

WHAT MYTHS REVEAL ABOUT HOW HUMANS THINK:  
A COGNITIVE APPROACH TO MYTH

by

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ABSTRACT

WHAT MYTHS REVEAL ABOUT HOW HUMANS THINK:

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This thesis has two main goals: (1) to argue that myths are natural products of human cognition; and (2) that structuralism, as introduced by Claude Levi-Strauss, provides an over-arching theory of myth when supplemented and supported by current research in philosophy of mind, cognitive psychology, and cognitive anthropology. With regard to (1), we argue that myths are naturally produced by the human mind through individuals' interaction with their natural and social environments. This interaction is constrained by both the type of body the individual has and the environment in which the individual is situated. From this interaction, we argue, is produced the human-body metaphor which plays an essential role in forming analogical mental models which humans use to navigate, predict, and think about their

environment(s). With regard to (2), we argue that these analogical mental models are the structures from which myths are created, just as structural anthropology suggests.

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## CHAPTER 1

### MYTH: A COGNITIVE APPROACH

We are really going to have to learn to make progress working together; the alternative is to make fools of ourselves working separately.

Jerry Fodor, “Modules, Frames, Fridgeons, Sleeping Dogs, and the Music of the Spheres”<sup>1</sup>

#### 1.1 Prefatory Remarks

Perhaps the most disheartening situation any scholar can face is continually to have to defend the nature and relevance of his research. Questions like, “What is it that you are doing again?” and “Why is that important?” and “How did you get interested in that?” are certainly inquiries that only serve to increase the imposter complex from which many academics with whom I have spoken suffer from time to time. There is nothing like having constantly to explain and defend your existence. Yet, there are benefits that come from such questions as well. These questions give one reason to reflect and fine-tune what it is one is trying to do, and each pass at the questions makes one better suited to answer them. Before you, the reader, begin this thesis, let me take a few moments to defend the nature and relevance of my research.

In an interview, Claude Levi-Strauss commented that the structural way of thinking had been with him all of his life. He saw common structures in spellings of words, in language, geology, painting, and music. These appeared to be invariant elements masked by superficial differences (Levi-Strauss, 1995). In reflection on my

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<sup>1</sup> Fodor (1990).

own life, I believe that I too have been gifted (or cursed) with this same way of thinking. My mental life, for as long as I can remember, has been driven by what Pascal Boyer has called relevant connections (Boyer, 2003b). I tend to look for interpretations of whatever it is that I am considering in such a way that I can produce as many rich inferences as I can with as little mental exertion as I can get away with. Of course, this is not always a good thing. Nevertheless, if it were not for this little cognitive habit of mine, this project would never have come to fruition.

I was first introduced to the structural theory of myth as an undergraduate by Professors Lewis Baker and Charles Chiasson. I found something intuitively appealing about this theory; it helped to explain a lot with a little. After expressing my interest in structuralism to Professor Chiasson, he at first tried to curb my interest by pointing out all of the various problems with the theory. Then, after much inquiry on my part, he suggested that I read works by Levi-Strauss and Jean-Pierre Vernant. In the five years between graduating with my bachelor's and returning for a graduate degree, I did just that.

But as much as myth has fascinated me, so too has philosophy. In particular what interested me was a close relationship, particularly present in the ancients, between myth and philosophy. It seemed to me, and still does, that philosophy was a natural off-shoot from myth. Inasmuch as myth represents human views of the cosmos, philosophy is an attempt by those same humans to analyze their view of the cosmos and to draw inferences from that view: "If this is what I believe, then what follows?" Philosophers, at least since the ancient Greeks, have spent a considerable amount of

time either trying to prove mythical beliefs or to disprove them. What few have examined, however, is the intimate connection that I believe still exists between myth and philosophy.<sup>2</sup> My original goal, when I returned to school, was to do research and to write about that intimate connection. But, as with most goals, mine changed.

I never imagined myself having an interest in philosophy of mind. I did not know much about it, and frankly, I did not really want to know. Nevertheless, I found myself in a course on philosophy of mind taught by Professor Denny Bradshaw. At first, again to be frank, I thought it was much ado about nothing. But, as we got to the latter parts of the course and the “big picture” of how current research into the mind had implications for nearly every major disciplinary branch, especially perennial problems in philosophy, psychology and anthropology, my interest was captivated. What spurred this interest even more was the introduction to mental models theory as presented and defended by Colin McGinn in *Mental Content* (1989, Chapter 3).

A relevant connection was made. McGinn’s introduction to mental models theory seemed all too familiar. The theory made claims which were in many ways similar to those I had read in structural anthropology. It described how the mind developed a world view which was the project undertaken by Levi-Strauss some 40 years before. Moreover, there seemed to me to be a similar structure shared between the theories. Again, with a little information, I made a lot of inferences.

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<sup>2</sup> Some of the works which occupied my time were J.P. Vernant’s *The Origins of Greek Thought* (1982), L. Brisson’s *Plato the Mythmaker* (1998), F. M. Cornford’s *From Religion to Philosophy: A Study in the Origins of Western Speculation* (1991), S. Daniel’s *Myth and Modern Philosophy* (1990), and P. Y. Forsyth’s *Atlantis: The Making of Myth* (1980).

A major part of my research I have viewed as making sure that both the mental models theorists and the structuralists said what I thought they ought to say in accord with the inferences I made. As the research progressed, I have commented many times that I am so very glad that they have indeed said what I thought they would say. This project is, in part, a demonstration of them saying just that.

But it is also an argument. It is an argument that structural anthropology and mental models theory are of a piece. Each has important implications for the other. Together they strengthen their case(s). Together they illustrate the amazing capacity of the human mind to attempt to understand the world in which it finds itself both through myth and philosophical reasoning. Together they show how the mind gives rise to both; and why they are both important.

## 1.2 The Thesis in Broad Strokes

*All human cultures, past and present, have myths.* This is not meant as a trivial statement. It is not meant to convey, as a mere matter of fact, that all human cultures have myths. It is meant to convey a curiosity—*all* human cultures have myths. We can be just as assured of this phenomenon when approaching a new culture as we can be assured that the culture will have some form of government. We have a strong intuition, if not a full-blown theory, as to why some form of government appears in every culture; yet, there is really no such intuition or encompassing theory when it comes to why *every* culture has myths. Moreover, in looking at myths in cultures from our hard-earned scientific viewpoint, it seems almost unimaginable that cultures with

what can only be considered irrational and false beliefs (again, from our viewpoint) could have survived in a world that seems to require rational, truth-seeking inquiry. Furthermore, if we accept from the evolutionary perspective that our goal (as a species) is survival, it would seem that it is of the utmost importance to track things and events in the world.<sup>3</sup> Yet, myth appears to run contrary to that intuition. From the scientific viewpoint, many of the characters and events depicted in myths never existed; myths are not tracking anything in the world. All this leads us to a probing question: *Why myths?*

One of the major goals of this thesis will be to answer that question. We shall argue that myths are a natural product of the human mind. To support this argument, research from four areas will be employed; structural anthropology, cognitive psychology, philosophy of mind, and cognitive anthropology. We shall argue that a synthesis of the research carried out in these areas produces a cognitive approach to understanding and explaining myth emerges.

The suggestion that structural anthropology will play an important role in our approach is likely to strike the informed reader as odd. After all, structural anthropology has been considered by most to be a defunct project. On top of that, it has been taken to be an interpretive approach to myth rather than a cognitive approach. On the contrary we shall argue that structural anthropology *is* a cognitive approach and that when seen in this light it is both a valuable and viable theory for understanding and

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<sup>3</sup> I am assuming that the acceptance of the scientific viewpoint requires the acceptance of evolutionary theory.

explaining myth. Demonstrating the value and viability of structural anthropology in current cognitive research (specifically, as directed toward myth) is another goal of this thesis.

To achieve this second goal, we shall demonstrate that cognitive research, independent of the structuralist project, supports the structuralist approach to myth.<sup>4</sup> Specifically, the focus will be on synthesizing cognitive research on mental models with structuralism. We shall argue that the structures discovered through properly constrained structural analysis are mental models.

Mental models theory proposes, as we shall see, that the mind organizes its content by placing that content into structural relations with one another. The resulting organization models states of affairs in the world. Structural analysis, carried out by the ethnographer, is a methodological approach which extracts these mental models from individuals in culture and makes the mental models explicit.

Contrary to received wisdom, we shall argue that structural analysis is neither arbitrary nor interpretive. With regard to the former, we shall show that structural analyses are non-arbitrary in two ways. First, these analyses are subject to the constraints on mental models. Secondly, that these analyses are constrained, in large part, by the human-body metaphor.

With regard to the latter, we shall argue that structural analysis, properly conceived and constrained, is not an interpretive approach to myth, but rather a

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<sup>4</sup> The claim here is not that independent cognitive research has had as its goal to support structuralism. Rather, the claim is that the results of the research have unintentionally given support to structuralism and that this has, until now, gone unnoticed.

cognitive approach. While we do not deny that structural analyses can and do provide interpretations of myths, we suggest that the primary value of these analyses is that they expose the underlying cognitive processes at work in the human mind. These analyses make explicit how individuals in a culture structure (with the constraints mentioned above) the mental content they receive from their environment(s) into myths.

We shall argue that, by understanding myths *as* mental models, we are in a better position to answer the question *why myths?* Our answer will deviate from the conventional view in philosophy that the function of beliefs is to track truth. We shall argue, on the contrary, that the primary function of beliefs is to track *what works*. What works is pragmatically oriented, not truth oriented. Most importantly, beliefs need not be true in order to work. We shall further argue that myths (and rituals)<sup>5</sup> provide an effective way by which to transmit what works to individuals within a culture.

### 1.3 Omissions

We believe it important briefly to discuss certain things which we shall not pursue in this thesis. Their omission should not be taken as implying the denial of their importance to the study of myth. But, since they would only be ancillary to our project and arguments, we chose to ignore them in print while remaining ever cognizant of them.

It will likely strike the reader as odd that a thesis about myths spends little time discussing myths themselves. Our purpose, however, is to lay the groundwork for a

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<sup>5</sup> Part of our argument will be that myths are rituals, albeit in oral form.

cognitive approach to myths in order that they may be discussed scientifically. We propose, at the end of this thesis, a hypothesis which can be empirically tested by being directly applied to analyses of myths. Our hypothesis is meant to supply a fruitful means for further research on myths. Since the scope of this thesis is philosophical we do not provide such research here. It is our intent to undertake such research in a later project.

Another topic that is omitted from this thesis is memes. While we fully understand and appreciate the implications that meme theory has for the study of myth, it was beyond the scope of our thesis. The informed reader might find this omission particularly odd given the fact that we are defending structuralism as a cognitive approach. Claude Levi-Strauss made liberal use of what he called a “mytheme” which is a specific species of meme appearing in myth. Given the current (sometimes heated) debate in cognitive studies concerning the role of memes in cognition, this omission will likely appear glaring. While we find this research both intriguing and unsettling,<sup>6</sup> it was not essential to our present project. Understanding the mytheme within the scope of current research of memes is another project we shall defer to a later time.

We shall also not engage ourselves in lengthy discussions in an attempt to define myth. We argue, within the context of our project, that myths should be understood as mental models in the minds of individuals in a culture. We are interested in how the mind both produces and accepts myths as models of the world. We fully realize, however, that this is far too narrow to capture the full essence of myth. Myths have a

long history of oral and written transmission into which we do not venture. Having said this, allow us a few brief and blunt comments as to what we take myth to be within the context of its oral and written history.

*As we see it, myth is a traditional, religious tale in which the course of nature or human events is intervened upon by a supernatural being or force.* We further assert that beliefs in myths can only be maintained in a culture when there is support for those beliefs by accompanying rituals. We are not claiming that each individual myth in a culture must have an accompanying ritual, but that myths as a whole (i.e., the mythology of a culture) must be supported by ritual. For instance, there is not a ritual (of which we are aware) that accompanies the myth of Jonah and the Big Fish found in the Old Testament of the *Bible*. Yet there are rituals that support the mythology of the Old Testament and the *Bible* in both Judaism and Christianity. Sometimes, as we shall argue later, the accompanying ritual may be nothing other than reading, or reciting, the myth aloud in a religious context. In this sense, myth is ritual.

#### 1.4 Mental Models and the Sciences

Since mental models will play a substantial role in the cognitive approach we shall develop, we think it important to avoid any misconceptions about what the phrase “mental model” means in the context of this thesis. Talk of mental models is pervasive in both the physical and human sciences, yet each discipline describes what a mental model is in a different fashion. In the physical sciences, mental models are described as

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<sup>6</sup> It is unsettling in the sense that memes are often discussed in terms of a cognitive virus which

representations, paradigms, models, and theories. In the humanities proper, they are described in terms of paradigms, theories, and meta-theories. In anthropology, mental models have been discussed as mazes, worldviews, and *Weltanschauungen*. In philosophy, they have been defined in terms of *Weltanschauungen*, worldviews, theories, conceptual schemes, interpretive frameworks, and models.

All of these disciplines are employing a common theme; but, they are doing so for differing reasons. In humanities, talk of mental models is an attempt to get a meta-description of various themes that have dominated western culture. In anthropology, mental models are discussed in an attempt to give a holistic understanding to a specific culture. In philosophy, talk of mental models has been varied. In early instances, it was meant to provide the God's eye view of a philosophical position. In some later instances, the discussion was derogatory. In the physical sciences discussions are held in attempt to give a God's eye view of the current research paradigm under which scientists have worked, or are currently working, so that a full picture of what the world might look like given current commitments.

The problem incurred by so many disciplines using the phrase “mental model” is that they are providing various discipline-specific definitions for what is in essence a similar idea: an idea of a mental representation that provides a “map” for an individual. That map is an instantiation of particulars, concepts, symbols, relations, properties and linguistic descriptions. These combine to create a working simulation in the mind of the individual of roughly how the world works.

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takes advantage of certain brain processes and in some sense takes over the mind of an individual.

“Map” is a fitting metaphor for mental models as we shall use the phrase. A mental model is a mental representation that allows one to orient himself in conceptual space. Moreover, a mental model allows one to plan out a strategy for maneuvering in that space. These strategies are predictions that are in many ways similar to those one might make when planning a venture according to a map (e.g., the most direct and safest route, the amount of time in travel, the amount of gas used, where to stop, etc.). Furthermore, just as we can share maps, we can also share mental models. In the same way that an actual map is essential negotiating a trip, a mental model is essential in negotiating our world.

A critical confusion that we do wish to avoid is confusing mental models with doxastic systems. A mental model is not the belief of an individual, though it may be the object of belief. Beliefs, arguably, are propositional; mental models need not be and often are nonlinguistic. Mental models may include linguistic elements, perhaps even propositions, but they are not beliefs. On the contrary, mental modeling is the representational system that undergirds beliefs and thus supports doxastic systems.

### 1.5 A Look Ahead

Now that we have introduced our project in broad strokes, we wish to offer a guide to what follows. Chapters Two and Three offer the technical background from which we shall develop our approach in Chapters Four and Five. Chapter Two focuses on structuralism. We begin by considering the essential elements of structural theory as offered by Claude Levi-Strauss, in particular, his focus on cognitive laws which he

argued were responsible for the creation and structure of myths. These are known as *Laws of Transformation*. Next, we look at the manner in which Levi-Strauss employed the Laws of Transformation and models in explicating his theory. He argued that the Laws of Transformation operated on models. These models are the structures, according to Levi-Strauss, from which myths are born. As we shall see, these claims by Levi-Strauss were met with several objections. We demonstrate, however, that these objections were based on a misconception and therefore do not hinder the tie between structures and models. After that, we show how understanding structures as models, as Levi-Strauss emphasized, provides for *analogical* models (models produced from the projection of structural relations from a source domain to a target domain) which are the essential elements of myth. Finally, we introduce, discuss, and adopt two updates to structural theory which have been recommended by contemporary structuralists: the human-body metaphor and the delineation of levels of structures. The former emphasizes the role our own bodies play in understanding our environment, whereas the latter allows for plasticity and agency which were not available under Levi-Strauss's original account.

In Chapter Three we examine mental models theory by the lights of three proponents of the theory: Kenneth Craik, Philip Johnson-Laird, and Colin McGinn. Beginning with Craik, we see the origins of mental models theory and its goal of accounting for an essential characteristic of human thought, prediction. This process, according to Craik, is carried out by the mind's ability to represent and to simulate events *via* models. This process is fundamental to problem-solving.

In the next section, we take up the technical and formal development of mental models theory by Johnson-Laird. Here, we introduce and discuss the constraints on mental models and model types. These demonstrate how mental models are non-arbitrary sets of symbols which are arranged in structures and transformed into various model types which represent relevant aspects of the world. We shall also argue, considering objections which have been raised against Johnson-Laird, that an important distinction must be made between the mental model as a representation and those things, such as images, which serve as the content of the mental model.

Finally, in our discussion of McGinn, we discuss the philosophical implications of mental models theory and how the theory serves to answer issues in the philosophies of language and mind. McGinn argues that mental models theory has more explanatory capacity than competing theories (such as *The Language of Thought Hypothesis*) in accounting for seven philosophically problematic areas of mental content: conceptual structure, truth and falsehood, logical relations, modes of presentation, holism, predictiveness, and naturalism. We take each of these seven issues in turn and look at McGinn's case for it. Finally, and most importantly for our own account that we shall begin in the next chapter, we look at the arguments which McGinn presents concerning the development of worldviews from mental models. It is this capacity in particular which gives mental models the edge in providing a naturalistic account of content of thought.

In Chapter Four, we build on the background discussions of structuralism and mental models theory to begin developing our cognitive approach to myth. We begin to

synthesize these discussions to demonstrate how myth is a natural cognitive product of the human mind. First, we discuss where myths fit within an evolutionary perspective. Our argument here, as alluded to previously, is that evolutionary processes are geared toward what works rather than truth. We argue that myths “work” in this sense. Essential to understanding how myths work in this context is the theory of affordances. To bolster our account, we introduce, employ and expand the theory of affordances—that is, the theory that organisms perceive relations between themselves and their environments which are constrained by the type of body the organism possesses. Most importantly here, we introduce three types of affordances which aid human success in their natural and cultural environments: natural, intentional, and social affordances. We then demonstrate how these affordances allow us to address two problems: how views of the human body vary from culture to culture and sometimes within the culture itself, and how the structural process of inversion works within myths.

In the following section, we argue, from a synthesis of current research from various disciplines, that the human-body metaphor is the natural product of the interaction between affordances (and more broadly, the image schema) and the body schema. It is the body schema that organizes our perceptual experience in relation to what type of body we possess. Thus, we process and mentally structure the environment we perceive in terms of our body—giving us the human-body metaphor. Furthermore, we argue, when the human-body metaphor is combined with memory and thought a mental model is produced. This demands, in line with current research, that mental models must be embodied.

From this necessary condition on mental models, we argue that the human-body metaphor is an essential element in the genesis of *analogical* models which are themselves essential to structural analysis. It is the human-body metaphor that provides the basis for understanding. We use our bodies as the source domain from which we project *structural relations* onto a target domain, that is, our environment(s). From this, in the following section, we examine the nature of analogical models themselves.

Three things become clear concerning the nature of analogical models. First, we learn from contemporary cognitive research that inferences generated concerning a target domain which are made from analogical models are predictable—provided that the one can determine the source domain in conjunction with the background beliefs of the individual under consideration. Secondly, we learn that analogical models are highly constrained and non-arbitrary in large part because of their structural characteristics. Finally, we demonstrate that the nature of analogical models, in conjunction with the human-body metaphor, helps us to understand two curious phenomena present in myth, animism and anthropomorphism.

Now that we shall have demonstrated how myth can arise from analogical models, we demonstrate how myth and ritual in turn serve as the mechanisms of transmission of cultural models to individuals within a culture. In this section we show how affordances, the human-body metaphor, and analogical models all act in accord through myth and ritual to transmit culturally relevant information and interests. To understand this process more fully we first introduce the close relationship that exists between child's play and ritual. We then briefly digress into a discussion concerning

how child's play aids in the transmission of mental models. We then argue that this same process of transmission is applicable to ritual. From this, we then argue that myth stands in a special relationship to ritual in that myth itself is a species of ritual. Finally, we show how this view of myth and ritual, as the media of transmission of cultural models, fits snugly within structural theory as presented and defended by Levi-Strauss.

In the last chapter, Chapter Five, we consider the numerous challenges to structuralism. These objections have largely fallen into one of two categories; either structural analyses are said to be arbitrary or they are said to be unverifiable. We carefully consider and explicate these objections. Following that discussion, we consider what constraints must be met in order that a structuralist account can be considered both scientifically valuable and viable. Before we begin our defense of how these constraints can be met, we examine current research into mythical content and show how it supports a synthesis of both structuralism and mental models in accounting for the origin mythical of content. Having demonstrated this, we return to offer our solution to the objections levied against structuralism considered at the beginning of the chapter. Here we offer an empirical hypothesis that should allow for a non-arbitrary way to verify structural analyses given by an ethnographer. Finally, in the last section we consider possible objections to our approach, and how they may be overcome, in addition to the implications that our approach carries for both structural anthropology and cognitive anthropology.

We hope that our approach may help to guide future discussions of myth. Perhaps we can understand, finally, the importance of myth to human cognition. Myth

has been discussed in a disparaging manner by philosophers since the time of Plato. Myth has been seen in contrast to naturalism and rationality. We hope to show, however, that myth is both natural and rational—even though it does not meet the strict logical and empirical criteria of the theories which philosophers champion. At the very least, we hope, to spark renewed interest on the part of philosophers in taking a critical new look at myth.

Moreover, we hope that cognitive anthropologists will see reason to revisit structuralism. While we are not holding up structuralism as a panacea for the current problems in the field, we do believe that it holds many suggestive clues. Structuralism, when properly fused with the theory of mental models, can account for many of the mysteries concerning myth. Not the least of these is why humans continue to believe in them.

Finally, we hope our project emboldens the ethnographer to provide structural analyses—among other types—without fear of the objections suffered in the past. We believe that structural analyses, properly constrained, offer much in aiding an understanding of a culture. With this having been said, let us turn our attention to Claude Levi-Strauss and structural anthropology.

## CHAPTER 2

### STRUCTURAL ANTHROPOLOGY, MODELS, AND THE MIND: LEVI-STRAUSS AND SINCE

.../M]yths signify the mind that evolves them by making use of the world of which it is itself a part. Thus, there is a simultaneous production of myths by the mind and a production, by the myths, of an image of the world which is already inherent in the structure of the mind.  
Claude Levi-Strauss, *The Raw and the Cooked*

#### 2.1 Claude Levi-Strauss, Structuralism, and the Mind

Our task is to see what emerges when structural anthropology and the cognitive science of mental models are brought together. The purpose of this task is to ground the study of myth in the science of the mind. Why is it, and how is it, that humans come to see the world mythically? What cognitive processes are involved in relating the natural world with the cultural world?<sup>7</sup> And why is it natural for these processes to produce myths?<sup>8</sup> These questions are as much a matter of anthropological investigation as they are an investigation for cognitive science. Therefore, to begin, a close analysis of what structural anthropologists claim to be at work in human culture and mind is in order.

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<sup>7</sup> This is the question which Claude Levi-Strauss seeks to answer throughout the four volumes of the *Mythologiques* and in *The Savage Mind* (1972). It is also the focus of Seth Kunin in “The Allegory of the Olive Tree: A Case Study for (Neo)Structuralist Analysis” (2003), as we will see toward the end of this chapter. There are numerous other structuralist who I could name here, but they are not directly relevant to this point or chapter.

<sup>8</sup> This question is addressed within the field of cognitive science by Pascal Boyer (1996; 2000; 2001; 2003a; 2004), Thomas Lawson and Robert McCauley (Lawson & McCauley, 1990; 2000; 2005; McCauley & Lawson, 1999), Stewart Guthrie (1980), and Justin Barrett (2000). These authors, in part, also represent the burgeoning new field of cognitive anthropology.

Our investigation must begin where anthropological structuralism began, with the father of structural anthropology—Claude Levi-Strauss.

In 1955, Claude Levi-Strauss publicly introduced what would become one of the dominant fields of study in anthropology, structuralism.<sup>9</sup> In “The Structural Study of Myth,” Levi-Strauss opens with an attack on the current state of study in anthropology of religion reminiscent of Hume’s earlier attack against speculative philosophers:

Instead of trying to enlarge the framework of our logic to include processes which...belong to the same kind of intellectual operations, a naïve attempt was made to reduce them to inarticulate emotional drives which resulted only in withering our studies.

Of all the chapters of religious anthropology probably none has tarried to the same extent as studies in the field of mythology. From a theoretical point of view the situation remains very much the same as it was fifty years ago, namely, a picture of chaos. Myths are still widely interpreted in conflicting ways: collective dreams, the outcome of a kind of esthetic play, the foundation of ritual...Mythological figures are considered as personified abstractions, divinized heroes or decayed gods. Whatever the hypothesis, the choice amounts to reducing mythology either to an idle play or to a course kind of speculation.

In order to understand what myth is, are we compelled to choose between platitude and sophism?...Whatever the situation may be, a clever dialectic will always find a way to pretend that a meaning has been unraveled. (1955, 428-429)<sup>10</sup>

What bothered Levi-Strauss was two points: first, that investigation into mythology was largely non-empirical, rather speculative; and secondly, myth was being treated as an abnormality in human thought, set apart and opposed to, rationality. He wished to change both.

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<sup>9</sup> The word “structuralism” throughout this paper is meant to denote *paradigmatic* structuralism as opposed to *syntagmatic* structuralism as practiced by Vladimir Propp in *Morphology of a Folktale* (1968). For more on this distinction, see Csapo (2005, Chapter 5, "Structuralism")

<sup>10</sup> This paper is one of the most widely cited and reprinted in anthropology. This work was reprinted most notably in Levi-Strauss (1963d, pp. 206-231) and Sebeok (1958, pp. 81-106).

Levi-Strauss sought to ground the study of mythology in what he called the “concrete” –that is, the empirical. This was not to be done by trying to prove that the subject matters of myths themselves had some sort of empirical basis in reality (such as Zeus being the personification of a thunderstorm), nor by taking the contents of myths as “data,” nor cataloging them, but rather by looking for the empirical origin of mythical thought. To do this, Levi-Strauss turned to the mind:

...Mythology has no obvious practical function:...it is not directly linked with a different kind of reality, which is endowed with a higher degree of objectivity than its own and whose injunctions it might therefore transmit to minds that seem perfectly free to indulge their creative spontaneity. And so, if it were possible to prove in this instance, too, that the apparent arbitrariness of the mind, its supposedly spontaneous flow of inspiration, and its seemingly uncontrolled inventiveness imply the existence of laws operating at a deeper level, we would inevitably be forced to conclude that when the mind is left to commune with itself and no longer has to come to terms with objects, it is in a sense reduced to imitating itself as object; and that since the laws governing its operations are not fundamentally different from those it exhibits in its other functions, it shows itself to be of the nature of a thing among things.... [I]t is enough to establish the conviction that if the human mind appears determined even in the realm of mythology, *a fortiori* it must also be determined in all its spheres of activity....

I believe that mythology, more than anything else, makes it possible to illustrate such objectified thought and to provide empirical proof of its reality....I therefore claim to show, not how men think, but how myths operate in men’s minds without their being aware of the fact. (Levi-Strauss, 1983b, pp. 10-12)

Several aspects of Levi-Strauss’s approach to myth become apparent from the above. First, Levi-Strauss sees myths as products of the mind. Myths are neither the products of *only* culture nor of some experience of a “higher” reality. Therefore, any empirical study of mythology must go beyond the content of the myths themselves and focus on the mind that produces, embraces, and transmits these myths. Secondly, the cognitive laws governing the production of myths are not different from those which

govern the other functions of the mind.<sup>11</sup> Thirdly, he claims that these cognitive laws which govern the production of myths are deterministic. These cognitive laws, which he calls *laws of transformation*, limit the possible range of mythical beliefs, myths, and variations of myths. By understanding these laws of transformation, Levi-Strauss holds that this adds the much needed element of scientific explanation to the study of myths, predictability.<sup>12</sup> Fourth and finally, Levi-Strauss maintains that these laws of transformation work at the unconscious level in the human mind in the same way that grammar works in speaking a language. The speaker need not be aware of the rules of grammar in order to speak correctly; and, in fact, she need not even consciously know

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<sup>11</sup> Compare Levi-Strauss's claim that the operations of the mind which produce myths are not different than the operations that produce other functions with the recent claim of Pascal Boyer, a cognitive scientist:

It is quite clear that explicit religious belief requires the suspension of the sound rules according to which most scientists evaluate evidence. But so does most ordinary thinking, of the kind that sustains our commonsense intuitions about the surrounding environment. Most surprisingly, religious notions are not at all a separate realm of cognitive activity. They are firmly rooted in the deepest principles of cognitive functioning. First, religious concepts would not be salient if they did not violate some of the most entrenched notions.... Second, religious concepts would not subsist if they did not confirm many intuitive principles. Third, most religious norms and emotions are parasitic upon systems that create very similar norms...and emotions...in non-religious contexts. (2004, pp. 30-31)

Boyer's use of "religious belief" should be read, in most cases, as synonymous with mythical belief although technically religious beliefs and mythical beliefs are not taken to be coextensive, even though there is a great deal of overlap. For instance, one may hold to superstitions which may have mythical basis but not a religious one. In addition, not all religious beliefs are mythical. For example, believing in the "golden rule" might be a religious belief, but it is not necessarily mythical (though it might be mythically based).

The problem confronted here is that, at least in the field of cognitive study of religion, the scientists who work in this field do not readily differentiate between mythical and religious belief. They use the terms synonymously. This is because the only religious beliefs on which they focus are of the mythical variety. While I see this as a lack of clarity on their part, I nevertheless feel pressed to accommodate this use in order not to rewrite their ideas. I can only urge and hope that greater care in the future will be taken in differentiating between religious belief and mythical beliefs.

<sup>12</sup> Pascal Boyer argues for an idea very similar, and in some ways structurally the same, as Levi-Strauss. Boyer argues for a *limited catalogue of supernatural beliefs*, that are formed by violations of expectations on a basic ontological category which provides rich inferences. (1996, p. 84; 2000, pp. 196-ff; 2001, Chapter 2; 2003a, pp. 119-120; Boyer & Ramble, 2001, pp. 536-ff)

the rules of grammar at all.<sup>13</sup> This ability, according to Levi-Strauss, relies on what he calls *deep structures*, which are innate within the human mind.

There are several ways in which these deep structures operate in the human mind. First, they manifest what Levi-Strauss calls the “thirst for objective knowledge.”<sup>14</sup> (1972, p. 3) This thirst allows the mind to take in raw data from the environment, and begin to break it down—that is, categorize it. This categorization process involves four steps:

- (1) contiguity
- (2) resemblance
- (3) difference
- (4) interest, relevance, and usefulness

The first two begin the process of decomposition by the mind and is what allows for unity in both nature and culture. In the realm of nature, resemblance and contiguity are what permit the formation of taxonomies (1972, p. 63); animals are grouped together according to properties that they share with one another (land-dweller, water-dweller, and sky-dweller—for a start). In culture, resemblance plays its most important role when assigning a totem or tutelary deity for an individual or clan. Those who share a totem or tutelary deity are said to resemble each other by some property.

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<sup>13</sup> Levi-Strauss was heavily influenced by the work in structural linguistics carried out by Ferdinand de Saussure and Roman Jakobson, and makes numerous comparisons between the structuralism that he is putting forward, and their linguistic project.

<sup>14</sup> This thirst for “objective” knowledge is the idea that Daniel Dennett incorporates from behaviorist psychology, which he calls “epistemic hunger” or the “curiosity drive,” is essential for any powerful learning system. (1996, p. 92)

Resemblance operates, according to Levi-Strauss, according to the *law of correspondence*—that is, “equivalent parts are regrouped among themselves and then all together in terms of the same relevant characteristic.” (1972, p. 147) Furthermore, resemblance can arise at two levels, the sensible and the intelligible. The sensible level arises from sensible qualities such as color, shape, etc.. In contrast, the intelligible level arises from functions such as construction of nests, dams, dwellings, etc.<sup>15</sup> (1972, p. 63).

Difference is the most important of the three in understanding structuralism. Difference operates according to the *law of opposition*, where two things or properties are set in opposition to one another as binary operators. Levi-Strauss argues that it is by the formation of (simple) oppositions that initial logical structures begin to form (1972, p. 146; 1981, pp. 559-560).<sup>16</sup> These oppositions, however, should not be understood solely as contradictions; for the two members of the pair need not contradict each other in the strict logical sense:

In abstract these relations can be reduced to one of *binary opposition*, which term tends to be used in two somewhat different senses. The first sense is one precisely analogous to that in which a logician ascribes truth values to a propositional variable ‘*p*’, such that it is either true or false, and conversely such that ‘not *p*’...is either true or false. This sense is further exemplified in the logical calculus of classes when the universe of discourse is said to be divided into the class *a* and its complement  $\sim a$  (‘not *a*’), two mutually exclusive and exhaustive categories. In this sense, a structural anthropologist might divide the members of a group into the categories of ‘married’ and ‘not married’, which

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<sup>15</sup> Roy D’Andrade, borrowing from A. Wierzbicka, argues in a similar vein that folk taxonomies make use of relations between *kinds of things* and a *functional class*. Relations can be between a thing and another thing, a thing and a function, or between a function and a function (1989, pp. 803-804).

<sup>16</sup> Levi-Strauss (1981, p. 690) anticipates Jose Bermudez’s argument (2003, Chapter 7) by claiming that this binary operation is a type of “protologic,” what Bermudez calls an “excluded alternative,” and does not require language and is indeed present in animals. Bermudez claims that this type of reasoning can be seen as form of conditional reasoning (“If not-A, then B”) rather than a disjunctive syllogism. (p. 142)

would constitute a binary opposition. The second sense in which the concept is used is far less rigorous in terms of formal logic, and includes the bulk of the binary oppositions found in structural analyses...for example, fire/water, Sun/Moon, ant-eater/jaguar. These are not logically pairs of complementary, exhaustive, mutually exclusive categories in the sense in which ' $\alpha$ ', ' $\sim\alpha$ ' is, but are shown to by the author to be perceived as such, within *specific contexts*, by the groups who employ the terms in their myths. (Lane, 1970a, p. 16)

The importance of this law for Levi-Strauss cannot be overstated: it allows for the formation of structures, the perception of things and properties as distinct, makes possible naming and classifying, as well as problem solving and prediction (Levi-Strauss, 1955, pp. 442-444; 1972, pp. 75-ff; 1981, pp. 537-560, 694; 1995, pp. 22-23). Opposition is a crucial means of how the mind relates mental content in structural form.<sup>17</sup>

Interest, relevance and usefulness, likewise, are an important means of categorizing and organizing mental content. These allow, in part, for the delimitation of concepts as reflected in languages from different cultures (Levi-Strauss, 1972, p. 2; Sperber, 1979, pp. 28-30). It should be understood, however, that interest, relevance, and usefulness are not what makes things known, but rather things are of interest, relevance and useful because they are known (1972, p. 9).<sup>18</sup>

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<sup>17</sup> C. K. Ogden (1967, originally published 1932) discusses the various types of opposition that can occur in language, and all are consistent with the ways in which Levi-Strauss employs the term. Moreover, in anticipation of later work by George Lakoff and Mark Johnson (1980), as well as Joseph Bastien (1978), Ogden traces the source of opposition to directional attitudes in relation to the human body.

<sup>18</sup> Bermudez (2003) and Millikan (2004) discuss this type of relevance in connection with Gibsonian affordances. Sperber (1996, p. 134), however, takes this farther and suggests that for higher-order organisms relevance-guided attention is a means by which to solve the internal processing problem: "the problem encountered by any cognitive system able to identify perceptually and hold in memory much more information than it can simultaneously process conceptually." It allows such an organism to select which information will be conceptually processed.

The above are the initial relations of mental structures that serve to create myth. Two secondary relations, however, are also crucial to these processes and also are part of the laws of transformation. The first is mediation, and the second is inversion.

Mediation plays a very important role in the structuralism of Levi-Strauss. Myths, he claims, have as their primary purpose “to provide a logical model capable of overcoming a contradiction (an impossible achievement if, as it happens, the contradiction is real)...”<sup>19</sup> (Levi-Strauss, 1955, p. 443). Mediation is the means by which the contradictions/contraries presented to the mind by the binary operators are overcome. “Overcoming,” however, is not the logical role that mediation plays: mediation is a logical relation that allows the structural conjunction between the binary pairs. What Levi-Strauss appeals to here (in a loose sense)<sup>20</sup> is Hegelian dialectical logic of thesis, antithesis, and synthesis. This dialectical logic, however, operates at an unconscious level of the mind (Rossi, 1982c, p. 15). It is through the mediation process that myths begin to form in the mind and in society:

[The ramifications of binary operations—that is, mediation,] Levi- Strauss sees as codes which transmit information; they express beliefs, they are the ritual explanation of certain paradoxes which social life, in all of its expressions, inevitably creates. He starts from the opposition of the cooked to the raw, of culture and nature, and from this constructs models which allow the whole

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<sup>19</sup> Recall that not all the binary operators present in (social) thought are *real* contradictions. Instead, however, they may be contraries. See also Hanaff (1998, pp. 166-ff) and Leach (1970, pp. 72-73) for the types of oppositions present in Levi-Strauss’ structural analyses.

<sup>20</sup> I say “loose sense” because it is not always clear that Levi-Strauss, and other structuralists as well, are using mediation in the strict sense of synthesis in Hegelian dialectical logic. It would be an interesting project at some future point to catalog all of the ways in which Levi-Strauss employs mediation, but such a project is out of the scope of this present thesis.

In addition, it is worth pointing out that Hegel himself did not use the words “thesis,” “antithesis,” or “synthesis” in his work.

corpus of myth, apparently confused, diverse and discrete, to be intelligibly ordered, both internally and in relation to one another.<sup>21</sup> (Lane, 1970a, p. 33)

Inversion is the permutation of myth that produces variants. This is perhaps the most surprising discovery by Levi-Strauss: some of what had previously been taken as wholly different myths, through structural analysis and the principle of inversion, Levi-Strauss was able to demonstrate were variants on the same myth. What occurred in such cases was that one term was replaced by its contrary, or that an inversion was made between the function and the term value of two elements (Levi-Strauss, 1955, pp. 442-443). Characters or other important elements in a myth are subject to being reversed: Two opposing characters or elements in one myth may reverse their roles in another myth, thus producing a variant of a myth. This can be seen in many different cases such as when two or more myths are combined into one, or when a culture holds to two seemingly contradictory myths about a character, artifact, or event, or across cultures, where similar myths are found but the characters, artifacts, or events in the myths appear to have opposing functions. What Levi-Strauss found in these cases was that the structure of the myths remained the same while inversion had taken place regarding one or more characters or elements in the story and their roles or values had been inverted—that is, the function and the term value had been replaced by its contrary.<sup>22</sup>

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<sup>21</sup> See also Levi-Strauss (1972, pp. 149-150). Levi-Strauss also argues that ritual, like myth, seeks to overcome oppositions: see Levi-Strauss (1972, pp. 236-237; 1981, pp. 667-*ff.*).

<sup>22</sup> The importance of this discovery about the production of variants through inversion is emphasized by Sperber (1979, p. 37).

The secondary relations of mediation and inversion are where the structural formation of myths is completed. These allow for the contents of the myth and its variants<sup>23</sup> to be connected in a meaningful way. What follows from this, for Levi-Strauss, is that the contents themselves are not what create the meaning of myths, but rather it is the structure that is formed by the way in which the contents from all the variants are related that creates the meaning; in the end it may be the case that there is no final (definitive) meaning of the myth(s) (Levi-Strauss, 1995, pp. 44-45; Levi-Strauss & Eribon, 1991, pp. 141-142).<sup>24</sup>

Perhaps the best way for the reader to understand how structuralism and the laws of transformation work is provided by Levi-Strauss in *The Savage Mind* with his kaleidoscope analogy that I shall quote at some length:

This logic works rather like a kaleidoscope, an instrument which also contains bits and pieces by means of which structural patterns are realized. The fragments are products of a process of breaking up and destroying, in itself a contingent matter, but they have to be homologous in various respects, such as size, brightness of colouring, transparency. They can no longer be considered entities in their own right in relation to the manufactured objects of whose 'discourse' they have become the indefinable debris, but they must be so considered from a point of view if they are to participate usefully in the formation of a new type of entity: one consisting of patterns in which, through the play of mirrors, reflections are equivalent to real objects, that is, in which signs assume the status of things signified. These patterns actualize possibilities whose number, though it may be very great, is not unlimited, for it is a function of the possible lay-out and balances which may be effected between bodies which number is itself finite. Finally, and most important, these patterns

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<sup>23</sup> This is not to suggest that there is a "true" myth or an "ur-myth" and its variants. In this case all that is meant is that a myth (*Ma*) under consideration can only obtain meaning from its relation to its variants (*Mb*, *Mc*, *Md*...*Mn*), where these latter myths are considered in variation to *Ma*. It might just as well be the case that *Ma* could be considered as a variation of another myth under consideration, *Md*.

<sup>24</sup> This consequence of meaning prompted Dan Sperber to suggest that structuralism permits the dispensing of talk of meaning with regard to symbolism. (1975, pp. 83-84; 1979, p. 42) Lawson and McCauley dispute Sperber's conclusion in *Rethinking Religion* (1990, pp. 138-ff.)

produced by the conjunction of contingent events (the turning of the instrument by the person looking through it) and a law (namely that governing the construction of the kaleidoscope, which corresponds to the invariant element of the constraints just mentioned) project models of intelligibility which are in a way provisional, since each pattern can be expressed in terms of strict relations between its parts and since these relations have no content apart from the pattern itself, to which no object in the observer's experience corresponds—even though, by such a manoeuvre, particular objective structures, such as those of snow crystals or certain types of radiolaria and diatomaceae might be revealed which their empirical basis were yet unknown, to the observer who had not yet seen them. (1972, pp. 36-37)

Structuralism, as Levi-Strauss would later put it, "...is the quest for the invariant, or for the invariant elements among superficial differences" (1995, p. 8). The invariant was the way that the human mind structures its contents by means of the laws of transformation. These processes occurred at the unconscious level of the mind in its deep structures. And, those same processes were not only those which underlay mythical thought, but all human (logical) thought, even science. Levi-Strauss concludes "The Structural Study of Myth" with the following claim: "In the same way we may be able to show that the same logical processes operate in myth as in science, and that man has always been thinking equally well; the improvement lies, not in an alleged progress of man's mind, but in the discovery of new areas to which it may apply its unchanged and unchanging powers"<sup>25</sup> (1963c, p. 230).

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<sup>25</sup> This claim by Levi-Strauss has become highly controversial considering the recent work of Robert McCauley (2000, pp. 65-ff; 2005) and Pascal Boyer (2003b). McCauley claims that science is *radically* counter-intuitive as opposed to religion being *modestly* counter-intuitive. He further argues that religion is naturally geared toward human cognitive capacities, whereas in contrast, science is not. Because of this, science requires much greater training, and cultural and institutional support. Boyer, on the other hand, suggests that not only is religious thinking different than science, but there are different cognitive capacities engaged depending on the type of "science" performed; whether natural science, social science, or humanities. In the last chapter of this thesis, we will briefly look at the importance of mental models theory specifically in relation to science, rather than specifically at Levi-Strauss' claim here. Important in the defense of Levi-Strauss' claim will be the work of Stewart Guthrie (1980) who

## 2.2 Structuralism and Models

Talk of models has been applied to anthropological structuralism in a number of ways by a number of scholars. One of the earliest applications of the term “model” to structuralism was by Levi-Strauss himself in the entry “Social Structure” (1953).<sup>26</sup>

It should also be kept in mind that what makes social-structural studies valuable is that structures are models, the formal properties of which can be compared independently of their elements. The structuralist’s task is thus to recognize and isolate levels of reality which have strategic value from his point of view, namely, which admit of representation as models, whatever their kind. (pp. 528-529)

It is important to note here that Levi-Strauss explicitly states that structures *are* models.

But the question remains, what does he consider a model to be? In order to say a structure consists of a model, he lists four requirements:

1. The structure must exhibit the characteristics of a system, and be made up of elements such that if one of the elements undergoes a change, then all of the other elements are affected.
2. For any given model of the type, it should be possible to order a series of transformations which would result in a group of models of the same type.
3. The properties resulting from the transformations producing a group of models will make it possible to predict how the model will be affected if one or more of the elements of the model are subjected to certain modifications.

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argues from models theory that there is no disjunction between religious and nonreligious thought; they share “similarity in form and continuity of substance.” (p. 181) At this point I mention it only for the reader to be aware of the controversy.

<sup>26</sup> Reprinted by Levi-Strauss (Levi-Strauss, 1963b).

In addition, I should note that I have found no evidence to suggest that Levi-Strauss was familiar with the mental models theory of Craik (1943), even though there does seem to be striking similarity in their descriptions of models (as we shall see in the next chapter). Levi-Strauss was surely at least familiar with the theory by the time Clifford Geertz published his essay “Religion as a Cultural System” (1973d, originally published in 1966) where Craik is explicitly cited in Geertz’s now famous passages describing “models of” and “models for,” but this was 13 years after the publication of Levi-Strauss’s first use of the term “model” in way that is consistent with Craik’s. Levi-Strauss indirectly credits his use of “model” to Durkheim and the laws of thermodynamics (Levi-Strauss, 1953, p. 529; Nutini, 1965, p. 709).

4. "The model should be constituted so as to make immediately intelligible all the observed facts." (1953, p. 525)

These four requirements suggest several things. First, it is clear that a model is holistic in the sense that changes to any of the elements of the model will change the model itself.<sup>27</sup> Secondly, the model must share the (relevant) properties of that which is modeled. Thirdly, it should be possible to apply the laws of transformation (see above) to the model at hand and produce models that are of the same kind. From this group of models, it must be possible to make predictions. Fourth, and finally, the model should make intelligible those observable facts which it seeks to explain (1953, p. 525).

Using models allows Levi-Strauss to make an important distinction between social structure and social relations, and demonstrates why it is that the two should not be taken as synonymous. Social relations are part of the elements which constitute the models out of which social structure is built. The implication here is that social structure itself cannot be reduced to the set of social relations. Further, as indicated, there is not just one model which forms a social structure, but several.

He distinguishes four types of models: *mechanical* and *statistical*, and *conscious* and *unconscious*. If the elements of the model are on the same scale as the phenomena modeled, then such a model is mechanical. Mechanical models are the domain of the invariant elements and their relations processed and stabilized by the deep structures of

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<sup>27</sup> Sperber (1968, pp. 222-223) thinks that Levi-Strauss has overstated his claim here. Sperber argues that there are zones of local coherence in models where a change in one of the elements may merely cause a local change in the model without affecting the whole model. He notes that the French kinship system has a term for both the masculine and feminine of cousin (*cousin* and *cousine*, respectively). But, he argues, if the French were to drop the determination of sex, and adopt the sexually neutral term "cousin" as in English, this would not affect the rest of the kinship model; for an uncle, aunt, brother and sister could all remain the same terms.

the human mind. In the case of these models, if the relation between the model and that which it models is isomorphic in all instances, then it is mechanical. Prohibitions, for instance, are mostly modeled mechanically. If the culture prohibits the marriage M of a brother b to a sister s, then a model will be constructed by participants in that culture of  $\sim bMs$ . There can be no cases, in that culture, in which the relation of marriage between a brother and sister are permitted; therefore, the model is isomorphic to all instances to which it is relevant, thus mechanical.<sup>28</sup> If, however, the elements are on a different scale, such a model will be statistical. These models have elements and relations that vary by contingent factors, and are not determined (in full) by deep structures. Statistical models, however, do help determine invariants in a particular cultural phenomenon by determining average values and thresholds. Moreover, there may be models created from both mechanical and statistical models; such models are said to have *intermediate form* (Levi-Strauss, 1953, pp. 528-529; Nutini, 1965, pp. 709-710; Rossi, 1982a, pp. 46-58).

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<sup>28</sup> Levi-Strauss (1953, p. 528) himself uses kinship to illustrate a mechanical model. In many societies whom one may and may not marry is stable with no variations. In other cultures, such as in the France, the prohibitions allow for no variations whereas to whom one is allowed to marry greatly varies with regard to relation, social standing, ethnicity, etc.. In this case, the allowances can be modeled; however their model will be statistical. The actual kinship system will include both the prohibitions and the allowances, therefore, the model will be of intermediate form.

In the case of myth, something that is mechanically modeled would be the violations of ontological categories (by breach or transfer) to create supernatural beings or objects; see Boyer (1996, pp. 92-93; 2000, pp. 198-ff.; 2001, Chapter 2; 2003a, pp. 119-120; Boyer & Ramble, 2001, pp. 536-ff.). Inasmuch as the specific beings or object are variable, as well as the specific type of violation of the ontological category to which it belongs, then a model of the specific supernatural beings and objects of a culture would be statistical or intermediate form.

Conscious models are used by society to perpetuate their “norms.”<sup>29</sup> They are not intended to be explanatory models of social phenomena, but rather are used in the transmission of social beliefs and customs. These models Levi-Strauss refers to as “home-made” models. Home-made models are poorly constructed and usually inaccurate models that serve to screen and hide shallow (social) structures.<sup>30</sup> These models can be investigated by the anthropologist through the theoreticians of the culture under study, and may provide, if accurate, “some insight into the structure of the phenomena.” If, on the other hand, they turn out to be inaccurate, then they provide the anthropologist with biases and types of errors which exist in the culture that work in perpetuating social norms of that culture (1953, p. 527).

Unconscious models are often masked by the conscious models of a society, yet they are the models that the anthropologist should strive to uncover. They are manifestations of the deep structures of the mind, and are not consciously perceived by the society (1953, pp. 526-527). It is by uncovering the unconscious categories of these models that the anthropologist can find the oppositions between the natives’ ideal image of their society and how it is that it actually functions. These are the discrepancies the

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<sup>29</sup> Levi-Strauss states that conscious models are usually known as “norms,” which seems to suggest that conscious models themselves are nothing other than cultural norms. This is problematic for a number of reasons picked up on by both Hugo Nutini (1965) and Peter Caws (1974) that we shall address shortly.

<sup>30</sup> This claim is supported by the research of Stewart Guthrie into “theological incorrectness.” Subjects are asked first to explain their (conscious, home-made) theological concepts about God, and these are often found to contain numerous violations of intuitions about intentional agents. Secondly, they are then presented a narrative about an event which they are then asked to explain and summarize given their religious convictions. In this task, subjects presented their (unconscious) God-concept in a manner that was very similar to an ordinary intentional agent and was minimally counterintuitive (2000, pp. 29-31). What this demonstrates is that the conscious model in which the subjects thinks he believes is not the same as the unconscious model that the subject will employ in real-life situations.

society tries to hide or to justify by their rituals, myths, and religious representations (1983a, p. 80).

Unconscious models, therefore, seem to lie at the heart of structural analysis, but surprisingly, Levi-Strauss says little more about them specifically. If, however, as argued by Hugo Nutini (Nutini, 1965), unconscious models for Levi-Strauss simply are social structures, then *all* of Levi-Strauss' work is about unconscious models. Nutini argues this on the basis that Levi-Strauss first says that conscious models "are usually known as norms" and concludes that section of the text by stating "the cultural norms are not of themselves structures" (Levi-Strauss, 1953, p. 527). Since, as observed earlier, Levi-Strauss equates social structures with models, if cultural norms are not structures, then cultural norms cannot be models. Therefore, since Levi-Strauss has said that conscious models are "norms," conscious models are really not models at all. Thus, all that is left to determine social structure is the unconscious models; therefore, the social structure simply *is* the unconscious model (Nutini, 1965, pp. 708-709).

Granted, Levi-Strauss is anything but clear on this matter. Yet, I think it is possible to give a more generous reading to Levi-Strauss here so that it is possible to leave conscious models intact. What I take to be a more accurate reading is that Levi-Strauss has taken a step back (in claiming that "cultural norms are not of themselves structures") from the initial distinction of conscious and unconscious models, and considers them both to be part of the whole social structure, or social model. What he is criticizing in the text are those anthropologists who take cultural norms to be the whole of social structure, and this he thinks is a mistake (and rightly so). Furthermore, it is not

at all clear from the text that Levi-Strauss means “norms” in quotes in the first instance to be equivocated with cultural norms in the second instance. If a reading along these lines is correct, then Nutini’s concerns are alleviated.<sup>31</sup>

Peter Caws also picks up from Nutini on problems with Levi-Strauss’ notion of models (Caws, 1974). His foremost objection to Levi-Strauss’ formulation is that Levi-Strauss describes “a structure as a kind of model, rather than a model as a kind of structure” (p. 2). Caws began his essay making a number of appropriate philosophical distinctions that serve to clear up some of the confusion which he finds in Levi-Strauss’ exposition:

If we adopt the definitions of *system* as a set of *entities* mutually interrelated and interdependent, themselves functioning together as an entity at some higher level of organization, and of *structure* as a set of systematic *relations*, concrete if embodied in an actual system, abstract if merely specified but not so embodied, then the notion of a *model* can be defined as follows: an abstract structure is a model if it stands for a homologous concrete structure, a concrete structure is a model if it stands for a homologous concrete structure differently embodied. By “stands for” I mean that features of the model are substituted for features of the structure whose model it is, for purposes of presentation, or instruction, or explanation, or imaginative variation, or computation, or prediction. (p. 1, *emphasis* original.)

What Caws sets up to do with this introductory paragraph is to make useful distinctions between models and structures glossed over by Levi-Strauss, and also to suggest a more intelligible way of distinguishing models themselves apart from Levi-Strauss’ conscious

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<sup>31</sup> I want to stress again, however, that Levi-Strauss is anything but clear on the matter, and a close reading of this text does little to alleviate the confusion. For instance, Levi-Strauss at first says that conscious models do not explain phenomena, but then, in the next paragraph, says that they interpret raw phenomena. In the end, however, I think that Levi-Strauss is trying to stress the idea that both the conscious and unconscious models make up the whole of social structure, although, undoubtedly, the unconscious models should be of most immediate interest to anthropologists, and the conscious models may help to provide some insight into the unconscious models of the society. (Levi-Strauss, 1953, p. 527)

and unconscious distinction. Models are *sets* of mental structures that have homologous relations and stand for (as a relation) social reality (in this case). Moreover, Caws argues, there are three distinct types of models: operational, representational and explanatory (pp. 3-5).

An operational model corresponds to the way that a subject practically responds and acts in his environment. It is the model that governs the subject's interaction in his society. A representational model,<sup>32</sup> however, corresponds to the way the subject thinks things are in his environment. These two models often are, though not necessarily, incompatible with one another, as Levi-Strauss discussed. By distinguishing these first two types of models, Caws avoids the problems arising from invoking the psychologically loaded terms "conscious" and "unconscious."<sup>33</sup> Nevertheless, Caws admits that if either of these two types were to be unconscious, it would be the operational model, for the suggestion of a representational model as unconscious would be a contradiction in terms. But, he argues, "there seems to be no reason a priori why incompatible mental structures may not coexist in the same head consciously, provided that they are not invoked at the same time" (p. 4).

Explanatory models are a different case for Caws; they are the scientific views of the world held by scientists (in this case, anthropologists). "An explanatory model is

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<sup>32</sup> Caws also suggests that there are perhaps two instances of representational models, descriptive (the way the subject thinks things are) and prescriptive (the way the subject thinks things are supposed to be), but he does not press the issue (p. 4).

<sup>33</sup> Caws, however, is willing to admit that labeling the operational model as unconscious and the representational model as conscious is most often an accurate approximation to the actual state of affairs (p. 4).

always one of the scientists' mental structures; it is never 'in' the data nor...in the heads of the members of the social group being examined" (p. 5). The explanatory model must account for both the empirical data gathered by the anthropologist and the relationships between the operational and representational models of the society. The source of the confusion in reading Levi-Strauss' account of unconscious (operational) models, according to Caws, is that Levi-Strauss fails to distinguish between the operational and the explanatory model; "[a]nd the latter will always be the richer of the two...." (p. 5). What Levi-Strauss has done through his structural analysis is not only uncover the operational (unconscious) models in the heads of the natives, but he has also sought to explain them. By failing to distinguish between the operational and explanatory models, Levi-Strauss has conflated (or better, meshed) the uncovered operational models with his own explanatory models that seek to explain them. In doing so, Levi-Strauss has confused the embodied unconscious objective structure present in the society and the model he developed from data and relationships between the operational and representational models which explains the phenomena at hand. Unless these are untangled, Caws argues, "...confusion reigns" (p. 5).

These distinctions between the three models were an attempt by Caws to help make sense of a troubling assertion by Levi-Strauss, that "[t]he term 'social structure' has nothing to do with empirical reality but with models which are built up after it" (Levi-Strauss, 1953, p. 525). To what Levi-Strauss would be referring in this case, according to Caws, is the explanatory model that Caws claims is never "in" the data nor in the heads of the natives. In this sense, therefore, social structure really does not have

anything to do with empirical reality—social structure comes from the construction of the mental models at play within the individual, the society, and the anthropologist who studies them.

The apparent contradictory claim by Levi-Strauss that social structure has nothing to do with empirical reality spurred a heated twenty year debate (see Maybury-Lewis, 1960; Nutini, 1965; Schneider, 1965; Caws, 1974, 1976; Hanson, 1976; Cohen, 1977; Rossi, 1977; Levi-Strauss, 1983). Detractors argued that this eliminated any hope of empirical verifiability, while structural proponents argued that what Levi-Strauss meant was that the explanatory model which the anthropologist creates from the empirical data is not in the data itself.<sup>34</sup>

We maintain, however, that the entire debate rested on the misconception of a subtle distinction that Levi-Strauss was attempting to make. This distinction is between a representation and the content of a representation. It is the content of the representation that is based in ‘empirical reality’ rather than the representation itself. The representation is how the content is presented to the mind. Levi-Strauss attempted to explicate this distinction twice:

This should help to clarify the difference between two concepts which are so close to each other that they have often been confused, namely, those of *social structure* and of *social relations*. It will be enough to state at this time that social relations consist of the raw material out of which the models making up social structure are built, while social structure can by no means be reduced to the ensemble of the social relations to be described in a given society (Levi-Strauss, 1953, p. 525 *emphasis original*).

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<sup>34</sup> The proponents argue that this holds for scientific explanations as well. Laws of nature, inasmuch as they are explanatory, are not found in the data itself, rather they are abstracted from the data.

And,

Similarly, it is hopeless to expect a structural analysis to change our way of perceiving concrete social relations. It will only explain them better. If the structure can be seen, it will not be at the earlier, empirical level, but at a deeper one, previously neglected; that of those unconscious categories which we may hope to reach by bringing together domains which, at first sight, appear disconnected to the observer: on the one hand, the social system as it actually works, and on the other, the manner in which *through their myths, their rituals, and their religious representations*, men try to hide and justify the discrepancies between their society and the ideal image of it which they harbor (Levi-Strauss, 1983a, p. 80, *emphasis added*).

Using this distinction, the contents of the model are the social relations, while the model itself is the social structure and is the representation of those social relations. It is the social relations which “have to do” with empirical reality in this case; therefore, it is wholly incorrect to take Levi-Strauss to be saying that models have *no* tie to empirical reality; they do through their content. The model, as a representation in the mind, is what supplies the structure to the content.

From the above, we now have an understanding of how the elements of myth are formed and related to one another through models, but what of the elements—the mental contents—of myths themselves? The elements of myth, according to Levi-Strauss, lie in between percepts and concepts. The first intermediary is *images*, and the second is *signs* (Levi-Strauss, 1972, p. 18). Images are formed by the interaction between the discreet data transmitted from the eye (or other sense organ) as binary oppositions to the brain which reconstructs the object from the data.<sup>35</sup> Images, therefore, have an intellectual aspect to them which the percept (the discreet raw datum)

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<sup>35</sup> “Images” should be taken in a loose sense here meaning that they are not solely, even though predominately, visual.

does not have (1981, p. 678).<sup>36</sup> “Images are fixed, linked in a single way to the mental act that accompanies them” (1972, p. 20). Images only have one particular reference relation, and thus may not be substituted for another image, sign or concept.

Signs lie in the intermediary position between images and concepts, and unite the two together as the signifying and signified respectively.<sup>37</sup> Levi-Strauss describes signs as being like images in that they are concrete entities with acquired significance and may lack comprehension (thus act as place holders for future concepts). Moreover, both images and signs cannot, like concepts, stand in an unlimited number of relations with entities of their same type, but they can stand in a limited number of successive relations with other entities. Signs, however, are like concepts in their ability to refer to something else—that is, they may be substituted for something else. Yet, signs are not unlimited in this capacity as concepts are. Furthermore, signs interpose and incorporate a degree of human culture into reality (1972, pp. 18-21).<sup>38</sup>

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<sup>36</sup> In *Thinking Without Words*, Jose Bermudez borrows heavily from Gibsonian affordance theory to argue that perception is a low level rational process because perception is not neutral. Thus, in accord with Levi-Strauss, there is an intellectual aspect to “images” taken in the loose sense mentioned in the above note (35) (Bermudez, 2003, p. 121). Millikan (2004, p.158) says of Gibson’s theory of perception, “basic perception consists in ‘picking up’ or extracting certain abstract patterns in the ambient energies arriving at the organisms sensory surfaces, which patterns then guide the various activities of the organism directly. No inference or calculation is required, but merely sensitivity to certain variants and invariants in the energies impinging on the active organism that, on the one hand, carry information about the relations of significant distal affairs to it and, on the other, directly guide its motions to take account or make use of these distal affairs.”

<sup>37</sup> Signs may be icons, sounds, or words. One of the main roles of signs is to act as an intermediary between images and concepts such that by the use of a sign, an individual may “call forth” the appropriate image or concept needed.

<sup>38</sup> Levi-Strauss opposes signs to concepts in this respect in that he claims that “concepts aim to be wholly transparent with respect to reality.” (1972, p. 20) Considering the context of this claim in the work, it is difficult to understand exactly how he makes this distinction between signs and concepts. I will let this go at that.

By the limited number of relations allowed images and signs, through the processes of transformation, they form a system, or structure, in which any alteration to one element of the structure automatically affects all the other elements.<sup>39</sup> A myth is formed when this structure permits a structural *set* to be constructed from an object and an event. In other words, myths tell a story which is created from the structure of the elements combined with the event about which the story is told (1972, pp. 17-22, 26).<sup>40</sup>

Levi-Strauss explicitly describes this type of (mythical) thinking as analogical.<sup>41</sup> “The savage mind deepens its knowledge with the help of *imagines mundi*. It builds mental structures which facilitate an understanding of the world in as much as they resemble it. In this sense savage thought can be defined as analogical thought” (1972, p. 263).

Perhaps nowhere is to what Levi-Strauss refers better illustrated than in the Western Apache practice of “speaking with names.” In this practice, the Apaches

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<sup>39</sup> This corresponds to the first requirement Levi-Strauss listed for a model above.

<sup>40</sup> Levi-Strauss contrasts this to art which he claims begins with the set—that is, the story, and then extracts and portrays the structure.

A similar point is made by Peter Munz (1956). He argues that a myth-maker compounds several persons and events into one and this gives the myth its universal characteristics. Further, he adds:

The truth of a myth does not depend, in any case, on whether it is a true description of a single event to be located in space and time, but on whether people recognize themselves and their lives in it or not. It is not at all surprising that some myth-makers should have exploited this relation of myth to reality in order to create a special technique. Unperturbed as to whether what they say is strictly possible or not, they say things which could never have happened in order to emphasize certain qualities or features of their story. They know quite well that the use of the myth will not depend on whether any statement in it is an exact description of what actually happened. And therefore they can afford to emphasize their story and to underline certain parts in it by free invention. Thus we get the seemingly paradoxical conclusion that that myth may easily be the most enlightening which is literally the least credible (p. 15).

<sup>41</sup> The research of Guthrie emphasizes this point. He argues that religious thoughts are plausible models of the world, and that models themselves depend on analogy (specifically a human-like analogy) (1980).

console and counsel one another by speaking the names (giving signs) of people or places, or both. In fact, an entire dialog may occur between interlocutors that is nothing more than “speaking with names;” in such cases, the conversation is completely lost on someone who is alien to the culture, for these signs are culturally loaded. Keith Basso describes this practice as follows:

Western Apache conceptions of language and thought are cast in pervasively visual terms. Every occasion of ‘speaking’ provides tangible evidence of ‘thinking’, and thinking occurs in the form of ‘pictures’ that persons ‘see’ in their minds. Prompted by a desire to ‘display thinking’, speaking involves the use of language to ‘depict’ and ‘convey’ these images to members of an audience, such that they, on ‘hearing’ and ‘holding’ the speaker’s words, can ‘view’ the images in their own minds. Thinking, as Apaches conceive of it, consists in picturing to oneself and attending privately to the pictures. Speaking consists in depicting one’s pictures for other people, who are thus invited to picture these depictions and respond to them with depictions of their own. Discourse, or ‘conversation’, consists in a running exchange of depicted pictures and pictured depictions, a reciprocal representation and visualization of the ongoing thoughts of participating speakers (Basso, 1996, p. 84).<sup>42</sup>

According to Basso, the practice of ‘speaking with names’ accomplishes the following:

1. Produce a mental image of a particular geographical location.
2. Evoke prior texts, such as historical tales and sagas.
3. Affirm the value and validity of traditional moral precepts (i.e., ancestral knowledge).
4. Display tactful and courteous attention to aspects of both positive and negative face.
5. Convey sentiments of charitable concern and personal support.
6. Offer practical advice for dealing with disturbing personal circumstances (i.e., apply ancestral knowledge).

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<sup>42</sup> The words in single quotes are words for which Basso provides the Apache word as well. I have chose to exclude the Apache from this passage since it is of little help in conveying the point of the passage for our purposes.

7. Transform distressing thoughts caused by excessive worry into more agreeable ones marked by optimism and hopefulness.
8. Heal wounded spirits (1996, p. 100).

By using the signs of “speaking with names” the Western Apaches are able to initiate a wide variety of recollection, referential, and inferential processes. Here, most clearly, the signs do play the role of intermediary between images and concepts. In addition, their power to interpose and incorporate human culture into the ‘thinking’ process is demonstrated.

Further, in a study conducted by Justin Barrett and Brant VanOrman in 1996 the role of iconography and image use (signs) in Catholic and Protestant worship was examined to determine what affect these had on their concepts of God. The experiment was to determine which group of Christians had the more theologically (doctrinal) correct views, particularly, God not being limited by space and time. Counterintuitively, it was found that those subjects who both had high exposure to anthropomorphic God images and claimed to use such images in their worship (such as praying to, or before, an image of Jesus) had more theologically correct concepts of God than non-image users. The former were predominately Catholic, while the latter were predominately Protestant. This study suggests that the use of signs in worship allows for more abstract thought because the symbolic nature of the image is given more emphasis than the concrete properties. What is more interesting still is that the non-image-using Protestants reported having anthropomorphic (mental) images of God

while the Catholics did not have clear mental representations of God (Barrett & VanOrman, 1996).<sup>43</sup>

What might be further suggested from this study falls in line with what Levi-Strauss proposed about the intermediary role of signs between images and concepts. Without the use of signs, mental representations (images) grossly limit conceptual inferential abilities to concrete properties. With the use of signs, however, conceptual inferential abilities are expanded to abstract properties thus allowing unlimited relations and inferences. The use of signs, therefore, allows concepts to act unrestrictedly.<sup>44</sup>

Finally, Clifford Geertz stresses that for Levi-Strauss sacred objects “provide the raw materials for analogical reasoning. The relationships perceived among certain classes of natural objects or events can be analogized, taken as models of relationships—physical, social, psychological, or moral—obtaining between persons, groups, or other natural objects or events” (Geertz, 2001, p. 13).<sup>45</sup> These models, according to Geertz’s analysis, are formed from systems of signs which are presented in

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<sup>43</sup> Many of Barrett’s and VanOrman’s conclusions in this study appear to be contradictory. For instance, of the Protestants in the study that claimed to use images in their worship, they performed more poorly on “God items.” This means that their concept of God was more anthropomorphic than non-image using Protestants. However, all Catholics in the study were image users, but they performed significantly better on the “God items” than the Protestants. Using the data collected from the Protestants, Barrett and VanOrman conclude that “exposure to images for purposes of worship may lead to distorted, more limited concepts of God” (Barrett & VanOrman, 1996, quote from p. 44). But, when considering the difference between Catholic and Protestant answers to the “God items” this does not appear to be the case.

<sup>44</sup> “Memory off-loading” is likely at work here. The use of symbols (images of God) “jars” the memory of the image-user to recall the more complex theological views present in his religious beliefs. For more on the ability and benefit of this cognitive process of “off-loading,” see Dennett (1996, pp. 134-*ff*)

<sup>45</sup> Geertz uses the term “model” in the sense introduced by Craik (see note 12 above).

myth and ritual. These systems “fix and organize abstract conceptual relationships in terms of concrete images and thus make speculative thought possible” (p. 13). The fundamental role that myth and ritual play in culture is to transmit the information conveyed in these sign systems to members of the group (p. 14). In other words, the sign systems of myth and ritual help to assimilate the models of the individuals to those of the group.<sup>46</sup>

### 2.3 Updates to Structural Theory

Numerous modifications to structural theory have been suggested and tried over the years, but for the purposes of this enterprise, I will focus only on two particular theorists: Joseph Bastien and Seth Kunin.

Joseph Bastien, in his influential ethnography of Andean life, *The Mountain of the Condor: Metaphor and Ritual in the Andean Ayllu* (1978), argues for an ecological structuralism that examines the cosmology, politics and religion of a society in metaphorical relation to the human body. According to his study, metaphors used in a society give anthropologists an illuminating view into how a society (in a particular the Andean society discussed) composes a holistic framework which makes the culture unique. As forecasted by both Ogden (1967) and Levi-Strauss (1972),<sup>47</sup> Bastien’s work is the first major ethnography that demonstrated the importance of the body in

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<sup>46</sup> See also, Geertz (1973a, pp. 352 - 354).

<sup>47</sup> See the previous section, above, for the importance of analogy in constructing structural models according to Levi-Strauss. See also Guthrie (1980).

metaphor, and the role of analogy in a finely tuned social structure. Moreover, the widespread use of the body metaphor in language would later be confirmed in the arguments presented by George Lakoff and Mark Johnson in *Metaphors We Live By* (1980). What is demonstrated in Bastien's work is the essential nature of metaphor and analogy to the laws of transformation argued for by Levi-Strauss. Contiguity, resemblance, difference, and interest are often structurally related through metaphor and analogy, and the metaphor that is most important is the metaphor of the human body to the environment. It would seem, therefore, that one of artifacts the deep structures of the human mind—that is, an artifact of fundamental cognitive processes—is to relate metaphorically to the environment in terms of that which is most intimately known, our own body.<sup>48</sup>

Seth D. Kunin, in “The Allegory of the Olive Tree: A Case Study for (Neo) Structuralist Analysis” (2003), argues for several updates to the structuralist theory. First, he argues for a delineation of levels of structure as they appear in culture as products of individual minds. Secondly, he proposes that the laws of transformation, particularly the law of opposition, should be expanded to deal with more complex social structures in which triadic or larger oppositions occur. To do this, Kunin argues for *ideal types*. Thirdly, he tackles a pressing issue in structuralism, the role of agency, and

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<sup>48</sup> I say this with the intention that the body includes the mind, which is something that Bastien does not consider. Bastien in fact takes structuralism to presuppose a mind/body dualism, but he offers no defense of this claim (1978, p. 192). On the contrary, I have found no evidence, particularly from Levi-Strauss, that such is the case.

argues for a modification of structuralism that frees the discussion from strong determinism usually present in structural analysis.<sup>49</sup>

Kunin, following Levi-Strauss, sees structuralism as “ultimately concerned with establishing the underlying, unconscious patterns of the brain that shape the way we categorize the world and thus ultimately how we think and act” (2003, p. 108). He argues, however, that there a number of levels of underlying structure which it is useful to distinguish; each of these levels is relevant at different stages of structural analysis. He delineates them into a hierarchy as follows (p. 108):

N — Culture and context specific

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S<sup>3</sup> — Culture specific

S<sup>2</sup> — Culture group specific

S<sup>1</sup> — Universal

He then employs the following analogy between a computer and the human brain to clarify these:

S<sup>1</sup> is analogous to a computer without any software. The computer has particular patterns hardwired into it, but these patterns can be developed in a number of ways, depending on the software. S<sup>2</sup> might be a form of machine language or general software that tells the computer what to do with material on various disks. The disks and the memory initially have no content, but the computer is programmed to know what to do with the content when it is added. S<sup>3</sup> is analogous to the level when data is inputted into the computer. Based on its programming, the computer will file the material in the appropriate place. As each piece of material is added, it will affect the placement of the next piece of material based on the computer program. The N level is the final product, perhaps the picture or game presented on the computer monitor. It presents the categories and ordered material from the previous level into a form that can be used (2003, pp. 108-109).

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<sup>49</sup> Kunin makes clear in his abstract (2003, p. 105) that he is only offering refinements to structural theory rather than making significant alterations or challenging the principles of traditional structuralism.

Kunin proceeds to elaborate on these levels of structure more specifically.  $S^1$  is the most basic and abstract level of structure: it is part of the biological structure of the human brain which is itself without content.  $S^1$  is a functional mechanism in the brain that serves to structure rather than itself being a structure. Further, in opposition to traditional structuralism, Kunin suggests that this level of structure is far more plastic than had previously been supposed. Rather than simply being confined to dyadic structure, he argues that this mechanism has the potential to form a variety of more complex structures, such as triadic oppositions or higher.<sup>50</sup>

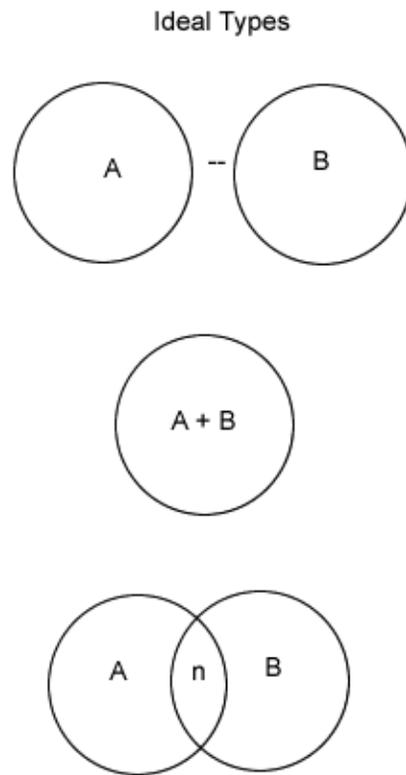
The next level of structure,  $S^2$ , is also abstract, and has no specific content. It is the functional level of categorization by which meaningful patterns are constructed that are actualized into a specific structural form that may be dyadic, triadic, etc.. These structural forms are realized through relations between categories in what Kunin calls ideal types that take one of three forms:  $A - B$ ,  $A + B$ , or  $A \cap B$ . If there is no overlap between these categories, then the relationship is said to be negative (-). If what is found in category A is also found in category B, then the relationship is to be positive (+). What differentiates category A and B in the latter case is the relevant qualities by which the content is categorized. The neutral relationship (n) is where there is the possibility of overlap between A and B, but there is some content which remains exclusive to its respective category (see Figure 1).<sup>51</sup>

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<sup>50</sup> Kunin uses the example of American Immigration to demonstrate a triadic pattern: “individuals start as outsiders; are transformed th[r]ough belief or an oath into insiders; and finally, are seen to be Americans (no longer foreigners). . . .” (2003, p. 107).

<sup>51</sup> Kunin’s ideal types bear a striking resemblance to Bermudez’s protologic (2003, Chapter 7).

It is the  $S^3$  level at which content is added to the structure. This level is both narrowly culture specific and context specific. Irrespective of both type and character of content, the content is organized as determined by  $S^3$ . The content itself, however, is “specific to the particular cultural, ritual or mythological system” (2003, p. 110). This content, in a mythological system, takes the form of mythemes which are set in relation to other mythemes as determined by the underlying structure and has, at this level, neither narrative nor ritual form.



**Figure 2.1 Ideal Types**

It is at the N level, according to Kunin, that mythemes “are organized and ordered into a coherent narrative or ritual form” (2003, p. 110)<sup>52</sup> The mythemes become myths. As Kunin explains at some length:

The N, or narrative, level is the myth, ritual or custom. While narrative is clear regarding myth, it is also present in the diachronic, transformative development found in ritual or customary practice. This is the myth, ritual or custom as we find it in the text or ethnographic situation. The narrative level is that at which the particular cultural object is played out as part of individual or communal practice. The order of the elements found at this level is not of structural significance except inasmuch as it may indicate diachronic transformation of the symbolic elements being used. In order for one to tell a story or construct a ritual, the elements may have been reordered based on the needs of the narrative. Structuralist analysis suggests that at the underlying levels of structure, diachronic or narrative development is not significant, and the elements and their interrelations can be reversed or re-ordered in different ways on structural rather than narrative considerations. It is the repetition of elements rather than their narrative order that is significant.

The N level is highly culture and context specific. Myths and rituals will change both geographically and diachronically based on different cultural or historical contexts.... Unlike the levels of underlying structure, N is conscious rather than unconscious (2003, p. 109).

What Kunin offers here is a further elaboration of Levi-Strauss’s idea that a myth is formed when the (underlying) structure permits a structural set to be constructed from an object and an event.<sup>53</sup> When the object and event are placed in the structure as contents, what emerges at the N level is narrative that is historically and culturally situated. This provides context.

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<sup>52</sup> For ritual, it would be the “riteme.” Further, mythemes and ritemes should be understood as subclasses of memes; they function and are transmitted in the same manner as memes. See Dennett (1990) and Millikan (2004, Chapter 2) on the nature, function, and transmission of memes.

<sup>53</sup> See section 2.2 above.

Kunin, however, wants to avoid the strict determinism of structural manifestations as presented in traditional structural analysis; he wants to allow for agency of both a conscious<sup>54</sup> and unconscious<sup>55</sup> variety. To do this, he appeals to emphasis that an individual or a cultural group might place on one specific structural relation, whether that be a category, a mediator,<sup>56</sup> or a transformational relation. What is essential to this agency for Kunin is that the emphasis is not placed on the particular content, but rather on the structural relation. Therefore, he argues, the emphasis provided by agency still illuminates the underlying structure, and how the mind builds structural sets (Kunin, 2003, pp. 111-115).

Kunin's proposed modifications serve to give structuralism more flexibility and more breadth. With these modifications, the relation between social structure and the mind, Levi-Strauss's main goal, remains intact. By proposing additional levels of structure—thus proposing multiple cognitive processes in the mind that are manifest in culture—Kunin expands structural analysis in such a way as to allow for more complex systems of culture. Further, by breaking away from the strict determinism of traditional structuralism by admitting agency, he allows for a wider range of variations in culture

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<sup>54</sup> To explain conscious agency Kunin appeals to the notion of *jonglerie*—identity juggling. By this process, individuals emphasize or de-emphasize different aspects of a structural equation (2003, p. 113).

<sup>55</sup> To explain unconscious agency, Kunin appeals to Levi-Strauss's notion of *bricolage*. (Levi-Strauss, 1972, pp. 16-ff.) Bricolage occurs at the level of  $S^3$  and determines the unconscious emphasis of qualities in placing objects in categories (Kunin, 2003, pp. 112-113).

<sup>56</sup> Another interesting aspect of Kunin's theory that I will not take time to explore here is the introduction of positive and negative mediators. A positive mediator serves to bring two categories together, whereas a negative mediators serves to provide a clear demarcation between categories (Kunin, 2003, p. 111).

than laws of transformation alone can provide. Nevertheless, Kunin still maintains that structure, rather than content, is the essential key to understanding cultural manifestations of ritual and myth (as well as other types of social structure; kinship, politics, economics, etc.).

#### 2.4 Summary and Conclusion.

We began this chapter with a series of questions. The theories presented in structural anthropology lead to a plausible answer to the first two: Why is it, and how is it, that humans come to see the world mythically? And, what cognitive processes are involved in relating the natural world with the cultural world? In answer to the former, structural anthropology argues that as humans take in the world around them, the numerous cognitive processes included in the laws of transformation are involved in categorizing, relating, and structuring experience into models that represent the world. These models are analogical, based on the analogy between the world and the human body (including the mind) and how it experiences the world in which it finds itself. Myths arise from this dynamic process. The answer from the first, therefore, leads to the answer to the latter. The processes of categorization, opposition, and transformation permit the human mind to mediate the cultural world with the natural world through analogy.

The last question with which we began (why is it natural for these processes to produce myths?) shall be answered through the following two chapters. The next chapter will demonstrate the cognitive science behind the structuralists' use of models.

By examining mental models theory we shall see that structuralists' employment of models is firmly rooted in the science of how the mind works. In Chapter 4, we will return explicitly to myth and see how it is that by combining mental models theory with structural anthropology a scientific explanation of myth begins to unfold. There, we shall also look deeper into the cognitive science of religion as well as cognitive role that analogy plays in providing humans an understanding of the world that is, quite naturally, mythical.

## CHAPTER 3

### MENTAL MODELS AND THE NATURE OF THOUGHT: CRAIK AND SINCE

[E]xperimental psychology is not going to succeed unaided in elucidating human mentality; artificial intelligence is not going to succeed unaided in modeling the mind; nor is any other discipline—linguistics, anthropology, neuroscience, philosophy—going to have any greater success. If we are ever to understand cognition, then we need a new science dedicated to that aim and based in part on its contributing disciplines.

Philip Johnson-Laird, “Mental Models in Cognitive Science”<sup>57</sup>

#### 3.1 Craik and the Nature of Thought

In 1943, against the swelling tide of the psychological theory of Behaviorism, Kenneth J. W. Craik published a small treatise, *The Nature of Explanation*, that would have a profound effect on the way that psychology and the emerging field of cognitive science would view human thought processes. That effect, however, would be nearly 40 years in the making. After the fall of behaviorism in the 1950’s, psychologists returned to the drawing board (as it were) to explain human thought and behavior. In the midst of this re-examination, Craik’s work was rediscovered.<sup>58</sup> The importance of this rediscovery is stressed by Colin McGinn:

That book [*The Nature of Explanation*] is remarkable for its boldness and its prescience, particularly in view of the intellectual climate at the time it was written. For this was the period of Behaviourism, and Craik’s theorizing runs flat against the dogmas of that misbegotten scientific ideology: he is cheerfully up to his neck in internal structures and processes, constrained only by

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<sup>57</sup> From P. N. Johnson-Laird (1980).

<sup>58</sup> As we saw in the previous chapter, however, Craik’s work had remained alive in other disciplines, at least anthropology, where it was employed most notably by Clifford Geertz (1973d).

considerations of an overall explanatory adequacy. In this respect, as in others, he anticipated the ‘scientific revolution’ that was to issue in what is now called ‘cognitive science’. Craik’s work draws upon philosophy, neurophysiology, biology and computer science (as well as engineering and electronics) to confect a striking and sophisticated theory of thinking. In effect, he is seeking an explanatorily adequate theory of cognitive competence of the kind later sought by Chomsky for language and Marr for visual perception.... For these reasons Craik is commonly regarded today as the father of the modern ‘cognitivist’ approach to psychological theory—and with considerable justice. (1989, pp. 173-174)

The essential question that Craik asked which differentiated him from his peers in psychology at the time was “What kind of internal structure would be necessary and sufficient to confer the capacity to *think* on an organism?” (McGinn, 1989, p. 174 *emphasis original*)

While I do not wish to spend a great deal of space covering ground that has been well mapped and analyzed previously (Craik, 1943, Chapter 5; P. N. Johnson-Laird, 1983, Chapter 1; 1989, pp. 469-470; 1993, pp. 1-2; McGinn, 1989, Chapter 3), there are a few key points from Craik’s theory that I wish to bring to the fore. First, what was the capacity to think for Craik? One of the most fundamental properties of thinking, according to him, was predictiveness—that is, the power of *predicting events*. “[T]he processes of thought, reduced to its simplest terms, is as follows: a man observes some external event or process and arrives at some ‘conclusion’ or ‘prediction’ expressed in words or numbers that ‘mean’ or refer to or describe some external event or process which comes to pass if the man’s reasoning was correct” (Craik, 1943, p. 50). The product of reasoning, if correct, produces a final result (mentally) that is similar to the result which occurs in actual physical processes should they be so caused (p. 51).

Reasoning *imitates* the process that it is attempting to predict, and it does so by three essential cognitive processes:

1. 'Translation' of external process into words, numbers or other symbols,
2. Arrival at other symbols by a process of 'reasoning', deduction, inference, etc., and
3. 'Retranslation' of these symbols into external processes (as in building a bridge to a design) or at least recognition of the correspondence between these symbols and external events (as in realising that a prediction is fulfilled). (p. 50)

These three cognitive processes, according to Craik, are carried out by models which are "any physical or chemical system which has a similar relation-structure to that of the processes it imitates." (p. 51) Thinking, therefore, is essentially the manipulation of models.

The most important aspect and advantage of models is what Craik calls the "trial of alternatives." With models, one may 'try out' various alternatives without having the expense of bringing about the actual causes that it is imitating. For example, if an engineer were charged with building a bridge, it would be far more convenient, economical, and expedient for her to test her designs on small-scale models rather than building the actual (functional and full-scale) bridge each time. She can predict how the bridge will react under stresses and conditions it will incur by imposing them first on her small-scale models which bear the same relation-structure to an actual bridge (were it to be built).

A mental model is a representation constructed to represent such a small-scale model in the mind, though obviously not out of the materials used to construct the actual, or even the engineer's small-scale physical model, bridge. The mind imitates the

physical processes (events) that the bridge might undergo without the expense, time, or inconvenience of building even the small-scale physical model.<sup>59</sup> Thus, the essential function of a mental model that falls out from its predictive ability is *problem solving*.

Creatures<sup>60</sup> that are endowed by evolution with the ability to model their environment demonstrate learning and problem solving abilities above what operant conditioning would allow. They do not have to learn *only* from mistakes; they can carry out simulations in their minds which predict likely events prior to taking action, and thus stand a greater chance of avoiding error. The evolutionary advantage that the ability to construct mental models of their environment gives to creatures is enormous (Currie, 1995, pp. 157-160; D. C. Dennett, 1996, pp. 88-93). The ability to mentally simulate one's environment in order to predict it is a powerful tool for survival in a world that is often unforgiving of mistakes.

Interest in Craik's work was ignited in cognitive psychology in the late 1970's and early 1980's. By the late 1980's and throughout the 1990's and to the present, mental models theory has become a well-established study, and is being employed as an explanatory mechanism for various forms of human activities such as: reasoning and comprehension (P.N. Johnson-Laird, 1980, 1981, 1989, 1993, 2001), understanding discourse (in addition to P. N. Johnson-Laird, 1989, 1993, see also the collection of

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<sup>59</sup> I am not suggesting here, nor was Craik, that such physical small-scale models are not in many cases essential and useful prior to constructing an actual bridge, but only that there is an analogy between the building of such physical small-scale models and what occurs in mental models. In other words, there is no suggestion here that actually building such a small-scale model is a redundant step.

<sup>60</sup> Daniel Dennett (1996) refers to creatures endowed with the capacity for mental models as Popperian creatures. In his four tier hierarchy of mind-havers they are the penultimate category followed by language users.

essays included in Rickheit & Hable, 1999; and Britton & Graesser, 1996), aesthetics (Currie, 1995, 1997; Feagin, 1997) decision theory, imaginative thinking, artificial intelligence, science, (see the collection of essays in Oakhill & Garnham, 1996, for an overview of the various applications), analogical reasoning, naïve physics, technical understanding, and differentiating experts from novices (see the collection of articles in Gentner & Stevens, 1983, for these applications). Most importantly, for our purposes, however, mental models theory has been invoked in anthropology (Bloch, 1991; Geertz, 1973; Guthrie, 1980; and in the collection of essays gathered in Holland & Quinn, 1987; and Holy & Stuchlik, 1981).<sup>61</sup> We shall return to this specific application of the theory further after examining mental models in more detail in this chapter.

In what follows, I will employ two texts to serve as the focal point in understanding the theory of mental models, Philip N. Johnson-Laird's *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness* (1983), and Colin McGinn's *Mental Content* (1989).<sup>62</sup>

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<sup>61</sup> Of course my argument is that anthropological structuralism is an application of mental models theory, but it would be question begging of me to include it in the anthropological applications as this point.

<sup>62</sup> There is certainly the temptation, regardless of publication order, to place McGinn's work prior to Johnson-Laird's since McGinn relies more heavily on the earlier version of mental models developed by Craik. Nevertheless, both historically and developmentally, I believe it is crucial to place Johnson-Laird's work first because some of the notions which McGinn uses to embellish Craik's earlier (and somewhat impoverished) theory come from not only the work of Johnson-Laird, but also works that subsequently relied on his development of mental models theory.

### 3.2 Mental Models Theory: The Essentials

Johnson-Laird credits his idea of the mental model to three eminent thinkers; Ludwig Wittgenstein (who later abandoned the idea), Kenneth Craik, and David Marr, who developed models of perception. From Wittgenstein, Johnson-Laird extracted the idea of “the image as a model of reality;”<sup>63</sup> from Craik, the predictiveness component; and from Marr, the inferential abilities the cognitive agent exploits from vision in the construction of models (Philip N. Johnson-Laird, 1993, pp. 1-2). From these, Johnson-Laird defines a mental model in terms of both its contents and its functional role. With regard to the former, he states that a mental model is an internal representation of a state of affairs that corresponds to a state of affairs in the external world. This internal representation is a form of representation of knowledge that is “the natural way by which the human mind constructs reality, conceives alternatives, and verifies hypotheses,” by engaging in the process of simulation (1993, p. 1).

Johnson-Laird provides three conditions which define a mental model as a representation of knowledge. First, the structure of the model corresponds to the structure of the situation that it represents. Secondly, a mental model consists of two types of elements; those elements which correspond to perceptual entities, which may be instantiated as a perceptual or imaginary image; and elements corresponding to abstract notions. From these two types of elements, depending on the dominant type of element used in constructing the model (even to the exclusion of the other), Johnson-Laird provides for two types of mental models, physical or conceptual. The procedures

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<sup>63</sup> Johnson-Laird also credits Wittgenstein with the notion of the prototype (1980, p. 72).

for manipulating the mental model are then determined by the model type.<sup>64</sup> Finally, he argues that what separates the mental model from other proposed forms of representations is that it does not contain variables in either the logical or mathematical sense (1989, p. 488). Variables of the sort that might be contained in a mental model are mainly derived from the indeterminacy of a situation either present or described, but these can be “filled in” by schemata or prototypes.

Johnson-Laird also describes the important functional roles that mental models theory plays in explaining cognition. Among other things, mental models are theoretical entities that attempt to make sense of implicit and explicit inferences. According to Johnson-Laird, they provide a better explanation of such inferences than hypothetical mental logic, and a better explanation of meaning, comprehension and discourse than other forms of semantic representation. Further, he asserts the following roles for mental models:

[M]ental models play a central and unifying role in representing objects, states of affairs, sequences of events, the way the world is, and the social and psychological actions of daily life. They enable individuals to make inferences and predictions, to understand phenomena, to experience events by proxy; they allow language to be used to create representations comparable to those deriving from direct acquaintance with the world; and they relate words to the world by way of conception and perception. (1983, p. 397)

According to Johnson-Laird, mental models are a third of a tripartite inventory of higher cognitive processes which serve to represent the world: linguistic representations, models, and procedures for manipulating them (1983, pp. 446-447;

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<sup>64</sup> We will return to a discussion of manipulating these two types of models (and their variations) below.

1989, p. 491). Linguistic representations are arbitrary sets of symbols, whereas mental models are non-arbitrary sets of symbols; and both have their respective procedures for being arranged and transformed to carry out their respective roles in representing the world. Thus, the mind, at least in higher cognitive processes, ultimately is a symbolic system (1989, p. 469).

The contents, construction, and manipulations conducted by this symbolic system, as it pertains to mental models, are outlined by ten constraints on possible models:

1. *The principle of computability*: Mental models, and the machinery for constructing and interpreting them, are computable.<sup>65</sup>
2. *The principle of finitism*: A mental model must be finite in size and cannot directly represent an infinite domain.<sup>66</sup>
3. *The principle of constructivism*: A mental model is constructed from tokens arranged in a particular structure to represent a state of affairs.
4. *The principle of economy in models*: A description of a single state of affairs is represented by a single model even if the description is incomplete or indeterminate.
5. Mental models can directly represent indeterminacies if and only if their use is not computationally intractable, i.e., there is not an exponential growth in complexity.<sup>67</sup>
6. *The predicatability principle*: One predicate can apply to all the terms to which another applies, but they cannot have intersecting ranges of application.<sup>68</sup>

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<sup>65</sup> This follows from the doctrine of functionalism (P. N. Johnson-Laird, 1983, p. 398).

<sup>66</sup> Johnson-Laird argues that our notions of infinity arise from mathematical reasoning, and thus depends on different mechanisms than those which are responsible for “naïve or intuitive” reasoning which are directly based on mental models (1983, pp. 444-446).

<sup>67</sup> This point is also made by Levi-Strauss (1972, p. 89): “The dimensions multiply, and the growth of axes of reference beyond a certain point paralyses intuitive methods: it becomes impossible to visualize a system when its representation requires a continuum of more than three or four dimensions.”

<sup>68</sup> Johnson-Laird gives the following example: “Thus, for example, *animate* and *human* apply to certain things in common, *animate* applies to some things to which *human* does not apply, but there is nothing to which *human* applies and *animate* does not” (1983, p. 411). What Johnson-Laird appears to have in mind here is what Seth Kunin (2003) described (see the previous chapter, section 2.3) as ideal

7. *The innateness principle*: All conceptual primitives are innate.
8. There is a finite set of conceptual primitives that give rise to a corresponding set of semantic fields, and there is a further finite set of concepts, or ‘semantic operators’, that occur in every semantic field serving to build up more complex concepts out of the underlying primitives.
9. *The principle of structural identity*: The structures of mental models are identical to the structures of the states of affairs, whether perceived or conceived, that the models represent.
10. *The principle of set formation*: If a set is to be formed from *sets*, then the members of those sets must first be specified (P. N. Johnson-Laird, 1983, pp. 398-429).

These constraints on mental models allow for two major types, physical models and conceptual models. From these, there are six types of physical models and four types of conceptual models. Let us briefly consider these in turn.

Physical models have as their contents a finite set of tokens of entities, and a finite set of their properties and relations that correspond to the states of affairs in the world which are perceived. A model that has these basic components and is static is called a *simple relational model*. If, however, the only relations represented in the model between tokens is spatial, meaning that the tokens are located in a dimensional space (typically of two or three dimensions), then such a model is a *spatial model*. The simple relational model and the spatial model can serve as “frames” which get absorbed into more complex models. The first such physical model is the *temporal model*. In this model, spatial models serve as frames—provided that the dimensions between them are constant—which are placed in temporal sequence which corresponds to the temporal order of events that it represents. These models, however, do not have to be represented

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types. Further, Johnson-Laird argues that the virtue of this constraint is that it explains the differentiation between natural and artificial (unnatural) concepts.

in real time. When a temporal model is psychologically continuous and represents the changes and movements of depicted entities with no temporal discontinuities, then it is called a *kinematic model*. If to a kinematic model are added causal relations between frames, then such a model is a *dynamic model* (1983, pp. 422-423).<sup>69</sup>

The last type of physical model for which Johnson-Laird argues is the *image*. He describes this model as “a viewer-centered representation of the visible characteristics of an underlying three-dimensional spatial or kinematic model. It therefore corresponds to a view of (or projection from) the object or state of affairs represented in the underlying model” (1983, p. 423). His inclusion of the image as a model is quite perplexing since he had argued that images are functionally distinct from mental models and propositional representations (pp. 156-158). Moreover, Johnson-Laird counts the image as a specific type of representation distinct from mental models—that is, they “are the perceptual correlates of models from a particular point of view” (p. 165, see also p. 157). Nevertheless, he also states that images are a special form of model, “a two-dimensional representation that is projected from an underlying three-dimensional model” (1989, p. 491).<sup>70</sup>

What, in particular, is confusing about Johnson-Laird’s claim here is two things: First, how an image can both be a view of a model and a model itself; secondly, how an image can be functionally distinct from a model, yet still be a model. Both of these

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<sup>69</sup> The metaphysically troublesome “causation” is a necessary abstract relation of the make-up of some physical models. Nevertheless, Johnson-Laird allows that the perceptual system is sensitive to this relation, and thus has its introduction to models through perception.

<sup>70</sup> In Johnson-Laird (1980), he seems not to differentiate between mental models and images at all. Rather, he argues without explanation that what applies to images applies to mental models.

claims have logical difficulties. Either an image is a model or it is not. Carefully noting Johnson-Laird's language, however, we notice that although he includes the image in the typology of mental models, he does not explicitly state that the image itself is a model; for he does not call it an "image model."<sup>71</sup> But, if this is the case, then there is still a difficulty categorizing the image within the typology of physical models. This solution<sup>72</sup> only appears to alleviate the difficulty.

Johnson-Laird was also called to task on this problem by Michel Denis and Manuel de Vega (1993).<sup>73</sup> They argue, "If one takes the definition that Johnson-Laird proposed of an image, it is clear that this entity is found, in fact, in the relation of subordination with regard to certain types of physical models, and that it is situated at a functionally distinct level" (p. 90). They suggest, in contrast, that there are two essential modes that imagery serves for mental models. First, imagery is part of the procedures that contribute to the *formation* of mental models. The image supplies the primary material of a mental representation in which the spatial relations between elements are expressed under the form of spatial relations. In other words, the image supplies the primary content of a mental model that represents spatial relations. Secondly, once the mental model has been constructed, they argue that the image takes on another role. Here, the image furnishes *instantiations* of a mental model from a particular point of view. In this

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<sup>71</sup> All of the other physical models listed in the topology have model as part of their name, e.g. spatial model. This is noticeably missing from the name "image."

<sup>72</sup> This reading of Johnson-Laird was generously offered to me by Professor Denny Bradshaw.

<sup>73</sup> Denis and de Vega are arguing their point within the context of using mental models to comprehend discourse.

mode, the image is able to create visual scenes which have not been previously perceived, and thus anticipate states of affairs. In addition, the image allows for the comparison of distances and directions. With these capacities, the image is able to affect inferences (pp. 87-88).<sup>74</sup>

The problem with Denis and de Vega's account, however, is now the image plays two functionally distinct roles rather than one. In the first mode which they describe, the image is in the role of content, whereas in the second it is playing the role of a representational token. What needs to be clarified is whether the image is a representation or the content of a representation, since these are functionally distinct. A better solution would be to understand the image merely as the content of a representation, specifically a mental model.<sup>75</sup>

Understanding the image as content as opposed to a representation makes sense. We are aware of the content of our representations rather than the representations themselves. We speak of representations only in second-order discourse, but in first-order discourse, we speak of the content of our representations. Furthermore, rather than understanding images as the mediators of experience, in the fashion that Johnson-Laird wishes to do (1989, p. 471), images have the sole function of serving as content for mental models. Mental models, as representations, have functions that exceed the capabilities of perception, such as predictability. Therefore, if the image is to aid in

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<sup>74</sup> Denis and de Vega admit from the instantiation mode of the image that the image does share properties that are generally attributed to mental models, in particular calculability, finiteness of character, constructiveness, economy, and structural identity (p. 88). I think it is also appropriate to include predictability here.

<sup>75</sup> This solution was generously offered to me by Professor Charles Nussbaum.

these capabilities, it cannot be as closely associated with perception as Johnson-Laird would like images to be. According to this solution, images are activated only when the sensory input is shut down. Images are formed apart from direct sensory input; rather they are formed by the representational processes involved in mental models to serve as content for them. While we are not aware of the image's process of formation, we are, however, aware of the image itself; we are aware of the content of the mental model rather than the mental model itself.

If this solution is correct, then we can understand why there is such a close relationship between mental models and images as has been described in the literature. We can also understand why images display many of the characteristics and constraints as those attributed to mental models. While images are not mental models themselves, they do serve as the content for mental models. This solution maintains the functional distinctness of images, while at the same time explaining how it is that they are closely related to, and play a part in, physical mental models. Given these objections and considerations, Johnson-Laird was later pushed into accepting a solution of this type (de Vega, Marschark, Intons-Peterson, Johnson-Laird, & Denis, 1996, ; Philip. N. Johnson-Laird, 1996).<sup>76</sup>

In addition to physical mental models, Johnson-Laird argues that there are also conceptual mental models, and these are the types of models called for in discourse (1983, p. 423). There is not, however, a clean break between physical mental models

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<sup>76</sup> After several months of considering and debating this problem arising from his early work, it was by fortune that I learned that Johnson-Laird came to accept this solution in 1996 when faced with objections earlier posed by Denis and de Vega (1993).

and conceptual models; for there are conceptual equivalents to the various types of physical models. But, as we shall see, what differentiates conceptual models from physical models is that conceptual models require a number of novel features that enhance their representational power (p. 426).<sup>77</sup> Conceptual models allow for the representation of individuals, their properties and identities between them. Such a basic conceptual model with those contents is called a *monadic model*. The contents of the monadic model are modeled in the representation by the following components:

- (i) A finite number of tokens representing individual entities and properties;
- (ii) Two binary relations, identity (=) and non-identity ( $\neq$ ), either of which may hold between any pair of individual tokens from two different sets to indicate that the corresponding individuals are, or are not, identical. Non-identity is the negation of the identity relation.
- (iii) A special notational device (to which recursive revision is sensitive) indicating that it is uncertain whether there are any entities of a particular sort (P. N. Johnson-Laird, 1983, p. 425).

Component (i) is a condition of the principle of finitism constraint which applies to conceptual models as it did to physical models. Component (ii) introduces a new type of relation not available in physical mental models, the relation of identity. This binary relation holds between individual tokens.<sup>78</sup> Finally, component (iii) introduces an arbitrary notional device for parenthetically representing entities whose existence is

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<sup>77</sup> According to Johnson-Laird, the most powerful feature of conceptual models is recursion (see below).

<sup>78</sup> It is curious that Johnson-Laird does not mention an identity relation holding between individual tokens' properties. As we shall see in the set-theoretic model, however, he does allow for identity relations between tokens representing sets (P. N. Johnson-Laird, 1983, p. 428). The relation of non-identity is a type of negation, and negation can only be represented in conceptual models. Johnson-Laird describes this, in fact, as a one-place relation of a model or component of a model which is a negation of a relation (pp. 423-424).

uncertain in the model's domain (p. 424).<sup>79</sup> This component is subject to recursive revision (essential to conceptual models, p. 423), which is the ability to entertain various revisions of the model that are consistent with the premises but inconsistent with the conclusion. If no such revision of the model is found, then the inference is valid.<sup>80</sup> This revision mechanism is constrained, however, by the truth conditions of the discourse that it represents, but also allows for the revision of the model should a subsequent assertion in the discourse turn out to be inconsistent with the current model. In holding with the principle of economy, such indeterminism as represented in component (iii) is "simulated by a procedure that constructs an initial model on the basis of plausible, though sometimes arbitrary, assumptions, and recursively revises the model should such an assumption turn out to wrong" (p. 408).

It is also in the monadic model that connectives and quantifiers are introduced to reasoning. Negation, disjunction, conjunctions and conditionals come into play here. It is important to understand, however, that they are not used in mental models theory in the same manner as in formal or syntactic theories. They are ways in which the

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<sup>79</sup> Johnson-Laird admits that how it is that such representational tokens are actually represented in the mind is likely to remain unknown (p. 425).

<sup>80</sup> General (or background) knowledge plays a crucial role in the search for alternative models. When subjects reach a conclusion which conforms to their knowledge, they generally abandon the search for alternate models. On the other hand, if the conclusion conflicts with their knowledge, they continue their search for alternate models. "Thus, the model theory accounts for 'inferential satisficing,' i.e., the tendency to overlook the existence of models refuting plausible conclusions" (Philip. N. Johnson-Laird, 1996, p. 103)

cognizer manipulates models, their properties, and their relations (see Johnson-Laird, 1980; 1981; 1983; 1989; 1993; 2001).<sup>81</sup>

The second type of conceptual model is the *relational model*. This type of model adds to a monadic model a finite set of mappings (many-to-one or one-to-one) between sets of tokens contained in the model.<sup>82</sup> With the addition of these features, the machinery is in place to handle “all the customary types of referring expression[s] in natural language...” such as definite and indefinite descriptions and proper names (1983, p. 426).

The *meta-linguistic model* is the third type of conceptual model. This model “contains tokens corresponding to linguistic expressions, and certain abstract relations between them and elements in a mental model of any type (including a meta-linguistic model).” Two semantic relations come into play in this type of model, *refer to* and *means*. Furthermore, as indicated by the definition of this type of model, a model (of any type) may be recursively *embedded* in a meta-linguistic model. This allows for both second-order thought and discourse about models. For instance, assume that assertion P corresponds to a model of the world. In this case, the relation could be described as:

( $P \rightarrow (\text{model of the world})$ )

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<sup>81</sup> Johnson-Laird's treatment of connectives and quantifiers is extensive, and I could not hope to do it justice here. If the reader wishes to pursue this treatment further, see the references cited, most notably 1983 where a full analysis is rendered.

<sup>82</sup> Johnson-Laird provides the following statement as one which requires a relational model; “There are more a's than b's” (1983, p. 425)

If however, one further believed that P is true, then this could be represented by adding an additional relation which embeds the first model:

(P is true  $\rightarrow$  (P  $\rightarrow$  (model of the world))).

In this case, the first relation (the arrow in bold) represents a relation of meaning (1983, pp. 426-427).<sup>83</sup>

The fourth and final type of conceptual model that Johnson-Laird discusses is the *set-theoretic model*. Inasmuch as the mind can treat sets as entities themselves, this model provides an explanation as to how this can be done. A set-theoretic model consists of “a finite number of tokens directly representing sets. It may also contain a finite set of associated tokens designating the abstract properties of a set, and a finite number of relations (including identity and non-identity) between tokens designating sets.” In addition, this model allows sets for quantification over sets (1983, p.428).<sup>84</sup>

Finally, to complete this discussion of Johnson-Laird, he argues that there are five types of procedures for manipulating the mental models that he discusses: those that map propositional representations into models;<sup>85</sup> those that project an underlying model into a two dimensional view or image; prototypes and schemata that specify by default certain variables in mental models; analogies that allow the application of a model of

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<sup>83</sup> Johnson-Laird is quick to point out that he is not advancing a theory of truth by this example (1983, p. 427).

<sup>84</sup> Johnson-Laird argues that it is the tenth constraint listed above that avoids Russell’s paradox in set-theoretic models, since it is “impossible a model of a set that is (or is not) a member of itself” (1983, pp. 428-430).

<sup>85</sup> We shall discuss this in more detail later in our review of McGinn.

one phenomenon to be mapped to a model of another;<sup>86</sup> and finally, the most basic and essential of all the procedures, the sensory precursors that produce mental models from the perceptual system (1983, pp. 446-447).<sup>87</sup>

### 3.3 Mental Models as the Basis for Mental Content

Now that we have been introduced to the mental models theory, and have established the essential aspects of the theory, it is time to turn to the question of what is gained by this theory of cognition. One of the major proponents of mental models theory is philosopher Colin McGinn, who sees the theory as a major step forward in dealing with philosophically problematic issues of mental content.<sup>88</sup> The last chapter of his book, *Mental Content* (1989), is devoted to the mental models theory and the philosophical and experimental advantages of it. While he does appeal to the work of Johnson-Laird in his vigorous defense of mental models, for the most part, McGinn returns to the initial insights of the theory as set forth by Craik.<sup>89</sup>

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<sup>86</sup> The relationships between schemata, analogy and mental models will prove important for our investigation. We shall return to these topics and discuss them at some length in the next chapter.

<sup>87</sup> In Johnson-Laird (1989, pp. 470-471) he argues that perception is a primary source of mental models. Other sources include other people's explanations (a model by proxy), and those which we construct for ourselves either from basic components or from analogy of models that we already possess (p. 487).

<sup>88</sup> Like Johnson-Laird, McGinn is concerned with showing how mental models theory is superior to sentential theories (especially, for McGinn, in accounting for propositional attitudes). I have chosen, however, to remain far afield from this debate since it is not of direct importance for our purposes.

<sup>89</sup> Because of McGinn's heavy use of Craik, McGinn exclusively considers only physical models in his analysis.

McGinn argues that mental models theory has a greater explanatory capacity to account for seven philosophically troubling areas of mental content:

1. Conceptual structure
2. Truth and falsehood
3. Logical relations
4. Modes of presentation
5. Holism
6. Predictiveness
7. Naturalism

What drives much of McGinn's argument is a ground/object distinction. He argues that mental models serve as the ground for propositional attitudes, and that the propositions themselves serve as the object. It is this distinction which McGinn argues allows mental models to account for the conceptual structure of thought. Mental models are the underlying mechanism with the right kind of structure to realize content; however they do not share the same kind of structure as propositions. He further emphasizes that the structure of mental models is not logical. Instead, he argues that the structure of mental models is analog. This means, in simplified terms, that the content of a mental model resembles properties which are isomorphic to states of affairs represented. For instance, as in a photograph, the picture of a bird resembles a bird in a way that the word "bird" does not.<sup>90</sup> Moreover, the relationships between the model of the bird and the actual bird are not logical. Nevertheless, from the mental model of the bird it is possible to make propositional statements about the bird which have logical

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<sup>90</sup> There is a long-standing debate concerning the nature of resemblance, and whether this relation can actually do any work in either image or mental models theory. We shall defer discussion of this debate to the next chapter.

form. This, McGinn maintains, is a unique ability of humans to move from psychological space to logical space *via* language (McGinn, 1989, pp. 182-188).

In addition to positing that mental models ground conceptual structure, McGinn further argues that mental models ground truth and falsehood in thought, inasmuch as thought is propositional. If it is the case that only propositions can be said to be true or false, and mental models are not propositional but rather analog representations, then how can it be the case that mental models ground truth and falsehood in propositional statements? Here, McGinn makes two moves: the first is to argue that mental models can be more or less accurate or inaccurate to what they represent, and second that mental models have a teleological background. As an analog representation, mental models serve to represent states of affairs in the world. If a mental model is accurate, then the properties of the model map onto properties in the state of affairs in the world; if inaccurate, such isomorphism between the model and the state of affairs does not obtain.<sup>91</sup> This alone, however, will not provide for the normative force of truth and falsehood, and thus, McGinn introduces what he calls the “teleological background” for models which has its foundation in Craik (see Craik, 1943, p. 52). With Craik, McGinn argues, “A model not only replicates things in the world more or less accurately; it is *supposed* to replicate accurately and supposed *not* to replicate inaccurately” (McGinn, 1989, p. 189 *emphasis* original).<sup>92</sup> Thus mental models are goal oriented, and this gives

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<sup>91</sup> Also see Johnson-Laird (1989) pp. 473-474, 489 for a further discussion on the relationship between truth and falsity and mental models.

<sup>92</sup> Mental models are, above all, economical. According to Craik, mental models are processes which are to be cheap, quick and convenient (Craik, 1943, p. 51). Johnson-Laird argues that humans spend little, if any, time considering false (inaccurate) models. He argues that the goal of reasoners “is to

them their normative force.<sup>93</sup> Therefore, propositions which themselves linguistically index accurate models of a states of affairs are true, whereas propositions which linguistically represent inaccurate models of states of affairs are false (1989, p. 189).

If mental models are going to serve as the basis of content, then they must also support the development of logical relations found in propositional content. In accounting for this, McGinn is working with a handicap inasmuch as he is only working with physical models.<sup>94</sup> Here, as discussed with Johnson-Laird above, physical models only enter into spatial, temporal and causal relations with one another. None of these relations are logical. Nevertheless, McGinn is still confident that even mental models of the physical type can account for logical relations in propositions concerning physical models. He argues, “These nonlogical relations *underlie* the production of thoughts which do stand in entailment relations with other thoughts, but they are not to be confused with those logical relations” (McGinn, 1989, p. 190 *emphasis* original). He suggests that “the introduction and elimination rules of logic...will correspond to various kinds of association and detachment of models” (p. 190), and this is something that Johnson-Laird detailed at length in his 1983 work (P. N. Johnson-Laird, 1983). As we have observed above in our discussion of Johnson-Laird, there is good reason to

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arrive at true, or at least plausible, conclusions rather than simply valid conclusions,” and in this way, “people are *deductive satisfiers*” who stop searching for alternative models when they arrive at a putative conclusion that coincides with their beliefs (Philip N. Johnson-Laird, 1993, p. 18 *emphasis* original).

<sup>93</sup> As Ruth Garrett Millikan would put it, mental models have the *Proper function* to represent the state of affairs accurately (Millikan, 1984, 1986, 1989a, 1989b, 1995, 2004).

<sup>94</sup> This section is exceptionally puzzling. By the time McGinn wrote this, considerable literature already existed demonstrating how mental models could account for logical relations in propositional content (see Johnson-Laird, 1980, 1981, 1983, 1989).

accept that mental models theory can account for logical relations in propositional content, especially when the conceptual model is introduced.

In his discussion of modes of presentation of mental models, two specific philosophical problems guide McGinn. The first problem is Frege's problem about informative identities. How is it that two (or more) contents can share the same referent, but have different senses, such as in the case with the morning star and the evening star? To answer this, McGinn introduces a notion well-known in mental models theory, the partiality of models: "No model *m* of an object *x* simulates every aspect of *x*; *m* will always select certain features of *x* to model." (McGinn, 1989, p.191).<sup>95</sup> Mental models, according to McGinn, are aspect specific, meaning that they are selective<sup>96</sup> in which properties are instantiated. Because of this feature of models, "two mental models might simulate different aspects of an object and hence differ in their manner of representing it" (p. 191).

The problem of Twin Earth, however, is the converse of the above problem. In this situation, two different objects are represented the same, water and retaw (a fluid, on another world, which shares the same macroproperties and functions as water, but unbeknownst to those on the world has a different molecular make-up than water).<sup>97</sup>

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<sup>95</sup> The partiality of models is an aspect forced on them by the first two constraints mentioned by Johnson-Laird above (See also, P. N. Johnson-Laird, 1983, pp. 398-399). This aspect is also discussed by Norman (1983).

<sup>96</sup> We shall discuss the process of selectivity more in the next chapter. McGinn, for his part, argues that models are selective according to the environmental context in which they are embedded (McGinn, 1989, pp. 199-ff).

<sup>97</sup> See Hilary Putnam (1973) for further details of this thought experiment.

Whereas in the morning star-evening star problem, the model was too finely individuated, in the Twin Earth problem, the model is not finely individuated enough to recognize that the two fluids are not the same. To argue for how mental models theory can account for this phenomenon, McGinn again invokes the partiality of mental models. Because mental models are selective in the properties they instantiate, it is possible that two different objects are represented in the same way. In this case, the macroproperties and functions of the two fluids are modeled, but the molecular structure of the two fluids is not. Thus, the two different objects are modeled in the same way (McGinn, 1989, p. 192).

McGinn also argues that mental models account for the development of worldviews, and, in fact, this development is a natural one from the holistic nature of models. He argues that there are two types of holism present in mental models, integral and circumstantial. Integral holism employs the idea of cluster-concepts: Certain concepts can only be possessed in a cluster with other concepts; they cannot be possessed alone.<sup>98</sup> This, according to McGinn, is a natural development from the function of mental models—that is, they simulate states of affairs. Modeling states of affairs makes mental models inherently holistic. They must model multiple features simultaneously, thus the concepts used in such a model are naturally clustered with one another. Circumstantial holism, on the other hand, claims that concepts and clusters of concepts necessarily and freely interact with one another, and do not operate in isolation. If cluster-concepts, in part, can be viewed as models, then we possess a large

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<sup>98</sup> See Hilary Putnam (1968) for further details on cluster-concept.

number of submodels. It is the free combination and interaction of those submodels which leads to circumstantial holism, and the development of a worldview. To explicate this fully, McGinn writes:

Think of your total worldview—your entire system of beliefs—as your overall model of the world, itself made up of a huge number of submodels. This big world-model is a bit like a toy city, composed of a large number of variously connected submodels—of houses, bridges, roads, parks, people, etc. This toy city is not such that any given part of it could exist without the other parts, though it has some parts of which this conditions holds (no model buildings without model bricks and mortar, for example); but it may yet be true that the several parts of the city operate in concert, as a sort of complex unity, so that what happens in one part of the city may be affected by what happens in other parts. There is a local clustering and global interaction. The elements of your world-model are likewise circumstantially related to other elements by dint of having a place in the whole system, but it is not as if the big model can only be bought and installed as a package. In constructing a total model of the world the mind must keep track, as it were, of where each element fits, thus allowing for circumstantial holism; and it must also build into each submodel whatever structure is necessary to make it rich enough to match its worldly prototype, thus delivering integral holism. (McGinn, 1989, p. 195)

McGinn believes that the capacity of mental models to form predictions is a tremendous asset for the theory for two reasons. First, mental models provide the mechanism by which prediction can be made by the mind. Second, mental models are an important adaptive asset to creatures that use them. With regard to the former, following Craik, McGinn argues that the capacity to think is essentially the ability to solve problems, and to do this requires the ability to predict. Mental models, by their ability to simulate states of affairs (past, present and future), are ideal mechanisms to make predictions possible. Furthermore, with regard to the latter, this capacity to predict is an enormous adaptive advantage to creatures with this ability. By considering alternatives through running “off-line” simulations, creatures are able to think before

they act, rather than actually perform the various actions which might prove fatal. Moreover, the simulations provide the creature with valuable information about the state(s) of his environment, for it is the context of the problem which provides the content of thought (McGinn, 1989, pp. 195-196).<sup>99</sup>

It is precisely this ability for mental models to provide content which McGinn hails as the theory's strongest asset in meeting the naturalistic constraint. Mental models give a naturalistic account of Intentionality—the “aboutness” of thought. The intentional relation is accounted for by the natural relation-structure found between the model and what it represents. As analog representations, mental models “connect you to the world by means of entirely natural relations” (McGinn, 1989, pp. 197-199, quote from p. 199).

Mental models ground objects of thought naturally. Because of this capacity, mental models, according to McGinn, successfully deal with the seven philosophically troubling areas of mental content. The theory exposes the nature of thinking, and explains how thoughts can be about something. Even more important for our purposes, mental models provide the explanatory mechanism in accounting for our worldview(s). The theory exposes and explains how we connect, imagine, conceptualize and interact with our environment in a holistic fashion. Models provide the worldviews by which we navigate and function in the world (McGinn, 1989, p. 199).

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<sup>99</sup> The evolutionary advantage that prediction from mental models provides has also been stressed

### 3.4 Summary and Conclusion

Craik, Johnson-Laird, and McGinn have now provided us with the appropriate background to understand mental models theory. The theory has vast explanatory power with regard to human cognition. It explains how we think. It also explains, in part, what we think about. The initial conjectures about human cognition set forth by Craik have developed over the latter half of the previous century into a detailed and complex model of the abilities and complexities of human reasoning. More than that, it has also accounted for its limitations (see Johnson-Laird, 1980, 1981). We have a better understanding of why we so often commit many of the logical errors we do.

With the aid of mental models, humans not only “take in” their environment, they understand it and make predictions about it. With the additional support of language, we humans share our mental models of the world with others. We then build cultures around these models. In short, we can say that a culture, at its heart, is a group of people sharing a mental model (D’Andrade, 1987, 1989).

Having now seen the foundation for mental models theory, we shall explore in the next chapter one of the most dynamic areas of research concerning mental models, analogy. Moreover, we shall see how it is through this research that a convergence has begun to occur between cognitive science and anthropology. We shall push this convergence even farther by demonstrating the strong relationship that is shared between mental models theory and structural anthropology, especially concerning myth. In fact, we shall argue that they are of a piece. This will have, of course, important

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in Daniel Dennett (1996), Gregory Currie (1995), and Kendall Walton (1997).

implications for both theories, but we shall spend our time, in the last chapter, mostly considering the implications for structural anthropology, and anthropology in general. Yet, there are important implications for philosophy as well concerning the nature of thought, and the importance of considering culture in philosophical analysis. We shall briefly discuss this as well in the last chapter.

## CHAPTER 4

### THE CONVERGENCE OF MENTAL MODELS, THE HUMAN-BODY METAPHOR, AND ANALOGY

In fact...we are here straddling the border between psychology and philosophy, taking from each whichever aids our understanding. There is little point in tormenting ourselves with anxieties about disciplinary boundaries. Let the illumination fall where it may and don't fret too much about its source. That, at any rate, would be my advice.  
Colin McGinn, *Mental Content*<sup>100</sup>

#### 4.1 Myth *Qua* Mental Models

The previous two chapters have given us the background necessary to develop our cognitive theory of myth. In Chapter two, we saw that Claude Levi-Strauss has a sophisticated theory of models that support his Laws of Transformation. These models are analogical in nature and model the structure of myths. His theory demonstrates how content from the world is analogically arranged into models in the mind so as to make the world intelligible. These analogical models are highly constrained and non-arbitrary. Furthermore, we learned from the later work of Joseph Bastien that the human body is essential in the construction of analogical models as found in myth and ritual.

In Chapter three, we turned our attention to the cognitive science of mental models. Here we saw that mental models provides an account, as Levi-Strauss had done, of how the mind takes in content from the world and arranges it intelligibly in

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<sup>100</sup> From Colin McGinn (1989, p. 170).

models. But more than that, mental models theory not only gives a descriptive account of how the mind models states of affairs, but also of how the mind conceptualizes those states of affairs and predicts future states of affairs. These abilities, according to the theory, are the essential characteristics of thought. Moreover, we saw how mental models are responsible, due to their holism, for the development of worldviews. It is the development and the sharing of these worldviews from which culture emerges.

Building on what we learned from Colin McGinn (§3.3), we can now take our first pass at explaining myth *qua* mental models. From the cognitive approach we are developing, a myth is a group of cluster concepts that form a submodel. A submodel is an analogical model that freely interacts with other submodels, thus forming a holistic mental model, or worldview. This worldview is an entire system of submodels of an individual that in turn is shared in large part, reciprocally, with other members of his culture, and thus becomes a mythology.

At this point in the development of our account, there are three parts that will help us to understand the nature of myth: the human-body metaphor, mental models, and a specific species of mental model, the analogical model. Moreover, we are also arguing that understanding the nature of myth in this way is perfectly in line with structural analysis. If this is correct, then the received wisdom that structuralism is an interpretive approach to culture is misconceived. On the contrary, in accord with the way in which Levi-Strauss himself argued his case (§ 2.1), structuralism is a cognitive approach.

In what follows, we shall demonstrate how the human-body metaphor, mental models, and analogical models converge to give a coherent, albeit speculative, account of how myths are firmly grounded in natural cognitive processes. We shall first give an account of the origins of the human-body metaphor and the role it plays in human cognition. Secondly, we shall argue that the human-body metaphor is an essential component in mental models. Thirdly, we shall demonstrate that mental models can converge with analogy to form analogical models to be used in order to understand and predict our environment. Finally, we shall argue that myth and ritual are especially well suited for the transmission of analogical models inasmuch as they take advantage of our natural cognitive processes.

The support for our speculative account—that is, how our account might be empirically verified—will be deferred to the next chapter when we shall take up the objections to structuralism. We must also account for the types of content and structure that comprise a myth. Not every analogy, mental model, or structure is a myth. We recognize myths both by their content and by their structure even though we may not know exactly how to define myth in terms of necessary and sufficient conditions. Thus, if we are successful in demonstrating a strong cognitive tie between analogy, mental models, and structuralism, we shall still need to demonstrate how these contribute to understanding myth *qua* myth. This is a discussion we shall also defer to the last chapter.

#### 4. 2 The Human-Body Metaphor and its Origins

Mother Nature is the ultimate pragmatist.<sup>101</sup> She is more interested in what works than with what is true. The two do not always coincide. Many philosophers of mind have missed this point. They have argued that the function of our system in interacting with the environment is to believe, or to find, what is true. Mother Nature simply does not work that way; and she did not design us to work that way.<sup>102</sup>

Philosophical reasoning is a recent phenomenon in human history, appearing only within the last 5,000 years. Scientific reasoning is even more recent than that.<sup>103</sup> If any human endeavors could be said to have truth as their goal, these two would be best suited to fit the bill. Yet, clearly we were not designed to engage in these activities. They neither come naturally to humans, for they take a great deal of education, nor are they a natural part of human culture. Philosophy and science are not found in all human

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<sup>101</sup> My use of “Mother Nature” is pedagogical rather than literal. Since we are talking of functions here, we are forced to take the intentional stance—that is, to talk “as if” we were intentionally designed for harmony with our environment (Dennett, 1990; 1991; 1996; 2006; Hume, 1975). It makes more sense here to talk as if we were designed by Mother Nature than by a theory, evolution.

<sup>102</sup> Daniel Dennett (2006, Chapters 5 and 6) also argues that natural selection designs creatures in such a way as to exploit regularities in the environment in a way that works, rather than designing them to seek or understand the “truth” of those regularities.

<sup>103</sup> Philosophy was not invented by the Greeks, but rather was refined by them. Early forms of philosophy concerning metaphysics and ethics date back to the Egyptians, Mesopotamians, and Hebrews (Frankfort, 1977). Regarding science, there is a subtle distinction to be made here between science for the sake of discovery and technological invention. It is often the case that these two are taken to be synonymous, but they should not be. Until recently in human history—the last 400 years or so—the quest for new technology drove scientific discoveries. The science was happened upon through the attempt to develop new technology. With science at least since Newton, however, the situation has been reversed; science drives technology. Highly skilled inventors take advantage of pure theoretical discoveries to inform their technology, rather than using their experiments with technology to happen upon theories. Technology is not driven by a quest for truth in a way that science can be said to be so (McCauley, 2000).

cultures; and where they are found they require a high level of institutional support (McCauley, 2000; 2005).

Humans function well in their environment, even with a host of false beliefs. Many believe that objects are solid. In the past, humans have believed that the Earth was not only the center of the solar system, but also the center of the universe. Humans have also believed that the Earth is flat. The scientifically educated person, however, knows that these beliefs are false. Yet, the falsity of these beliefs did not and does not keep people from functioning successfully in their environment. These beliefs work, even though they are not true. Mythical beliefs can operate in the same way. It is not the case that all mythical beliefs can be true. For instance, if belief in the Hindu gods is true, then Christianity must be false. Even if one culture's mythical beliefs turn out to be true, that would still leave many, many other cultures with false beliefs. No mythical system holds a clear majority of adherents. Mythical beliefs present a pressing problem for the thesis that human beliefs evolved to track truth.

From an evolutionary perspective, if we see beliefs tracking what works rather than what is true, mythical beliefs can be more easily understood. The benefit of a mythical belief might be the causal by-product of that belief rather than its truth. For example, mythical beliefs can provide group identity, cohesion, and psychological comfort to their adherents.<sup>104</sup>

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<sup>104</sup> This is just a small sample of benefits that can be derived from mythical and religious beliefs. For a more exhaustive list of alternatives, see Boyer (2001; 2003; 2004), Newberg (Newberg, d'Aquili, & Rause, 2001), McCauley (2000), and Dennett (2006).

In this way, our account is not going to suppose that one of the constraints on human belief systems is the truth of that belief system. Instead, the initial constraint on our account will be what works in helping humans successfully negotiate their environment. Belief systems simply have to work in a way that allows for successful negotiation of the environment. Success, in this sense, is measured in terms of survival of the organism and its species rather than by the truth of its beliefs.

Andrew Newberg and his colleagues explain success in terms of survival:

It is, in fact, a fundamental requirement of survival: Organisms must tirelessly process a torrent of constantly shifting sensory data. They must sort it, process it, weave it into some useful rendition of reality, and then move about freely within that reality in ways that best enhance their chances of survival.

In basic terms, an animal's survival depends upon its ability to negotiate its environment in order to have the best chance of finding mates and food, while keeping low its chances of falling off a cliff or blundering into the path of a hungry predator....

The most likely reason that living things are capable of such remarkable sensory processing...is that their intricate neural networks, which interpret sensory input, were not logically engineered in top-down fashion by scientists. These organic, internal networks were assembled, neuron by neuron and from the bottom up, over millions of years of evolutionary trial and error.... The goal of every living brain, no matter what its level of neurological sophistication, from the very tiny knots of nerve cells that govern insect behavior on up to the intricate complexity of the human neocortex, has been to enhance the organism's chances of survival by reacting to raw sensory data and translating it into a negotiable rendition of the world (Newberg et al., 2001, pp. 14-15).

One of the fundamental goals of cognition, therefore, is to allow us to process successfully sensory information in a manner that is relevant to our survival. Considering further what Newberg and his colleagues have said, what works has itself two immediate constraints. The first constraint is what has been determined to be relevant for the survival of the organism by millions of years of evolutionary trial and error. Secondly, what works is constrained by the neurological sophistication of the

organism. The “negotiable rendition of the world” cannot exceed the organism’s processing abilities.

At least in the case of humans, we shall need to add a third constraint to determining what is relevant to our negotiable rendition of the world, *cognitive economy*. Determining what works is constrained by processing costs and available inferences. *Ceteris paribus*, if processing costs are the same, the material with the inferentially richer interpretation will be selected; and if the inferential value is the same, the material that requires the least processing will be selected (Boyer, 2003b, p. 352).

Mother Nature provides a fourth constraint on determining what works—regularities in the environment. Cognitive systems presuppose regularities in the environment. In fact, the proper functioning of those systems relies on regularities in nature.<sup>105</sup> What works, therefore, is also constrained by these regularities in our environment (Dennett, 2006, pp. 127-ff.).

As Roger Shepard explains:

Whatever we possess in the way of perceptual and/or representational system must be the product of a long evolutionary history. Our remote ancestors, like many surviving primitive species (ranging from single-celled animals to worms), could not extract *higher-order* invariants corresponding to distal objects of the sort that usually concern us now. Instead, they proceeded on the basis of proximal stimuli of a chemical or mechanical nature. Only with the evolution of increasing powerful mechanisms for the processing of optical,

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<sup>105</sup> Certainly the notion that is lurking in the background here is Ruth Garrett Millikan’s notion of Proper function (Millikan, 1984; 1989a; 1989b; 2004). Our account, at this point, is too broad to fit neatly with her account which is concerned with specific biological and cognitive mechanisms, but we do hold to the idea that the functioning of our system has accounted for the survival and proliferation of the system itself.

acoustical, and tactual information have we gained access to remote objects and events.

...[T]he primary function served by this more sophisticated perceptual processing was to partition the information available in these various incoming forms into (a) the invariants uniquely corresponding to distal objects, events, and layouts, and (b) the complementary variables corresponding to the moment-to-moment changes in the disposition of those objects, events and layouts, and of the self in relation to them. Such a partitioning is now pervasive: We visually perceive both a persisting object and its current spatial relation to us. We also recognize both the face of a friend and its momentary expression, both what has been written and the format in which it is written, both what has been said and the emotional state of the speaker, and both a particular melody and the pitch height and timbre at which it has been played (Shepard, 1984, p. 421, emphasis original).<sup>106</sup>

According to Shepard, it is the invariants that play the largest role in our evolution. The cognitive processes which evolved are appropriate only to the world we inhabit. On any other world, these processes might have been quite different. In other words, our environment strongly constrains the cognitive processes we have. Moreover, Shepard argues, those invariants which have remained most stable throughout evolution have become deeply internalized, as representations, in our cognitive systems. This internalization has allowed creatures to act independently of direct stimulus.<sup>107</sup> In this way, therefore, the external invariants have become internal constraints for synchronizing internal representations, and the resonance of these

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<sup>106</sup> Cf. Dennett's "Real Patterns" (1991a) and José Luis Bermúdez (1995, p. 162). Bermúdez writes:

...[P]erception is fundamentally a process of extracting and abstracting invariants from the flowing optical array. Organisms perceive an environment that has both persisting and surfaces and changing surfaces, and the interplay between them allows the organism to pick up the sort of information that specifies, for example, visual kinaesthesia.

<sup>107</sup> The experiment that Shepard cites demonstrates that hamsters have an internalized biological clock that operates independently of laboratory manipulated stimuli. In the experiment, hamsters maintained their daily schedules of eating and sleeping independently of the researcher's manipulation of daylight and night. In other words, their daily routine was internally synchronized with the regularity of the Earth's rotation producing day and night (Shepard, 1984, p. 422).

internal representations with the environmental invariants are what Shepard, following J. J. Gibson, calls *affordances*.<sup>108</sup>

As Shepard further argues, what we take to be direct perception of our environment is actually the *resonance* between experienced invariants of our environment activating our internalized representations of those invariants. These resonances are *embodied* constraints (p. 433). But again, the internal representations may be activated in the absence of external stimuli (independent of direct stimulus)—that is, activated entirely from within.<sup>109</sup> Moreover, these internal representations are constrained by the same principles that constrain external states of affairs. For instance mental rotation of images and imagined trajectories of those images were represented in the same constrained time and space as the real objects (p 439).

While it is necessary that its internal representations resonate to states of affairs in the world, according to affordance theory *what resonates with the organism is entirely dependent on what type of body it has*. Affordances are the perceptions of “relations of possibility between actors and environments” (Bermudez, 1995, p. 155). In this manner, the perception of the environment of the organism is relativized to it as the perceiving subject. The environment is perceived in terms of afforded actions for the organism, therefore, “[t]he whole notion of an affordance rests on relating the

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<sup>108</sup> Shepard argues, *contra* J. J. Gibson (1990) who held that internal representations were made unnecessary by the theory of affordances, that internal representations are not only needed but necessary to explain various mental capacities such as image rotation and manipulation, and prediction of future states of affairs. For a further critique of Gibson’s theory and a defense of Shepard’s view, see Bermúdez (1995, pp. 162-163).

<sup>109</sup> The fact that these internal representations can be activated entirely from within will become more important in an upcoming discussion in the next chapter concerning agency detection.

environmental information to one's own possibilities for action and reaction" (Ibid).

What actions are afforded depends on the body that the organism has.

Affordance theory gives us the origin and basis for the human-body metaphor. We perceive and understand our environment, in large part, in terms of our own body. But, in order to appreciate more fully how the human-body plays a role in both our natural and cultural environments, we need to distinguish three types of affordances. The first we share with other animals through biological evolution, while the last two types may be specifically human, arising from cultural evolution.<sup>110</sup>

The first type of affordance is a *natural affordance*. This affordance allows for the possibility of action with objects naturally occurring in our environment. Water affords the possibility of drinking. A bovine may afford the possibility of eating, while a lion may afford the reaction of fear and flight. A member of the opposite sex of our species might naturally afford the possibility of sex. All of these affordances are constrained by what type of body we have. If we were a fish, water would afford us swimming rather than drinking. If we were a rattlesnake in the path of a bovine, this would afford us rattling our tail to announce our presence, or flight, or strike. If we were a vulture, encountering a lion might afford us the possibility of eating what remains of its prey. All of these responses to things naturally occurring in the environment are in part determined on what type of body the actor has.

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<sup>110</sup> Inasmuch as it is entirely beyond the scope of this thesis, I leave it an entirely open question as to whether we may share these affordances with other animals, especially other primates.

Michael Tomasello (1999, pp. 84-85) argues for a second type of affordance, the *intentional affordance*. This type of affordance pertains specifically to cultural objects and artifacts. Here, the individual comes to perceive the artifact as having an affordance based on his understanding of the intentional relation between himself and the object—that is, what he may use the object for. For instance, a cup affords drinking, a hammer affords hammering, and a car affords driving.

The third and last type of affordance, we shall call the *social affordance*. Social affordances differ from intentional affordances in one substantial way. Where Tomasello's intentional affordances account for possibilities of action with cultural objects and artifacts, our social affordances account for possibilities of action with other intentional agents. The possibility of action for the individual in this case is governed by the roles and functions that both the individual and the intentional agent have in society. For instance, a police officer would afford a different possibility of action for a person being robbed as opposed to the person doing the robbing. But, we should not limit such social affordances to possible interactions between the individual and other humans. For instance both beasts and supernatural beings, as intentional agents, have a role and function in society which provides for social affordances.

Understanding the human-body metaphor in terms of affordances provides us a way to address two pressing problems. The first is how it is that the views about the body vary from culture to culture, or even within a culture. The second is how to understand the process of inversion in structural analysis (see § 2.1).

Jamake Highwater (1991) and Roy D'Andrade (1987) have argued that there is a great variation between cultures as to how members of that culture view themselves. George Lakoff and Mark Johnson (1980) have demonstrated that the human-body metaphor can vary greatly even within one culture. Inasmuch as humans, as a species, all have the same type of bodies it would seem that there should not be such a great variation from culture to culture or even within a culture as to how members of a culture view their bodies. How can what we have said about the human-body metaphor and affordances take this diversity into account? There are three ways.

First, the essential notion of affordances is that we perceive our natural and cultural environments in terms of possible actions we can take with our bodies in that environment. Not all environments afford the same possibilities for action, nor do all situations within a given environment afford the same possibilities for action. How we perceive our environment is dependent on what type of body we have, but how we view our body is also dependent on the environment in which we live. This latter point can be both understood in terms of, and help to understand, totemism.

In totemistic societies, individuals and groups are categorized in terms of features of their environment, especially animals. It is not the resemblance between the appearance of the individual and the animal that allows for this categorization, but rather certain characteristics of the animal, particularly its affordances in the surrounding environment, that allows for this categorization. A clever and successful hunter might be perceived to have the affordances of a wolf, while a swift-footed runner

may be perceived as having the affordances of a rabbit.<sup>111</sup> As an environment varies, so too do the needs of a culture. What is reflected in totemistic societies are those affordances which are most important to the culture's survival. Therefore, not only can the view of the body vary from culture to culture, it can vary within the culture as well.

Secondly, while the human-body metaphor emerges from how we perceive our environment in terms of our body, it takes on new life in society. Metaphors between the human body and social structure run both ways. This was one of the crucial points made by Bastien (1978), and reiterated by Lakoff and Johnson (1980) and Highwater (1991). Leaders of a society are said to be “heads of state” and “the head rules the body.” The crucial point here, as we see it, is that parts of the human body can be said to make available affordances that are unique to that part; a hand grasps, while a head thinks.<sup>112</sup> The categorization of members of society by body-part metaphors is not unlike what occurs in totemism—that is, the members are categorized in terms of their characteristic affordances.<sup>113</sup> In addition, different social structures may call for different body-part metaphors.

Thirdly, how we see our own body is dependent on our own role and function in a culture. Different roles have different functions which have different affordances.

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<sup>111</sup> This perspective on affordance theory also helps to explain two further cultural phenomena: why in totemistic societies naming ceremonies are usually delayed until the child is entering adulthood; and why gods are either depicted with animal body parts or features, or have an assigned animal as their symbol. With regard to the former, after years of interaction with the child, his natural abilities have been observed and this weighs heavily on the name the child will receive and the function he will serve in the society. With regard to the latter, it is the affordance of the god that is being depicted or symbolized.

<sup>112</sup> It has been argued by Bruno Snell (1953) and E. R. Dodds (1951) this “affordance-type” thinking concerning body parts was commonplace among the ancient Greeks.

The roles and functions needed for a society are dispersed among its members, which means that each member will have a different social affordance. Moreover, each individual may have more than one role and function in a given society. The individual may have a job, be a father, and a husband, all of which provide him with different roles and functions, and likewise different affordances. Thus we can account for differing views of the body within a culture, and even within an individual himself.

We turn now to the process of inversion in structural analysis. By the process of inversion, a variant of a myth is produced when characters or other important elements in a myth are subject to being reversed: Two opposing characters or elements in one myth may reverse their role in another myth, thus producing a variant of a myth. The overall structure of the myth, however, remains unchanged. It has been objected that analysis of this process (if not the process itself) is both arbitrary (Runciman, 1969, p. 257) and unconstrained (Pettit, 1975, p. 92). On the contrary, we maintain that the inversion itself, and the analysis of that inversion, are both non-arbitrary and constrained by affordances. The important thing that is being reversed, or replaced by its opposite, is not the character or the element, *per se*, but rather the (natural, intentional, and social) affordances allowed to different characters or by the different elements between myths. If the myth itself can be metaphorically understood as the environment in which the character fulfills his role, and that environment remains

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<sup>113</sup> This is exactly the metaphor that Plato had in mind for his Republic with the tripartite division of the soul. Each member of the society was assigned a role according to which part of the “soul’s” affordance they were most capable of fulfilling (See The Republic in Cooper, 1997).

structurally unchanged, then what are being inverted are the affordances; and thus the myth is depicting a variant of the human-body metaphor.

As we have just shown above in the previous objection, across cultures and in even within a culture, there are variations of the human-body metaphor which are non-arbitrary because of, and constrained by, the affordances allowed by the cultural and natural environments. The structural consistency of the myth *considered as* the environment constrains the affordances and the inversions of those affordances in a non-arbitrary way. The structural analysis of that inversion is constrained by the human-body metaphor depicted in the myth that permits the affordance of action allowed by the character in the myth as the environment presented.<sup>114</sup>

There is a further constraint placed on the process of inversion by the human-body metaphor indirectly through opposition. As we saw in § 2.1, opposition not only plays an integral role in the process of inversion, but also structural analysis itself. If this essential element was taken to be unconstrained and arbitrary, then both the process of inversion and structural analysis itself would be seen as interpretive at best and useless at worst. Fortunately this is not the case. C. K. Ogden (1967, pp. 94 -ff, originally published 1932) demonstrated that opposition is a symbolic form derived from “a very special relation” between the body and its spatial environment (p. 95).

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<sup>114</sup> It is important to note here that the environment presented in a myth need not be either the cultural or natural environment of the adherents. In fact, the cultural environment presented in the myth may be radically different (as Christian myths that present an ancient Hebrew environment), or the environment itself may be supernatural (as in many cosmogonies) and not natural. Interestingly, in the case of the latter, while the natural and intentional affordances may be supernatural, the social affordances usually remain consistent with human culture (particularly the culture in which the myth was formed).

Moreover, Ogden's analysis revealed twelve types of oppositions, and argued that several of those types, such as oppositions of sides (e.g. right/left and in-front-of/behind) and extremes (e.g. up/down and top/bottom), required a third mediating term, the body, to make the opposition explicit. As we shall soon see, his description of these processes laid the groundwork for later research into analogy which would develop around the ideas of spatial experience, visual schematism, and mental projection. Our point for the present, however, is that rather than being unconstrained and arbitrary, opposition is firmly constrained by the human-body metaphor which we have argued at length is itself neither arbitrary nor unconstrained.

The human-body metaphor, which arises from affordances, works well in aiding us to negotiate our environment. The reason it works well is because it is economical. By playing off cognitive processes already in place in perception, the human-body metaphor requires few additional resources. Nevertheless, the human-body metaphor, as we have seen, provides for rich inferences concerning our possible interactions with the environment. In the next section we shall argue that the human-body metaphor is capable of providing these rich inferences by its interdependence with mental models. Moreover, we shall argue in § 4.4 that it is the interdependence between the human-body metaphor and mental models that gives rise to analogical models.

#### 4.3 The Human-Body Metaphor, Schemas, and Mental Models

The human-body metaphor has its basis and origin in affordances; but the human-body metaphor is not an affordance itself. The two are not synonymous.

Affordances allow for direct perceptions (in Shepard's sense) of the environment. An affordance resonates to the external environment *via* an internalized representation of that environment. What resonates with an organism is entirely dependent on what type of body it has. The affordance is the perception of relations of possibility between the organism's body and its environment.

Recall, however, that we have argued there are two types of evolution involved in the creation of affordances, biological and cultural. While natural affordances are biologically internalized, intentional and social affordances are internalized through cultural transmission.<sup>115</sup> Therefore, humans are in need of the ability to create new internal representations in response to their environment, and this will require that they grasp how their body can interact with situations and environments that are novel to them. Whether or not that possibility for action in the novel environment or situation becomes an intentional or social affordance, however, depends on whether or not the environment or situation is invariant in the culture; just as biological evolution fashions us with natural affordances by the consistent reinforcements of invariants in the natural environment, so too cultural evolution fashions us with intentional and social affordances by consistent reinforcements from the cultural environment. We shall argue that initially grasping the possibility of action in the novel situation or

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<sup>115</sup> These distinctions must be a continuum rather than a sharp trichotomy. Certainly the ability to have intentional and social affordances must be biological, and it may be the case that some of the intentional and (particularly) social affordances themselves are biologically internalized. The relationship between a parent and child serves as an example of how social affordances can be both biologically and culturally internalized. See Dennett (2006, pp. 128-131). We shall also argue in an upcoming section that myth and ritual are especially well suited for cultural transmission of both intentional and social affordances as well as models.

environment requires the interaction of two representational schemas, the *body schema* and the *image schema*. Once it is grasped and sufficiently reinforced, however, the body schema is no longer directly needed, and the internal representation (image schema) created is capable of resonating with the environment as an affordance directly perceived. It is the interaction between the body schema and the image schema we shall call the human-body metaphor.

The interaction between the body schema and the image schema occurs *via* an additional representational system, analogical models. The content of the image schema is understood by the projection of the body schema onto the image schema. This projection takes place through analogy, or metaphor, by using the body schema as the source domain by which to understand the target domain—the image schema. It is this process of projection, by analogical models, which provides the human-body metaphor.

Another distinction is that the human-body metaphor is not fully dependent on direct perception as is the case with an affordance. It is capable of being applied beyond perception—that is, to things and events not presently perceived. To accomplish this, the human-body metaphor once again requires additional representational systems. These additional systems are schemas and mental models.<sup>116</sup> Let us examine how all of this plays out in the case of the human-body metaphor.

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<sup>116</sup> According to Johnson-Laird (1983, p. 190) schemas are a special type of model capable of producing images. As we have seen in the previous chapter, however, mental models have vastly more capabilities than this, therefore the reader should not take “schema and mental model” as a redundancy.

According to Mark Johnson, image schemas “are structures that organize our mental representations at a level more general and abstract than that at which we form particular mental images”(Johnson, 1987, pp. 23 -24).<sup>117</sup> Further, he writes:

[T]hey do not have the specificity of rich images or mental pictures. A schema consists of a small number of parts and relations, by virtue of which it can structure indefinitely many perceptions, images, and events. In sum, image schemata operate at a level of mental organization that falls between abstract propositional structures, on the one side, and particular concrete images, on the other.

The view I am proposing is this: in order for us to have meaningful, connected experiences that we can comprehend and reason about, there must be a pattern and order to our actions, perceptions, and conceptions. *A schema is a recurrent pattern, shape, and regularity in, or of, these ongoing ordering activities.* The patterns emerge as meaningful structures for us chiefly at the level of our bodily movements through space, our manipulation of objects, and our perceptual interactions.

It is important to recognize the dynamic character of image schemata. I conceive of them as *structures for organizing* our experience and comprehension (Johnson, 1987, p. 29 emphasis original).

Image schemas organize both concrete regularities of basic perceptual experience and higher-order regularities that are abstracted from both the physical and cultural environment. The latter are abstract schemas which subsume the concrete schemas and form a hierarchical structure. Whenever we reencounter a regularity for which we have previously formed an image schema, the appropriate schema(s) is activated, and the activated schema constrains both what we are likely and unlikely to perceive and remember. This manner of activation gives rise to expectations in us concerning the physical and cultural environment (Mandler, 1997, pp. 40-45).

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<sup>117</sup> Johnson’s image schemata play the role that Seth Kunin (2003) assigned to the S<sup>2</sup> (culture group specific) level in structural analysis. This is a functional level of categorization by which meaningful patterns are constructed that is actualized into a specific structural form that may be dyadic, triadic, etc. These structural forms are realized through relations between categories in what Kunin calls ideal types that take one of three forms: A – B, A + B, or A n B (see § 2.3).

Humans are particularly adept at picking out regularities in their environment. These regularities are *invariants* that hold between past events and present events.<sup>118</sup> When we encounter an event that contains an invariant for which we have a previously formed image schema, that schema is activated thus aiding us in understanding the present experience in terms of the past. The previously formed image schema is projected onto the present circumstance, constraining our experience, while at the same time giving rise to expectations and predictions about some future circumstance.

The physical and cultural environments are only part of the story, however. We are not merely passively acted upon by our environments—we *interact* with them. This requires that we not only are able to represent our external environments, but our internal environment—*our body*—as well. This representational process, at the subconscious level, is carried out by our body schema.<sup>119</sup> The body schema *actively* organizes perceptual experience pragmatically in relation to the body and projects this pragmatic spatial sense into objective space.<sup>120</sup> This process allows for an ecological interaction between the body and the environment that allows us to navigate

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<sup>118</sup> Recall from § 2.1 that Levi-Strauss insisted that structural analysis is the search for the invariant. This discussion of image schema and body schema gives us a further context in which to understand that statement. Moreover, Levi-Strauss himself made use of schemas in his structural analyses (Levi-Strauss, 1983c, p. 161-165)

<sup>119</sup> It is important to differentiate between the body schema which is a subconscious process that allows us to form a body image and the body image which is the conscious content of that body schema (Eilan, Marcel, & Bermudez, 1995, p. 18; Gallagher, 1995, pp. 227-ff.).

<sup>120</sup> It has been suggested that this process is carried out in the posterior section of the parietal lobe known as the orientation association area (OAA). “[T]he distinction between the self and other may have its roots in the ability of the left orientation area to judge between these two simple categories of reality—that which can be grasped and that which can’t.”(Newberg et al., 2001, p. 28). If this is correct, then the most basic level of categories are based specifically on the bodies interaction with its environment.

successfully our surroundings. Thus, the body schema provides the basis for possibilities of action in our environment (Gallagher, 1995).

The interaction between our body schema and our image schemas structure our experience *in terms of the human-body metaphor*. Because humans have higher-order consciousness, especially self-consciousness, we are capable of combining these internal representations with memory and thought to form *mental models* of past, present or future events (Butterworth, 1995, p.89). Let us flush out how this works.

The human-body metaphor is essential to human cognition. According to George Lakoff and Mark Johnson (Johnson, 1987; Lakoff, 1987; Lakoff & Johnson, 1980, 1999), the root of all metaphor is *our personal lived bodily experience* of the world. Without this embodiment, neither analogy nor metaphor is possible.<sup>121</sup> We compare entities and properties in the world on the basis of how our bodies interact with them (both through sense perception and physical manipulation of objects). Furthermore, we divide the spatial orientation of the world using our bodies as the axes; thus spatial metaphors are ultimately relative to our own orientation in comparison to the objects under consideration.

Metaphor allows for the conceptual organization of objects. Objects are both distinguished and categorized by our bodily experience of them. This is accomplished

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<sup>121</sup> Here would be the place, if we were willing, to fully step into the debate as to what counts as a metaphor and what counts as an analogy. We are not willing to do so, however. The debate over this issue, which has spanned millennia, has thus far only led to disagreement and confusion. For our purposes, we will take metaphor to be a special class of analogy in that metaphor, in our view, is an analogy taken for granted. Any comparison made implicitly by a metaphor may be made explicit through analogy. Yet, it seems, only strong or commonly used analogies find their way to metaphorical usage. This is by no means meant to be definitive on the issue. Our purpose here is only to inform the reader of our view on this controversial issue.

by the cognitive process of (embodied) image schemas. These schemas allow us pre-conceptually to order our experience into meaningful structural representations as we navigate, manipulate and perceive our environment. Finally, what makes analogy and metaphor cognitively economical is that they provide material for making rich inferences. By analogy, we can reason about one thing in terms of another; therefore, rather than having to reason from scratch about every new object of our experience, we can, by the comparison of analogy and metaphor, carry inferences made from the interaction with the first (*base*, or *source*) object to the second (*target*) object.

It is this interaction which Lakoff (1987) argues forms non-classical category structures and basic-level categories which are *idealized cognitive models* (ICM). In particular, he argues for a *basic opposition model* which structures the centers of domains-of experience in *base models* which themselves structure relations between domains-of-experience. For instance, a basic opposition model will allow for the contrast between the domains of female and male within the larger domain of humans.<sup>122</sup> Further, in accord with Seth Kunin (2003, see § 2.3 in this work), Lakoff's basic opposition models allow for more complex oppositions than merely binary oppositions (Lakoff, 1987, pp. 91-104).<sup>123</sup>

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<sup>122</sup> Andrew Newberg and his colleagues suggest that the basic opposition model is driven by a binary operator which rises from the inferior parietal lobe (Newberg et al., 2001, pp. 50-51).

<sup>123</sup> In this section of his work, Lakoff is expounding on the classification of the world according to the aboriginal Dyirbal tribe in Australia. As Lakoff describes, explains and relates the Dyirbal categories, it is hard not to see parallels between his analysis and structural analysis. They bear remarkable similarities, but we will not go as far as to say they are the same.

Gregory Murphy and Douglas Medin (1985) argue that ICMs are *theories* which are constrained by a person's goals and activities as she interacts with her environment. ICMs, as theories, provide a means for connecting concepts such as to explain diverse facts. Our theories allow us to categorize the world based on the context of background assumptions made from our interaction with our environment. The data we receive from our environment is often unclear and noisy;<sup>124</sup> but because of the cognitive economy of models, "theories also typically involve simplifying assumptions that trade parsimony for power" (p. 303). This categorization is not random. There is a logical and biological necessity that correlates categories—the *structural properties* that fulfill various functions of that which is being modeled. "This approach avoids the explosion of CORRELATED links because it draws on previously existing knowledge about the attributes to connect them: The links are already in memory" (p. 300, EMPHASIS original).

It is the goals of the individual which determine which concepts formed by ICMs become cultural affordances. Alan J. Lambert and Alison L. Chasteen argue that one's goals play an important role in cognitive accessibility of concepts: "...certain concepts may, by virtue of their relevance to life goals, vocational choice, or personal disposition, become *chronically* accessible due to their frequent activation over time and situations" (Lambert & Chasteen, 1999, p. 310, emphasis original, see also Murphy & Medin, 1985, p. 296). Concepts that attain this chronic accessibility are what form

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<sup>124</sup> Cf. Dennett (1991a).

culturally driven affordances. This chronic accessibility, on our view, is what gives intentional and social affordances their force.

It should now be clear that there is a close and dynamic relationship between the human-body metaphor and mental models. This relationship is made explicit by Arthur Glenburg (1999). Glenburg argues that mental models are dependent on embodiment. In order to provide meaning to a situation by providing a set of available actions to an individual, he posits that mental models are a mesh of *affordances*, *action-based knowledge*, and *action-based goals*.

To clarify, Glenburg offers an example of mental models that may be formed from the interaction of our body and a chair. What makes a chair a chair to us is that it affords sitting. Thus, how we represent the informational content received from the object is dependent on what type of body we have. But our knowledge from memory also affects what action I might take on those affordances. If we know that one of the legs of the chair was recently glued, or that a person who occupied the chair vacated it temporarily, then we can use that knowledge to block our affordance of sitting in the chair. In addition, the meaning of the situation depends on action-based goals. Both the affordance and the use of the chair will be affected by our goals. If our goal is to rest, then we will sit in the chair. If, however, we wish to change a light bulb on the ceiling, we may use the chair to stand on to reach the light fixture. All of this, again, is dependent on the interaction between the representation of our particular body type (our body schema) and representation of the object (the image schema). Thus, the human-body metaphor is essential to our mental models of situations.

Before leaving our discussion in this section, we wish to demonstrate how our account alleviates two objections that have been raised against Lakoff and Johnson's explanation of metaphor by the use of schemas and ICMs. First, let us consider the objection raised by Mary Douglas (1992). Douglas argues that even if Lakoff is right about certain schemas (e.g. the container schema, the part-whole schema, etc.) being universally available, it is still the case "to be useful he would need to have a hypothesis about constraints on how the images are used in cognition...[and] if anything can be used as the source domain, then his theory is of little help" (p. 241).

Douglas's complaint therefore has two parts: the first is that Lakoff fails to provide constraints on how the image schemas are used; and secondly, that Lakoff has failed to constrain what can be a source domain. In answer to the former, we have argued that image schemas interact with the body schema (thus creating the human-body metaphor), and that these schemas are then integrated with action-based knowledge and action-based goals as mental models to predict future states of affairs. In answer to the second, we have argued that it is our possibility of interaction with our environment that constrains the source domain. This possibility of interaction is constrained by what type of body we have, our background knowledge, and our goals. Moreover, borrowing from Murphy and Medin, source domains are constrained by our ICMs *as* theories. Therefore, our account avoids the criticism leveled by Douglas.

Bipen Indurkha (1992) levels a related criticism. He argues that although the Lakoffian experiential account can articulate the empirical phenomena associated with metaphor, the account breaks down in that it fails to *explain* the phenomena. For

instance, while Lakoff and Johnson emphasize that structured precepts (i.e. schemas, ICMs) are dependent on our bodies, at the same time they do not wish to universalize this inasmuch as they wish also to maintain that structuring of concepts also takes place against “a vast background of cultural presuppositions” (Indurkha, 1992, pp. 126, 293; Lakoff & Johnson, 1980, p. 57). They fail to explain just how these cultural presuppositions work with schemas and ICMs. If one uses the Lakoffian account, Indurkha contends, there is little—if any—relief in sight:

To sum up, the Lakoffian experiential account *articulates* the empirical phenomena, but *does not explain* them. That many of the conventional metaphors in language have physical domains as their source is an empirical fact. Calling them precepts merely captures this fact. That precepts are understood directly, is again an empirical fact (ignoring their genesis), as they are not understood as anything else. That abstract domains are understood metaphorically by precepts is another fact. That an abstract domain can be structured in different ways by different precepts, but not arbitrarily, is yet another empirical fact. So far all these features of the experiential account are statements of empirical fact. The real problem is in explaining how this restructuring of abstract domains is possible, without being arbitrary. And why the abstract domains cannot be understood as such, like precepts. This is where the experiential account is silent. Anywhere Lakoff and Johnson come close to dealing with this problem, they vehemently assert that this is so—alternative conceptualizations are possible and they are not arbitrary—but they say nothing whatsoever to illuminate how and why this is so (Indurkha, 1992, pp. 126-127, emphasis original).

Our account has sought to stave off this criticism by demonstrating that both schemas and models are non-arbitrary, and in an appropriate way. We have introduced the notions of natural, intentional and social affordances. These, we have argued, are constrained both biologically and culturally, based on how our bodies are capable of interacting with the objects or agents at hand. As we saw, particularly in the case of intentional and social affordances, cultural background knowledge can play an integral

role in constraining how it is we perceive the objects and agents in our environments. In the case of restructuring abstract domains, we have argued that this process is constrained by our theories as models which include action-based knowledge and action-based goals. Therefore, once again, our account avoids the criticisms leveled against the Lakoffian experiential account.

We have argued that the human-body metaphor plays an essential cognitive role in how we perceive, categorize, model, and theorize about our environment. Furthermore, the human-body metaphor is what makes metaphor and analogy possible. This metaphor gives us the basis for understanding one thing (our environment) in terms of another (our body). In other words, we take our body as the source domain to understand the target domain of the environment. In addition, we have also seen that background knowledge and goals of the individual are essential to this process. It is our goals, in fact, which can force some of our internal representations to become chronically accessible, thus becoming a culturally driven affordance.

We have yet explicitly to flesh out, however, how these processes give us the analogical models which are essential to structural analysis. How analogical models are formed, and how they function in cognition, will be the topic of the next section.

#### 4.4 Analogical Models

Mark Johnson (1987, p. 112) explicitly relates image schemas to the formation of what Dedre and Donald Gentner call “analogical models.”<sup>125</sup> He argues that Gentner and Gentner demonstrate that humans use image schemas to understand domains-of-experience and to solve problems. This is done by projecting the structural relations from a source domain to a target domain. Thus, metaphorical structures constrain some reasoning processes of humans. Moreover, he concludes:

I am suggesting...that such models *constitute* an individual’s understanding of a phenomenon and thereby influence their acts of inference. The metaphors, or analogies, are not merely convenient economies for expressing our knowledge; rather, they *are* our knowledge and understanding of the particular phenomena in question (Johnson, 1987, p. 112 emphasis original).<sup>126</sup>

The experiment by Gentner and Gentner (1983), to which Johnson refers, demonstrates that the source domains that subjects use to understand a target domain affected, in a predictable fashion, the inferences the subjects made concerning the target domain; this is called the *Generative Analogy hypothesis*. In the experiment, subjects were divided into two groups and each group was given a different model by which to

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<sup>125</sup> Johnson briefly mentions that the metaphorical system that he is building is “somewhat different” than the analogical models of Gentner and Gentner, but in regard to the particular article and experiment that he considers, and we shall consider, there is no important difference (Johnson, 1987, p. 109).

<sup>126</sup> Compare two similar claims made about the epistemic importance of analogy and models. First, Johnson-Laird proposes:

[O]ur view of the world is causally dependent both on the way the world is and on the way we are. There is an obvious but important corollary: all our knowledge of the world depends on our ability to construct models of it. Since this ability is a product of natural selection, our knowledge indeed depends on our biological make-up as well as on things-in-themselves (P. N. Johnson-Laird, 1983, p. 402).

Philosopher Panayot Butchvarov likewise argues “All understanding, including analytical understanding, is analogical” (1974, p. 33). The thesis that all knowledge is metaphorical is also discussed and supported by Bipin Indurkha (1992, Chapter 8).

understand the flow of electricity. One was given the “flowing waters” model, and the other was given the “teeming crowds” model. When the subjects were then asked to explain different phenomena concerning electricity (such as serial or parallel circuitry) it was found that the inferences they made concerning the flow of electricity in those questions varied greatly depending on which of the models they had been provided. For instance, subjects using the flowing fluid model performed better on questions concerning batteries than resistors; whereas those using the moving crowd model performed better on resistors, particularly in parallel, than with batteries. The upshot of this experiment is that if one can determine the source domain (in conjunction with the subject’s background beliefs)<sup>127</sup> from which a subject is attempting to understand a new target phenomenon, then one can predict the inferences which will be generated concerning the new target domain.

The Gentners’ account of analogical models was critically reviewed by Marie-Dominique Gineste and Bipen Indurkha (1993). The central problem for the Gentners’ account of analogical models is how to justify the similarities exploited in these models and how those similarities provide better inferences than random ones. In other words, what constrains which source domain and properties are chosen to be projected from the source domain to the target domain? “It is a question of processes by which a source representation is used in order to model a target, that is to say processes which create the resemblances where they did not exist before the analogical relation or before the metaphor had been produced” (p.165).

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<sup>127</sup> The importance of background beliefs is emphasized in this role by Murphy and Medin (1985).

In response to these criticisms, Dedre Gentner and her colleagues have offered two theories of constraints that they have demonstrated to be at work in processes of analogical models: The *multi-constraint theory* and a theory arising from four characteristics of analogy.<sup>128</sup> In the multi-constraint theory the constraints are provided in three broad classes. The first is the *similarity* constraint. Analogical models are guided by direct similarity between the key relations between objects within the source domain and objects within the target domain. What is crucial here is that it is not the objects in the two domains which must be similar, but rather their *structural relations*.<sup>129</sup> There must be a structural-mapping between the source domain and the target domain such that there is a one-to-one *correspondence* between the structural relations in the source domain and the target domain—that is, an *isomorphism*. Establishing such an isomorphism is the second constraint on analogical models.<sup>130</sup> Finally, they suggest that the third constraint is the *goal* of the reasoner. Analogical models are invoked for specific purposes in order to achieve specific goals. The reasoner maps the source domain onto the target domain to achieve a solution to a problem or achieve understanding of the new phenomenon. They caution, however, that these constraints are not rigid rules (Gentner, Bowdle, Wolff, & Boronat, 2001, pp.

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<sup>128</sup> In addition to the constraints offered here in support of analogical models, the reader should also recall the constraints we have previously offered in support of metaphor, analogy, and models. All of these constraints in combination are more than sufficient to overcome the objection presented by Gineste and Indurkha.

<sup>129</sup> One of the controversial claims of Levi-Strauss was that it was not content of a myth that was important for the purpose of analysis, but rather the relations between the contents (Levi-Strauss, 1972, pp. 36-37). For critiques of this claim, see Kirk (1970, pp. 71-73) and Sperber (1975, Chapter 3).

199-203; Gentner & Gentner, 1983, pp. 101-106; Gentner & Holyoak, 1997, p. 33; Gentner & Markman, 1997, p. 47; Holyoak & Thagard, 1997, p. 36).<sup>131</sup>

Adding to the multi-constraint theory Dedre Gentner and Arthur Markman (1997) argue that four characteristics of analogy also serve as further constraints. First, the relations in the source domain must be *structurally consistent* and isomorphic to the relations in the target domain. Secondly, the analogy must have *relational focus*, meaning that the source and the target domain must “involve common relations but need not involve common object descriptions” (p. 47). The third characteristic of analogy is *systematicity*. This characteristic is the “tacit preference for causal predictive power” (p. 47) represented by “the presence of higher order connections between lower order relations” (p. 49). Fourthly and finally, Gentner and Markman argue that *alignable differences* play an important role in structural alignment.<sup>132</sup> These are differences that are connected to a common system, and are contrasted to non-alignable differences where “aspects of one situation...have no correspondence at all in the other situation” (p. 50). Alignable differences allow for *relational focus*<sup>133</sup> on relevant differences of common causal or goal structure between the source and target domains.

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<sup>130</sup> For more on structural identity as a constraint on mental models, see also P. N. Johnson-Laird (1983, pp. 419-422).

<sup>131</sup> What Gentner and her colleagues are suggesting is consistent with the “soft laws” of Terence Horgan and John Tienson (1989; 1990).

<sup>132</sup> The important role of differences in resemblance was also forcefully argued by Levi-Strauss (1963e, pp. 77-78).

<sup>133</sup> Relational focus is the focus on the common relations between objects, and not on descriptions of the objects themselves (Gentner & Markman, 1997, p. 47). This process is supported by both the binary operator and the causal operator introduced by Newburg and his colleagues (2001).

As evidence of the important role played by alignable differences in analogy, they demonstrated that subjects found it much easier to list differences between high-similarity pairs such as hotel—motel, than between low-similarity pairs such as magazine—kitten. In fact, they reported, subjects often expressed irritation and confusion in being asked to list differences between low-similarity pairs. These characteristics of analogy, therefore, are sufficient to show that even if there is a potentially indefinite amount of similarity relations between two objects, reasoners do constrain the similarities in analogy that they are willing to consider relevant, and that similarity does indeed play an important role in explaining metaphor and analogy.<sup>134</sup>

Analogical models, through metaphor and analogy, allow us to make the unfamiliar familiar. We understand new objects, events, and circumstances in terms of that which is already known to us. There is nothing which is more known to us than our own bodies. This is why the human-body metaphor is so essential to human cognition, and why it serves as the basis for metaphor and analogy. This also helps us to understand the predominance of *animism* in human culture.

We infuse the natural world with human characteristics in an effort to understand and predict it. In doing so, we take what Dennett (1990, 1991b, 1996, 2006) has called the *intentional stance*. We treat something as an intentional system when we see that something as an agent with limited beliefs about the world, specific desires, and

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<sup>134</sup> Marie-Dominique Gineste and Bipin Indurkha have argued that not only does analogy map structural relations from the source to the target domain, but also that analogy provides for the emergence of new similarities between the source and the target. They propose an interaction theory of analogy which implies a change in the representation of the object of description (the target) such that it allows for new resemblances to emerge (Gineste & Indurkha, 1993).

enough common sense to do the rational thing given those beliefs and desires (2006, pp. 109-114). The intentional stance, at its core, is an effort to make the unfamiliar familiar by using an analogical model in which characteristics of the human body, particularly the mind, is projected onto objects in the world.

We shall also argue in the next chapter that this type of analogical reasoning is responsible for another curious phenomenon in myth, *anthropomorphism*. Through this type of reasoning, we treat not only things as having human characteristics, but we also attribute human qualities to causes of events. We often see causes of events in the world as being the result of rational actions rather than (merely) physical causation. In this way, not only can we attribute physical causes to natural events, we also claim that those events happened for a *reason*. We shall return to this in the next chapter.

#### 4.5 The Transmission of Analogical Models by Myth and Ritual

Thus far we have argued that our perception of the world is structured into a negotiable rendition (as Newburg and colleagues called it) by internal representations, specifically schemas and models. These schemas and models are constrained in multiple ways, but the two most important are the way the world is and the type of body we have. We understand the world in terms of our body in two ways. First, how our body can interact with our environment: this gives us affordances and the human-body metaphor. Secondly, we make the unfamiliar familiar by projecting characteristics of our body into our environment by analogical models.

We have also argued that culture plays a large role in forming and constraining some of internal representations, particularly our intentional and social affordances. Our concern now will be how culture can play this role. We shall argue that culture exploits cognitive processes already present in the human mind to transmit cultural models to the individual.<sup>135</sup> Further, we shall argue that myth and ritual are especially well suited for this transmission of models.

Culture plays a significant role in determining which regularities and invariants humans track in their environments. It achieves this function in three ways; imprinting, social learning, and imitation (simulation). Dennett (2006, pp. 128-131) argues that cultural imprinting, beginning at birth by parent-offspring transmission, plays a powerful role in what we track in our natural and cultural environments. Some reliable environmental regularities are transmitted from generation to generation by social learning. We have been designed, through natural selection, to pay careful attention to, and to imitate, our early caregivers' facial expressions, intentional movements, interactions with others, and to defer to their authority. These behavioral traits do not end in childhood, but rather are also activated throughout our lives in response to others whom we hold as authority figures. We have mechanisms especially suited to both the reception and delivery of information about our environment from and to our conspecifics (Tomasello, 1999, Chapter 3).

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<sup>135</sup> For pedagogical purposes we will treat culture with the intentional stance. We wish to avoid a direct discussion of the ontological status of culture itself inasmuch as it is beyond the scope of this thesis.

To understand further how imprinting, social learning, and imitation work together in myth and ritual will require that we take a brief digression into child's play. The connection between children's pretending and games and ritual has long been noted (Huizinga, 1950; Scheffler, 1997; Tomasello, 1999). Furthermore, by imitating those we consider experts, or persons in authority the child learns about her cultural environment.<sup>136</sup> The practice of imitation allows us to both create and store mental models of potential action regarding specific domains. Many childhood games, including imaginative play, involve imitating real cultural situations (playing house, having a tea-party, war games, pretending a broomstick is a horse, etc.). It has been argued that these phenomena serve two purposes: first, the child learns to take one thing for another—that is, refer to one thing as another (Scheffler, 1997, p. 97); and secondly, to place herself into “intentional space” of another (the one whom they are imitating) to discern the actions of that other (Tomasello, 1999, p. 84). The former encourages the development of symbolic systems which, fostered by creativity and imagination, form families of representations providing rich inferences (Scheffler, 1997, pp. 105-106).<sup>137</sup> The latter, as described by Michael Tomasello, serves an intentional purpose:

By engaging in this imitative learning, the child joins the other person in affirming what ‘we’ use this object ‘for’: we use hammers for hammering and pencils for writing. After she has engaged in such a process the child comes to see some cultural objects and artifacts as having, in addition to their natural sensory-motor affordances, another set of what we might call *intentional affordances* based on her understanding of the intentional relations that other

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<sup>136</sup> Maurice Bloch (1991) has argued that much of what we learn is a non-linguistic enterprise.

<sup>137</sup> This process has low processing costs with maximum inferences—that is, cognitive economy. We shall return to the importance of Scheffler's insight here shortly in our explicit discussion of ritual.

persons have with that object or artifact—that is, the intentional relations that other persons have to the world through the artifact.

The distinction between natural and intentional affordances is especially clear in children's early symbolic play because in symbolic play children basically extract the intentional affordances of different objects and play with them (Tomasello, 1999, pp. 84-85, emphasis added).

Through play, the child imitates an intentional agent's interaction with objects and artifacts, and it is through this that the child learns what possibilities for action those objects and artifacts hold, that is—intentional affordances. But we contend that there is more going on than merely learning interactions with objects and artifacts; children are learning how to interact with other intentional agents in their society—that is, attaining social affordances.

As mentioned earlier, ritual is compared to child's play by Scheffler and Tomasello in these accounts. They argue that ritual fulfills both of the functions we have just noted in child's play. According to Israel Scheffler (1997, pp. 144-146), ritual plays on a confusion between mention-selection and denotation. Scheffler's idea of mention-selection is what allows us to say that a picture of a man is a man. When we say that the picture of a man is a man, we are not saying that the picture of a man physically is a man, but rather that the picture mentions and selects a physical man. To say that the picture of a man actually is a man is to say that the picture of a man is a denotation of a man. Scheffler maintains that in ritual confusion between mention-selection and denotation occurs. He writes:

...The mimetic gesture portraying the act of god is in such a capacity denotative. In addition, however, it mention-selects representations of the same act, itself included. But then, by confusion of such mention-selection with denotation, the gesture in question is itself taken to be the act of a god, and not merely a portrayal of such act (1997, p. 144).

Thus, these ritual acts function as signs in the way described by Levi-Strauss, Basso, Barrett, and Geertz in § 2.2. They provide the raw materials for analogical reasoning by fixing and organizing abstract conceptual relationships in terms of concrete images (Geertz, 2001, p. 13). In doing so, the information conveyed in these sign systems is transmitted to the group which aids in assimilating the models of the individual to those of the group.

Rituals also demonstrate the affordance relationships perceived between objects (both natural and artifacts) and persons, groups or other objects and events. These affordance relationships are “taken as models of relationships—physical, social, psychological, or moral—obtaining between persons, groups, or other natural objects or events” (Geertz, 2001, p. 13, see § 2.2 in this thesis. To this we would add the relationships, i.e. intentional affordances, obtaining between artifacts as well). Rituals demonstrate and reinforce for the participants and observers how one should interact with the natural and cultural environments. As Geertz would state it, rituals “are sets of symbols whose relations to one another ‘model’ relations among entities, processes or what-have-you in physical, organic, social, or psychological systems by ‘paralleling,’ ‘imitating,’ or ‘simulating’ them” (Geertz, 1973d, p. 93). Thus, in the same way a child learns what actions are possible between intentional agents and artifacts and other intentional agents by imitating those actions, rituals demonstrate and reinforce those possible actions as well—that is, they demonstrate and reinforce both intentional and social affordances.

According to Lakoff and Johnson, in agreement with what we have just noted, ritual is a particularly effective mode of transmission for cultural information due to its metaphorical nature:

Each ritual is a repeated, coherently structured, and unified aspect of our experience. In performing them, we give structure and significance to our actions, minimizing chaos and disparity of our actions. In our terms, a ritual is one kind of experiential gestalt. It is a coherent sequence of actions, structured in terms of natural dimensions of our experience. Religious rituals are typically metaphorical kinds of activities, which usually involve metonymies—real-world objects standing for entities in the world as defined by a conceptual system of religion. The coherent structure of the ritual is commonly taken as paralleling some aspect of reality as it is seen through the religion (Lakoff & Johnson, 1980, pp. 233-234).

Our negotiable rendition of the world can be structured, through ritual, by metaphorical activities. The activities in ritual are represented by the participants and objects modeling the cultural (religious) conceptual system. Ritual accomplishes the transmission through the activity of imitation. Each participant and object stands in a particular structural relationship to one another, and it is those structural relationships which are transmitted *via* ritual. Lakoff and Johnson further suggest that ritual is represented to the participants and observers as “experiential gestalts consisting of sequences of actions structured along the natural dimension of experience—a part-whole structure, stages, causal relationships, and a means of accomplishing goals” (1980, p. 234).<sup>138</sup> Ritual, as such an external representation, transmits to the individuals, both as participants and observers, goal-oriented internal representations

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<sup>138</sup> Here Lakoff and Johnson are specifically speaking of what they call “personal rituals,”—that is, those actions carried out by individuals in their everyday lives. I see no reason, however, why this cannot be applied to religious rituals as well.

(i.e. analogical mental models) which, in turn, resonate with natural dimensions of experience (i.e. as affordances).

Thus far our focus has been on ritual. It is our position, however, that the same cognitive processes exploited in ritual for the transmission of cultural information are also used in myth. Ritual never stands alone in active religions; rather, myth is a fundamental part of the religious process.<sup>139</sup> For ritual to be an effective visceral experience it must be connected to ideas, and “[t]he ideas that animate religious ritual are rooted in stories and myth.... This is the primary function of religious ritual—to turn spiritual *stories* into spiritual *experience*; to turn something in which you believe into something you can feel” (Newberg et al., 2001, pp. 90-91, emphasis original). Moreover, the recitations of myths are often rituals themselves (Geertz, 1973d, p. 112).<sup>140</sup> Furthermore, myth and ritual arise from the same psychological processes of humans that seek to find and impose order on their surroundings (d’Aquili & Laughlin, Jr., 1979; Fiske & Haslam, 1997, pp. 220-221). In addition, as Eugene d’Aquili and Charles Laughlin, Jr. define ritual, it is clear that myth *is* ritual:

... [Ritual is] a sequence of behavior that (1) is sequentially structured (patterned) (2) is repetitive and rhythmic (to some degree at least)—that is, it tends to recur in the same or nearly the same form with some regularity; (3) acts to coordinate affective, perceptual (cognitive in man and other higher

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<sup>139</sup> Robert Segal (1980, p. 175) argues that myth is not originally (within the context of religion) a narrative with explanatory power, but rather is a script for ritual. It is only when the ritual with which the myth is associated is believed to have lost its magical power (the power to control nature or the gods) that it is seen to be merely explanatory.

<sup>140</sup> For instance, the ancient Babylonian creation myth, *Enuma Elish*, was recited at the beginning of every new year. The purpose here was to magically recreate the cosmos and to keep it in order. In addition, the myth of the Last Supper provides the script, and is part of the ritual, of the Christian Eucharist.

vertebrates); and motor processes within the CNS [central nervous system] of individual participants; and, most particularly, (4) coordinates and synchronizes these processes among the various individual participants. (1979, p. 156)

With this definition of ritual, it is clear that myth meets the four qualifications:

(1) myth is sequentially structured; (2) myth is both repetitive and rhythmic;<sup>141</sup> (3) myth does coordinate affective, perceptual, and motor processes of the participants; and (4) myth coordinates and synchronizes those same processes across participants. Finally, and most importantly, even if myth is not considered to be ritual by all structuralists, myth and ritual are considered to be different transformations of identical elements and they are analyzed and interpreted in exactly the same fashion (Segal, 1980, pp. 183-184).<sup>142</sup>

Both Claude Levi-Strauss and Clifford Geertz argued that myth and ritual are especially well-suited for the transmission of culturally relevant information and interests because of the shared cognitive mechanisms that they exploit. The principle value of myth and ritual, according to Levi-Strauss, is that they preserve cultural

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<sup>141</sup> The repetitive and rhythmic nature of myth is clearly seen in its oral tradition. The repetitive and rhythmic nature had clear advantages in aiding memory to recall and retell the myths. Moreover, being both repetitive and rhythmic aided in the transmission of myths through culture. In addition, Rita Anderson (1999, p. 205) argues that mental imagery, as a mnemonic device, played an important role for the orator in recalling the myth; the orator would revisit and replay (simulate) the events represented in the myth.

<sup>142</sup> Richard Buxton (1994, pp. 151-155) objects to the myth/ritualist view. His major argument is that a myth cannot be adequately captured in ritual actions; that myth deals with far more issues with more complexity than ritual can and does. I certainly do not dispute this, but his objection hardly addresses the issue with which I am concerned. It is my contention that the retellings of myths are themselves rituals, and this is something to which Buxton, at least partially, agrees (p. 152). He states, "That the narration of Greek myth might actually form part of a ritual is certain." I am not, however, taking a hard line on this: I agree with Segal that even if the myth/ritualist view of religion is false it will "...still serve to suggest the importance of myths and rituals in understanding both religion and theories of religion" (p. 184).

methods of observation and reflection by which to speculatively organize “the sensible word in sensible terms” (Levi-Strauss, 1972, p. 16). Myths and rituals “teach” a culture’s classificatory systems based on the society’s goals and interests. Therefore, Levi-Strauss emphasizes, “...*the principle of underlying classification can never be postulated in advance*. It can only be discovered *a posteriori* by ethnographic investigation....” (p. 58, emphasis original). Pushing the importance of myth further, he writes:

The mythical system and the modes of representation it employs serve to establish homologies between natural and social conditions or, more accurately, it makes it possible to equate significant contrasts found on different planes: the geographical, meteorological, zoological, botanical, technical, economic, social, ritual, religious and philosophical (p. 93).

As we have been arguing, the modes of representation of myth are mental models, specifically, analogical models. The use of myths and rituals provide ways of transmitting the worldview(s) of a culture to individuals. They are effective because they exploit biological and cognitive mechanisms already present in the individual’s mind. As Geertz explains it:

In sum, human intellection, in the specific sense of directive reasoning, depends upon the manipulation of certain kinds of cultural resources in such a manner as to produce (discover, select) environmental stimuli needed—for whatever purpose—by the organism in search for information. And this search is the more pressing because of the high degree of generality of the information intrinsically available to the organism from genetic sources (Geertz, 1973c, p. 79).

Our biological and cognitive mechanisms are dependent upon, and must be supplemented by, cultural resources.<sup>143</sup> The specific resources that Geertz has in mind

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<sup>143</sup> See also Geertz (2000, Chapter X).

are symbolic systems, particularly those symbolic systems available through myth and ritual. But that is not the only role of myth and ritual, according to Geertz: myth and ritual exploit what Andrew Newberg and his colleagues (2001, p. 52-53) have called our emotional value operator.<sup>144</sup> Geertz argues that ritual and myth provide the public images of sentiment which are necessary for (decisive) decision making (Geertz, 1973b, p. 82). In other words, myth and ritual invoke our emotions to provoke us to think and act in a certain manner.

By exploiting the emotional value operator, myth and ritual provide normative constraints on the individual, and how he interacts with his natural and cultural environments (Geertz, 1973d). Moreover, as argued above by Levi-Strauss, it is through myth and ritual that the natural and cultural environments merge into a negotiable rendition of the world.

#### 4.6 Summary and Conclusion

This chapter has given support to our claim that structural analysis is a cognitive approach. We have demonstrated how what we take to be major components of structural analysis are firmly rooted in cognitive processes. These components include the human-body metaphor, opposition, inversion, and analogical models. First we argued that the human-body metaphor emerges from affordances—that is, we perceive

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<sup>144</sup> The emotional value operator is what internally motivates our own survival, aids in reasoning and rational thinking, and prompts our attention to features in our environment which are relevant to our survival. With regard to the importance of emotion in performing these tasks, see also Antonio Damasio (1994) and Noel Carroll (1997). Ritual is especially effective in this regard through what Robert McCauley and Thomas Lawson (1999) have called sensory pageantry.

our environment in terms of how our body can interact with it. Secondly, we argued that opposition emerges from the mediation of the human-body to its environment. Thirdly, we argued that inversion takes place when an affordance of a character or object is replaced by its contrary in the environment presented by the myth. Finally, we argued that since the human-body metaphor is essential to the development of mental models, then we can understand the human-body as fulfilling the role of the source domain which is projected onto the target domain—the environment, thus giving us the analogical models of which Levi-Strauss wrote.

We have also argued that some analogical models, as myths, give us a negotiable rendition of the world in which the cultural and natural environments merge. These analogical models need not be “true” representations of the world, but merely need to work within the constraints on the cognitive system. We have detailed those constraints at some length. One of the most important of the constraints is cognitive economy. Our minds seek out those representations which have the lowest processing costs, yet provide for the richest inferences. This is, in large part, what works. We have also argued that one of the most economical representations which we can project into our environment to attain understanding is our representation of our own body, that is—our body schema. It is by this process that we animate the world in which we live, and attribute reasons to events.

This brings us to our topics for the next, and final, chapter. First we shall consider objections that have been presented against structuralism, specifically those related to claims that structural analysis is arbitrary and unverifiable. In order to

overcome those objections, we shall argue that that mythical content arises naturally from, and is constrained by, our cognitive processes. Finally, we shall present our hypothesis as to how structural analyses can be verified, thus overcoming the former objections.

## CHAPTER 5

### IN DEFENSE OF STRUCTURAL ANALYSIS QUA MODELS, AND THE ORIGINS OF MYTHICAL CONTENT

The tried-and-true may not be true, but at least it is tried, so it gives us something to do that we know how to do. And usually it will work pretty well, about as well as it ever did in any case.  
Daniel Dennett, *Breaking the Spell: Religion as a Natural Phenomenon*<sup>145</sup>

#### 5.1 A Look Back and Forward

Thus far, our arguments have sought to give a foundation for two related claims: First, that myth arises from, and is structured by, natural cognitive processes; secondly, that structural analysis is a cognitive approach which will aid the anthropologist in extracting the structures of myth created by those cognitive processes. We have argued, in line with Levi-Strauss, that myths are analogical models and that these analogical models arise naturally from our interaction with our natural and cultural environments. In fact, it is through myths that the natural and cultural environments merge into a coherent worldview.

We wish now to demonstrate how our account overcomes traditional objections to structuralism and argue that structural analyses are neither arbitrary nor unverifiable. Building on what we have said in the previous chapters, we shall argue that the structure of myths is highly constrained. This will be demonstrated by a discussion of the origins of mythical content from cognitive processes we have previously considered (i.e.

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<sup>145</sup> Dennett (2006, p. 162).

schemas and analogical mental models). We have seen how those cognitive processes themselves are highly constrained, and now we shall argue that those constraints serve to constrain myths in a highly structured, and non-arbitrary, way.

Once we have demonstrated this, we shall offer a hypothesis concerning how structural analyses can be verified, provided that the appropriate constraints are met, by the anthropologist who offers the analysis. We propose that structural analysis, properly conceived and constrained, is a powerful tool which can be used by ethnographers engaged in fieldwork attempting to approach and understand myths. The implications of this approach will be discussed in our final section.

We hope, at the least, that this thesis will renew interest in one of the most influential anthropological theories of the previous century. At the most, we hope that our theory will reinvigorate the research of culture using the structural methodology. We believe that if this latter hope is fulfilled, it will prove both fruitful and insightful for the study of culture and for understanding the relationship between the mind, culture and nature.

## 5.2 Verificationist Objections to Structuralism

In the “Structural Study of Myth,” Claude Levi-Strauss claimed to introduce a much needed empirical approach to the study of myth (1955). No objection to this claim, however, has had better traction and longevity than the objection that structuralism is not verifiable. This objection is offered in four different forms: Structuralism is not an empirical investigation, structuralism is arbitrary, structuralism

is non-falsifiable, and structural claims are meaningless. The force of these objections has been taken to be definitive against structural anthropology (Colby, Fernandez, & Kronenfeld, 1981, p. 439). For, if the objections are viable, structural analyses can be seen to be nothing more than poetic mythical expressions themselves or some form of literary criticism (Kirk, 1970, pp. 59-60; Runciman, 1969, p. 262; Sperber, 1975, p. 67; 1985, pp. 92-93). If these objections are right whatever structural analyses are, they are not empirical. Therefore, if structural anthropology is once again to gain its status as an empirical research strategy for the study of culture, particularly myth, a method to demonstrate that structural claims are verifiable must be offered.

As mentioned above, the verificationist objection to structuralism has been formulated in four ways. Any answer to this objection which hopes to prove structuralism empirically verifiable must take into account each of these forms. We shall introduce each of these forms of the verificationist objection, and then place each of them in a context by discussing the ways that the objections were offered.

*Structuralism is not an empirical investigation.*

This objection rests on the well-founded assumption that empirical claims are verifiable: there is some fact of the matter that can either verify or falsify an empirical claim. The objection follows this general form:

If an investigation is empirical, then claims supported by that investigation should be verifiable.

A structural investigation does not produce claims that are verifiable.

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Therefore, structuralism is not an empirical investigation.

This objection addresses specifically Levi-Strauss's claim that structuralism is an empirical investigation. There have been many proponents of this objection, and all of them have raised this issue in a slightly different manner. Perhaps the most succinct version of this formulation, however, was raised by Mary Douglas. She stated that structural theory awaits "a perfect experiment." Without such a validation of the theory, Douglas suggests that one should suspend judgment on the relevance of structuralism (1967, p. 68).

W. G. Runciman introduces this objection more forcefully. Building on Douglas's critique, Runciman claims, "...it is impossible to see how the theory of Levi-Strauss could be validated in any analogous way within the framework of its own assumptions. It always remains to be asked why the mythography of Levi-Strauss is not itself a myth..." (1969, p. 262). Runciman argues that what is needed in order to validate structuralism as an empirical theory is some way to demonstrate that the analysis presented by the structural anthropologist is isomorphic to the phenomena that he seeks to explain.<sup>146</sup> In this vein, Runciman continues his critique:

The only force in the injunction of structuralism would seem to lie, as with doctrine, in the emphasis placed on the search for isomorphism. But here the same difficulty arises. The success of the method, if it can be so called, will rest not on the search for isomorphism by itself but on the extent to which it leads to a valid reduction—that is, to a demonstration that one class of phenomena can be strictly identified with another....But the discoveries are not arrived at by means of any methodological axiom derived from the notion of 'structure'. They are arrived at by finding that the laws governing two discrete classes of phenomena are isomorphic, that their constants are identical and that the two sets of terms are empirically interchangeable. It may well be that there is both

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<sup>146</sup> See also Philip Pettit (1975, p. 97) concerning the verifiability of structuralists' claims of isomorphism.

an isomorphism of laws and an interchangeability of concepts between apparently discrete areas of social phenomena. But the explanatory value of the discovery will depend on the empirical identification. (Runciman, 1969, p. 257)

In other words, it is not enough for the structuralist to claim that there is an isomorphism between his description of the culture and the culture itself. There must be some way to empirically demonstrate this isomorphism, not only between the structures and their analyses, but also between the laws governing those structures and constraining the analyses such that there is a smooth reduction of one to the other.<sup>147</sup>

Unless there is, structuralism is of little use to anthropology.

Cognitive scientist Dan Sperber sees structural analyses as heuristic devices capable of offering “good empirical arguments for preferring one [structural] description and throwing out another” (1975, p. 67). Nevertheless, he indicts structural theory for not being a scientific theory as that is understood in the natural sciences. The problem for structuralism is that it lacks the necessary rigor to be testable. The reason structural theory fails as a scientific explanation is because the properties that it ascribes are not causal. Any scientific explanation, according to Sperber, must be a causal explanation concerning fundamental properties. Structuralism fails to provide causal explanations. Instead, the properties which structuralism describes are neither fundamental nor causal, but are rather epiphenomenal. For this reason, according to Sperber, structuralism fails to be scientific. Moreover, he argues that structuralism meanders between observation and theory without really accounting for one or the other. Because of this, structuralism can be seen as nothing more than generating

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<sup>147</sup> We discussed the laws which Levi-Strauss proposed in § 2.1.

interpretive discourse about the intuitive experiences of the ethnographer (Sperber, 1985, pp. 92-93; 1996, pp. 45-47).

*Structural Analysis is Arbitrary.*

This objection, as just alluded to by our discussion of Sperber, claims that explanations of a cultural phenomenon offered by structural analysis are arbitrary—being relative to the anthropologist giving the analysis. The objection is also closely tied to the issue of isomorphism discussed above. Unless there is a method to demonstrate that there is an isomorphic relationship between what is being described in or by a culture and the description offered by the anthropologist, then such a description is said to be arbitrary. The general form of the objection is as follows:

Either structural relationships are produced in or by the culture, or the structural relationships are produced by the anthropologist.

If structural relationships are produced in or by the culture, they could be verified.

Structural relationships cannot be verified (*via* the first objection above).

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Therefore, structural relationships are produced by the anthropologist.

This objection, more so than the others we are examining, has provoked the most discussion. The arbitrariness objection was first raised by Runciman (1969). He argued:

It is not enough to produce a ‘structural’ parallel between the components of the work of art and the presumptive content of the artist’s repressed impulses and fantasies. It has also to be shown that the artist *was* under the influence of these repressed impulses and that he *therefore* produced the work of art whose symbolism can be ‘decoded’ along these lines (Runciman, 1969, p. 259, *emphasis* original)

Here Runciman is calling for some verifiable way for structural methodology to demonstrate that the analyses it provides concerning a culture can be shown to arise from the mind of the individuals of that culture and is not merely an arbitrary description constructed by the anthropologist according to structural methodology.<sup>148</sup>

Philosopher Philip Pettit also criticizes structuralism for being arbitrary. He claims that the structuralist is at liberty to shift his hypothesis, vary the level of abstractness of his descriptions, and invoke any rules of transformation to demonstrate that any two myths are really variants of the same one. Pettit sees the structuralist project as an “anything goes” methodology because of its high level of abstraction and its lack of constraints. Because of this, no structural claim can have any more relevance to the culture which it describes than any other (Pettit, 1975, p. 92).

Sperber also sees the structural descriptions as arbitrary. Unlike Runciman and Pettit, however, Sperber does not see this as a fault of structuralism, but as a necessary condition. Sperber argues that structuralism is arbitrary because it could not be otherwise. He writes:

...In fact, arbitrariness is one of the means of symbolic production: e.g., a collection of ordinary objects transformed into relics, pebbles tossed at random and interpreted by divination, surrealist experiments in automatic writing, etc. Symbolic thought is capable, precisely, of transforming noise into information; no code, by definition, would be able to do this. Any model of symbolism is inadequate if it is not capable of this same feat...(Sperber, 1975, p. 67).

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<sup>148</sup> G. S. Kirk is in full agreement with Runciman’s critique (Kirk, 1970, pp. 54, 77-ff). Nevertheless, even if structuralism cannot be verified, according to Kirk, it is still “always worth adopting *among other approaches*” (1970, p. 78 *emphasis original*), and Kirk makes liberal use of structural analyses in his own work.

Sperber's main point here is that there is good reason for thinking that the methods employed in structural analysis do proceed similarly to natives' symbolic thought (1975, p. 66). Arbitrariness is simply built into symbolic thought, and any method that attempts to unravel it must, to some degree, be arbitrary as well. Therefore, structuralism is not to be faulted for being arbitrary, for it could not be otherwise. Nevertheless, Sperber does reject structuralism in his work because he believes that structuralism fails to tell us what a symbol really is (1975, p. 64).<sup>149</sup>

*Structuralism is Non-falsifiable.*

The charge of non-falsifiability is an old and familiar call for verification. Luc Brisson has argued that whether or not a claim could be falsified is what separates philosophy from myth for Plato (Brisson, 1998). In addition, philosopher Antony Flew, in his well-known paper "Theology and Falsification" (Flew, 1964), asserted that until theologians and theistic philosophers of religion could give a case under which their beliefs could be demonstrated to be false, their positions hold little philosophical weight.

The general form of the argument is as follows:

If a claim is empirical, then there must be conditions under which the claim can be true and conditions under which it can be shown to be false.

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<sup>149</sup> Sperber believes that the most valuable contribution of Levi-Strauss's structuralism was that it allowed stripping away the semiological burden that symbols have meaning. "[I]f symbols had meaning, it would be obvious enough (Sperber, 1975, p. 84; see also, Sperber, 1979, p. 42)." Thomas Lawson and Robert McCauley in *Rethinking Religion* dispute Sperber's conclusion (Lawson & McCauley, 1990, pp. 138 - ff). In addition, one of the problems that stands out in Sperber's critique of structuralism is that he is not interested in myth, but rather in physical manifestations of symbols in ritual and religious beliefs broadly construed. Because of this, his critique does not directly address the object of structural analysis, myth.

There are no conditions under which the claims produced from structural analyses can be shown to be false.

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Therefore, claims produced from structural analyses are not empirical.

K. O. L. Burridge was the first to level this charge against structuralism. He argues:

The issues [with structural analyses] are whether the empirical exercise, fieldwork, can invalidate Levi-Strauss's method—I do not see how it can—and whether such formulae as may be produced are self-explanatory or refer to something other than themselves. If fieldwork cannot invalidate a method—should the method be followed? (Burridge, 1967, p. 114)

Burridge is arguing that structural analyses cannot be verified by claiming that there are no empirical findings produced from fieldwork that could (conceivably) demonstrate the methodology is invalidated, that is—falsified. In other words, it is not known under what circumstances the theory could be proved false; for part of what it is to understand that a proposition is true is to know under what circumstances the proposition could be false. This does not mean that there must be a case in which the proposition is false; merely that there is at least a hypothetical case in which it could be false.

Burridge's argument is reinforced by Pettit when he argues:

The vague formulation of hypothesis, the description of units in terms of unlimited abstractness, the appeal to transformations in an inadequately constrained sense: these are faults that I see in Levi-Strauss's method. They mean that with ingenuity—and this is not something that Levi-Strauss lacks—the analyst of myth can fail to falsify almost any typical hypothesis about the structure underlying a given range of myths (Pettit, 1975, p. 92).

*Structural Claims are Meaningless.*

This too is an old method of demanding verification.<sup>150</sup> The general form of the argument is as follows:

Any supposed empirical claim that is not verifiable is meaningless.  
Claims produced from structural analyses are not verifiable.

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Therefore, structural claims are meaningless.

This is an argument which few have explicitly stated against structuralism, but they have certainly implicitly maintained it. For instance, G. S. Kirk argues that unverifiable analogies offered in some structural analyses, such as “society is a machine” and the mind is rigid like analytical functions—which are not literally true, have become stringently enforced to the point of absurdity (Kirk, 1974, p. 84). Likewise, Pettit argues that due to the lack of constraints and the arbitrariness of analyses in structuralism “with such leeway no analytic goal can seem preposterous” (Pettit, 1975, p. 92). According to these arguments, the lack of verifiability for structural anthropology leads to the absurd, the preposterous, the meaningless.

These objections and objectors included here are by no means exhaustive, but they are paradigmatic—they represent the forms of the verificationist objection that we observed at the outset. As we have also seen, the verificationist objection against structuralism has had tremendous traction and longevity. Moreover, it has convinced many that structuralism is at best impotent and at worst dead. This is so much the case that by the time that cognitive approaches to understanding culture were being taken

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<sup>150</sup> This claim was first raised by David Hume (Hume et al., 1975).

seriously in anthropology, structuralism was being pushed aside with historical epitaphs:

Structuralism was an attempt to formalize relationships in symbolic expressions, particularly in myth, and to deal with the deeper kinds of meaning expressed by cultural forms. It lost impetus because the basic units of analysis, the basic decodings, seemed often so arbitrary and were never substantiated in any rigorous way (Colby et al., 1981, p. 439).<sup>151</sup>

The verificationist objection has persuaded many that, as a research project, structural anthropology is not a viable option. It fails to be the empirical investigation into culture that its dwindling numbers of proponents have claimed it is.

It is our position, however, that such epitaphs are premature; in fact, we shall argue that it is the rise of the cognitive approach in anthropology that breathes life back into structuralism. Lest we forget, structuralism was one of the first cognitive approaches to cultural phenomena. It laid the groundwork for identifying the cultural phenomena that needed cognitive explanation (Sperber, 1996, p. 47). But as we shall demonstrate by examining mythical content, structuralism, as we have come to understand it through the previous chapters, fits snugly into current research in cognitive science. And it is this fit that will provide the methodology for writing the epitaph to the verificationist objection to structuralism instead.

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Compare that epitaph with this more recent one by Roy D'Andrade:

Both structuralism and symbolic/interpretative anthropology are now abandoned agendas. I believe that abandonment was due not just to shifts in intellectual fashions, but to the problem that comes with an inherently unverifiable approach. No one could build on what was done before, because building requires criticism, modifications, and selection of what is sound from what is unsound, and this is not possible in a world where there is no way of knowing what is better and what is worse (D'Andrade, 1995, p. 249).

### 5.3 Structural Theories and Science

No one denies that myths display structure. Moreover, there is agreement that this structure is a product of the mind and how it interacts with its environment. The problem lies in how to approach and understand that structure. Most would agree that Levi-Strauss was illuminating something interesting about myth but considering the objections we just discussed, they are unwilling to support his account. Nevertheless, there is structure underlying myth:

Virtually all myths can be reduced to the same consistent pattern: identify a crucial existential concern, frame it as a pair of incompatible opposites, then find a resolution that alleviates anxiety and allows us to live more happily in the world. Why should this be so? We believe that myths are structured in this way because the mind makes sense of mythical problems using the same cognitive functions it relies upon to make fundamental sense of the physical world. (Newberg et al., 2001, pp. 62 -63)

The question is how to make sense of that structure in a non-arbitrary and verifiable way. This is where, according to its critics, Levi-Strauss's structural analysis of myth falls short. Before we embark on answering those criticisms, however, let us briefly consider what kind of answer(s) would be sufficient.

Thomas Lawson and Robert McCauley, in their groundbreaking work *Rethinking Religion* (1990), propose a structural account of religious ritual.<sup>152</sup> What concerns us now is not the account they provide, but rather the criteria that they propose a structuralist account must meet. They propose several constraints on both structural theories and structural explanations in order that such accounts are both non-arbitrary

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<sup>152</sup> Lawson and McCauley (1990, pp. 41-44, 172-174) consider Levi-Strauss's structural theory in detail, but reject it along the same lines considered in the objections above.

**Table 5.1 Lawson and McCauley's (1990, pp. 177-180, *emphasis original*) constraints on structural theories and structural explanations.<sup>153</sup>**

	<b>Structural Theories</b>	<b>Structural Explanations</b>
<b>General Science</b>	<ul style="list-style-type: none"> <li>(1) Address a system's components and internal processes (and the relationship between the two).</li> <li>(2) Propose systems with quite specific structures in order to explain phenomena—that is, they constitute hypotheses about the structures of an underlying mechanism responsible for observable effects.</li> </ul>	<ul style="list-style-type: none"> <li>(1) Offer detailed models of <i>mechanisms</i> underlying the co-occurrences of events which scientific laws describe.</li> <li>(2) Explicate the underlying mechanisms which are responsible for the orderly behaviors that the laws describe.</li> <li>(3) Are both causal and hypothetical, though the causality in question is not, at least first and foremost, efficient causality. They are causal, rather, in the sense that “the structure invoked to explain can also be called the <i>cause</i> of the feature being explained” (McMullin 1978, p. 139).</li> <li>(4) Involve retroductive inference—that is, the inference is from the character of effects to hypothetical accounts of their causes in this special sense of “cause.”</li> <li>(5) Organize causal laws within the framework of accounts of often unobservable, underlying mechanisms.</li> </ul>
<b>Cognitive Sort<sup>154</sup></b>	<ul style="list-style-type: none"> <li>(3) Usually offer functional analyses that attempt to isolate patterns of interactions within systems whose complexities do not readily lend themselves to capture in terms of laws.</li> <li>(4) Hypothesize about psychological systems in terms of principles which specify constraints on the forms of those systems' products—that is, they advance hypotheses about the human cognitive system that can account for uniformities which underlie the phenomena under scrutiny.</li> </ul>	<ul style="list-style-type: none"> <li>(6) Generates a new conceptual framework in science which is “justified” precisely to the extent that is shown to have explanatory power” (McMullin 1978, p. 145).</li> <li>(7) Gains plausibility as a function of the fecundity of the overall theory from which it rises.</li> <li>(8) Connects with interpretive pursuits.</li> </ul>

<sup>153</sup> In some instances the constraints here have been paraphrased in order to meet the format of the numbering system we have used to elucidate these constraints. In addition, the quotes from McMullin are used in Lawson and McCauley. The text to which they refer is McMullin, E. 1978, “Structural Explanation,” *Philosophical Quarterly* 15, pp. 139-147.

and of scientific value. First, they discuss such accounts in a general way as they pertain to all sciences, and then they supply additional constraints for structural theories and explanations of the cognitive sort (see Table 5.1).

According to Lawson and McCauley, structural explanations must be more than interpretive. Structural explanations, by the use of general principles and abstract concepts, must support a structural theory which has scientific value. To be of scientific value, a structural theory must have the epistemological goal of extending our knowledge and be “*empirically tractable* in domains beyond that to which it was initially applied” (1990, p. 28, *emphasis* original).

Lawson and McCauley argue that structural explanations are deemed scientific if they meet the following qualifications:

1. Operate by means of *systematically related, general principles* that employ concepts at levels of abstraction removed from that by which the phenomenon to be explained is currently characterized.
2. Such systems of principles from which explanations proceed are empirically culpable beyond their initial domain of application.
3. The reason the explanatory principles of the most obviously scientific explanation are systematically related is that a theory, employing the sort of abstract concepts discussed under the first qualification, organizes them.
4. The status of the explanatory principles turns on the success of the theory that generates them.
5. Possesses explanatory punch sufficient to count as science only within the network of meanings the over-arching theory supplies (Lawson and McCauley, 1990, p. 174, *emphasis* original)<sup>155</sup>

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<sup>154</sup> It has been pointed out to me by Professor Charles Nussbaum that qualification 3 under structural theories and qualifications 6 and 7 under structural explanations should be placed with general science, inasmuch as they are as applicable to other scientific domains (e.g. biology) as they are to cognitive science. I have chosen, however, to leave them in the grouping presented by Lawson and McCauley.

<sup>155</sup> We have chosen to paraphrase some of these qualifications in order to elucidate them in our format. See also McCauley and Lawson (1990) pages 26-29 for further explication of these qualifications.

From these constraints on structural explanations, Lawson and McCauley argue that a scientific, structural theory (provided that it meets the constraints in Table 5.1):

[S]hould employ a common set of concepts and general principles in its various explanations. In addition, a satisfactory theory makes testable claims about universal constraints on the phenomena in some domain. Those constraints delineate both what is possible and not possible in the domains the theory addresses. (1990, p. 174)

In the previous chapters we have laid the groundwork for demonstrating that the structuralist theory of myth is indeed a scientific theory, in particular, a scientific theory of the cognitive sort that meets all the qualifications detailed above. We have set the stage to argue that the phenomenon of myth can be explained at the cognitive level by analogical models of a particular sort. These analogical models are structures that operate at a level of abstraction removed from the phenomenon of myth. As such, these structures, as we have shown, do operate by systematically related principles which are accountable at a descriptively lower level than the domain of myth. Structuralist theory rises or falls based on its commitments to certain cognitive mechanisms and processes rather than merely its analysis of myth; if it is the case that these commitments fail empirically, then so too does the structural theory of myth.

Mental models theory, as we have developed it in the previous two chapters, serves as a structural explanation for the cognitive theory of myth we are proposing. Although mental models are not generative in the Chomskian sense to which Lawson and McCauley hold, in that mental models do not have grammatical categories, they are still generative. They are so in the sense that they allow for the generation of finer and

greater detail concerning that which is modeled. Therefore, our account can be deemed scientific.

Perhaps it is worth stating the obvious here. We have introduced cognitive processes and mechanisms to support structuralist theory that simply were not available to Levi-Strauss when he first formulated his theory. Nevertheless, as we have demonstrated throughout this thesis, he did hint at them repeatedly. In a very real sense, his theory of myth arrived before its time. Many have criticized Levi-Strauss for not doing more to find cognitive support for his structuralist theory. We must remember, however, that during the years when Levi-Strauss was developing and writing his theory, there was no such thing as cognitive science. Indeed, we should recognize the fact that cognitive science has independently proposed many of the cognitive processes and mechanisms to which Levi-Strauss initially pointed to his benefit.

The cognitive mechanisms and processes we have proposed in support of structuralist theory thus far are in line with those which Levi-Strauss suggested. Our case should not be seen as an *ad hoc* fix of structuralist theory.<sup>156</sup> Instead, we are demonstrating that structuralist theory fits smoothly with independent discoveries in cognitive science. In the next section we shall take up the current research of mythical content directly and demonstrate how it fits with what we have said previously about the role of affordances, the human-body metaphor, and mental models. This will give us a structuralist theory of myth in line with that of Levi-Strauss and meeting the qualifications proposed by Lawson and McCauley.

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<sup>156</sup> Cf. Lawson and McCauley (1990, p. 28)

#### 5.4 Mythical Content

Undertaking a cognitive study of mythical content is a recent phenomenon. There have been a number of independent researchers and studies that have proposed various narrow approaches to aspects of mythical content. No one, however, has given a comprehensive cognitive account of myth itself. This is an enormous challenge. We are proposing that, when all of these narrow approaches are taken together in connection with what we have previously discussed concerning structuralism and mental models, a coherent account of myth emerges that is both non-arbitrary and verifiable.

Recall that we argued in Chapter 4 for the important role played by myth and ritual in culturally transmitting mental models to individuals. We also argued that it was from the nature of affordances, the human-body metaphor, and mental models that we could understand the cognitive roots of cultural phenomena as they relate to myth and ritual, such as totemism, animism, and inversion. We also suggested that the most widely noted characteristic of mythical thought, anthropomorphism, was the result of those cognitive processes. We now wish to demonstrate this in full force in connection with mythical content.

In what follows, we shall offer summaries of some of the most recent research into the cognitive nature of mythical content. Considered independently of our project, the work of these researchers is of great importance; but we wish to take their research a step further by synthesizing their individual contributions so that a coherent account of myth (not just mythical content) emerges. The research is not new, but the way we

shall organize it to provide a coherent structural account that is non-arbitrary and verifiable is. We shall demonstrate the verifiability of this account in the next section.

Let us begin by taking up the account of mythical content<sup>157</sup> offered by Pascal Boyer (1996, 2000, 2001, 2003, 2004; Boyer & Ramble, 2001; see also Dennett, 2006). Boyer proposes that we cognitively parse the world into natural ontological categories (i.e. persons, artifacts, animate beings, events, and abstract objects). This parsing occurs with the aid of *schemas* (what Boyer calls templates). As these things are encountered in our environment, the appropriate schema is activated allowing for quick recognition and categorization. More importantly, the activation of these schemas allows for vast inferences relative to their appropriate categorization. These inferences, we suggest, are based on the *affordances* of these natural ontological categories—that is, the possibility of our interaction with these varies according to the ontological category to which they belong.

According to Boyer’s hypothesis, mythical beliefs offer an efficient method of distributing culturally relevant information to individuals of a group. Mythical content exploits cognitive economy where the goal is to provide the richest inferences with the least processing costs. Boyer proposes that mythical content operates by violating our (inferential) expectations concerning an item within a certain domain by attributing properties (affordances) to that item that it does not have. This violation aids in

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<sup>157</sup> Boyer actually uses the phrase “religious beliefs” rather than “mythical beliefs” (see note 5 § 2.1).

memory and transmission, as well as offering rich inferences with relatively little extra processing costs. Let me explain.

Consider the following two propositions:

1. John owns an orange Volvo.
2. I have a tree in my backyard that hears and answers prayers.

Boyer's research has demonstrated that of the two propositions, Proposition 2 is considerably more likely to be remembered and transmitted. This is because the concept of "a tree that hears prayers" violates our expectations concerning our domain-specific knowledge of trees. Trees do not hear prayers; in fact, trees do not hear at all. In contrast, even though it is unusual to see an orange Volvo, there is nothing counterintuitive (in Boyer's sense) about this concept. There is no counterintuitive violation of our domain-specific knowledge concerning Volvos or cars in general. It is the counterintuitive violation of our domain-specific knowledge concerning trees in Proposition 2 that makes it attention-grabbing. Because it is attention-grabbing, it is far more likely to be held in memory and transmitted to our fellows.

Furthermore, this phenomenon exploits our natural tendency toward cognitive economy. By claiming that the tree has the power to hear and answer prayers, we have loaned characteristics naturally belonging to another ontological category, persons. This requires little extra processing since that schema is already in place. Yet, by doing so, we have vastly increased the inferences that can be made concerning the tree. We can now make inferences about this tree beyond those we would normally make about trees. Our inferences can be drawn from our experiences with persons who hear and respond to our requests. In other words, we have multiplied our affordances with the

tree. We have increased our possible interactions with it. We have achieved minimal processing costs, but attained manifold inferential ability.

Boyer's hypothesis does not end there, however. He also introduces what he calls a limited catalog of religious (mythical) beliefs which are produced by projecting human characteristics onto non-human things. Moreover, these characteristics are hierarchical. The characteristics which are projected are:

- (i) Anatomical Structure
- (ii) Physiological Processes
- (iii) Personal Identity
- (iv) Social Organization
- (v) Intentional Psychology

These characteristics are hierarchical such that if one were to attribute anatomical structure to an item, this would entail that the item also had a physiological processes. Each former characteristic entails the latter. Therefore, not only would the item have the inferences of the specific characteristic with which it is being attributed, it could also carry the inferences to those characteristics following from the specific characteristic. But, as our example of with the tree demonstrates it is possible, and even likely with mythical beliefs, to attribute higher-order characteristics without attributing lower-level ones.<sup>158</sup>

Though Boyer does not consider this directly, what is in play here is the human-body metaphor. We are projecting our body (including the mind) onto items in our

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<sup>158</sup> All of the inferences of the lower-level characteristics are potentially there, though they are likely not to be exploited. For instance with our tree, since our emphasis is on the psychological processes available to it because it is able to hear and respond we are unlikely to be concerned with inferences regarding anatomical structure and physiological processes.

environment. This increases our possibility of interaction (our affordances) with those items. By doing so, we are creating an anthropomorphic rendition of our environment.

But what happens with the object of the mythical belief is itself an intentional agent? According to Boyer's hypothesis, the most important characteristic which is retained in such a case is intentional psychology. The counterintuitive violation usually occurs by replacing the human body with its opposite. We propose, beyond Boyer, that in (religious) societies where a strong mind/body dualism is held (e.g. Christianity, Islam, Buddhism, etc.), and the body is viewed as matter versus spirit, the opposition is the complete negation of the physical body. This produces mythical beliefs concerning ancestors (who visit, watch, and help the living), spirits, ghosts, and even gods. There are also cases, however, in which the human body is replaced by characteristics of another ontological category, such as an animal while retaining the intentional psychology of a human.<sup>159</sup> We propose that in these societies the essential dualism is between man and beast (e.g. Greece, Egypt, etc.)<sup>160</sup> and by replacing the human body with its opposite the body takes the form of an animal with the appropriate contextual affordance.<sup>161</sup> The least common, and the exception which proves the rule according to

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<sup>159</sup> Johan Huizinga (1950, p. 141) argues that theriomorphic imagination is a root of totemism, and that the best way to understand this phenomenon is through child's play.

<sup>160</sup> Humans, particularly in Greek mythology, can be taken to be both in opposition to, and mediators between, gods and beasts. Therefore, depending on the context of the myth the human body can be replaced by either of these two oppositions—the body of a god, or that of a beast. This would be an interesting avenue of further research in the context of affordance theory.

<sup>161</sup> Levi-Strauss himself recognizes affordances (what he calls "capacities") of animals being used in this manner (see Levi-Strauss, 1995, pp. 21-24).

Boyer, is the case of a person in which intentional psychology (the mind) is removed. This is the case of the zombie.

What Boyer's hypothesis and research demonstrates in relation to our thesis is that mythical content is created by attributing to items in our environment affordances in opposition to those which they naturally have. These affordances are projected onto the item *via* the human-body metaphor as the source domain. Yet, as we have argued, there are different types of affordances; natural, intentional, and social. Moreover, we see different parts of our body as exposing different affordances. What part of our body we are projecting will constrain the affordances that are also projected. The projections are carried out *via* mental models.

In connection with, and qualified by, Boyer's hypothesis of mythical content, the research of Stewart Guthrie (1980; 1993) is of particular importance to our thesis. Guthrie argues that religious beliefs are seemingly plausible mental models of the world grounded in daily experience. Further, the fundamental component of these models is the human-body metaphor that is systematically applied to nonhuman phenomena. In fact, it is the human-body metaphor, according to Guthrie, which is the basis for the meaning and knowledge we find in our environment.

As Johan Huizinga (1950, p. 136) reminds us, "As soon as the effect of a metaphor consists in describing things or events in terms of life and movement, we are on the road to personification. To represent the incorporeal and the inanimate as a person is the soul of all myth-making...." As Boyer argued, the most important aspect of ourselves that we project onto our environment (by the human-body metaphor) is our

*mind*. We, by default, perceive objects and events in our environment as if they are intentional. For example, if we see a twisted twig in the path ahead of us, our first (default) assumption is that it is a snake, or if we hear bushes rustle behind us, the default assumption is that it is a predator rather than merely the wind. This cognitive projection operates by what Justin Barrett calls the hyper-active agency detection device (HADD) and, it has been argued, HADD was an important evolutionary step fundamental to our survival. But more than that, HADD promoted mythical thought; for the one feature that is common to all supernatural beings is that they have minds (Barrett, 2000, pp. 31-32; Barrett & Johnson, 2003, pp. 208-210, 214-216; Boyer, 1996, pp. 86-92; 2001, pp. 142-ff; 2003a, p. 120; Burkert, 1983, pp. 12-22; S. Guthrie, 1980, p. 191; 1993, pp. 82-ff).<sup>162</sup>

There is further evidence in current research that closely ties mental models to the development of myth and ritual. Donald Norman (1983) has argued that mental models give rise to “superstitious” behavior patterns. One of the fundamental principles at work in mental models is that of economy (P. N. Johnson-Laird, 1983, p. 408-409). Because of this, Norman argues that “...people maintain ‘superstitious behavior patterns even when they know they are unneeded because they cost little in physical effort and mental effort” (Norman, 1983, p. 8). As he further argues:

...[Mental models] contain only partial descriptions of operations and huge areas of uncertainties. Moreover, people often feel uncertain of their own knowledge—even when it is complete and correct—and their mental models include statements about the degree of certainty they feel for different aspects of their knowledge. Thus, a person’s mental model can include knowledge or

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<sup>162</sup> For a debate of this view, see Steven Mithen and Pascal Boyer (1996).

beliefs that are thought to be of doubtful validity. Some of this is characterized as 'superstitious'—rules that 'seem to work,' even if they make no sense. These doubts and superstitions govern behavior and enforce extra caution when performing operations. This is especially apt to be the case when a person has experience with a number of different systems, all very similar, but each with some slightly different set of operating principles (Norman, 1983, pp. 8-9).

Superstitious behavior, for Norman, is due to the limitations on models which imply an individual's uncertainty as to the causal mechanism, yet an individual's experiential certainty as to actions and outcomes. "Superstitious behavior indicates that the person has encountered difficulties and believes that a particular sequence of actions will reduce or eliminate the difficulty" (1983, p. 11).

Norman's observations have suggested that due to the principle of economy in mental models, people are inclined to hold beliefs of a superstitious variety concerning their interaction with their environment since they are pragmatic and require less mental processing. To compensate for the limitations of these superstitious beliefs formed from mental models people are likely to engage in repetitive ritualistic behavior in an attempt to control the outcome of these interactions. This evidence suggests that myth and ritual are natural products of mental models.

This suggestion is given support by Merlin Donald (1991, pp. 214-*ff*). He argues that the origins of myth are to be found in metaphor and mental models. Mythical thought is comprised of a system of explanatory and regulatory metaphors designed to model the entire human universe such that it may be explained, predicted and controlled. These models normatively regulate behavior and affect and determine the perceptions and significance of objects and events of everyday life. Furthermore, in

a dramatic and challenging suggestion, Donald sees myth *qua* models as the driving force behind the development of language:

...[M]yth is the prototypical, fundamental, integrative mind tool. It tries to integrate a variety of events in a temporal and causal framework. It is inherently a modeling device, whose *primary* level of representation is thematic. The pre-eminence of myth in early human society is testimony that humans were using language for a totally new kind of integrative thought. Therefore, the possibility must be entertained that the primary human adaptation was not language *qua* language but rather integrative, initially mythical, thought. Modern humans developed language in response to pressure to improve their conceptual apparatus, not vice-versa. (p. 215, *emphasis original*)<sup>163</sup>

He argues that this pressure to improve our conceptual apparatus was spurred by mimetic representations. Drawing on Johnson-Laird's distinction between conceptual and perceptual models (see § 3.2), Donald argues that mimetic representations acted as an intermediate level between the two. While mimetic representations involve reference, semantics and the ability to express relations, they lack critical elements of symbolic thought possible in conceptual models. Language *qua* myth developed from the pressure of mimetic representation *qua* ritual to improve our conceptual apparatus to include symbolic thought.

We have now fully presented our case in favor of Levi-Strauss's structural theory of myth. We have demonstrated how the phenomena present in myth and described by Levi-Strauss are supported by underlying cognitive mechanisms and processes. We have shown how the Laws of Transformation (resemblance, contiguity,

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<sup>163</sup> Levi-Strauss makes a similar point:

Myth and ritual do not always correspond to each other. Nevertheless, they complete each in domains already presenting a complementary character. The value of ritual as meaning seems to reside in instruments and gestures: it is a *paralanguage*. The myth, on the other hand, manifests itself as a metalanguage, it makes full use of discourse, but does so by situating its own significant oppositions at a higher level of complexity than that required by language operating for profane ends. (1983c, p. 66, *emphasis original*)

opposition, relevance) are given support and explanation by the very nature of analogical models (§ 4.4). We have also argued in Chapters 3 and 4 that these models are highly constrained and non-arbitrary as Levi-Strauss initially suggested. We have also argued in Chapter 4 that essential to understanding how analogical models work in human cognition is the human-body metaphor. We have proposed this as a critical update to structuralism which serves as an additional constraint to the theory. The human-body metaphor also provides additional cognitive support to two fundamental processes in structural analyses, mediation and inversion. We argued that the human-body metaphor served as the mediator between ourselves and our environment(s). We also argued that the process of inversion was supported by the human-body metaphor in connection with affordance theory (§ 4.2).

Finally, in this section we have argued that these underlying cognitive processes give us the origins of mythical content which are structured according to the constraints on mental models. We have also argued that myths are the natural products of these models. All of this together has given support to our claim that the structural theory of myth is a viable and scientifically valuable cognitive theory; for we have met the constraints we examined by Lawson and McCauley in the previous section. We have provided a (cognitive) structural theory of myth that should be deemed scientific.

What remains, however, is addressing the direct objections against structuralism; namely that the theory, when applied to myth, is both arbitrary and unverifiable. We shall argue in response that when myths are understood *as* analogical models these concerns are eliminated. We shall argue that what emerges from the

constraints provided by analogical models is a hypothesis that will allow for the verification of structural analyses. After presenting our hypotheses, we shall discuss in the last section some of the implications our hypothesis should have on further research on mythology.

### 5.5 The Solution to the Verificationist Objections to Structuralism

The inspiration for our solution came from results of two different and unrelated sets of experiments. The first demonstrates how a source model can be mapped onto a novel (target) problem. The second demonstrates how to confirm a deeper, unconscious model in spite of a shallow, conscious representation. It is against the backdrop of these experimental findings that we shall see how to verify structural analyses.

Mary Gick and Keith Holyoak (1980, 1983) demonstrated how one narrative could be used as source model to solve a problem introduced in a second (target) narrative by the process of *analogical transfer*.<sup>164</sup> This was done by mapping the structural relations from the first narrative onto the structural relations of the second narrative. For example, two narratives were given to subjects; the first (source) was the Attack-Dispersion story, and the second narrative, the Radiation Problem introduced the target problem to be solved. Two versions of the narratives were as follows:

#### *Attack-Dispersion Story*

A small country was controlled by a dictator. The dictator ruled the country from a strong fortress. The fortress was situated in the middle of the country, surrounded by farms and villages. Many roads radiated outward from the fortress like spokes on a wheel. A general arose who raised a large army and vowed to capture the fortress and free the country of the dictator. The general

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<sup>164</sup> For further discussion of this set of experiments and findings see Gineste and Indurkha (1993).

knew that if his entire army could attack the fortress at once it could be captured. The general's troops were gathered at the head of one of the roads leading to the fortress, ready to attack. However, a spy brought the general a disturbing report. The ruthless dictator had planted mines on each of the roads. The mines were set so that small bodies of men could pass over them safely, since the dictator needed to be able to move troops and workers to and from the fortress. However, any large force would detonate the mines. Not only would this blow up the road and render it impassable, but the dictator would then destroy many villages in retaliation. It therefore seemed impossible to mount a full-scale direct attack on the fortress.

The general knew, however, just what to do. He divided his army up into small groups and dispatched each group to the head of a different road. When all was ready he gave the signal, and each group marched down a different road. Each group continued down its road to the fortress, so that the entire army finally arrived at the fortress at the same time. In this way, the general was able to capture the fortress, and thus overthrow the dictator (Gick & Holyoak, 1980, p. 352).

#### *The Radiation Problem*

Suppose you are a doctor faced with a patient who has a malignant tumor in his stomach. It is impossible to operate on the patient, but unless the tumor is destroyed the patient will die. There is a kind of ray that can be used to destroy the tumor. If the rays reach the tumor all at once at a sufficiently high intensity, the tumor will be destroyed. Unfortunately, at this intensity the healthy tissue that the rays pass through on the way to the tumor will also be destroyed. At lower intensities the rays are harmless to healthy tissue, but they will not affect the tumor either. What type of procedure might be used to destroy the tumor with the rays, and at the same time avoid destroying healthy tissue (Gick & Holyoak, 1980, pp. 307-308)?

The subjects, however, were not given these narratives in isolation. Prior to the introduction of the target radiation problem, subjects were given a variety of narratives to read; among them were a number of various "distracting" narratives, and at least one version of the Attack-Dispersion narrative. Then they were asked to solve the Radiation Problem. The results demonstrated that the subjects were able to scan their memory for related problems, and what mattered most in determining what was the most related

problem was not its contents, but rather the structural relation of its contents.<sup>165</sup> It was demonstrated that the manner in which the subjects solved the target problem was by mapping the relational structures from the source domain onto the target problem domain. The importance of this experiment, for our purposes, is that if one can establish the source domain of subjects (or culture), then one can predict and demonstrate how they map the relational structure (model) of the source domain onto a *novel* target domain, as well as the inferences which will follow from this analogical transfer (as in the Gentner and Gentner experiment discussed in § 4.4).

Determining the source domain with which an individual in a culture would work to solve a novel problem, however, is not an easy task. Working with an individual(s) in a culture is not nearly as easy to control as working with a subject in an experimental setting. Moreover, the anthropologist cannot, as in the Glick and Holyoak and Gentner and Gentner experiments, provide the individual with the mental model to solve the novel problem. The anthropologists' task is *to determine what the mental model is* which is at work in the individual in a culture. The difficulties of this task have been well noted. Let us quickly review the pertinent points of our previous discussion on this matter from § 2.2.

Levi-Strauss originally made this point with the distinction between *conscious and unconscious models*. He argued that the anthropologists' task was to reveal the unconscious model which was usually screened and hidden in shallow conscious social

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<sup>165</sup> Levi-Strauss argued at length that relational structure between contents were more important than the contents themselves (1972, pp. 36-37; 1995, pp. 44-45; Levi-Strauss & Eribon, 1991, pp. 141-142).

structures. These conscious models, which Levi-Strauss referred to as “home-made” models, are generally poorly constructed and inaccurate but nevertheless might provide the anthropologist with some insight concerning the structure of social phenomena. Shallow conscious models of this type can suggest to the anthropologist what biases and other types of errors exist in the culture that work in perpetuating the social norms of that culture (Levi-Strauss, 1953, p. 527).

The unconscious models, however, are manifestations of the deep structures of the mind and are not consciously perceived by the individuals in a society. It is by uncovering the unconscious categories of these models that the anthropologist can find the differences and oppositions between the natives’ ideal image of their society and how it is that it actually functions. These are discrepancies that the society tries to hide or to justify by their rituals, myths, and religious representations. It is these unconscious models that lie at the heart of structural analysis (Levi-Strauss, 1983a, p. 80).<sup>166</sup>

The distinction between the conscious and unconscious models of Levi-Strauss was further expounded and refined by Peter Caws’ introduction of *representational and operational models*. A representational model corresponds to the way the subject thinks things are in his environment. The operational model, however, corresponds to the way that a subject practically responds and acts in his environment. These two models often

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<sup>166</sup> For discussions of Levi-Strauss’s notions of conscious and unconscious models, and the problems associated with them, see Hugo Nutini (1965), Peter Caws (1974; 1976), Schneider (1965), Hanson (1976), Cohen (1977), and Rossi (1977; 1982). Also, see our discussion of these problems in § 2.2.

are, though not necessarily, incompatible with one another, as Levi-Strauss discussed. By distinguishing these two types of models, Caws is trying to avoid the psychologically loaded terms “conscious” and “unconscious” although he is willing to admit that labeling the operational model as unconscious and the representational model as conscious is most often an accurate approximation of the actual state of affairs. Even if this is not the case, however, Caws argues that there is no reason why incompatible mental structures may not coexist in the same mind consciously, provided that the two models are not invoked at the same time (Caws, 1974).

Donald Norman (1983) also explored the difficulty in determining a subject’s mental model. He distinguished between the observer’s *conceptual model* and the subject’s actual *mental model*.<sup>167</sup> To determine the subject’s actual mental model, according to Norman, requires experimentation and observation<sup>168</sup> and the consideration of both representational and functional issues. There are three factors in particular that he argues should be considered: the belief system, observability, and predictive power. The mental model reflects the beliefs that the subject has about the system at issue; and these beliefs can be acquired through observation, instruction, or inference. In addition, there must be a correspondence between the accessible aspects of the person’s mental model and the observable aspects of the system. Finally, the subject must be able to run simulations within the model to allow for understanding and prediction of the system’s

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<sup>167</sup> Peter Caws likewise distinguished the observer’s model as the *explanatory model*. It is the explanatory model that the anthropologist uses to explain the representational and operational models present in a culture (Caws, 1974).

behavior. Even with these considerations, however, Norman warns that determining a subject's mental model is no easy task:

Let me warn the nonpsychologists that discovering what a person's mental model is like is not easily accomplished. For example, you cannot simply go up to the person and ask. Verbal protocols taken while the person does a task will be informative, but incomplete. Moreover, they may yield erroneous information, for people may state (and actually believe) that they believe one thing, but act in quite a different manner. All of a person's belief structures are not available by introspection, especially when some of those beliefs may be of a procedural nature. And finally, there are problems with what is called the "demand structure" of the situation. If you ask people why or how they have done something, they are apt to feel compelled to give a reason, even if they did not have one prior to your question. They are apt to tell you what they believe you want to hear (using their mental models of your expectations). Having then generated a reason for you, they may then believe it themselves, even though it was generated on the spot to answer your question. On-line protocols generated while in the act of problem solving and that give descriptions of activities rather than expectations are much more reliable (Norman, 1983, p. 11 n. 2).

The difficulty of determining a subject's mental model is where our second inspiration for the verification of structuralism comes into play. Justin Barrett, Frank Keil and Brant VanOrman (Barrett & Keil, 1996; Barrett & VanOrman, 1996) set up experiments to determine to what extent Christian subjects actually believed and modeled a "theologically correct" doctrinal view of God. The theologically correct view of God depicts God as a being not constrained by time and space, and nonphysical; and when the subjects were explicitly asked to describe God, they abided by this theologically correct view. In order to determine whether or not this was the concept of God that the subjects actually used in everyday life, Barrett and colleagues presented their subjects with a number of theologically neutral narratives about God's

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<sup>168</sup> The importance of these requirements for the anthropologist is also discussed by Maurice Bloch. He further argues that the greatest contribution that anthropology can make to psychology in

interaction with the world and then asked the subjects to paraphrase the narrative. The results of these tasks demonstrated that the subjects did not actually model God in accord with the theologically correct view. Instead, through their paraphrasing of the story, they depicted God with overt human characteristics and limitations: they described the actions of God as if God were physical, moved through space and acted sequentially. In short, contrary to the theologically correct view which is not anthropomorphic, the subjects actually modeled God as anthropomorphic, which is “theologically incorrect.”

The results of this experiment demonstrate how introducing a novel target problem can help establish and verify the source domain with which the subjects work. The introduction of the novel target problem forces the subjects to map their actual (unconscious, operational) model to the target domain. This mapping can be noted by observing the structural relations at play between the source and the target domains. Moreover, the inferences that the subjects draw about the target domain are equally important, for they demonstrate the constraints placed on the target domain from the structural mapping with the source domain. As the experiments discussed above demonstrate, inferences about the target domain are directly influenced by the source domain.

With all of this now having been considered, we are now ready to explicitly state our hypothesis as to how structural analyses can be verified in accord with the objections we stated in § 5.2.

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understanding these issues is participant observation (Bloch, 1991).

*The hypothesis: When presented with a novel target problem that is structurally isomorphic (but not similar in content) to an observed cultural form, informants will solve the target problem using inferences motivated and constrained by a mapping from the cultural form to the target domain.<sup>169</sup>*

From this, we can form the null hypothesis that if the structural analysis does not correspond to the cultural form observed, then either the informants will not be able to solve the novel target problem, or their solution is neither capable of being structurally mapped onto the source domain nor constrained by the source domain.

Moreover, we suggest that the anthropologist should be sensitive—when constructing, analyzing, and verifying his structural analysis—to the human-body metaphor. These analogies may not be explicit, and therefore careful attention must be maintained in order not to miss them. It is our belief that in many cases of cultural forms the closer the structural analysis is to the human-body metaphor the more accurate the analysis will be. This will not always be the case; but since society is often seen and described in terms of the human body, it will often be the case. In such a case, the human-body metaphor will be present not only in the source domain, but also in the solution to the novel target domain.

### 5.6 Implications of the Hypothesis, and Conclusions

We have argued that current and independent research in cognitive science, cognitive anthropology, and philosophy of mind support Levi-Strauss's structural approach to myth. We have also argued, contrary to received wisdom, that

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<sup>169</sup> I am grateful to Professor Charles Nussbaum for his help in formulating this hypothesis in such a

structuralism is a cognitive approach rather than merely an interpretive approach. There are underlying cognitive mechanisms and processes independent of the phenomenon of myth that support structuralist theory. Yet, also in accord with Lawson and McCauley (see § 5.3) we assert that structuralism connects with interpretive approaches, and that structural analysis may foster useful and insightful interpretations. This is part of its explanatory force.

Our hypothesis implies a number of constraints to structural analysis that were not previously recognized. These constraints, however, are motivated according to cognitive concerns rather than interpretive concerns. In addition, many of the cognitive constraints that we have introduced offer new insights as to how a structural analysis should be performed. Most important of these is how the human-body *qua* source domain is mapped onto the environment(s) *qua* target domain in such a manner that meets the constraints of analogical models.

Our hypothesis implies that myths are *pragmatic*. They are a natural and essential mind tool for understanding, problem solving, and predicting events in our environment(s). Because of our emphasis on this characteristic of myth, we are likely to be confronted with the objection that we have neglected an even more important aspect of myth—namely, that myths are *sacred*. Put another way, the objector is likely to claim that we have turned myth into *praxis* and ignored its fundamental characteristic of *poiêsis*. While it is true that we have not raised or addressed the question of *why* myths are sacred, we do not deny that they are.

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concrete manner. Any fault with the hypothesis, however, remains my own.

Provided that the objection is not raised as an “academic smokescreen” (D. C. Dennett, 2006, pp. 258-ff)—that is, as suggesting that myths cannot be understood apart from their sacredness and that the investigator must share those religious sentiments in order to unlock the mysteries which myths contain—we should offer some defense to this charge. Myths, in living religions,<sup>170</sup> are sacred in some sense. The problem is, however, *sacred in what sense?* There is extreme difficulty in developing a concept of the sacred that holds across cultures (Boyer, 2001, p. 57; S. E. Guthrie, 1993, p. 18).

Nevertheless, numerous speculative theories concerning what makes something sacred have been offered. Michael Kearney (1984, pp. 156-157) argues that what makes an object or act sacred is the amount of immanent power inherent in it. Michael Shermer (2002, Chapter 18) suggests that beliefs can attain sacredness due to what he calls the *intellectual attribution bias* (i.e., that our own beliefs are held for rational reasons, while others hold their beliefs based on need and emotion) and the *confirmation bias* (i.e., that we naturally only look for evidence that supports our beliefs). In this way, we have a substantial intellectual stake in our beliefs of which we are proud. Roy Rappaport (1999, Chapter 9) argues that the common characteristic of sacred beliefs is that they are unverifiable and thus cannot be questioned. Daniel Dennett (2006) argues that religious beliefs are sacred not only because they cannot be questioned but also because they have a cost associated with their endorsement. The more likely a person is to be held up to ridicule and persecution for their beliefs, the more sacred that belief becomes. Stewart Guthrie (1993, pp. 202-204) also argues that

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<sup>170</sup> Myths of ancient Egypt, Greece, and Mesopotamia certainly were at one time taken to be sacred

sacredness is unquestionable, but he sees the origins of this in social relationships. To question a social relationship would be at the same time an undermining of that relationship. Social relationships demand loyalty, a type of unquestioning behavior. Sacred things carry with them strong social relationships which require such loyalty. M. D. Faber (2004, Chapter 10) also sees the origins of sacredness in social relationships, but argues that the most sacred are those relationships projected from the parent-child relationship.

Our suggestion, based on our thesis, would be that a continuum of sacredness could be established proportional to the extent individuals in a culture project themselves, *via* the human-body metaphor, into their environments. Though we are not prepared fully to develop and defend this idea here, it is a possible avenue of further research. Our prediction would be that the more a culture is disposed to promote the projection of themselves into their environments, the more things in their environments will be sacred. Moreover, where a strong material/immaterial dualism is accepted, and the essential essence of oneself is seen to be immaterial, we would expect that fewer items in the natural world will be held to be sacred. Again, we mention this only as a suggestion for further research at this point.

Let us return, however, to the pragmatic nature of myth. We have argued that myths serve as a method of understanding and predicting our environments. Myths help to solve problems in a proscriptive normative manner. This idea should not strike us as odd. Anyone who has ever attended a sermon has likely seen myths used in this

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to their adherents. As their religions died out, however, the myths lost their sense of sacredness.

pragmatic fashion. The priest will introduce a problem confronted in daily life, and then invoke a myth which promotes right action or reaction to this problem.<sup>171</sup> This is not a new phenomenon. When the embassy is sent to Achilles in *The Iliad*, they invoke myths to convince Achilles that he should rejoin the fight against the Trojans. Plato believed that myths should be used as pedagogical tools to regulate behavior of citizens (Forsyth, 1980). Jesus used parables and referred back to Biblical events and characters to proscribe right behavior. Myths have proscriptive normative force.

It also might be objected that the contemporary cognitive approach which has developed in anthropology should not be seen as the heir to the older structuralist project. Contemporary cognitivism has superseded that project and taken the investigation of the link between mind and culture in new directions not possible under the theory which Levi-Strauss set forth. Moreover, Levi-Strauss himself never sought support for his theory from the empirical findings of experimental psychology.<sup>172</sup> Therefore, the suggestion that cognitive anthropology should become concerned with structuralism is a step backward for the project rather than a step forward.

We have a few things to say in response to this objection. First, we would remind the objector that during the time period in which Levi-Strauss was developing his structural theory of myth there was little in the way of cognitive psychology to which to appeal. What there was, however, Levi-Strauss and his followers did attempt to appeal to in the context of the theory (for examples see, Levi-Strauss, 1963a, pp. 324-

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<sup>171</sup> This is roughly the idea behind the recent popular slogan “What Would Jesus Do?”

<sup>172</sup> This objection was raised to me by Professor Robert McCauley in personal communication (11 December 2005).

ff; Levi-Strauss, 1972, pp. 268-269; 1981, pp. 627-ff; Levi-Strauss & Eribon, 1991, Chapter 15; Rossi & Contributors, 1982).

Secondly, we have not argued that current research in cognitive anthropology should be motivated by structuralist concerns. On the contrary, we have argued that current research and findings in cognitive science, philosophy of mind, and cognitive anthropology have independently lent support to the structuralist theory. Moreover, we have argued that when this independent current research is taken together, and seen by the lights of structuralist theory, the research and findings take on new significance which was not visible when taken in isolation. Our proposal is that structuralist theory can be informative and suggestive in relation to current research—not that structuralist theory should replace current research.

Finally, our suggestion is that in the case of the cognitive study of myth it may not be the case that cognitive anthropologists need to reinvent the wheel in the sense of recreating an over-arching theory of myth—if they are motivated to do so at all. At present, such an over-arching theory by which to tie the independent research together is lacking. There are several pieces of the puzzle, but as of yet, there is no framework in which to view them together. Our suggestion is that, at least until such time as an alternative theory is presented, structural theory can be such a framework. Again, this is not to suggest that research must have a structuralist motivation. Rather, we suggest that structural theory can provide a framework by which independent research can be viewed. In doing so, it may well be the case that another framework may emerge. At

present, however, as we have seen, structural theory does provide new significance to current research. This is a boon to both the research and to structural theory.

Levi-Strauss's goal of removing chaos from the studies of mythology remains just as important for us today as it did for him in the middle of the last century. We have argued, with minor adaptations, that the structural study of myth can now, as it did then, serve to alleviate some of the chaos. It provides us with a framework by which to view and consider the many avenues of research in the cognitive study of mythical beliefs. This is not because we have superimposed structural theory onto current research. Our study has demonstrated, on the contrary, that the current research offers tremendous support for structural theory. If our arguments have been correct, perhaps we can now ask to what extent structural theory can support current research.

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In the fall of 2006, Hodge is planning to attend The Institute for Cognition and Culture at Queen's University in Belfast, Northern Ireland to attain a Doctorate in Cognitive Anthropology. There, Hodge intends to continue his research into myth, mental models, and the human-body metaphor. After graduation from the Institute, he plans continue his research and teach at the university level.