

Geography: Critical Factors in the Analysis of Complex Systems

By

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Ivan Burl Welch

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Geography: Critical Factors in the Analysis of Complex Systems

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# Geography: Critical Factors in the Analysis of Complex Systems

## Abstract

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Geography is a discipline of discovery and exploration. From earliest human endeavor until today, it remains the key to understanding human interaction with the landscape. A conceptual framework of geographic factors provides a holistic analytical approach to the complex systems experienced by humankind across the globe. Physical, Cultural, Economic, and Political variables combine to create the environment of individuals and nations.

A holistic and comprehensive framework of geographical variables is needed for a systematic study of geostrategic issues for the purposes of policy making and strategic planning. Geographic scale, its impact on human action and incorporation into human culture, is pervasive. These factors of geography and their variables must be applicable at many scales of human interaction and experience. The complex system of human geo-strategic interaction demands this. Humans are a product of the natural environment, fundamentally a part of the planet. This basic context energizes the processes flowing within the geographic variables. Human nature, acting in the spatial context, is the engine of human generated change that moves through time and is measured on the landscape. It is possible to model this reality and study the interaction. This interaction is observable and informative.

The purpose of this dissertation is to identify geographic variables that inform a systematic approach to the analysis of geostrategic issues. These geographic factors have been drawn from the legacy of geographic thought and imagination. The factors and their corresponding variables operate holistically in cycles of action measured across space and time. By use of basic statistical analysis, lines of enquiry can be identified for the expanded use of Agent-Based Models for the purpose of inferential predictive analysis. The unique contribution of this dissertation is a novel conceptual construct for analysis of complex systems in a geostrategic context. The contribution is four-fold: First the organization of geographic factors into a linked field of key variables. Second the creation of a multi-modal process of these variables through a nested set of operational imperatives. Thirdly the construction of the operational

imperatives process cycle which informs the resulting fourth contribution of a predictive path of inquiry and analysis.

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## Section 1 Introduction

In this paper two simple definitions will be used for “geography” and “geographer”. Geography is description of the earth and a geographer is one who describes the earth (Pattison 2011).

### ***Problem, Purpose and Thesis***

Since the close of the Cold War (1991) and the advent of the War on Terror (2001) the United States government has turned its human and fiscal resources toward policy and actions as the leader of a new geostrategic milieu. In the past decade the United States has launched all elements of national power to the far corners of the globe, seeking to influence economic and political stability. This effort has revealed significant gaps in the government’s ability to integrate its agencies, departments, and offices in the pursuit of effective policy and methods (Chiafullo 2009). Geographic variables as part of any holistic analytical model are essential to policy making or planning. To date, they have been largely ignored. An integrative, holistic framework of analysis and understanding is missing.

The purpose of this dissertation is to identify geographic variables that inform a systematic approach to the analysis of geostrategic issues. These geographic factors have been drawn from the legacy of geographic thought and imagination. Their identification and emphasis is the primary contribution of this paper. These

geographic factors are Physical, Cultural, Economic, and Political.

My thesis is that a holistic and comprehensive framework of geographical variables is needed for a systematic study of geostrategic issues for the purposes of policy making and strategic planning. Geographic scale, its impact on human action and incorporation into human culture, is pervasive. These factors of geography and their variables must be applicable at many scales of human interaction and experience. The complex system of human geo-strategic interaction demands this. Humans are a product of the natural environment, fundamentally a part of the planet. This basic context energizes the processes flowing within the geographic variables. Human nature, acting in the spatial context, is the engine of human generated change that moves through time and is measured on the landscape. It is possible to model this reality and study the interaction. This interaction is observable and informative.

## *Structure of the Dissertation*

In Section two I explore the thoughts of geographers, historical and contemporary, to support my selection of geographic variables. From Gilgamesh to Cohen, the section is a broad overview of the geographic literature, seeking the thread of human spatial inquiry that propels this study. The focus is geostrategic analysis at the state-to-state level. Further, I will review the shift in scientific thought that supports my selection of geographic factors within a non-linear, stochastically dynamic, and complexly interactive world.

In Section three I identify and introduce Geographic Factors and their variables that are selected based upon a distillation of the broad heritage of geographers cited in the literature review. These factors are chosen as isolates of the whole, meant to provide a framework of analysis that point to patterns of casual interaction and final potential status of geostrategic actors. These factors are robust enough to inform an interdisciplinary analysis that reflects the comprehensive nature of classical geographic thought. They have utility in case study and scenario development. Their compilation is the primary contribution of this paper.

In Section four I point to an area of future application and research. I suggest an agent-based model set up as an expert system for analysis. The operational imperatives of geostrategic actors in the context of our geographic factors are discussed and illustrated. Agent-based models are of use for scenario building and

predictive analysis. The lack of funds and resources is the major constraint for realizing the use of this geographic operational dynamic model.

In Section five and Section six a simple correlation approach is made with the geographical factors and genocide as a further proof of principle for this analytical approach. First a data set of nations with genocide experience and several adjacent nations without genocide experience is used to explore correlation with genocide and the geographic factors. Finally a comparison of two nations is done to highlight correlation between the geographic factors and genocide with more emphasis on the targeted population.

Section seven provides a summary of findings and conclusions.

## Section 2 Literature Review

The purpose of this section is to support my selection of geographic variables through examples of past geographic thought and theory.

### *Geography, a Human Cultural Context*

#### **Ancient Thinking**

What is a geographer? One who writes about or maps the earth. The earliest definitions infer literacy, yet symbolic communication of the earth and human interaction with it surely counts as well. An oral tradition that depicts descriptive

understanding of the earth was valid long before it was captured in print.

If humans are the natural offspring of this planet, then spatial we were, spatial we are, and spatial we shall forever be. Within the biosphere every life form owes its existence to site and situation. Be it at a hydrothermal vent on the ocean floor or in the orbital path of manned space flight, life is bound to its place and space. Life, be it as basic as sulfide oxidizing bacteria or as complex as a human, depends upon the resources and parameters of their environment; their spatial context (Bronfenbrenner 1994). So as we search for our first human geographer of importance, we need only look to the first humans. It is well documented that the bio-behavioral adaptations of fully modern hunter-gatherers are intimately tied to climate and environment (Marean 2008) (Henshilwood and Marean 2003).

Versed in the instinctual skills of all land mammals and with a burgeoning cognitive capability, our first human became our first Geographer as he traveled from the tree line into the savannah selecting routes to the best food sources, watering spots, and favorite places of protection. Categorizing and cataloging these resources in a manner that could be convincing to peers and conveyed to progeny. Sensing, defining, and using the growing awareness of their interactive roles within space and time on mother earth (Marean 2008).

### ***Gilgamesh***

Even in our “pre-history,” special needs required special skills, which lead to specialists. We have artifacts from these times that point to the tool maker, the story teller, and the artist. Verbal myth passed down to us the roles of explorer and hero: these who alone and in like-minded bands sought knowledge beyond the horizon. And with the telling of these tales we find those who would record and compile the discoveries and adventures. All are linked to a people and a place, be it myth or material. To describe the earth for current use and future resource: this is geography. And great geographers occupy the mists of our prehistoric past. One such character of particular note is Gilgamesh (George 2003). Either a historic Sumerian king of Uruk ruling circa 2650 BCE or protagonist of a heroic epic, or both: he fills the role of geographer in every classic sense (Glacken 1993) (Livingstone 1993).

A man and a myth amidst the great cultural hearth land of the Tigris and Euphrates Rivers, whose story spans the prehistoric to our literate past, he is the personification of our human experience of yearning, moving, and seeking that which will ensure the immortality of our breed. His quest is the deep canyon that all voices of geographic discovery echo in. As King he embodied the grounded assurance of his people’s place in the physical world, having mastered his environs by coexisting with the fluvial life of the great valley, firing the clays of the earth into hard bricks for temple and fortress, and establishing his progeny. He turned his attention to the horizon as all geographers do. He looked both to the horizons marked by the setting



and rising sun, because he sought the greater horizon of the mind's eye. His quest was for human comprehension of a seemingly divine creation; he sought to know the context and constraints of his existence.

Gilgamesh treks to visit the "Faraway" to find the remedy for death. He returns from the ends of the earth to tell the tale, and remains mortal as all men. The journey and its landmarks built the meaning of "reality" for many great peoples, and set the foundation for the cultures that sprang from that greater region of the valley of two great rivers (Wiseman 1985).

From mythic to literate history, geographic thought comes to us - spatial thinking - gathering of knowledge of the physical and social world for the purpose of inquiry and advantage. The endless journey toward a receding horizon, drawn by a desire to know, to experience, and to tell the tale of discovery, this is the Geographer's call and craft. "He journeyed beyond the distant, he journeyed beyond exhaustion and then carved his story on stone" (George 2003).

Our spatial thinking began in a time where the topography of the earth and the topography of heaven had relations and connections of marvel and mystery. Then the pathway to higher spiritual truth was synonymous to the pathway known to the far-lands. And the home of the Gods was in sight of the hardy seeker.

We could easily go to the great creation myths of the Hindic and Sinic

traditions to learn the same lessons. The Yellow Emperor (2697-2597 BCE) guided his people through the landscape of the Middle Kingdom and gave meaning to all cultures to follow on that land. Manu, with the help of the gods, preserved mankind beyond the deluge and established practical morality for all Hindic culture to follow (Olivelle 2009). These traditions are tied to the spatial understanding of peoples today, whether it be mental or material spatial realities.

No man or woman reared and educated in this nursery of heaven and earth could doubt their relationship with the ground at their feet and stars above, nor their conjoined destiny within that context. Made of the earth, brought forth by those gods with interest and responsibility, the humans were the main story (Nissiotis 1962).

### ***Greeks***

Western scholastic tradition owes much to the Greeks. It is their words that are still used as standard terms in the study of spatial knowledge. The long lineage of Hellenistic philosophers, mathematicians, astronomers, and geographers can be accessed in the many volume *Geography of Strabo*. Strabo sets a timeless standard for the study of the earth from the point of view of the Human heart. He would have us to accept that Homer was the progenitor, the father of Geography (Strabo 1932, p.5-23).

As geographers, Gilgamesh and Homer are of the same ilk: mythic, masculine, and motivational to an entire culture. Strabo ignored Gilgamesh, which is

understandable, whether by omission or commission. The Epic of Gilgamesh might have been muted to Greek ears by the long ages or tainted by its land of origin being under the sway of the Persians. Either cause has much the same effect. Cultural blindness to what has gone before us, wrought by proscribed world views and mandatory meaning prescribed by our own tribe, haunt us still today. Here we are reminded that all humans exist in a spatial context and all humans have geographic thought of importance and experience of interest.

Little can be added to the bold and sound philosophy of the Geography Strabo lays down for us early in his voluminous work. It is a practice proper for statesmen, generals, and the common man; those engaged in practical pursuits (Strabo 1932, p. 35-47).

If Homer be our progenitor as western geographers, then the legacy is clear. All sites and all scenarios find their potential within the use and experiences of humans and the technologies that they bring. Some of the Greek fathers were more direct and are blamed for the roots of determinism in the landscape, or the concept of geographic determinism. The place makes the people. Yet Strabo speaks plainly enough:

For such a distribution of animals, plants, and climates as exists is not the result of design — just as the differences of race, or of language, are not, either — but rather of accident and chance. And again, as regards the various

arts and faculties and institutions of mankind, most of them, when once men have made a beginning, flourish in any latitude whatsoever and in certain instances even in spite of the latitude; so that some local characteristics of a people come by nature, others by training and habit. (Strabo 1932, p.395)

There is no implacable geographic determinism here. Yet he is consistent in his treatment of the many lands and peoples he catalogs, pointing out how much they owe to the resources that surround them and the relative location of their habitations.

### ***Middle Ages***

From our ancient texts we can see the foundational quality of culture as a geographic factor. The next long period of civilization's development and spread reveals the impact of the economic factor.

### **Islam**

These earliest of philosophers and scholars (geographers in their own right) were recording and contemplating the panorama of human experience that had taken 10,000 years to unfold. They observed astutely, were critical of their sources, and became captives of their own experience. They can easily be blamed for ethnocentrism and clearly reveal the dominating overlay of culture on the physical landscape. The homeland of the geographer is often closest to ideal in their own minds. It seems this legacy continued into the Christian or monotheistic era, as the light of Greek intellect illuminated the scholars and geographers of Islam. Ibn Khaldun (1332 CE/732 AH – 1406 CE/808 AH), gave much credit to the effect of the

air (climate):

Now, Negroes live in the hot zone (of the earth). Heat dominates their temperament and formation. Therefore, they have in their spirits an amount of heat corresponding to that in their bodies and that of the zone in which they live. In comparison with the spirits of the inhabitants of the fourth zone, theirs are hotter and, consequently, more expanded. As a result, they are more quickly moved to joy and gladness, and they are merrier. Excitability is the direct consequence.

In the same way, the inhabitants of coastal regions are somewhat similar to the inhabitants of the south. The air in which they live is very much hotter because of the reflection of the light and the rays of (the sun from) the surface of the sea. Therefore, their share in the qualities resulting from heat, that is, joy and levity, is larger than that of the (inhabitants of) cold and hilly or mountainous countries. To a degree, this may be observed in the inhabitants of the Jarid in the third zone. The heat is abundant in it and in the air there, since it lies south of the coastal plains and hills. Another example is furnished by the Egyptians. Egypt lies at about the same latitude as the Jarid. The Egyptians are dominated by joyfulness, levity, and disregard for the future. They store no provisions of food, neither for a month nor a year ahead, but purchase most of it (daily) in the market. Fez in the Maghrib, on the other hand, lies inland (and is) surrounded by cold hills. Its inhabitants can be observed to look sad and gloomy and to be too much concerned for the future. Although a man in Fez might have provisions of wheat stored, sufficient to last him for years, he always goes to the market early to buy his food for the day, because he is afraid to consume any of his hoarded food.

If one pays attention to this sort of thing in the various zones and countries, the influence of the varying quality of the air upon the character (of the inhabitants) will become apparent. (Khaldun, 1967)

The Islamic scholars built upon the Greek tradition and added their experiences to the development of Geographic thought as they rode the high crest of

Islamic diffusion across the known world. As that wave receded from Iberia (1492 CE) the Romanized peoples of Europe had taken up the ancient Greek knowledge yet again to launch toward the unknown horizon in search of the wider world and their place in it. By the time the surge of Islam was ebbing along the Danube (1683 CE), Strabo's heirs had experienced a re-birth to knowledge and exploration in every milieu. The geographic gauntlet had passed to Europa and her children.

### **China**

An explosion of explorations was wrought by the technologies of sail, driven by royal decrees both in Europe and Asia. Emperor Zhu Di of China preceded his Iberian counterparts by more than a century and in 1421 CE launched his first fleet of exploration, commerce, and conquest. Admiral Zheng He (1371–1433CE), a Chinese follower of Islam, made seven great voyages toward the setting sun. (Levathes, 1994) His fleets reached the shores of Africa and the ever present specter of speculation takes him even farther. His great achievements and the records of his travels languished within dynastic court policy in China. The Son of Heaven chose to entrench within the bounds of the Middle Kingdom and leave the wilder world to its own device. By 1513 CE the admiral's ambitious alter ego, Afonso de Albuquerque (1453 – 1515CE) was following in his wake establishing Portuguese presence all the way to China (Diffie 1977, p. 271).

## ***Early Modern period***

### **Europe**

The bearded, armor clad, conquerors from Madrid and Lisbon soon disturbed the cosmology of many empires; from Montezuma to the Ming. Funded by the royals of the Iberian Peninsula, soon all courts of Europe joined in the race to the resource frontiers around the globe. The long and familiar list of Age of Discovery explorers began to grow (Fernández-Armesto 2006). Columbus, Vasco da Gama, Magellan, and Cook all contributed to the linking of human community around the planet. Their journals and charts opened the stage for colonization and imperial expansion. The modern era, soon arriving in the form of an industrial revolution, sought to better exploit the natural resources so readily at hand. The centrality concepts of many people were put to the test. New gods, new diseases (Diamond 1991), and new weapons were convincing arguments to the long built up belief that your land was the true land of man, protected by the choice position on earth, and enabled by a privileged relation with the gods.

By the time the Industrial Age had matured, geographic thought swirled around the abundant resources of an open planet. Geographers raced to the frontiers to experience and record. They provided maps and methods to catalog, characterize, and then confirm a new mental map of reality. As always it was important to have the endorsement of culture in any claim to other's resources. And if old gods failed you, new ideologies were ever ready to provide sanction to personal and political

actions required in the perpetual industry of humankind.

### ***Modern Era***

We saw how the perspective of culture was used by the ancients as an interpreter of the physical world to dictate their geography. In the early modern era the elements of economic variables dominate the exploration of the world. Now we turn to the modern and post modern eras where geographers codified the political factor of geography.

### **Humboldt**

New ideas and ideals proliferated as if spun from the great iron textile machines of the industrial age. Innovation in means and methods regarding industry, commerce, and the nature of community spread across Europe, to the new world, and lapped at ancient gates. Geographers surveyed this emerging landscape recording and analyzing. Alexander Von Humboldt (1769 – 1859) epitomizes this effort early in our modern era (Dickinson 1976, p. 142). His expert explorations in the New World and Europe laid the foundations of biogeography. His experience of the New World fired the imaginations of many European intellectuals and bore fruit in philosophy, geography, and the emerging natural sciences. A lifetime of close contact with the physical landscape, framed within a spatial construct, enabled a holistic vision of the universe that revealed his monumental intellect. In his crowning work, *Kosmos*, he gave voice to a rising scientific understanding of the known world, maintaining the human context and perspective (Sachs 2006).



Humboldt established the modern groundwork of geography in the western world and others were quick to build upon it. Karl Ritter (1779 – 1859) understood geography to be the basis for appreciating the physical sciences as well as human history. His life's work of nineteen volumes sought to articulate the close relationship of human experience and physical environment. His detailed exposition of the earth's physical features as akin to the parts of an organic body seems to have stimulated later geographers in their pursuit to explain the human experience on the planet. His years spent in the learned lecture halls of Berlin laid a broad foundation for future Germanic geographic thought (Gage 1867, p.201-202). Of course the political idea of an organic state was developed much earlier by the notable Greeks.

### **Ratzel**

Frederick Ratzel (1840 – 1914) receives much credit or discredit as he established the fields of human and political geography within the Prussian (German) scholastic tradition (Wanklyn 1961). His term *lebensraum*, living room (space) or habitat, served to become a lynchpin in new political thought in Europe. His academic career touched influential geographers such as the American Ellen Churchill Semple (1863 – 1932) and his Swedish student Rudolph Kjellen (1864-1922). Semple was able to translate and transfer Ratzel's concepts of cultural and political geography to the English speaking world. (Semple, 1923) Kjellen built upon the idea of an organic state that required an expanding habitat for healthy existence (Kjellén 1917). According to Kjellén, *die Geopolitik ist die Lehre unber den Staat als*

*geographischem Organismus oder Erscheinung im Raum*. Roughly, “Geopolitics is the study of the state as a geographical organism or phenomenon in space” (Kjellén, p.46). He also coined the term “*geopolitik*” that would become infamous.

Ratzel was himself influenced by the American naval theorist Alfred T. Mahan (1840 – 1914). Their shared geographical concerns and writings were the underpinnings of geopolitical thought in the Industrial Age. Ratzel set the intellectual stage for practical prognostications amidst the modern nations of the world. The wonders and weapons of the modern age could be put to use around the earth.

### **Mahan**

Admiral Alfred T. Mahan wrote of the historical importance of British naval power as seen in the geo-political realities of his day (Mahan 1987). He pointed out how the prowess and persistence of British naval power set the stage for a particular order among European nations. Britain’s fortunate physical circumstance of being an island nation allowed a focus upon naval forces. With no land boundaries to be threatened by hostile armies, naval power could grow at the expense of a land force. The British navy soon became unrivaled in audacity and success in battle. Britain exploited this strength into a widespread Empire that in turn provided the wealth to maintain their Navy. Other European nations tied to the Eurasian landmass were required to maintain significant armies to assure their own security from contiguous rivals and to maintain fleets at further expense as well. Many historic and cultural factors combined so that no great coalition of mainland European nations organized

to confront English hegemony of the seas.

Mahan's insight into the geo-political realities of sea power deeply affected his homeland and others. He went on to develop a geostrategic concept of naval bases in the world's littoral regions to exploit the technology of sea power for national goals. This sea power based geo-political model influenced the great fleet build-ups seen at the turn of the 20<sup>th</sup> century and inspired the joining of the world's great oceans by cleaving the Isthmus of Panama. It also gave credence to a spatial construct or a geopolitical model for approaching national, regional, and global life. As to be expected, it was followed by new ideas and innovations.

### **MacKinder**

Mahan's emphasis on sea power was eclipsed for a time by the vision of the British geographer Sir Halford MacKinder (1861 – 1947). MacKinder held that the key to world domination was domination of the Eurasian "heartland" (MacKinder 1904). He saw the consolidation of that great continuous landmass under a single sovereign will as the one sure threat to the rule of Britannia. His fear of the historical moment was centered on Czarist Russia, but the anticipated danger was made all the more real when a unified yet defeated Germany hammered out a geo-political vision built upon the long labors of Major General Doctor Karl Haushofer (1869 – 1946). Haushofer integrated themes of the organic state espoused by Rudolph Kjellen and the "lebensraum" identified by Fredrick Ratzel to create a school and model of geo-political thought that purported the natural moral right of nations to expand their

influence as far as required ensuring their security and destiny. (Moller 1987) This active and aggressive approach was well suited for the National Socialists of a defeated Germany and, with general staff efficiency, volumes of geostrategic data and analysis were compiled. The Axis powers sought to consolidate the heartland and in those efforts proved the vulnerability of sea power as they closed the French seaports and threatened critical British naval bases from their landward approaches. Pressure on Suez and the fall of Singapore pushed the World Island back into the forefront of geo-political thought where it would remain even after the demise of the Axis powers.

### **Spykman**

Just as Mackinder had seemed to threaten Mahan's view of dominate sea power with an unassailable land fortress that enjoyed interior lines of communication, Nicholas J. Spykman (1893 – 1943) sought to shift geostrategic importance to the "Rimlands" and coastal waters that surrounded this great land beast. He saw afresh the need for all eyes to turn back to maritime prowess to hold this outer crescent that would in turn contain and dominate the heartland (Sempa 2006). Now that the traditional afloat force could be augmented with sea and land based airpower, Spykman was all the more convinced that the reigns to world power were to be held by those who made up the outlying maritime nations, bold and cunning enough to maintain presence and power in the great Rimlands of the old Eurasian world. To Spykman this was the scenario best suited to the subduing of the Axis Powers and ensuring the subsequent world peace (Bordonaro 2009).

With the closing of the Iron Curtain and the increase of Soviet military power the western world based much of its policy of containment of the Union of Soviet Socialist Republics (USSR) on Mackinder's concept of the Heartland and how the control of the Eurasian "World Island" is central to world power. Mackinder foretold the necessity of an oceanic alliance that would be needed to slow the great land power's consolidation and constrain its expansion. Nicholas Spykman's emphasis on the control of the Rimlands around this heartland gave a geographical outline of where the western alliance would establish treaty organizations (NATO, CENTO, SEATO) and garrison its forces (Spykman 1944). At this historic juncture, geography was losing its voice of prophecy and practice.

### ***Postmodern Era***

Geographers were always scribes as well as explorers. They were the amanuensis to all travel and exploration. They toiled as the quiet recorders of fantastic narratives and patiently plotted track, trek, and topography. For centuries they did this as a member of their own guild, recording, analyzing, and postulating for themselves to the satisfaction and amazement of their royal patrons.

This majestic march of the arts preceded science and spanned court and continents continuing into the Ages of Enlightenment, Exploration, and the grand epoch of imperial exploitation. The catalogues, charts, and commentaries of geographers were expanded into voluminous libraries of knowledge by the fledgling sciences of biology, geology, anthropology, and all manner of other specializations.

The corporate knowledge of humankind, parsed by science, seemed too immense and complex to be approached by any one discipline.

By the time the 20<sup>th</sup> century's second great convulsion of world war was closing, Geography had been reduced to the near silent scribes of science, accountants of tabular data, and custodians of commissioned charts. As geography struggled to avoid the modern dismissal of art for science in a post-modern age, it took on quantitative airs, technical appellations, and sterile discourse (Livingstone 1993, pp. 304-346). This path bore its own fruit of computation, computerization, remote sensing, and the birth of integrative geographic information systems (GIS). These tools are of great utility. GIS offers a quiet echo of the holistic contextualization of spatial, human, economic, and political realities Geography once knew; but no machine, or operating system can produce geographic insight unless informed and energized by geographic thought (Inkpen 2005).

Geography had reduced its academic role to be only the scribes of science and allowed others to form the accepted approaches to human experience without a contextual and spatial framework grounded in a physical world. History still ruled time in the Arts and Sciences, yet Geography had lost its pre-eminence as the discipline called upon to describe the world, delineate its bounds, and inspire its explorers. The great stained glass window of geography was shattered into its colorful constituent parts; context was sacrificed for greater categorical clarity. Economics,

sociology, political science, and ecology took lead in policy and prognostication (Dobson 2007).

Political Geographer Saul B. Cohen (1925 - ) modified the concept of Rimlands into a zone of shatterbelts (Cohen 1963) (Cohen 2003). He saw these marginal states more as an area of constant conflict that must be cajoled, controlled, and engaged to contain the monolithic and threatening USSR. This type of geopolitical model underwrote intervention in Korea and Viet Nam as well as the wider activities of containment throughout the Cold War (1946 – 1991) (Mackubin 1999).

History records many ravages of this heartland by Mongols, Teutonic knights, and even the French. What Mackinder characterized as an impenetrable fortress of vast resource and potential in the 19<sup>th</sup> century has proven to be a much less central and threatening geostrategic position (Dienes 2002). With the fall of the Iron Curtain and the demise of the Soviet Union, it would seem the “heartland” theory had reached the end of its usefulness (Cohen 1991). However Mackinder’s characterization of the Eurasian landmass as the “pivot of History” finds new life in the policy discussions of those European nations struggling with a geopolitical identity crisis at the end of the Cold War (Brown 2001). A Eurasian identity may be more empowering to Russia rather than accepting a second class status in the West (Dunlop 2001). Even Western Europe may find a revival of interest in ties to the Eurasian interior and toward those southern shatterbelts of Anatolia, Mesopotamia, and Persia.

A Berlin-to-Baghdad railway could have new meaning and portent and the study of *geopolitik* may be redeemed.

This idea of a Eurasian heartland surrounded by shatterbelts continues to hold sway with reinforcing events such as the dissolution of Yugoslavia, instability in the Maghreb, decades of warfare in Southwest and Southeast Asia, and continuing crisis in Korea. Focus on these bloody areas as prologue has spawned popular geo-political constructs such as Samuel P. Huntington's *Clash of Cultures*. He sees a fundamental conflict between the cultures of the world being acted out in the Crescent of Conflict (Huntington 1996). His model would anticipate greater dissolution of nations in the shatterbelts and violent spill-over into the wider world. This supports the growing concern that forces beyond the control of the nation-state are afoot. Some hold that ideologies acting in transnational groups will supplant national power. The age old powers of diffusion and adaptation are now labeled Globalization and touted as a new world order. It seems a reexamination of the geographical context in light of geostrategic imperatives is in order to ascertain a new bearing for the voyage ahead.

The great geo-political theories that have gained notoriety and had much ink spilt over them have some questionable worth in understanding contemporary (current) world geo-politics. Most of the theories or models seem to be products of their time and do well to describe the geo-strategic world of their authors. They had significant success in stimulating political policy and action in their own day and are



most valuable to us as precursors and building blocks to the future, which is our present.

## ***Science and Geography***

### **The Modern Scientific Method**

#### ***Quantification of Geography***

The quantification and specialization of Geography over the past century has tied the field to Scientism (Merriam-Webster 2010) by default. There is no need to go outside the scientific community to challenge the omniscience of its method or approach. As in the days of Galileo, the nature of “science” has changed yet again (Kuhn 1996 ). However this time it is not the Church that censors. The power institutions are now in the hands of the Scientific, and it is they who often fail to hear their own prophets, clutching to obsolete paradigms with uncharacteristic blind faith.

#### ***Newtonian Physics***

The Newtonian world of linear cause and effect in a Cartesian construct propelled western science into the industrial age. The accepted scientific method was adequate for the mastering of steam and iron. It supported the exploration and exploitation of all manner of metals, petrochemicals, and even the more esoteric electro-magnetic forces. Newton’s worldview and scientific paradigm was adequate for that progress. “Using this model, physics has made astonishing progress, gaining great reputation among all the other disciplines (and has become) the standard for all

of science” (Grof 1985 p.17). And from this great movement of the physical sciences, art and humanities were deeply influenced. The current state of the academic disciplines of medicine, psychology, anthropology, sociology, economics, geography, and all related applied subjects are fruits of man and his environment being observed anew in the framework of this Newtonian Universe (Bannister 1991) (Kiel 1996).

### ***Paradigm Shift***

Sticking with an obvious Western-based or biased narrative, we can see that the shifts from one world view to another, from the Ptolemaic geocentric system to the astronomy of Copernicus and Galileo, required a significant rejection of an accepted basic truth and methodology. Hierarchies and institutions are slow to adopt changes to fundamental beliefs. It is only after the death of the old guard, figuratively or literally, that a new day dawns. This mental movement creates an opportunity for reassessment of the direction in which problem solving could take. Once a new view of reality is adopted, the definition of an acceptable problem and the standards of a legitimate solution are subject to change.

### ***Quantum Physics***

And change has come to the physical sciences yet again. The Quantum Revolution (Maku 1997) pushed physics into a new world. “Even Newton, who discovered the cosmic laws which guided the motion of planets and moons, was at a loss to explain the bewildering nature of matter” (Maku 1997, p.7). A new shift from

the physics of Newton to the physics of Einstein took place. During the 20<sup>th</sup> century, physics has been transformed along with the fundamental understanding of the nature of matter. Science now deals with principles of uncertainty based upon the dual wave and particle nature of light, as well as theories of Chaos that provide definition to processes once seemingly inexplicable. This shows how the current scientific consensus may not be the only or best way forward in gaining a geographic understanding of our world.

Unfortunately, the sisters to the science of physics have not been so quick to take up the new vision and paradigm of Postmodern Science (Boje 2000). “The worldview long outdated in modern physics continues to be considered scientific in many other fields, to the detriment of future progress” (Grof 1985, p.17). These self limiting paradigms are restricting our exploration of the human experience on the planet.

### ***The Postmodern Scientific Method***

#### **Multiple Ways of Knowing**

Post modern thought suggests that the nature of knowing (epistemology) is more than the modernist positivism of scientific thought which has sprung from the Enlightenment. Critical deconstruction of the modern paradigm reveals pools of prejudice founded upon social power bases, inviolate ideology, and intellectual intolerance. At the very least post modern constructions (Grassie 1997) suggest multiple foundations to what we purport to be reality.

This is an encouragement and impetus to recast our perspective of geography and the human drama unfolding on the planet. We can trust our human experience and perception more than we allow.

## **Chaos**

Newtonian expectations proposed smooth transformations that can be plotted by linear actions or reactions; but that framework does little to help us with complex dynamic systems that produce nonlinear results. Newtonian geometry is good for the calculation of ballistics but not weather prediction.

Where chaos begins, classical science stops. For as long as the world has had physicists inquiring into the laws of nature, it has suffered a special ignorance about disorder in the atmosphere, in the turbulent sea, in the fluctuations of wildlife populations in the oscillations of the heart and the brain. The irregular side of nature, the discontinuous and erratic side---these have been puzzles to science, or worse, monstrosities. (Gleick 2008, p.3)

Chaos and Complexity theory offer new perspective to the social scientist's field of study. Chaos Theory (Nonlinear Dynamic Systems) is a collection of concepts and phenomena that have been recently observed, or successfully applied, throughout the natural and social sciences. Consequently, scientists' understanding of deterministic systems has been altered, and unexpected regularities have been observed across a wide range of natural domains, for example, physics (turbulence), physiology (neurological processes) (Korn 2001), chemistry (reactions), biology (structure and

growth) (West 1994), and economics (stock market behavior) (Vaga 1994). Chaos theory investigates the unpredictable behavior that can arise in systems, obeying deterministic laws, as a result of their sensitivity to variations in the initial conditions or to an excessive number of variables. Although deterministic laws enable the condition of a system to be predicted at any time in the future, to do so often depends on an ability to specify with great precision a set of parameters at an exactly specified moment.

Chaotic systems are sensitive to initial conditions and can exhibit radical change in overall activity while maintaining self-similar patterns at various scales within the overall chaotic pattern. Chaos Theory may belie its own name, as patterns seem to emerge.

The thought here is to point out that complex systems may indeed hide patterns that are discernible at the proper scale and phase. Even if our use of Chaos Theory is metaphorical, it may embolden the social scientist to approach the most complex of systems, human interaction, with the intent of finding the potential wealth of rich, dynamic structure (Ketterer 2006).

Human behavior is site specific and culturally determined. This precludes a uniform appearance. Yet the categories of action and the elements of use remain fundamentally universal. Thus in this apparent radical diversity of human cultural, economy, and politics; we can find factors that are shared in all human activity. These

will become our Geographic Factors and variables. In a physical sense, when it rains all cultures get wet, yet the complex “meaning” of rain will vary.

### **Fractals**

As highlighted in fractal geometry (Mandelbrot 1967), exquisite and repetitive patterns can exist at every scale and level of detail. Moving from the orbital view glimpsed from the window of the International Space Station, if one could fall continually down into the up rushing detail of the California coast, they would see the seemingly simple curves of the coast transform into a complex trim of connected bays, shores, headlands, all crinkled and connected from Vancouver Island to Baja California. As the observer gets closer, the design and detail repeat themselves at another scale from Point Conception to Point Loma. From a bird’s eye view only the beach of San Onofre can be seen in one glance and it also resembles the first impression from the orbital platform, curved, crinkled, and connected. Now if the observer looked down at their feet upon the simple meeting of water and sand, this tiny shore-scape is a clear cousin if not a twin of each preceding perspective. The fractals of nature differ from those of mathematics. The rough shape revealed at one scale is not exact in resemblance to that at another, but the pattern is recognizable.

Once again we see that the complex physical realities around us are more complex than Newton might allow, yet still share patterns at various scales of observation that inform a holistic investigation. Geographic Factors and variables are related in ways unseen by previous consensus and usage.

## **Patterns**

So too, in the interaction of Geostrategic players who are bound to a physical earth, we may find recognizable patterns at various scales of detail that can inform us in a predictive manner. These patterns will be the complex result of four geographic factors interacting. For example, we must look to and categorize the factors of culture that have an effect on meaning to find the broader pattern. When it rains all cultures get wet. Each allows the wet to inform their cultural reality specific to site and sensibility. This is the precise point where the social scientist (geographer) must leave the paradigm of Newton and open the mysterious charts of Einstein, sailing into the Einsteinian universe of relativity, chaos, and fractals; allowing this view to inform and guide a journey through the complex, non-linear, multivariate, dynamic world of the human interface with one another... in time and space.

This is manifestly true as we seek to understand, explain and predict the interests and actions of not only modern states, but the current trans-national entities such as drug cartels, terrorist organizations, and the multinational organizations in business and non-profit, as well as emergent regional and global actors such as the European Union (EU), World Trade Organization (WTO), and the World Bank.

## ***Human Perspective***

### **All Geography is Human**

Geography is the description of the earth (Pattison 2011). This description and analysis of the planet, along with all its processes and participants, is fundamentally a human effort to relate to the landscape. That complex human perspective can never be abandoned nor supplanted. The collection of subject attributes, the cataloguing of geographic variables, must be more than an exercise in accounting and tabular organization.

### ***Human Factors***

Geographic analysis is a call to the holistic, the intuitive, creative, and artistic interpretation of these factors of humankind's spatial interactions with the earth (Prince 1962). The variables are significant only in the context of human experience. It is within the geographical factors of physical, cultural, economic, and political that we seek out these patterns of human experience and action. Surely there was geographic reality before human existence, yet now that we exist our experience has created our perceived geographic reality.

Human experience and experimentation is the surest tool for the analysis and use of the emerging patterns of life within this kaleidoscope of variables, variants, and seemingly chaotic vacillations.



The mammals we call our ancestors are most readily distinguishable from the non-human groups by their continuous and increasing use of tools. Be it from our first forming of a stone hand-axe to the construction of the particle accelerator, humans are known by their technology. I speculate that our earliest technologies came first in the form of software instead of hardware. The dawning of human consciousness and the ideas that found expression in action and eventually language were our first human technologies (software). It was the idea of using a stone as an extension of one's strength that was the technological breakthrough.

Our first uniquely human technology was our biological software: the software of awareness, personal cognizance, and personal conscious. With the knowing of separateness we put "me" into meaning, and thus derived Human Consciousness. Homo sapiens entered the race for world dominance on the day the proto became self aware and sought meaning for being there and being themselves. The "enlightened" human would assure their off spring accessed the most effective protections and nutrients. Now motivated not only by instinct to mate, propagate, and rear, but also by the new "Human" self awareness; their progeny carried the genetic blueprint of physical and mental dominance upon an age old landscape.

### ***Geographic Factors***

#### **Human Context**

Human self awareness and examination, was the basis for all the thoughts and dreams that now underpin every society, institution, and endeavor. It was this earliest

technological software that articulated the framework of meaning--for us, our families, and all social groupings thereafter. Who am I as an individual? Who am I as a member of a family? Who am I in the context of my social groups? The answers to these questions would inform the actions played out in the larger economy of interactive life. Thus the creation of culture, economy, and politics is a technological breakthrough, a creation of software. It is this bundled software of ideas that inform and empower the hardware of cultural, economic, and political institutions (Campbell 1991).

I would posit that this creation or discovery of technology was in direct response to the site and situation of a place and circumstance. Perhaps it occurred along a resource frontier; a place where a human mind was faced with the dilemma of right action to insure access to an essential resource. A sibling reached for the resource and the software said, "Share the resource". A near kin reached for the resource and the software said, "Share but beware". A stranger reached for the resource and the software said, "Not us, don't share" (Nolin 2008). This social technology enables us to distinguish "us" from "them" and justifies the use of other technologies (warning words, sticks and stones) to protect our critical resource (real or perceived).

Now the competing stranger in question gets to call upon their technologies for use in this conflict along the resource frontier. Perhaps they can yell as loud and

effectually as we do (communication) and have brought the fruits of their economic technology, an item for trade. Have they developed a superior sticks-and-stones technology (McCall & Shields 2008)? If so they can take the resource and monopolize it for their own social group.

So the interface goes forward. The screamers run off the silent, the silent and armed run off the screamers, and the screamers with the best arms run off everyone. Then the stage is set for economy. The power group sets rules based upon cultural meaning and values. Others interact within the equilibrium of violence (Marceau 1997) that enforces the rules. This continues until the resource is exhausted or meaning and motivation changes.

As long as the resource was abundant enough to support all demands without conflict, egalitarian social interaction (Woodburn 1982) would suffice (perhaps only in theory or myth). What worked for chimpanzees and great apes would work for humans (Flack 2000). However with the advent of greater resource requirement, either perceived (greed) or real (need), conflict arose. Now the social group that could generate the motivation and the means could exclude others from the resource and monopolize that economy. They had in effect created a “meaning machine,” which motivated their “stealing machine,” which was enforced and protected by their “killing machine.” Egalitarian groups were supplanted by exclusive groups. Economies of open conflict developed into economies of open cooperation. Exclusive

groups gained surplus resources that allowed more time for refining their meaning software to allow more procurement technologies and create a more powerful enforcement machine. In the historical record this can be seen in the growth of village, city, and empire across the globe. Specific examples relating these more rhetorical titles to the geographic factors and variables follow below.

I intend to use these geographical factors of Culture, Economy, and Politics to explore the contextual nature of human activities and organizations. Each of these Geographic factors will be refined into selected variables that can be used to reveal greater detail and integration.

Entire scientific disciplines of inquiry have grown from these original geographic factors. These disciplines with their ever expanding bodies of research stand as evidence to the validity of the geographic factors. Sorting out the sub-variables is more akin to cartography: a meeting place of art and science.

It was in the context of the earth and human life upon the earth that all academic and practical disciplines found their origins. In the ancient Chinese, Indian, and Western education traditions we find the same categories of knowledge. These emerged and were institutionalized. All these and the expanded modern curriculum of universities are the elements of information that stream from the four basic geographical factors listed here: Physical, Cultural, Economic, and Political.

## ***Scale***

For the geographer scale is everything. It can be the cause of discovery or deception. It is perhaps the first step in the mind of a geographer as he attempts to visualize the nature of any phenomena. As the geographic mind thinks spatially in the first instance, the relative location, distance, intensity, pattern, shape, and size are all delimited by the scale from which the geographer chooses to observe and visualize. Scale acts as an automatic filter as to what elements of data will be pertinent. Individual trees must give way to a forested ground cover as the eye gains altitude either in analog through smaller map scale or in visual reality as in a rising aircraft. Conversely from an orbital view the pattern of continents with mountains and great river courses is evident, but one must descend towards the earth's surface or consult maps of larger scale to see the cultural landscape of road and rail networks.

Scale is a critical tool of analysis. We do well to mimic the artist who will draw back from the canvas to understand the effect and integrated context of the image created by individual brush strokes. So too the geographer seeks virtual distance through chosen scale of observation. Various patterns will emerge at various scales, so investigation of the same space, the same data, at different scales is imperative.

A model is a representational simplification or generalization of a greater reality or concept. Therefore one must always consolidate some elements to facilitate construction and utility of the model. A scale must be chosen that will absorb

aggregation of detail without losing critical function. A model of the earth to be used to measure relative latitude of locations could be a globe of some 12-inch diameter and serve the purpose. A marble would be inadequate for the latitude measurement but well suited in a model of the solar system executed on the Mall in the District of Columbia. Mathematical and theoretical models must be constructed under the same constraints and considerations to seek meaningful results.

The Geographic factors and their variables provide this function of nested scalability. The unit for analysis (family, tribe, nation, state, etc.) echoes the same factors at various modulations. Thus the physical environment of the family may be limited to a metropolitan area and concentrated in specific locations of key activities (domiciled in a neighborhood, school in adjacent municipality, shopping in a concentrated distant district, recreation at a regional park, etc.). The physical variables have their routine and relative impacts at this family scale of analysis. Topography determines ease of foot traffic, air quality may limit activities (ozone alerts), and access to potable water will impinge on daily routine.

These same geographic variables, addressed at the scale of a state will have equal impact, yet different form. Topography will be categorized by affect on larger scale movement of people and goods. Effects of air quality and climate will inform understanding of widespread agriculture and industry. The hydrosphere will now indicate the distribution of population, economic activity, and potential hazards.

The geographic factor of Culture will share the impact of scale. The language the family speaks may be shared with the broader community, yet awareness of specific pet names, family idioms, and neighborhood slang will be critical. If we move our level of analysis to that of state, then the broader categories of mother tongue, dialect, language of commerce and linguistic family will become critical. Economic and Political factors also experience a change in form but not substance as scale is altered during data collection and analysis.

The Geographic factors and variables have utility at several scales of analysis. The interaction and impact of the geographic factors differ at various scales in terms of scope and magnitude, not in type or kind. This understanding is essential to geographic analysis. Based upon an anthropocentric approach, the model can be populated with data from the individual, family, tribe, nation, or state with equal validity.

## Section 3 Geographic Factors and their Variables

The elements of geography, by definition, include the entire physical world. The selection of which of these multitudes of factors are of use as a variable in an analytical model is akin to the challenges found in the science of meteorology. Some atmospheric variables are commonly agreed upon by academics, practitioners, and layman alike. Barometric pressure, air temperature, and relative humidity are all recognized as predictive indicators. World climates and their characteristics are identified. The genesis, movement, and impact of annual weather systems are predicted. Monitoring, study, and evaluation of these systems are enabled by models expertly constructed and applied. The key to the accuracy of these predictions are the variable sets meteorologists chose to populate the models with.

The scope and scale of weather prediction is daunting, yet practical and worthwhile. So too the examination of select geographic variables can lead to a perspective from which patterns can be discerned, circumstances linked, and outcomes analyzed. The purpose of this effort is to identify pertinent factors and distill out the prime variables necessary for the predictive analysis of human activity in a geographic context.



# Geographic Factors

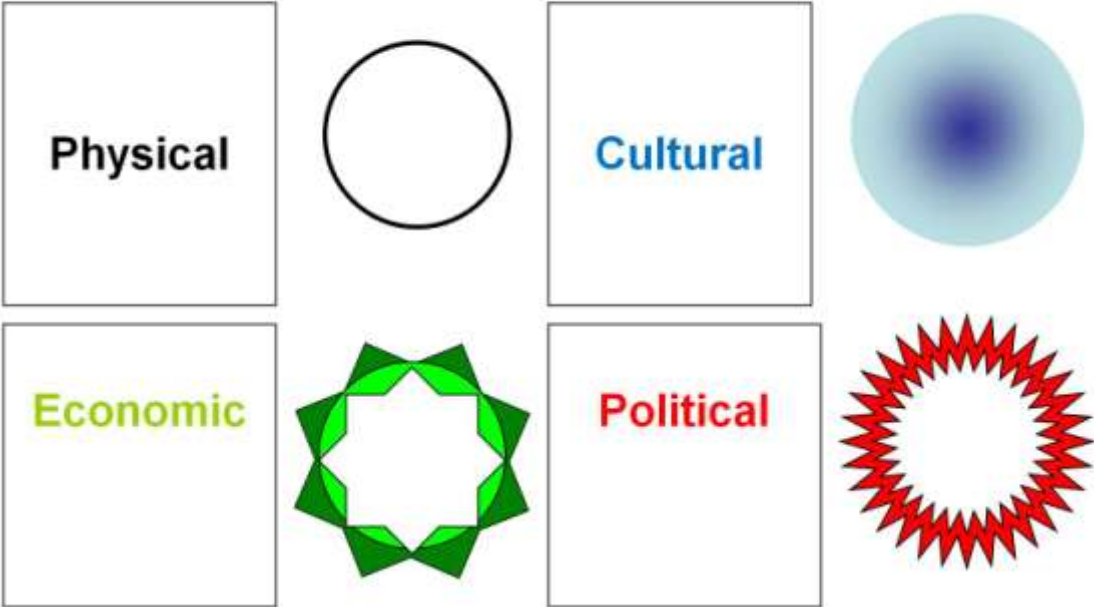


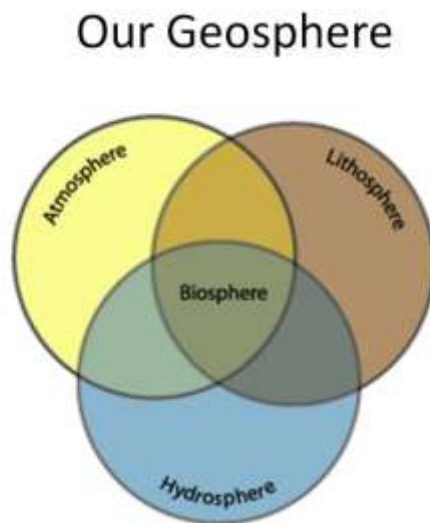
Figure 1: Geographic Factors and graphic symbols

## *Geographic Factors: Physical*

### **Physical Geographic Variables**

The rock hard foundation of geography is of course the earth itself. As a factor for consideration in the descriptive examination and understanding of our environment we need look no further than beneath our feet and over our head. The solid ground, the shifting air, and the waters all support the biosphere around us. They literally set the stage for human action and interaction.

Physical variables of geography include all measurable aspects of our environment from each of the “spheres” by which we have come to categorize the earth.



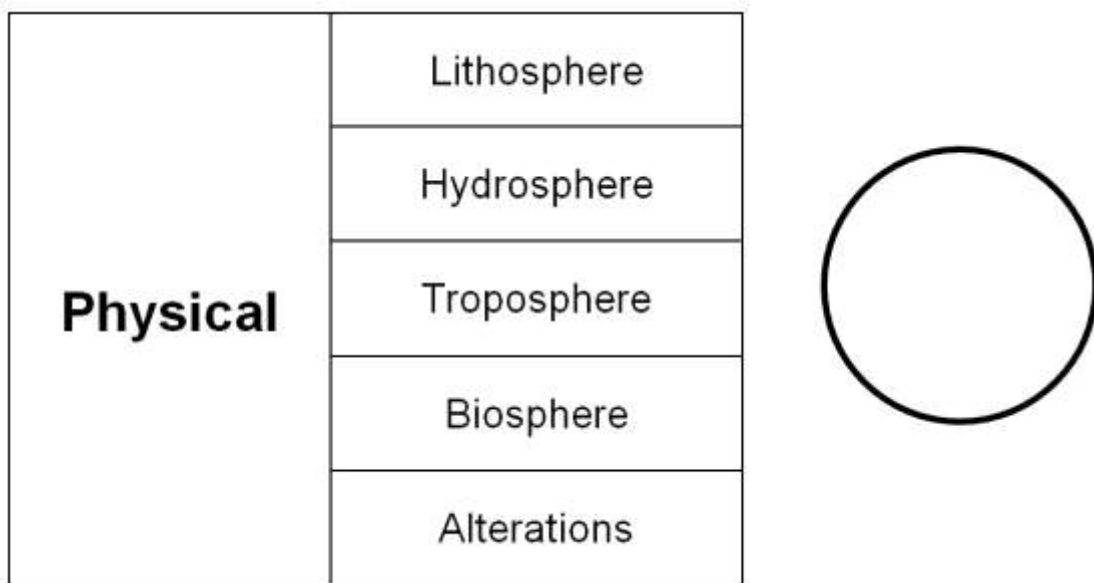
**Figure 2 Physical Factor: Geosphere**

These include the lithosphere, the atmosphere, the hydrosphere, and the biosphere. At our feet we contact the lithosphere measured by relative topography, soil type, substrate, and all manner of the chemists' and surveyors' craft. Take a breath and we interact with the troposphere. This gaseous portion of the atmosphere predates and permeates our experience and very life, moment by moment. Joining these spheres of solid and gas, is the hydrosphere that encompasses the planet in great oceans, fresh water lakes, and is caught up in the atmosphere as vapor and droplet.

Myriad meters of rivulet and river move water across land lucky enough to enjoy that liquid embrace. Great coverings of ice shape the earth, and shift across oceans in a slow dance. As the lithosphere allows, the hydrosphere moves through the hard heart of the planet rising as boiling steam and bubbling spring to seek out the greater bodies of ocean and atmosphere.

How the hydrologic cycle is manifest at a particular site of the lithosphere can determine vegetation, animal habitation, and the very food, clothing, housing, and economies of man. Driving that engine through climate and weather is the incident of solar radiation, specific to each site along the ladder of latitude.

As the sun allows through the movement and storage of its energy, life flourishes or recedes. The biosphere is that realm within all the others where life finds its expressions and leaves its mark. It is from this sphere we humans make our mark; humans alter every environment they contact.



**Figure 3: Physical Geographic Variables with graphic symbol**

The physical geographic variables to be considered are the lithosphere, hydrosphere, troposphere, biosphere and human alterations to these physical realities. Thus we compile the variables within the geographic factor of “Physical.” As we investigate any geostrategic actor we will begin with this physical factor and its variables. The actual data sets for each variable may be as extensive as resource will allow, yet the sets are interrelated and analyzed from a human perspective or operational mode.

This is the critical spatial foundation for analysis from the geographical perspective. To ignore this physical geography factor forestalls any holistic approach to geostrategic analysis. It is from this factor and its variables that we

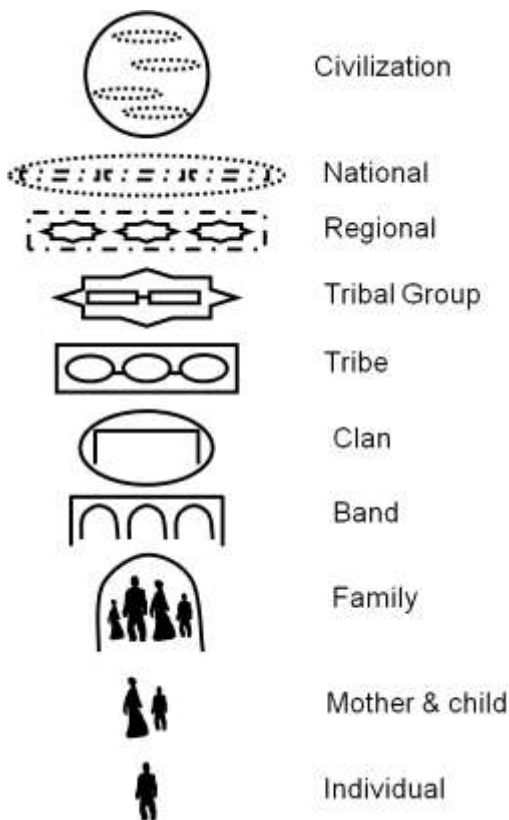
derive the physical constraints and potentialities that cannot be ignored. It is upon this physical matrix that the other factors are built. Culture, economics, and politics all find ultimate expression in this physical world.

### ***Geographic Factor: Cultural***

#### **Cultural Geographic Variables**

Culture is the common denominator of all those who are like you, and who include you within their circle of acceptance and meaning. Components of this critical construct include language, the requirements of family, the food we share, religion, and the precepts of property.

The first circle of human culture is the heart of a single loving mother. All concentric, tangent, and overlapping orbits of family, tribe, and nation revolve about it. Who is “us” and upon whom the “not us” name is given is the most basic cultural constraint (Clove & Ron 2005). Within this notion of family, a network or hierarchy of relationships is delineated. Power, prestige, and position are parceled out to every player in the human social game.



**Figure 4: Cultural Factor - Family (Social Structure)**

A shared language and myth is both the cause and effect of a common world view. A shared perception of reality; both mundane and sacred, is derived from the language of mind and mouth. Meaning cannot be spoken until it is imagined and imagination cannot be articulated without a language. Each tongue, each language, informs the speaker as well as the listener. A language’s vocabulary and structure reveals the people’s origins, perceptions, and priorities of the people who speak it. It is a primary means for how they think and process data.

Man may not live by bread alone, yet it is their “daily bread” that fuels the life

that speaks the language. Wheat, rice, and all manner of seeds surrounded by meaty fruit are the fodder of mankind. This sustenance has flourished into a cornucopia of all flesh and plants duly gathered, selected, and harvested. From the foods' specific physical context, a cultural one is created. Omnivorous mammals all, humankind has chosen their food ways from necessity and modified them by will, and remains marked by that choice. Looking at food as a cultural variable can open windows to greater analysis of what is sacred, what is comforting, and what provides calories.

As language provides a matrix of image, inspiration, and interaction; and as food sustains life; so then religion combines these into meaning and purpose for both time and eternity. We use religion here in the western sense, yet it would encompass Taoism as a way of life, and Confucianism as a philosophy and ethical construct without dependence or acknowledgement of a divine or supernatural being. So the variable of religion records a hierarchy of purpose and a construct for moral and ethical action. As the mind contains language so too food requires a container, beginning with the earth herself and ending in the final store house of the body. These earthy corporeal vessels enjoin experiences that create awareness of unbounded forces flitting at the edge of language. Religion recognizes a space that contains all that humans were, are, and ever hope to be.

All humankind's temporal existence and effort revolves around space both real and imagined. Within this space are objects of value both humble and grand.

How people deal with these tangible and intangible assets is the realm of property. From the water hole, or cave, or the fruit laden bush, to bank accounts and web domains, or any resource of choice; all are deemed property in human eyes. These elements of property vary greatly by type and kind in each culture, yet each culture shares the concept of property. The access to these resources is the beginning of ownership. Either unclaimed or shared by others, exclusive use is an enviable position to seek and maintain. Property is a common understanding required of any culture. It is here that we can tie culture to the physical landscape tangibly. Here we answer the question what can be owned, who can own it, and how that ownership is codified.



Figure 5: Cultural Geographic Variables with graphic symbol



The second set of key factors of our analysis of geostrategic reality is culture. It is within culture that we find the indicators of world view, decision making criteria, and the very meaning of life on the planet.

### ***Geographic Factors: Economic***

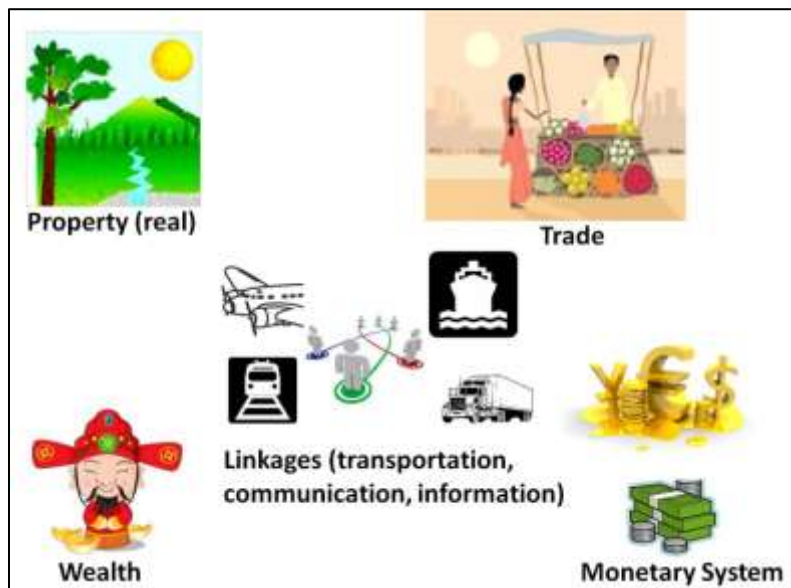
#### **Economic Geographic Variables**

In its broadest sense economics deals with the production, distribution, and consumption of goods and services, or the material welfare of humankind. These goods and services are “properties” that populate the transactions seen on the landscape. Economics is the result of human interaction in regards to property; what it is and who owns it (Bethel 1999).

Within the framework of culture, real property is the fundamental start of human economies. The tangible means for survival (water, food, and shelter) are our ultimate real properties. Knowledge, though intangible, is property as real as any. Knowing the route to the waterhole, the right plant to eat, and the techniques of protection are all “properties” worthy of value and recompense.

Once these elements of real and un-real properties are identified, then a system of trade may come into existence. This piece of fruit exists, I pluck it forming a right of eminent domain, I taste it to measure its value, I offer it to my mate, my mother, my master; seeking a quid pro quo (Dunbar 1988) in a sense of “enlightened

self-interest” (Dennet 1995). If I can secure the required resource without challenge, it is mine. If there is challenge and I take it in your absence it is mine. If I attempt to seize it from your hand, we either barter or fight. As we chose to barter, we establish relative value of properties, and services. All actions and objects have a value, a currency. From our collection of these recognized resources, we develop an amount of wealth or capital.



**Figure 6: Economic Geographical Variables**

Wealth, available exclusive resource, or capital are recognized and amassed. The words of definition and warehouses of distribution are measures of this wealth. From cowry shells to pounds sterling, from a gourd of water to a supertanker of oil,

from a stone axe to an industrial plant: measures of wealth are required for each economy.

In each civilization a representation of this relative wealth was required. We agree to a currency and system of money. This determines how we can measure, move, and manipulate value within our economy.

All these linkages of property, exchange, value, and currency become the matrix of our economy. The transportation of goods, dissemination of information, and all manner of communications become enablers of our economy. The nature and attributes of these systematic linkages becomes emblematic of our economy. It is within these linkages that friction occurs; frictions that require the lubrication of policy and politics.

These economic variables are bounded in time and space by cultural constraints. Within a cultural context they are transformed into infrastructure, transport, and edifices that provide a physical foundation for the society.

<b>Economy</b>	Property (real)
	Trade
	Wealth
	Monetary System
	Linkages (transportation, communication, information)

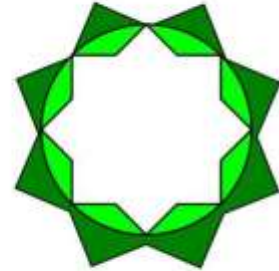


Figure 7: Economic Geographical Variables with graphic symbol

## ***Geographic Factors: Political***

### **Political Geographic Variables**

Political power is embodied in the systems of control and governance of the state. This political power is ultimately based upon information. This information comes from the data that is dynamically linked and processed within the linkages of the economic variables. It informs actions meant to cajole, conquer, and control. Political power provides the enforcement of the rules and regulations in the systems of money, trade, and property. In turn political power is underwritten by cultural thought ways, traditions, and meaning. It is culture that defines sanctioned acts of violence and who may carry them out. The geographical factors of culture, economics, and politics are co-joined and interdependent.

This political power is expressed in state's control of information, diplomacy, military, taxes, and censorship. The body of information used for political power is derived from many sources. It is combined into "strategic communications" by states and trans-national entities. This information campaign is meant to influence the perceptions of family, friends, and foe alike. All manner of media contains it. All means of transmission carry it. All in contact are influenced by it.

At each level of political power interaction, diplomacy plays its part. Diplomacy is the art and practice of conducting negotiations between parties. It is the skill to handle matters without arousing hostility and resistance. Negotiation is the subtext of all political information. It is the nuanced discussion of the potential

consequence of actions against the implied and stated interests of the engaged parties. It is a practical means of measuring the impact of the constant information stream that is released by an entity of power into the wider world. Continued diplomatic success precludes the use of military force.

Military science, action, and forces are an adjunct to the ebb and flow of diplomacy. Military might remains the sure enforcement of the stated outcomes of political dialog and diplomacy. If the soft voice does not convince, perhaps the big stick will. From the issuing of a parking ticket to the delivery of a smart bomb; the state's policies of control are given physical impact through application of armed force.

Political power is imbedded into economic activity by taxes, tariffs, and tribute. It is by these means that political power is sustained and expanded in a fiscal sense. Some believe the ability to tax is the ability to kill. It is certainly the means to accrue wealth required for the continuance of the ability to enforce political control.

Political power does not exist without some means for coercive violence. The first step on the path to ultimate human sanction (execution or homicide) is censorship. The ability to squelch information is fundamental to political power. Drown the offending information in a sea of friendly propaganda, remove the offending party from the means and media of communication, or silence through physical violence. The political variable of censorship resonates with the similar

information control found within the economic and cultural factors as well.

All the political variables exist in space through their impact on the physical environment as depicted in cultural and economic properties. Information is exposed in every cultural act, norm, and edifice. Negotiation is enacted in every economic transaction and every personal interaction. Sanctioned violence is embodied in sport and perpetrated by parent and police. Cultural norm determines each thought, word, or action that must be censored. The cultural, economic, and political factors once again become tangible in the physical form of the landscape, as reflected in means of communication, facilities for negotiation, and institutions of imprisonment.



Figure 8: Political Geographic Variables with graphic symbol

These geographical variables (physical, cultural, economic, and political) are the factors to be measured across selected landscapes. Measured in the time tested structures of social science, metering quality and quantity, without the stricture of a potentially *passé* linear Newtonian model.

<b>Physical</b>	Lithosphere	<b>Cultural</b>	Language
	Hydrosphere		Family
	Troposphere		Religion
	Biosphere		Food Ways
	Alterations		Property (ownership)
<b>Economic</b>	Property (real)	<b>Political</b>	Information
	Trade		Diplomacy
	Wealth		Military
	Monetary System		Tax
	Linkages (transportation, communication, information)		Censorship

Figure 9: Geographic Factors with Variables



# Geographic Factors

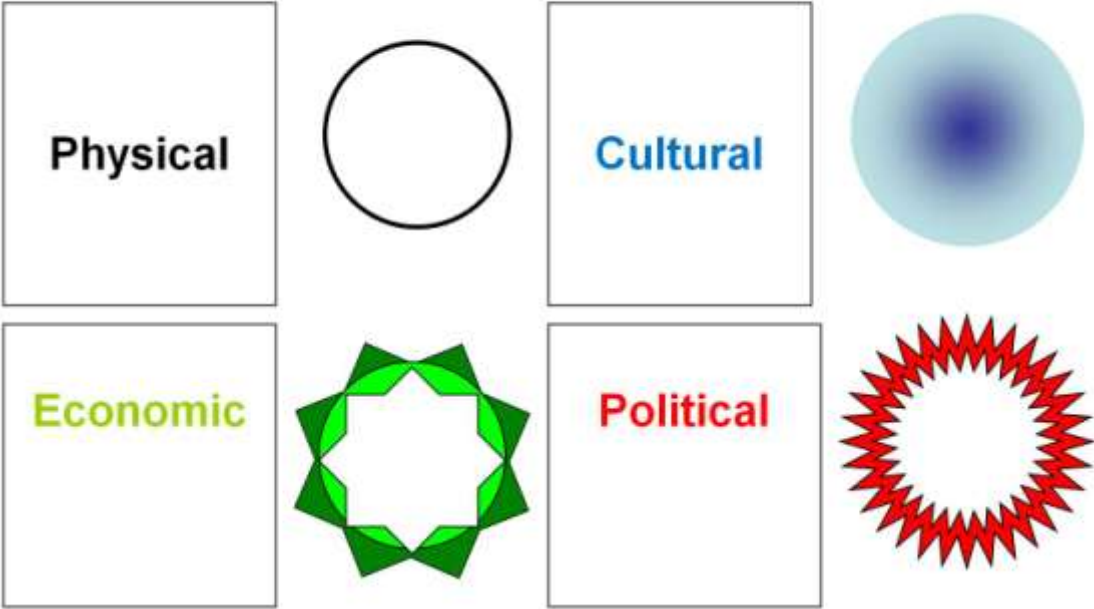


Figure 10: Geographic Factors and graphic symbols

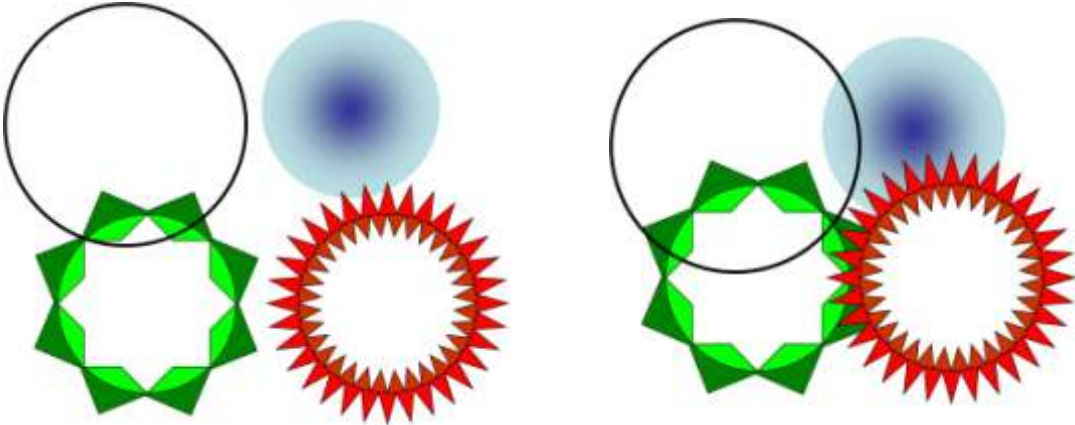
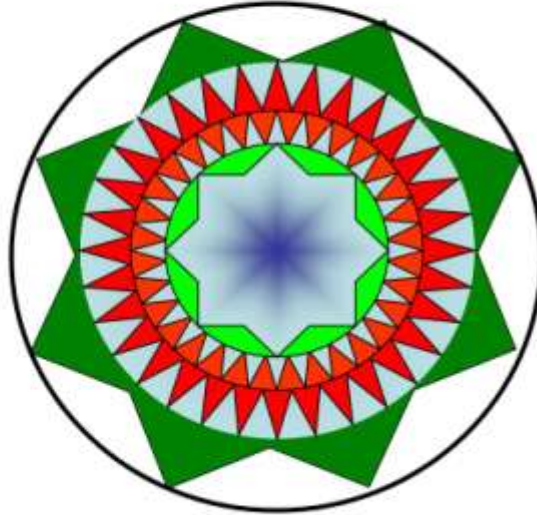


Figure 11: Converging Geographic Factors Graphics

## Geographic Factors and Variables with converged graphic symbols



Physical	Lithosphere
	Hydrosphere
	Troposphere
	Biosphere
	Alterations

Cultural	Language
	Family
	Religion
	Food Ways
	Property (ownership)

Economic	Property (real)
	Trade
	Wealth
	Monetary System
	Linkages (transportation, communication, information)

Political	Information
	Diplomacy
	Military
	Tax
	Censorship

**Figure 12: Geographic Factors and Variables with converged graphic symbols**

## Section 4 The Research Road Ahead: Agent-Based Model

### *Model Methodology*

In selecting an approach to the analysis of the select geographical variables, a prime consideration was to stay true to a non-linear, Einsteinian, chaotic, and holistic construct. One such approach is agent-based modeling (Bonabeau 2002, p.7280):

In agent-based modeling (ABM), a system is modeled as a collection of autonomous decision-making entities called agents. Each agent individually assesses its situation and makes decisions on the basis of a set of rules. Agents may execute various behaviors appropriate for the system they represent—for

example, producing, consuming, or selling. Repetitive competitive interactions between agents are a feature of agent-based modeling, (J. & R. 1996); (Axelrod, 1997)... At the simplest level, an agent-based model consists of a system of agents and the relationships between them. Even a simple agent-based model can exhibit complex behavior patterns (Reynolds, 1987) and provide valuable information about the dynamics of the real-world system that it emulates. In addition, agents may be capable of evolving, allowing unanticipated behaviors to emerge.

The ABM mindset is conducive to the scalable investigation of geographic impacts on human activity.

Many academic fields have found merit in these “simulation models in the study of ... evolving systems composed of many heterogeneous agents that exhibit bounded rationality and explicitly interact in a decentralized fashion. These models are known as agent-based models (ABMs)...” (Fagiolo 2007, p.189). The most appealing characteristics of ABM for our effort are shared by economists and include: a bottom-up perspective, heterogeneity, bounded rationality, and networked direct interactions (Fagiolo, Moneta, & Windrum 2007). Fagiolo (2007, p.189) explains:

*1. A bottom-up perspective* A satisfactory account of a decentralized economy is to be addressed using a bottom-up perspective because aggregate properties are the outcome of micro-dynamics involving basic entities (agents) (Tesfatsion, 2002). This contrasts with the top-down nature of traditional neoclassical models, where the bottom level typically comprises a representative individual and is constrained by strong consistency requirements associated with equilibrium and hyper-rationality. Conversely, AB models study economic systems that may be persistently out of equilibrium (if any) or fluctuating around some meta-stable states.

2. *Heterogeneity* Agents are (or might be) heterogeneous in almost all their characteristics. These can range from initial endowments and other agents' properties, all the way through to behavioral rules, competencies, rationality, and computational skills.

3. *Bounded rationality* The environment in which real-world economic agents live is too complex for hyper-rationality to be a viable simplifying assumption (Dosi, Marengo, & Fagiolo, 2005). It is suggested that one can, at most, impute to agents some local and partial (both in time and space) principles of rationality (e.g., myopic optimization rules). More generally, agents are assumed to behave as bounded rational entities with adaptive expectations. Moreover, since they are not initially endowed with a full understanding of the underlying structure of the environment in which they operate, they engage in open-ended searches wherein the nature of learning is at odds with Bayesian decision rules assumed by neoclassical economics.

4. *Networked direct interactions* Interactions among economic agents in AB models are direct and inherently non-linear (Fagiolo G., 1998; Windrum & Birchenhall, 1998); (Silverberg, Dosi, & Orsenigo, 1988). Agents interact directly because current decisions directly depend, through adaptive expectations, on the past choices made by other agents in the population (i.e., a widespread presence of externalities). These may contain structures, such as subgroups of agents or local networks. In such structures, members of the population are in some sense closer to certain individuals in the socio-economic space than others. These interaction structures may themselves endogenously change over time, since agents can strategically decide with whom to interact according to the expected payoffs. When combined with heterogeneity and bounded rationality, it is likely that aggregation processes are non-trivial and, sometimes, generate the emergence of structurally new objects (Lane, 1993a,b)

Each of the aspects above apply to the nature of our geographical contextual analysis.

Geographic processes begin from the bottom-up. From the tumbling of the first stone in a rock slide to the migration of the first immigrant, patterns and processes begin

with individual action. Our agents and actors are fundamentally heterogenous, from the variance in language to latitude and longitude of location. No one reasonably expects humans to act in a continuously “rational” manner. Our global environment (physical, cultural, economic, and political) ensures often seemingly irrational and chaotic behavior. Finally, all our selected variables are intertwined and integrated by the very subject of our inquiry: human experience and action in a geographic context.

Therefore agent-based modeling is a technique suitable as a framework for pursuing a study of geographical operational dynamics as seen in light of a classic human-centric approach to our spatial experience.

Within our ABM approach I will provide a rule set of “operational imperatives” that will initially inform the decisions and actions of our agents. Our interactive agents are the geographic variables themselves. As Bonabeau says, “...in ABM, one models and simulates the behavior of the system’s constituent units (the agents) and their interactions, capturing emergence from the bottom up when the simulation is run” (p.7280). Our complex constituent units are the generalized geographical variables enumerated above (Figure 12). Their individual actions related to dynamics of the other variables create the holistic condition of the player we are examining.

### ***Operational Imperatives***

The operational imperatives are those facets of geographic reality that must be

included in each consideration and calculation of human activity as it occurs in a spatial context. Capability, Intent, Action, and Outcome are essential measures of the human situation that can inform a sequential interaction observable in history, on the current landscape, and projected into the future. These are time tested in the military arts of analysis and prediction as the critical elements of information needed to plan and execute operations from the tactical to the strategic levels (U.S.Army 2004). Each operational imperative is further parsed into three modes unique to each imperative. This is meant to facilitate the agent-based model (ABM) characteristic of revealing synergistic emergent phenomenon. These modes are described for each operational imperative below.

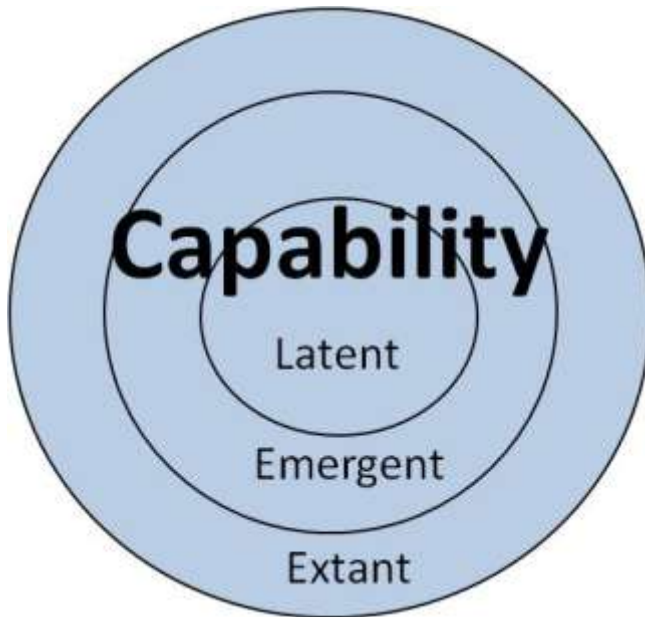


Figure 13: Operational Imperative – Capability

### Capability

The first operational imperative is “Capability” (Figure 13). This consists of an evaluation of capabilities in each of the four Geographic Factors. Recall that each Geographic Factor is comprised of five variables (Figure 12). Each geographic variable is to be considered in three operational modes: extant, emergent, and latent.

Each considered capability is listed in three operational modes as above (Figure 13). Extant capabilities are those that are currently known, exercised, and often even flaunted. Emergent ones are those in development, on the cusp of distribution, or just taking effect. For example, in the year 1780 steam power was an

emergent capability, in 1880 railroads were an emergent capability in the American West, and in 1980 the internet was an emergent capability. Latent capabilities are those dormant aspects and patterns often hidden from cursory investigation and analysis. The non-participating number of potential voters could be a latent political capability. Undiscovered oil and gas reserves could be a latent economic capability. Each Geographical Variable is to be considered as a Capability; distributed in the three modes, Extant, Emergent, and Latent.

Consider how we will populate the data matrix by examining the four Operational Imperatives (Capability, Intent, Action, and Outcome) in the context of the Geographical Variables. The recording of Capability in the first Geographical Variable set of “Physical” is straight forward. A common description of topography related to the examined player’s site and situation can be used in our “Lithosphere” variable under our Extant operational mode. Narrative descriptive information can be indexed, converted, quantified, or interpolated as necessary.



<b>Geographic Factor</b>	<b>Operational Imperatives</b>		
<b>Physical</b>	<b>Capability</b>		
Variables	Operational Modes		
	Extant	Emergent	Latent
Lithosphere			
Hydrosphere			
Troposphere			
Biosphere			
Alterations			

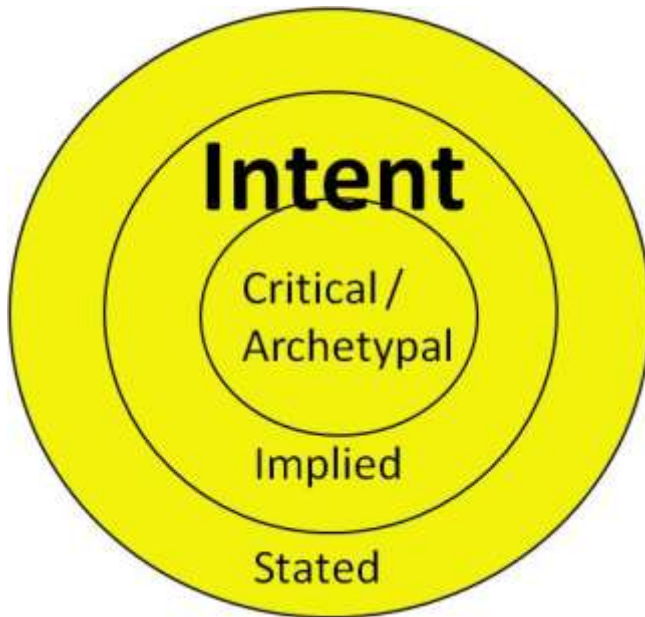
**Figure 14: Data Matrix Example**

Within the Hydrosphere we record aspects germane to the nature and scale of our examined player. This “examined player” may be a regional organization, a nation, a state, or other human organization. Rivers, major lakes, and per capita consumption of fresh water are all data points to be used in the analysis of nations, states, regions, cities, etc. These data are not merely a tabular accounting of a descriptive nature as in a regional geography approach. They are data for analysis as

it interacts with other Geographic Factors within an Agent-Based Model. Coastline and navigable waters are aspects that may be included here or under other variables as appropriate, for example, in Factor: Economy under the Variable: Linkages.

Troposphere has to do with climatic air movements (seasonal winds, hurricanes, etc) as well as air quality. Within the Biosphere all manner of flora and fauna are screened. Also the human demographics can be recorded. Finally, human prompted alterations to the physical landscape are considered. The transition of the American Great Plains to agricultural fields is a good example. Obviously all these delineated parts of the physical world are integrated and interactive. As we develop rule sets for each agent, this must be taken into consideration and is a strength of the Agent-Based Model approach.

The example discussed above is within the Extant Operational Mode. The remaining two modes (Emergent and Latent) would also be considered and recorded for the Physical Geographic Variable set.

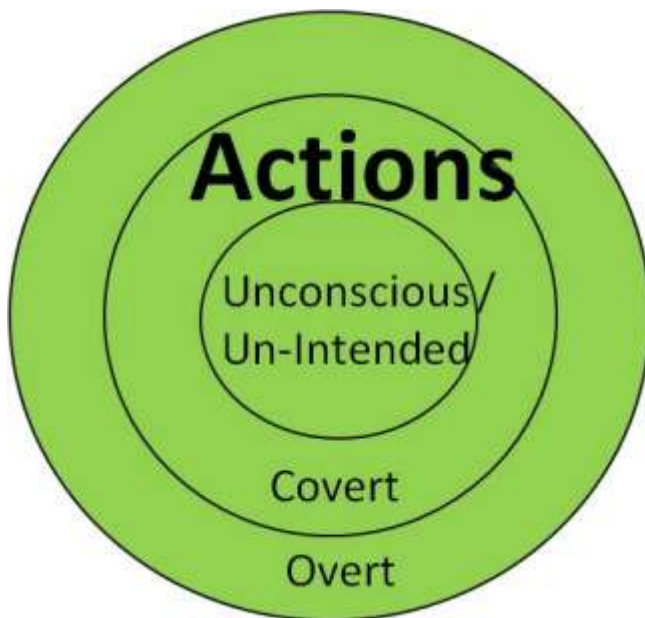


**Figure 15: Operational Imperative - Intent**

### **Intent**

The next Operational Imperative is Intent. Here we capture aims of our player regarding the Geographic Variable set in question (Physical, Cultural, Economic, or Political). The three modes to consider for this Operational Imperative are: Stated, Implied, and Critical (Archetypal). Each time we consider intent we examine the written, spoken, and recorded communication of our player's goals. From this we ascertain the Stated intent. Political speeches, religious doctrine, published budgets; these all telegraph stated intentions. Of course these proclamations will espouse official positions and may include purposeful misdirection. Implied intent is the unspoken consequence of the stated intent. A government announces it will increase service; the Implied Intent is increased taxes. Critical Intent is that fundamental motivation that

cannot be denied or ignored no matter what is said or left unsaid. The Critical or Archetypal intent of a mother is the protection and survival of her child. She may vow to uphold the law, or leave implied that her loyalty is to another relationship, yet her normal desire for her child's safety and survival will over-ride those sentiments. These operational imperatives and the modes are not fundamentally spatial, rather more conceptual. However their consequences are always evidenced in a spatial context within the geographic Factors and their Variables.



**Figure 16: Operational Imperative - Actions**

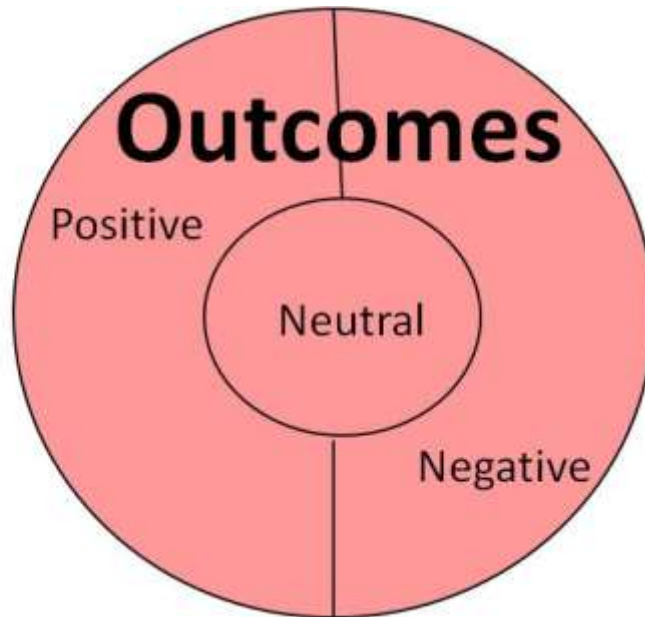
### **Actions**

The third Operational Imperative is Actions, what our player does or has done. The modes of this Action to be considered are: Overt, Covert, and Unintended (Unconscious). Each time we record actions we sort those that are claimed publicly or

revealed by necessity, these in the Overt category. Covert actions are inherently hidden in contemporary events, yet may be revealed in historical documents or captured in alternative sources. The Unintended or Subconscious actions observable in individuals are often repeated at greater scale by nations and organizations; passive-aggressive behavior, compulsion, reaction to perceived danger, etc.

An example of unintended or subconscious actions could be how Saddam Hussein continued to claim the right to maintain nuclear, biological, and chemical weapons programs even after the humiliating defeat and destructions suffered in the first Gulf War (1991). In the decade leading up to the 2003 Invasion of Iraq (Operation Iraqi Freedom), Saddam Hussein took many overt and covert actions to maintain his government and his own personal survival. Yet his constant resistance to inspections regarding his destroyed and defunct weapons programs only fueled the resolve and conviction of the west to conduct regime change through sanctions, air strikes, and finally invasion.

All these actions result in outcomes which continue to inform the operational imperatives cycle.



**Figure 17: Operational Imperative - Outcomes**

### **Outcomes**

Our final Operational Imperative is Outcomes. Here we measure and mete out the results of our player's actions. The modes of these Outcomes are: Positive, Negative, and Neutral. Positive in the sense the outcome builds upon the intentions of the player. Thus the Outcomes are referential back to the Intentions. The outcomes build our data set for the next set of capabilities in the operational cycle. This completes a complete cycle of the Operational Imperatives.

So each Geographical Variable set is processed through the Operational Imperatives. Examples of these data matrices are in Figures 18-21.

The refinement of Geographic Variable Selection and the adroit perception of

the operational modes within each Geographic Imperative are critical to the predictive nature of the proposed model. It is very much an Expert-system requiring all the skill and experience of any difficult navigation challenge. This is the key – using geographical thinking as “The” expert system.

Physical	Capabilities		
	Extant / Active	Emergent / Inactive	Latent / Potential
Hydrosphere			
Lithosphere			
Troposphere			
Biosphere			
Alterations			

Figure 18: Geographic Variable Sets processed through Operational Variable – Capabilities

Cultural	Capabilities		
	Extant / Active	Emergent / Inactive	Latent / Potential
Language			
Family			
Food Ways			
Religion			
Property (ownership)			



<b>Economic</b>	<b>Capabilities</b>		
	Extant / Active	Emergent / Inactive	Latent / Potential
Property (real)			
Trade			
Capital			
Monetary System			
Linkages (transportation, communication, information)			

<b>Political</b>	<b>Capabilities</b>		
	Extant / Active	Emergent / Inactive	Latent / Potential
Information			
Diplomacy			
Military			
Tax			
Censorship			

Physical	Intent		
	Stated	Implied	Critical/archetypal
Hydrosphere			
Lithosphere			
Troposphere			
Biosphere			
Alterations Modifications			

Figure 19: Geographic Variable Sets processed through Operational Variable – Intent

Cultural	Intent		
	Stated	Implied	Critical/archetypal
Language			
Family			
Food Ways			
Religion			
Property (ownership)			

<b>Economic</b>	<b>Intent</b>		
	Stated	Implied	Critical/archetypal
Property (real)			
Trade			
Capital			
Monetary System			
Linkages (transportation, communication , information)			

<b>Political</b>	<b>Intent</b>		
	Stated	Implied	Critical/archetypal
Information			
Diplomacy			
Military			
Tax			
Censorship			

Physical	Actions		
	Overt	Covert	Unconscious / Unintended
Hydrosphere			
Lithosphere			
Troposphere			
Biosphere			
Alterations			

Figure 20: Geographic Variable Sets processed through Operational Variable – Action

Cultural	Actions		
	Overt	Covert	Unconscious / Unintended
Language			
Family			
Food Ways			
Religion			
Property (ownership)			

<b>Economic</b>	<b>Actions</b>		
	Overt	Covert	Unconscious / Unintended
Property (real)			
Trade			
Capital			
Monetary System			
Linkages (transportation, communication, information)			

<b>Political</b>	<b>Actions</b>		
	Overt	Covert	Unconscious / Unintended
Information			
Diplomacy			
Military			
Tax			
Censorship			

Physical	Outcomes		
	Positive	Negative	Neutral
Hydrosphere			
Lithosphere			
Troposphere			
Biosphere			
Alterations			

Figure 21: Geographic Variable Sets processed through Operational Variable - Outcomes

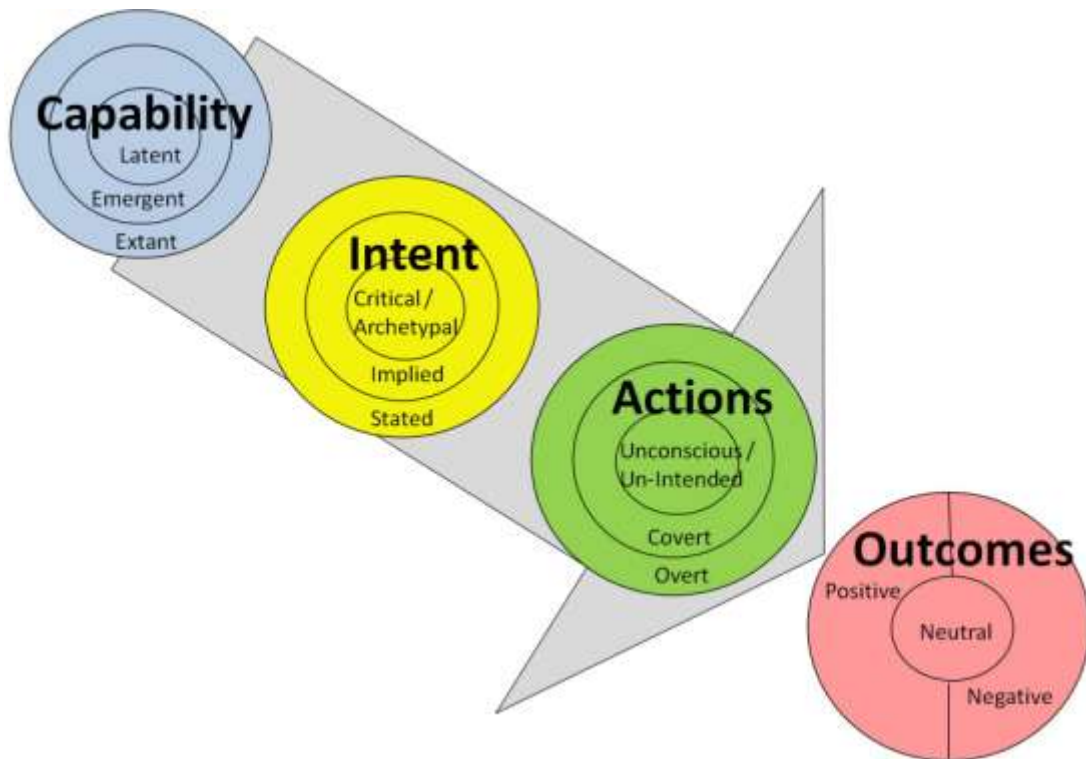
Cultural	Outcomes		
	Positive	Negative	Neutral
Language			
Family			
Food Ways			
Religion			
Property (ownership)			

<b>Economic</b>	<b>Outcomes</b>		
	Positive	Negative	Neutral
Property (real)			
Trade			
Capital			
Monetary System			
Linkages (transportation, communication, information)			

<b>Political</b>	<b>Outcomes</b>		
	Positive	Negative	Neutral
Information			
Diplomacy			
Military			
Tax			
Censorship			

### ***Operational Imperatives Process Cycle***

Our interests are primarily in state based entities (players) operating in a global milieu. In reality states operate according to an intractable number of rules, principles, and yet unknown influences. Our structure of operational imperatives works within three modes which facilitate the agent-based model (ABM) characteristic of revealing synergistic emergent phenomenon. Repetitive iterations of a prescribed process cycle for each modeled agent will provide recognizable patterns that lead to inferential predictive analysis. One such cycle is depicted in Figure 22.



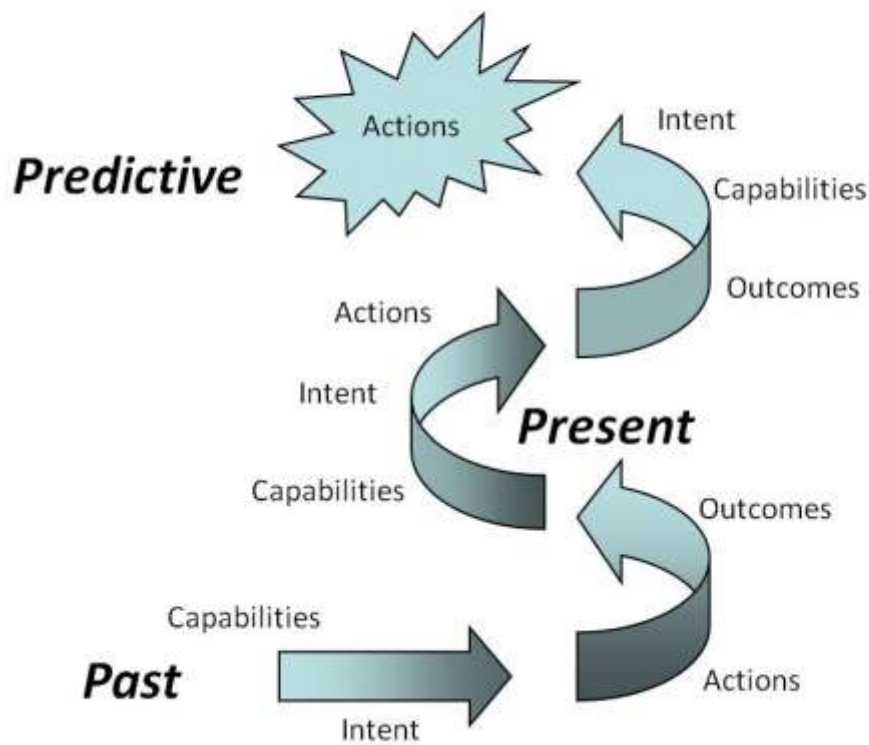
**Figure 22: Operational Imperatives Process**

For the purpose of our study we approach each player in a cycle of analysis



starting with the considerations of all Geographic Variables through the Operational Imperatives within the datum of the “Past,” the “Present,” then speculatively into the “Predictive.”

## Operational Imperatives Process Cycle.



**Figure 23: Operational Imperatives Process Cycle**

The three-phased cycle can be interjected anywhere into the history of our player. This procedure supplies us with an opportunity to refine our selection of

variables and record the operational modes based upon historic outcomes. If we are studying a geostrategic player, for illustration a European state, we can begin our first cycle of examination in 1918, just after the First World War. Our next cycle begins in 1928 and, even though we name it “Present,” it is populated by our current historical knowledge from the time period. Our third cycle is “Predictive” and it starts in 1938. As objectively as possible we predict the actions of our selected state using the four Geographic Factors of Physical, Cultural, Economic, and Political. Then we validate, verify, and adjust our process based upon the actual events of history. Now our model is more robust and reliable. The period 1928 to 1938 becomes our next beginning cycle (named Past) and 1938 to 1948 is our “Present.” Once again 1948-1958 is predicted by our Expert System and agent-based model (ABM) approach. This effort is then compared to historical record for verification, validation, and adjustment. This allows evolutionary learning within our expert system and Agent-based Model. As is typical of the scientific method, now our refined “Predictive Cycle” of 1948 to 1958, becomes our new starting point or “Past.” This three-phase cycle continues until we project into the actual future and establish a working forecast of player actions.

The imperatives operate within a cycle where capabilities inform the intent of the chosen player which in turn enables action producing outcomes that underpin changes in player capabilities measured all across the gamut of geographical variables. This unfolds in the “Past, Present, and Predictive” spiral.



in this paper. Adoption of this geographic approach will provide more usable results from model-based analysis.

The validity of these geographic factors, operating in an Agent-Based Model, can be investigated through proven methods such as Dean S. Hartley's verification, validation, and accreditation tool designed for Human Cultural Behavior Models (HCBM) (Hartley 2010). The necessary amount of funds, computer hardware, programming expertise, and program management to execute and evaluate an Agent-Based Model of this magnitude is daunting. Without these resources it is impossible to conduct the specific tests and demonstrations necessary to move beyond the "thought experiment" stage. In the following sections, a simple correlation approach will be used to provide further proof of principle.

## Section 5 Geographic Factors related to Genocide: Macro Scale

In this section we will employ the Pearson Correlation Coefficient to measure indications of relationships between our Geographic Factors and Genocide.

A simple application of the Geographic Factors on a mega-scale can illustrate their analytical utility. Here we will take incidents of Genocide and see if there is a correlation with the Geographic Factors (Physical, Cultural, Economic, and Political). Our null hypothesis would be that there is no relationship between the measured phenomena of the Geographic Factors and incidents of genocide. Genocide is an extreme test as related to other forms of conflict and offers us a clear target of analysis.

The general alternative hypothesis is that since genocide is experienced within a human social context, then there may be a significant correlation to certain cultural, economic, and political expressions manifest at the time and place of the acts of genocide. Using our Geographic Factors and Variables as independent variables we will explore their correlation with the dependent variable of genocide. This may provide us with additional information that can focus further data gathering and analysis.

The term genocide is a mid twentieth century term, accredited to Rafal

Lemkin (1900-1959), a professor of law. His definition (1944, p.80) is our baseline:

New conceptions require new terms. By "genocide" we mean the destruction of a nation or of an ethnic group. This new word, coined by the author to denote an old practice in its modern development, is made from the ancient Greek word *genos* (race, tribe) and the Latin *cide* (killing), thus corresponding in its formation to such words as tyrannicide, homicide, infanticide, etc. Generally speaking, genocide does not necessarily mean the immediate destruction of a nation, except when accomplished by mass killings of all members of a nation. It is intended rather to signify a coordinated plan of different actions aiming at the destruction of essential foundations of the life of national groups, with the aim of annihilating the groups themselves. The objectives of such a plan would be disintegration of the political and social institutions, of culture, language, national feelings, religion, and the economic existence of national groups, and the destruction of the personal security, liberty, health, dignity, and even the lives of the individuals belonging to such groups. Genocide is directed against the national group as an entity, and the actions involved are directed against individuals, not in their individual capacity, but as members of the national group.

Therefore, in the broadest sense, what are the relationships among factors and the incident of genocide? Is there a correlation of cause and effect with aspects of economy and genocide? Can a causal relationship be established between political variables and genocide? Does one particular physical landscape appear to have greater incidents of genocide? These are questions that will drive our data selection and analysis below.

The constructs in this evaluation will be to use incidents of genocide in the 20<sup>th</sup> century that are broadly accepted in the historical, political, and social literature.

Each of the incidents chosen has its own body of literature and analysis. *Century of Genocide*, edited by Samuel Totten and William S. Parsons, is one compilation that contains all of our chosen genocide events (Totten and Parsons 2009). Figure 25 below provides a matrix of the genocides chosen. States are listed in alphabetical order by region. Also included are “control countries” that exist in proximity to those states that experienced genocide, but did not experience genocide themselves. These control countries share common historical and geographical traits with the states that experienced genocide.

<b>Country</b>	<b>Genocide</b>	<b>Deaths</b>
<b><i>Europe</i></b>		
Armenia	Armenians 1915-1923	500,000 killed
Belarus	None	
Bosnia	Bosnian Muslims 1995	8,000 killed
Denmark	None	
Germany	European Jews 1939-1944	5,000,000 to 6,000,000 killed
Ukraine	Ukraine Peasants 1932-1933	2,400,000 to 7,500,000 dead
<b><i>Africa</i></b>		
Burundi	Hutu 1972	200,000 to 300,000 killed
Namibia	Hereros 1904-1906	60,000 killed
Rwanda	Tutsi 1994	500,000 killed
South Africa	None	
Uganda	None	
<b><i>Southwest Asia</i></b>		
Iran	None	
Iraq	Kurds 1988	50,000 to 200,000 killed
<b><i>South and Southeast Asia</i></b>		
Bangladesh	Bengalis 1971	3,000,000 killed
Cambodia	Khmer 1970s	2,200,000 killed
Indonesia	Indonesian Communists 1965-1966	500,000 killed
Thailand	None	
<b><i>Central America</i></b>		
Guatemala	Maya 1980s	200,000 killed (1960 – 1996)
Honduras	None	

Figure 25: Selected 20th Century Genocides and Selected Adjacent States



Indices from selected private and public research organizations regarding physical, cultural, economic, and political factors are used to capture an aggregate of data for the Geographic Factors and Variables. Figure 26 depicts the sources and characteristics of these indices. Each data source will be explained more fully in context below.

Geographic Factor	Research Data Source	Description
Physical	Laboratory for Anthropogenic Landscape Ecology (Laboratory for Anthropogenic Landscape Ecology 2010)	Anthromes (version2) 1700ce – 2000ce.  Population & Land Use (Agency 2010)
	Department of Geography & Environmental Systems	Population density (persons km <sup>-2</sup> )
	University of Maryland	% Urban area
		% Crop area
		% Pasture area
		% Irrigated area (Aquastat 2012), ( Goethe Universitat Frankfurt am Main 2008)  % Rice area (Ramanjuttu 2010)

Figure 26: Geographic Factor Data Source - Physical

<b>Geographic Factor</b>	<b>Research Data Source</b>	<b>Description</b>
Cultural	Association of Religion Data Archives (Archives 2012)	<ol style="list-style-type: none"> <li>1. Government Regulation of Religion Index</li> <li>2. Social Regulation of Religion Index</li> <li>3. Government Favoritism of Religion Index</li> <li>4. Religious Persecution Index</li> </ol>

Figure 26: Geographic Factor Data Source - Cultural

<b>Geographic Factor</b>	<b>Research Data Source</b>	<b>Description</b>
Economic	The Heritage Foundation (Miller, Holmes and Feulner 2012)	<ol style="list-style-type: none"> <li>1. freedom in business</li> <li>2. trade</li> <li>3. fiscal</li> <li>4. government spending</li> <li>5. monetary</li> <li>6. investment</li> <li>7. finance</li> <li>8. property rights</li> <li>9. freedom from corruption</li> <li>10. labor freedom</li> </ol>

Figure 26: Geographic Factor Data Source – Economic

Geographic Factor	Research Data Source	Description
Political	Freedom House (Puddington 2012)	Political and Civic Freedoms Index as measured in these sub-areas:  Political Rights - a. electoral Process b. Political Pluralism and Participation c. Functioning of Government  Civil Liberties - d. Freedom of Expression and Belief e. Associational and Organizational Rights f. Rule of Law g. Personal Autonomy and Individual Rights

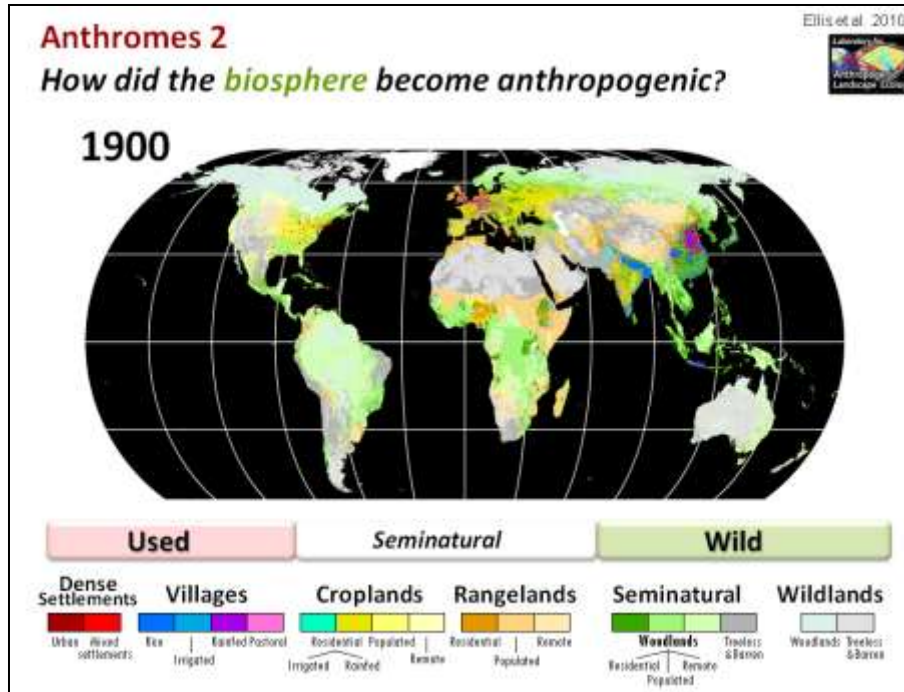
Figure 26: Geographic Factor Data Source – Political

## **Physical**

Using the “Ecotope- Anthomes“ index, compiled by the Laboratory for Anthropogenic Landscape Ecology, no correlation between the “Physical Geography” of a country and the incident of genocide was found. The Spearman’s Correlation Coefficient = .29 (with an  $r^2 = .08$ ). This is not statistically significant.

The physical environment is a complex structure made up of a myriad of features that require a demanding and extensive effort to catalog. However for the purpose of this illustration we use the anthomes as a composite index for the geographic physical factor and its variables. Given the great number of elements from which the index was derived it is a reasonable surrogate in this sample.

The five variables of the Physical Geographical Factor described in Section 3 (lithosphere, hydrosphere, troposphere, biosphere, and human changes) can be examined well by using anthropogenic ecotope mapping (Ellis et al. 2006) and analysis. Ecotope features are mapped by a multi-stage scale-explicit, rule-based, direct interpretation of land use and vegetation features in georeferenced high resolution remotely sensed imagery by a trained mapper, combined with direct verification of features in the field (groundtruthing) by the mapper in collaboration with local land managers who assist wherever features are confusing or extant only in the past (Ecotope Feature Mapping 2008).



**Figure 27: Depiction of Anthrome Typology (Laboratory for Anthropogenic Landscape Ecology 2010)**

The typology of ecotopes or anthomes is categorized on a scale from “Wild Lands (unused by humans) to Dense Settlements (used completely by humans).” Data from the Google Earth 1900 data (Laboratory for Anthropogenic Landscape Ecology 2010) was used to examine correlation between physical variables and genocide. Using this index, no correlation between physical environment and genocide was found. It appears that genocide is not limited to any particular area of the earth or environment.

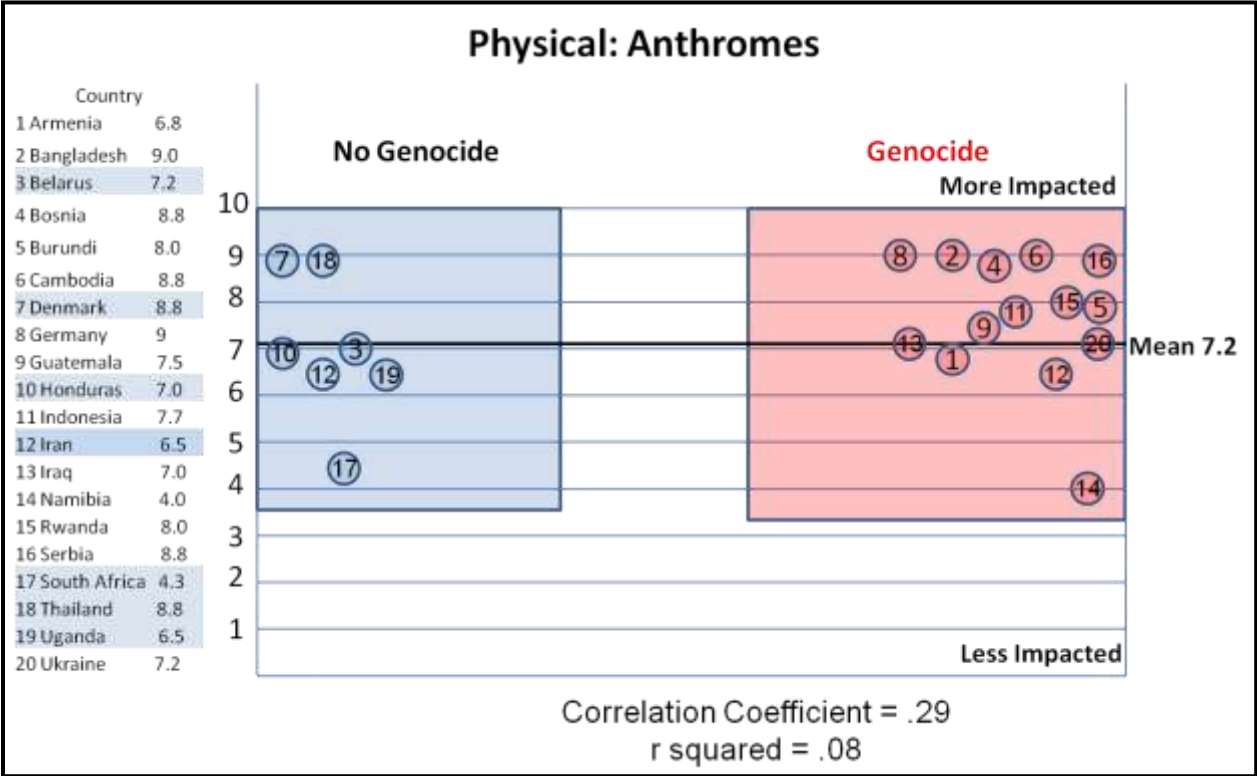


Figure 28: Physical: Anthromes Genocide Correlation

**Cultural**

Using the “Religious Freedom” index compiled from data by the Association of Religious Data Archives (ARDA), a significant correlation between the “Religious Freedom” of a country and the incidence of genocide was found. The Spearman’s Correlation Coefficient = .52 (with an  $r^2 = .27$ ).

Of the five variables of the Cultural Geographical Factor described in Section 3 (Language, Religion, Family, Food Ways and Property), freedom of religion can be a key indicator of cultural climate. The Association of Religious Data Archives (ARDA) has amassed data for countries in several aspects regarding the practice of religion in the 20<sup>th</sup> century. Four indexes of note are their Government Regulation of Religion Index, the Social Regulation of Religion Index, Government Favoritism of Religion Index, and the Religious Persecution Index. These in compilation provide a sense of the religious freedom within a country. These index data bases are developed from US State Department reports (Association of Religion Data Archives, 2012). Brian Grim and Roger Finke (Grim and Finke 2006) describe the coding of the U.S. State Department's International Religious Freedom reports. Detailed descriptions of each of these four indexes are enumerated on the ARDA website (Archives 2012).

The index of Religious Freedom used in our analysis reflects both government policy and societal attitudes in our target countries. Governments and civil society implicitly work in tandem to create atmosphere and landscape of religious freedom and tolerance. This practical expression of religious freedom is a forceful indicator of cultural climate.

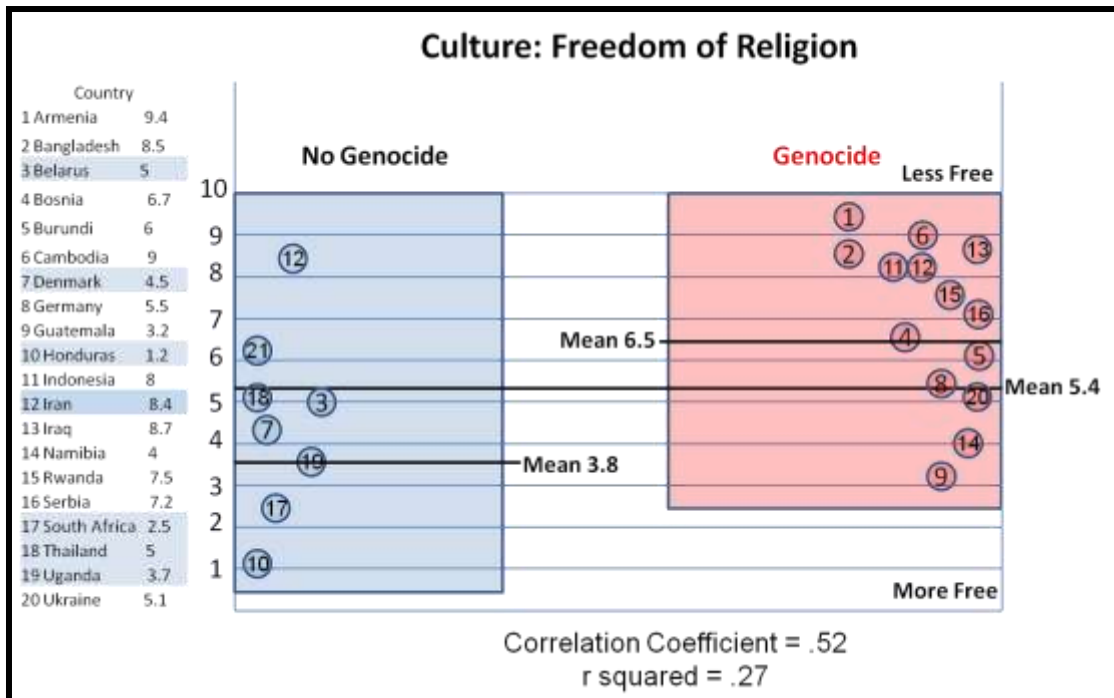


Figure 29: Culture: Freedom of Religion Genocide Correlation

## Economic

Using the “Economic Opportunity and Prosperity” index compiled by the Heritage Foundation and the Wall Street Journal, no significant correlation between the “Economic Freedom” of a country and the incident of genocide was found.

Economic freedom was defined as “Economic freedom is the fundamental right of every human to control his or her own labor and property. In an economically free society, individuals are free to work, produce, consume, and invest in any way they please, with that freedom both protected by the state and unconstrained by the state. In economically free societies, governments allow labor, capital and goods to



move freely, and refrain from coercion or constraint of liberty beyond the extent necessary to protect and maintain liberty itself” (The Heritage Foundation 2012). The index was created from ten measured components of economic freedom. These are freedom in business, trade, fiscal, government spending, monetary, investment, finance, property rights, freedom from corruption, and labor freedom ( The Heritage Foundation 2012).

An in-depth explanation of The Heritage data methodology is available on their website.

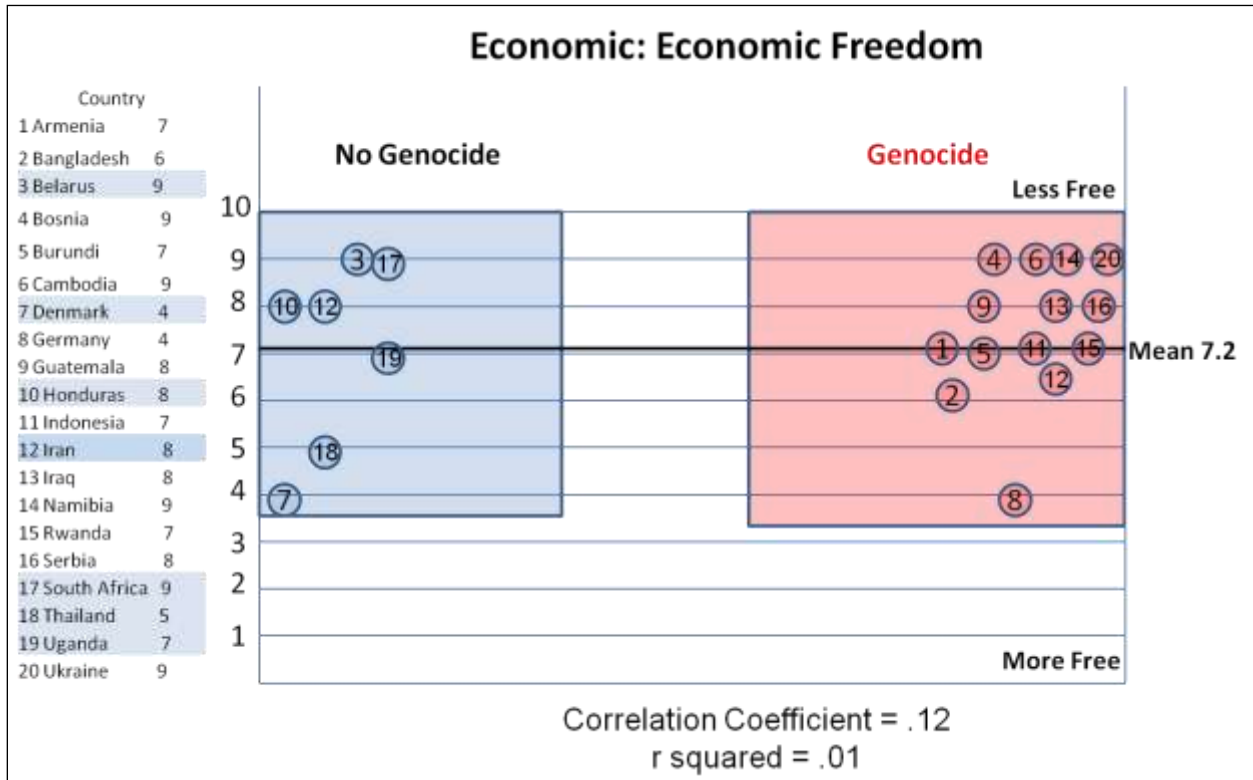
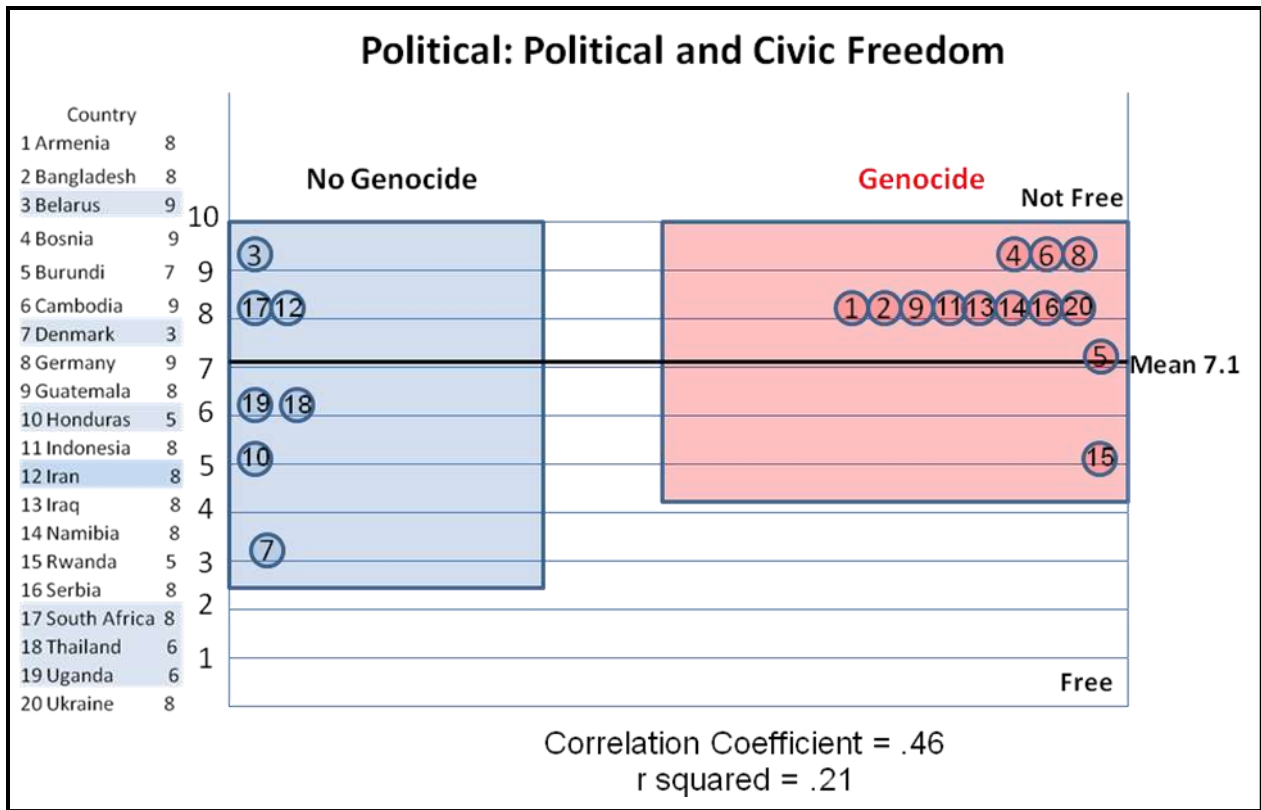


Figure 30: Economic: Economic Freedom Genocide Correlation

## **Political**

Using the *Freedom in the World* index compiled from data by the Freedom House, a significant correlation between the “Political and Civic Freedom” of a country and the incidence of genocide was found. The Spearman’s Correlation Coefficient = .46 (with an  $r^2 = .21$ ).

The *Freedom in the World* survey (Freedom House 2011) provides an annual evaluation of the progress and decline of freedom in 195 countries and 14 related and disputed territories. The survey, which includes both analytical reports and numerical ratings, measures freedom according to two broad categories: political rights and civil liberties. The Political rights ratings are based on an evaluation of three subcategories: electoral process, political pluralism and participation, and functioning of government. The Civil liberties ratings are based on an evaluation of four subcategories: freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. A detailed description of each category is available on the Freedom House website (Freedom House 2011).



**Figure 31: Political: Political and Civic Freedom Genocide Correlation**

The results of the study indicate a significant correlation between the two geographical factors of Culture (freedom of religion) and Politics (Political and Civic Freedom) and the incident of genocide. In states where the cultural climate gave preference to one religion over another and was less tolerant of alternate beliefs, genocide had a greater occurrence. It was also evidenced that a lack of political and civic freedom improved the possibility of civic violence in the form of genocide.

## Section 6 Geographic Factors related to Genocide in Cambodia

In Section 5 it was demonstrated that at the macro or geostrategic level, a correlation exists between Cultural and Political factors and the events of genocide. In Section 6, analysis on a larger scale (in a cartographic sense), is made on the nations of Thailand and Cambodia that lie adjacent to one another in Southeast Asia. Here we are seeking differentials in geographic variables that may be precursors of a mass killing event or genocide.



Figure 32: Southeast Asia (CIA)

Again the Pearson Correlation Coefficient is used to measure indications of relationship between the Geographic Factors and Genocide. Our data set remains the indexes used in Section 5; yet they are more reflective of the focused analysis on the conditions experienced by the targeted groups in the genocides. The results show that the Cultural, Economic, and Political Geographic Factors are correlated with the incident of genocide when there is a comparison of Thailand and Cambodia.

### Physical

The nations of Thailand and Cambodia are adjacent in Southeast Asia, sharing similar terrain, climate, and land use. The Anthromes rubric of human interface with the physical environment reveals that the two states share the similar proportions of villages, rice agriculture, and woodlands. In the previous section, no significant correlation was found between type of Anthrome and incident of genocide.

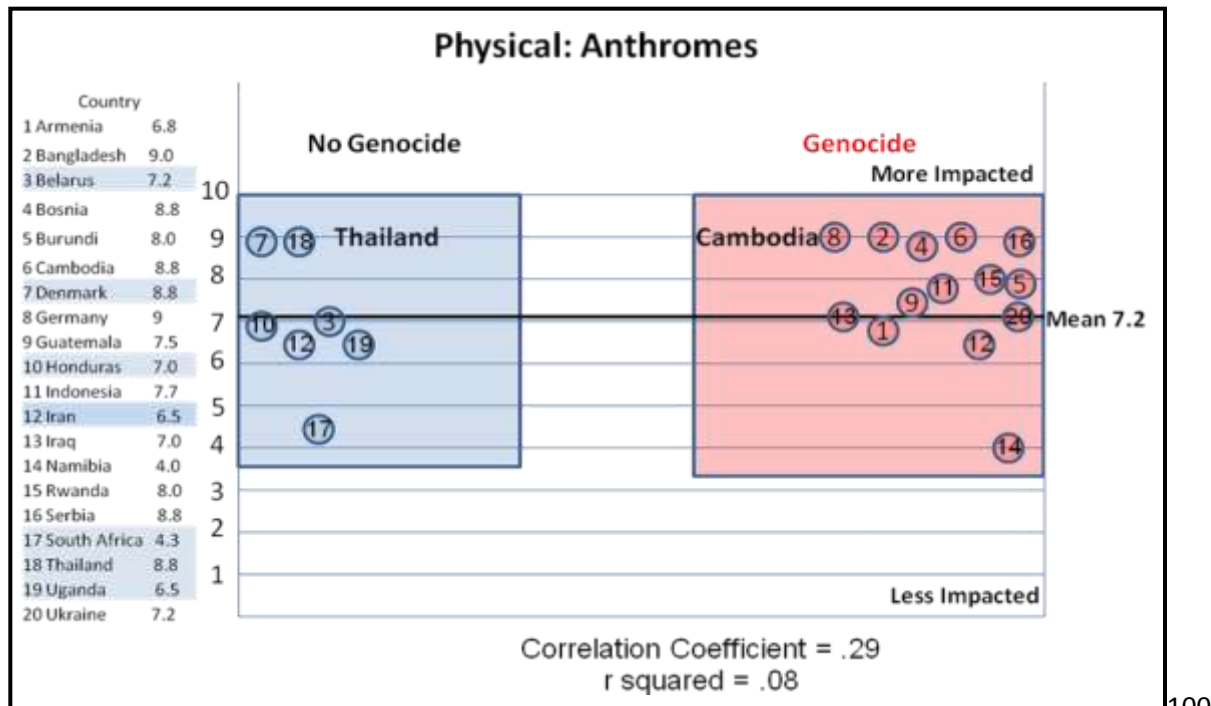


Figure 34 shows the similarity of Thailand and Cambodia in this physical measure. It appears that at both the macro and the micro scale, the variables of the physical environment are not related statistically with the occurrence of genocide.

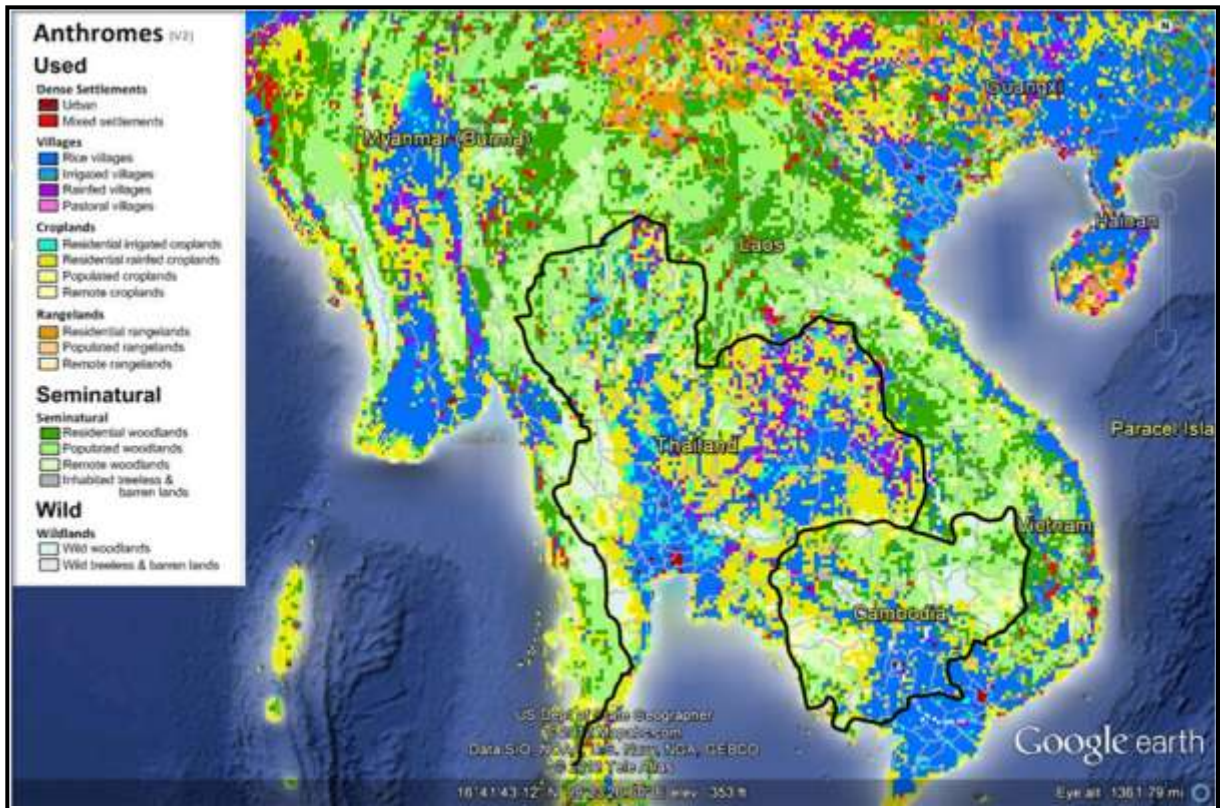


Figure 34: Anthromes -Thailand and Cambodia

## **Cultural**

The “Religious Freedom” index compiled from data by the Association of Religious Data Archives (ARDA) is used again to examine cultural variables perhaps related to mass killing or genocide at this larger scale of comparison.

The most significant component of the Freedom of Religion Index is the Government Regulation of Religion Index and the Religious Persecution Index. In Cambodia during the reign of Pol Pot, virtually all of the 70,000 Buddhist monks in the country were killed (Kiernan 2009). Temples and monasteries were evacuated, destroyed, and desecrated (Khmer-Buddhist Education Assistance Project 2011). This destruction and killing was driven directly by the decisions of the government. It can be seen as a radical adjustment to the culturally acceptable religion. The replacement ideology was one of extreme communalism where families were separated from one another, all property confiscated, and daily activities dictated and monitored by selected overseers. The rich food ways of the Khmer people degenerated into to a thin gruel of rice eaten in an enforced communal setting. The nation’s traditional relationship to land, family, and religion was transformed within “high-level cooperatives” (Kiernan 2009).





**Figure 35: Cultural Geographic Factor and Variables**

Each of the Cultural variables of religion, language, social structure, food ways, and property are evident in the Thailand – Cambodia comparison. The differentials in these variables between Thailand and Cambodia reflect the correlation found in-between the Cultural Geographic Factor and genocide.

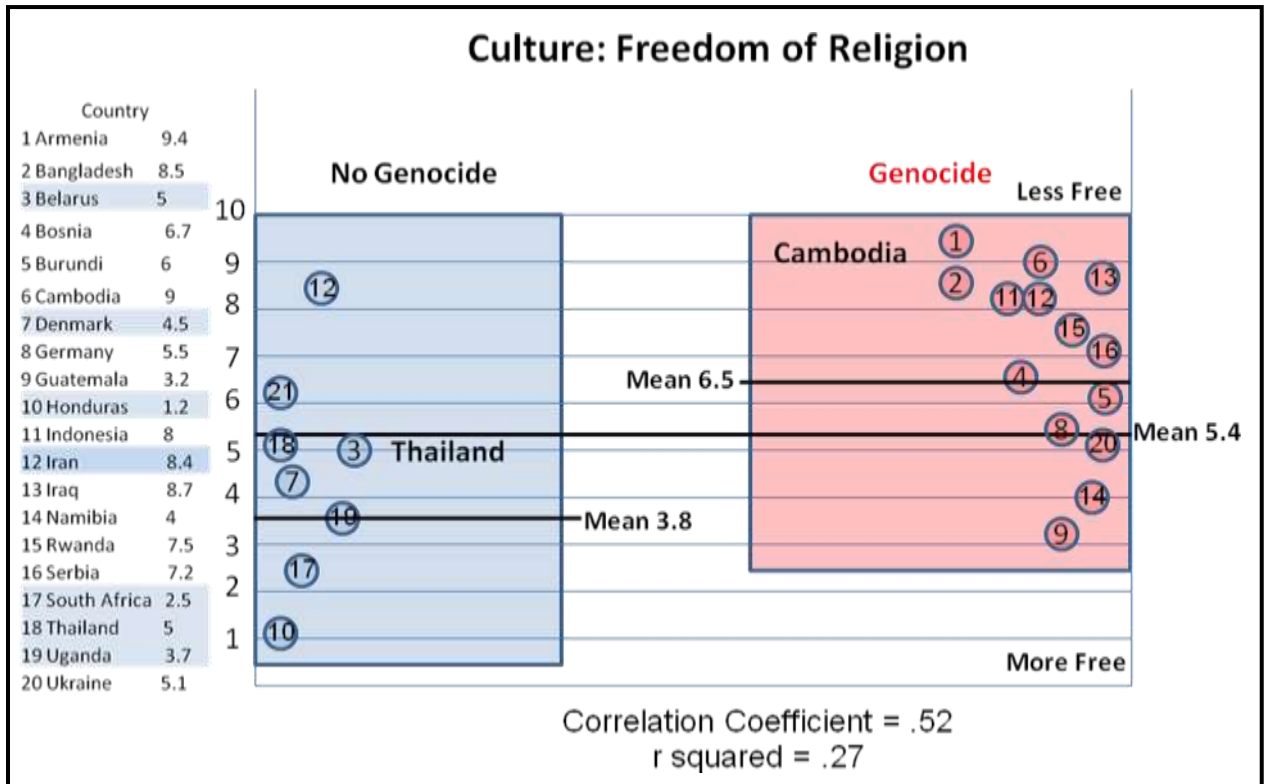
“DK’s (Democratic Khmer) assault on traditional Cambodian society and, in particular, the family was devastating for women. Women tried desperately to stay in touch with family members as they were scattered across different work camps. The central roles for women in society as mothers, market sellers, holders of property, cooks for family meals, and as the key link in larger kinship networks were all shattered. It was now the *Angkar* who provided food, raised one’s children, decided who would marry whom and where and how one would live.” (Ledgerwood 2009)

The Khmer Rouge *Angkar* had labored to purge the non-Khmer (Chinese and Vietnamese) peoples from the population. They had clearly identified those who were

“other” and subject to societal sanction. Ethnic groups were victims of “a campaign of systematic racial extermination” (Kiernan 2009, 347). Even ethnic Khmer were segregated into the “old” and “new” people as a means of differentiation and identifying the “other”.

Contemporaneously, Thailand remained under the value system of Buddhist teaching and the historical social structure of monarchy and traditional family structure. No cultural turmoil or societal changes identified a significant element of “other” within the Thai nation. The large Chinese minority was more integrated than in any other Southeast Asian country (Welch, 2011).

The index of Religious Freedom used in the analysis reflects both government policy and societal attitudes in Thailand and Cambodia. Governments and civil society implicitly work in tandem to create the atmosphere and landscape of religious freedom and tolerance. When the cultural climate allows for a sharp distinction of “other” in a societal context, then the pathway to mass killing and genocide becomes an open possibility.



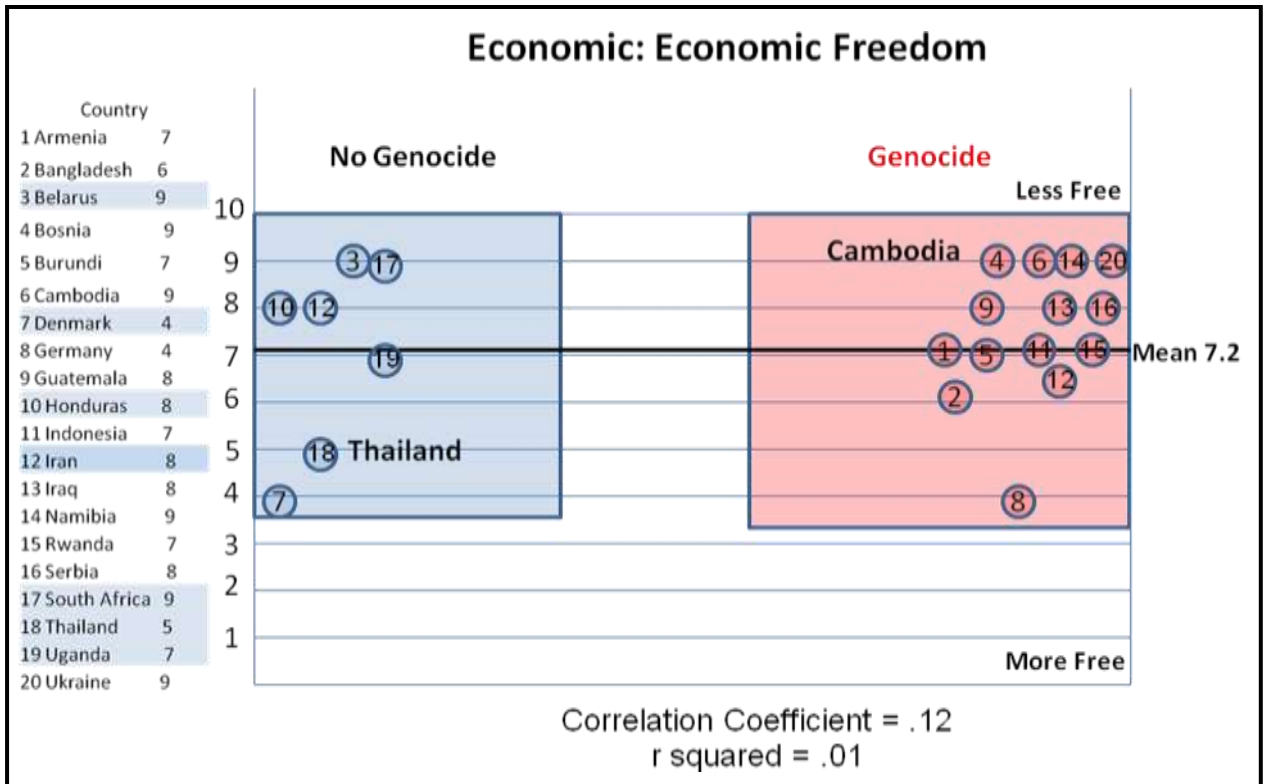
**Figure 36: Culture: Freedom of Religion Genocide Correlation**

Using the “Religious Freedom” index compiled from data by the Association of Religious Data Archives (ARDA), a significant correlation between the “Religious Freedom” of a country and the incident of genocide was found. The Spearman’s Correlation Coefficient = .52 with an  $r^2 = .27$ . The differential of Thailand at 5 on the index and Cambodia at 9 on the Religious Freedom Index, reflects an even stronger relation of these geographic cultural variables to the event of mass killing at this level of analysis.

## **Economic**

Using the “Economic Opportunity and Prosperity” index compiled by the Heritage Foundation and the *Wall Street Journal* no significant correlation between the “Economic Freedom” of a country and the incident of genocide was found among the full data set presented in Section 4. However, this may not hold true at the larger scale of analysis.

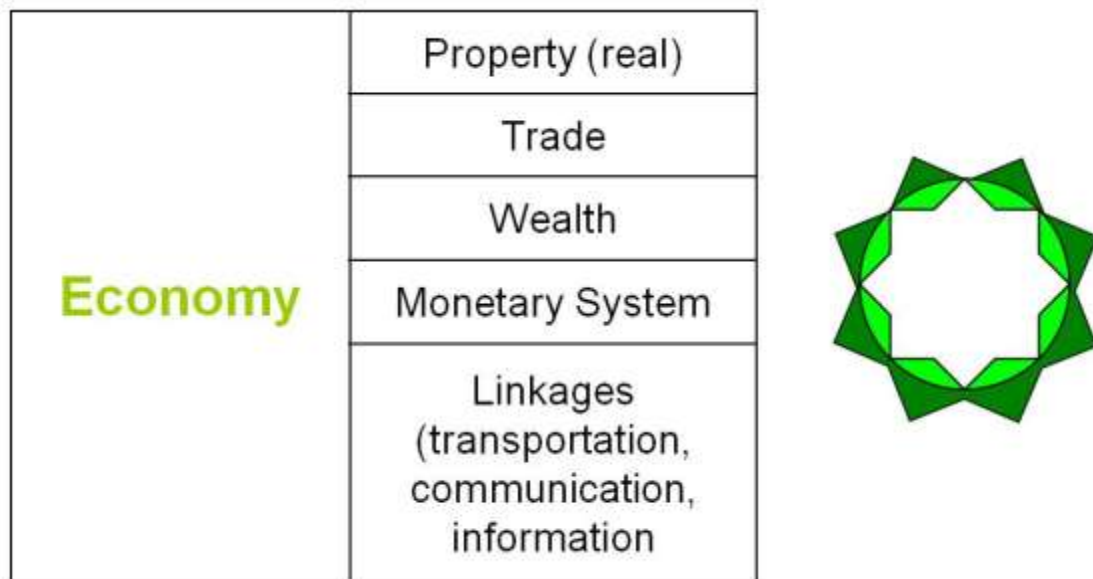
A simple comparison of where Cambodian and Thailand appear on the Economic Freedom Index shows a marked difference. During the period of genocide in Cambodia, the Khmer Rouge controlled every aspect of economic activity possible. They appear on the index at the 9 position, with 10 being the complete lack of economic freedom. Thailand fits in at 5 marking a very free economy within the Heritage foundation criteria.



**Figure 37: Economic: Economic Freedom Genocide Correlation**

The Khmer Rouge did away with all aspects of personal property, calling for all assets to be given into the control of the collective. All markets were abolished. No personal wealth was allowed, as all property was taken by the state and all currency was abolished or withheld. They effectively did away with currency. All Cambodia's borders were closed, transportation links closed or strictly monitored, and telecommunications severed or centralized. All information regarding public policy, political action, and personal predicaments was controlled by the Khmer Rouge. This in effect gave the Cambodian people no tangible resources or means of communication needed to fight or flee the tyrannical consolidation and subsequent

mass killings. In this particular case of Cambodia versus Thailand, economic freedom played a critical role in the trapping of a population within the “killing fields” (Sharp 2009). The identified Economic Geographic variables of property, trade, wealth, monetary system, and linkages provide the window into this correlation of Economic Geographic factor and genocide.



**Figure 38: Economic Geographic Factor and Variables**

This leads to the consideration that the economic freedom of the potential targeted group is more important than the economic character and condition of the entire nation as a measure of correlation to genocide. Thus a review of the Economic Geographic factor with a focus on the targeted group is suggested. Did the European Jews in Germany, Ukraine Peasants in the USSR, and the Hereros of Namibia have

any degree of economic freedom? This remains an ambiguous variable, and is very much tied to the political factors, yet must be examined. The perpetrators of the mass killing certainly reduce the economic freedoms of their targets in most cases, yet an economic equality can exist right up to the acts of genocide, as in Cambodia. However this equality is measured in the same degree of austerity and lack of economic freedom.

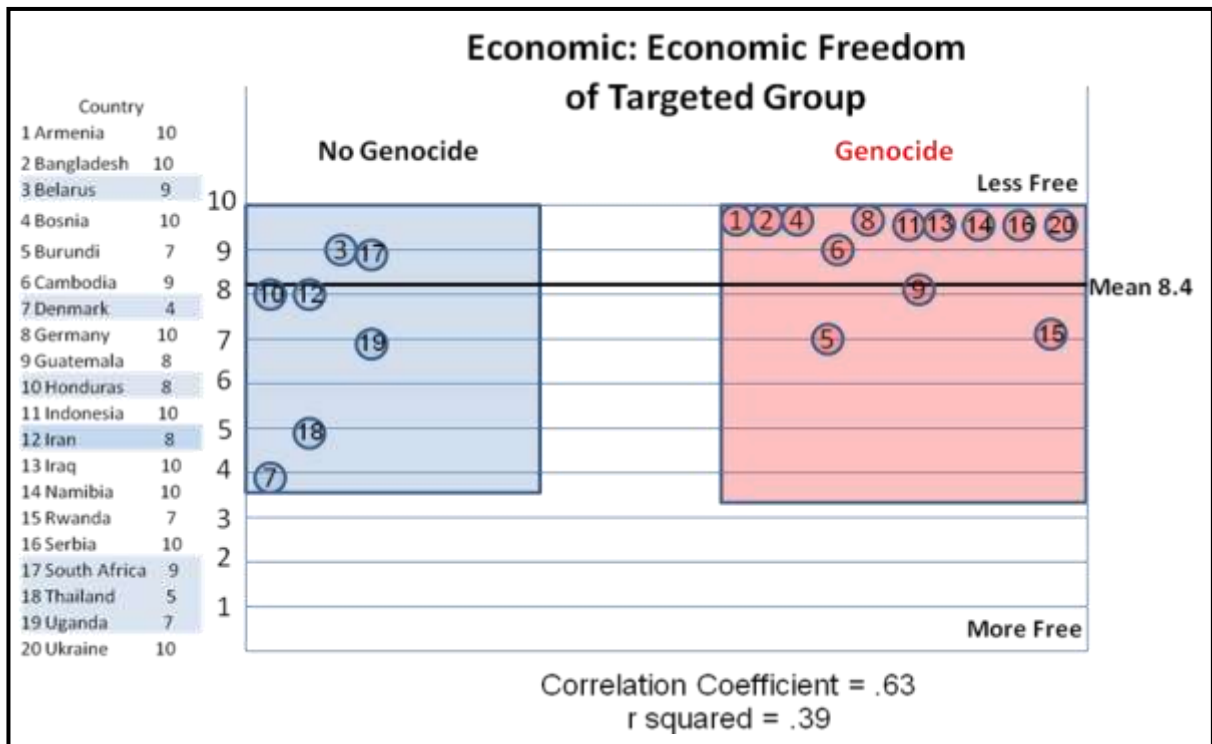


Figure: 39 Economic Freedom of Targeted Group

A recalculation of correlation, with each of the genocide nations providing no economic freedom to their targeted group or sharing the same degree of economic freedom (Burundi, Cambodia, Guatemala, and Rwanda), shows a significant pattern

change. Now economic freedom exhibits a correlation coefficient of .63 to genocide and an r squared value of .39. This may primarily point us to a definitional aspect of genocide; that the target group loses its economic freedom. Yet it is a meaningful variable that can point to a population's vulnerability to targeted mass killing. Without economic freedom, population groups have few resources to resist or flee genocide.

### **Political**

In Section 4 the correlation of political and civic freedom with the incident of genocide in our macro level sample set was recorded. Using the "Freedom in the World" index compiled from data by the Freedom House, a significant correlation between the "Political and Civic Freedom" of a country and the incident of genocide was found. The Spearman's Correlation Coefficient = .46 (with an  $r^2 = .21$ ).

The political and civic freedom experienced in Cambodia during the Pol Pot regime was close to nil in every category and aspect.

"The Khmer Rouge perpetrators of the 1975-79 Cambodian genocide at first hid their ruling Communist Party of Kampuchea (CPK) behind the secretive term *Angkar* ("The Organization"). But on Mao's death in 1976, Pol Pot proclaimed DK's allegiance to Marx, Engels, Lenin, Stalin and Mao. A year later the CPK declared itself to be a Communist Party. Stalinist-style collective labour projects, political and class purges, and mass population deportations marked its four years in power." (Kiernan 2006)

Pol Pot combined communist ideology with genocidal racism (Kiernan 2005).



The state, by definition, holds a monopoly on the legitimate use of physical force (Weber 1946). In the exploration of the Political Geographic factor, a spectrum of violence was characterized that begins with the control of information and concludes with the presumed right to kill. This state application of force, to the point of killing, is central to the event of genocide. Most of these projections of political power are used primarily on the population of the state. This state sanction of lethal violence against its own people within its own territories is the most significant factor in mass killing and genocide.

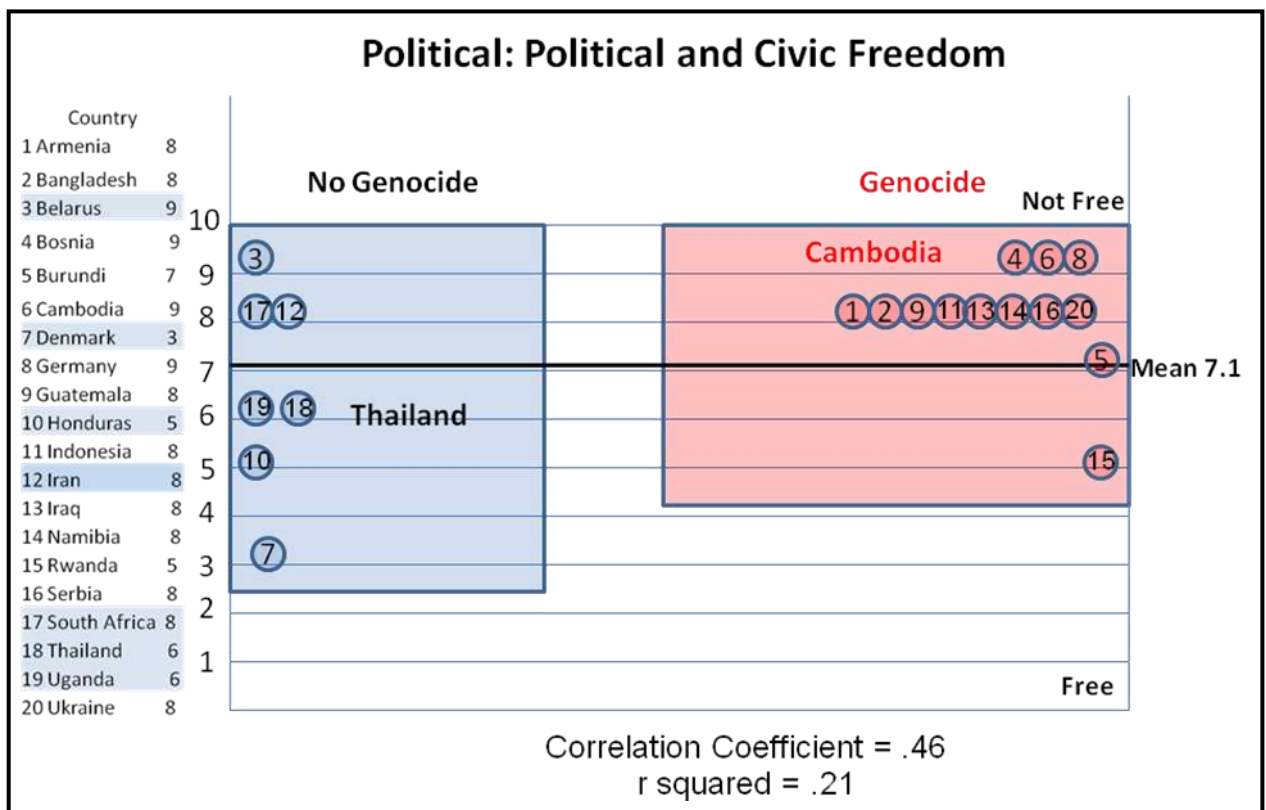


Figure: 40 Political: Political and Civic Freedom Genocide Correlation

The Khmer Rouge's focus of these elements of political power against the

Khmer people and ethnic minorities reduced the targeted groups' political and civic freedom to zero (Becker 1986). All aspects of information flow were captured and controlled by the Khmer Rouge. No public discourse was allowed, only strictly orchestrated policy pronouncements and forced self criticism. Khmer Rouge cadre and agents exercised all manner of military and police power. No recourse to civil officials or courts was available to the people. Seizure without charge, imprisonment without trial, and summary execution were the order of the day (Ponchaud 1978).



**Figure 41: Political Geographic Factor and Variables**

In Thailand, during this dark time in Cambodia, a new beginning for constitutional government was launched by the freest elections in Thailand's history (Zimmerman 1976). Information flow exploded with the ending of press restrictions

in 1973. In 1976 political factions fought in the streets of Bangkok, revealing vibrant civil dialogue, but descending into violence, death, and government crackdown. With the support of the King and the military, a government was formed under the prime minister-ship of Thannin Kravivichien, a former Supreme Court justice. Strict censorship and new controls on society were instituted. Another cycle of constitutional reform and election of parliament ensued in 1979. Yet at no time was the government's policy (overt or covert) to kill a targeted group of its citizens.

Recall that the *Freedom in the World* survey provides an annual evaluation of the progress and decline of freedom in 195 countries and 14 related and disputed territories. The survey, which includes both analytical reports and numerical ratings, measures freedom according to two broad categories: political rights and civil liberties. The Political rights ratings are based on an evaluation of three subcategories: electoral process, political pluralism and participation, and functioning of government. The Civil liberties ratings are based on an evaluation of four subcategories: freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. A detailed description of each category is available on the Freedom House website (Freedom House 2011).

The recalculation of this geographic factor as was done with the Economic factor above shows another pattern shift. It reveals greater correlation between the Political Geographic factor with each of the genocide nations providing no Political

and Civic freedom to their targeted group or sharing the same degree of Political and Civic freedom (Burundi, Guatemala, Rwanda, and Ukraine). Now Political and Civic freedom exhibits a correlation coefficient of .61 to genocide and an r squared value of .38. This may point primarily to a definitional aspect of genocide; that the target group loses its political and civic freedom. Yet it is a meaningful variable that can point to a population's vulnerability to targeted mass killing. More importantly it contains the ultimate variable of the state sanctioning the killing of its citizens.

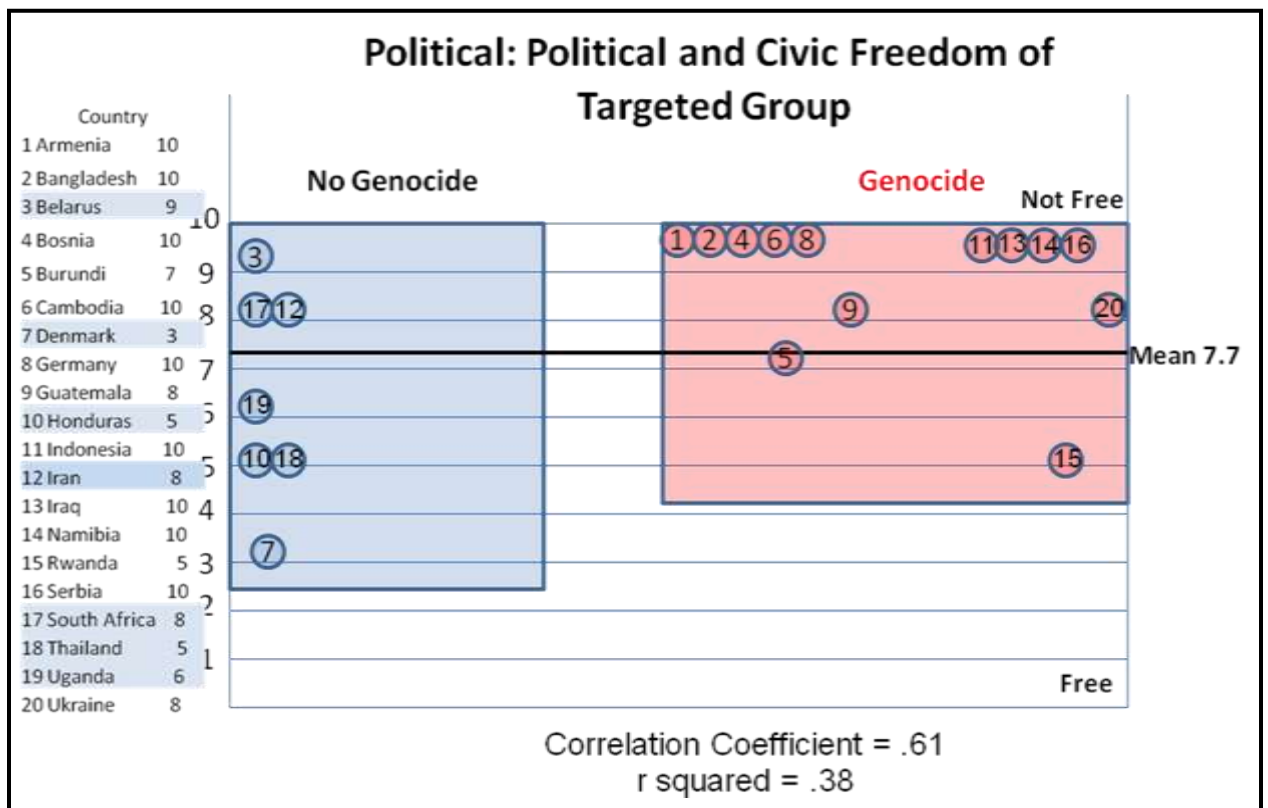


Figure 42: Political and Civic Freedom of Targeted Group

## Summary

The level of correlation indicated by the analysis using the Pearson correlation coefficient provides impetus to conclude that the Cultural, Economic, and Political Geographic factors have utility in determining the occurrence of mass killing and genocide, especially at the scale of analysis used in this section.

Within the factor of Culture, religious freedom as measured by the state's regulation and persecution of religion is a consistent precursor to genocide. The ability for the government and the people to define groups as "other" and then pursue a narrative of violence is tied to the fundamental systems of meaning in that society. Religion embodies that meaning. Economic freedom was not a significant factor at the macro scale, yet when recalculated in the comparison of Thailand and Cambodia, it appeared the variables of economic freedom were significant. The targeted group always lacked the resources to fight or flee. Political and Civic freedom included the critical aspect of the sanctioned use of deadly force against those identified as other.

These Geographic factors and the variables discussed can assist in the identification of potential populations at risk for genocide or mass killing. Below is a table showing several groups that mirror the index scores of the states experiencing genocide. It suggests Afghanistan and Myanmar are candidates for mass killing or genocide. The other states show an economic freedom that currently may preclude a

genocide event. A focus on economic variables would be appropriate for further analysis. This information would support the use of greater resources in the use of an Agent-Based Model informed by the geographic operational dynamics approach to the given nation.

	Culture Mean 5.4	Economic Mean 8.2	Political Mean 7.7
Afghanistan	7.5	Not Available	8.6
Bahrain	6.6	2.5	8.6
Belarus	6.1	5.1	7.9
Iran	7.8	5.8	8.9
Iraq	8.0	4.0	7.9
Myanmar	8.5	6.2	9.1

**Figure 43: States Vulnerable to Genocide**

## Section 7 Findings and Conclusion

The unique contribution of this dissertation is a novel conceptual construct for analysis of complex systems in a geostrategic context. The contribution is four-fold: First the organization of geographic factors into a linked field of key variables. Second the creation of a multi-modal process of these variables through a nested set of operational imperatives. Thirdly the construction of the operational imperatives process cycle which informs the resulting fourth contribution of a predictive path of inquiry and analysis.

The proof of principle is shown in the correlation of genocide with selected geographic factors and their variables. The dissertation provides a detailed explanation and format for a more aggressive and expansive pursuit of this type of analysis through agent-based modeling. Justification of the organization of geographic factors into a unified field of key variables is established in geographic thought and application historically. The processing of variables through a nested set of operational imperatives in a multi-modal context is a proven military intelligence technique, modified here into a novel tool of craft that operationalizes the geographic factors. Identification of the operational imperatives process cycle places the geographic variables in time as well as space. It also creates a dynamic path for updating the operational imperatives through causal linkages. It is the combination of these elements of the new conceptual construct that informs a path to analysis and

prediction within complex systems, particularly in the geo-strategic context.

This in effect answers the short-comings of Brian J. L. Berry's geographic matrix, where he acknowledged the need for "the second level of inter-connections across areas, connectivity of places; flows and interactions, "and "the dynamic, interrelated processes" (Berry 1964, p.10).

The purpose of this dissertation is to identify geographic variables that inform a systematic approach to the analysis of geostrategic issues. These geographic factors and their corresponding variables operate holistically in cycles of action measured across space and time. The proposed concept model of Geographical Operational Dynamics is well suited to inform an Agent-Based Modeling system focused on scalable players. Significant resources in funding and personnel are required for further validation of this approach for causal and predictive analysis.

What remains missing in the realm of geostrategic analysis is a holistic interactive operational conceptual framework such as the one delineated in this paper. Adoption of this geographic approach will provide an organizing structure for the use of multi-level and multi-variant model-based analysis.

The methodology of Agent-Based Modeling discussed in Section 4, along with the correlations explored in Sections 5 and 6, point to the utility of this approach in geographic analysis. These geographic factors are applicable at many scales of



human interaction and experience. Humans are a product of the natural environment, fundamentally a part of the planet. This basic context energizes the processes flowing within the geographic variables. Human nature, acting in the spatial context, is the engine of human generated change that moves through time and is measured on the landscape. It is possible to model this reality and study the interaction. This interaction is observable and informative. These factors of geography enable the practitioner to do the integration and interface required for application to policy and action.

Another outcome of this effort is a re-introduction of geography as the integrative force for both domestic and foreign policy. In addition it is a challenge to academia as a cross-disciplinary guide to the study of contemporary human-centric research challenges.

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