cognition: Why do worldviews exist?

The starting point in addressing this question is the evolutionary elaboration of the human brain. The starting assumption is that consciousness is a by-product of an increasingly complex brain and not the cause of it becoming complex. The second observation is that consciousness includes, but is not limited to, an awareness of causality. As soon as the first hominids became aware of cause and effect the need for a cognitive structure to facilitate decision-making was born. Supplying this need provided the adaptive benefit that drove the further evolution of the cognitive structure involved in the creation of our worldviews.

The third point is that the evolution of our awareness of causality preceded the evolution of our language ability. The following passages are from John Maynard Smith and Eors Szathmary.

> "It is hard to suppose, therefore, that the increase in brain size, by a factor of almost three, could have been a response to selection for improved technical skill [i.e. making stone tools]. What selective force did lead to our larger brains? It is conceivable that the relevant factor was the evolution of language. It seems more likely, however, that language as we now know it evolved rather recently, and that it was responsible for the dramatic changes that have occurred in the past 100,000 years, not for the increase in brain size that took place earlier."—Maynard Smith & Szathmary, 1995, 276

> "We suggest, therefore, that the ability to form concepts and to manipulate them evolved because thinking helped survival, independently of whether the thought could be communicated."—Maynard Smith & Szathmary in Murphy & O'Neill, 1995, 74

Perhaps it is memory capacity that is the cognitive ability that was first selected for in the evolution of our cognition. The idea is straight forward. Increased memory capacity should logically come before the capacity to process that memory. Two million years ago our ancestor, *Homo habilis*, may have started down the road suggested by Jared Diamond where our brain "was performing tasks qualitatively similar to a chimpanzee's but smarter." (in Murphy & O'Neill 1995, 46) That smarter brain required more memory. And as you increase memory capacity you create the raw material that allows the evolution of more sophisticated cognitive processes such as the awareness of causality. But how does it follow that you need a decision-making faculty once you are aware of cause and effect?

Awareness and Chains of Causality

Once an individual becomes aware that given actions produce predictable results, then they become aware that different actions will produce different outcomes. If I do "A" then "C" always happens, but if I do "B" then "C" doesn't happen, "D" happens. The mere awareness of cause and effect produces the inherent need to make decisions about our behavior. What is it that I want to happen "C" or "D"? How do I decide? How do we decide between the different possible outcomes of our actions? In some cases this is a very easy decision. If I do "A" I will catch the rabbit and, therefore, not starve. In other cases the decision is very difficult. If I give the rabbit to my wife she will survive, but I will not. But if we share it, since it is so small, both of us will slowly starve.

What can be stated with a degree of certainty is that our innate capacity for decision-making was selected for over geological time for its ability to provide rapid decisions in an increasingly complex mental landscape. It is the result of competing

selective pressures in the evolution of human cognition—the continuing need for rapid decision-making, but in an increasingly complex and rich mental sensory environment coupled to a continually growing memory. Why didn't the human mind get bogged down in its ability to make rapid behavioral decisions as its mental awareness of the external world of cause and effect became increasingly more complex? What is it that allows us to choose quickly one course of action out of all of the possible courses of action that our minds could possibly sort through? Daniel C. Dennett in his book *Darwin's Dangerous Idea* provides the concept of "heuristic search" as his explanation to this question:

> "...the branching tree of all possible moves [decisions] has to be ruthlessly pruned by semi-intelligent, myopic demons [computational rules], leading to a risky, chance-ridden exploration of a tiny sub-portion of the whole [decision] space."—Dennett, 1995, 209

Heuristic search may be the algorithmic solution (read computational rules) used in the cognitive structure of our brains so that we can make rapid decisions in a complex decision space. But what is clear is that the neural decision-making structure that we find in our brains today is the adaptive compromise solution to the competing forces in our cognitive evolutionary history. The structure of this cognitive "organ" sets the boundary conditions of our worldview by imposing limitations upon its environmentally determined state. This environmentally determined state is, therefore, the resulting phenotypic response of our genome to the external world. This dynamic condition or "state" is what I define as our worldview. It is the functional condition of our mental ability to make decisions.

An important qualification—The cognitive neural structure that is involved in the creation of our worldview is only a part of the total brain / mind complex and should be thought of as only one out of a vast number of neural structures that make up that complex.

Hardware, Software, and Black Boxes—A Causal Analogy

A causal analogy is one where the causal relationships between the elements of a system are the same for two different systems even while the mechanism of the two systems are very different. Such an analogy for understanding the relationship of the cognitive neural structure to its environmentally determined state is that of computer hardware programmed by a specific software and with a specific data base. In the analogy the hardware is the cognitive neural structure and the specific software plus data base is the environmentally determined state of the structure. For anyone who is familiar with computers it is easy to see that computer hardware sets the limit on what the computer can do. The software, on the other hand, comprises the specific directions that allows the computer to function. Without it the computer would be useless. With it the computer can perform very specific tasks such as word processing. It is also clear that the software determines just how well the computer can do a given task. In effect there is a

synergistic interaction between hardware and software that determines the resulting abilities of the computer. A good software program cannot overcome the limitations of a computer with too small a memory. Just as a very powerful computer is useless with software that is poorly written. It takes a critical level of performance of each working with the other to create a functional state in the computer. But for a computer to actually produce something useful it needs a third component and that component is input. Input is the data base information that the software program must have in order to function. For the human worldview this input is sensory information about the external world. I will return to the importance of the nature of this input later. But for now it is useful to remember the hacker's homily of garbage in—garbage out.

I am aware of the criticisms of using the computer as an analogy for the human mind. I understand that this analogy is an oversimplification of an incredibly complex and dynamic organ. I also recognize that environmental factors play a crucial role in the development of the physical brain. There are many tragic examples of this ranging from fetal alcohol syndrome, to the effects of malnutrition on the developing brain, to stimulus depravation in young infants. But the basic analogy of hardware for the genetically determined physical brain and software plus data base for the environmentally determined mind is a valid causal analogy because the causal relationships between the elements of the two systems, the brain and the computer, are the same even while the mechanisms of the two are very different.

Let me clarify the main points of my position. At birth the genome represents only a future potential for the mind, not a specific predetermined outcome. This genetic potential is intrinsically limited by our evolutionary history. George C. Williams in his essay *A Sociobiological Expansion of Evolution and Ethics* provides a very clear picture of the role of the genome in determining the phenotype (Paradis & Williams, 1989).

> "The gene pool of a population is a record of reproductive success and failure in that population, and at conception an organism gets a sample of this record. The sample is its instructions for producing the machinery by which it adapts to its environment. All other useful information, such as that learned and stored in the brain, depends on the initial genetic information. New information can be exploited [only] because organs for the gathering, storage, and use of information are specified in the genes. Such organs are no less biological than those for the gathering, storage, and use of food. Both kinds of organs are there because they have been useful in previous generations for transmitting genes to later generations."

Just what these genetically determined "organs" for thinking are we do not know. We can, however, treat these cognitive neural structures as a "black box" whose internal organization can not be directly known and yet whose inputs and outputs can be directly observed. There is nothing new in this conceptual approach. Charles Darwin was forced to treat inheritance as a "black box" because at the time he developed his theories it was still many decades before Mendel's work on genetics would be generally known (Mayr,

1982, 682). But in spite of his ignorance of modern genetics, Darwin was able to reason out his theory of natural selection. He did so by observing directly one of the outputs of genetic inheritance in what we now call intraspecific variation. It was this observation of the output of the black box of inheritance that allowed him to build his theory. We can not, as of now, understand what the genetically determined cognitive structures of the brain are like. And yet, we do observe the environmental "inputs" that these structures receive, and we can observe the behavioral "outputs" that they, along with the environment, produce.

The analogy of the computer can be extended to included the concept of a black box. There are very few of us who understand the internal mechanisms and detailed circuitry of a computer. But this does not stop us from using one nor does it limit a software engineer's ability to program software. It is possible to understand human decision-making by treating the cognitive structure in our brains where the process occurs as a black box and observing, instead, what the relationships are between the inputs and outputs of our behavior.

The black box that I am interested in is the cognitive neural structure that I referred to in my formal definition of a worldview. It is the physical structure in the brain, the organ if you will, that allows us to make "adaptive" decisions. By adaptive I mean adaptive in the evolutionary sense. We have a cognitive neural structure in our brains that is there because it was selected for by natural selection. We make decisions the way we do because it has increased our adaptive fitness in the environment. One way it has increased that fitness is by allowing us to make rapid behavioral decisions in a complex mental world. (Again, this may be the result of Dennett's heuristic search algorithm for decision-making.)

Adaptive Imaginary Representations

Do our mental models of reality, our worldviews, out of necessity track external reality? Or is this yet another example of naive realism leading us astray? David Sloan Wilson in his article *Species of Thought* provides an evolutionary theory of worldviews that do not correspond to external reality or, in his words, how natural selection can act blindly in the preservation of adaptive imaginary views of reality (Wilson, 1990). In his article he suggests that our worldviews can be an adaptive imaginary representation of reality but have little correspondence to external reality.

> "The complexity of real-world causal structures forces us to abandon the "model of reality" concept ...". "There is, however, another pathway whereby simple minds can produce a suite of adaptive phenotypes [behaviors] in a complex world—by constructing mental representations that are not models, but, rather, are *themselves the instructions*. In other words, some parts of the mind could be designed not to construct models of reality, however crude, but rather to construct fictional worlds that are sincerely believed to represent the real world, and which unambiguously motivate a suite of phenotypes [behaviors]. A person who constructs or

> adopts one of these fictional worlds need not perform complex calculations to determine how to behave, because the imagined world is specifically designed to make such calculations unnecessary. Intelligence may go into the construction of a fictional world, but once constructed almost anyone can be guided by it. The suite of phenotypes [behaviors] motivated by a fictional world may be adaptive or maladaptive in the real world. A selection process presumably operates among alternative fictional worlds, leaving a subset whose corresponding suites of behaviors are, on balance, adaptive." "One can easily imagine the invention of entities and relationships that have no counterpart in the real world, but which nevertheless have the effect of motivating behaviors that are adaptive in the real world."—Wilson, 1990

Evolutionary Mismatch or Poorly Trained?

But which environment is our decision-making neural structure adapted for —the one in our evolutionary history—or the one we live in today? In their book *New World New Mind* Robert Ornstein and Paul Ehrlich explore this question at length and their conclusions are straight-forward.

> "There is now a mismatch between the human mind and the world people inhabit. The mismatch interferes with the relationships of human beings with each other and with their environments."—Ornstein & Ehrlich, 1989

The mismatch they refer to is between the world that our brains evolved in and the world we live in today. They go on to address the nature of our worldview.

> "Like those of other animals, our brains evolved to understand only a small portion of the world, the portion that most affects our capacity to survive and reproduce. Each animal, whether a bee, butterfly, frog, chimp, or human being, lives within its own '"small world"' which is a mere caricature of the outside world. This simple caricature of the environment sufficed for most organisms in most environments; for most people throughout history; and it still works for many people. But it is now fatally obsolete." (ibid., 12)

Ornstein & Ehrlich are not, however, completely pessimistic. They go on to state:

> "...but we can also change more than we might have dreamed, by calling on some of the very many diverse mental abilities within ourselves." They conclude with a guarded question: "If we learn how we think, how our mind is structured, and how to overcome the innate limitations and biases of mind, can we then learn to act on that knowledge?" (ibid., 198)

But how are we to make the changes in our thinking that are necessary? The second element in this evolutionary view of human cognition is that, yes, evolution has prepared us for a world that no longer exists, but we can "retrain" our thinking to "see" the present world as we must in order to survive. Their conclusion is that we must learn a new way of thinking that avoids relying on unthinking biases. (And again, are unthinking biases part and parcel of a heuristic search algorithm for decision making?) This is the antithesis of the type of thinking required for fast, decisive decision-making that Ornstein & Ehrlich say evolved in our ancestors for short-term "fight or flight" decisions.

So we have a problem—our innate cognitive decision-making is better suited for short-term "fight or flight" decisions. Whereas, what we need today are well reasoned decisions made about our long-term problems. Have we now become maladapted to our world? Have we now reached the point in our evolutionary history where we need "nurture" to over-come the limitations of our "nature"?

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