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APPROVAL

Of a thesis submitted by
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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, formant, citations, bibliographic style, and consistency and is ready for submission to the Division of Graduate Education.

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Fig. 1  Google Earth images showing location of San Rafael Swell
Located near the edge of the North American Plate, in the great west of the United States, is an area known as the Colorado Plateau. Encompassing four states Utah, Colorado, Arizona, New Mexico, it is also known as the four corners region. This Area has been widely recognized as one of the most powerful landscapes in the world and holds special meaning to the Native peoples of America. It is an area which is known to produce irregularities in the earths geomagnetic field. These irregularities have been described as many different things from spirits to extraterrestrials. More notably known for it’s unique and diverse geology, this area is home to the Grand Canyon. It provides one of the most elaborate timelines of the earths history known. Near the western edge of the Colorado Plateau is an area of Utah known as the San Rafael Swell. It is a dome shaped anticline approximately 70 miles long and 40 miles wide. The area was thrust upward nearly 2000 feet above the surrounding desert and has since been eroded into a natural spectacle which defies verbal description. The forms and powers of this land have drawn people for thousands of years and are at the epicenter of a debate about proper land use. The area is caught in a battle between ranchers, miners, environmentalist, and recreationists. Currently it is under the jurisdiction of the BLM but is being investigated as a candidate for National Monument Designation. The goal of this thesis is to develop a project which exposes the essence of place through a scaled experience of the process of erosion. By eroding through the interwoven layers of human striation upon the land, a theoretical smooth space emerges. At this point the land in understood as a continuously changing entity of large scale systems. The human ability to comprehend the vast scale of these systems is directly related to our ability to recognize rhythms and patterns based on human scale units of measure. We can abstract these patterns in the form of architecture which will then interact with the large scale process of erosion. This interaction will create new patterns which can be re-shaped into architectural form. This cycle will help to reconnect man with nature both physically and mentally providing a deeper understanding of our role in the greater scheme of things and a better understanding of the scale of our place in this universe.

1 Gallagher talks about these geomagnetic fields and their effect on humans on Pg 22
Fig. 2  Google Earth images showing scale structure of sand dunes in the Sahara desert of Africa.
The term absolute possesses several meanings, some of which can be contradictory, so it is important that to clarify how absolute is defined in this thesis. Deleuze and Gauttari in *A Thousand Plateaus* refer to smooth and striated space. They refer to smooth space as being heterogeneous, described by a felt or patch work, rhythmic values, and continuous variation. Striated space is homogeneous, described by weaving, melody and harmony, and metric constants. The main difference then is unpredictable, ever-changing, chaotic space vs. predictable, everlasting, ordered space. In striated space the absolute is defined by a point of singularity and perfection. This is experienced through relative globalism, or orientation in relation to a set of constants. These constants are segmentations created by humans based on a set of values. Historically, relative globalism was achieved through visual landmarks, or relation to stars. As technology progressed, the development of longitude and latitude lines allowed for better mapping of the land. Most recently, the Global Positioning System or GPS uses a complex system of satellites to pin point specific locations. In smooth space, absolute is defined by a nonlimited locality. This is experienced through absolute localism or orientation in relation to a continuously varying set of local conditions. For example, the nomadic hunter is continuously orienting himself to a migrating herd of animals. In these definitions, absolutes are extremes. This thesis argues that the true absolute lies on a sliding scale between the extremes of smooth and striated space, globalism and localism, order and chaos. In my reasoning, absolute is defined by a nonlimited place of singularity, which occurs at an infinite variety of scales. The absolute is experienced only in the present and at one scale, but exists at a variety of scales in both the past and future. This place is experienced through continuous orientation within an ever-changing environment in relation to abstract rhythms and patterns based upon scaled units of measure. Experiences as events are defined by Yi-Fu Tuan as, “modes through which a person knows and constructs a reality.” Experience as an action implies venturing into the unknown and experimenting with the uncertain. As time goes on these experiences become only memories. Memories of the past serve as units of measure to which humans compare future experiences. In this way they allow us to orient ourselves in time. Humans apply this same concept to orient Themselves in space. In his book, *Towards A New Architecture*, Le Corbusier imagines a primitive temple and how it’s walls are laid out based on units of measure. These units of measure are based on the constants of human proportions such as the body, foot, hand, and finger. Rhythms appear in the layout as relative distances of various objects in relation to one another. By ordering the space in such a way, the temple carries a sense of human scale and creation rather than natural scale and creation. Human creations such as architecture cannot reproduce forms created by natural process, nor can natural process reproduce forms created by human activity. Humans can abstract natural patterns using scaled units of measure to create architecture. The architecture can then provide an ordered framework around which natural processes are allowed to flow. The interaction between them creates new rhythms and patterns which can then be re-abstracted into architecture. By emphasizing the cycles of continuous variation through a scaled experience of space and time, architecture becomes absolute.

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1. The discussion about smooth and striated space is described in great length, they give several examples which are helpful in understanding the concept for further reading see Pg 488
3. These two different absolutes are discussed further along with derivations and examples on Pg 382
4. Yi-Fu Tuan very clearly lays out the basis of human experiences looking at development and various ways in which we shape our experience Pg 8
6. His idea of the primitive temple is more in depth I have abstracted it looking for certain information for the complete text see Pg 69-72
Fig. 3  Google Earth images of San Rafael Swell with highlighted areas of specific time periods, starting top left with the oldest and ending bottom right with the most current.
The physical landscape we see today at the San Rafael Swell emerged out of a complex interplay of physical systems. Plate tectonics force land to shift, crack, swell, fold, and curl. Weather patterns bring wind and rain which slowly eat away at the land. Various forms of life inhabit the land, each altering it if even in the most minute way. These are all components which control the amount of erosion which occurs at a place. Erosion generates a wide diversity of soil types and shapes. It is then a mechanism by which place emerges in smooth space. It serves as a leveling mechanism moving sediment from high lands to lowlands. The process is both subtractive and additive, and occurs at a variety of scales. At one scale wind can move a single grain of sand, at another scale, wind can shift entire dunes. The rate at which something changes can serve as a measure of time. Therefore time also occurs at a variety of scales. At the scale of moving a grain of sand, time is relatively short. At the scale of moving entire dunes, time is relatively long. Humans experience a specific degree of erosion and time, based on human scale. The forms which exist today represent only a small point along the sliding scale of physical emergence. Thus to better understand the rhythms and patterns which emerge from the land one must look at a larger scale of time and investigate the interplay between the various systems of erosion at this scale.

The following section on physical emergence of place is a hybrid between several sources which illustrate generally accepted theories. Theories such as Continental Drift or Plate Tectonics and Evolution have multiple viewpoints which argue specifics about how each operate, but the general principals remain similar. It is also important to note that the time scale of these events is completely different than that of human perception. The events happen so slowly, humans see a relatively unchanging earth in our lifespan, or even with in the span of human civilization. The timeline presented here is generally accepted by a large percentage of scientists. For further reading see:


Geologic History of the San Rafael Swell By A. Lynn Jackson, BLM in the book
Fig. 5  Offshore spit of land caused by sediment from runoff in shallow sea conditions.

Fig. 6  Estuary at Copper River delta in Alaska showing deposited sediment from mountains.

Fig. 7  Ancient shoreline along base of a recent uplift.

Fig. 8  Dried lakebed being filled with sediment from eroded mountains.
During this time the area of the San Rafael Swell was located near the equator.¹ The area was part of a vast continental margin or seaway which ran from Alaska to Mexico. Geologists call this a Cordilleran Geosyncline, which is described as a deep linear trough where thickened sequences of stratified rock were deposited over long periods of time.² At times the sea would completely cover the area and deposit thick marine sediment. At other times it would retreat, leaving the area exposed to the forces of erosion. The cause of these recessions is believed to be connected with climate shifts and plate tectonics.³ It is from this sea that the beginnings of single cell organisms started to emerge. These organisms slowly evolved and began to diversify in form and function, and developed into marine invertebrates and eventually vertebrates. With each recession, organisms began to adapt to life on land.⁴ At the end of this era there was a great uplift which forced the land upward forming the Paradox Basin, an isolated sea which evaporated leaving huge deposits of salt and gypsum. Over the course of time more and more layers built up, compressing the layers beneath them. They would eventually harden under extreme heat and pressure and form complex systems of granite and other metamorphic rock. Only rock from the very end of this period is exposed at the Swell.

¹This is based on the present day, widely accepted, continental drift theory, which Barnes describes in brief summary on Pg66.
²Barnes suggests that astronomic events such as solar flares and sunspot activity could contribute to long term climate shifts Pg 65.
³This is partially based on the theory of evolution but primarily based upon fossil records and findings of geologists worldwide. Pg.15-17
²Geologic History of the San Rafael Swell By A. Lynn Jackson, BLM in the book
Fig. 12  Draining lowlands showing fractal-like erosion patterns.

Fig. 13  Tidal flats as the water recedes exposing rippled patterns in mud.

Fig. 14  Tidal flats which have been exposed long enough for plants to start growing in mud.

Fig. 15  Vast swamplands with dense vegetation and rich with biodiversity.
By this time the San Rafael Swell had drifted roughly to its current position. At the beginning of this era, the land was covered by an estuary where a shallow bay met a river delta. The sea continued to retreat, and exposed giant mudflats interlaced with meandering freshwater streams.\textsuperscript{1} These mudflats consisted of marine deposits and the eroded sediment of nearby highland mountains, which had recently been uplifted; the primary force of erosion was water. By this time life on land had evolved into the first mammal-like reptiles and soon into dinosaurs. Vast swamps and sluggish streams created a warm humid environment perfect for thriving plant and animal life.\textsuperscript{2} When the sea receded, the land would dry into an arid land of shifting sand dunes; the primary force of erosion in this case being the wind. In its last invasion, the sea rose nearly 1500 feet bringing with it marine deposits. The sea gradually retreated, creating a vast marshland once again. Organic matter from the marsh would later be covered by volcanic ash, blown in with the wind, and sediment from the highlands, carried down by the water, to form coal and oil.\textsuperscript{3} These forces of wind and water erosion have deposited layer upon layer of sediment over the area of the San Rafael Swell. At the end of this period, a cataclysmic geological event caused the earth’s plates to accelerate, which caused immense pressure on the west coast of the United States.

\begin{itemize}
    \item \textsuperscript{1}Lapses in the geological strata called unconformities exist during these times. Pg 17-19
    \item \textsuperscript{2}These conclusions were drawn from various fossil records which are found in geological strata which represent a certain time period. Pg 19-20
    \item \textsuperscript{3}The coal and oil are the remnants of carbon based life forms such as plants and animals. Pg 21
\end{itemize}

Fig. 19  Alluvial fan showing eroded deposition of eroded mountain sediment.

Fig. 20  Alluvial fan showing eroded deposition of eroded mountain sediment.

Fig. 21  Glacier flowing like a current toward the ocean, carving giant canyons on its way.

Fig. 22  Geologic fold or thrust-belt were earths crust buckles under extreme pressure.
Pressure from the Pacific plate traveled eastward until it ran into the thicker Colorado plateau. The pressure triggered volcanoes to erupt all around the edge of the Colorado plateau, as well as slow but violent uplifts such as the San Rafael Swell. The pressure continued to grow from the west, causing the entire region to uplift. As the ground swelled from below, the newly formed upper layers broke apart, giving way to the older strata. This uplift created more violent weather patterns which accelerated erosion in the area. Immense rains slowly ate away at the growing swell. The water-borne sediment filled the low-lying areas and created large shallow lakes. Around 11 million years ago, the entire region west of the Sierra Nevada mountains was raised about a mile, once again changing the weather patterns. The colder, harsher climate also changed the survival patterns of life on the land. Warm blooded mammals such as mammoths, bears, and horses, started to dominate the high grasslands. Toward the end of this period, the world was facing the onset of a major ice age. Glaciers came to be the dominate force of erosion as they moved like giant bulldozers over the earth. Then, as the glaciers melted, their runoff would create raging rivers which cut deep into the earth. It was during the ice age that a bridge between Asia and North America formed. Nomadic humans followed migrating animals over the bridge. Humans began to alter their surroundings increasingly and became one of the primary forces of erosion in the years to follow.

1 Barnes goes into a detailed timeline describing specific events which cause the pressure from the west and the rise of the Swell Pg 22, 77
2 Most geologist are at a loss in describing what caused this regional uplift, one theory is that the region passed over a zone of previous sea floor spreading. Pg 79
3 Barnes describes in detail the various ways both directly and indirectly that man has either accelerated or created a new means of erosion. Pg 81-84

Place thus far has been discussed as it relates to large scale, complex, physical systems. In order to understand the sense of place, one must look at place as it relates to the human experiential perspective. Each person has a unique perspective based upon life experiences. Experiences are modes through which a person knows and constructs reality. Each person’s reality is constructed by abstractions supplied to their brain, by their sensory organs. These abstractions can be tinted by various value systems, such as emotions, spirituality, philosophy, ethics, and reason. As these experiences shape our perspective, they become only memories. Experience as an action implies venturing into the unknown and experimenting with the uncertain. Memories serve as units of measure to which we can compare new experiences, thus they become a mechanism by which humans can comprehend the unknown. This same principal is applied to most human activity. To understand immense distances and vast amounts of time, humans have developed units of measure which reflect a more human scale and can therefore be more easily comprehended. Therefore everything humans understand of a place is filtered through the lens of human scale. Humans systematically segment smooth space to create striated space. With each overlay of striation, humans become more disconnected from smooth space which occurs at varying scales, and more self absorbed in striated space which occurs at the human scale. As with most systems in the desert, one must look closely to notice the subtle striation of space. The following chapter will trace man’s experiential perspective in the San Rafael area to reveal the current level of striation which exists today.

1, 2 Yi-Fu Tuan very clearly lays out the basis of human experiences looking at development and various ways in which we shape our experience Pg 8
3 Tuan further elaborates on the idea of experience in its active sense on Pg 9
Fig. 26  Reconstruction of a Fremont pit house.

Fig. 27  Various Rock art of the Fremont culture, showing abstract representations of animals and possibly the Cosmos.
The first known humans to arrive in the San Rafael Swell were the Paleo-Indians. They were a nomadic people who followed big game as they migrated over the arctic land bridge.¹ With their memories of crossing arctic lands to serve as a unit of measure, their experience of this land must have been one of great prospect. Always on the move, their day to day experience was constantly changing. The Paleo-Indians’ place existed largely in smooth space with emphasis placed on the paths of continuous variation. As the big game of the ice age began to disappear, the Archaic culture had adapted to a different way of life. They then had to rely on a wider variety of plants and animals to survive. Still a highly mobile people, their experience eventually gained them the knowledge of where to go to gather different plants at different times, based upon memory.² The Archaic peoples’ place existed minimally in striated space; their paths became segmented by specific points, although emphasis was still placed on the path. Around 1,600 years ago a new culture was emerging. This culture seemed to be a hybrid between the southern agricultural tribes and the northern hunter gatherer tribes. They adopted the sedentary lifestyle of the Anasazi, but retained the flexibility of the great plains hunter gatherers.³ Many of the traditions were kept alive by highly expressive rituals, depicted in their elaborate rock art, and passed down from generation to generation. The rock art also contains anthropomorphic figures, and geometric shapes such as wavy lines, zigzags, rainbows, and concentric circles, which appear to be abstractions of reality.⁴ The Fremont peoples’ place existed partially in striated space and partially in smooth space. Their paths became overshadowed by points of settlement and they began to use symbolic creations to quantify their experiences. These cultures lived in relative balance with this place for thousands of years, but would soon experience a change so rapid and unknown that memory would serve them no help in comprehension.

¹This theory is based on archeological findings such as the projectile point. It should be noted that another theory exists which suggests that humans migrated up from South America. For more information see: http://en.wikipedia.org/wiki/Paleo_indian
²The Archaic culture had several different phases which archeologists distinguish by variation in projectile point refinement, and architectural styles, which tell of lifestyle changes believed to reflect subtle climate changes. Pg 17-18 Geary, Edward A. A History of Emery County. Salt Lake City, UT: Utah State Historical Society Emery County Commission, 1996.
³There are two distinct types of Fremont culture each of which have five regional variants, here I am focusing on the San Rafael group Pg 13-17
⁴Many theories exist which speculate as to the meaning of rock art, some Archeologist believe these figures to depict creation stories and celestial bodies, others feel we read too much into them. Pg 45-57 Houk, Rose. Dwellers of the Rainbow, Salt Lake City, UT: Lorraine Press, 1988.
Fig. 28 1807 Map of internal Provinces of New Spain

Fig. 29 1882 map of grand canyon area as result of Powell expedition of the Grand Canyon.

Fig. 30 USGS summary map of expedition routs from 1541-1844

Fig. 31 1882 sketches which were part of the Powell expedition.
Starting around the 1700s the Spanish explorers were seeking trade routes between California and New Mexico. The Swell and surrounding area presented a significant challenge to cross country travel. For this reason, it was largely unexplored until the arrival of the first Anglo-American explorers in the early 1800s. As part of the territorial expansion of the United States, these explorers sought to map the new territory and determine a path for the transcontinental railway. They set out to find the most direct route between points. Their techniques were rudimentary by today’s standards, but at the time represented a high degree of sophistication. Using landmarks and relative distances between them, the explorers would map out, using a grid system of latitude and longitude lines, an abstract representation of their experience. This representation would reflect their values. For instance, they would pay special attention to rivers and mountains which would pose technical challenges to construction of the railway. The Early explorers’ sense of place was largely striated. The path was an ordered mapping between points, created by an abstraction of the land into a set of human values. J.W. Powell described the area as, “a land of desolation, dedicated forever to the geologist and the artist, where civilization can find no resting place.” At the end of the 1800s civilization found a resting place and further segmented the land.
Fig. 33  Early USGS maps marking areas of geologic interest.

Fig. 34  Photo showing early oil drilling rig in San Rafael desert.

Fig. 35  1895 map demarking early emery county boundaries.

Fig. 36  Early photos of settlements surrounding the San Rafael Swell
Around the 1870s by order of Brigham Young, the Mormons came to settle in the area. They had found areas where farming and ranching would be feasible surrounding the Swell and near rivers. These lower valleys surrounding the Swell also served as the summer grounds for livestock, while the Swell served as the wintering grounds. By the late 1870s, plans for irrigation systems were developed to increase the amount of farmable land. J.W. Powell proposed strict size limitations and organization of farms based on irrigation systems, to maximize productivity of the crop. The early Mormon settlers' sense of place existed in a striated space, segmented by homesteads, fields, pastures, and towns—abstractions of the land based upon agricultural values. In the early 1900's a growing America needed natural resources. People began to realize the quantities of natural mineral resources buried beneath the earth. The area was mapped out again and this time value was placed on mineral deposits. Almost every kind of mineral has been mined at some point, in and around the San Rafael Swell, including gold, silver, copper, lead, zinc, gypsum, sulphur, coal, uranium, oil, and even helium. Various prospectors and multinational companies claimed mineral rights all throughout the area based upon values of mineral wealth. The prospectors and miners experienced place within a striated space of abstract territorial claims based on natural resource value. Throughout this time period place was formed in a highly erosive way. Overgrazing, irrigation, and stripping the land of its resources would all serve to spur the upcoming series of striations upon the land.

Fig. 37 Early photos of the mining and ranching industries in and around the San Rafael Swell

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1. This was one of the last valleys to be colonized, due to its rugged remote location. It was part of a larger Mormon colonization of the state in which 400 towns and villages were established in 30 years. 
Pg 58-60

2. This plan was part of J.W. Powell’s Report on the Lands of the Arid Region, in which he concluded that the homestead laws were poorly adapted to arid regions such as Utah. Pg 84

3. Over the year thousands of claims have been made very few have produced long term economic success. Geary gives several examples of this boom and bust development in the San Rafael area. Pg 204-211

Fig. 38  Recreational guide maps for visitors to the area highlighting designated areas for preservation and recreation.
The most recent striation of space in the San Rafael area is the designation of state and national forests, wildernesses, monuments, parks, and recreation areas.1 Within the region there exists Capital Reef National Park, Bryce Canyon National Park, Arches National Park, Canyonlands National Park, Escalante Grand Staircase National Monument, Lake Powell Recreation Area, and several wilderness and national forest areas. Several factors are assessed in the decision to designate areas, such as historical and scientific interest, as well as areas of scenic beauty.2 These areas are to be preserved for protection, further research, recreation, and enjoyment of the people. The place can now be experienced as a striated space based upon abstract values of the landscape preservation. Visitors come to the area for a variety of reasons, including sightseeing, off road driving, boating, rock climbing, hiking, biking, and rock hounding. They come from all over the world with equally diverse perspectives and values. As people travel from town to town, park to park, and place to place, they travel between various layers of striation. Their experiences are based upon their own values and become an abstraction of an abstraction. Thus, people and places become more separated from the natural reality of smooth space, and they emerge in an abstract reality of striated space.

Fig. 39  A Jeep crawling up the smooth sandstone face.

Fig. 40  Photograph showing the tracks left behind by off road vehicles near the Swell.

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1 It should be noted that earlier designations were made in the early 1900’s, but exact boundaries were altered or finalized some time later. Pg. 198-199


2 Certain areas of the San Rafael Swell are currently under review for National Monument designation. A detailed description of the process including evaluative criteria is presented to the public at http://www.ut.blm.gov/sanrafaelswell/
Fig. 41  Google earth images narrowing the scale of the site to the southern end of the Swell. Diagonally cutting through the area from top left to bottom right is muddy creek.
This research has revealed that one can look at place through a variety of lenses, and at a variety of different scales. Through a polarized lens of human scaled striation or a clear theoretical lens of large scale smoothness. Looking through either of these lenses filters out certain views in order to frame a certain picture. It allows for a narrow focusing of thought to better understand an idea. The next step is to look through an omni-directional lens, which allows one to see the whole picture and how the individual parts relate to the whole. This lens allows one to constantly readjust their focus, to observe place at a variety of scales. To better understand the rhythms and patterns of the Swell it is important to intimately understand specific sites, as well as how those sites relate to the larger area. The Swell is approximately 70 miles long by 40 miles wide. At the southern end, there is an area which has a great diversity of site conditions sloped, flat, exposed, protected, dry washes, wet washes, as well as different soil types. Within this area several sites will be chosen. They will be strategically spread throughout these different conditions in order to project an accurate representation of the larger area. The following section locates specific sites which reflect the various smooth and striated properties that make up this area.
Fig. 42  Clear skies over the desert landscape.

Fig. 43  Clouds billowing brewing a powerful late afternoon summer thunderstorm.

Fig. 44  Cold winter storm in the San Rafael Swell.

Fig. 45  Rivers turn to mud during a flash floods, moving vast amounts of earth.
In the big picture, weather is affected by large systems which move in from other places. The scale of these systems is so large that one person or place may only experience scaled localized conditions of the system. As a result, humans experience weather in the Swell as very diverse and extreme. Heat in the summers literally bakes the ground. Dry winds suck every minute amount of moisture out of the earth. Sudden storms brew over the mountains and dump rain in violent downpours. The bitter cold of winter is exaggerated by gusting winds which sweep across the landscape. Weather can change in the blink of an eye, and you could be caught in the wrong place at the wrong time.

Fig. 46 Various weather conditions in and around the San Rafael Swell
Fig. 47 Graphs illustrating measurements of various elements of weather over the course of a year.
With the development of various devices to measure temperature, humidity, rainfall, and wind speed, humans have found ways of quantifying the localized weather conditions. As time goes on, humans have developed databases which store years worth of measurements. Taking measurements at the smaller, human, scale has allowed meteorologists to develop an understanding of large scale systems. They recognize rhythms and patterns in these systems which are then abstracted to develop averages that help them to predict future weather behavior. In the San Rafael Swell, temperatures on average are cooler in the winter and warmer in the summer. It is generally more rainy in the fall, and more windy in the spring. These graphs and averages are striations or large scale abstractions of the more dynamic nature of weather experienced at the human scale but nonetheless, they help humans understand the phenomena of weather at this place.

This data is recorded from weather stations in Hanksville Utah which is about 15 miles from my site. More information on the weather of this area is available at http://www.wunderground.com/US/UT/Hanksville.html


Fig. 48  Graphs illustrating average precipitation at Hanksville, Utah which is the closest weather station to my site.

Fig. 49  Graphs illustrating muddy creek water levels over the course of one year.
Fig. 50  Jagged skyline of eroded sandstone forms at the San Rafael Swell.

Fig. 51  Layering of multiple geologic strata.

Fig. 52  Road cutting through the smoother eroded forms of shale like stone of mudstone.

Fig. 53  Smooth painted hills contrast the jagged forms of sandstone in the background.
At a large scale, land is viewed as a series of gradually changing surfaces or plates. These plates are so large, they can’t be seen or experienced at the human scale. Instead, humans experience scaled localizations of the land as diverse and sudden changes in geography. The land can seem to stretch out in front of you for miles, then suddenly crack wide open. Giant blocks of sandstone cap mountains which seem to melt right into the landscape. Goblin like formations carved into sandstone carry and eerie mystique. Smooth rolling painted hills of purple, red and white are interrupted by dark craggy volcanic intrusions. Streams and rivers carve out the most amazing canyons which seem to curl and fold like a silk gown. During flash floods the canyons become engulfed in a raging surge of muddy water. The silt and soil of these floods creates vast washes. It is a land which is constantly being reshaped and reformed by the process of erosion.
Fig. 56 USGS 7.5 minute quadrangle map at edge between Factory Butte section and Hunt Draw section.
With the advent of new technologies, humans have been able to record localized geographical conditions. Over the years, humans have developed a large database of maps and images of the land. Some designate areas of mineral riches, others designate travel routes. In the early to mid 1900s, the USGS did a comprehensive survey of the area and broke it down into quadrangles.¹ For each quadrangle they would map the topography in an abstract representation of contour lines. These maps are extremely helpful while navigating through the area, and they are the most detailed maps available. They essentially segment the land into intervals based upon relative height above sea level. Elevations within the Swell range from 4,500-6,800 feet above sea level. Other maps and graphs allow us to look at the region as segmented by rock and soil types such as shale or mudstone, Entrada, Carmel Navajo Kayenta, and Wingate sandstone, and limestone.² Looking at these databases, geographers have recognized rhythms and patterns in the land which have helped them to understand large scale systems such as plate tectonics. All of these maps and descriptions are ways of striating the land in attempts to better understand it.

¹The USGS has the complete series of 7.5 minute topographic maps available at http://geology.utah.gov/maps/topomap/7_5Quads/index.htm
Fig. 57  Hearty desert shrub breaks through rocky soil.

Fig. 58  A bee is attracted to the brilliantly colored desert flower.

Fig. 59  Ants construct an underground fortress in sandy soil.

Fig. 60  Cryptogamic soil covers the earth preventing erosion.

Fig. 61  A lizard warms up on a rock in the sun.

Fig. 62  A rattlesnake warns of a strike with the shaking of his tail.

Fig. 63  A rabbit is at attention ready to flee the attack of a predator.

Fig. 64  A Peregrine falcon blends in with the dry desert grasses.
Life in the swell exists at a variety of scales from small microorganisms to larger members of the deer family.\textsuperscript{1} At any scale, one must look closely to see the thriving diversity of life which exists in the Swell. Cactuses and other small plants lie dormant under the soil for months only to bloom in the spring for maybe a few weeks. A variety of small insects and scorpions make homes under rocks and in the softer soils. Small lizards and rodents seek shade under hardy desert sage plants. Larger animals make this area their home as well. Peregrine falcon, owls, and hawks perch in dwarfed cottonwood trees that line small streams. Desert big horn sheep, mule deer, antelope, and even wild burros and horses quench their thirst at a local watering hole. Some areas support more life than others. For example, there are some geological strata which contain higher levels of minerals. In some cases, these levels are too high to support plant life. Some soil types contain a very small form of life called cryptogamic soil. These are small moss-like plants which help to form a sort of crust over the soil, preventing it from eroding. The cryptogamic soil is under increased pressure from off road vehicles. This ecosystem is extremely diverse, made up of several different highly fragile but balanced micro-ecosystems. These small scale ecosystems are an integral part of the equilibrium which exists at the level of the large scale ecosystem. As this area begins to attract more people, certain precautions must be taken in order not to destroy the delicate ecosystem of

\textsuperscript{1}There are many more species than the ones mentioned here many of which are either endangered or threatened for a detailed list see http://www.ut.blm.gov/sanrafaelswell/
Fig. 68  People climbing through the narrow slot canyons carved out by water and wind.

Fig. 69  People having fun in the moon-like landscape on a ATV.

Fig. 70  People camping near the muddy creek.

Fig. 71  A person examining the fractured remains of fossilized dinosaur remains.
The San Rafael Swell has been a place which has resisted human occupation due to its inaccessible rugged landscape. In the twenty-first century this is what seems to draw people to the area. As the surrounding National Parks become flooded with tourists in the summer, the Swell provides a quiet, private retreat, and a place to get away from it all. Some people come to slowly climb their way up the narrow, meandering slot canyons, leaving behind footprints and anchor bolts. Others come to enjoy a leisurely float through beautiful winding rivers flanked on either side by towering faces of desert varnished sandstone. Some people come to look for natural treasures such as petrified wood and dinosaur bones, leaving behind footprints, taking with them souvenirs. Others come to capture the natural beauty, using photography or by painting abstract landscapes. Some come simply to camp under some of the most clear skies in the lower 48 states, leaving behind a ring of rocks and ashes. Others come to study the land and interpret all the lessons which it can teach us—about the earth’s history, about life surviving with minimal water—about delicately balances ecosystems. The researchers leave behind fences and signs designating research areas as off limits to other users. Some come riding in on horses to round up desert cattle which have wandered off into the dusty abyss. Others come to enjoy the open desert on off road vehicles, leaving behind a network of tire tracks on the ground. People come to the area for different reasons, but all to gain something they need or want, whether peace of mind or piece of stone. Whether physically or mentally, people take memories from this place which will help influence their future explorations of place. Everyone who visits the area alters the environment in some way and at some scale. Moving one rock in the sandy soil changes the flow of the wind across the surface, the change in wind shifts the sands to make a new form. Constructing a paved road effects the patterns of water run-off, in some cases increasing erosion and in other cases decreasing it. These human scale changes provide a set of changing conditions. These changing conditions interact with various large scale systems to create new rhythms and patterns based on human experiences.
PRESENT AREA CONDITIONS
scale site selection

Within this scaled area of the Swell, several smaller scale sites have been chosen for their specific set of landscape conditions. These conditions will be abstracted into human scale rhythms and patterns. Then each will house a structure meant to interact with the forces of erosion in a specific way. The changes experienced by the structure would reflect a humans scale both in time and space. Then by compiling observations and measurements of these changes patterns will emerge which would reflect the larger scale systems of erosion which have shaped this place over millions of years.

- **Site 1** This site was chosen because it lies at the confluence between two creeks. The soil in the area is quite soft and erodes easily. The designed response should reflect the changing nature of the water runoff at various times throughout the year.

- **Site 2** This site lies in the center of a seasonal wash. Dry during most of the year, but easily affected by flash floods. Located at the deposition end of the wash, the soil is very loose and sandy with small pebbles throughout. New layers are deposited with every passing of the season of flash flood. The designed response should emphasis the effects of these flash floods.

- **Site 3** Perched on the edge of a steep drop off, this site is highly exposed to the gusty desert winds. The soil is a mixture between larger sandstone slabs, and a very soft loose sand. The designed response should examine the relationship of soil hardness and wind erosion.

- **Site 4** This site occupies the intersection between a sloped harder sandstone face and the flat softer ground soil. Rainwater runoff from the harder face soaks into the softer soil at this point. The designed response should seek to explore the effects of water absorption and subsequent evaporation.

- **Site 5** Located near an open pit coal mine, and a popular off road vehicle destination, this site offers the opportunity to investigate human erosion. The designed response should encourage the participation of humans in erode it’s form.

- **Site 6** This site also lies in the path of a seasonal wash. Located at the beginning or displacement end of the wash, the soil is a compact conglomerate of sand small pebbles. With each passing of the season of flash flood the water cuts deeper removing more soil. The design response should seek to emphasis these effect.
The various structures are to serve as places of interpretive importance. It will seek to create a microcosm representing the vastness of the geologic process of erosion. It is hard for humans to comprehend cubic miles of earth being moved over millions of years by wind and water. This series of structures will attempt to create an abstract human scaled experience of erosion. By reordering the natural setting into human scale structures, changes made to them by the natural process of erosion can be experienced. Each structure will isolate certain conditions in order to focus on localized small scale erosion. While change can be experienced gradually, it tends to be more profound if experienced at its extremes. The latter draws on memory as a base by which to contrast the change. Memories can be carried on by rituals and material creations. Thus the construction of the structures is as important as the structures themselves. Erected each spring, the structures will sit exposed to the forces of erosion. Upon returning the following spring, one can witness the dramatic change the structures have undergone over the course of a year. Each year, the process of erosion causes subtle variations in the designed forms, creating new patterns. As the structures are gradually destroyed it will be rebuilt in accordance with the new set of conditions of site. In this way the structures become timeless and reflect the large scale changes which occur on the land which humans cannot directly experience. To better understand the nature of this project three precedent studies have been selected which illustrate various principles which would be applied to the project.
Fig. 73 An Andy Goldsworthy sculpture being effected by the incoming tide.
In his book *TIME*, artist Andy Goldsworthy experiments with concepts of time, change and place. The book is a collection of works that depend on relative positions of time and place for their full experience. Many rely on the changing characteristics of place over time to form the art piece. One such work is the Dumfriesshire clay wall, in which Goldsworthy covered a wall with clay taken from his homeland. Behind the clay, he specifically placed different materials which would affect the rate at which the clay would dry and thus the patterns formed by cracking. He organized the materials in such a way as to create a river design, which would take its form over the course of several days. This project was produced indoors under a controlled environment. Other projects are constructed outdoors and are subject to the processes of the natural environment. These projects engage time at different degrees, some at the level of a day, others at the level of a year. In one series of works, Goldsworthy explores the effects of the incoming tide on various forms and materials. In another series, he explores the effects of the changing seasons. They all depend on recording or measuring at different times in order to witness the change brought about by the natural process. Goldsworthy is interested in the way his works decay over time. He stated, “Lately the challenge has been not simply to wait for things to decay, but to make change an integral part of a work’s purpose so that, if anything, it becomes stronger and more complete as it falls apart and disappears.”

His works rely on the re-ordering of nature to reflect human intervention, but encourage nature's participation to alter, decay and eventually make them disappear. In regards to his works, he says, “My touch is the most recent layer of many layers that are embedded in the landscape which in turn will be covered by future layers-hidden but always present.”

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Fig. 75  Looking upward inside the Meditation space at the ceiling which is held back from the wall to allow light to flood the monolithic walls.
Architect, Tadao Ando is a master of capturing the essence of nature in his architectural forms. He says in regard to his designs, “I work on the essence and try to condense it into an abstraction.” His abstractions are pure geometrical shapes such as squares and circles. These forms become abstract when contrasted to the natural setting and thus take on the sign of humanity. The design of the Meditations space is a cylinder with its diameter equal to its height and is constructed entirely of concrete. Through its minimal material selection and simplistic form, the space becomes devoid of allusions, creating a distilled experience. The experience becomes focused on the nature of space in constant variation. Ando’s designs become the backdrop for the natural spectacle of light, wind, water, and sound. He states, “The buildings are read relative to the way their forms understand a series of invisible factors such as the past and future temporality of a place.” In this way Ando creates an experience which allows for the contemplation of time and change within the landscape.

Fig. 76 Various views of the Meditation space designed by Tadao Ando for the UNESCO headquarters in Paris.

1, 2 These exerts are taken from pg 57
Fig. 77 The moving precast concrete fingers of Calatrava’s Shadow Machine, cast ever-changing shadows.
Constantly blurring the lines between art and science, Santiago Calatrava is an architect who pushes the boundaries of traditional form. His structures not only serve as the backdrop for natural activity, they interact with it. In his design of the shadow machine, Calatrava conceived of a sculpture which generated a sinuous motion similar to that of human fingers. The connection between the fingers and the drive mechanism allows for circular motion, avoiding simple up and down motion. The perpetually fluctuating, yet synchronized movement of its individual parts, cast ever-changing shadows on the space beneath. This creates an abstract experience caused by rhythmic modulations of light and shadow as well as constant variation of form and space. In his book Santiago Calatrava: The Poetics of Movement, Alexander Tzonis states, “Movement from one physical state to another indicates the potential variations of adaptation, endowing form with the ability to change in response to its environment, use, and structural forces.”

The complex movement of this structure indicates the passage of time and reflects the complex cycles of nature. The motion of the shadow machine is still derived from mechanical devices and thus does not directly correspond to natural processes. If the motion were to be driven by such forces as wind, water, sound, and light, the structure could further reconnect man with nature and provide a more meaningful experience.

Fig. 78 Photographs taken at different times capture the different forms created by the Shadow Machine.

1These exerts are taken from pg 96
Fig. 79 Regional overview compiled from 400 Google Earth Images with sites highlighted on center strip (left to right = Site 1 to Site 3).
Within the scaled area of focus three specific sites have been chosen. Each location has been selected by mapping three systems. These systems reflect different degrees of response to either global or local conditions. Each site is located where these systems are in the closest proximity to one another. This process ensures that the site specific locations reflect both local and global influence.

**System 1** - The longitude line 110d52m43s W: This longitude line represents relative globalism. It is a striation imposed upon the land which does not react with the local conditions. This major grid line shows up on all the USGS maps as a constant by which you could orient yourself relative to while navigating the landscape.

**System 2** - Seasonal Washes: These washes represent the absolute local condition of drainage topography. These washes are always changing in response to seasonal weather patterns and local soil conditions. They present difficult obstacles to cross-country travel.

**System 3** - Roads: These roads represent a hybrid between global and local conditions. They were initially laid out to follow section grid lines. But as these roads approached obstacles such as washes their coarse becomes altered to find the easiest path of travel.

Fig. 80 Satellite Images from USGS Overlaid with the three governing systems for site location
Fig. 81 Site 1 showing highway 24 crossing the wash.
At site 1, highway 24 which connects Capitol Reef to Lake Powell, crosses directly through the site. People speed through the site in their car, unaware of the erosion wash. This erosion wash is quite large, and is growing with every flash flood. Currently the way that the road and the wash interact is through two large culverts. These culverts interfere with the natural flow and cause accelerated erosion on the down-stream side and decelerated erosion on the up-stream side. At this site I decided that the appropriate design response was to develop a bridge which allows for the natural processes at work in the wash to take place.

Fig. 82  Culverts at current road-wash interaction.

Fig. 83  Wall collapse at erosion wash.
Fig. 84 Construction Sequence of Bridge

- Steel Columns
- Steel I Beams
- Earth Walls
- Elliptical Transverse beams
- Tension Cables
- Steel grid deck and grate driving surface
This bridge is designed to draw attention to the natural process of erosion. It consists of a steel deck platform which is suspended by cables. The deck is constructed from a steel grate which allows for views down into the wash. The cables are anchored back to a massive wall which is allowed to erode and expose the bolts. The cables can be tightened or loosened to adjust to the changing ground conditions. New cables can be strung as the span becomes greater. The entire structure is laid out on a grid so that the width of the erosion wash can be measured relative to it year after year. In this way the structure brings attention to the quantitative changes as well as the qualitative changes. It also responds to both global and local systems of construction using imported steel as well as on site soil for earth walls.
Fig. 86 Sequence of erosion wash growing over time and the addition of new tension cables.
Fig. 87 Sequence showing the progression of erosion to the anchor wall and the cables being tightened over time.
Fig. 88  Schematic sketch showing sequence of erosion to the wash and new tension cables
Fig. 89  Detail Sketches of anchor bolts and bridge grid system
Fig. 90 Site 2 Satellite Image showing retention pond, road, drainage basin badlands.
Site 2 is located on a flat barren plateau. The gentle sloping plateau creates a large drainage basin, at the center low point lies a man made retention pond to provide water to grazing cattle. There is enough vegetation to allow year round cattle grazing. Site 2 lies at the convergence of cattle trails running between the grazing land and the water source. The rolling badland hills attract Off Highway Vehicles (OHV’s). I determined that this site would be a great location to house a research station to monitor human caused impacts to the delicate landscape and desert ecosystem.

Fig. 91 Cattle Grazing in the winter.  
Fig. 92 Culvert at road and wash intersection.  
Fig. 93 View looking north towards the San Rafael Reef and plow mark from old road.
Floor System: SIP's between LVL floor joists
Fig. 94 Construction sequence of structure

Steel Column Grid with horizontal ties for wall forms

Roof: System earth over corrugated metal over SIP's

Cast earth walls

Glazing connected using spider joints

Solar roof shade and movable wall screens
The research station at site 2 is designed to measure the impact of grazing, cross-country travel and other human causes of erosion. The steel column grid is laid out based upon the global positioning of the longitude line. The earthen walls on the south and west sides is a response to local and regional solar and wind patterns, protected the most exposed directions. The walls are cast using a laminar technique to reflect the sedimentary process which created the surrounding landscape. Solar shading screens made of a thin photovoltaic polymer sandwiched between two metal mesh screens, respond both passively and actively to the sun's energy. The floors and roofs are constructed with Structurally Insulated Panels (SIP's). The structure finds a balance between global and local materiality. It uses repetition and modulation of structural parts as sources of scale to measure the natural landscape, and human interaction within the landscape.
Fig. 97  Exterior hallway perspective showing deck and wall screens.
Fig. 98 Interior perspective looking towards the swell.
Fig. 99  Sequence illustrating the erosion of southern earth wall.
Fig. 100  Sequence illustrating the solar shade changing form in response to summer and winter solar angles. (left to right = summer to winter)
Fig. 101 Sketches of beam to column connections, section, and glass column connection.
Fig. 102 Sketch of building after erosion has taken its course.
Fig. 103  Site 3 Showing the road cross Hunt Draw and start up onto Little Wild Horse Mesa.
Site 3 is located in a lowland floodplain, near the convergence of Hunt Draw and Muddy River. Hunt Draw is one of the major washes that allows access to the San Rafael Reef, a popular place for hiking, camping and canyoneering. It is also near one of the only year round water sources in the area. The road at this point initiates its ascent onto Little Wild Horse Mesa. I determined that this would be a great place to serve as a base camp or trailhead for traveling recreationists.

Fig. 104  The dirt road which provides access to the site with the San Rafael Reef in the background.

Fig. 105  The lowland floodplain with sparse vegetation.
Fig. 106 Site 3 with the four camping structures
The design for this trailhead camping area includes shaded parking, four semi-enclosed camping structures, a water pump structure, and a shower and toilet facility. The camping structures are simply designed to provide a protected area for a tent. The earth walls protect the south and west sides while retractable screen provide variable enclosure to the north and east. The water pump structure provides a raised grate that leads to a manual water pump. This grate allows you to walk above the muddy erosion from the leaking water of the pump. The showers are elevated as well with two large solar water bladders located on the roof of the bathrooms. The toilets themselves are bin composting toilets. The entire linear organization of the site follows the longitudinal line.

Fig. 107 Overall layout of site 3 with camping structures on the left and water facilities to the right.
Fig. 108 Water Pump Structure with steel grate and manual pump.
Fig. 109  Shower stalls with steel grate floor, corrugated metal walls, and retractable fabric doors.
Fig. 110 Sequence of retractable wall screens open to closed
Fig. 111 Sequence showing different wall screen configurations.
Fig. 112 Conceptual sketches of roof form and water platform.
Fig. 113 Images taken at different wall construction sites
The Earth walls are constructed using a technique that I have been refining. It is similar to cast earth or rammed earth, with some differences in process. The wall is cast in layers each with different degree of hardness. This causes the wall to erode more in some places than other and create a more natural look. I constructed three test walls one at each site and let them weather over a one month period. Upon return I found the South and West sides to be the most weathered.
FINAL PROJECT

the movie
FIGURE TABLE
photographs, images, maps, graphs

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