OTHERING MONTANA'S T.REX AND THE CONSEQUENCES OF MUMPSIMUS

by

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DEDICATION

To my father John Hvereven Smith, and my friend Jack Tracy Reich, two lives cut short.

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TABLE OF CONTENTS

ABSTRACT

The term Othering has its origin in human to human contact; it is based on the perception of differences, creating an in-group and an out-group. Othering can also be projected on to other animals, plants, or the natural environment, living or dead, extant or extinct. To help comprehend the consequences of Othering, Montana's *T. rex*, displayed at the Museum of the Rockies, on the campus of Montana State University, is examined through the lens of the philosopher Hans-Georg Gadamer's philosophical hermeneutics, specifically Gadamer's hermeneutic circle. The hermeneutic circle proposes that: "one cannot understand the whole until one understands the parts, and one cannot understand the parts until one understands the whole" (Wikswo and Porter 3). The literal relationship humans share with the *T. rex* is surveyed through multiple methods including osteology, morphology, taphonomy, and forensics. Time, place and space of the paleo-habitat of the *T. rex* is calculated and compared to the modern equivalent. Concepts of biophilia, attraction to the natural environment, and biophobia, aversion to the natural environment, are examined. Americans historical association with "wilderness and the western regeneration myth is explored. Americans have defined themselves through the naturalization of their nation, while simultaneously objectifying nature as a place to conquer, seeing nature as a resource both physically and metaphorically. By separating themselves from the natural environment a cognitive dissonance, or mumpsimus, becomes engrained. Mumpsimus is an obstinate continuation of an unreasonable behavior. This behavior has created a detrimental relationship with the biosphere and its inhabitants through environmental modifications, the foundation of which is the consumption of fossil fuels. Mumpsimus is examined by investigating cognitive and neurological studies. These studies identify the roots of this behavior and why it continues. Methods for addressing the situation are discussed. These methods can help Americans obtain a deep understanding of their relationship to the biosphere past, present and the future.

CHAPTER ONE

INTODUCTION

Standing 14 feet high, close to 40 feet long and possessing a skull with 40 teeth, each one serrated like a steak knife, *Tyrannosaurus rex* would catch anyone's attention, past or present. The skeleton, on display at the Museum of the Rockies on the campus of Montana State University, in Bozeman, Montana is about 85% complete and is impressive (Derstler and Meyers76). Officially named Montana's *T. rex*, this skeleton was put on exhibit and opened to the public on April 10, 2015.

Why does anyone care about the fossilized bones of a creature that died over 65million years ago? Why does the skeleton possess a cultural and monetary value, significant enough to have had armed guards posted during its excavation? Would there be a similar response if it had been a small reptile or an invertebrate, some snail of an unknown name?

Bones, fossilized or not, pique the interest of human beings. If the bones are from a relative, they have a personal connection, an emotional relationship to an individual that has passed. Whether the remains are human or from another animal, the bones create a platform for contemplation of many subjects, including our own mortality. Bones can also be kept as a trophy, a reminder of a life taken either to protect or feed relatives. This imposing skeleton of the Tyrant Lizard king is not a trophy, however, at least not from a band of *Homo sapiens'* returning from a hunting expedition. Nor is it a reminder of a confrontation that ended after a band of warriors protected their village.

Interest in bones and fossilized bones in particular varies from one observer to another, but it is unlikely that this skeleton was put on display for an increasingly important reason: to help us to recognize the relationship we physically share with the biosphere and the ancestry we literally share with a *T. rex* and all life on Earth.

The fossilized bones of this *T. rex* can tell us many things about Montana's *T. rex*. In addition, examining these bones can also reveal many things about ourselves. This study focuses on two characters: Montana's *T. rex* and us, as Americans. *Tyrannosaurs rex* born and lived in what is now America, this sleeping giant, an individual standing alone, it carved its way through nature, powerful and like no other, exceptional; *T. rex*, is a symbol of a myth of America. This is the myth of the American individual who needs no one's help, the frontiersman, the self-made "man". This is a myth of America I explore. This thesis looks at the methods used to create this myth, the persona of American individualism.

We can look to the past to find evidence of the origins of life, helping us to understand our shared relationship with the past, present, and future members of our biosphere. We can look to the future by exploring the past to help predict biological or geologically induced changes to our shared environment. And we can look at the present in this same way, revealing how our actions, specifically the effects of industrial society's carbon output and our agricultural practices, have consequences.

Our activities are affecting the biosphere. Countless studies have been published on the impact humans are having on the environment. We are aware that there are consequences to our actions and it is increasingly clear that we must alter our behavior.

But studies have shown that more education about fossil fuel use and the corollaries to the environmental crisis of global climate change will not help bring this about (Kahan et al. 732). So how can this cognitive dissonance or mumpsimus, defined as an obstinate continuation of a behavior that has been shown to be erroneous, be addressed?

In this thesis I explore ways of knowing that can help facilitate the necessary changes to our behavior. I examine the roots of our mumpsimus through cognitive studies and explore additional fields of study in order to provide an avenue to understand the following: First, that everything in the biosphere is related, if not literally then through the "web of life". Second, our activity is affecting the biosphere. And third, and critical, that we are not separate from the biosphere.

The territory I use to explore the different ways of seeing and understanding is the skeleton of Montana's *T. rex.* The map that guides and helps navigate the investigation is the philosopher Hans-Georg Gadamer's philosophical hermeneutics, specifically Gadamer's hermeneutic circle, which proposes that: "one cannot understand the whole until one understands the parts, and one cannot understand the parts until one understands the whole" (qtd. in Wikswo and Porter 3). This circle requires an inquiry through a dialog of continual questioning of what we understand about the subject that is being observed. Of equal importance, it requires an inquiry into ones understanding of our own perceptions and prejudices. Gadamer recognized that becoming familiar with the unfamiliar was influenced by what he called a prejudice and that interpretation cannot be done without prejudices. He was saying that when we interpret, we are all bound to our prejudicial understanding. And in the end, interpreting and understanding is essentially

the same thing (Mackenzie 45). The understanding that we bring to interpreting something unfamiliar was formed from our past experiences, creating both productive and unproductive prejudices. The purpose of employing the hermeneutic circle of self-examination is to become aware of our prejudices and to keep from being swayed by the un-productive, emotional, and subjective prejudices.

The core of this thesis posits that Othering (us vs. them) is one of the prejudices that keep us from achieving a deep understanding of our relationship with the biosphere. Because of perceived differences, we experience Othering when we create in-groups, others who share similar perceived qualities and out-groups, others who do not share similar perceived qualities. (Staszak 43). Just as germane to this thesis, we Other more than our fellow human beings, we also Other non-human species and we Other the environment, man-made or natural. Man-made environments, for the purposes of this study, include areas or places altered by mankind, e.g., villages, towns and cities. Natural environments constitute places or spaces on which humans have had less impact, e.g., ecosystems outside of man-made environments. These places will be referred to as Nature and, or the biosphere.

We are part of Nature, including the biosphere, and therefore are a natural part of it; what we do and create should also be considered natural. But for the purposes of this study, a distinction between man-made and natural is made for ease of discussion. For the same reason, even though we are animals, this study will make the distinction between humans and other animals; human animals and non-human animals will be simply referred to as humans (us) and animals. This study will show that defining differences

through Othering is based on perception, creating varying degrees and levels of boundaries, which form subjectively, based groups. These boundaries are porous and malleable and can be changed when it is perceived to be beneficial.

I contend, in this thesis, that the more we learn about and become familiar with the Other, through the lens of the hermeneutic circle, the more we are able to break through the perceived borders. The intent of this investigation is to help us recognize our predisposition to Othering and to come to a deeper understanding of our relationship to the biosphere that we share with past, present, and future organisms. The perceived values that create Othering and the consequences associated with Othering offer many layers to uncover. It is a complicated story. Information from many disciplines and sources will be presented in this convoluted exploration of relationships.

For this thesis, the different ways of exploring Othering were selected based on my initial inquiry into why we Other and where Othering originates. Is Othering a learned behavior or is it genetic or a combination of the two? There are many ways of investigating Othering and I chose the methods for this thesis based on how well they answered this initial inquiry. I distilled the parameters of Othering to the following: A concept of self (subject) which leads to the recognition of a non-self (object). This distinction requires a physical distance between self and the entity being observed and it also requires time, which allows the observed to be described (quantified) and defined (qualified). How is self described and defined? Just as with Othering, there are also many ways of investigating the concept of self. For this study I chose to describe and define

self in a biological sense, since this is what this study recognizes, we, humans are just one of many animals living, biological beings, in a shared biosphere.

The first question for the hermeneutic circle is: How do we know that we know something? "Knowing" can be broken down into knowns and unknowns, the different combinations of which can shed light on the differences between belief and knowledge. I then ask what are the consequences of these combinations of knowns and unknowns? Then I explore why it is important that we have an understanding of these combinations. The awareness of our prejudices within knowing and Othering is the foundation for recognizing our prejudices when we go on to use the hermeneutic circle for interpreting and understanding Montana's *T. rex* and ourselves.

Once this foundation of knowing and Othering is understood, I explore this place we call Earth, this planet the *T. rex* skeleton shares with us today including our perceptions of its world and how that understanding can help us perceive our world today. Because I believe that before we can have a deeper understanding of Montana's *T. rex*, we need to have a contextual appreciation of the vast age and geological episodes of this place we call home. Place and space is examined in order to better understand time through the concept of distance. Interpreting the Earth through this hermeneutic approach will help the observer go beyond a simple emotional observation that is based on prejudices of the familiar and known, of our everyday experiences. It will help cut through the subjective and pleasurable distractions one experiences of the world around helping us to achieve a deeper understanding of the natural world.

Americans have a history of defining what it is to be an American through their relationship with Nature. Eric Kaufmann, a professor of politics, identifies two ways a nation relates to its natural landscape. Depending on the history and interpretation of its wilderness, nature is nationalized or the nation is naturalized. Nature is nationalized when there are attempts made "to generate a sense of homeland and sacred territory among the members of a population" (Kaufmann 667). This is accomplished by connecting landscape with communities and their historical relationship; placing the national culture onto a particular place, celebrating the societies '*settled'* lands; this is in contrast to 'naturalizing a nation' which praises the "uncivilized, primeval quality of untamed nature and stressing its regenerative effect upon civilization" (Kaufmann 667).

Americans have defined themselves through the naturalization of their nation, while simultaneously objectifying nature as a place to conquer, seeing nature as a resource both physically and metaphorically. Americans have projected an interpretation of nature as a garden a place of innocence, as Leo Marx referenced in *The Machine in the Garden*, '"[the]'pastoral ideal' – the sentimental belief that man can live in a 'middle landscape' situated between nature's primitivism and civilization's authority" (qtd. in Bryant 64). Or when labeling nature as a wilderness, a savage space, as Henry Nash Smith recognized in the *Virgin Land*. Nature observed in both these ways is actually separate and removed, far from being a subject. Nature is interpreted as a symbol to validate a particular narrative, it is actually seen as an object to consume. We create reserves and parks, setting aside public land, giving each a name. These are places where we are urged to "commune" with nature but it could be argued that "consume" would be

a better term; the resources of these places are to be metaphorically ingested. We are encouraged to "take in" the surrounding views, sights and smells. We give nature and the biosphere names like Gaia and Mother Nature, both entities that are expected to provide. Today Americans are caught between the naturalization of our nation and nature becoming nationalized. We praise the uncivilized in places like Yellowstone National Park, while observing it from the inside of our cars. And after 2001, the phrase "Homeland" has become increasingly familiar, stirring feelings of our natural land as "Nation". But there is still a remnant of the romantic myth of regeneration through wilderness and it is still alive, just more "civilized". We can still move "out west" and carve out a place in the woods or prairie, one to twenty acres at a time, advertised as ranchettes or places to escape. Gone are the days that Frederick Jackson Turner wrote about when the American wilderness stripped:

> off the garments of civilization and arrays him [the American] in the hunting shirt and moccasins. It puts him in the log cabin of the Cherokee and Iroquois….In short, at the frontier the environment is at first too strong for the man…the outcome is not the old Europe, not simply the development of Germanic germs….The fact is, that here is a new product that is America (qtd. in Kaufmann 676).

This is not to say there are no longer working ranches and farms in the west. Those were established generations ago still in the "family" or taken over by neighbors or corporate entities. There is little room for nostalgia for the myth of regeneration for those families trying to hold on in the increasingly competitive world of agriculture. But for those outside that business model, a ranchette, a gated mountain community, or the mountain man reenactment rendezvouses gives the illusion of a relationship with nature.

I contend that these nature/nation relationships are experienced as subject to object encounters. According to the philosopher Martin Buber there can be two types of communication in a relationship, I-thou (subject to subject) and I-it (subject to object). An I-thou relationship "is one in which an individual is appreciated in all his/her uniqueness and is not objectified". An I-it relationship is one in which "a person uses and experiences the other person as an object for his/her profit or self –interest" (Roy and Starosta 10). But doesn't all life have a relationship within Nature as an I-it, in the sense that a rabbit is a resource for a coyote? I would argue the coyote and the rabbit are experiencing an I-thou relationship. Meaning the coyote is experiencing or appreciating the rabbit in all its uniqueness and it is not objectified, it just tastes "good" (I-thou). We cannot know what it is "like" to be either the coyote or the rabbit but can observe that they are experiencing their environment and relationship within their world, in their "natural state". When we observe the coyote-rabbit relationship we are not, except in very rare circumstance, focused on waiting for the coyote to finish up, hoping for the left overs, in the same way a raven may be. We are not of their world; we are observing from outside their world and our experience is an objectification of the scene for our own emotional self –interest (I-it). Can we ever truly experience Nature as an I-thou?

Buber believed it is possible and he addressed how using a tree as an example, explained well in the quote below.

> I consider a Tree. I can look on it as a picture….perceive it as movement…..classify it in a species and study it as a type....subdue its actual presence….dissipate it and perpetuate it in number, in pure numerical relation.
> In all this the tree remains my object, occupies space and time, and has its nature and constitution.

> It can, however, also come about, if I….become bound up in relation to it. The tree is now no longer *It*. I have been seized by the power of exclusiveness.
> To effect this it is not necessary for me to give up any of the ways in which I consider the tree……Rather [it] is everything, picture and movement, species and type, law and number, indivisibly united in this event.
> Everything belonging to the tree is in this: its form and structure, its colours and chemical composition, its intercourse with the elements and with the stars, are all present in a single whole.
> The tree is no impression, no play of my imagination, no value depending on my mood; but it is bodied over against me, as I with it- only in a different way.
> Let no attempt be made to sap the strength from meaning of the relation: relation is mutual…..I encounter no soul or dryad of the tree, but the tree itself (7-8).

To help achieve Buber's subject to subject relationship in our encounters with the observed, in this thesis I employ Gadamer's hermeneutic circle which requires a continues dialog and questioning with the observed as well as a dialog with the self to continually check prejudices.

As an initial attempt, the examination of the bones of the *T. rex* skeleton on exhibit are viewed through Gadamer's hermeneutics. Ivan Karp, a museum theorist, points out that museums, through exhibition, create and define the Other in order to justify the "self" (qtd. in Marstine 14). Othering can reduce the observed to mere objects supporting racial, social, or other categories of biases. Studying the displayed bones of Montana's *T. rex* through hermeneutics will help break down the borders Othering creates. These bones were once a living, dynamic physical structure making up a skeleton that traversed the Cretaceous landscape of what is now referred to as Montana. Its bones supported and protected the soft tissues of this *T. rex*, creating the sustaining blood cells, and adapting to the daily stresses Montana's *T. rex* encountered. *T. rex*'s bones offer

clues about its behavior as well as its anatomy and this data can be used to reconstruct the soft tissues, the muscles and tendons, giving the scientist and artist the ability to create a life restoration. This fleshed-out model enables an observer a glimpse, an interpretation, of what this creature looked like 65 million years ago. These bones will reveal much about this creature's life and times. We will look at how bones are created and modified throughout life utilizing the discipline of osteology. The functional morphology of the skeleton will be explored by examining the shapes and proportional relationships of bones and what they reveal about the *T. rex*'s behavior. The methods of forensic science, specifically 3D facial reconstructions will also be explored to see what this field of Anthropology can help us understand about the soft tissues that once surrounded this skeleton.

The details of these bones will reaffirm that this skeleton is a unique individual *T. rex* , that millions of years ago, walked and ran through what are now neighborhoods, farms, and ranches in Montana. This *T. rex* could not be another *T. rex* put on display, it is as different from any other *T. rex* as we are from any other human being. This uniqueness, however, is not to be confused with being special or exceptional; Montana's *T. rex* is "just" another animal, one of many representatives of the nodes on a cladogram that it shares with this place we call Earth, with uncountable other life forms throughout time. But it is physically or biologically unique, a statistical improbability. Each zygote over millennia had to have come to full term in order for "it" to exist as who "it" is; as a unique genetic or DNA "fingerprint" just as each human is today. This *T. rex* along with its shared biota experienced and interacted every minute of its life with its environment,

just as a coyote and rabbit do today. Its genetic uniqueness, reminds us of our own individual genetic uniqueness, a bond which can help us change our perception of the creature and our relationship to the environment from an object to subject.

The sediment that buried the bones can also help us understand the environment that the *T. rex* experienced. Other aspects of the surrounding formations above and below the *T. rex*'s grave, paint a picture of a very turbulent time. By understanding the Late Cretaceous environment we can be reminded that nature is not just a resource. It is a dynamic interrelated and changing system. It can be affected by the geological forces of the Earth itself as well as unanticipated events from the heavens; in the case of the Cretaceous biota the "unanticipated" event was an asteroid. But nature can also be affected by the lifeforms within the biosphere itself. As a Petri dish can be overrun by the exponential growth of bacteria, the Earth is also finite and contains a finite amount of "resources" that can be consumed. Earth, too, has limits.

In the final chapter I examine further the history of how Americans have created a connection between Nature and National identity, specifically American exceptionalism. I explore the physical limits of both our environment and the energy we consume in our current subject-object relationship. This is in contrast to Montana's *T. rex* and its fellow biota, where we have, at least theoretically, an ability to challenge the behavior that is influencing our environment. The biota in the Late Cretaceous simply lived as they did within the parameters of their environment, until they no longer could.

This *T. rex* has a history, it was and still is an individual that shared and consumed in a dynamic environment. America also has a history, the United States may be an

individual nation but there is nothing singular about it, no matter how many times a common defining character has been attempted. How do we uncover who this *T.rex* is and how will this help us discover America? First we will look at what we know or more precisely we will break down the different combinations of knowing.

CHAPTER TWO

KNOWNS AND UNKNOWNS

What do we know about Montana's *T. rex*? There are the familiar (known) physical attributes: length, height, width, and different shaped bones: skull bones, leg bones and vertebrae. However, there is more to know than what is gained from this initial observation. There is also the unfamiliar (unknown) information that can be discovered by examining the bones, exploring both the surface and beneath. The interpretation of all this information about these bones will draw on different systems of knowledge and ways of knowing. But how do we differentiate these ways of knowing? When the observer stands in front of the *T. rex* what are the ways in which this animal can be interpreted?

To investigate what we know, ways of knowing, or what we believe we know, the German philosopher Hans-Georg Gadamer's philosophical hermeneutics, the art and discipline of interpretation, is employed. This approach to interpreting will be used to observe Montana's *T. rex*, assisting the observer in moving past an initial emotional assessment of the obvious physical attributes of the skeleton. This will enable the observer to go beyond simply viewing the *T. rex* skeleton and actually becoming a participant creating a dialog with it. This is not the kind of linguistic dialog humans have with each other. The *T. rex* and its environment cannot "speak" in the way humans do. But by utilizing hermeneutics, the bones can "speak" for the *T. rex* and the information contained in the sediment surrounding the bones can speak for its ancient environment. This kind of dialog is an aspect of Gadamer's hermeneutics, specifically the hermeneutic circle, which asserts: "one cannot understand the whole until one understands the parts,

and one cannot understand the parts until one understands the whole" (Wikswo & Porter 3). This hermeneutic circle requires an inquiry, a dialog of continual questioning into what we understand about the subject that is being observed and foremost, also an inquiry into our own understanding of how we observe. This participation through dialog will ultimately reveal our deep relationship with Montana's T. rex and our shared relationship with the biosphere, past, present and future.

Gadamer was interested in exploring the character of human understanding and the way in which it is gained through interpretation. He used the term *interpretation* in a phenomenological sense, the "reflective study of meaning as it is experienced by the first person singular" (Meszaros 241). He realized that becoming familiar with the unfamiliar was influenced by what he called prejudice and that interpretation cannot be done without prejudice. He was not trying to defend the prejudices that are

> irresponsible, idiosyncratic, parochial or otherwise self-willed understanding in the human sciences, but to argue that all human cognition is 'finite' and 'limited' in the sense that it always involves…implicit judgments concerns, or commitments which shape definitively our grasp of the subject matter in ways we can not anticipate or control (Wachterhauser 231).

Gadamer was saying that when we interpret, we are all bound to our understanding. And in the end interpreting and understanding is essentially the same thing (Mackenzie 45). This understanding was formed from our past, which created the prejudices. He was critical of those who sought to eliminate all prejudices, including philosophers from the Enlightenment. He believed they were being prejudiced against prejudice:

> The overcoming of all prejudices, will itself prove to be a prejudice, and removing it opens the way to an appropriate understanding of the finitude

> which dominates not only our humanity but also our historical consciousness (Gadamer 288).

As objects are observed and interpreted, the observer will inherently bring prejudices to this interpretation of both the unfamiliar and the familiar. Gadamer was interested in how these prejudices are formed and how they become authoritative traditions. He "is asking how it is possible to change the authoritative traditions of meaning-making and how we can distinguish between those authorities that are useful and those that are restrictive" (Meszaros 243). According to Gadamer's philosophical hermeneutics authority can be thought of as knowledge or the acknowledgment of knowledge. Without reflecting on one's own knowledge or prejudices, they will remain authoritative practices, becoming second nature and manifesting as the routine way of interpreting. But "[as] our prejudices become apparent to us, they can also become the focus of questioning" (Meszaros 244-245).

By examining Montana's *T. rex* through the hermeneutic circle, the observer's prejudices are challenged. It reveals a new way of interpreting: the meaning-making space between the familiar (known) and the unfamiliar (unknown) which is where interpretation resides.

With its foundation in aesthetics, philosophical hermeneutics was used to look at the experience of art: concerts, (art) museums, festival, and text (Davey). This way of observing is also well suited for interpreting exhibits in a natural history museum, specifically the mounted skeleton of Montana's *T. rex*.

Gadamer's hermeneutics helps cut through the subjective pleasurable distractions one experiences from viewing an object. The goal is to deepen the experience without

being trapped by the subjective emotional response to the aesthetic that can arise from observing an object. This process is a vehicle to help move beyond the enjoyable distractions of aesthetic appreciation and reveal to the observer hidden or previously unknown linguistic and cultural realities (Davey).

To reach a deeper knowledge of the observed, the hermeneutic circle invites the development of an I-thou relationship. In order to form a true dialogic and authentic relationship the observed must be removed from an I-it relationship and moved to an I-thou relationship. In other words, the observed, a text in the following quotation, is no longer an object but is interpreted as a subject:

> [Beyond text all] genuine human dialogue, according to Gadamer, involves not simply understanding what the other is saying and how the other feels, but coming to grips with one another. For Gadamer, this shared understanding means transcending to a higher universality that overcomes not only one's own particularity, but that of the other as well. Thus language completes this 'fusion of horizons' between rhetor and the audience where both are conjointly transformed into different beings" (Roy and Starosta 10).

The inquiry does not stop once an I-thou relationship is established. It calls for a dialog of a continuation of questioning, inquiring about the whole as well as the parts of the observed. Again, Gadamer said "one cannot understand the whole until one understands the parts, and one cannot understand the parts until one understands the whole" (Wikswo and Porter 3).

But in order to understand Montana's *T. rex* as a whole, the observer must have some prior understanding of the parts, including an examination of the prejudices that are brought to the process. To help examine these parts it is helpful to first employ epistemology, or the study of knowledge.

How do we differentiate ways of knowing? There are many ways to investigate knowledge. To aid an examination of our prejudices and to help distinguish between which prejudices are productive and those which impede our understanding, investigating the combinations of knowns and unknowns can help strip away the unproductive prejudices that create the suppositions surrounding what we observe.

This approach to observing is aided by uncovering personal conceptual layers of knowing (knowns and unknowns): what we know, what we don't know, what we think we know and don't, and what we don't know we don't know. This conceptual knowledge about knowns and unknowns is in contrast to specific fields of knowledge, such as geology and biology. Specific fields of knowledge will be used in later chapters to reveal relevant facts about the skeleton.

To help clarify the different combinations of knowns and unknowns, an often misunderstood response to a question asked of former U.S. Defense Secretary Donald Rumsfeld is helpful. The quote concerns what he knew regarding the U.S. invasion of Iraq:

> ….as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we don't know. But there are also unknown unknowns- the ones we don't know we don't know. (DoD 7).

This quote earned Rumsfeld the undeserved Golden Bull Awards' Foot-In-Mouth honor from the Plain English Campaign (Steyn 1). An article in the British newspaper *The Telegraph*, in support of Rumsfeld, clarifies his confounding statement:

> …John Wayne is holed up in an old prospector's shack. He peeks over the sill and drawls: "It's quiet out there. Too quiet". What he means is that he knows the things he doesn't know. He doesn't know the precise location

> of the bad guys, but he knows they're out there somewhere, inching through the dust, perhaps trying to get to the large cactus from behind which they can get a clean shot at him. Thus he knows what to be on the lookout for: he is living in a world of known unknowns. But suppose, while he was scanning the horizon for a black hat or a glint of a revolver, a passenger jet suddenly ploughed into the shack and vaporized both him and it. That would be one of Rumsfeld's unknown unknowns: something poor John Wayne didn't know until it hit him (Steyn 1).

The above quote makes clear the differences between the combinations of knowns and unknowns and Rumsfeld talked about known knowns, known unknowns, and unknown unknowns but did not bring up unknown knowns. Slovenian philosopher Slavoj Zizek describes unknown knowns as "the disavowed beliefs, suppositions and obscene practices we pretend not to know about, even though they form the background of our public values" (1-4). This definition posits that individuals may know something but pretend they don't. That is one way of looking at an unknown known, but cognitive studies can help interpret an unknown known in another way. An unknown known can be something individuals don't know but believe they do know; there is no pretense involved. They truly believe they understand the particular situation or concept when, in fact, they are actually clueless. This unknown known is referred to as incompetence in this study. For someone to know they know something (known known) or to know there is something unknown (known unknown) requires a degree of competence (conceptual proficiency). In the case of an unknown known, individuals may think they are competent but are actually incompetent; as Charles Darwin noted "ignorance more frequently begets confidence than does knowledge" (Kruger and Dunning 1121).

Unknown knowns can have consequences when interpreting a skeleton of an extinct creature like Montana's *T. rex*. As an example, past exhibits of *T. rex* were

mounted with their tail dragging on the ground, standing like a kangaroo, even though early observations of the skeletal elements were recognized to be “bird like”. To address any assumptions, we can incorporate the hermeneutic circle, which questions our prejudices based on previous beliefs. Observing in this way can help us go beyond just interpreting this *T. rex* and help avoid the consequences of unknown knowns as the following example reveals: Two Pittsburg banks were robbed in broad daylight in 1995. The assailant looked straight into the video camera and proceeded to acquire his ill-gotten gains. He was apprehended shortly after, mumbling something about “But I wore the juice” (1121). He was under the belief that by rubbing his face with lemon juice it would render him invisible, apparently because lemon juice can be used as “invisible” ink. He was confident that the video cameras were useless against his recently acquired power. The results of a study based on this incident are referred to as the Dunning Kruger effect. The study revealed that an individual requires some level of competence before they can realize they are incompetent. Mr. Wheeler, the bank robber, was not competent; he experienced the consequences of an unknown known (1121). Knowing, or coming to the realization that we don’t know something and acknowledging that we are incompetent, is crucial for creating an opening that allows something new to be learned. The questioning of one’s own incompetence, from this study’s perspective, should be practiced often. To think you are competent in all things is a sure sign that you aren’t.

When humans are assessing their competence, examining their combinations of knowns and unknowns, cognitive biases should also be considered, specifically for this thesis, confirmation bias. Confirmation bias is the human predisposition to look for and

interpret evidence in such a way that it reinforces existing beliefs. The likelihood of eliminating all biases is next to impossible but what is helpful is to recognize that biases exist and watch for them (Nickerson 175).

The neurocultural hypothesis of Dr. Bruce Wexler can help make sense of the seemingly self-destructive behavior described by the Denning Kruger effect as a confirmation bias. Wexler posits that when the brain process information:

> [f]irst, since these internal structures select and value sensory input that is consistent with them, they create an exaggerated sense of agreement between the internal and external worlds. Second, since internal structures shape perceptual experience to be consistent with the structures themselves, they limit further alteration of brain structure by environmental input (Wexler 154).

As a result of this self-reinforcement of preconceived beliefs, humans prefer the familiar, creating a consonance between the inner and outer world [harmony]. And humans avoid the unfamiliar, avoiding dissonance; they prefer the pleasure of harmony over discord (155, 159).

Until young adulthood the brain remains plastic and the internal environment is "programed" by the external environment. As the brain decreases in plasticity with age, the internal environment becomes "fixed". After the brain has been "programmed" by the external environment, during the remaining years of life the individual tries to fit the changing external environment to fit the internal "programming". Wexler also points out, humans are capable, to a greater degree than any other animals, of modifying their external environment. These "human alterations in the shared social environment include physical structure, laws and other codes of behavior, food and clothes, spoken and written language, and music and other arts" (3). These changes to the external environment in

turn affect the development of the brain. These adaptive changes to the external environment have evolved to the point that some children in Euro-American societies are being raised, to a large part, in human-created environments, affecting the development of both this generation and future generations (3).

After the internal environment has been created and the plasticity of the brain has decreased an incongruity may occur when the external environment changes either by man-made or natural means. When this incongruity is experienced the individual or society attempts to alter the external environment. If this new environment cannot be altered enough to create harmony, the individual or group will often ignore, discredit, forget, or re-interpret the new information. Examples of situations in which this occurs include the contact zone of cultures, borders, immigration, inter-generational, and the death of a loved one (160).

All the above aspects of processing conceptual knowledge, in this chapter, were presented as a way to employ the hermeneutic circle to one's own interpretations, beliefs and prejudices when observing the Other in this case Montana's *T. rex*. When we view Montana's *T. rex* as an object/I-it, we create the Other, keeping us from developing a deeper understanding we continuing to observe it as a member of an out-group. This I-it relationship reinforces the prejudices that ignores, discredits, or forgets new information about the Other. The next chapter examines the "parts" of how we Other and offers ways to understand why we Other.

CHAPTER THREE

MONTANA'S T. REX: OTHERING IN PLACE AND TIME

Each person standing in front of Montana's *T. rex* will bring their own prejudices, knowns, and unknowns to the exhibit. Each has personal perceptions and inquiries. It's certain, however that when an observer walks into the exhibit hall, the interpretation of Montana's *T. rex* will not be the size of the skeleton and the imposing battery of teeth. Although the above information, the description of the object, is recognized and contributes to the final interpretation of the skeleton, the understanding of this creature, standing in silence, is not "us". The observer can look left and right and see "us", the fellow visitors in the room, and this *T. rex* is definitely not us; it is in a different category. It is the Other.

The concept of Othering is most familiar when describing human to human interaction, creating us and them, an in-group and an out-group. In the *International Encyclopedia of Human Geography* Jean-Francois Staaszak states:

> Otherness is due less to the difference of the Other than to the point of view and the discourse of the person who perceives the Other as such. Opposing Us, the Self, and Them, the Other, is to choose a criterion that allows humanity to be divided into two groups: one that embodies the norm and whose identity is valued and another that is defined by its faults, devalued, and susceptible to discrimination (43).

Othering is contextual. It requires distance, a literal space between us, the self, and them, the Other. It also requires time, an interval for the evaluation and determination of the Other. Othering is a perception that someone, the out-group, is distinct and different from self, or the in-group.

According to Dr. Paul Bloom, a professor of psychology at Yale University, Othering does not originate as a learned behavior but it can certainly be reinforced through peer pressure. It starts immediately after birth. A newborn will exhibit a preference for its mother or primary caregiver, vs. anyone else. The infant interprets a difference between individuals through its visual, auditory, and olfactory senses. If a baby is raised only by the mother, the infant will have a preference for women. If an infant is raised only by the father, the infant will show a preference for men. This partiality also appears if an infant is raised by a single ethnic or racial group; the baby will exhibit a preference for that group. In other words, the baby recognizes the parent's physical traits of pigmentation, facial proportions, and hair. Babies simply prefer what they are used to seeing. But if the infant is raised with parents and extended family that is racially or ethnically diverse, the baby will not exhibit any preferences for a particular physical trait (Bloom, *Just Babies* 103-106).

Humans make sense of the world by creating categories of self and not self, us and them. This behavior, as noted above, is observed immediately after birth. But it could also be argued that Othering starts before birth, revealing a genetic or at least an epigenetic component to Othering. Studies have shown that a baby recognizes the language it was hearing before it is born. After delivery the baby shows a preference to individuals who speak this same language but will show an aversion to someone with an accent. Additional studies have shown this linguistic preference continues throughout childhood and contributes to determining early friendships (111-113). So, even if a baby

is raised in a racially diverse environment, void of any racial preference, there is still the potential for a linguistic prejudice.

This suggests there is a predisposition for Othering. Othering starts at birth, if not in the womb. New categories of Others may then continue to be created, depending on the external environment, at least into young adulthood. This assessment is based on the neurocultural hypothesis by Dr. Wexler. Prejudices acquired up until young adulthood are created or "programmed" by the external environment and after young adulthood, because of the decrease in brain plasticity, they will be very difficult to modify (Wexler 160).

Human to human in-groups are formed by spheres of influence starting with the immediate family, continuing with extended family, community, on to citizenship of State and Country. The in-group can be a particular city vs. a neighboring city. But this in-group / out-group border can change when those cities are interpreted as being part of the in-group of a State. State vs. State boundaries of Othering can also be removed if the Country, the States belongs to, is interpreted as the in-group. These borders can become plastic when deemed beneficial. In addition, people can be recognized as members in multiple in-groups. This is why people can belong to the in-group of United States as citizens but still be defined as an out-groups by some citizens, manifesting as cultural and racial conflicts. But these prejudices can be overcome, in some cases temporarily, if there is a mutual benefit to the different groups. This reinterpretation of the Other can take place when an out-group, for example another country, is determined to be the enemy of the in-group's country. This can become a rallying point for the defense of the nation,

where “we” all come together to battle the “evil doers” (Perez-Rivas)As another example, after a natural disaster a community can move beyond old borders of Othering to support fellow citizens, regardless of race or ethnicity.

Community-based Othering is directed towards the individuals within the borders of a geographical locality as well as the geography itself. But if a geographical location is perceived as shared by more than one community, this “neutral” territory is not Othered by either community, an example of which is the shared borders of National Parks and other public lands.

Human in- and out-grouping is not the only form of Othering. Othering also occurs when humans interact with the natural environment, including our own personal environment, the multitude of microbes living in and on our bodies. Immunology or immune theory is a field of study that investigates this relationship. At its foundation is the concept of the biological self and non-self. Tellingly, the terminology used in immunology is the same that is used during human to human Othering, specifically in warfare: attack, defense, battle, and combat (Tauber).

To gain a greater understanding of these microbes, the Human Microbiome Project is looking at the incredible diversity, and mapping the DNA, of these microbes (Turnbaugh et al. 804). This investigation has found that humans host 10 times more microbes than there are cells in the human body. From the human participants in this study scientists have discovered somewhere between 500 to 1000 species of bacteria in the human mouth alone. At any given time, there are around 100 to 200 species in a person’s mouth and each tooth, gum, and tongue have different “ecosystems” containing

different combinations of these bacteria; these combinations differ from the inside to the outside of each tooth. There are 2,000 microbes on every square centimeter in our lungs and within those microbes, 128 different species of bacteria have been identified (Turnbaugh et al.804; Zimmer 1).

With this information, how do we separate the biological-self from the non-self? The non-self microbes would need to be broken down into in-groups, those who benefit the self, and the out-group, those who would be considered pathogens. Are the non-self in-group microbes essential for our life to continue? If so, how are these microbes defined as separate from us? Is a border defined by function? Or is it DNA? It can't be DNA alone. We have mitochondria inside our cells and this mitochondria have their own DNA, separate from our DNA. Are mitochondria to be considered a non-self in-group or are they defined as self, because they exist inside our cellular structure? Using the hermeneutic circle, maybe an argument can be made for the mitochondria, the "parts", to be a non-self in-group, but from the "whole" perspective the borders are difficult to define. In a recent paper, the following authors bring in the hermeneutic circle in order to understand a similar observation in biology and medicine:

> In many ways, the identification of whole versus parts reduces to the need to define boundaries, which in living organisms are often neither well defined nor amenable to explanation by a quantitative theory, and support high fluxes and multiple interactions (in the human, for example, there is the microbiome bounded by the lumen of the gastrointestinal tract, and different microbiomes on external surfaces). Of interest to biology are the boundaries within an organism, and boundaries within those boundaries. Whereas in physics, systems boundaries may be defined for computational convenience and to minimize the complexity of the problem, in biology they are defined in terms of biological function… (Wikswo and Porter 3).

Some may find these Others, our anatomical microcosm, fascinating and create an in-group with them, while others maybe repulsed and delegate the microbes to an out-group. This same emotional response of Othering occurs beyond the human anatomical landscape and can also be experienced when humans make contact with the external natural environment. This category of Othering, for this thesis, is defined as biophilia and biophobia. Biophilia is an attraction to nature which creates an in-group, and biophobia is a repulsion or discomfort with nature, creating an out-group (Orr 186-187).

Biophobia can be used to describe the rejection, by some, when they deny that humans are animals. We remove ourselves from the natural environment, forgetting about or believing we can leave behind our shared relationship with the biota. We can even become uncomfortable with our own bodies. But every day our bodies give us a gentle and sometimes not so gentle reminder of what we are.

> Humans are animals that perspire and perspiration has its odor. We secrete from the eyes, ears, lungs, bronchial tubes, skin, sinuses, nose, sexual organs, and colon. We salivate, masticate, expectorate, regurgitate, urinate, defecate, masturbate, fornicate, exudate, suppurate, lacrimate, fight, kill, sleep, hemorrhage, die, and decay. Yet we reject our animal kinship and even subordinate other humans arbitrarily defined as 'inferior' to prove our superiority (Williams, Biophobia, "Social Boundaries, and Racism" 174).

Humans construct boundaries in reaction to the aversion to our bodies through ritual, ceremony, and myth. And these human constructs need to be constantly repaired and maintained in order to keep nature from reminding us, we are animals (Williams, "Biophobia and the Human Body" 59). When there is an aversion to our animal nature, it can be based in the emotional response of disgust. But where does disgust originate? Children do not seem to be born with the emotion but develop it later in life. Studies have

shown that it is “switched on” at some point and is not a learned behavior. It has also been shown to reinforce Othering (Bloom, *Just Babies* 140).

As difficult as it can be to make clear the borders of the biological self it is equally difficult to clearly define the borders of the notion of the biological individual. Just as there are parts that make up the whole of the biological self, there are parts or entities that make up the biological individual, as can be seen through the following quote:

> At ground level, we see ants, beetles, moles, marmots, alligators, ivies, mushrooms, algae blooms, and ostriches. Through magnification, we see or infer flagella-propelled protists, tRNA molecules, prions, and bacteria of many kinds. At larger or collective scales, we can find herds of zebra, sweeping and astonishing coral reefs, biofilms made up of many different species of organisms, and even fungus complexes several hectares in area and with masses greater than an elephant's. Each of these entities is a candidate for exemplifying some kind of biological individual….(Wilson & Barker).

When viewed from a conventional position of distance and time, self and individual is a context-dependent construct, which enables the Other to be defined. Once the observation point is moved, physically or figuratively, changing the distance of the observation to the microscopic level, the self with all the microbes in tow, or macroscopic level, an individual herd of wildebeest, the borders of the Other becomes porous if not dissolve.

We see these same subjective concepts of self and individual, outside of the biological definitions, applied to Americans historical relationship with nature, specifically National identity associated with the western frontiersman. There are also very similar border and boundary problems. The narrative of the rugged individual in the American wilderness, alone and individually carving out more Nation from the

wilderness, this border of the individual, this self-made man, is as porous as the biological notion referred to earlier. This frontiersman was not alone; there was an enormous infrastructure pushing and supplying this “adventure”. He may have objectified and Othered the nature around him, but he really was, all along, even if unknowingly, a part of it. This may seem reminiscent of John Donne’s often quoted words “no man is an i[s]land “ but it is less understood that the intention of these words may also have been a political reminder that actions have consequences (Gray and Shami 340). The consequences of our nation-making out of wilderness was not simply the transformation of an “empty space”, as it was then perceived; it interrupted a living and diverse ecosystem, inhabited by a multitude of indigenous peoples with cultures in place (Ramirez 78-79).

This long-standing authoritative practice, this prejudice of identifying America or an American with an objectified wilderness is limiting. We have a "deeper" history to identity, one that recognizes the interconnected relationship we share, that recognizes our likeness as opposed to "otherness." We walk into the exhibit of Montana’s *T. rex* with the same lack of understanding of our deep relationship to it and what it can teach us as the frontiersman did in confronting the landscape of wilderness. These explorers could have learned from the world they were a part of, if they had not objectified nature. Just as we can learn from the exhibit of Montana’s T.rex if we move to an I-thou relationship.

How can the impacts of this innate behavior of Othering, I-it relationships, be minimized? First, this study makes an important distinction between a predicament and a

problem. Othering is a predicament. The reaction to the perceived differences is a problem. The difference between a predicament and a problem is explained as follows:

> a problem calls for a solution; the only question is whether one can be found and made to work, and once this is done, the problem is solved. A predicament, by contrast, has no solution. Faced with a predicament, people come up with responses. Those responses may succeed, they may fail, or they may fall somewhere in between, but none of them "solves" the predicament, in the sense that none of them makes it go away (Greer).

The predicament of Othering is here to stay but the consequence of the resulting prejudices can be addressed as the problem they are.

Second, the hermeneutic circle is employed and used for self-reflection to examine the prejudices of Othering. The prejudice of I-it, vs. I-thou, should be recognized and understood, as known knowns, and addressed. Othering is always going to happen, we just don't know when, this is a known unknown. The awareness of prejudices and how they become authoritative is what Gadamer's hermeneutics addresses. By examining the authoritative traditions of meaning-making, the prejudices, and distinguishing between those authorities that are useful and those that are restrictive are identified, in order to move beyond them (Meszaros 243).

Third, more awareness of a predicament is not the only thing required for change. If a member of an in-group recognizes which prejudicial authorities are restrictive, this individual will still need to deal with peer pressure. In a climate change study researchers found that more education did not help promote positive behavioral changes that would address global warming. The study showed that individual behavior was more strongly influenced by the beliefs of the in-group (Kahan et al. 732). For example "(a)n oil worker who expresses concern about climate change may be mocked, while an English professor

who calls climate science a hoax may be shunned. People therefore adjust their beliefs to fit those of others around them" (Battistoni). For change to occur, the individual can either leave the in-group or else address the mumpsimus within the in-group. But first the individual needs to identify and recognize their prejudice. This phenomenon reinforces the earlier observation that confirmation biases need to be addressed when evaluating ways of knowing.

Fourth, a study showed that prejudices decrease if an out-group is interpreted through both positive and negative attributes rather that positive attributes alone (Brauer et al. 757). In other words, prejudices decrease if more diversity is attributed to an out-group.

Fifth, is there is a component of emotions in play when an in-group or an out-group is determined? If so, is it disgust or the opposite, empathy? Empathy is an emotion that at first glance would seem to be another way to break down the borders of Othering. But as the following will show it is not always beneficial. Empathy can be divided into "what is sometimes called 'cognitive empathy', the capacity to understand the thoughts and emotions of others, and 'emotional empathy' the capacity to feel what others feel" (Bloom, "Against Empathy, Response" 1). In *The Fog of War*, Robert McNamara, former Secretary of Defense during the Vietnam War, writes that Lesson One is "Empathize with your enemy…[w]e must try to put ourselves inside their skin and look at us through their eyes, just to understand the thoughts that lie behind their decisions and their actions;" this is an example of cognitive empathy (qtd. in Blight and Lang 27). If a fellow citizen's child is killed during an enemy attack, the citizen will most likely

empathize with their fellow citizen rather than with the enemy; this is an example of emotional empathy. In this instance empathy can actually strengthen the Othering of the out-group, or enemy, which can escalate the violence.

Paul Bloom suggests that compassion may be a more effective response than empathy. To highlight the differences between empathy and compassion we can look back at the above situation of a fellow citizen's child.

> A highly empathetic response would be to feel what [the citizen] feels, to experience, as much as you can, the terrible sorrow and pain. In contrast, compassion involves concern and love for your [fellow citizen], and the desire and motivation to help, but need not involve mirroring your [fellow citizen's] anguish (Bloom, "Against Empathy" 4).

In this situation empathy, an I-it relationship, can give rise to revenge where compassion, an I-thou relationship, would not. With empathy there is a component of Othering when revenge is a possibility. On the other hand, compassion would have an understanding and have concern for both the enemy and the fellow citizen. Empathy has an emotional factor that allows someone to feel what another in the in-group feels, a relationship of "feeling with" the one that is being empathized.

> In contrast to empathy, compassion does not mean sharing the suffering of the other: rather, it is characterized by feelings of warmth, concern and care for the other, as well as a strong motivation to improve the other's wellbeing. Compassion is feeling for and not feeling with the other (Singer and Klimecki 875).

Inquiries regarding this relationship of "feeling with" are reinforced by studies that show the same brain structure that is activated when someone feels pain is the same structure that is activated in a person that is empathizing with someone that is in pain (Loggia, Mogil, and Bushnell 168).

Empathy can also cause emotional strain and can be a source of "burnout" when experience too often. To alleviate this stress, training in compassion has been shown to "overcome empathetic distress" (Kilimecki 873). Is it possible to feel empathy and compassion for non-human animals? What about the environment? Some animals can trigger empathy:

> …long-lashed large-eyed animals get a disproportionate share of our concern - that the killing of baby seals provokes more outrage than the killing of coypu. A motivation that is based on an ability to empathize is equally parochial (Holton and Langton 226).

Empathy is generated by a perceived relationship or connection. We are drawn to puppies and kittens, proportionally big heads and eyes among other features of neoteny, creating an in-group, experiencing biophilia. Lizards and snakes and spiders, not so much; these creatures are more likely to be associated with the experience of an out-group or biophobia. These behaviors may have an evolutionary component, and recognizing this helps us understand why we do it, but both biophilia and biophobia are emotional responses that inhibit an I-thou relationship. Even empathetic biophilia is not the most appropriate response to the biosphere if we want to create a deep understanding of our relationship to it. The I-thou relationship of compassion, on the other hand, would not distinguish between a puppy, a lizard, or a spider. For this thesis there were no studies located that revealed any distress associated with the state of compassion compared to the distress associated with the emotion of empathy.

Sixth, the way to minimize the Othering of biophilia and biophobia is through knowledge. That is, the knowledge of us, individually and collectively, and the knowledge of our fellow inhabitants of the biosphere, past, present, and with the future in

mind. Here again the hermeneutic circle can be employed. One cannot understand the whole of the environment and biosphere until one understands the parts and one cannot understand the parts until one understands the whole. (see below the chapter on the Earth and environment).

Seventh, place, a conceptual category, is where Othering is created. As stated above, Othering is contextual: it requires distance, the space between the individual that is Othering and the Other. It also requires time, an interval for evaluation and determination of the Other.

> The fact that people, objects, and behavior can be thought of as in place or out of place suggests that place is more than a description of particular 'things' that can be identified, mapped and described. In addition to using place to refer to things in the world across scales (ontology), place can be thought of as a way of understanding the world around us (epistemology) (Cresswell 358).

Place, a location within an area (space) creates in-siders and out-siders. Each has their "own place". When an out-sider is viewed as inhabiting the in-siders place, the Other is "out of place" (the in-group is in place, the out-group is out of place).

What is this place in which we Other? It is actually the same place that Montana's *T. rex* walked through in the very distant past, the environment has changed but we remain in the same place where this particular *T. rex* took its last breath. Next we will look at this place we refer to as Earth.

Earth, Understanding Place, in Space and Time

In this thesis the concepts of space and place are interpreted in the following way: Space is described as an area. It can be small, large, or infinite, space continues until it makes contact with place. Place is described as a specific locality within the area of space. Space and place will be discussed as physical areas and localities. The boundaries of place are determined by the observer and, depending on the relationship to the locality, place can be "large" or "small". For instance, today a ranch on the Rocky Mountain front could be thousands of acres. To the rancher this is a locality, it is a place; it is "his" ranch, "his" place. To a land developer, this ranch appears as an area, space that could be broken up into many sellable places. The land developer is a modern reflection of the frontiersman's or homesteader's view of the early west: a vast "virgin" space, a landscape in which to carve out their own place. When the frontiersmen and homesteaders were surveying this landscape as space, it is quite possible the indigenous peoples of this territory considered it differently, viewing it as locality, as place. Viewed this way, there was no space in which to carve out a place.

> Humanistic geographers have developed a notion of place that sees it as a way of 'being-in-the-world' developed from the philosophy of phenomenology. 'Being-in-the-world' through place involves subjective attachments to the world…..to counter the perceived meaninglessness of concepts such as space and location. [Humanistic geographers] wanted to explore what it was like to be human in a world of places. [They were] concerned with how places were created through personal attachment as well as the shared forms of meaning production… (Cresswell 357).

Each individual sharing the same place will have a different sense of that place. This is the result of the prejudices that are formed by the individual experiences and

interpretations. Where Montana's *T. rex* took its last breath is a place. This place is a location, separated through space from other places. An assumption is made here that Montana's *T. rex* also had a sense of place, at least in terms of a territory, recognized and presumably defended. What was it like to experience place as this *T. rex*? In the same sense as "Thomas Nagel's question, 'What is it like to be a bat'- what, that is, is it like for the bat (not for us) to be a bat"(Laycock 271). Although we can try to project what it would be like for us to be a *T. rex,* experiencing place, we cannot actually know what this experience was like. But creating an awareness of how this creature may have experienced place can remind us of how we are experiencing place, becoming one of the layers or ways that help build a conceptual meaning of *T. rex* as being-in-the-world.

The place where the remains of Montana's *T. rex* came to be discovered was in the Hell Creek Formation, on a sandstone hill in the northeastern region of Montana. As Montana's *T. rex* was being excavated, tensions flared. Ownership of the fossil and its perceived value caused confrontations between the land owners and the crew of excavators in the field. Threats were made and armed guards were called to protect and watch over the crew while the creature's remains were excavated. Peck's rex, its name at the time because of the proximity to the Ft. Peck reservoir, was deemed to have scientific value and should be preserved in the public trust. There was a dispute, however about actual ownership of the land including the fossils. The ranchers who claimed ownership of the land believed the fossils belonged to them and disagreed with the crew of excavators who planned to send the fossils back to a museum (Browne).

Before this excavation, Montana's *T. rex* burial plot laid quiet, countless creatures walking over the grave, for over 60 million years. This place, as well as the rest of the Earth, has seen many changes before this *T. rex* traversed its home. Equally there were many geological changes over an immense period of time after the *T. rex* perished. The age of the Earth is known, but some believe the earth is only around 6,000 years old. Some, who believe this, also believe *Homo sapiens* and dinosaurs walked side by side. In an interview with the director of the Creation Museum in Kentucky, Ken Ham, he said dinosaurs were on Noah's ark and since all animals were herbivores before the Fall of Adam "…it is possible that carnivores ate plants and grains while they lived on the ark" (qtd. in Asma 37). Some believe the fossilized bones of dinosaurs are the remains of dragons; others believe they are the remains of fallen angels, placed in the ground by a deity to test the faith of its followers. Some even believe fossils are created by paleontologist in the basement of museums (These are personal observations from conversations I have had with a minority of individual from the general public). But those that employ reasoning and have confidence in the natural sciences understand that Montana's *T. rex* died about 65 million years ago (Horner and Lessem 20). That is close to 60 some million years before the ancestors of modern humans accomplished their first bipedal step.

We may understand that the life and times of Montana's *T. rex* took place in a corner of what is currently referred to as Montana, and that it eventually died some 65 million years ago, but it is difficult to truly understand how far back in time this is. If it were possible to go back in time to where this creature lived and died, where would that

place be? The excavation site where its bones were discovered is its final resting place and it died somewhere near there, eventually being transported and buried in sand. But this place has not always been where it is right now. The earth, our solar system, and our galaxy are traveling through space and because of this, a very precise calculation would be needed before taking that trip back in time to the place where Montana's *T. rex* was buried.

In *How to Get from Space to Place in a Fairly Short Stretch of Time,* Edward Casey posits space and time come together in place. Space and time, he writes, "arise from the experience of place itself. We are always in place never really anywhere or anywhen" (Casey 39). Place and space are concepts that are relative to each other. It is helpful to have the concept of one to talk about the other. Some philosophers, both premodern and postmodern including Archytas, Aristotle, Heidegger, and Bachelard held that the concept of place preceded space. They adhered to the Archytian Axiom "Place is the first of all things." Heidegger said "spaces receive their essential being from particular localities and not from 'space' itself". This was in contrast to, modern philosophers, Descartes, Galileo, Newton, and Kant. In the *Critique of Pure Reason*, Kant inferred that the human subject at best had a position in its time and space but place was of little concern. (16, 20). This thesis takes the standpoint of the former philosophers; in order to understand space you start with the concept of place.

From the premodern and postmodern philosophers perspective humans experience place first, then space. When we travel from place to place through space, time is a factor, which creates the concept of distance. Distance, it is posited here, is a concept that is

easier to comprehend than the concept of time alone, especially vast periods of time. To understand time, specifically deep time, converting time into distances traveled from place to place in space can be helpful. Where the *T. rex* died is a place. The area surrounding this place that is not conceptual part of this specific place is considered space. Meaning the area surrounding its grave is considered space; just as the earth is a place surrounded by "outer" space.

For a very short time, in geological speak, it has been understood that the earth is not the center of the universe. The earth rotates around the sun and the sun is moving through space, with the planets in "tow," along with countless other stars in the galaxy we call the Milky Way. The Milky Way is traveling around 1.3 million miles per hour (Kraan-Korteweg and Lahav 53) and there are 8760 hours in a year, so the Milky Way travels close to 11.6 billion miles per year and the *T.rex* we are looking at died 65 million years ago. Using these calculations, Montana's T. rex took its last breath roughly 762 quadrillion miles away from where its bones were excavated, give or take a million years or 11 quadrillion miles:

(1,340,000 miles/hour x 8,760 hours/year = 11,738,400,000 miles/year. 65,000,000 years ago x 11,738,400,000 miles/year = 762,996,000,000,000,000 miles).

This creature has traveled a long ways. It died somewhere behind us in space, if it can be said we are going forward. While it has been traveling through space it has stayed in "place," in terra forma, since its burial around 65 million years ago. And a few years ago, a miniscule amount of time, a handful of *Homo sapiens* uncovered the burial plot, cleaned the bones, and stood the skeleton upright for humans to admire.

What is this place, Earth, that Montana's *T. rex* lived and died on? And why does it matter for this study? The answer to these questions is another part of the hermeneutic circle. Investigating the Earth will lay a foundation for a deeper understanding of the planet so it can be viewed as a whole, to help move beyond thinking of our environment or the biosphere as space, as an I-it relationship. This place we call Earth has a deep history and its history is pertinent to help us create an I-thou relationship, changing it from an area of space to a location of place.

Some refer to our third planet from the sun as Gaia, a feminine entity defined by popular culture as a mother, a living and all connected benevolent entity. If she is respected and cared for, some believe, she will provide an environment for a sustainable living. This popular view of Gaia, outside most of the scientific community, has its origin over 40 years ago (Ward, *The Medea Hypothesis* 27). If this view of Gaia is accurate what happened to Montana's *T. rex* and its kin? Did *T. rex* and its fellow biota, disregard their relationship with Gaia? It is more likely Montana's *T. rex* and its brethren were no more aware of the concept of Gaia than the deep ancestors of *Homo sapiens*. Biota continues to do what it does, century after century, until it doesn't.

Within the current scientific community, there are two main Gaia hypotheses. The first one is the "Self-regulating Gaia" or "Homeostatic" hypothesis which states that life maintains its environment, not always optimal, but livable. The second is the "Optimizing Gaia." This hypothesis posits that life makes the environment better for itself (29-32). James Lovelock published a scientific paper, the original Gaia hypothesis, in 1972 but his hypothesis was not picked up by the general public until he published a book further

explaining his hypothesis in 1979. That publication caught the attention of both the popular culture as well as the scientific community, not favorably by all in the later. The public interpreted the book to mean that Gaia, had Vitalism at its core, a life force outside the confines of a scientific rigor. Even though this was not his intent he was still criticized by the scientific community. This was because Lovelock didn't spend much time defending himself against this proposed Vitalism, and that didn't help his standing (Thompson 78). Later Lovelock distanced himself from some of the more extreme views (Ward, *The Medea Hypothesis* 31).

Recently there has been another hypothesis proposed by Peter Ward, a distinguished paleontologist (Peacock 35) at the University of Washington and an astrobiologist with NASA. He proposed the Medea hypothesis, named after the wife of Jason the Argonaut; Medea, Jason's wife, ended up killing all of their children. The two Gaia hypotheses propose that the earth or life regulates itself for an optimal or an adequate environment to sustain life. Contrary to these hypotheses, the Medea hypothesis focuses on the facts that the earth has gone through more than a few turbulent times including several mass extinctions. Earth, in fact, is a place that has been punctuated by very inhospitable events. One of the earliest episodes was the "methane crisis" around 3.7 billion years ago. Clouds of methane released by microbes kept the sun's rays from reaching the earth, causing an extinction of almost all of the planets earliest life. The next mass extinction occurred around 2.3 billion years ago, brought about by the evolution of photosynthesis, which plunged the Earth into a frozen ball of ice, including the oceans, lasting 100 million years. "All that survived were the photosynthesisers and

microbes that evolved rapidly to tolerate oxygen" (Ward,"Gaia's Evil Twin" 30-31). Around 700 million years ago another "snowball earth" episode occurred after the evolution of the first multicellular plants. The next event, around 400 million years ago, a 50 million year ice age was caused by the reduction of CO2. This ice age is attributed to the rise of forests in the Devonian period (Ward, *The Medea Hypothesis* 29).

Animals evolved around 565 million years ago and since then there have been five major mass extinctions and ten smaller ones. All mass extinction episodes except for the Gamma-ray burst 443 million years ago during the Devonian and the Cretaceous/Tertiary mass extinction were caused by the living organisms themselves (Ward, *The Medea Hypothesis* 79-89). At the end of the Cretaceous the mass extinction was caused by an asteroid but the biodiversity was already on a decline, most likely associated with the increase in "Gaia's" volcanism. The asteroid delivered the fatal blow to the dinosaurs and other taxa (Ward, *The Medea Hypothesis* 81-82). Based on Earth's past there will likely be more mass extinctions. This is something humans outside the scientific community may want to start seriously evaluating (see below).

The biota on Earth is estimated to be about 4/5 through its life expectancy. The long term forecast for Earth's biota, because of a projected overall decrease in CO2, is not favorable; the Earth is in its twilight years. Life began on Earth around 3.8 billion years ago and it is estimated that the planet will be lifeless again in about 1 billion years. Not to worry, that is around 11 quintillion miles away. (The current increase in CO2 and other greenhouse gasses is a serious event for humans and most of the other inhabitants of the biosphere. This should not be confused, however, with the very long term eventual

decrease in CO2). The Earth and the biosphere are complicated and difficult to simplify into one of these competing hypotheses. Peter Ward doesn't believe he has proven the Medea hypothesis to the point of being accepted as a theory, but it has undermined the validity of the Gaia hypotheses, including those that suggest Vitalism at its core. The Earth, according to the Medea hypothesis, is not a self-regulating optimum or near optimum entity. The type of life that exists today is simply here because the current environment is conducive. The biomass and overall diversity of life has been on a decrease since its peak somewhere between 1 billion-300 million years ago; the Earth is slowly dying (Ward, *The Medea Hypothesis* 115-127).

The eventual death of all life, as we know it, on earth is difficult to comprehend. It is just as difficult as trying to grasp deep time in the future and the deep time of the past. But if the eventual death of the Earth is truly understood, even if it is way beyond our life time, we will have an opportunity to come to terms with our own mortality, gaining an understanding of the Earth as place, and realize our actions have consequences. A reasonable and accurate appreciation of the world we live in is critical in order to move through the denial that supports the mythology and belief in an all-caring benevolent Earth.

When there is a belief in a benevolent entity that controls the environment for us, whether a God or a life-force like Gaia, or an equally problematic belief in the progress of science and technology's ability to "take care of it", humans are less likely to enact the changes necessary to address current environmental issues (Meijers and Rutjens 494). Faith in another, "taking care of it", needs to be recognized for the cognitive bias that it

is, before behavior will change. The difference between humans and Montana's *T. rex* is, we have the ability or the perception that we can alter our behavior. But are humans really capable of looking into the long term future, beyond the next generation, and acting in the future generation's best interest? The answer is yes. But it will take effort to go beyond the perception we can, and move in to a deeper understanding of who we are. To help with this who, we will look at the *T. rex* bones to help understand not what they are but who they are; leading to an understanding of our relationship to them, and what they can teach us about ourselves. In keeping with the hermeneutic circle and the emphasis on "reflexivity" in American Studies[1], we will look at the parts, the bones, to understand the whole, Montana's *T. rex*, and the whole in order to understand the parts including the setting, the exhibit, where Montana's T. rex resides.

[1]See, for example, Doris Friedensohn, "Towards a Post-Imperial, Transnational American Studies: Notes of a Frequent Flier," *American Studies*. 38:2, (Summer 1977): 69-85. Also see, George Lipsitz Listening to Learn and Learning to Listen: Popular Culture, Cultural Theory, and American Studies, in Lucy Maddox, ed*., Locating American Studies The Evolution of a Discipline* (Baltimore: John Hopkins University Press, 1999), pp. 310-331.

CHAPTER FOUR

MONTANA'S T. REX: SKELETON AND BONES

The skeleton of Montana's *T. rex* stands motionless. The bones appear to be silent but they are not "inaudible". They have something to say, if we learn how to listen in a new way. This skeleton represents a slice from time and place, a time traveler of sorts, like a photograph that brings back an old experience. There is no need to hurry, these bones aren't going anywhere. We can take "our time" to experience this exotic creature in the setting of the Museum of the Rockies.

Humans have a long history of exoticism: a taste for exotic objects, places, and people (Staszak 43). In both the past and present we have removed the exotic from its original setting and brought it back to marvel at in circuses, zoos, fairs and museums. And more than once, we have even done this to our fellow human beings (Rydell 30-32).

One way of experiencing Montana's *T. rex* and the surrounding exhibit, is by recognizing the commonalities that natural history museums and circuses share. Why the circus? Because that is the expectations many visitors have when arriving at a museum. They come with anticipations of experiencing something between a circus and a library. Museums are perceived to be institutions of learning, much like libraries but visitors expect to be entertained, in much the same way as a circus does. When visitors enter a library they bring with them a readiness to spend time reading. When a visitor goes to a museum they find information panels but very few actually take time to read them beyond the description of who or what the item is. Both the visitor and exhibit designer place high expectations on those small panels, intending to transmit a great deal of

information on a small space in a short amount of time. Recognizing that the observer may be coming to a natural history museum with preconceived ideas of being entertained by a circus-like experience, encourages the examination of emotional prejudices, and helps move the observed from an I-it to an I-thou relationship.

The *T. rex* exhibited at the Museum of the Rockies is exotic projecting all the characteristics that lead to Othering in exoticism. The manner in which a circus exhibits the exotic is reflected in the exhibition of Montana's *T. rex* it has also been taken out of context, in this case its long gone paleo-environment and removed from the setting of its burial plot. Neither the animals in a circus nor this skeleton have any say in their new location. The skeleton is observed in the same way as the tigers and elephants are in a circus; what are missing are the noises, motion, and smells. But circuses, and natural history museums, can go beyond simply being places of entertainment; they can be a place where the space between human and animals can be examined. The label copy in the museum exhibit takes the place of the ring master; the words spread across the panels invite and guide, beckoning the observer to experience more. The ring and ring master's role in the circus is described well by Paul Binder, co-founder of the Big Apple Circus:

> [B]ecause there's so much at stake, and because everyone depends on everyone else, mastery [on the part of the performers] here is not a threat, but a necessity and a pleasure, founded on trust and relying on the order of things…..The ringmaster represents the necessity, grandeur, and weight of certain hierarchies, which exist for the sake of our well-being and the survival of those whom he introduces, who are, people and other animals both, in their own eccentric ways, masters as well. He is here to lead us into a kind of understanding that all of us here, in all our diversity - not just of race or background or age or sex, but of species as well - all of us are in this together. He's the one person in the ring who knows how it all connects, who makes it all come together and make sense. Everything about his presence represents his sense of duty to a higher intention, and

> we need him" (Dallery p. 255-6). "[C]ircus is the art form most closely involved with the relationship between animals and people…circus is the art form most directly concerned with exploring the conundrum and the fact of people *as* animals (255).

Just as with the interaction in a circus, the exhibit of Montana's *T. rex* can be used to ask not only what is this *T. rex* and what is its behavior "but also what am I, what are we, how are we"(252).

Communication and interaction in both a museum exhibit and in a circus, either as the observer or as the trainer of the animals, can benefit from Gadamer's hermeneutics. Vicki Hearne, an animal trainer, believes "the necessity in a good trainer, the good visitor of animal worlds, [is] to be mindful of imminent and inevitable failure in the normal course of affairs"(qtd. in Dallery 261). This dialog enables the trainer to respond appropriately, to unlearn habits of restrictive authoritative traditions in order "to be genuinely surprised, caught off guard, stymied, flummoxed; and then to give the process time so that our failure to be comprehensible to the animal will become clear, and a path out of it will show up" (261). This type of animal training demonstrates the same process we are using for "training" ourselves to let the facts lead to an understanding of the whole, only to return back to the facts, or parts. As the circle or spiral of understanding brings the useful authoritative traditions, prejudices, forward, we look at Montana's *T. rex* in a new way. And this new way of seeing, this approach to understanding, never stops.

Extreme techniques of training or working with animals, using force and pain or the extreme kindness, that "sweet sentimental praise which says nothing to the animal…[n]either extreme allows for listening, for picking up the animal's responses"

(261). The I-it relationship of extreme training techniques, mirrors the emotional extremes that an observer may bring to the *T. rex* skeleton; these emotions are the prejudices that prevent the observer from having a dialog.

The dialog we seek with the *T. rex* requires knowledge based in facts. The facts are the parts, the foundation for understanding in the hermeneutic circle, and the foundation is where they belong. Both the observer of the *T. rex* and the animal trainer must be mindful that their facts are tools and that the tools are not the objective. In this thesis, within the hermeneutic circle describing the parts precedes a description of the whole. Once the observed is described, the circle continues around to defining the parts and leading to defining the whole. Describing is quantitative and defining is qualitative, creating a circle or a spiral of a continuation of questioning. The aim of this dialog is to participate in the continuing the task of observing (Wheeler). The parts in this dialog with the *T. rex* skeleton are its bones and the facts of the bones are where this study is going next.

The attraction of a *T. rex* skeleton is undeniable. There doesn't appear to be a simple explanation for this attraction but Stephen J. Gould offers one possibility: "I know of no better response than the epitome proposed by a psychologist colleague: big, fierce, extinct-in other words, alluringly scary, but sufficiently safe" (qtd.in Mitchell 9). This is most likely part of the attraction; humans visit zoos and circuses, after all, to look at "wild" animals from a safe distance, or through the safety of a motorized safari. Something less obvious is at work, however. Bones are alive, until they aren't and this imposing skeleton is not alive. The information we can tease from the bones allows us to

bring it back to life not only in the mind's eye, but also through sculpture, paintings, in exhibition, and cinema. But it is still dead. What else might be contributing to this attraction?

Bones are more than static structures for support, they are a living, functional, and significant part of every vertebrate. Montana's *T. rex*'s bones once walked the earth; they were not just associated with the *T. rex*, they are this *T. rex* or what remains of a unique biological individual. Every life form is biologically unique "a given human being could not have originated from a different zygote" (Robertson & Atkins). This is also true for Montana's *T. rex*. It is as biologically unique as every *Homo sapiens*, past, present, or future. Each animal living today is the individual it is because of their ancestors' actions. It is because a specific ovum and spermatozoon came together over countless generations going back to the beginning of when the "first" zygote produced the next generation. Thus, we are who we are as a specific biological individual because of the exact ovum and spermatozoon came together at the moment they did; otherwise we would be as different from ourselves as we are from our siblings. Compound this concept by the immeasurable generations preceding each individual throughout deep time and we begin to understand just how biologically unique and improbable each life, including this *T. rex*, actually is.

This same sense of uniqueness can also be projected on to objects. This perceived essence of uniqueness has been examined in psychological studies. These studies investigated how some believe there is an "essence" associated with some objects. They labeled this perceived essence as a "contagion." This contagion is associated with the

previous owner of the object; in a sense, it is believed the previous owner of the object can be connected with, through the association with the object. This can be the physical touching of the object or observing it on display. Objects with this contagion associated with it can have a perceived value, which sometimes translates to sizeable sums of money. Objects owned by celebrities demand a higher price at auction than would an object off the shelf (Newman and Bloom 1-3). If the item was not owned by a famous individual it would just be considered used, second hand, and deemed much less valuable. The item must be presented and verified as authentic to create this perceived value. But authenticity is not only recognized for its monetary value:

> [It is] used either in the strong sense of being 'of undisputed origin or authorship', or in a weaker sense of being 'faithful to an original' or a 'reliable, accurate representation'. To say that something is authentic is to say that it is what it professes to be, or what it is reputed to be, in origin or authorship (Varga & Guignon).

In order for the *T. rex* on display to be presented as authentic, the museum must be perceived to have the authority to authenticate the fossils and display them appropriately. Montana's *T. rex* fulfils all three of the above qualifications of authenticity: This skeleton is the original fossil material, any cast elements are molded from the original, and any missing material is accurately reconstructed. Connect with this authentic skeleton and you are connecting to more than the contagion of these bones, the *T. rex* didn't just touch these bones, these bones *are* the *T. rex*.

Humans draw bones close to themselves because bones have an essence more than a contagion. Bones are, and what remains of, a biologically unique individual. And this skeleton, the fossilized bones of the *T. rex*, stands available to communicate with its

essence through a dialog. Even though these bones are Immovable, each supported by steel each bone gives up clues to this creature's life. The shape of each bone, the proportional lengths of the limb bones, all give insight into this once dynamic creature. Even the internal structure of the bones can give up clues about the *T. rex* (Schweitzer, Wittmeyer, and Horner 93-100). How do these bones, fossilized through deep time by percolating minerals, turned to "rock", give up their information?

Bones are what remain after the desiccation of soft tissue, whose desiccation and decomposition starts at the point of death. The remaining skeletal structure creates many areas of study. Taphonomy, biomechanics, histology, and forensics, are several methods employed by geologists, paleontologists, biologists, anthropologists, and archeologists, to examine the remains of humans and other animals, extinct and extant. When human remains are found, forensic methods are utilized to help determine the sex, age, ancestry, and the cause of death (White 360-362, 400-403). Taphonomy is similarly employed to examine bones and bone assemblages; this method studies what happens to bones after the point of death (Lyman 1). The field of biomechanics is used to analyze joint movement, which helps reveal types of locomotion and other behaviors (Kreibaum 1-64). Histology is the study of microscopic structures of bone and fossil bone anatomy (Wheater, Burkitt, and Daniels 1-271).These methods are the map this study uses to traverse the territory, internal and external, of the bone structures.

There are two ways bones are created through ossification or osteogenesis. The direct formation of bone is intramembranous ossification. It begins when embryonic connective tissue, mesenchyme, is transformed into osteoblast. Osteoblasts are cells that

functionally lay down bone through a process of mineralization. During mineralization some of the osteoblasts are trapped becoming osteocytes. Osteocytes become responsible for maintaining the bone matrix. Bones also develop through endochondral bone formation, which occurs when a hyaline cartilaginous model is formed first and later replaced by true bone. (Wheater, Burkitt, and Daniels 128-144; Tortora and Anagnostakos 124-139). Cartilage formation, chondrogenesis, first appears in many parts of the embryo including the long bones, vertebral column, and parts of the skull. Cartilage can develop through interstitial growth, mitosis and continued secretion of matrix that binds large amounts of water (appositional growth) a process of laying down matrix by chondrogenic cells on the outer edge of the cartilage (Wheater, Burkitt, and Daniels 128-144).

Limb elements, or long bones, begin as small cartilaginous models of the adult counterpart. Through endochondral ossification they are converted into woven bone, an immature form that is eventually remodeled into lamellar bone. Lamellar bone is formed as either compact bone, a solid mass forming the walls of the shaft, the diaphysis, or formed as cancellous bone, a spongy mass which occupies the inside or medullary cavity (Wheater, Burkitt, and Daniels 128-144; Tortora and Anagnostakos 129-133).

Bones protect vital organs and also function as a system of levers for movement. Bones are also used for mineral storage, and blood cell formation. Bones are the components of the skeletal unit, a living and dynamic structure that gives support and protects a functional matrix: the soft tissues and spaces associated with the skeleton (Moss, “Functional Cranial Analysis” 21-31). During embryonic development, as the

functional matrices or the embryonic soft tissues are forming the skeletal structure is also developing and also responding. The overall form of the skeletal structure is genomic, meaning the genes determine the overall shape of the bones but epigenetic events, soft tissue formation and induced stresses, will cause bones to remodel (Moss, "The Functional Matrix Hypothesis" 338-342; Gjelsvik 69-77). The amount of morphological change from the remodeling of the bone is related to the amount of stress applied, creating robust or gracile shapes. But the general shape of a bone is restricted by genetics, disregarding any pathology. As bones are stressed, one side is compressed creating a negative charge triggering bone to be deposited. On the opposite side there is a positive charge, causing the structures of bone to be reabsorbed. Where bones are stressed remodeling occurs. Crests, ridges, and tuberosities (where muscles and tendons attach to bone or enthesis) develop in order to strengthen the skeletal structure to keep it from failure. This remodeling or what is referred to as piezoelectric effect, is what keeps the skeletal structure plastic and adaptive (Wainwright et.al 186-187).

The skeletal form and functional relationship was recognized as far back as 1892 in a publication by Julius Wolff known as Wolff's Law or the Law of Bone Remodeling (qtd. In Murray 100,134). An example of the dynamic properties of skeletal tissues ability to respond to stress, specifically from an injury, is pseudarthroses. This occurs when a fractured limb bone won't heal. Instead, in some cases, it forms a moveable joint at the point of fracture. An encapsulated, cartilaginous remodeled articulating surface is created, forming a joint, with synovial fluid. Pseudarthroses is rare but was documented in a wounded veteran presumably from World War 1. The veteran received an injury that

resulted in a fractured upper arm bone (humerus). It would not heal and a pseudarthoses joint was formed between his shoulder and elbow (qtd. in Murray 86).

The skeleton is a living structure, reacting to the physical environment through bone remodeling, while supporting and protecting soft tissues of muscles and organs, gives an animal its basic form. Through the contraction and relaxing of the muscle fibers, the skeletal elements produce movement. The surface topography and overall form of a mature skeleton is a result of both the genotype and the environment it lived in. The bones making up the skeleton of this *T. rex* are the remains that became fossilized over deep time. These are the remains that can be examined to understand the deep ancestral relationship humans share with it and all vertebrates. This relationship is not, in the sense of the Gaia theory, the Earth as alive, proposed by James Lovelock when he said:

> The entire range of living matter on Earth from whales to viruses and from oaks to algae could be regarded as constituting a single living entity capable of maintaining the Earth's atmosphere to suit its overall needs and endowed with faculties and powers far beyond those of its constituent parts (qtd. in Ward *The Medea Hypothesis* 28).

Nor is it a relationship with Gaia, "The Cruel Mistress" that can be brought back in to balance through a ceremony of forgiveness at The Burning Man Festival, in the deserts of Nevada. Where "[t]hose seeking forgiveness and atonement were invited to enter a chamber where they would witness 'the great mystery of Gaia', where their sins would be purified and they could be 'Re-Virginated' (according to the [Burning Man] website)…" (25). The relationship we share with the biosphere is one that is connected through competition for resources. "All living things share a mutual interdependence, a common

origin, and two fundamental problems of survival: the tendencies toward disorder and death" (Postlethwait & Hopson 21).

We cannot escape from the relationship of all vertebrates being literally related. Actually all life is related, as far as we know. It is only a matter of going back far enough to find their common ancestors (14). The earliest signs of life are found around 4 billion years ago, the evolution of photosynthesis takes place around 2.8 billion years ago, multicellular plants evolve around 700 million years ago and the first animals evolve close to 600 million years ago. Bones reveal clues to this relationship which helped establish the Theory of Evolution. Somewhere around 300 million years ago the deep ancestors of both Montana's *T. rex* and modern humans negotiated the geography of the Carboniferous period. This creature was a member of the group referred to as amniotes. These are animals that produce eggs with a protective membrane, allowing them to reproduce outside the confines of water. This group gave rise to reptiles, birds, and mammals. If we go back even farther we could find the shared ancestry of amniotes with amphibians and, theoretically, to ancestors leading back to the very first life forms (14).

Understanding this connection between all vertebrates is central for acquiring a deeper understanding of our relationship with the past, present, and future biota. The understanding of this relationship, for this thesis, starts with the skeletal architecture or body plan that all land vertebrates share. This is a relationship that can be traced back to around 350 million years ago (Radinsky 86). Today, we can observe that some vertebrates have a few more or less fingers and toes, a few more or less skull elements, or maybe a longer tail. However, the general body plan, termed bi-lateral symmetry is seen

as the pairing of limbs, fingers, and toes. Montana's *T. rex* has fingers and toes which have decreased in number, two functioning fingers per forelimb and three toes per hindlimb. This is contrast to the five digits of *T. rex*'s and our shared ancestor that traversed the landscape of the Carboniferous. There are many vertebrates that are more derived, or changed, from the basic body plan of humans. Horses have only one finger per forelimb and one toe per hindlimb; snakes don't appear to have any, although some snakes, such as boas, actually retain a small remnant of their hind limbs (Benton 194). Whales, seals and other marine mammals also display bilateral symmetry with limb elements modified for aquatic life.

Humans, apart from changes in the design, morphology, and articulation of elements that allow for upright locomotion, still retain a pretty generalized or "primitive" post-cranial skeleton. The five fingers and toes humans have on both sides of their body are the same number as that of a salamander. In addition, wrist movement in humans can be traced back to the morphology found in amphibians 365 million years ago (Shubin 36). Humans have a tail, or what's left of it. Humans even have the same elements that make up the back of the lower jaw of the *T. rex*. But now those bones have "migrated" to compose the elements that make up our inner ear (Kardong 272-275); these bones that we share with the *T. rex* are considered homologous, they share an anatomical ancestry. The above differences in form and the number of homologous skeletal elements in all vertebrates are the result of ancestry and function over time (14).

Homologous elements or homology refers to an anatomically shared ancestry, while analogy refers to anatomically shared function. Birds and beetles both have

analogous wings but are not homologous because they did not inherit wings from a common ancestor. Birds, bats and a Pterodactyl share analogous wings, meaning they evolved through separate linages. Birds evolved feathers that are now used for flight and bats and Pterodactyls both use a wing membrane for flight. Bats support their membrane with all their fingers while Pterodactyls only support their wing with one robust finger on the leading edge of the wing. Birds, bats and Pterodactyls all use their hand and finger elements to support their wings. Because those elements share a common ancestor they are considered homologous (349). When homology and analogy are considered, during the analysis of bones, comparisons across taxa can be made which helps identify or allude to behavior. It can also be used to help reconstruct soft tissues of extinct taxa, including Montana's *T. rex*.

As noted above the site where muscle and tendons attach to bone (enthesis) leave marks forming a crest, ridge, or a tuberosity; some refer to these topographical changes on the bone surface as muscle scars. These sites retain their relative position on the bone throughout development to maturity, suggesting that the placement is genetic (Benjamin & McGonagle 520). Because of epigenetic influences, including physical stresses from the external environment, the size of these markers can be interpreted as evidence of types of activity (Foster, Buckley, and Tayles 511). Because of this, the same bone from the left and right side of an individual can be compared and help determine the dominant side. For instance a right handed professional tennis player will have a more robust right humerus, as compared to the left humerus, including larger muscle attachment points.

The overall shape of long bones, their cross-section, and their bone thickness, can help estimate the mass of the animal. The internal structure can offer clues to its age, sex and aspects of behavior (Schweitzer, Wittmeyer, and Horner, 93; Cooper et.al 2609-2615). The proportions of the limb elements can reveal whether it was bipedal or a quadruped as well as the type of locomotion, whether the animal was built for running (cursorial locomotion) or stability (graviportal locomotion). The shape and angle of the articulating surfaces of the vertebrae can help in reconstructing the shape of the spine, neck, back and tail. The skull shape, placement of the eyes and the shape and count of teeth help determine if the animal was a carnivore, omnivore or herbivore.

Forensic investigations also use this same understanding of bones to interpret evidence of behavior. A recent study revealed the oldest known "murder" or lethal interpersonal violence dating back to a little over 400 thousand years ago. A Neanderthal skull from the Middle Pleistocene revealed two episodes or strikes during a face to face conflict resulting in a lethal blunt force trauma (Sala et.al 1). But not all forensic methodology is used for crime scenes. Forensic 3-D reconstructions, of both known and unknown individuals, recreate the facial features using a combination of science and artist skill. The bones of the skull and the attachment sites of the muscles, based on a long history of scientific investigations, aid the artist/technician in the reconstruction of the soft tissue with clay. The thicknesses of soft tissues on predetermined sites on the skull are known through countless dissections first documented in 1883. The first known account of a 3D facial reconstruction dates back to the Neolithic, around 8000 years ago. It appears this was a form of ancestor worship in which the skulls were covered with

plaster and shells placed in the eye sockets (Verze 6). Modern facial reconstructions start in the eighteenth century in Italy.

> These artists can be credited with pioneering the theory behind facial reconstructions: that is, from the shape and proportions of the skull can be inferred how the muscles were attached and shaped, defining the parameters of the face; anatomical correctness was important, rather than an exact likeness (7).

With this understanding of soft tissue reconstruction, what can be deduced from looking at the bones of Montana's T. rex and its kind?

We will see that there are many attributes revealed: the known knowns. But first what are the known unknowns, what are the things bones can't tell us? Bones can't tell us the color or pattern of the skin although in rare cases fossilized skin impressions have been found. The surface of the skin reveals shapes and textures but the integument has gone through desiccation or other physical influences postmortem. Also pigmentation does not fossilize so color has to be deduced through camouflage theory or other extant comparisons. Feather impressions have been preserved in some cases and when not preserved, some forelimb elements, the ulna in particular, display changes in topography suggesting feather attachments that mirror similar topography in some modern birds. Other soft tissues, muscles, eyes and internal organs, the functional matrixes, are rarely fossilized. There are many things these bones will eventually reveal, the things that we think we know until future discoveries prove those observations were wrong, the unknown knowns. Our knowledge will increase as new discoveries are uncovered and the old views change. There are also unknown unknowns, thing we don't even know we don't know because we don't know the questions to ask. The field of paleontology is

always changing, always asking. What can the fossilized bones of Montana's *T. rex* tell us?

Bones

Limb Bones

From a biomechanical view the skeleton is a combination of levers. There are several types of levers in the human body. Depending on the function of each lever there will be different proportions of each limb bone. Limb element proportions indicate the mechanical design for types of function, including locomotion.

To help determine types of locomotion, the relative proportions, of the length of the upper leg bone (femur) and the lower leg elements are examined. The ratios of the femur to the shin bone length (tibia and fibula) or more precise information can be gained by determining the ratios of femur to tibia/fibula including the foot (pes) bones (metatarsals), and to the toe bones (phalanges and unguals). A short femur and a long tibia indicate the animal was built for a greater range of motion, which translates to the ability to run, the shorter the femur to tibia length, the greater the range of motion, and the faster the animal can run. This is seen in cursorial animals: deer, horses, and their predators in the dog and cat families. In contrast, the longer the femur and the shorter the tibia including the pes the smaller the range of motion, which translates to stability or strength. This is seen in graviportal animals, like elephants whose skeleton is design to address weight bearing issues. A femur to tibia ratio of 1:1 is a compromise, balancing speed and stability and strength.

Plantigrade, Digitigrade, and Unguligrade

Humans stand "flat" on their feet, the metatarsals (foot bones), phalanges and unguals (toe bones) . This posture is referred to as plantigrade. Dogs stand on their phalanges and uguals (toes), with the elongated metatarsals (foot bones) lifted off the ground. The foot and toe bones are no longer combined to create a platform for standing. This digitigrade posture also gives a mechanical design that is advantageous for running/speed but also allows for some stability/strength. But not all digitgrade animals are cursorial (runners). Elephants are digitgrade but are graviportal (a longer femur to tibia ratio)

Deer stand on their unguals, the terminal two toe bones. This unguligrade posture sacrifices stability for speed, not a bad idea when the deer may need to escape from a digitigrade predator. There are other skeletal features that contribute to locomotion including the flexibility of the spine and the freeing up of the shoulder blade (scapula) which will increase the stride length (Walker 253, 300).

The ratio of the total length of the hindlimb or leg, (femur, tibia/fibula, pes) to the total length of the forelimb or arm (humerus, ulna/radius, manus) including the shape of the manus can also help predict something about locomotion. A longer hind limb to a shorter forelimb, depending on the exact ratio, and the type of articulation within the manus can predict bipedalism, walking on just the hind legs, vs. a quadruped, walking on hind and forelimbs.

The forelimbs can reveal additional information about locomotion. These are the elements that will identify specialized forms of locomotion or uses: flying, digging,

grasping (swing from trees, picking fruit etc.). The analogous ways vertebrates have evolved flight was discussed earlier. Digging animals have a “block” shaped humerus. In extreme cases, such as a Golden mole, the width of the head or top of the humerus is 97% of the length of the humerus (Hildebrand 97). There are also obligatory quadrupeds, using their hind and fore limbs only for locomotion but there are also quadrupeds like raccoons or kangaroos that can use their forelimbs not only for locomotion but also for manipulating the manus (hand) for uses other than locomotion.

What do the limb elements tell us about Montana’s T.rex? Looking at the articulating surfaces of the metatarsals and phalanges, and then measuring the degree of movement in each joint will reveal the posture of the foot: plantigrade, digitigrade, or unguligrade. Then the degree of motion is measured in both the ankle, the joint between the metatarsals and tibia/fibula and the knee, the joint between the femur and tibia/fibula. The articulations of these joints show that the hind limb posture is digitigrade. There are fossilized tracks attributed to *T. rex* that backs this up (Lockley and Hunt 213-218). It stood on its phalanges, much like a bird unlike those of birds however the *T. rex* femur is about the same length of its tibia, showing a compromise for stability and strength, understandable when you weigh somewhere between 8,000 and 12,000 lbs. (see below).

What about those little forelimbs? At a glance they can be seen to show without a doubt *T. rex* was a biped. The ratio of femur and tibia length to the forelimb, the humerus and ulna/radius length is about 4.5:1. Humans have a ratio of about 2:1. The absolute length of the *T.rex* arm including the hand (manus) is about the same length as that of an adult human but the limb element proportions are quite dissimilar. The length of the

ulna/radius in *T. rex* was about half the length of the humerus, where in humans the radius and humerus are about the same length. The manus (hand) makes up the difference for the combined length, making the *T. rex* manus proportionally longer than the human manus. These proportions encourage some interesting speculation about the function of those "little" arms. Conjecture about the use of the arms started after the first forelimb associated with a *T. rex* was discovered. The debate not only argued whether the arms were vestigial or functional but also questioned whether the arms could shed light on the discussion surrounding *T.rex*'s method of acquiring dinner; was T. rex a scavenger or a predator (Lipkin and Carpenter 167)?

Function based on proportional size of any appendage may not be the best starting point for a debate over function vs. vestigial. Martin Lockley et.al published a study that showed that, proportionally, little arms are a result of a genetic corollary; in carnivorous dinosaurs there appears to be a morphological pattern of large heads, short necks resulting in short arms. This is contrasted with dinosaurs that have small heads, long necks, which results in long arms (152). This may help explain the size of the arms but it does not address the question surrounding their function. Carpenter and Smith published work that indicated those little arms were actually very robust and built for strength: "Although proportionally the forelimb [of T. rex] is very small, the mechanical advantage reveals an efficiently designed force-based system (vs. a velocity-based system) used for securing its prey during predation" (90). There is no indication these robust "little" arms are vestigial despite the comment from the paleo-artist Greg Paul "the reduced size of the forelimb shows they were not important to their owners, so they should not be important

to us" (qtd.in Lipkin and Carpenter 167). The forelimbs appear to be functional, for what purpose, no one really knows but they contribute something to the whole of this *T. rex*. Was *T. rex* a predator or a scavenger (Horner and Lessem 203-220)? Neither of these behaviors require arms to secure a meal, as can be observed in birds of prey (Holtz 383) or birds that scavenge, so these little arms cannot help answer the above question.

The placement of the eyes in *T. rex* also doesn't help answer the scavenger/predator question; *T. rex* may have had stereoscopic vision which would allow for depth perception (Horner and Lessem 185). This would help a predator but it would not preclude scavenging. This same thing can be said about the business end of the *T. rex*, its teeth. They were thicker than other carnivorous dinosaurs which would allow for the "bone crushing" behavior of scavengers but this would still not preclude predation. The best summary regarding this debate, which investigated the probability of *T. rex* being an obligate scavenger, is a study by Thomas R. Holtz Jr.:

> The hypothesis of obligate scavenging in *Tyrannosaurus rex*…is provisionally rejected. Previous morphological features suggested as correlates of this hypothetical life habit were not found to reject the possibility of predation in tyrannosaurids….Although obligate scavenging is rejected as a model…tyrannosaurids would be effective scavengers (390).

It is probable *T. rex* took the path of least resistance. It scavenged when an opportunity arrived and when hungry enough it actively sought out prey. While *T. rex* was actively pursuing a meal, how fast could it traverse its environment? Top speeds vary depending on which study is considered and the methods used. The range is estimated to be between 11 mph (Hutchinson and Garcia 1018-1021) up to 20 mph (see below). Regardless of how fast *T. rex* could run John Horner and

Don Lessem point out: “For me, it’s simply a matter of common sense….predators need to be only a bit faster or more maneuverable than the fastest animal they hunt” (200). The mass of *T. rex* should also be considered when determining the maximum speed it could have safely run. There are several methods that can be used to estimate the mass of a *T. rex*; it can be based on a 3D scaled down model or the mass can be calculated by taking measurements of the limb bones.

The scaled down 3D “fleshed-out” model is created using the forensic methods discussed earlier. The original bones are measured and scaled down and mounted by articulating the bones. Clay is placed in where the major muscle groups associated with the individual bones would be. For example, the anterior and posterior points of the illium (pelvis) are the starting points, proceeding down to the point of attachment in the area of the femur and tibia/fibula (knee joint). The bones, in a sense, “tell” the model maker where the muscles go. After the model is completed it is placed in a measured container of water and the displaced water is measured. The mass of the full sized *T. rex* can be determined by scaling up the displaced water. This can be done because both the density of water and living creatures is known. This has been done for another *T. rex* that is a little larger than Montana’s *T. rex*; its estimated mass is calculated to be around 6,000 kg. or 6.5 tons (Farlow, Smith, and Robinson, 713-725). Another approach is to measure the circumference of the limb bones, in this case, the femur because *T. rex* was a biped. This method is based on an earlier study that measured limb element circumferences and compared that to the mass of living animals (Anderson, Hall-Martin, and Russell 53).

Using this method Peter Larson confirmed earlier studies, there were two "morphs" within the *T. rex* species; there is a robust form and a gracile form. He estimates the robust skeletons at a maximum mass to be a little over 6 tons. The gracile skeleton's maximum mass is close to 4.5 tons (Larson 117), suggesting Montana's *T. rex* mass is close to 4 tons (122). As noted above, mass can be a factor in determining how fast an extinct animal may have been able to safely run. Farlow, Smith and Robinson calculated a *T. rex* with a mass of around 6 tons could not survive a fall traveling at a little over 40 mph. They concluded that around 20 mph would have been the maximum safe speed (713, 723), which turns out to be close to the same mass and safe speed for a modern African elephant (Horner and Padian 1879).

One more piece of information can be deduced from the recognition of the robust and gracile morphs of *T. rex.* An investigation utilizing histology discovered medullary bone in a robust form of a *T. rex*. Medullary tissue is associated with the production of egg shell, (Schweitzer, Wittmeyer, and Horner 93). It was determined that the robust morphs are female and the gracile morphs are males. Montana's *T. rex* falls into the gracile morph group, which identifies this *T.rex* as male (Larson 122).

Montana's *T. rex* can now be referred to by its sex; and he was most likely somewhere around 20 years old when he died. This is based on an investigation into age and growth of the known *T. rex*s as of 2004. John Horner and Kevin Padian calculated *T.rex* reached full size in less than 20 years (1875) and the oldest T. rex found died around 28 years old (Erickson et.al 772).

The cause of death of Montana's *T. rex* is unknown but it appears, after death, that the body was transported into a nearby oxbow. As the bloated body decomposed the bones dropped to the bottom of the lake and the bones were eventually buried (Derstler and Myers 80). The surrounding environment of his grave was likely a flood plain shared by turtles, "alligators", fish, including species of gar. There were also other dinosaurs in the area, including dromaeosaurs, hadrosaurs, and *Triceratops* (78,79). Forests of conifers, cycads, palms, and flowering plants have been identified as some of the flora of this region (Henderson and Harrison 86). The environment was very warm and changing; the climate was going through temperature variations before and after the passing of Montana's *T. rex*.

Climate studies reveal that the Cretaceous Period, 145 to 66 million years ago, was a very warm period of time. The Arctic Ocean surface temperature reached 35^0 C (95^0F) and in the deep ocean temperature were in the range of 20^0 C (68^0 F). (Friedrich, Norris, and Erbacher 107). These temperatures are about 7-8^0C warmer than they are today (108) There were periods of cooling and subsequent warming events but overall the Earth was equivalent to a greenhouse (107). These high temperatures were related to the increase of CO_2 contributed by volcanism from around the world, specifically the Deccan Traps, termed as flood basalt volcanism; this volcanism is believed to be a significant contributor to the mass extinction at the end of the Cretaceous (Tobin et al., "Extinction Patterns" 187,180). Temperatures started cooling by 8^0C, at least during the summer months in and around Montana's *T. rex's* neighborhood in the last 300,000 years of the Cretaceous (Tobin et.al,"Environmental Change" 351). These temperature variations and

the complications associated with it, were apparently taking their toll on life 65 million years ago (Horner and Lessem 155). The impact of the asteroid near Chicxulub, Mexico that is often cited as responsible for the extinction of the dinosaurs, evidently just finished them off (Tobin et al."Extinction Patterns" 180).The biota in the Late Cretaceous could do very little about the changing environment any more than we could stop the next episode of the caldera in Yellowstone National Park. But there are things we can do about our contribution of CO^2 and methane that is affecting our environment.

CHAPTER FIVE

MUMPSIMUS, THE ENVIRONMENT, AND THE MONKEY'S UNCLE

Who is this creature standing in the Museum of the Rockies? What are the known knowns. The skeletal structure of this *T. rex* classifies it as a gracile morph, identifying it as a male. He is around 38 feet long, 12 feet high. He weighs in around 10,000 pounds and was around twenty years old when he died.

He is biologically unique, as much an individual as any observer standing in front of him. He shares homologous skeletal elements with us, from his skull to his tail. Starting with the skull, we share a bi-lateral symmetry with this *T. rex*. What appears to be missing in our skull are the two bones that make up the joint between the jaw and the skull in *T. rex*. But humans and other mammals do in fact have these bones; their function is now different and the homologous bones are now part of the mammalian middle ear (Kardong 272-275). Embryological studies and fossil discoveries reveal these bones, the quadrate and articular, have "migrated" away from the joint and have been adapted for an auditory function. There are also obvious differences in our dentition, his are exclusively for eating meat and we have dentition for an omnivorous diet. As noted earlier, we also share with *T. rex*, homologous limb bones both front and hind; *T. rex* however has fewer fingers and toes.

T. rex is a distant relative, not through a direct line but through a shared ancestry. All life from its beginning, through the present, and to future generations, is literally related. This understanding brings a deeper meaning to the more familiar relationship we

share with the biosphere, referred to as the web of life. If we can understand our connection with the remains of a 65 million year old creature, seeing that we have the same skeletal structure, that we have the same bones, a few more or a few less, just in a different shape, how much easier is it to see this same relationship with today's living biota?

This insight reminds us that all our fellow human beings are literally relatives, as well. Each time we encounter a new person, we encounter someone with whom we share an ancestor. It may have been one thousand, fifty thousand, or over one hundred thousand years ago, that our multiple Great, who can count how many, Grandparents sat down together and shared a meal. It may have been on a different continent but somewhere, sometime there was a relationship. Each migration out of Africa tens of thousands of years ago (Postlethwait and Hopson 437-440) separated groups over time but now, as the world has become "small," we are bumping back into our long forgotten cousins. Much too often these encounters are not favorable; concepts of territory are not unique to any one culture.

Somewhere, sometime, hundreds of millions of years ago, Montana's *T. rex*'s ancestor and our ancestor were one. They scurried across the Carboniferous forest floor, searching for food, shelter, and a few moments of pleasure. That brief moment of pleasure gave rise to the countless generations that eventually gave you and me a turn in the biosphere. That Carboniferous ancestor was not human or dinosaur, but it was as biologically unique as each of us. The needs and desires may not have changed much but a lot has happened since then. Land masses have shifted, mountains were pushed up, and

soils were created and then eroded. Climates changed, temperatures rose and fell, plants and animals have come and gone. They adapted until they didn't. Earth has not been an easy place to make a living. That's one thing that hasn't changed.

Montana's *T. rex* lived and died on this planet we call Earth, traversing the State we call Montana; he may have even visited North Dakota a few times. He likely took a tour up into Canada, no passport needed. This place, his final resting point, was 762 quadrillion miles through space from where he was "discovered."

Americans have a history with this term, "discovered." Montana's *T. rex* had been there, in his final resting place, for around 65 million years. This was his locality, his place, until he was "discovered." Americans made many discoveries as they moved west. Not least was the discovery of this "virgin" landscape that stretched to the Pacific Ocean. What about those "discovered" cultures already inhabiting this landscape? I doubt they said "Hey, thanks for finding us." What if, when encountering this "wilderness," Euro-Americans could have recognized this land as place; recognized a land already seen by its inhabitants as place for tens of thousands of years. A "humanized landscape" a place where Native American Dennis Martinez asserts "[t]he North America that European peoples invaded and settled was not a 'virgin' land undisturbed by people. There was no 'pristine wilderness' here" (qtd.in Denevan 580). A place where unique individuals told stories, lived lives, loved children, formed families, communities, and nations; a place, the Northern Hemisphere, where an estimated 2 million people lived before 1492 (585). We cannot go back in time and experience how Euro-Americans, saw this land as space, something and somewhere to "tame," in which to start a new life and expand the nation

from this "raw land." But today we can acknowledge and examine the consequences of this brazen exceptionalism and also acknowledge and greet those same cultures who currently endure as nations within America.

Alexis de Tocqueville in 1835 wrote about North America as an "empty continent, a desert land awaiting its inhabitants…[this land] was inhabited only by wandering tribes who had no thought of profiting by the natural riches of the soil" (qtd.in Lord and Burke 22). A quote by Odessa Ramirez, a Native American activist in the 1990's, couldn't agree more with how the Euro-American people interpreted this land:

> Native American priorities and ways of thinking about the world we all live in are different from those of the Euro-Americans and their descendants. For instance, Native Americans believe that we were all put on this Earth as equals along with the plants, the animals, the elements, the air, the water, the wind, and Earth. One does not own the other. Rather, we gave and took from one another only what was needed to survive. Thankfully, there are those of us who still believe in these ways. But the white man came here in a search for gold and other precious metals….The white man sees as important only that which makes him wealthy or powerful in the material sense. Worse yet, the white man also sees his way as the only correct way (78, 79).

Tocqueville and Ramirez appear to be in agreement on the way Euro-Americans viewed landscape but disagree on whether this view was virtuous. Ramirez's statement may be an over simplification, since she presumes that all Native Americans shared the same beliefs; it also doesn't address the warfare and territory division that was present in North America's non-Euro-American population. But, her statement does highlight the different ways of interpreting land as place and space between the indigenous people and the Euro-Americans.

America's land, or "wilderness", has been interpreted in a variety of ways. Some saw this land as a potential for national identity and/or economic and/or political gain. In *Virgin Land* Henry Nash Smith reviewed Jackson Turner's "frontier hypothesis". Turner defined the frontier as the place where civilization and savagery made contact. This border was the division that defined two Wests: one of agricultural settlements and the other a West where the retreating line of free land began (251). This "free land" represented and was physically an area of immense wealth for the American nation. Turner believed this wilderness was:

> a bank account on which…[Americans]…might continually draw to meet losses. This was the vast unoccupied domain that stretched from the borders of the settled area to the Pacific Ocean….No grave social problem could exist while the wilderness at the edge of civilization [*sic*] opened wide its portals to all who were oppressed…Here was a magic fountain of youth in which America continually bathed and was rejuvenated (254).

But this wilderness was not unoccupied; it was already a "humanized landscape". In *The "Pristine Myth" Revisited*, William Denevan surveyed several interpretations of wilderness, a term with many meanings. After his first paper in 1992 when he coined the term "pristine myth", challenging the notion that America was a pristine place before Columbus, Denevan "maintained that by the time the first Europeans arrived in the New World its environment had been modified to varying degrees in most places by settlement, subsistence, burning, and other activities of Native Americans" (577). His point was that America was a "humanized landscape"(another term he used) and this understanding of pre-Columbian place was not being recognized within either the public or academia. Denevan does allow for a difference in scale, however, quoting towards the end of his second paper part of a statement by D. Griffen: "acknowledg[ing]… 'however

intensive native peoples' landscape manipulations may have been, they [mostly] fade to insignificance in comparison' with changes by modern people" (586).

Today these modern people, Americans, are reaping the consequences of the changes that we and past American generations have made to our landscape. The consequences have arrived as an environmental crisis. If this crisis is not seriously addressed, it has the potential to mirror two previous mass extinctions. One occurred at the end of the Cretaceous and the other at the end of the Permian; both had high levels of CO_2 in the atmosphere and the oceans (Tobin et. al, "Extinction Patterns" 180).

A mass extinction is not an event, unless we are talking about an asteroid impact; a mass extinction is a process which happens over considerable time, at least in terms of human life spans. This expanse of time is problematic for a species that starts losing its brain plasticity in young adulthood. Humans appear to adapt to a changing environment one generation at a time, which is a problem when facing a crisis like global climate change. The consequences of today's behavior will be a reality for future generations, in the same way that we are experiencing today the consequences of decisions that previous generations have made. Data compiled by NASA confirms arctic temperatures are warming, sea levels are rising, glaciers are melting, and the oceans are acidifying (*The Official Web Site of Global Climate Change, NASA*). The climate on planet Earth is changing. This change is difficult to recognize for those who confuse local weather events with overall climate change. As previously discussed, we tend to look for answers to hard questions by finding data that confirms our preconceived views. This confirmation bias may have helped our species survive in prehistoric times but it is not

helping us today. The quote often attributed to Mark Twain sums this up, “It ain’t what you don’t know that gets you in trouble. It’s what you know for sure that just ain’t so” (Marks 150).

Another lack of response to a challenge occurs when those who do understand the predicament we are in, experience cognitive dissonance or mumpsimus: we know something should be done but we leave it for another day or for someone else. Because of these behavioral predispositions, I believe we respond better to a challenge if it arrives as an event, rather than a challenge that arrives as a process, and global climate change is a process. Because it is arriving as a process, to address the challenge of global warming, we need to have an understanding of the cause.

Global climate change is caused or at least exacerbated, by the energy we consume. The byproduct of this energy consumption is CO_2 and one of the consequences of the increase of CO_2 is an increase of methane. Both are currently contributing to the warming of the planet today just as they contributed to global warming in the distant geological past. The creatures from the past may have contributed methane to their environment through digestive means but they were not burning fossil fuels. The CO_2 of their time was coming from volcanism. The creatures from the Cretaceous and Permian couldn’t do anything about those volcanoes, but we can do something about our energy consumption. It is simple but not easy; each individual can choose to use less energy.

In order to subsist, societies have to live within the parameters of their environment. A society’s survival is directly dependent on the available energy/caloric resources, whether that energy comes directly from the flora and fauna consumed or from

an intermediate (external) energy sources that are adapted to help procure the required calories. An intermediate energy source could be oxen or horses, fire, and/or fossil fuels. Whether through direct or through intermediate sources, the energy or calories acquired have to be equal to, or greater than the energy or calories expended to acquire the sustenance needed for survival. Montana's *T. rex*, in order to survive while he was traversing his environment, required more energy/calories returned from consuming his prey than the energy/calories he expended or invested in procuring those potential calories. This is energy return on investment [EROI]. Modern societies also have similar restrictions. But with the discovery of calorie dense fossils fuels, the gap between the minimum energy required for survival, and the total calories, internal and external, actually used for survival grew exponentially.

The manipulation of external energy may have started with fire but with fossil fuels you can do more than heat a room or cook a meal; they can produce the equivalent of human labor. Investigative journalist Andrew Nikiforuk surveyed the historical association humans use of fossil fuels in *The Energy of Slaves Oil and the New Servitude*. By the 1880s steam powered machinery, running a 16 hour shift was producing the equivalent of 150 million horsepower, or the work of 3 billion people (22). That is a sizable increase in the work force. Fast forward to America today consuming an estimated 7.8 billion barrels of oil a year; there is an equivalent of a little over 7 years of human labor in a barrel of oil (65), which multiplied by our consumption, equals 54 billion years of human labor used every year. This is based on the average American, around 300 million citizens, using a little over 26 barrels of oil a year. Another way to

look at it, is that equates to about 89 virtual slaves for every American citizen (65). In the 1940s it was estimated, based on the world's energy consumption including hydro power, that there were close to 38 billion inanimate energy slaves in use and that the United States "owned" 54% of them (69).

In the 1960s a petroleum geologist calculated the energy it would take for Mother Nature to create a gallon of petroleum; photosynthesis, heat, and pressure over millions of years were included in his calculations. For humans to accomplish this same thing, the actual cost of creating a gallon of petroleum was estimated to be $1 million (69). Americans are currently paying around $2.00 to $3.00 a gallon for gasoline, which is quite a bargain.

That production to purchase price difference, paraphrased in the words of Dr. Ron Lamb from Southern Oregon University, is how we are able to create the machinery to plow and harvest, produce the chemical fertilizer, pump the water, produce, package, and deliver a loaf of bread for around $3.00. The Calories to produce that entire infrastructure are exponentially more than the few Calories consumed in a sandwich at lunch time (R. Lamb, personal communication 1983). If we use that loaf of bread as an example, it currently takes 6000 Calories to produce a loaf of bread that contains around 1500 consumable Calories. That figure does not include the Calories used to create and maintain the infrastructure to manufacture the equipment that is used through the complete process of bringing the grain to the bakery (Hendrickson). It is helpful to be aware of these externalities associated with fossil fuels, because it appears we are at peak oil; according to systems ecologist, Charles Hall, the EROI for oil stared out in the

United States at 1000:1 and is now 3-5:1 for "tough" oil, like tar sands, etc.(qtd.in Nikiforuk 214,216) . Unless there is a conspiracy suggested by Lindsey Williams, in *The Energy Non Crisis*, to keep the oil wells capped (Williams 1-20), or oil is created by inorganic means referred to as abiogenic oil, which has been discredited (Glasby 85); or there is an infinite supply of oil beneath the earth's crust, which seems unlikely on a finite planet, we will eventually have to replace this energy with an alternative. That is, we must find an alternative if we want to keep our current life style and protect the environment. But is that even possible?

There are economic parameters like EROI and environmental costs that need to be considered for green energy just as with fossil fuel use. There is an enormous amount of energy "floating" around out there; all we have to do is tap into it, or so the saying goes:

> …any physicist can explain how a single twenty-five-cent quarter contains enough energy bound up in its atoms to power the entire earth, but since we have no way of accessing these forces, the quarter remains a humble coin rather than a solution to our energy needs (Zehner 8).

Alternative energy sources are heavily dependent on oil for their manufacturing and that manufacturing itself takes a toll on the environment. Ozzie Zehner points out in his book, *Green Illusions* that the externalities of green energy are hidden behind subsidies and their environmental impacts are not considered (17-28, 63-64, 103, 134-35).

Without considering the externalities associated with solar panels, there appears to be "enough solar energy reaching the earth each hour to power the world economy for one year," according to Lester Brown (qtd.in Zhener 8). There is no question that there is an abundance of sunshine but how can it be harvested? There are claims made by Bjorn Lomborg, stating if less than 3% of the Sahara Desert were covered in solar panels it

would power the world (qtd.in Zhener 8). Zehner points out that both of those statements are somewhat true. It is true that the amount of sunlight arriving on that small area in the Sahara is equivalent to the energy that the world consumes, but how would that energy be harnessed, keeping in mind EROI and our current technology? What kind of investment would be required to bring it online? If the costs of the solar cells, including mining, manufacturing, and processing, plus the costs of the batteries were totaled, the price tag would be $123 trillion. The yearly maintenance would be a little under $700 billion. But based on smaller projects in California, a more realistic estimation puts it closer to $1.4 quadrillion. The manufacturing and installation of the panels would also pump 149,100 megatons of CO_2 into the air. This does not consider the environmental costs of the mining and/or the waste disposal created by the project. Finally, anyone who wanted to be an energy customer of that project would have to live near the solar plant, in the desert, because transmission of the power further out would be unfeasible (Zehner 1-30). Zehner, in *Green Illusions,* also covers related externalities that are associated with wind, nuclear, and other "green" technologies.

Calorie dense fossil fuels cannot be replaced by any known alternative energy sources. And believing "someone will eventually figure something out" is not a good back up plan. What is America going to do?

This predicament, in part, has its roots in America's past relationship with Exceptionalism and the development into exemptionalism. In a paper by An American lawyer, Harold Hongju Koh, *On American Exceptionalism*, he quotes historian Margaret MacMillian:

> American exceptionalism has always had two sides: the one eager to set the world to rights, the other ready to turn its back with contempt if its message should be ignored….Faith in their own exceptionalism has sometimes led to a certain obtuseness on the part of Americans, a tendency to preach at other nations rather than listen to them, a tendency as well to assume that American motives are pure where those of others are not….(1480).

America's view of its self goes beyond the above duality; it also uses its "exceptional powers and wealth to promote *a double standard*" (1485) "ways in which the United States actually exempts itself from certain international law rules and agreements, even ones that it may have played a critical role in framing" (1482), including the Kyoto Protocol. This is what Harvard professor Michael Ignatieff calls American Exemptionalism as opposed to exceptionalism (1482). This political definition of exemptionalism plays out in the environmental arena as well. Because of our exceptional "ingenuity, technology, creativity and economic system" we are exempt from the physical laws that all other species adhere to within the biosphere. And "resource depletion is irrelevant because alternative resources will be developed if there is enough demand backed by money" (Cairns 331). This Exemptionalism has now brought us to the point of testing those beliefs; to throwing more money at some newer technologies that will fix the predicament older technology brought us to.

The deep-rooted identity of exceptionalism and its offspring exemptionalism was in full force during the George W. Bush administration. There were many reports and articles written concerning the administration's suppression of federal scientist's reports on climate change. In Aaron McCright and Riley Dunlap's *Anti-reflexivity -The American Conservative Movement's Success in Undermining Climate Science and Policy* it is

argued that these alleged offences, the "altering, distorting and suppressing [of] scientific findings for government reports", were instigated by the administration "to protect the industrial capitalist order" (101).

American Exceptionalism is still alive and well. An Australian, now citizen of the U.S., Rupert Murdoch made a speech at the Hudson Institute in December of 2015:

> Before I thank Henry Kissinger, and before delivering my modest message, I feel obliged to alert college students, progressive academics and all other deeply sensitive souls that these words may contain phrases and ideas that challenge your prejudices. In other words, I formally declare this room an "unsafe space"…. For America to be embarrassed by its exceptionalism is itself exceptional and absolutely unacceptable. In his great book "World Order," Henry [Kissinger] writes: "The affirmation of America's exceptional nature must be sustained." He continues: "As the modern world's decisive articulation of the human quest for freedom and an indispensable geopolitical force for the vindication of humane values, America must retain its sense of direction (Murdoch).

If America is exceptional, perhaps this is the time to lead. Not in the simplistic and binary way Murdoch presents or in the past style that led to exemptionalism (the notion that we are exempt from the limits or constraints others are obligated to adhere to) or in the nationalistic and parochial style suggested by Murdoch's words "The world, as we know it, depends upon our great country" (Murdoch).

Instead of, being a light on the hill for the world to see, maybe it is time to be a light for ourselves: a time for reflexivity, not to turn inward into isolationism, but a time to self-reflect on how we arrived at this place, at this time. Utilizing Gadamer's hermeneutic circle we can transform our nationalism into an I-thou relationship with the rest of the world, through a process of understanding the parts of who we are in order to understand the whole and in order to understand the whole we commit to understanding

the parts. This is in contrast to an I-it relationship with the world that allows us to be seduced into thinking the world cannot go on without us as Murdoch suggests:

> …importantly, there is a yearning outside the country for American assertiveness and engagement. As we have seen in Syria and in Ukraine and in the streets of Paris, without this country's self-confident championing of that "human quest for freedom and humane values," global affairs collapse into nightmare—the policy wasteland becomes fertile territory for terror (Murdoch).

This self-reflection begins by examining our international policy specifically as Murdoch points out, our involvement in Syria and in Ukraine. Or we could look at the recent newspaper article about the housing shortage on the Pine Ridge Reservation where people are sleeping in the back seats of vans and in plywood-walled shacks (Nord), to access Murdoch's point about America's "self-confident championing of that 'human quest for freedom and humane values'" (Murdoch). And as he suggests, we should also look to our past:

> We are all often struck by the exceptional qualities of America and by the exceptional and selfless influence America has exercised on the world. We can idly and mildly joke, but if it were not for U.S. intervention in the Pacific, we Australians would not speak with our distinctive drawl, but in the rather polite verb endings of Japanese (Murdoch).

We should indeed look at World War II and other wars and recognize the sacrifices of the individual soldiers, sailors, and Marines while also recognizing the individuals "back home". Whose family past or present has not been affected by our wars and conflicts? But instead of accepting a simplistic phrase pandering to national pride, we could look at the context of the war in the pacific and recognize that war should not be used to rally national identity. Our time of national sacrifice also encompassed a past that some would rather not talk about: towards the end of WWII, speaking of America's fire-bombing of

Tokyo, General Curtis LeMay said "If we'd lost the war, we'd been prosecuted as war criminals" (qtd.in Blight and Lang 113). Nor is it helpful when war is used to vilify an opposing political party. Again, from Murdoch's remarks:

> In the 1960s and 1970s, America intervened in Vietnam, an intervention that has been caricatured and distorted in the days since. The left seemed to be happy for the incarceration of millions, whether in Vietnam under Ho or in China under Mao. Why agonize over inhumanity when you could blithely celebrate yourself? (Murdoch).

Murdoch would be hard pressed to find anyone outside a mental facility who would "be happy [to see]…the incarceration of millions, whether in Vietnam under Ho or in China under Mao" (Murdoch). or anywhere else in the world.

Murdoch goes on to invoke terrorism, "land of the free; home of the brave", Ronald Reagan and America standing firm against the Soviet Union, America providing "a stable background for the rise of China, which went from the impoverishment of mindless ideology to the magic of market forces", and he finally notes the EPA's inability to regulate "fracking" and suggests that the Government agency's initials should actually stand for Environmentalists Punish America (Murdoch). The only thing he doesn't mention is space, maybe because America is now hitching a ride with the Russian space program. Space, however, is actually where we may be able to profoundly understand the way in which we truly are exceptional.

Instead of blindly accepting America's recent exceptional legislation which allows private companies to mine resources in outer space, possibly violating the Outer Space Treaty of 1967, we could look to the universe and see how truly exceptional we are.

Dr. Peter Ward, a professor of geological sciences and Dr. Donald Brownlee, a professor of astronomy present the Rare Earth Hypothesis, a case for just how exceptional Earth is in the universe. In their book *Rare Earth,* subtitled *Why Complex Life is Uncommon in the Universe*, the authors survey the parameters necessary for complex life to exist, as we know it. Although the number of planets in the Universe is inconceivably large the Universe appears to be finite, meaning that there are not an infinite number of planets for complex life to have evolved on (278). It also appears that there is only a "substantial fraction of stars that [actually have] planetary systems", somewhere around 5-6% (268). The amount of metal in both stars and planets affect the likelihood of animal life. Metal-poor stars decrease the probability of life because they affect a planet's ability to retain water for oceans, develop an atmosphere, or have plate tectonics, all critical to the evolution of complex life. Research has shown that "entire [known] galaxies are metal-poor and hence likely devoid of animal life" (31). There are also narrow "habitual zones" within a solar system as well as within a Galaxy, and a large moon is also required for a planet to have a stable climate (266).

Even if all the parameters for an Earth-like planet were met, the planet would still have to maintain a hospitable environment long enough for life to evolve; on earth, the planet was void of complex life for three and a half billion years. Ward and Brownlee present a well-researched hypothesis that suggests complex life, as we know it, is extremely rare in the universe; they estimate that there may be only a few thousand planets that have evolved advanced life forms (271). If their hypothesis is true, that is an exceptionalism we may want to explore.

As Americans, by understanding Ward and Brownlee's "Rare Earth Hypothesis," we can redefine our national identity, having come to know that there is a deeper meaning to exceptionalism. We can go beyond the insular national identity defined by American exceptionalism, a notion that can be located in the Republic's founding as a chosen people in the promised land, "…the belief that the United States exhibits a form of greatness that should draw all other nations into the orbit of its influence. Enlightened nations that understand where their true self-interest lies will voluntarily align themselves with this greatness…" (Helmuth 1).[1] There is an alternative to this view of exceptionalism that is shared with Montana's *T. rex* and all our past, present, and future generations; an exceptionalism that goes beyond the national identity that led to exemptionalism in our past. We can also understand that there is no room for exemptionalism on a finite planet, redefined as place. And we can accept an alternative exceptionalism that recognizes the rareness of our existence and our interrelatedness with all life, rather than our otherness, in a shared biosphere, on this exceptional planet, Earth.

[1]For specific examples of American exceptionalism including the concept of "the right of eminent domain" see , Keith Helmuth, "American Exceptionalism and Human Solidarity," *Quaker Eco-Bulletin*. 4:5, (September-October 2004), pp.1-4. Also see, relating to the issue of nativism, Eric Kaufmann, "American Exceptionalism Reconsidered: Anglo-Saxon Ethnogenesis in the "Universal" Nation, 1776-185," *Journal of American Studies*. 33:3 (December 1999), pp.437-457.

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