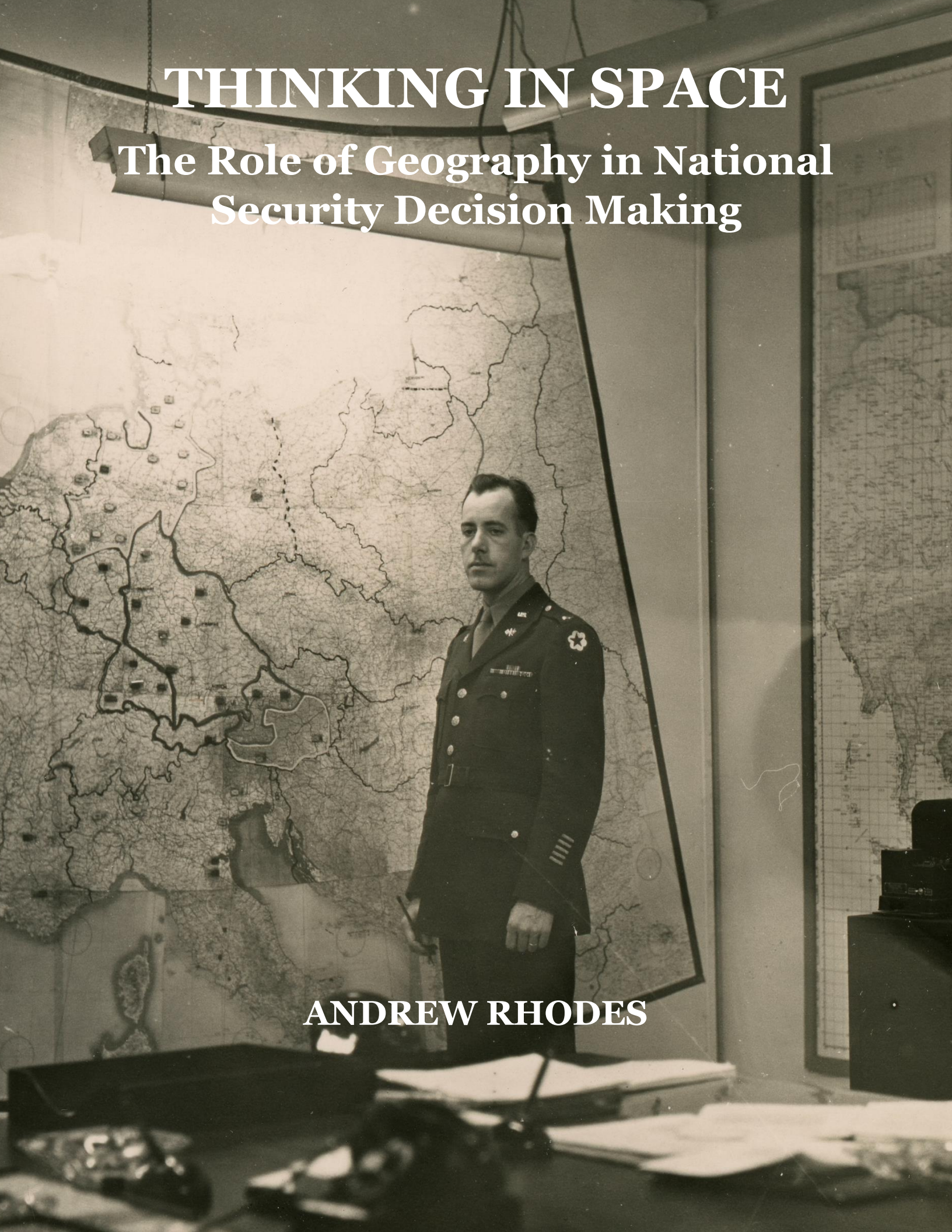


THINKING IN SPACE

The Role of Geography in National Security Decision Making



ANDREW RHODES

REPORT DOCUMENTATION PAGE			<i>Form Approved</i> <i>OMB No. 0704-0188</i>	
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1. REPORT DATE (DD-MM-YYYY) 02-15-2019		2. REPORT TYPE FINAL		3. DATES COVERED (From - To) N/A
4. TITLE AND SUBTITLE Thinking in Space: The Role of Geography in National Security Decision Making			5a. CONTRACT NUMBER N/A	
			5b. GRANT NUMBER N/A	
			5c. PROGRAM ELEMENT NUMBER N/A	
6. AUTHOR(S) Andrew J Rhodes			5d. PROJECT NUMBER N/A	
			5e. TASK NUMBER N/A	
			5f. WORK UNIT NUMBER N/A	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Associate Dean of Academics for Electives and Research Naval War College 686 Cushing Road Newport, RI 02841-1207			8. PERFORMING ORGANIZATION REPORT NUMBER N/A	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSOR/MONITOR'S ACRONYM(S) N/A	
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A	
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution Statement A: Approved for public release; Distribution is unlimited.				
13. SUPPLEMENTARY NOTES A paper submitted to the faculty of the NWC in partial satisfaction of the requirements of the curriculum. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC, the Department of the Navy, or the US Government.				
14. ABSTRACT The ability to "think in space" is more than navigation, map-reading, or geographic literacy. Spatial reasoning is a key aspect of critical thinking and geography is a valuable tool for communicating critical thought. This study seeks to advance the conversation about how geographic information shapes operational and strategic decisions and how it sits at the junction of theories of geopolitics, the art and science of cartography and visualization, and the unique cartographic consciousness of the American national security establishment. The US government is punching below its weight when it comes to the use of geographic information in strategic analysis, policy making processes, and its communication of global policy. The tools, resources, and imperatives are all at hand to elevate the spatial thinking of those charged with securing the national interest. This challenge promises to grow only more daunting in an era of great power competition that will require new spatial thinking—and relearned old thinking—on a global scale.				
15. SUBJECT TERMS (Key words) Geography, Cartography, Geopolitics, Decision Making, Grand Strategy, Cognitive Psychology				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT N/A	18. NUMBER OF PAGES
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED		
				19b. TELEPHONE NUMBER (include area code) (401) 841-7490

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The Role of Geography in National Security Decision Making

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Directed Research Paper

February 2019

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Cover photo: White House Map Room circa 1943, Courtesy of the Franklin D. Roosevelt Presidential Library and Museum.

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Introduction

The same winter the Athenians resolved to sail again to Sicily, with a greater armament than that under Laches and Eurymedon, and, if possible, to conquer the island; most of them being ignorant of its size and of the number of its inhabitants, Hellenic and barbarian, and of the fact that they were undertaking a war not much inferior to that against the Peloponnesians.

-Thucydides¹

The ability to “think in space” is more than just geographic literacy. Thinking about the relationship between global geography and national power is vital to our national security and future economic wealth. The lack of sophisticated and intuitive knowledge of regional and global geography harms our national interest and diffuses our national power. The contemporary national security enterprise should be enjoying a golden age of geographic consciousness, but this is not the case. Government and commercial organizations are producing a massive amount of high-fidelity geographic information, while ubiquitous hardware and software have democratized geospatial tools. And yet the use of geographic information in national security decision making is underperforming its potential: at best stagnant and perhaps less effective than in the past.

Maps are a powerful form of communication, but few decisionmakers, and the professionals who support them, are sufficiently conscious of the ways in which every map contains overt and hidden messages, every map simplifies and abstracts reality, and every map shapes the context in which the reader consumes the content. Because there is a risk in believing that “if it is on a map it must be true,” one insightful scholar of cartography, Mark Monmonier,

¹ Robert Strassler, ed., *The Landmark Thucydides*, Richard Crawley trans., New York: Touchstone, 1996, 361.

has argued that “every map is a lie.” Much has been written about the nature of geography and cartography as means of communication, and several scholars have made a compelling case that “geography matters.” But there has been little recent analysis of how geographic information bears on the current US national security enterprise and how it “matters” in the context of national security decisions.

This study seeks to advance the conversation about how geographic information shapes operational and strategic decisions and how it sits at the junction of theories of geopolitics, the art and science of cartography and visualization, and the unique cartographic consciousness of the American national security establishment. Alan Henrikson argues that US foreign policy officials largely conduct their business as if in Plato’s cave, relying on indirect information to make decisions about places and issues remote from their own perception through the lens of a “mental map.”² This cartographic consciousness is facing new challenges that make it harder, but also more important to think critically in space.

Considering the nature of “thinking in space” at higher levels of the US government parallels the classic study by Richard Neustadt and Ernest May, *Thinking in Time: The Uses of History for Decision Makers*. In addition to emulating the title, this study shares a few basic assumptions with *Thinking in Time*. The first assumption is that busy decision makers and their advisors manage a tremendous quantity and diversity of information every day and can consume only a small amount of geographic information. The quality of the information itself is not the main factor in determining what gets selected for consumption. A second assumption is that these pressures of time and limited information do not lend themselves to critical thinking or questioning assumptions, whether about historical analogies or a geographic presentation. Third,

² Alan Henrikson, “The Geographical Mental Maps of American Foreign Policy Makers,” *International Political Science Review* 1:4 (1980), 496.

is that it is possible to achieve marginal improvements in the use of (geographic) information, or, to borrow a phrase from Neustadt and May, to be “more reflective and systematic.”³

The first three sections of this paper borrow Kenneth Waltz’ model of three “images” of international relations to discuss how thinking in space happens on three levels: the individual, as a government or nation, and on the level of global structure. In the sense of Waltz’ first image, we must first consider how an individual, such as a national security professional, engages with geographic information. It is then worth considering the second image: how American society, including its vast national security bureaucracy, has grown more or less conversant in geographic information in its history. Waltz’ third image leads us to consider how a geographic understanding of the international system—that is, geopolitics—has bounded and focused US national security decisions since World War II.

Building on this theoretical foundation, the fourth and fifth sections of this paper consider with more specificity the current environment and coming challenges. It is both the best of times and worst of times for the use of geographic information in national security decision making: the ability of leaders and advisors to think critically in space has not kept pace with the potential of technology. This challenge promises to grow only more daunting in an era of great power competition that will require new thinking—and relearned old thinking—on a global scale. This study will conclude with a few modest recommendations for opportunities to make marginal near-term improvements with existing means.

An initial survey of these issues suggests several areas for further research on specific causes of disuse or abuse of geographic information in the national security establishment. Further study is required on how the US government can better employ its remarkable capability

³ Neustadt and May, 2.

and capacity to create and manage geographic information to address shortcomings. The US government is punching below its weight when it comes to the use of geographic information in strategic analysis, policy making processes, and its communication of global policy. The tools, resources, and imperatives are all at hand to elevate the spatial thinking of those charged with securing the national interest.

Part I—The Science and Art of “Thinking in Space”

In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it.

-Jorge Luis Borges⁴

What is “space” and what does it mean to think within it? A brief consideration of some fundamental questions provides an important reminder of just how complicated this simple question can be and encourages more flexible thinking about issues of geographic decisions that will follow. At the most basic level, “thinking in space” is the act of an individual—a primitive human scratching in the dirt or an admiral reading a map—seeking to make sense of abstract space beyond their sight and perhaps beyond their direct experience. There is a rich scientific and cultural literature on the diverse ways in which humans process spatial information. The essential cognition of spatial reasoning inside the human brain varies widely among individuals and across cultures. Anyone who has struggled to give directions or participated in a tense navigation discussion in a moving car knows that some people are think differently about the physical space through which they are moving. Indeed, there is a diverse array of tools, frameworks, and language by which individuals interpret and communicate how they relate to the world around them. In Japan, the term “hōkō onchi” has become increasingly common to describe someone who is “directionally tone-deaf.”⁵ One famous study found unique patterns of activity and even

⁴ Jorge Luis Borges, “On Exactitude in Science” in *Collected Fictions*, Andrew Hurley, trans., New York: Viking Penguin, 1998.

⁵ Joshua H. Roth, “Hōkō onchi: Wayfinding and the Emergence of “Directional Tone-Deafness” in Japan, *Ethos* 43, no. 4 (December 2015):402-422

structural changes in the hippocampus of the brains of London taxi drivers who mastered the encyclopedic knowledge required to pass the city-wide driver licensing exam.⁶

The science of thinking in space spans multiple disciplines of cognitive science, including behavioral psychology, the physical and neurological aspects of visual sensing, and the physiological performance of the brain. Gary Klein's work on the nature of decision making in different situations draws an important parallel to the nature of vision in bright light and relative darkness: the human eye concentrates light on cone cells to intently study an object in bright light, but scatters light to rod cells to perceive images in the dark.⁷ Thinking in space can be an exercise in both kinds of perception and thinking. A decision maker might give brief, intense focus to the geography of a national security problem, might devote broad study to its geographic context, or might make a decision based solely on a personal mental map of the issue. Mental maps are clear examples of the heuristics that Daniel Kahneman highlights in his work on the different types of human decision making.⁸ Journalists, and sometimes strategists, regularly draw analogies between chess and foreign policy or military strategy, and there is a solid body of literature on issues of spatial perception, eye movement, and heuristics relate in human decision making in a chess match.⁹ However, few scholars have examined the relationship between true geographic heuristics (i.e. with a map in the "real world" instead of a chessboard) and national security decision making, with the exception of Alan Henrikson's work on the mental maps of American diplomats.¹⁰ Further, there has been little systematic study of how senior levels of the

⁶ Maguire, Eleanor A., David G. Gadian, Ingrid S. Johnsrude, Catriona D. Good, John Ashburner, Richard S. J. Frackowiak, and Christopher D. Frith. "Navigation-Related Structural Change in the Hippocampi of Taxi Drivers." *Proceedings of the National Academy of Sciences of the United States of America* 97, no. 8 (2000): 4398-4403.

⁷ Gary Klein, *Streetlights and Shadows: Searching for the Keys to Adaptive Decision Making*, Cambridge: Massachusetts Institute of Technology Press, 2009, 5-6.

⁸ Daniel Kahneman, *Thinking, Fast and Slow*, New York: Farrar, Straus and Giroux, 2011.

⁹ Allen Newell and Herbert Simon, *Human Problem Solving*, Englewood Cliffs, NJ: Prentice Hall, 1972, 775-784.

¹⁰ Alan Henrikson, "The Geographical Mental Maps of American Foreign Policy Makers."

US national security bureaucracy employ institutional resources and processes to support decision makers with geographic information, what good and bad heuristics develop, and how effective that geographic support is.

Modern scholars have debated the very definition of the space in which we think. The cultural historian Stephen Kern argues that different cultures experience space and time differently and that the advance of technology has further shaped the way individuals relate to time and space, particularly in the last two centuries. At the end of the 19th century and into the early 20th century the fundamental nature of two- and three-dimensional space became the subject of heated debate and study among philosophers like Immanuel Kant, physicists like Albert Einstein, and even revolutionaries like V.I. Lenin. Science had found the limits of Euclidean geometry and Newtonian physics in ways that required new and often uncomfortable ways of thinking. Kern highlights that Lenin, in *Materialism and Empirio-Criticism*, wrote a chapter entitled “Space and Time” arguing that space and time are an “objective reality in which matter moves in space and time independently of the human mind... in contrast to the Kantian view that time and space are not objective realities but forms of understanding.”¹¹ On the other hand, Einstein’s special and general theories of relativity dispensed with the idea of absolute space, in favor of a bendable space-time, and postulated the existence of an infinite number of spaces.

The importance of these scientific and philosophical debates to geographic perception is not that one must understand Einstein’s theories to read a map, but that these challenges to absolute objectivity empowered parallel work by biologists, anthropologists, and artists to

¹¹ Stephen Kern, *The Culture of Time and Space*, Cambridge: Harvard University Press, 2003, 134.

challenge the idea that there is more than one objective reality and individual perception. These developments had parallels in the visual arts where painters like Cézanne and Picasso abandoned the mathematical rules of perspective and juxtaposed multiple perspectives in a single cubist canvas. Modern scholars began to consider how spatial orientation might vary from one individual or one society to another. Skipping over a century of anthropology, the recent work of Lera Boroditsky presents excellent examples of the diversity of spatial reasoning possible in the human mind. Boroditsky describes an Australian aboriginal community whose language does not use relative spatial terms like “left” and “right,” but relies on absolute, cardinal directions, “saying things like ‘move your cup over to the north-northwest a little bit’ or ‘the boy standing to the south of Mary is my brother’.”¹² Another aboriginal group studied by Boroditsky instinctively constructs timelines from east to west, not from left to right as those who read western languages tend to do.¹³ Surveys of Americans, on the other hand, revealed that two-thirds could not indicate compass directions on a sunny day in a familiar environment. Members of these aboriginal groups may or may not make better national security decision makers than the average American, but they certainly demonstrate a greater intuitive capacity to orient themselves geographically, and a unique example of a way to think in space.

From the end of the 19th century to the outbreak of the First World War, technology, a topic to which we will return in later sections, also changed the way that people thought intuitively about space. The world had been shrinking steadily since the Age of Exploration, but the great railroads and the Suez and Panama canals made it more possible to conceive of the

¹² Boroditsky, Lera and Alice Gaby. "Remembrances of Times East: Absolute Spatial Representations of Time in an Australian Aboriginal Community." *Psychological Science* 21, no. 11 (2010): 1635.

¹³ Lera Boroditsky, "How Language Construct Time" in *Space, Time and Number in the Brain*, Stanislas Dehaene and Elizabeth Brannon, eds. Elsevier Science Press, 2011.

entire globe at once, as seen in Jules Verne's 1873 novel, *Around the World in Eighty Days*. Kern points out that the communications technology that emerged in this period, the telegraph and then the more personal telephone, introduced the idea of simultaneity to common experience such that people and events far removed in physical space were directly linked. Kern lays out a compelling example of the shocking arrival of simultaneity to world leaders and the global public in describing cataclysm of the summer of 1914: decision makers were not equipped to conceive of the true implications of the detailed timetables and operational imperatives their military staffs presented. And yet, as Kern outlines, the leaders of multiple nations thought they were thinking effectively in space: "When urging the Tsar to mobilize, Sazonov had translated delay into lives lost; when urging Poincaré, Joffre translated it into kilometers. In July 1914, time was equated with life and space."¹⁴

Cartography: Capturing Space on a Flat Surface

The impossibility of perfect or complete visual representation of space has been explored in fiction by authors like Lewis Carroll and Jorge Luis Borges who imagined a map on a scale of 1:1, something difficult to consult as "it would cover the whole country, and shut out the sunlight."¹⁵ Instead, every map must be a greatly simplified two-dimensional abstraction of three-dimensional space. This cultural digression is relevant to the nature of individual engagement with the subjective abstractions of geographic information. US national security decision making for the most part concerns itself with distances and speeds at which Newtonian physics will suffice, and rarely indulges in cubist cartography. But the fundamental point remains that geographic perspective and spatial thinking are imperfect and not absolute from one

¹⁴ Kern, 273.

¹⁵ Lewis Carroll, *Sylvie and Bruno Concluded*, London: Macmillan, 1893, 169.

individual to the next, even within the homogenous population that comprises the US national security establishment. Further, there is a richer world to be gained when freeing the imagination from the conventions of a single culture or the rigid perspective of classical art: as we shall see below, cartography gets easily trapped in comfortable conventions that limit its power to communicate.

Mark Monmonier begins his classic book *How to Lie with Maps* with the deliberately provocative argument that “not only is it easy to lie with maps, it’s essential.” This argument, perhaps unwittingly, echoes Picasso’s claim that “art is a lie that makes us realize truth,” when Monmonier goes on to describe a “cartographic paradox” in which “to present a useful and truthful picture, an accurate map must tell white lies.”¹⁶ These “white lies” are deliberate choices to trade some distortions against others in pursuit of effective visual communication. Some of the core aspects of this “cartographic license” are scale, projection and symbolization. A basic understanding of inevitable distortion and cartographic license is essential to thinking critically in space and unlocking the real potential of cartography as a means of communication.

The challenge of scale, highlighted by Borges and Carroll, is primarily a practical one: a wall-sized world map cannot contain the same detail as a state highway map but both have their purpose. High-quality atlases assemble many maps of different regions at different scales, but they are still compromises that cannot serve every purpose and tend to be expensive and cumbersome. Atlases are easier to transport than globes, though globes have a distinct advantage of at least being a three-dimensional simplification of three-dimensional space. The world’s largest globe, at a Garmin, Inc. facility in Maine, has a diameter of 41 feet and depicts the

¹⁶ Alfred H. Barr, *Picasso: Fifty Years of His Art*, New York: Museum of Modern Art, 1966, 270. Mark Monmonier, *How to Lie with Maps, Second Edition*, Chicago: University of Chicago Press, 1996, 1.

physical, but not the political, Earth at a scale of 1:1,000,000 (one millimeter represents one kilometer).¹⁷

Since globes with sufficient scale to show much detail are hard to move around, cartographers must project the three-dimensional earth onto a two-dimensional sheet of paper or digital screen. Map projections are probably one of the best understood sources of distortion but most American map users, if aware of the issue at all, think of the heavy distortion the Mercator projection causes to distance and area. The unlikely hold of the Mercator projection on American education is an instructive history of addiction to lazy conventions and the subject of another worthy Monmonier book, *Rhumb Lines and Map Wars*.¹⁸ But despite the efforts of the National Geographic Society to get more appropriate world maps into American classrooms, there is nothing technically wrong or inaccurate about the Mercator projection, which was a remarkable technological achievement that facilitated global trade and exploration and is still widely used in certain forms. There is also nothing inherently superior about other projections advertised as a corrective to Mercator merely for showing countries near the equator at the same areal scale as those in higher latitudes. Map projections should be selected and interpreted appropriately to the map's use. Equal area projections should be used when plotting density or comparing relative size of regions, equidistant projections present the most accurate depiction of distance between two points, a gnomonic projection shows accurate direct flight paths, and an orthographic projection faithfully shows the shape of landforms as on a globe or viewed from orbit. A map reader interested in the relative size of Greenland and Africa will be grossly misled by a Mercator projection, an airline passenger will have a hard time identifying the actual flight path

¹⁷ "DeLorme a Contender for Record Company Builds Huge Globe at Headquarters." *Bangor Daily News*, Jul 24, 1998.

¹⁸ Monmonier, *Rhumb Lines and Map Wars*

from a seat-back magazine map, and a planner at US Indo-Pacific Command will struggle to understand or convey the tyranny of distance in that theater with most of the maps at hand. There is rarely a perfect answer to choosing a map projection, though there are many wrong answers, and at a scale showing the whole world on a single sheet, a compromise solution like the Robinson projection seeks to minimize, but not eliminate, various types of distortion.¹⁹ The National Geographic Society used the Robinson projection for its world maps for many years before switching to the similar Winkel-Tripel projection. A map familiar to many in the US Government, “The World with Commanders’ Areas of Responsibility,” uses the compromise Miller Cylindrical projection to delineate the geographic combatant commands under the Unified Command Plan. Another use of Miller Cylindrical is the standard world wall map produced for the Pentagon.²⁰ Although the Miller Cylindrical projection has the advantage of being rectangular and fitting neatly onto a sheet, it fares only slightly better than the Mercator projection in the severity of distortion in high latitudes.

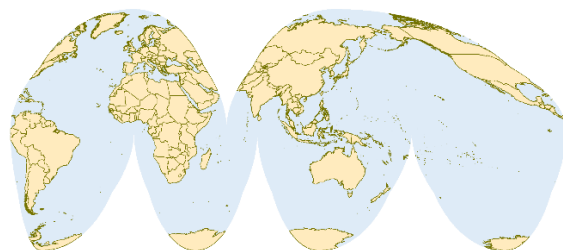
Robinson:

Compromise to reduce distortion of shape, area, and distance



Goode Homosoline

Distortion reduced by interrupting the map (often in ocean areas)



¹⁹ J.A. Steers, *An Introduction to the Study of Map Projections* (15th Edition), London: University of London, 1970.

²⁰ Defense Logistics Agency, “Mapping Customer Operations,” <http://www.dla.mil/Aviation/Others/Products/Mapping/Topographic/##7>. Accessed 18 January 2019.

Orthographic

Realistic “globe” view, but shapes and area are distorted and only one hemisphere can be depicted



Miller Cylindrical

Compromise that fits on a rectangular page



Gnomonic

Every line is a great circle, showing direct paths between points, but area and shape distorted. Only one hemisphere can be depicted



Mercator:

Useful for ocean navigation, but major distortion of distance and area (polar regions are typically cropped)



Comparison of six different common projections, all centered on Beijing. Maps by author, 2019

Every geography or cartography textbook compares projections, as in the basic example above, but one of the most insightful and incisive comparisons is “What Your Favorite Map Projections Says About You,” by the web comic XKCD.com, which is too large to include here, but includes this comparison among many others:²¹

²¹ “Map Projections,” <https://www.xkcd.com/977/>. Reproduced under Creative Commons Attribution Non-Commercial 2.5 License.



Courtesy of XKCD.com

Understanding and appropriately using scale and projection are essential, but with symbolization cartography quickly crosses from science to art and design. The creator of the Robinson projection, Arthur H. Robinson, called for map creators to heed principles of graphic design just as an author “must employ words with due regard for many important structural elements of the written language, such as grammar, syntax, and spelling.”²² Abstract symbolization is not just the syntax of cartography, but also the most powerful and potentially dangerous aspect of geographic communication. Symbolization is an easy source of inadvertent blunders, carefully crafted narratives, and deliberate deception. In this area cartography is no different than other forms of data visualization, as the use of symbols encodes and arranges data geographically. Such visualization is easy to do poorly and hard to do well, but as Edward Tufte argues, “certain methods for displaying and analyzing data are better than others. Superior methods are more likely to produce truthful, credible, and precise findings.”²³ Better visualization is not only easier to interpret and more compelling, it can also be beautiful. Poor visualization, including bad cartography, is difficult to interpret, unconvincing, and misleading.

²² Arthur H. Robinson and Randall D. Sale, *Elements of Cartography (3rd Edition)*, New York: John Wiley and Sons, 1969, 250.

²³ Edward Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative*, Cheshire, CT: Graphics Press, 1997. 27.

Tufte goes so far as to argue that poor communication through bad visualization can have life-or-death consequences. With one of the most famous maps in history, Dr. John Snow stopped an 1854 cholera outbreak in London and became the founding father of the modern field of public health. On the other hand, at NASA in 1986, “by fooling around with displays that obscured the data, those who decided to launch the space shuttle got it wrong, terribly wrong.”²⁴ The introduction of widespread use of PowerPoint at NASA between 1986 and 2003 did not improve matters and the obscuring, rather than revealing, of key data was evident in decisions related to the loss of another space shuttle and crew. Neither *Challenger* nor *Columbia* was lost because of a flawed map, but both tragedies provide important examples of how simple, ostensibly innocent choices about how to arrange, visualize and communicate data can influence weighty decisions.

Because maps often feature centrally in similarly national security decisions, the design choices that individuals make in crafting a cartographic message matter immensely to the individual recipients of that geographic communication. Even if scale and projection are appropriately and effectively used, the employment of line, color, information density, text labels, and symbols bear on how accurately and easily the reader can interpret the map. There is a vast literature on how to do this effectively, and practical guides to effective cartographic design appear regularly, but the central goal of clarity remains the same. According to Robinson, “the aim of cartographic design is to present the geographical data in such a fashion that the map, as a whole, appears as an integrated unit and so that each item included is clear, legible, and neither more nor less prominent than it should be.”²⁵ Robinson’s point on “prominence” suggests an analogy to other forms of communication, in that maps are encoded with a signal-to-noise

²⁴ Ibid, 27.

²⁵ Robinson and Sale, 250.

ratio (SNR) by which the receiver must discern the geographic information transmitted (signal) within the context of extraneous noise. In cartography, an individual map's signals are the key symbology and data layers that convey information, while the map's noise is the extraneous lines, words, colors, and symbols that obscure and distract. As in other communication systems, it is possible to improve transmission by amplifying the power of the signal or lowering the noise floor, but noise can never be eliminated and too powerful a signal can damage the receiver. The goal for designers of geographic communication, then, should be to strip as much noise from a map as possible, while modulating the power of what is included. Tufte calls high-quality cartography an ideal example of design densely-packed with data that allows easy interpretation through the principle of the "smallest effective difference." Tufte invokes the science of humans' remarkable visual system, which has both physiological and "psychophysical" dimensions that determine human ability to visually perceive signals despite ambient noise.²⁶ Tufte argues that designers should make "all visual distinctions as subtle as possible, but still clear and effective."²⁷ Managing this balance creates a dilemma for anyone trying to communicate through a visual message like a map. At one end of the spectrum are "data-thin" designs lacking useful information serve no purpose beyond graphical decoration. At the other end are visual presentations so full of noise that no signal is discernible, or so full of garish colors and overwhelming symbology that it pains the audience to study them.

The spatial reasoning of individual humans is a complex subject that draws on many scientific disciplines and is often better understood in artistic than scientific terms. Cartographic representation requires abstraction and the map reader can only imperfectly reverse this process

²⁶ T.E. Cohn and D.J. Lasley, "Visual Sensitivity," *American Review of Psychology* 37 (1986), 495-521.

²⁷ Tufte, *Visual Explanations*, 73.

through interpretation. The subtle choices of design matter to the effectiveness of geographic communication: careful and deliberate choices indicate critical thinking by the producer and allow the consumer to employ critical thinking to interpret the spatial information. We will return to these practical considerations later, but first, we must advance our understanding of thinking in space at the national level by turning from the abstract individual to an examination of the nature of American cartographic consciousness.

Part II—The Rise and Fall of American Cartographic Consciousness

The psychological isolationism of the United States, be it said in conclusion, can be in large measure traced to our failures in map-making and the teaching of geography—the prerequisites of education in international relations. The world is round. By the skillful presentation of its “roundness” strategic realities are made clear.

-Richard Edes Harrison and Robert Strausz-Hupé²⁸

In building from the foundations of individual human spatial thinking towards issues of how American national security decision makers “think in space,” it is worth considering whether there is a uniquely American cartographic consciousness. Every nation, and its government, has its own relationship with maps. The map of national territory is a critical dimension of national identity and governments have a vested interest in regular, public declaration of the extent of sovereignty. Kosovo and Cyprus put the outline of their borders on national flags, while Chilean weather maps always report conditions in the wedge of Antarctica that Santiago claims as its territory. A unique and evolving cartographic consciousness has shaped the way Americans understand their nation and its place in the world. Spatial thinking may have had an early hold on the national psyche in a nation founded by traders and explorers, and George Washington had an early career as a surveyor before his military and political life.

The arc of American cartographic consciousness has several principal phases, although the defining characteristics of our 21st century world view are not yet clear. This arc begins in the age of exploration, colonization, and conquest of the interior. There is an inflection between colonial America and the efforts of the young republic to craft its own geographic identity, and

²⁸ Richard Edes Harrison and Robert Strausz-Hupé, “Maps, Strategy, and World Politics,” *Infantry Journal*, November 1942, 40.

then a further shift as the nation survived its violent adolescence and, following the Civil War, embarked upon the very spatial idea of manifest destiny. The fulfilment of the continental ambition allowed America to conceive of its place in the world as Mahanian sea power, an identity that sustained it through the First World War and into the air-age globalism of World War II. In terms of geographic consciousness, the Cold War was an easy continuation of World War II, though the decades-long competition between the United States and the Soviet Union eventually took on its own geographic cast, and shaped American mental maps into an ideological red-versus-blue dualism. The “unipolar moment” that followed the end of the Cold War has not forged a new concept for contemporary American cartographic consciousness.

Before and after independence, there was a grand spatial dimension to American commitment to territorial expansion. This was evident in the colonial era but grew rapidly in the years after independence, most notably with the Louisiana Purchase and the Jefferson administration’s sponsorship of the Lewis and Clark expedition. Susan Schulten, a leading scholar of the role of cartography in American society, highlights important links between geographic education and the development of the early Republic. Emma Hart Willard, a prominent educator of the period, explicitly connected the teaching of geography with national development and promotion of an American identity.²⁹ Schulten notes that in early America geography was a core subject for schoolchildren being taught to visualize a growing nation, and educators of the era, including Willard, thought the study of geography and mapmaking were “particularly appropriate subjects for girls, both as a pathway to literacy and as a means of demonstrating accomplishment”.³⁰

²⁹ Jeremy Black, *Maps and History: Constructing Images of the Past*, New Haven: Yale University Press, 1997, 75.

³⁰ Schulten, Susan. "Map Drawing, Graphic Literacy, and Pedagogy in the Early Republic." *History of Education Quarterly* 57, no. 2 (05, 2017): 185-220.

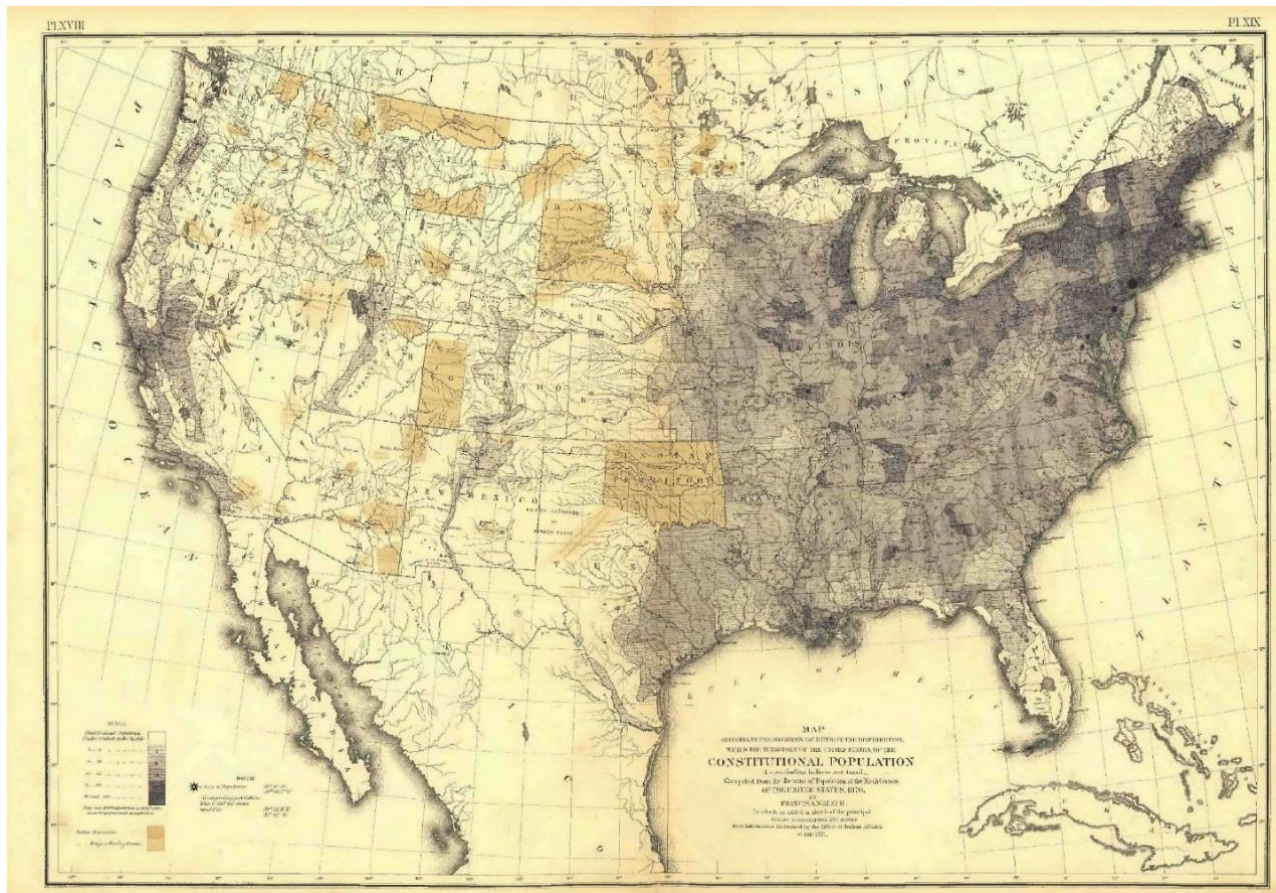
American spatial identity quickly took on a continental cast with manifest destiny and a hemispheric view with the Monroe Doctrine, both of which are geographic concepts. The US Navy led the first hesitant steps to make American thinking not merely continental or hemispheric, but global in the mid-19th century with the oceanographic work of Matthew Fontaine Maury, the first transatlantic cable, and Matthew Perry's opening of Japan. In popular culture, the 1851 publication of *Moby Dick* owed much to Maury, whose work not only charted global prevailing winds but also plotted the worldwide distribution of whales.

From the Civil War to World War II

The Civil War forced a turn inward for American geographic thinking: Maury lent his technical expertise to early Confederate mine attacks on Union blockaders, while the best cartographers of the age, such as Jedediah Hotchkiss, were dedicated to campaign planning maps. But the Civil War also represented a watershed moment in popular mapping, as newspapers published battle maps and Americans both north and south followed the progress of the war. Schulten points to the Civil War and the decades immediately after as a critical phase in American cartographic consciousness, due to the use of statistical cartography in the 19th century to visualize the rapid growth of the nation and engage the economic and political challenges of the era.³¹ Some of the first American maps to shade or color code the different states (i.e. a choropleth map) distinguished slave and free states, while the Lincoln administration closely studied maps detailing the distribution of slave populations in the South. The 1874 publication of the *Statistical Atlas of the United States*, charting data from the 1870 census opened a new era of American government use of cartographic data in support of policymaking. The expanded

³¹ Susan Schulten, *Mapping the Nation: History and Cartography in Nineteenth-Century America*, Chicago: University of Chicago Press, 2012.

capacity and reach of government mapping imprinted the national map on the public consciousness through everyday geography like weather maps, which became common in the post-Civil War era. This period also saw growing institutional commitment to the study and advancement of geography as seen in the establishment of the American Geographical Society (AGS) in 1851 and the National Geographic Society in 1888, and Harvard's appointing its first geography professor in 1878.



Population density, as depicted in the Statistical Atlas of the United States for 1870. Courtesy of the US Census Department

The end of the 19th century saw the true emergence of an outward and international perspective to American cartographic consciousness that had been glimpsed just prior to the

Civil War. The US Army enabled and enforced the closure of the western frontier and led the collection and distribution of domestic geographic data. But the US Navy was at the heart of the nation's global consciousness as the 19th century turned to the 20th, as seen in Alfred Thayer Mahan's writings on global sea power, the Spanish-American War, and the "Great White Fleet." Mahan did not achieve the popular acclaim in his own country that he enjoyed in Europe, but his impact on key leaders like Theodore Roosevelt was clear. The acquisition of Hawaii, Guam, and the Philippines forced an expansion of the national map on the vast scale of trans-Pacific distances.

With an adventurer and navalist like Theodore Roosevelt in the White House for most of the first decade, the 20th century was off to strong start in terms of a global geographic perspective among America's leaders. The career of Isaiah Bowman chronicles the sustainment and deepening of that perspective from one Roosevelt to another, lending continuity from before the First World War until after the Second. Bowman was best known as President of the AGS from 1915 to 1935 and author of *The New World: Problems in Political Geography*, published in 1921. But Bowman first made his mark on spatial thinking in American foreign policy with the Wilson administration, accompanying Wilson to the Paris Peace Conference. Through many months of negotiations in Paris, Bowman oversaw a small empire producing original maps to arm American negotiators with spatial analysis of key problems and create detailed proposals for new borders. Bowman's enterprise became the envy of many delegations, and an asset jealously guarded by Wilson. Bowman's group produced hundreds of maps per week, including a thick "Black Book" of recommendations on European territorial questions and a later "Red Book" that supported negotiations on territories outside of Europe. Wilson and Bowman both understood the power and language of maps to drive home a point where words and numbers failed, and to

counter opposing geographic narratives. Bowman himself noted that a “perverted map was a life belt to a foundering argument” and that all parties at Paris brought “their own bagful of statistical and cartographic tricks.”³²

Neil Smith argues that Bowman understood better than anyone that the First World War had not just changed the world, but had changed the geographic discipline that sought to describe and explain that world. Bowman’s *The New World*, which Smith calls “the inaugural text of modern American political geography,” went through repeated printings even though its interest in world affairs was out of step with the growing isolationism of the 1930s.³³ As Bowman states in the introduction to the Fourth Edition of 1928:

“To face the problems of the day, the men who compose the government of the United States need more than native common sense... They need, above all, to give scholarly consideration to the geographical and historical materials that go into the making of that web of fact, relationship, and tradition that we call foreign policy. As we have not a trained and permanent foreign-office staff, our administrative principles are still antiquated.”³⁴

During the 1920s, Bowman developed a relationship with another American politician who would have a critical role in expanding and tuning the national cartographic consciousness. Bowman began a regular correspondence with Franklin D. Roosevelt when the AGS elected FDR to the position of Councilor in 1921. Bowman continued the correspondence as FDR became Governor of New York, then President, and Bowman moved from the AGS to become President of The Johns Hopkins University. In the run-up to World War II, FDR consulted Bowman on issues of Jewish refugees (which revealed Bowman’s anti-semitism), as well as the

³² Quoted in Neil Smith, *American Empire: Roosevelt’s Geographer and the Prelude to Globalization*, Berkeley: University of California Press, 2003. 147-148.

³³ Smith, *American Empire*, 183.

³⁴ Isaiah Bowman, *The New World: Problems in Political Geography (Fourth Edition)*, Yonkers: World Book Co., 1928, iii.

critical question of where to place the North Atlantic boundary of the Monroe Doctrine. In the 1939-1941 period where America remained ostensibly neutral, FDR, Bowman, and others drew lines and debated the limits of the Western Hemisphere: a key issue for the rules of engagement for US ships and German U-boats escorting or attacking convoys to Britain.

World War II

With war on the horizon, Bowman lamented that the US Government remained as unprepared as he had argued in *The New World* in 1928.³⁵ When war came he took no pride in the apparent failures of the Treaty of Versailles but remained an influential voice in the next attempt at creating post-war structures as a delegate to the Dumbarton Oaks Conference. As Bowman's career was nearing its end, other cartographers rose to prominence during the geographic boom created by World War II. According to Henrikson, because of the war and the technological developments it highlighted, the 1940s sparked a "revolution... in the way Americans visually imagined the earth and represented it cartographically."³⁶ A study of thinking in space during World War II could fill several volumes, but two particular American cartographers are worth examining for their innovative efforts, and occasional success, at helping Americans and senior decision makers to see the world in new ways: Richard Edes Harrison (1902-1994) and Arthur H. Robinson (1915-2004).

Both men made remarkable contributions to American cartography, though Robinson is better known and Harrison probably more revolutionary. Robinson was an early employee of the Office of Strategic Services (OSS) and in 1942 established the OSS Map Division, the organization that evolved into the modern Cartography Center at the Central Intelligence

³⁵ Smith, *American Empire*, 325.

³⁶ Alan Henrikson, "The Map as an "Idea": The Role of Cartographic Imagery During the Second World War," *The American Cartographer* 1:2 (1975), 19.

Agency. During his OSS service, Robinson oversaw not just the collection and creation of war maps, but also created terrain models and a celebrated set of globes, among the largest ever produced, given to FDR, Churchill and George Marshall. FDR, whose long-standing interest in geography was just mentioned, established the White House Map Room after learning of Churchill's similar arrangement. Eisenhower valued the gift of Robinson's globe to Churchill for the goodwill it earned during his mission to London, and having Churchill and Roosevelt studying the same globe surely contributed to their shared understanding of the geographic dimension of the war. Following the war, Robinson would go on to a highly successful academic career, including development of the Robinson Projection and many books on cartographic design.

Richard Edes Harrison's career was less conventional than that of Robinson, for he lacked formal training as a cartographer and drew on a background in architecture and the visual arts. Beginning in 1930s, Harrison began producing magazine maps that emphasized non-traditional projections and perspectives that sacrificed convention to enable visualizations that better reflected the three-dimensional realities of the world than most narrowly-conceived two-dimensional maps.³⁷ Harrison's wartime mapmaking made a major contribution to the public's understanding of the geographic dimension to the war and his arguments about how to use cartography and geographic thinking in support of strategy making are remarkably salient today.

Fortune magazine published collections of Harrison's maps, first as an eleven-map supplement to the September 1940 issue entitled "Atlas for the U.S. Citizen," and then a much larger hardbound collection in 1944 entitled *Look at the World: The Fortune Atlas for World*

³⁷ Black, *Maps and History*, 230.

Strategy. Look at the World, in addition to dozens of original maps of war zones from multiple perspectives, advanced several arguments about how different nations' unique spatial perceptions influenced the making of good or bad strategy. In an essay at the beginning of *Look at the World*, Harrison makes an impassioned plea for the importance of "geographical sense" for Americans forced by the war from "a period of cartographic lethargy."³⁸ In addition to a discussion of geographic literacy and an overview of the unavoidable distortions of maps, Harrison also attacks the "psychological shackles of conventional maps," that prevent Americans from effective visualization of geographic challenges.³⁹ Harrison held particular disdain for the "invariable placing of North at the top [as] geographical cant in its most pernicious form."⁴⁰ Although his argument was simple—to challenge conventional perspectives—the effect was more profound, as seen in Harrison's work. In addition to certain narrow arguments, such as Japanese failure to appreciate the value of Alaska, Harrison also makes a series of broader points about the link between geographic visualization and strategic analysis. Harrison's influence is evident in another widely-published collection, the *War Atlas for Americans*, produced by the Office of War Information, which includes many Harrison-style orthographic views and maps that deviate from the "north-up" convention.⁴¹ Robinson probably also had a hand in the *War Atlas for Americans*: Robinson is not listed as a consultant but the foreword cites assistance from the OSS, for which Robinson was the chief cartographer. Atlases were at peak popularity during WWII, not just because of general interest in distant locations where a relative might be fighting, but because the President actively promoted them. Most famously, in his 23 February 1942 radio address, FDR asked an audience of some 60 million Americans to take out their atlases and

³⁸ Richard Edes Harrison, ed., *Look at the World: The Fortune Atlas of World Strategy*, New York: Fortune, 1944.

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ *A War Atlas for Americans*, New York: Simon and Schuster (on behalf of the Office of War Information), 1944.

follow along with his explanation of global strategic imperatives and the path to victory in a global contest.



FDR refers to a world map during his 23 February 1942 radio address, Courtesy of the Library of Congress Prints and Photographs Division

The Cold War

The popular atlases and magazine maps of cartographers like Harrison created the defining spatial conception of air-age globalism and readily bridged the final stages of World War II with the early phase of the Cold War. Timothy Barney's masterful *Mapping the Cold War* describes many ways in which the Cold War shaped American cartographic consciousness.⁴² Construction of an American-led post-war order, in discussion since before America even

⁴² Timothy Barney, *Mapping the Cold War: Cartography and the Framing of America's International Power*, Chapel Hill: University of North Carolina Press, 2015.

entered the war, continued the global consciousness brought by the war. But beyond the international perspective of the United Nations and the Bretton Woods institutions, the transition from World War II to an enduring superpower competition with the Soviet Union created a fundamentally new American spatial concept of the globe.

The threat of nuclear attack by strategic bombers and intercontinental ballistic missiles (ICBM) brought new military challenges, particularly the strategic value of the high north, into sharper focus. The use of maps with polar projections (i.e. a polar azimuthal equidistant projection) became essential to understanding the threat axis against which a distant early warning (DEW) line and NORAD would defend. The controversial work of Alexander de Seversky in the late 1940s typified this spatial conception of the Arctic as the “area of decision” situated most directly between the industrial heartland of the United States and Soviet Union. De Seversky represented a pure faith in the importance of strategic air power to a global contest and saw no utility in any other military instrument: sea power (especially aircraft carriers) and overseas bases were anachronistic irrelevancies extraneous to the central contest of air power over the pole.⁴³ With de Seversky, the air-age globalists reached their peak: the map of direct air distance and the defensive buffers around American cities would be all that mattered in a world where a nation’s entire combat power consisted of globe-spanning bombers with atomic bombs.

De Seversky added an apparently-rushed prologue to his 1950 book to explain that the Korean War was largely irrelevant to a full-scale conflict between superpowers, but that Korea did provide evidence in confirming his air power theories and the myopia of American forces relying on antiquated modes of combat. De Seversky’s heated rhetoric would soon fall away in

⁴³ Alexander P. de Seversky, *Air Power: Key to Survival*, New York: Simon and Schuster, 1950.

the face of other technological developments, but his dismissal of Korea does speak to the changing character of how Americans visualized the Cold War. The symbology of military operations and strategy—traditional map arrows of ground campaigns and even the air-age range rings—were giving way to mutually-assured destruction. The ICBM that could range any target from a heartland sanctuary called for cartographers to depict nuclear weapon blast radius and create spatial predictions of fallout patterns. For government experts these nuclear-age spatial concepts meant intelligence collection in support of targeting, urban planning challenges for civil defense, and debates on the relative merits of countervalue and counterforce nuclear strategies. But for the American public, the apparent instantaneity of an ICBM strike and the incomprehensible horror of a nuclear exchange made “duck and cover” drills and backyard bomb shelters more resonant than the geographic origins of the threat or visualizing the paths the missiles might fly.

The enduring cartographic imagery of the later Cold War became more ideological than military, reflecting the global contest for influence between the superpowers. Like the pre-Civil War choropleth maps of free and slave states, and later Blue-Red election maps, the simplistic Cold War map reduced the world to color-coded countries aligned to the United States and Soviet Union. As many scholars have discussed, this allowed another lamented misuse of the Mercator Projection, as the areal distortions allowed the depiction of a monolithic Communist Bloc covering an exceedingly large portion of the earth in menacing red.

Alan Henrikson, one of the leading scholars of the “mental maps” of American diplomats makes a provocative argument about how Americans visualized the Cold War. Beyond the uniquely American perspective on competition with the Soviets, Henrikson explores the nature of divergent perspectives on global affairs, even among American foreign policy elites, deriving

from their own geographic origins. A statesman like George Kennan, born in Wisconsin, educated at Princeton, and well-traveled throughout northern Europe, exhibited a “northern mind” and concern for the geostrategic balance among Westphalian states in the high latitudes.⁴⁴ In contrast to Kennan, Dean Rusk, who served as Secretary of State in the Kennedy and Johnson administrations, was born in Georgia and educated at Davidson College in North Carolina. Conventional interpretations point to Rusk’s travels in Germany in the 1930s and his service in wartime Europe as instilling in him a fear of appeasement that drove an excessive commitment to holding the line against communism in Vietnam. Henrikson, however, presents a more nuanced picture in arguing that Rusk exhibited a “southern mind” with an anti-colonial current and belief in the transformative power of economic development in a region devastated by war, poverty and injustice.⁴⁵

Barney also highlights a larger and enduring impact of the Cold War on American cartography. This was the cartographic dimension of Eisenhower’s “military-industrial complex.” The need to map, image, and surveil the globe with a level of precision and completeness that surpassed even the requirements of World War II launched another renaissance in geographic and cartographic science, but primarily for government and military uses. As Barney writes, the Cold War eliminated “lines between a peacetime geography and a wartime one—the apparatus of World War II’s cartographic militarization was in large part left standing, and that sense of collaboration across agencies, universities, and journalists remained.”⁴⁶ Scientists, cartographers, and eventually the public all benefitted from Cold War

⁴⁴ Alan Henrikson, “The Northern Mind in American Diplomacy,” *Fletcher Forum of World Affairs* 34:1 (Winter 2010).

⁴⁵ Alan Henrikson, “The Southern Mind in American Diplomacy,” *Fletcher Forum of World Affairs* 13:1 (Summer 1989).

⁴⁶ Barney, 7.

investment in geographic science, as technologies like digital mapping, the global positioning system, and satellite imaging became declassified and commercialized. The full application of cartography in the information age, principally the field of Geographic Information Systems (GIS), is squarely rooted in technologies that “remained a largely classified phenomenon throughout the Cold War.”⁴⁷ Much of the contemporary commercial GIS enterprise has a symbiotic relationship with government, particularly the military and intelligence community.

As much as the Cold War continued the remarkable technical achievements in cartography first ushered in by World War II, something was lost along the way. The American public did not, or could not, keep pace with these advancements in geography. In December 1950, with Korea taking a dark turn and de Seversky sniping from the sidelines, a *New York Times* headline lamented the poor results of a new survey on geographic education in American schools and colleges.⁴⁸ Indeed, for all the demand for geography skills in World War II, Harvard eliminated its Geography Department in 1948. Neil Smith argues that Harvard’s decision marked a key moment in an “academic war over the field of geography,” in which the institutionally-weak discipline faced challenges in establishing geography as a true science, something more than a set of technical skills, and able to differentiate itself from the other physical and social sciences.⁴⁹ Personal and academic rivalries also played a role in the Harvard affair, as did McCarthyite accusations that university geography departments were a “haven for socialists.”⁵⁰ Harvard’s elimination of geography represented an important signal to the academy and geography found a more natural academic home in midwestern land-grant universities than the

⁴⁷ Barney, 19.

⁴⁸ Barney, 96.

⁴⁹ Neil Smith, “*Academic War over the Field of Geography*”: *The Elimination of Geography at Harvard 1947-1951*, *Annals of the Association of American Geographers* 77:2 (June 1987): 155-172.

⁵⁰ Smith, “Academic War”, 166.

Ivy League. Yale established a Department of Geography in 1949 but it lasted only two decades, while geography served the business schools at Columbia and the University of Pennsylvania. Henrikson lamented (in 1980) that the Foreign Service had produced only one ambassador with an academic degree in geography, and that “from a university, Harvard, that no longer awards that degree.”⁵¹ Harm de Blij draws a narrow but provocative lesson from Harvard’s decision in his book *Why Geography Matters: Robert McNamara’s poor grasp of Southeast Asian geography was a fundamental weakness in his Vietnam strategy* McNamara, a Harvard graduate, couldn’t have studied geography as an undergraduate even if he had wanted to.⁵² As McNamara himself wrote late in life, he and the rest of the Kennedy-Johnson national security team were so woefully ignorant of regional affairs that Indochina was effectively “terra incognita.”⁵³

The American public’s geographic concept of the Vietnam War deserves its own study, but it appears evident that something profound had changed between World War II: not just in the strategic imperatives of two very different wars, but in the way that leaders “thought in space” about them and how they explained them to the American public. Kennedy, McNamara, and Nixon all used large maps during televised briefings to explain Vietnam and the broader context of regional conflict, but the effect was somehow less compelling than FDR’s radio address. Perhaps it is more difficult to employ cartography to accurately depict the capture of “hearts and minds” than to show the movement of armies or select targets for strategic bombing. Whether or not Vietnam was simply less “mappable” than World War II, the United States employed ample cartographic resources (alongside ample conventional ordnance) in support of its efforts in Vietnam. Indeed, as Barney points out, there was a deep tension or irony in US

⁵¹ Alan Henrikson, “The Geographical ‘Mental Maps’ of American Foreign Policy Makers,” 504.

⁵² Harm de Blij, *Why Geography Matters: More than Ever*, New York: Oxford University Press, 2012, p. 16.

⁵³ Robert S. McNamara, “We Were Wrong, Terribly Wrong,” *Newsweek*, 16 April 1995.

cartographers fielding separate requests for maps of the same terrain from the military for battle planning and from civilian agencies for development efforts.⁵⁴

The unconventional cartographic style of Richard Edes Harrison is out of fashion, and the appropriation of air-age cartography for simplistic arguments like those of de Seversky should remain a historical curiosity, but it is still not clear how to describe American cartographic consciousness in the post-Cold War or post-9/11 world. This confused state is the context to which we will return in Part Four. But first, it is essential to consider the realm of geopolitics and how geographic concepts not only relate to individual consciousness and the American worldview, but how spatial thinking has informed fundamental theories about the functioning of the international system.

⁵⁴ Barney, 165.

Part III—The Theory and Context of Geopolitics

Only statesmen who can do their political and strategic thinking in terms of a round earth and a three-dimensional warfare can save their countries from being outmaneuvered on distant flanks.

-Nicholas Spykman⁵⁵

After beginning with basic concepts of cartography and spatial cognition, then tracing the history of American cartographic consciousness, we now turn to the idea of thinking in space in the international system. Considering the development of geopolitics adds important non-American perspectives to the discussion and incorporates established theoretical concepts that seek to describe the behavior of states in the international system. Theories of geopolitics hold far more significance than rarefied academic debates: as with international relations theory, geopolitics shapes the way national leaders view the outside world and how they make national security decisions. To adapt a common expression, policymakers may not be interested in geopolitics, but geopolitics is interested in them.

Saul Bernard Cohen defines modern geopolitics as the “scholarly analysis of the geographical factors underlying international relations and guiding political interactions.”⁵⁶ Many authors have described the development of geopolitics and the history of leading figures, but Cohen provides a useful framework in tracing five stages of modern geopolitics: “the race for imperial hegemony; German *geopolitik*; American geopolitics; the Cold War-state-centered versus universalistic geographical; and the post-Cold War period.”⁵⁷ Geopolitics has many

⁵⁵ Nicholas J. Spykman, *America’s Strategy in World Politics*, New York: Harcourt, Brace and Co., 1942, 165.

⁵⁶ Saul Bernard Cohen, *Geopolitics: The Geography of International Relations (Second Edition)*, Lanham, MD: Rowan and Littlefield, 2009, 11.

⁵⁷ Cohen, 12.

critics, who find fault not only with the travesty of *geopolitik* under the Nazis, but also with the apparent power dynamics and geographic determinism of modern European and American geopolitics. We will leave aside post-modern critiques of neo-imperialist cartography for other venues and focus on a traditional consideration of the relevance of geopolitics to national security decisions in the contemporary international system.

Mackinder and Mahan

Most overviews of geopolitical thought begin with the work of Halford Mackinder, which elaborated the concept of a Eurasian “heartland,” control of which determined global power. However, Martin Glassner has pointed out two distinct concepts of geopolitics were apparent prior to Mackinder: the organic state theory pioneered by Friedrich Ratzel, and the geostrategy school exemplified by Alfred Thayer Mahan.⁵⁸ Ratzel, responding to the growth of a unified Germany under Bismarck, argued in 1895 that the state as a living being that would grow, decline, or evolve according to natural laws.⁵⁹ The Swedish political scientist Rudolf Kjellen was the first to use the term “geopolitics” and further developed Ratzel’s notions of organic states with scientific laws governing the interaction of the state and its environment. Kjellen, in his 1916 book *The State as an Organism*, went so far as to “espouse the doctrine that political processes were spatially determined.”⁶⁰

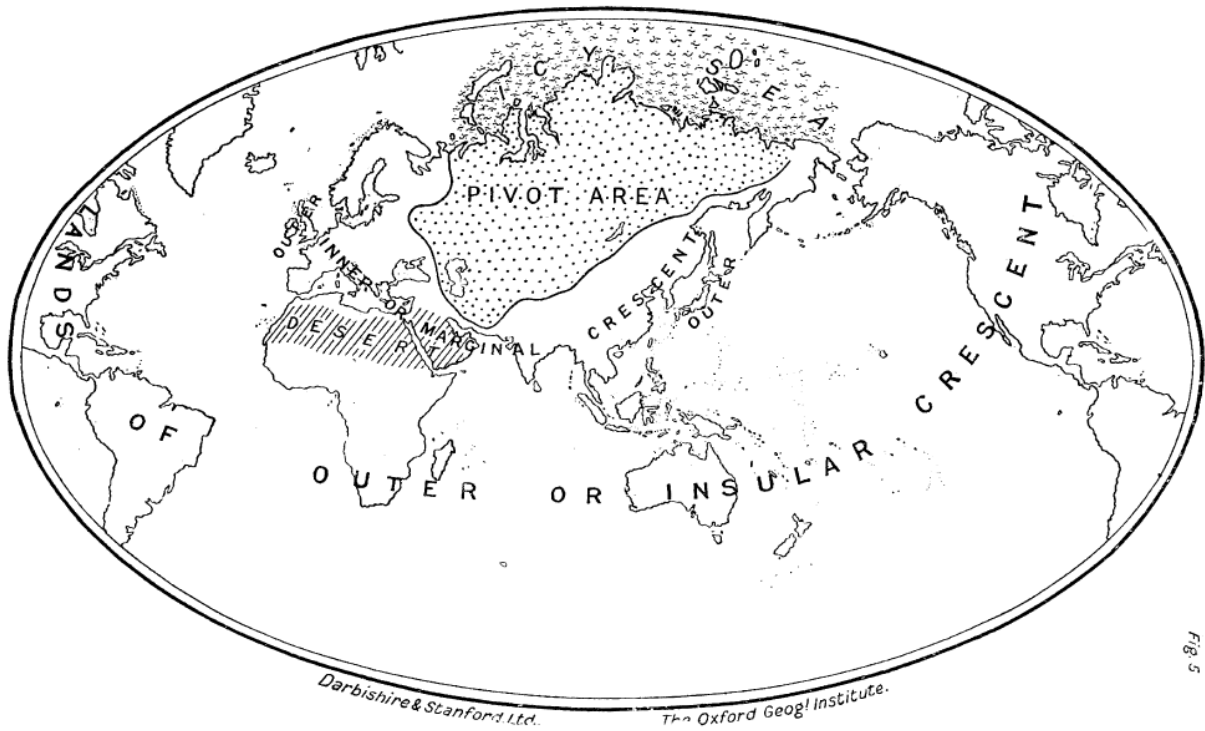
Mahan and Mackinder make an interesting pair: their careers overlapped (Mackinder was twelve years younger) but they advanced very different arguments about where the seat of global power rested. We have already discussed Mahan’s concept of sea power and advocacy for

⁵⁸ Martin Glassner, *Political Geography*, Hoboken: John Wiley and Sons, 1995. 322-324.

⁵⁹ Friedrich Ratzel, “The Laws of Spatial Growth of States” (1895), translated by Ronald L. Bolin, in Roger E. Kasperson and Julian Minghi, eds., *The Structure of Political Geography*, London: Aldine, 1969.

⁶⁰ Cohen, 20.

American pursuit of great power status on the strength of maritime commerce, naval supremacy, and global presence. Mackinder, writing at a time when Mahan's popularity and influence peaked in Europe, argued that the true pivot of world power was on land, and that technology had diminished the importance of maritime trade and naval power.⁶¹



THE NATURAL SEATS OF POWER.
 Pivot area—wholly continental. Outer crescent—wholly oceanic. Inner crescent—partly continental, partly oceanic.

*Mackinder's 1904 map, from "The Geographical Pivot of History"*⁶²

Scholars have debated how much Mahan and Mackinder truly differed as geopolitical thinkers: as much as they emphasize sea power versus continental power, Mahan the historian and Mackinder the geographer shared a common geographical model and common assumption about the role of military power and conflict in determining a nation's status in the international

⁶¹ Glassner, 325.

⁶² Halford J Mackinder, "The Geographical Pivot of History," *The Geographical Journal* 23:4 (April 1904).

system.⁶³ Later critics have argued that Mackinder over-valued the extent to which land transportation, especially railroads, could unify a territory and allow easy movement of resources and military power. However, Mackinder's influence on western strategic thought was profound as he elaborated enduring concepts of competing regional centers of power within a closed system. Mackinder's concepts provided a foundation for diverse strategists advocating imperialism, conquest, or containment, but Mackinder was no mere cold-hearted imperialist. As Cohen argues:

Whereas Ratzel's theories of the large state were based on concepts of self-sufficiency, closed space, and totalitarian controls, Mackinder was strongly committed to cooperation among states, democratization of the empire into a Commonwealth of Nations, and preservation of small states.⁶⁴

Ratzel, Mahan, Kjellen, and Mackinder all represent Cohen's first stage of geopolitics, while the second stage, which fused both organic state theory and geostrategy, became the most notorious version of the discipline: the *geopolitik* associated with Karl Haushofer and Nazi Germany. Haushofer appropriated Ratzel's theory of how available space (*raum*) determined the health of a state to advance the idea of *lebensraum* for the Third Reich. Margaret Sprout drew a connection between admiration for Mahan in Wilhelmine Germany and the appropriation of certain Mahanian thinking on expansionism.⁶⁵ Haushofer advanced a theory of a panregional world dominated by three principal powers: "Pan-America, Pan-Eur-Africa, and Pan-Asia, with the United States, Germany, and Japan as respective cores."⁶⁶ Through the 1920s and 1930s Haushofer institutionalized these concepts and created an academic home for panregionalism, *lebensraum*, and the pursuit of protectionist autarky through the journal *Zeitschrift für Geopolitik*

⁶³ Jon Tetsuro Sumida, "Alfred Thayer Mahan, Geopolitician," *The Journal of Strategic Studies*, 22:2-3, 42.

⁶⁴ Cohen, 19.

⁶⁵ Margaret Sprout, "Mahan: Evangelist of Sea Power," in Edward M Earle, ed., *Makers of Modern Strategy: Military Thought from Machiavelli to Hitler*, Princeton: Princeton University Press, 1944, 442-445

⁶⁶ Cohen, 21.

and the Institute for Geopolitics at the University of Munich. Haushofer served as a mentor to Rudolf Hess, giving Haushofer influence over the formative period of Nazi ideology and Hitler's "world view" or *Weltanschauung*.⁶⁷

Spykman and American Geopolitics

Two world wars, that looked to many like the fault of statemen seduced by geopoliticians, required a period of rehabilitation for geopolitical thought. Some historians pointed a finger at Mahan for contributing to the outbreak of the First World War, while Haushofer became the arch villain of the geography profession for guiding and abetting Nazi policies. It took time for geopolitics to shed this historical burden, particularly the Nazi association, but even before the defeat of Nazism geopolitical thinkers were developing the next stage, which Cohen terms "American geopolitics" and is most associated with Nicholas Spykman. Jakub Grygiel points out that this historical period that straddles World War II also saw the transition of geopolitics from the academic realm of geography to that of social science and international relations.⁶⁸

It is difficult to overstate Spykman's foresight into the strategic course of World War II, the nature of the postwar system, and the geopolitical imperatives that persist to this day. As a contributor to geopolitical thinking, Spykman fused Mahan and Mackinder to analyze the competition of great powers for regional and global influence. Spykman wrote a series of articles in the late 1930s and the influential book 1942 book *America's Strategy in World Politics*, while *Geography of the Peace* was published after his death, in 1944.⁶⁹ Spykman saw geopolitics as the careful balancing of power among strong nations. Spykman accepted much of Mackinder's

⁶⁷ Hans W. Weigert, *Generals and Geographers*, New York: London, 1942.

⁶⁸ Jakub Grygiel, *Great Powers and Geopolitical Change*, Baltimore: The Johns Hopkins University Press, 2006, 2-6

⁶⁹ Spykman, *America's Strategy in World Politics*.

geographic concept, but argued that the critical strategic pivot was not the “heartland” at the center of the Eurasian landmass, but the coastal “Rimland” that surrounds Eurasia, an area that Mackinder had called the “inner or marginal crescent.”⁷⁰ This led Spykman to modify Mackinder’s famous dictum and claim that “who controls the rimland rules Eurasia; who rules Eurasia controls the destinies of the world.”⁷¹ A strong power like the United States should therefore support buffer states (i.e. in the Rimland) and fight its enemies abroad, as only weak states fight defensively at their own borders or within their own territory. Such foreign engagement and entanglement, though necessary and inevitable, can be unpopular at home, leading to a natural cycle that Spykman perceived among great powers (especially the United States), between war, isolation, alliance, and a new war. Spykman called the tension between interventionism and isolationism “the oldest issue in American foreign policy,” evidence of how he combined insight into American elite and popular perceptions of the world with a deep study of geopolitical history.⁷²

Spykman made a remarkable contribution to the foundations of American grand strategy, but he was also a keen scholar of how a state and its people collectively think in space. In addition to the oscillation between isolation and intervention, Spykman studied the strategies and behaviors of land powers and sea powers and recognized the implications of how different nations view space, writing in 1938 that:

A sea power conquers a large space by leaping lightly from point to point, adjusting itself to existing political relationships wherever possible, and often not establishing its legal control until its factual domination has long been tacitly recognized. An expanding land power moves slowly and methodically forward, forced by the nature of its terrain to establish its control step by step and so preserve the mobility of its forces. Thus a land

⁷⁰ Francis Sempa, “The Geopolitical Realism of Nicholas Spykman (Introduction to the Transaction Edition)” in Nicholas J. Spykman, *America’s Strategy in World Politics*, New Brunswick: Transaction Publishers, 2008.

⁷¹ Nicholas J. Spykman, *The Geography of the Peace*, New York: Harcourt, Brace and Co., 1944, 43.

⁷² Spykman, *America’s Strategy in World Politics*, 5.

power *thinks in terms of continuous surfaces* surrounding a central point of control, while a sea power *thinks in terms of points and connecting lines* dominating an immense territory.⁷³

Spykman's worldview reflected American global strategy in World War II and, in addition to fusing Mackinder's land power and Mahan's sea power, also incorporates the air-age globalism introduced by the war. Indeed, Spykman's work on grand strategy was closely tied to the cartographers who helped shape American spatial thinking among both elites and the general population. Spykman gained influence in the Roosevelt administration when Isaiah Bowman promoted his work and it was none other than Richard Edes Harrison who drew the maps (using several unconventional projections) for the original edition of *America's Strategy in World Politics*.

Although Cohen calls this period of geopolitical thought "American," many of its great geographic thinkers were shaped by a youth in Europe: Spykman and Harm de Blij were both born in the Netherlands and spent their professional lives in the United States, while Alexander de Seversky first learned to fly in tsarist Russia before emigrating to the United States and promoting his brand of American air power. Several German-speaking thinkers also played a key role in countering Haushofer and rehabilitating the study of geopolitics, such as Hans Weigert, who fled to the United States in 1938. Robert Strausz-Hupé, an Austrian immigrant to the United States collaborated with Richard Edes Harrison, served multiple tours as a US ambassador abroad, and founded the Foreign Policy Research Institute. Ludwig Dehio began his 1960 book *The Precarious Balance* with a call to his fellow Germans to study their own 18th- and 19th-century history for important geopolitical lessons and reawaken an intellectual geopolitics

⁷³ Nicholas J. Spykman, Geography and Foreign Policy II, *The American Political Science Review*, Vol. 32, No. 2 (Apr., 1938), 224. Emphasis added. I am indebted to Jakub Grygiel, for whom I once worked as a research assistant, for highlighting this passage (Grygiel, *Great Powers and Geopolitical Change*, 10.)

destroyed by Nazism.⁷⁴ Dehio's contribution to geopolitical thought emphasized strategic balance, drawing on the lessons of power struggles within the European state system, particularly the rise of Prussia and Bismarck's creation of a unified Germany. Dehio made an impassioned plea for robust American leadership in the Cold War at a time of apparent Western decline and decadence in the 1960s, but his writing has important echoes to the early 20th century in light of comparisons of a rising China to Prussia and profound questions about commitment to American global leadership.⁷⁵

Universalistic and Post-Cold War Geopolitics

Cohen identifies the subsequent period as the "Cold War-state-centered versus universalistic geographical" stage of geopolitics. The state-centric approach is well known to students of international relations, as it runs from Winston Churchill, George Kennan, Dean Acheson, and Paul Nitze in the early Cold War to the later phase of Henry Kissinger and Zbigniew Brzezinski (two more geopoliticians who fled Europe in their youth). This concept of geopolitics is evident in the "domino theory" of communism's spread and the imperatives of containment. Glassner argues that containment represents the implementation of the central idea of a Spykman strategy for controlling the Rimland but points out there are no indications that Kennan had read Spykman.⁷⁶

A separate school of geopolitics emerged in the Cold War that rejected the realist state-centric approach, or argued the traditional model was dangerously incomplete. Cohen, himself one of the leading proponents of this "universalistic geopolitics," emphasized theories that took

⁷⁴ Ludwig Dehio, *The Precarious Balance: Four Centuries of the European Power Struggle*, trans. Charles Fullman, New York: Knopf, 1962.

⁷⁵ Dehio, 286-288.

⁷⁶ Glassner, 327.

greater account of subnational units and the liberal internationalist commitment to managing transnational problems through cooperative systems.⁷⁷ One of Cohen's key contributions to geopolitical theory was a new emphasis on unstable "shatterbelts" that are "strategically oriented regions that are both deeply divided internally and caught up in the competition between Great Powers of the geostrategic realms."⁷⁸ Others, including Mahan, had advanced shatterbelt-like concepts, but Cohen advanced a more complete and inclusive model of the international system, while emphasizing "cooperation, economic power, persuasion, and propaganda" instead of a singular focus on hard power.⁷⁹ The emphasis on power, evident not only in Spkyman's work but in the realist school of international relations, invited criticism from scholars who see a perpetuation of colonial mindsets and power dynamics that oppress marginalized groups and under-developed regions. Gearóid Ó Tuathail in 1999 argued for a "critical geopolitics" that contrasted with the "orthodox" geopolitics of Mackinder and the Cold War that "peddled dangerous simplifications about world politics while justifying the potentially catastrophic militarization of the European continent and other regions."⁸⁰

The immediate post-Cold War world initially appeared dramatically different than the preceding centuries of great power competition and traditional geopolitics. Francis Fukuyama described a world beyond ideological struggle among great powers in which "liberal democracy remains the only coherent political aspiration that spans different regions and cultures around the globe."⁸¹ Samuel Huntington argued that the role of the Westphalian nation state was in decline

⁷⁷ Cohen, 26-27.

⁷⁸ Cohen, 44.

⁷⁹ Glassner, 332.

⁸⁰ Gearóid Ó Tuathail, "Understanding Critical Geopolitics: Geopolitics and Risk Society." *Journal of Strategic Studies* 22, no. 2-3 (1999): 108.

⁸¹ Francis Fukuyama, *The End of History and the Last Man*, New York: Perennial (HarperCollins), 1992, xiii

and offered a vision of a world map with fault lines among several competing civilizations.⁸²

Shortly thereafter, the journalistic geopolitician Robert Kaplan heralded “the coming anarchy” of enduring chaos brought on by the inability of the international system to counter “scarcity, crime, overpopulation, tribalism, and disease.”⁸³ Kaplan called the depiction of this world “the last map,” which would presumably be studied at a distance by Fukuyama’s “last man.”

But by the second decade of the 21st century, the prospect of renewed great power competition was evident in the resurgence of Russia and China as competitors with the United States. Although Kaplan’s dire predictions from the early 1990s did not materialize, he was one of the earliest journalists of international relations to recognize that China represented a potential peer competitor to the United States.⁸⁴ Kissinger, who had lengthy discussions of global geopolitical with Mao Zedong in the early 1970s, responded to the rise of China by rejecting military containment and called for America and China to recognize each other’s enduring role in Asia and pursue “co-evolution,” with a balance of cooperation and competition.⁸⁵ Kissinger argues the stakes of getting Sino-American relations wrong could be cataclysmic and invokes the harsh lessons of great power conflict in the First World War. With a return of traditional geopolitics, we no longer anticipate Kaplan’s “last map,” and political developments make clear, as *The Economist* stated in its cover story on the 2016 US presidential election, that “history is back—with a vengeance.”⁸⁶

⁸² Samuel P. Huntington, “The Clash of Civilizations,” *Foreign Affairs* 72, no. 3 (Summer 1993).

⁸³ Robert D. Kaplan, “The Coming Anarchy,” *The Atlantic Monthly*, Feb 1994, 44-76.

⁸⁴ Toshi Yoshihara and James R. Holmes, *Red Star over the Pacific: China’s Rise and the Challenge to U.S. Maritime Strategy* (Second Edition), Annapolis: U.S. Naval Institute Press, 2018, 72.

⁸⁵ Henry Kissinger, *On China*, New York: Penguin, 2011, 526.

⁸⁶ “The Trump Era,” *The Economist*, 12 November 2016.

Kaplan, in contrast to his geographic lens of the early 1990s, highlighted the enduring importance of geopolitics to the post-Cold War world in his 2012 book *The Revenge of Geography*. Not only does Kaplan begin his first chapter with an argument for “recover[ing] our sense of geography” that was lost with the end of the Cold War, but he devotes a full chapter to the 21st century importance of Spykman’s Rimland thesis.⁸⁷ Some traditional Cold War strategists carried the concepts of traditional geopolitics through the first decades of the post-Cold War period. Brzezinski, from the late Cold War up until his death in 2017, offered his own vision of geopolitics as *The Grand Chessboard*, though Brzezinski neither fully developed the chessboard idea as a visualization nor did he explore the deeper implications of the chess analogy suggested by the spatial decision making work of Herbert Simon and others.⁸⁸ Brzezinski also did not expand much on Mackinder’s and Spykman’s arguments on the importance of Eurasia and Brzezinski never mentions Spykman. Jakub Grygiel, a Polish-born geopolitician like Brzezinski, has emerged as one of the foremost contemporary scholars of geopolitical theory and brings a much clearer review of Spykman into the 21st century. Grygiel’s 2017 book *The Unquiet Frontier*, with co-author Wess Mitchell, makes a geopolitical argument for resisting the lure of isolationism and sustaining US engagement abroad to counter Chinese and Russian probing for weak points in America’s international position.⁸⁹

The context and theory of geopolitics is not merely academic. Contemporary strategists can hold a meaningful debate over whether Mahan or Mackinder holds more sway over the strategists guiding China’s rise, and the answers to that debate hold key implications for how

⁸⁷ Robert D. Kaplan, *The Revenge of Geography*, New York: Random House, 2012, 3.

⁸⁸ Newell and Simon, op. cit.

⁸⁹ Jakub Grygiel and A. Wess Mitchell, *The Unquiet Frontier: Rising Rivals, Vulnerable Allies, and the Crisis of American Power*, Princeton: Princeton University Press, 2016.

America should compete with China over the long term. The American foreign policy establishment, whether realist or liberal internationalist, has been firmly rooted in Spykman's concept of forward engagement for the better part of a century.

Just as individuals may not comprehend the distortions of the map before them, and Americans may not reflect on the uniqueness of their cartographic perspective, national leaders may not realize it when they invoke geopolitical theories or engage in some of the great debates of geopolitics. Spykman would not be surprised, 75 years after his death, to see signs of a swing towards isolationism in America. And Spykman also discussed the possibility that the Asian littorals might some day "be controlled not by British, American, or Japanese sea power but by Chinese air power."⁹⁰ Spykman would surely want to understand how America's unmatched global reach, the multidomain power projection capabilities of the US military, and the character of American society were shaping views of the international system. He would probably be amazed at the geographic capability available to the American public and the geospatial support provided to American national security decisionmakers. But Spykman might well be dismayed at how poorly American statesmen (and stateswomen) were showing their ability to "do their thinking in terms of a round earth and three-dimensional warfare."⁹¹ This question, of how well the national security establishment thinks in space, is the subject of the next section.

⁹⁰ Spykman, *America's Strategy in World Politics*, 469.

⁹¹ Spykman, *America's Strategy in World Politics*, 165.

Part IV—Where Are We Now?

We simply rely on maps as if they were facts in the transformation of thinking and seeing. The astounding observation that, in the discussion of vital problems of the day, the maps as they are presented to us are being taken as stable and indisputable factors, as mere tools which do not themselves reflect aims and options of their creators—this naïve confidence in the truthfulness of the map indicates that many of us are not sufficiently aware that maps are weapons. Like the written and spoken word, like photographs and cartoons, the maps has become a psychological weapon in a warring world where the souls of men are as strongly attacked as their lives.

-Hans Weigert, 1941⁹²

I watch CNN, but I'm not sure I can tell you the difference in Iraq and Iran.

-Alan Jackson⁹³

May and Neustadt's explicitly addressed *Thinking in Time* to “those who govern” and “those who assist them” to make better use of history in making decisions. As mentioned in the introduction, this paper assumes that how decision makers employ, or neglect, geography matters in the same way that May and Neustadt understood history to matter to how senior officials in Washington make decisions. Neustadt and May articulated that “marginal improvement in performance is worth seeking” and that a “little thought can help” a busy official to make a better decision.⁹⁴ The quest for “marginal improvement” and sparing “a little thought” for the geographic context are the focus of the remainder of this study, assessing the current state of “thinking in space” and recommendations for the US national security enterprise.

⁹² H.W. Weigert, "Maps are Weapons," *Survey Graphic* 30, (October 1941), 528.

⁹³ Alan Jackson, “Where Were You (When the World Stopped Turning)” Arista Nashville Records, 2002.

⁹⁴ Neustadt and May, xvii.

A central hypothesis of this research project has been that national security decisionmaking is underperforming its potential when it comes to the use of geographic information. As much as national security decision makers have unprecedented access to geographic information and tools to visualize the world, this does not appear to be a golden age of spatial thinking in government. Proving or measuring this underperformance is extremely difficult. Neustadt and May did not employ quantitative metrics to demonstrate insufficient attention to history in decision making, but were nevertheless able to develop some meaningful insight into past practice and methods to produce marginal improvement. Similarly, there is very limited data on questions of geographic literacy, the trends in use of geographic data, or the effectiveness of spatial thinking within the US national security enterprise. Collection of such data would be a worthwhile endeavor to evaluate how well US government geospatial efforts are doing at supporting decision makers. And a data-driven understanding of the specific strengths and weaknesses of senior officials and their support staff when it comes to spatial reasoning and cartographic communication would undoubtedly suggest improved processes and technical fixes. Such data collection, however, is beyond the scope of this paper. We will focus instead on observable trends in the broader society, the development and propagation of relevant technologies, material evidence of cartography in national security publications, and demonstrated institutional practices in the national security enterprise.

Geographic Literacy in American Society

The low level of geographic literacy among Americans is a popular and long-standing lament. Serious journalists and late-night comedians have regularly highlighted the poor performance of Americans on simple tests to locate foreign countries. In one recent study of Americans, conducted at a time of high tension on the Korean Peninsula, 36% of respondents

could correctly identify North Korea on a map, while 16% of Americans correctly located Ukraine in a similar 2014 study.⁹⁵ The National Geographic Society (NGS) has sponsored a number of detailed surveys of geographic knowledge and map-reading skills, showing similar results among young Americans. In a 2016 NGS-sponsored survey of American college students, 49% of respondents correctly identified Iraq on a regional map, while a 2006 NGS-sponsored survey with demographics more similar to the general population had 37% of respondents identifying Iraq correctly.⁹⁶ These results are not new: the 1950 *New York Times* front page story mentioned earlier described a survey of American colleges that showed poor knowledge among incoming students and few requirements for the study of geography.⁹⁷ News coverage of a similar study in 1980, in which only 42% of college students identified Mexico as America's southern neighbor, led Harm de Blij, who has written extensively on geography education, to become a geography correspondent for "Good Morning America." De Blij offers some hope from his experience at Georgetown University's School of Foreign Service, where the foundational geography course, "Map of the Modern World," was not only a graduation requirement but also highly popular.⁹⁸ Nevertheless, de Blij notes that Georgetown's program represents at best a remedial model and a rare example. James Oigara offers a more detailed

⁹⁵ Kevin Quealy, "If Americans Can Find North Korea on a Map, They're More Likely to Prefer Diplomacy," *The New York Times*, 14 May 2017; Kyle Dropp, Joshua D. Kertzer, and Thomas Zeitzoff, "The less Americans know about Ukraine's location, the more they want U.S. to intervene," *The Washington Post*, 7 April 2014. https://www.washingtonpost.com/news/monkey-cage/wp/2014/04/07/the-less-americans-know-about-ukraines-location-the-more-they-want-u-s-to-intervene/?utm_term=.2a45141edf5b

⁹⁶ National Geographic Society and the Council on Foreign Relations, "What College-Aged Students Know About the World A Survey on Global Literacy," September 2016, <https://www.cfr.org/global-literacy-survey>. National Geographic Society and Roper Public Affairs, "Final Report: 2006 Geographic Literacy Study," May 2006, <https://media.nationalgeographic.org/assets/file/NGS-Roper-2006-Report.pdf>.

⁹⁷ Benjamin Fine, "Geography Almost Ignored In Colleges, Survey Shows: Yet Most Educators Deem It Vital to Good Citizenship-Students' Knowledge of Subject Found Woefully Inadequate," *The New York Times*, 18 December 1950, 1. Barney also references this article in juxtaposition to early Cold War headlines on the same day relating to the Korean War: see Barney, *Mapping the Cold War*, 96.

⁹⁸ Harm de Blij, *Why Geography Matters*, 21.

study of the nature of geographic illiteracy in America and his research into background factors focuses on areas for improvement in American primary and secondary education. Oigara also offers a three-level framework of geography knowledge covering 1) “place-name and location knowledge,” 2) “understanding of geographic interrelationships,” and 3) “critical geographic knowledge.”⁹⁹ Oigara’s research sharpens the discussion of the different skills that comprise geographic literacy and places greater emphasis on influences outside the classroom, such as personal travel (domestic and international) and urban-rural divides.

The role of the media in raising cartographic awareness among the population is a critical factor, best studied by Mark Monmonier in his book *Maps with the News*, which he dedicates to Richard Edes Harrison’s contributions to journalistic cartography.¹⁰⁰ The most frequent use of maps in mass media is probably the national weather map, although the national choropleth maps of red state and blue state election results have become ever-more seared into the national psyche. Monmonier surveys the types, frequency and quality of maps that appear in print media and on television and notes various challenges faced by journalists that are also common in the national security enterprise. The urgency to publish a story quickly can force compromises on design and accuracy, and those performing the primary work of assembling and telling the story lack a grounding in the principles of cartography and rely on others to manipulate the sophisticated tools for creating a map. Although many news outlets produce high-quality maps, the structural challenges of the news business can produce misleading maps of important issues. Monmonier noted a wide variance in the use of maps from one publication to another, either

⁹⁹ James Oigara, “A Multi-Method Study of Background Experiences Influencing Levels of Geographic Literacy,” Ph.D. Dissertation SUNY Binghamton, 2006.

¹⁰⁰ Mark Monmonier, *Maps with the News: The Development of American Journalistic Cartography*, Chicago: University of Chicago Press, 1989.

because of the newspaper's outlook, the resources available to it, or the preferences of the editor.¹⁰¹ Finally, Monmonier cataloged an occasional tendency to employ maps as non-substantive decoration, either to improve the visual layout of a newspaper page or to lend gravitas to a television studio background.¹⁰² Not only does the media play a role in the development of popular and elite geographic awareness, but the business practices of the media share several strengths and weaknesses with the national security establishment. A systematic study of the output of different groups—news outlets and government agencies alike—can provide insight into the cartographic resources, the geographic literacy, and the institutional biases of that organization.

Nationwide studies and general laments of geographic illiteracy have limited value in assessing the strengths and weaknesses of a national security establishment whose members tend to be more educated and well-traveled than the general population, and who are liable to learn some geography in the course of professional engagement with international affairs. New employees of foreign affairs agencies generally do not receive the same geography test as college freshmen and elected officials do not get sent to a remedial geography class if they do not bring a certain level of global literacy to the job. One exception is the Department of State's Foreign Service exam, which does include multiple-choice geography questions in its "Job Knowledge" section, albeit the questions cover what Oigara would classify as the lowest level of geographic literacy. Henrikson has studied how American diplomats view the world, as discussed earlier in relation to Dean Rusk and George Kennan. While Henrikson does not attempt to evaluate the objective "literacy" of the foreign service, he does create insight how "mental maps" develop on

¹⁰¹ Monmonier, *Maps with the News*, 178.

¹⁰² Monmonier, *Maps with the News*, 8-9.

the job by mining records of the diplomatic travels to examine how travels “determine the shape of individuals’ psycho-environments... [through] their actual life patterns, their overt behavior.”

Focusing on the “image plan” developed by long-tenured Secretaries of State, Henrikson concludes:

The total behavioral mental map of a U.S. Secretary of State is perhaps a unique one. Less spatially voluminous than that of a planetarily minded Defense Department planner and less concretely detailed than that of a CIA area specialist, it is, in terms of volume and detail combined, possibly the most "capacious" in the world.¹⁰³

Technology and Geography in the 21st Century

In the 21st century, the realm of geography, cartography, and navigation have become ever more digital. The world of “GIS,” which generally refers to Geographic Information Systems, but can also abbreviate the more general and academic field of Geographic Information Science, grew out of a set of military technologies developed in the Cold War. GIS now encompasses the collection, manipulation, analysis and display of ever richer data sets, empowered by global navigation systems like GPS, the storage of big data collected in the field, space-based imaging sensors, and the computing power to process it all.

GIS has become an essential tool for an ever-broadening set of organizations, from businesses seeking more efficient supply chains to local governments managing public services and utilities. In this sense, the essential skills for developing geographic tools and manipulating geographic information (i.e. GIS) has become much more an exercise in computer programming and development of user interfaces than of cartography. Indeed, some see the ideal outcome for

¹⁰³ Alan Henrikson, “The Geographical Mental Maps of American Foreign Policy Makers,” 521.

the geographic professional as empowering an end user with no geographic knowledge or critical thinking skills.

Digital navigation has become the ubiquitous and essential means by which many people around the world engage with the mapped environment, but has also prompted research into its impact on spatial cognition. Most Americans engage with geographic data through a mobile device or one of the integrated displays increasingly becoming standard equipment in newer cars. In the United States, Google Maps has established a dominant position as one of the most popular of all mobile apps: in 2017 it was the fifth-most popular app, installed by 57% of all US adult mobile device users, and in demand across all demographics.¹⁰⁴ Google Maps use does skew somewhat by age: in 2017 35% of users 55 and older rated Google Maps their app they “cannot go without,” while only 14% of users 18-34 responded the same way. This penetration has happened quickly: offline digital atlases became available on portable media in the 1980s, Mapquest launched its online web interface in 1996, and personal GPS navigation units became widely available with the falling cost of mobile devices and the end in 2000 of “selective availability” limits on GPS accuracy.

A growing body of research, however, has examined the impact of these technological tools on users’ spatial thinking. In 1913, Gerard Stanley Lee wrote that “the telephone changes the structure of the brain. Men live in wider distances, and think in larger figures, and become eligible to nobler and wider motives.”¹⁰⁵ A century later, there are numerous advantages to the modern smartphone, beyond just getting people to their destination accurately and efficiently, such as freeing up the attention and brain power of a driver to focus on other aspects of driving.

¹⁰⁴ comScore, “The 2017 Mobile App Report,” 24 August 2017, <https://www.comscore.com/Insights/Presentations-and-Whitepapers/2017/The-2017-US-Mobile-App-Report>

¹⁰⁵ Gerard Stanley Lee, *Crowds: A Moving-Picture of Democracy*, New York: Doubleday, 1913, 65.

Scientists and software developers alike have continued to refine navigational tools to evaluate the best ways to display information and reduce the effort required by the user, such as the best symbology for the base map, the merits of “north up” versus “track up” displays, or how to represent key landmarks or signs. However, the greater ease and narrow purpose of navigation tools, like GPS, and digital map applications, like Google Maps, have also led to what several researchers have identified as “spatial cognitive deskilling” where users acquire less spatial knowledge.¹⁰⁶ Demanding less skill of the user and stripping away context has clear benefits. Henry Grabar notes this is perhaps most evident in the way that a transit diagram, technically a “cartogram” rather than a map, allows a tourist to navigate the New York subway or London Underground but abandons geographic accuracy and provides little to no context on the surrounding environment. However, in contrasting smartphones and paper maps, Grabar argues that having “small screens and egocentric perspectives, mobile navigation systems function like blinders, reducing the landscape to the width of a street. They narrow the world.”¹⁰⁷ A remarkable 2018 New York Times map of every structure in the United States, produced in both paper and online interactive forms, prompted Harvard’s Susan Crawford to remark on how modern technology denies individuals important spatial context, saying that “we lose what’s fascinating about a place by not having this bigger picture.”¹⁰⁸

¹⁰⁶ Klaus Gramann, Paul Hoepner, and Katja Karrer-Gauss. "Modified Navigation Instructions for Spatial Navigation Assistance Systems Lead to Incidental Spatial Learning." *Frontiers in Psychology* 8, (2017): 193. Stefan Münzer, Hubert D. Zimmer, and Jörg Baus. "Navigation Assistance: A Trade-Off between Wayfinding Support and Configural Learning Support." *Journal of Experimental Psychology. Applied* 18, no. 1 (2012): 18-37. Claudio Aporta and Eric Higgs. "Satellite Culture: Global Positioning Systems, Inuit Wayfinding, and the Need for a New Account of Technology." *Current Anthropology* 46, no. 5 (2005): 729-753.

¹⁰⁷ Henry Grabar, “Smartphones and the Uncertain Future of 'Spatial Thinking,'” *Citylab* (Atlantic Monthly blog), 9 September 2014, <https://www.citylab.com/life/2014/09/smartphones-and-the-uncertain-future-of-spatial-thinking/379796/>

¹⁰⁸ Quoted in Tim Wallace, Derek Watkins, and John Schwartz, “A Map of Every Building in America,” *The New York Times*, 12 October 2018 (special insert to the Sunday Times, with online interactive at <https://www.nytimes.com/interactive/2018/10/12/us/map-of-every-building-in-the-united-states.html>).

Small navigational displays for the average driver replicates a capability available in military cockpits for decades and there have been various studies on how to optimize displays for tactical situational awareness.¹⁰⁹ The trend away from paper maps is moving from the tactical level to a broader scope: in addition to a tracking display, pilots increasingly rely on “digital kneeboards” for planning and in-flight reference, and digital charts are taking over the chart houses of navy and commercial ships alike. Some military officers have started to highlight issues with about spatial deskilling with digital tools. Screens limit the size and resolution of the map display and maintaining the interface of many sensors, processors, databases, and displays taxes the information technology support required to keep good maps available. The US surface fleet no longer requires its ships to maintain paper charts and relies heavily on the digital Voyage Management System that allows the fusing of navigational information from multiple sources and, in theory, can be updated more readily than a paper chart. Managing this sophisticated system to preserve, or ideally to enhance, situational awareness requires specialized training at the Surface Warfare Officer School.¹¹⁰ The Royal Navy uses a simpler system aboard its warships, a military version of the commercial Electronic Chart Display and Information System, with digitized paper charts that cannot be manipulated and has lower hardware requirements than US systems.¹¹¹ Anecdotally, some pilots have begun to express concerns about the proliferation

¹⁰⁹ Maura C Lohrenz, Michael E Trenchard and Melissa R Beck, “Clearing Up the Clutter,” *Defence Management Journal*, 2008. Maura C. Lohrenz, et al., “Optimizing Cockpit Moving-Map Displays for Enhanced Situational Awareness,” <https://apps.dtic.mil/dtic/tr/fulltext/u2/a508998.pdf>

¹¹⁰ Edward Lundquist, “Surface Warfare Officers School Employing New Technology and Training Methods,” Defense Media Network, 22 August 2018, <https://www.defensemедianetwork.com/stories/surface-warfare-officers-school-employing-new-technology-training-methods/>

¹¹¹ Martek Marine, Ltd. “About ECDIS,” http://www.ecdis-info.com/about_ecdis.html. An official inquiry into the 2010 grounding of the HMS Astute noted that the digital WECDIS system was not installed aboard the submarine and found that paper chart procedures were a contributing factor in the incident. See United Kingdom Ministry of Defence, “Service Inquiry: grounding of HMS Astute, Isle of Skye,” 1 January 2011, <https://www.gov.uk/government/publications/service-inquiry-report-into-the-grounding-of-hms-astute-on-22-october-2010>.

of visual aids in the cockpit hurting flying skills.¹¹² One study of pilot skill degradation did find that certain basic skills were declining through reliance on advanced instruments and that pilots consistently over-estimated their level of skill in the event of losing advanced systems.¹¹³ Among ground force commanders, as well, frustration is growing with the proliferation of digital tools that seek to enhance situational awareness over legacy systems but may produce the opposite effect. One US Army officer has authored multiple thoughtful critiques of digital Army systems, particularly Command Post of the Future, because their support requirements make them not field expedient, they can introduce as much noise as signal into a geographic display, and they are less effective than analog alternatives for conveying spatial information across echelons.¹¹⁴

Navigation and spatial cognition are certainly not the only skills and knowledge evolving in the smartphone age. Returning briefly to the parallels between the national security enterprise and the media, journalists have also had to adapt to the proliferation of devices displaying the news and the explosion in content created by the internet and ubiquitous networked camera phones. Journalists and editors have adapted stories and their supporting media to fit the small screens on which the majority of Americans get their news.¹¹⁵

Navigation studies provide important insight into how technology is changing individual spatial cognition, but Americans are using more geographic information than ever, often in more

¹¹² John P. Young, Richard O. Fanjoy, and Michael W. Suckow, "Impact of Glass Cockpit Experience on Manual Flight Skills," *Journal of Aviation / Aerospace Education and Research* 15:2 (Winter 2006). John Zimmerman, "The Truth About the iPad," *Air Facts* blog, <https://airfactsjournal.com/2011/09/johns-blog-the-truth-about-the-ipad/>. Ron Rapp, "Teaching Flight Planning: Digital vs. Paper," *The House of Rapp* blog, <http://www.rapp.org/archives/2011/06/flight-planning/>.

¹¹³ Michael W. Gillen, "Degradation of Pilot Skill," Master's Thesis, University of North Dakota, 2008.

¹¹⁴ John Bolton, "Modifying Situational Awareness: Perfect Knowledge and Precision Are Fantasy," *Small Wars Journal*, 10 June 2018, <https://smallwarsjournal.com/index.php/jrnl/art/modifying-situational-awareness-perfect-knowledge-and-precision-are-fantasy>. John Bolton, "Overkill: Army Mission Command Systems Inhibit Mission Command," *Small Wars Journal*, 29 August 2017, <https://smallwarsjournal.com/index.php/jrnl/art/overkill-army-mission-command-systems-inhibit-mission-command>.

¹¹⁵ "How the Phone Changes the News," *WIRED*, March 2018, 26.

sophisticated ways than just turn-by-turn navigation. GIS has become one of the most critical tools in a variety of fields across the physical sciences, social science, and in public policy. Every trip guided by GPS navigation takes place in a transportation system that is maintained, expanded and altered by detailed geospatial considerations and heated policy debate. Mark Monmonier dedicates a chapter of *How to Lie with Maps* to consider case studies in using (and abusing) compelling maps to win an argument in front of a local zoning board or appeal a property assessment.¹¹⁶ The power and potential pitfalls of cartography in urban and regional planning are domestic and local examples with clear parallels to policy at the national and international levels.

Product and External Output

Brain researchers have not yet subjected a population of American national security professionals to structural magnetic resonance imaging (MRI) scans to determine how their spatial reasoning compares to that of London taxi drivers.¹¹⁷ As much as we lack data on the inner brain function of American national security professionals, there is also little data on how exactly government officials employ the vast amounts of geographic data and finished cartographic products already created by the US government. It is not clear what internal studies or surveys the government conducts on the use and effectiveness of geographic support to decision makers, and such research might well remain classified by the basic nature of how the information was collected, analyzed and delivered.

However, there is a body of observable output from the national security enterprise in the public record that can be analyzed in the same way Monmonier studied the media business.

¹¹⁶ Monmonier, *How to Lie with Maps*, Chapter 6.

¹¹⁷ Maguire, et. al., op. cit.

Public strategy documents, congressional testimony, and some declassified products offer a limited lens on the frequency and quality of cartography in the discourse on issues of defense and foreign policy. Thinking in space is not just about support to decision making and the decision itself, but also the effective communication of the implementation of a given decision. Public documents help explain a national security issue to the public, directly or through their representatives in Congress, but also guide the execution of policy at lower echelons of the government. Geographic communication is an available tool for such efforts and the extent to which officials employ cartography and visualization to explain a decision is relevant, and potentially a meaningful proxy, to how much “thinking in space” went into that decision.

Neither the 2017 *National Security Strategy* (NSS) nor the 2018 *National Defense Strategy* (NDS) includes any maps.¹¹⁸ Similarly lacking any maps are the NDS critique by the Congressionally-mandated Commission on the National Defense Strategy, the 2018 *Nuclear Posture Review*, the Navy’s 2018 *Design for Maintaining Maritime Superiority* (version 2.0), and the *DOD 2017 Posture Statement*, although this set of documents does include photographs and charts and evidently had the aid of professional graphic designers. Despite a desire to explain strategy on a global scale, these documents use maps with less frequency than *The Economist*. By contrast, the annual report to Congress on “Military and Security Developments Involving the People’s Republic of China,” mandated since 2000, includes fourteen maps in its 2018 edition, including a diverse set of scales and projections.¹¹⁹ Although released by OSD, this report is fundamentally an intelligence product and is largely compiled by DIA, which in early 2019

¹¹⁸ Office of the Secretary of Defense, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: Office of the Secretary of Defense, January 2018).

¹¹⁹ Office of the Secretary of Defense, *Annual Report to Congress: Military and Security Developments Involving the People’s Republic of China*, 16 August 2018 <https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-CHINA-MILITARY-POWER-REPORT.PDF>

released its own “glossy” unclassified product on the Chinese military with twelve maps and many charts and diagrams.¹²⁰ Similarly, DOD’s 2019 *Missile Defense Review* includes two small but informative maps, both produced by the intelligence community, and a few small locator maps.¹²¹

The lack of maps in final publications does not mean that cartography and spatial thinking played no role in their development, presentation and implementation. Those who developed the 2018 NDS, for example, consulted maps while considering new operating concepts, testing these concepts in war games, and briefing key NDS messages to those charged with implementing it.¹²² However, these cartographic efforts were largely ad hoc and incidental to the process of developing and implementing strategy. The review above suggests that at multiple levels—whether considering grand strategy, military capability, national cartographic consciousness, or individual spatial cognition—the exclusion of geographic content misses a valuable tool. That some parts of the government employ geography in their public messaging and others do not could reflect deliberate choices, like those of certain newspaper editors, about the most appropriate or most effective ways to make an argument. More likely, however, is that various parts of the government differ in their employment of geography less because of deliberate choices than because of uneven distribution of resources and established institutional processes.

¹²⁰ Defense Intelligence Agency, *China Military Power: Modernizing a Force to Fight and Win* (DIA-02-1706-085), January 2019, http://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf

¹²¹ Department of Defense, *Missile Defense Review*, 17 January 2019, <https://www.defense.gov/Experience/2019-Missile-Defense-Review/>.

¹²² Personal experience of the author in 2017 and correspondence with principal members of the NDS drafting team in 2019.

Structure and Process of Employing Geography in National Security Institutions

The structure of the US national security enterprise lends some insight into how the component organizations and agencies employ geographic information to support the spatial thinking of policy makers. Geographic expertise and resources are scattered widely and inconsistently across the national security enterprise, but many organizations have some sort of department that produces cartographic or geospatial products, often in conjunction with other graphic design services. Among others, producers of geographic content relevant to national security include:

- The National Geospatial-Intelligence Agency
- Central Intelligence Agency, Cartography Center
- Defense Intelligence Agency
- Office of Naval Intelligence¹²³
- National Air and Space Intelligence Center¹²⁴
- Department of State, Bureau of Intelligence and Research, Office of the Geographer and Global Issues¹²⁵
- United States Agency for International Development, GeoCenter¹²⁶
- National Oceanic and Atmospheric Administration
- Congressional Research Service, Knowledge Services Group¹²⁷
- United States Geological Survey
- Library of Congress, Geography and Map Division
- Government Accountability Office¹²⁸

¹²³ The bulk of ONI's work, like any other IC component, is classified, but its public documents reveal a rudimentary cartography capability based on the inclusion of multiple original maps (and an online animated geospatial product) for its 2015 publication, "The PLA Navy: New Capabilities and Missions for the 21st Century," <https://www.oni.navy.mil/Intelligence-Community/China/>.

¹²⁴ There is less public information on NASIC than the other service intelligence centers, but the NASIC web site does list a "Geospatial and Signatures Intelligence Group" (see <https://www.nasic.af.mil/About-Us/>) and NASIC's graphics design capability was evident in the 2019 product, *Competing in Space*. See <https://www.nasic.af.mil/News/Article-Display/Article/1733201/usaf-nasic-releases-unclassified-competing-in-space-assessment/>. Accessed 24 January 2019

¹²⁵ Lowry Taylor, "Map Quest: Office of the Geographer Makes Information Visual," *State Magazine*, March 2009, 30-33. See also <https://www.state.gov/s/inr/owb/index.htm>.

¹²⁶ US Agency for International Development, "GeoCenter," <http://geocenter.digitaldevelopment.org/>, accessed 19 January 2019.

¹²⁷ Congressional Research Service, "Knowledge Services Group," <https://www.loc.gov/crsinfo/research/div-ksg.html>, accessed 15 December 2018.

¹²⁸ GAO publishes important analytic reports but is inconsistent in use of cartography. GAO reports have included both original maps and content from other government agencies and GAO does not appear to have a specific

Notably missing from this list of producers are the National Security Council, the Office of the Secretary of Defense, and the Joint Staff. These organizations are among the most influential in the interagency process, indeed the NSC is its central coordinator, but they lack organic support tailored to geography and cartography. Policymakers in these organizations may be avid consumers of geographic product and certainly do not lack support: all of them have dedicated support through the Intelligence Community (IC). However, allocating this capability almost exclusively to the IC has important implications. It is the IC's fundamental role to support senior decision making, and its extensive resources and expertise equip it extremely well to help decision makers think in space. However, the IC by nature and by design lives primarily in a classified domain, which can bring sensitive information into a geospatial context (i.e. GEOINT), but security can also hinder the ability to employ the full range of software and data available. A more subtle challenge arises from the relationship between the IC and policymakers, in which intelligence should seek policy relevance but avoid policy prescription. High standards of security and objective independence from policy are vital IC principles, but they can also serve to keep the best maps and most compelling geographic communications out of the hands of decision makers.

In parallel to the “academic war over geography” discussed earlier, the government, with some exceptions, has generally treated geography and cartography as a service to be provided, not core business. That is, cartography is a support function assigned to technical specialists, rather than focus areas for generalists or more senior officials. This has been particularly true in the military, which has considered mapmaking an enlisted function and not a skill set needed in

group assigned to cartography, but it does hire specialists in visual communications. See <https://www.gao.gov/about/careers/career-paths/>.

the officer corps. Further, the military has diminished even the enlisted focus on cartography through the elimination of certain specialties or their merger into other disciplines. The US Navy had enlisted Cartographer and Topographic Draftsman ratings in the 1940s, which were merged with the Draftsman rating, and then folded into the Mass Communications Specialist rating, primarily involved with photography and supporting public affairs mission.¹²⁹ Creation of graphic displays and maps are now listed as one of many tasks assigned to the Navy's Intelligence Specialist rating.¹³⁰ The Army currently offers two related enlisted military occupational specialties (MOS): "geospatial engineer" and "geospatial imagery analyst."¹³¹

In keeping with the increasing quantity and sophistication of geospatial data, government organizations have evolved from a focus on cartography into GEOINT. Service-based mapping centers became the Defense Mapping Agency, then the National Imagery and Mapping Agency, and now the National Geospatial-Intelligence Agency (NGA). As the primary producer of geographic information for the national security enterprise, NGA has seen steady growth in its mission and the demand for its products and employs some 14,500 people, mostly at its headquarters in Springfield, Virginia.¹³² In addition to its classified work with imagery and tailored geospatial products as a key component of the intelligence community, NGA is still responsible for the production of detailed topographic products and nautical charts for the entire

¹²⁹ US Navy Personnel Command, "Enlisted Community Management Branch," <https://www.public.navy.mil/bupers-npc/enlisted/community/Pages/default.aspx>.

¹³⁰ Ibid.

¹³¹ US Army, "Careers and Jobs: Geospatial Engineer (12Y)" <https://www.goarmy.com/careers-and-jobs/browse-career-and-job-categories/construction-engineering/geospatial-engineer.html>. United States Army, "Careers and Jobs: Geospatial Intelligence Imagery Analyst (35G)" <https://www.goarmy.com/careers-and-jobs/browse-career-and-job-categories/intelligence-and-combat-support/geospatial-intelligence-imagery-analyst.html>

¹³² National Geospatial-Intelligence Agency, "About NGA," <https://www.nga.mil/About/Pages/Default.aspx>. Accessed 18 January 2019.

globe, although map distribution is the responsibility of various government agencies.¹³³ Print copies of large format maps, such as NGA-produced Global Navigation Charts and Operational Navigation Charts are distributed through the Defense Logistics Agency, at least to DOD-subordinate parts of the national security enterprise.¹³⁴ However, the increasing trend for supporting government agencies has been for digital distribution and “print on demand” solutions to provide easier updates and eliminate wasteful stockpiles.

A subtle difference is apparent in the different treatment of geography at NGA and the Central Intelligence Agency. NGA’s doctrinal definition indicates that GEOINT “consists of imagery, imagery intelligence, and geospatial information,” emphasizing imagery and data over cartography: mapping is one subtype of the products included in “geospatial information.”¹³⁵ By contrast, CIA’s Cartography Center, which was first established by Arthur Robinson and has a far narrower mission, has emphasized cartography as communication: “to present the information visually in creative and effective ways for maximum understanding.”¹³⁶

One of the greatest constraints on presenting visual information in the contemporary national security enterprise is the 8.5 by 11-inch sheets of standard letter-size paper that make up briefing books. Cartographers have long published maps in a wide variety of shapes and sizes, but the modern professional environment allows any computer user to edit, publish and share a

¹³³National Geospatial-Intelligence Agency, “Products and Services,” <https://www.nga.mil/ProductsServices/Pages/PublicProducts.aspx>

¹³⁴ Defense Logistics Agency, “Map Catalog,”

<http://www.dla.mil/HQ/InformationOperations/Offers/Products/LogisticsApplications/MapCatalog.aspx>

¹³⁵ National System for Geospatial Intelligence, “Publication 1.0: GEOINT Basic Doctrine,” April 2018. Available at <https://www.nga.mil/ProductsServices/Pages/GEOINT-Basic-Doctrine-Publication.aspx>. Accessed 15 December 2018.

¹³⁶ Central Intelligence Agency, “The Mapmaker’s Craft: A History of Cartography at CIA,” <https://www.cia.gov/news-information/featured-story-archive/2016-featured-story-archive/mapmakers-craft.html>. Accessed 20 December 2018.

remarkable array of content, provided they remain within the parameters of what their recipients can view, print, or display. Amateur and professional cartographers alike must struggle with the tradeoff of creating the most compelling and accurate product possible while recognizing that it probably has to be effective in black and white and use the “portrait” layout to fit in a larger text document. The professional cartographer would no doubt want to produce a large format map, printed on a plotter, or even better an offset press, but this takes time and arrangements for special delivery of the final product. It is increasingly likely that the intended audience will at least have access to a quality color printer and is willing to include a map in “landscape” layout when appropriate. If one is truly lucky, the target customer’s printers, briefing books, and staff process will permit the use of 11 by 17 inch “tabloid” sheets: not quite a wall map, but twice the content of the standard sheet.

One of the flagship briefing books of US national security that highlights this issue is the President’s Daily Brief (PDB), which is delivered in a three-ring binder with letter-sized sheets. However, the PDB has taken some steps to follow broader digital trends with the first delivery of the President’s Daily Brief (PDB) to President Obama on an iPad in 2012.¹³⁷ In theory, the digital format would allow interactive content and panning or scrolling through a map that is larger than the screen size. However, the “narrowing” of perspective on mobile devices discussed earlier suggests there is also a danger of a digitally-delivered cartographic product contributing to spatial cognitive deskilling. It remains early in the history of studying how digital devices shape spatial cognition. The lag in new technologies assimilating into venues like the PDB suggests that the national security enterprise has much to learn in this area. Further, the

¹³⁷ Colin Clark, “President Obama Wants Smartphones, Tablets To Improve Intel Monitoring: Sez Head of White House Communications Agency,” *Breaking Defense*, 25 July 2012, <https://breakingdefense.com/2012/07/president-obama-wants-smartphones-tablets-to-improve-intel-moni/>

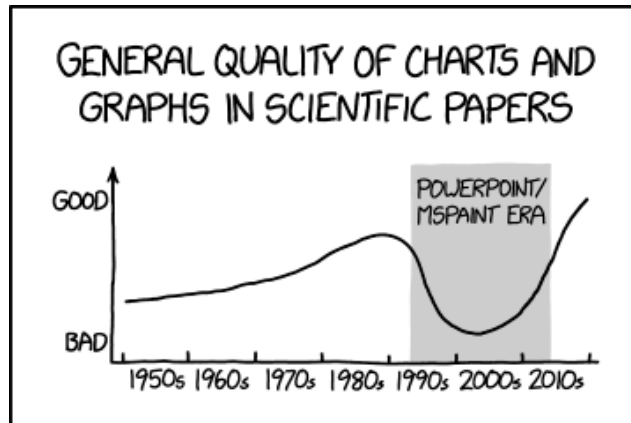
nature of the customer can overrule a technological trend: the iPad presentation of the PDB has presumably stopped during the Trump administration, which has reportedly taken a different approach to intelligence briefings.¹³⁸

The US military's primary means of decision support has long been "slideware" in support of briefings. What was once a stack of transparencies for an overhead projector or "Vugraphs," has now become the ubiquitous "deck" of slides in Microsoft PowerPoint. Slides often serve as a medium of communicating information even without the accompaniment of a presenter to deliver "the voice track." The dangers of the current addiction to Microsoft PowerPoint as antithetical to critical thinking are well established in formal critiques.¹³⁹ The self-conscious absurdity of PowerPoint has led to revealing cultural themes such as the "Creed of the PowerPoint Ranger," and the translation of the Gettysburg Address into PowerPoint slides.¹⁴⁰ For all of its many downsides, PowerPoint does have its advantages and these can be attractive when it comes to the ease of displaying maps and other geospatial information. PowerPoint provides a common format, is available on virtually every government computer, and users can share files easily by email. PowerPoint allows the easy import and annotation of images such as base maps, empowering any user to attempt thematic cartography by layering symbols, but PowerPoint is very much a double-edged sword.

¹³⁸Carol D. Leonnig, Shane Harris, and Greg Jaffe, "Breaking with Tradition, Trump Skips president's Written Intelligence Report and Relies on Oral Briefings," *The Washington Post*, 9 February 2018

¹³⁹T.X. Hammes, "Dumb-dumb Bullets," *Armed Forces Journal*, 1 July 2009. Spencer Ackerman, "Colonel Kicked out of Afghanistan for Anti-Powerpoint Rant," *WIRED*, 27 August 2010. <https://www.wired.com/2010/08/anti-powerpoint-rant-gets-colonel-kicked-out-of-afghanistan>. Edward R. Tufte, 1942. *The Cognitive Style of PowerPoint: Pitching Out Corrupts Within*. Second ed. Cheshire, Conn: Graphics Press, 2006.

¹⁴⁰"PowerPoint Ranger: Where the Battle Staff Commissersates" <https://powerpointranger.com/>.



Graphing quality of maps in US government presentations and documents might exhibit a similar curve, although the “PowerPoint Era” continues. Courtesy of XKCD.com¹⁴¹

The very ease of manipulating images and adding new symbols can obscure or misuse the underlying geographic data. PowerPoint itself, and the broader system of storing, transmitting, and displaying its files, also present important limitations. PowerPoint locks in a specific aspect ratio, limiting the options available to the amateur cartographer. Displaying a map of an area that is not a 16:9 rectangle presents challenges: it is perfect for a map of Colorado, but not for a country like Vietnam or Chile, with a major north-south extent (assuming one adheres to the arbitrary convention of orienting the map with north “up”). As any staff officer knows, PowerPoint file sizes grow quickly with images, especially high-resolution maps, and run the risk of exceeding the limits on permissible email attachments (often 15 or 25 megabytes). The incentive, or even imperative, is thus to reduce the resolution of embedded images: to deliberately reduce the quality of maps.

¹⁴¹ “Scientific Paper Graph Quality,” <https://xkcd.com/1945>. Reproduced under Creative Commons Attribution Non-Commercial 2.5 License.

Part V—Thinking in Space About Coming Challenges

Cyberspace. A consensual hallucination experienced daily by billions... A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity.

-William Gibson¹⁴²

战争时空观发生深刻变化... 战争空间急剧膨胀... 太空和网络成为军事竞争新的制高点

The view of time and space in war has undergone profound changes... the battlespace is expanding rapidly... Space and cyberspace have become new commanding heights of military competition.

-Major General Xiao Tianliang¹⁴³

Geographic context is an enduring aspect of decision making from the individual to the level of grand strategy. When a nation's leaders fail to think in space, or don't receive the support to put critical issues into a spatial context, suboptimal national security decisions result. Geography endures, even as the data on the map grows richer and changes rapidly, and the imperative for American leaders and national security professionals to think in space is growing. Indeed, the contemporary environment and threats looming on the horizon present new challenges, and a few opportunities, for thinking in space. The American national security enterprise must regain lost skills, but those charged with thinking in space in defense of the nation must also gain a new and more sophisticated understanding of the geographic information they consume, the limits of their own expertise in using it, and ways to cope with ambiguity.

¹⁴² William Gibson, *Neuromancer*, New York: Berkley Publishing (Ace Books Paperback Edition), 1984, 51.

¹⁴³ Xiao Tianliang [肖天亮], "Operational Cloud' Promotes Joint Operations to a Higher Level ["作战云"把联合作战推向更高层次]," People's Liberation Army Daily [解放军报], 5 January 2016.

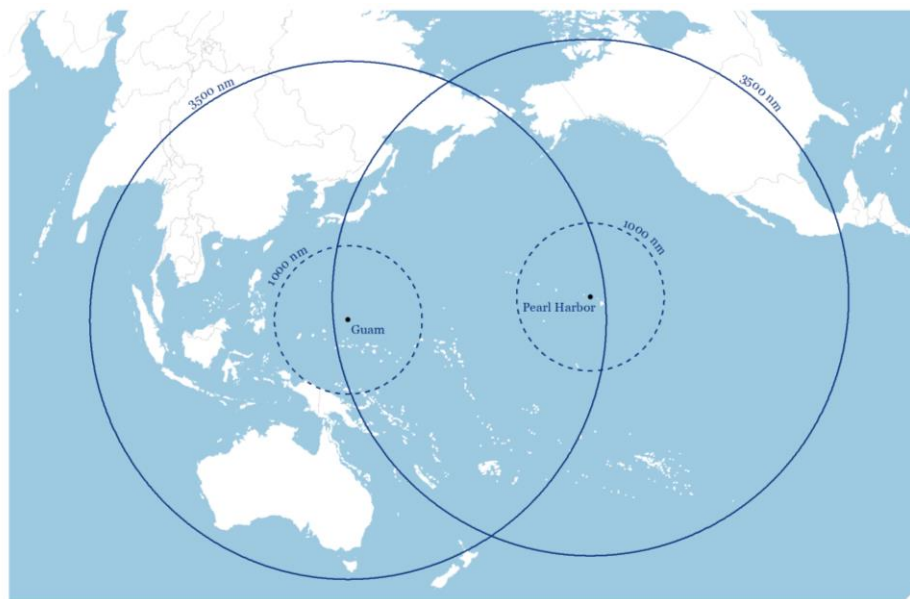
Great Power Competition

Major geopolitical shifts, such as the end of the Cold War, make the preceding generation of maps easy to identify in their obsolescence. The return of great power competition will bring back to the fore maps of a vintage not seen since before the fall of the Berlin Wall—global maps seeking to alarm, assure, or analyze global influence. Although it included no maps, the summary of the 2018 *National Defense Strategy* uses this kind of spatial language at several points to argue for a reappraisal of the nation’s strategic position. The NDS argues that “every domain is contested—air, land, sea, space, and cyberspace,” that battles are conducted “at increasing speed and reach,” and that “the homeland is no longer a sanctuary.”¹⁴⁴ By naming the leading competitors or pacing threats, the language of the NDS allows more geographic clarity than similar documents from the past that talked generically about capabilities or regions but did not specifically name countries. Stating explicitly that China, followed by Russia, should be the strategic focus of the US military, the NDS puts a geographic frame on planning discussions.

Chinese military modernization re-introduces old lessons about the tremendous extent of the Pacific theater. Preparing for a high-end conflict that emphasizes the air and maritime domain might require re-learning the cartography of the air-age globalism that took hold in the 1940s. If there is a map genre that captures the current strategic conversation on military competition with China, it is probably a map of overlapping Chinese missile range rings that has become increasingly common in the OSD annual reports to Congress on the People’s Liberation Army (PLA) and various products by defense think tanks like the Center for Strategic and

¹⁴⁴ *National Defense Strategy 2018*, 3.

Budgetary Assessments (CSBA).¹⁴⁵ Invoking the “tyranny of distance” has become a standard talking point for officials highlighting the difficulties of rapid response and the importance of forward deployment and foreign partnerships in the Pacific. If China is the primary concern for force planners, they must have better mental maps of the Pacific and be prepared to make effective geographic cases to the national leadership, the American people, and key allies. Alfred Thayer Mahan in 1898, just after the Spanish-American War, wrote that the 3,500 nautical miles from Hawaii to Guam defined the “standard distance” at the heart of naval planning for the United States. Today that same 3,500 nm distance is a defining reality of the Pacific theater, but few American strategists fully appreciate the implications of that distance. Meaningful preparation for the challenges the United States faces in the Pacific will require a better intuitive understanding of the geography of the region and more sophisticated analysis of the spatial implications of the theater.



Mahan's Yardstick: 3,500 nautical miles in the Pacific. Map by author, 2018.

¹⁴⁵ Bryan Clark, Adam Lemon, Peter Haynes, Kyle Libby, and Gillian Evans, “Regaining the High Ground at Sea,” Center for Strategic and Budgetary Assessments, 2018. <https://csbaonline.org/research/publications/regaining-the-high-ground-at-sea-transforming-the-u.s.-navys-carrier-air-wi>.

In Europe, too, US strategists are re-learning old lessons as they return to careful study of the map of Eastern Europe. The geography of the European theater is very different than the Pacific, but there are similar asymmetries in US efforts to defend forward against potential Russian aggression against its immediate periphery. Efforts to depict military capability in both theaters produce similar maps of layered range rings that highlight capabilities among both Russian and Chinese forces to conduct salvo attacks with long-range precision weapons.¹⁴⁶ Countering this threat is an explicit modernization goal of the 2018 NDS, which calls for US forces to “be able to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms.”¹⁴⁷ Considering the possibility of conflict in Eastern Europe highlights the importance of a globally urbanizing society. Many scholars have pointed out that future conflict, even between great powers, is likely to be more intensely urban. There is an appealing simplicity to World War II maps of broad lines sweeping across an ocean or continent that is less compatible with recent urban conflict. Future land conflict will likely have more to learn from recent efforts to depict and analyze the complex human geography of recent conflict in Afghanistan, Iraq, Syria, and elsewhere. The recent Russian employment of gray zone tactics, with deniable proxy forces and sophisticated disinformation campaigns makes these conflicts much more difficult to interpret spatially.

Much recent commentary has focused on the development of hypersonic weapons by the world’s leading militaries: while hypersonics pose major operational challenges, it is debatable whether they constitute a “game-changer” at the strategic level. The influence of hypersonic weapons on the spatial cognition of policymakers remains to be seen. While the US homeland

¹⁴⁶ *Ibid.*

¹⁴⁷ *National Defense Strategy 2018*, 6.

has long faced a nuclear threat from peer rivals like China and Russia, hypersonics make a conventional threat to US territory more credible than it has been in many decades. American officials could respond like European leaders of 1914 in failing to comprehend the speed and simultaneity of military movements, or there could be a collective envisioning of distant threats reaching out from the other side of the globe as depicted by de Seversky.

Spatial Visualization of New Domains

Space and cyberspace, and to a lesser extent the undersea domain, have become essential warfighting domains whose physical infrastructure is difficult to visualize spatially and whose physical effects are difficult to match with the geographic location where they bear. A leading Chinese military strategist has emphasized the criticality of outer space and cyberspace as warfighting domains alongside land, air, and sea, calling space and cyber the new “commanding heights” of military capability that could “determine the outcome of future wars.”¹⁴⁸ Many American and Chinese scholars have discussed space and cyberspace as part of a global commons and sought to adapt strategic concepts and regimes developed for both military and civilian use of the high seas. However, there has not yet been a 21st century Alfred Thayer Mahan or Julian Corbett to articulate (in spatial terms) a strategic concept for linking national strategy to the means to protect, contest, or control these new domains. Making smart investments to prepare for future conflict and compete with peer adversaries in these domains requires the commitment of a host of political, technological, and financial resources. These weighty decisions on national security require critical analysis of complex data. Thinking in space must play a part in these decisions, but visualization is difficult with these domains.

¹⁴⁸ Xiao Tianliang, *op. cit.*

Outer Space

The importance of space as a warfighting domain has grown steadily with more nations establishing a militarily valuable presence in space and growing dependence of leading nations like the United States on the space-based portion of a national C4ISR architecture. Further, the proliferation of capabilities to disrupt and destroy space-based systems, and the prospect of weapons on orbit, requires the translation or adaptation of many military and security concepts from the traditional land, air, and sea domains to outer space. Preparing for, deterring, and executing operations in the space domain require decision makers to perform some level of visualization. The space domain is a bad area for our thinking in space to prove wanting.

Outer space may not be terrestrial, but it remains fundamentally spatial in many of the ways in which we analyze and visualize traditional geographic problems. Despite parallels between space and the high seas as a commons, space has been more closely affiliated with the air domain than the maritime domain, both spatially and bureaucratically. The distances and speeds involved are much greater, but the national security challenges of space still relate to physical objects moving in ways that we can comprehend in reference to known places on the ground. The coordinates that describe the three-dimensional position of a satellite are no different than those of an airplane except that they change much more rapidly, the atmosphere is not a factor, and the distances are so great that the speed of light becomes a more important factor in communication. The legal regime governing movement through and the use of space is also less developed and more permissive than the body of law that governs territory, airspace, and the seas. According to the 1967 Outer Space Treaty, space is free to the use of all and no state may claim sovereignty in space or on any celestial body, but the precise vertical limit of

territorial airspace remains unsettled in international law.¹⁴⁹ The conventional spatial distinction between air and space is the “Karman Line” at 100,000 meters above sea level, although scientific definitions of the Earth’s atmosphere vary and the US government awards the Astronaut Badge (wings) for flights above 80,000 meters.

American policy makers seeking to accurately envision the spatial context of objects above the Karman Line probably fare little better than American high school students trying to locate Iraq on a world map. Supporting decision makers in their analysis of this domain will require a mix of traditional and unconventional geospatial products. A recent example of a traditional product is NASIC’s 2019 publication *Competing in Space*, which is notable for continuing a trend of US military intelligence agencies releasing “glossy” products to the public (DIA and ONI examples were noted above) with a relatively high proportion of visual and geographic content. *Competing in Space* does not include any maps *per se*, but it does better than most public DOD documents by employing multiple diagrams that seek to aid visualization of different orbits and their uses.¹⁵⁰ Similar visualizations, both spatially accurate and abstract, have started to appear in traditional media outlets, such as a December 2018 feature in *The Economist* that included both a diagram of data paths between satellites and ground stations, as well a visual explanation of the difference between low-earth and geostationary orbits.¹⁵¹ Aside from these journalistic efforts (and NASIC’s product is essentially journalistic in substance) there is not a widely-available body of reference material for visually studying earth orbits: outside of science

¹⁴⁹ United Nations, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, http://disarmament.un.org/treaties/t/outer_space/text. Dean N. Reinhardt, “The Vertical Limit of State Sovereignty,” *Journal of Air Law and Commerce* 72:1 (2007) <https://scholar.smu.edu/jalc/vol72/iss1/4>

¹⁵⁰ NASIC, *Competing in Space*.

¹⁵¹ “A Worldwide Web in Space,” *The Economist*, 8 December 2018, 22.

education posters, there are few wall charts or reference atlases of various satellite constellations.¹⁵²

While many details of different nations' space systems are necessarily classified, there is nothing to prevent the production of unclassified references for visualizing the domain. But such charts (i.e. unclassified base maps of space) do not yet adorn the walls of conference rooms where policy makers discuss investment in this vital domain. In part, the nature of orbitology argues against a static or "flat" reference product on paper, and in favor of animation and interactive displays. Although creating, transporting and displaying a digital interactive product has major practical limitations, as discussed above, they are almost certainly more accurate and effective than static products, if only because objects in space are, indeed, moving very fast all the time.¹⁵³ One example is a 2015 NASA animation showing the movement of its constellation of earth observation satellites in low earth orbit.¹⁵⁴ A young American student in 2018 created a remarkable online visualization, "Stuff in Space," of every object available in a public orbital catalog, that is beautiful in its complexity but difficult to interpret.¹⁵⁵ A worthy partner to this effort is a 2015 animation on the Quartz website that depicts the size, type, and orbit of every satellite in space with a simplicity not unlike a public transportation cartogram.¹⁵⁶ Like a subway

¹⁵² Diagrams like those in NASIC's product also appeared in newspapers in the 1980s during debate over the Strategic Defense Initiative. See, for example, "Star Wars: Scenario for Space Defense," *The Washington Post*, 18 March 1985, 6.

¹⁵³ NASA, "Catalog of Earth Satellite Orbits," 4 September 2009, <https://earthobservatory.nasa.gov/features/OrbitsCatalog>

¹⁵⁴ Marcus Woo, "Watch a Mesmerizing Animation of NASA Satellites," *WIRED*, 9 March 2015. "NASA Earth Observing Fleet," <https://www.youtube.com/watch?v=gF9UITYR5d0>

¹⁵⁵ "Stuff in Space," <http://stuffin.space>, accessed 7 February 2019. Fraser Cain, 9 April 2018 blog post on "Universe Today," <https://www.universetoday.com/138981/this-is-the-coolest-everything-thats-orbiting-the-earth-right-now/>.

¹⁵⁶ David Yanofsky and Tim Fernholz, "Every Active Satellite Orbiting Earth," <https://qz.com/296941/interactive-graphic-every-active-satellite-orbiting-earth/>.

map, this satellite animation sacrifices spatial precision for richness of detail on topological relationship.

Cyberspace

Cyberspace was not explored, developed and mapped in the same way as the physical earth, which introduces practical challenges to visualizing it and “cyberspatial” thinking. Cyberspace grows faster than it can be mapped and has not benefited from centuries of government-sponsored expeditions to publish ever-more complete maps of vast but finite terrain for the public. According to Adam Segal, physical and cyberspace are converging:

With internet-enabled cars, thermostats, and other devices by the thousands, there is in fact no separate cyberspace; the online world is increasingly physically present. “The Internet will disappear,” Google chairman Eric Schmidt said in January 2015, meaning that the online and offline worlds will merge to such a degree that we will no longer always be able to differentiate them.¹⁵⁷

Mapping cyberspace, whether to visualize the online world separately or to understand the growing overlap between physical and virtual domains, will become more important to national security decision makers. The earliest diagrams of the nodes of the ARPANET could fit on a single sheet of paper and were occasionally overlaid on a map of the continental United States, with jagged lines to show early satellite connections to Hawaii and the United Kingdom. In recent years, various means, some of them relying on illegal hacks, have generated maps of internet traffic and connected devices on a global scale.¹⁵⁸ A counterpart to the “Stuff in Space” website for cyberspace is “The Internet Map,” which uses the Google Maps engine to depict a

¹⁵⁷ Adam Segal, *The Hacked World Order: How Nations Fight, Trade, Maneuver, and Manipulate in the Digital Age*, New York: PublicAffairs, 2016, 38.

¹⁵⁸ Betsy Mason, “Beautiful, Intriguing, and Illegal Ways to Map the Internet,” *WIRED*, 10 June 2015, <https://www.wired.com/2015/06/mapping-the-internet/>.

galaxy of every site on the World Wide Web (as of 2011) and their links, with graduated and colored circles to show the location of the site's server and its volume of traffic.¹⁵⁹

Though the origins of the internet lie in a US Government project, the private sector dominates the management of cyberspace and the physical backbones that carries internet traffic. The private sector also plays roles in cyberspace that are monopolized by governments in other domains, such as intelligence collection. Adam Segal notes that discovering and responding to cyber attacks is increasingly done by private cybersecurity companies.¹⁶⁰ It is not surprising, then, that private companies own and manage the majority of key information for visualizing the internet. Ingrid Burrington wrote a field guide for New Yorkers trying to visualize the physical internet in her city because security restrictions and propriety business information prevents the creation of a comprehensive map of the maze of fiber optic cables that make up most of the telecommunications infrastructure in a modern city.¹⁶¹ There may be closely-guarded sophisticated visual representations of the internet, both logical and physical, that enable spatial thinking within government and technology firms, but the leading cartographers helping the public visualize the internet work for a private company, not a government agency or a society like National Geographic. TeleGeography, a Washington-based firm, has published high-quality maps of the physical internet, particularly the submarine cables that carry the overwhelming majority of internet traffic, since the 1990s.¹⁶² In interviews with TeleGeography researchers, Andrew Blum encountered a “small global fraternity that knows the geography of the internet”

¹⁵⁹ Ruslan Enikeev, “The Map of the Internet,” <https://internet-map.net/>, accessed 7 February 2019.

¹⁶⁰ Segal, 41.

¹⁶¹ Ingrid Burrington, *Networks of New York: An Illustrated Field Guide to Urban Internet Infrastructure*, Brooklyn: Melville House, 2016, 18.

¹⁶² TeleGeography, *Mapping Communication*, 2018. Electronic book available at <https://blog.telegeography.com/free-ebook-telecom-history-telegeography-map-portfolio>. Accessed 24 January 2019.

and has robust mental maps of the interaction between geography, the physical cables of the internet, and the movement of traffic through these “tubes.”¹⁶³ The expertise and cartographic product of a for-profit group like TeleGeography does not come cheap however: their visually-compelling “Global Internet Map” sells for \$250, and custom products to help a company visualize its physical internet footprint run from \$10,000 to \$20,000.¹⁶⁴

All of these visualization efforts are valuable and a variety of means will be needed to help senior officials develop rudimentary mental internet maps like those in the heads of the small fraternity Blum describes. As discussed earlier, the spatial expertise of the decision makers can only develop if the staff and advisers supporting them have the expertise themselves, as well as the tools to compile and present the data.

Undersea

The undersea domain has captured less attention in the popular press than space and cyber issues but many have argued that it is a sufficiently distinct and vital warfighting domain to merit separate discussion. Major General Xiao Tianliang, the Chinese strategist quoted earlier on the expanding battlespace, lists the undersea domain alongside space, cyber, near-space, the electromagnetic spectrum, and polar regions as parts of the global commons with key operational implications.¹⁶⁵ The civilian and military worlds alike rely heavily on seabed cables that provide the backbone of global communications. Undersea capabilities, as they relate to military operations in this country, are distinct in that they lie squarely among the US Navy’s responsibilities and do not generally confront challenges for bureaucratic ownership like

¹⁶³ Andrew Blum, *Tubes: A Journey to the Center of the Internet*, New York: HarperCollins, 2012, 33-34.

¹⁶⁴ TeleGeography, “Maps for Purchase,” <https://www.telegeography.com/telecom-maps/maps-for-purchase/index.html>. TeleGeography, “Custom Map Design,” <https://www.telegeography.com/telecom-maps/custom-map-design/index.html>. Both accessed 24 January 2019.

¹⁶⁵ Xiao Tianliang, *op. cit.*

cyberspace, of which every organizations claims a part, or outer space, which might soon have its own dedicated military service. Nevertheless, the undersea domain does challenge the geographic consciousness of national security leaders. A shortfall in thinking about undersea space is more of a lack of interest and imagination than a technical challenge. The basic bathymetry of the seafloor is reasonably well mapped for the purposes of general strategy, and many quality maps display the bathymetric contours of the world's oceans. However, it is possible, and even likely, that future challenges will require national security leaders to be more conversant in the shape and science of the undersea world. The US Navy's undersea warfighting capability is a tremendous advantage that will not go unchallenged and advances in deep sea science are creating new commercial opportunities on a much larger portion of the seabed. Those who develop and implement national strategy will have to become more spatially conversant in presenting and considering the strategic issues of the undersea domain.

Dealing with Ambiguity: Dangers of Dependence and Excessive Trust

As noted in the previous chapter, technology has made us heavy (even addicted) users of geographic information but has also changed the way we are programmed to consume it, arguably with a less critical eye and without context. The untimely shattering of expectations about the availability, quality, and accuracy of geographic information could produce slow/poor decisions at the strategic, operational, and tactical levels.

The changing way that geography supports deliberate analysis of long-term strategy is an important trend, but spatial thinking must also happen in crisis at the strategic level. A body of literature exists on the heuristics individuals, including national security leaders use to make rapid decisions, such as Daniel Kahneman's distinction between "System 1" and "System 2" mental operations. System 1 operations are quick and automatic, while System 2 operations

require focused attention and are vulnerable to distraction.¹⁶⁶ Kahneman includes chess as an example of System 1 thinking by a chess master, which is particularly true in time-limited games, although the average chess player requires both System 1 and System 2 thinking to contend with strategy and tactics in the face of an infinite number of possible games. Heuristics developed through expertise are essential and there are some valid parallels to the value of deep geographic expertise. A senior official with a deep, innate knowledge of a region can move on to more challenging questions, just as a chess master knows that a certain opening sequence will produce a certain kind of match and can think ahead to the kinds of positions and attacks likely to develop. The chess analogy has its limits in considering the geographic context of national security decisions because chess is a two-sided game of perfect information and all maps contain uncertainty and many of Monmonier's "lies." However, in national strategy, as in chess, useful and reliable heuristics do exist and can be acquired through sustained study and the development of expertise.

Where the chess analogy truly breaks down is that chess games do not include the loss of one player's ability to see the opposing pieces or concern that one's own pieces are no longer where they appear to be. There is a lack of research on what happens when a decision maker, conditioned to high accuracy and low ambiguity in the spatial information that aids their quick decisions, is suddenly denied that information or presented a deliberately deceptive spatial image. Naturally-occurring chaos in the geographic decision making environment is reason enough to build a set of cognitive tools for dealing with ambiguous geographic information. But deliberately false information will present a crucial challenge when deception is applied to the geographic inputs provided to decisionmakers. Sharp power and information warfare are on the

¹⁶⁶ Kahneman, *Thinking Fast and Slow*, 20-22.

rise and the United States has proven ill-prepared for dealing with the deception and disinformation campaigns at which an adversary like Russia excels. The erosion of objectivity has not yet impacted geographic information in the ways that other forms of media have suffered, but maps will not be excused from what a recent RAND study called “truth decay.”¹⁶⁷ Just as malign actors can exploit and exacerbate changes to the American media environment to sow confusion and disinformation, 21st century technology offers the potential for the distortion and proliferation of geographic disinformation in ways more effective and nefarious than Haushofer and the Nazi geopoliticians could have imagined.

In a tactical sense this can be traditional deception, but the threat of geospatial deception goes beyond traditional military techniques of false communications or visual decoys to confuse the intelligence and reconnaissance apparatus. Following the Gulf War, discussion of navigation warfare (NAVWAR) began to consider the operational impacts of protecting and attacking a combatant’s positioning, navigation, and timing (PNT) systems for effects on weapons guidance, command and control, and a variety of other operational functions.¹⁶⁸ The traditional military approach is to rely on “mission command” and delegate to a lower echelon. A warship in a GPS-denied environment can fall back on inertial navigation, dead-reckoning, and even celestial navigation to know where it is and follow commander’s intent to proceed with its mission. But little attention has been paid to the possibility of a systemic attack that, beyond rendering GPS inaccurate and crippling communications networks, fundamentally degrades or denies the ability of the national command authority to make geographically-informed decisions? Malcolm

¹⁶⁷ Jennifer Kavanagh and Michael D. Rich, *Truth Decay: An Initial Exploration of the Diminishing Role of Facts and Analysis in American Public Life*. Santa Monica, CA: RAND Corporation, 2018. https://www.rand.org/pubs/research_reports/RR2314.html.

¹⁶⁸ “Lockheed Martin Selected for U.S. Air Force Navigation Warfare Study,” *Business Wire*, 21 August 1996.

Gladwell describes the efforts of Paul Van Riper (aided by Gary Klein) in the 2002 Millennium Challenge exercise that highlighted how poorly US military commanders fare at processing a highly dynamic common operating picture (COP), particularly when a deceptive foe pollutes the COP with false contacts.¹⁶⁹ Gladwell and others have found that “less is more” when it comes to information in many crisis situations, a concept that parallels the spatial cognition and visualization theories of writers like Edward Tufte.¹⁷⁰ How operational commanders cope with ambiguity, geographic or otherwise, is a vital subject for ongoing study, but far less consideration has been given specifically to the geographic ambiguity confronted by strategic decision makers. It is increasingly easy to envision a conflict where the national command authority will have to issue new strategic guidance without knowing the true disposition of enemy and friendly forces or might have to act counter to a geographic picture it suspects of being deceptive.

Peacetime competition over whose map is true will get more severe in an era of sophisticated disinformation campaigns and ubiquitous high-quality tools. Drawing lines on a map to favor one nation’s interests over another is as old as map-making itself, and competing depictions of territorial boundaries aren’t going away. International disputes over where an incident took place are a staple of national security crises and different national capitals can present their own maps of illegal incursions across a line on a map. But a far more challenging possibility would be the introduction of “deep fakes” to mapping. Deep fakes create compelling visual and audio evidence of something entirely false thanks to machine learning that makes them “ever more realistic and increasingly resistant to detection... [with] rapid and widespread

¹⁶⁹ Malcom Gladwell, *Blink: The Power of Thinking Without Thinking*, New York: Little, Brown and Co.: 2005, 99-147

¹⁷⁰ Gladwell, 136.

diffusion.”¹⁷¹ A deep fake map would not just plot false data from a foreign actor, but might bear all the markings of a US government cartographer, accompanied by video evidence from a purportedly US government source, to tell a convincing geographic fairy tale. Recognizing innocent cartographic errors requires a basic level of geographic expertise and critical thinking but detecting and dispelling a deep fake cartographic myth might be nearly impossible.

The geographic information that supports and empowers national security decisions can be both part of the problem and part of the solution in future challenges. Many leaders have pointed to the need for improved critical thinking and rapid decision making in the conflict the nation will face in years to come. Gary Klein’s concept of “adaptive decision making” addresses decisions in “the world of shadows, the world of ambiguity.”¹⁷² Cartography has always been an art that manages the ambiguity of the geographic environment and, when used carefully and effectively, can serve as a powerful aid to spatial decisions even in an uncertain environment. However, to improve performance in these decisions, senior leaders in the US national security enterprise must seek to enhance their mental model used to think in space. As Klein puts it, they should strive to move from an “impoverished mental model” to a “rich mental model.”¹⁷³ A brief discussion of some preliminary possibilities for improving geographic mental models in the current US system follows in the next section.

¹⁷¹ Robert Chesney and Danielle Keats Citron, “Deep Fakes: A Looming Challenge for Privacy, Democracy, and National Security,” *107 California Law Review* (2019, Forthcoming). Available at SSRN: <https://ssrn.com/abstract=3213954>

¹⁷² Klein, 6

¹⁷³ Klein, 104.

Part VI—Opportunities to Realize Potential

It is just as important to study the proper and effective use of various forms of graphic presentation, as it is to study the values of different methods, treatments, grades, and forms of verbal presentation.

-William Morris Davis¹⁷⁴

In turning to practical solutions for addressing the issues, both large and small, that inhibit thinking in space in the US government, consider two fictional but highly plausible vignettes of geography at work in a 21st century bureaucracy.

Vignette #1: National Security Council, Working Level Interagency Meeting

In this notional scenario, NSC staff host various members of the interagency for a discussion in a conference room at the Eisenhower Executive Office Building. The room has no maps on the walls but is equipped with large computer monitors that can effectively display content with a set aspect ratio (i.e. PowerPoint slides), assuming that the participants had sufficient warning of the meeting and time to prepare and transmit the files to the NSC staff. The meeting would probably begin with an update from a representative of the Intelligence Community, who, if choosing to employ a visual aid like a map, could prepare slides, hand out copies of a product from a cartography shop, unfold a reference map on the table, or simply rely on a verbal presentation. In this notional scenario, the meeting is to discuss a natural disaster and there are no custom graphics available for the geography of the affected area. The IC representative grabbed a National Geographic map of the broader region on the way out of the office, and points out a couple locations on the table, but no other participants bring maps. After the meeting some of the interagency participants study the area on Google Maps with their smartphone on the way back to the office.

¹⁷⁴ Davis quoted in front matter of Arthur Robinson, *The Look of Maps: An Examination of Cartographic Design*, Madison: University of Wisconsin Press, 1952.

Vignette #2: Senior Briefing at a Geographic Combatant Command Headquarters.

In a second scenario, staff officers from the command's J2, J3, and J5 directorates collaborate on a slide deck, including a liberal number of maps they have pulled from the public internet, the NGA website, or a screen capture from a program like Google Earth. These diligent officers then annotate the map with symbology in PowerPoint without regard to the base map's projection or the original data. They then crop, resize, and reduce the resolution of the map to fit the restrictions of screen and file size. They have no training in cartography, no access to GIS software, and no specialists on staff to prepare compelling and accurate geographic products. After many rehearsals and much content-free "slideology," they email the PowerPoint file to a colleague in the room where the briefing will take place. As they walk from their cubicles to the conference room they might pass a historical photo of someone like Admiral Chester Nimitz pointing at a large wall map with a pointer while someone like President Franklin Roosevelt looks on attentively. The four-star who was supposed to take the briefing gets delayed and looks at the slides later, drawing her own conclusions about the meaning of the big red arrows. The deputy takes the brief in person and asks a question about the distance between two key airfields: no one in the room knows off the top of their head, the maps in the slides do not include a scale bar, and no one knows how much the base map's projection distorts distances.

Growing a National Security Workforce Equipped to Think in Space

The dedicated and patriotic professionals in the vignettes above are punching well below their weight when it comes to using geographic information. Any geographic communication, whether a reference map, a geospatial argument, or a complex digital data set, is a model and an abstraction. Geographic analogies can be powerful aids, but they carry the same risks of cognitive bias and shallow analysis as other simplifications, such as historical analogy. The shortcomings of historical analogy have been well studied by scholars like Robert Jervis, who warned of the "tyranny of the past upon the imagination," and the dangers awaiting those who

“do not examine a variety of analogies before selecting the one that they believe sheds light on their situation.”¹⁷⁵ Ernest May, whose advocacy of “thinking in time” provides key conceptual inspiration to this study, issued stern warnings in the 1970s about the dangers of misusing historical analogy and the tendency of national leaders to “use history badly.”¹⁷⁶ More recently, Paul Miller examined the flaws in US strategy in Afghanistan in terms of the improper employment of historical analogy.¹⁷⁷ However, the historian and Second World War veteran Michael Howard offered one of the most apt warnings about analogy, highlighting overlapping abstractions of history and cartography:

Military historians, more than any other, have to create order out of chaos; and the tidy accounts they give of battles, with generals imposing their will on the battlefield, with neat little blocks and arrows moving in a rational and orderly way, with the principles of war being meticulously illustrated, are an almost blasphemous travesty of the chaotic truth.¹⁷⁸

The same lesson applies to geography as to history: that the senior official or policy analyst should not rely on a single geographic perspective any more than one ought not depend on a single and imperfect historical analogy. Geography can be just as subjective as history and those who seek to more effectively think in space should seek out multiple perspectives in the maps they study and the mental maps they help create. For Harrison, a critical first step is to dispense with persistent conventions that inhibit a “flexible view of geography,” such as always placing north at the top of the map. Harrison argued that employing multiple projections was a simple means for improving the “geographical sense,” and noted that for all the Nazi obsession

¹⁷⁵ Robert Jervis, *Perception and Misperception in International Politics*, Princeton: Princeton University Press, 1976, 217-218, 281-282.

¹⁷⁶ Ernest May, *“Lessons” of the Past: The Use and Misuse of History in American Foreign Policy*, New York: Oxford University Press, 1973, xi.

¹⁷⁷ Paul Miller, “Graveyard of Analogies: The Use and Abuse of History for the War in Afghanistan,” *Journal of Strategic Studies*, 39:3, 446-476

¹⁷⁸ Michael Howard, “The Use and Abuse of Military History,” *Royal United Services Institution Journal* 107, Issue 625 (1962): 4-10.

with *geopolitik*, Haushofer and his colleague relied almost entirely on the Mercator projection.¹⁷⁹ According to Strausz-Hupé and Harrison, “the main pitfall to avoid is the continual use of one map, for the mind is inexorably conditioned to its shaped. It begins to look ‘right’ and all others ‘wrong’.”¹⁸⁰ As he demonstrated in his atlas, Harrison offered that one of the better antidotes to Mercator and excessive reliance on a single, familiar map was a set of orthographic projections, showing the earth as a globe from different angles.¹⁸¹

Jakub Grygiel, in addition to his scholarly analysis of geopolitics past and present, has argued that “the education profession is failing” the needs of national security.¹⁸² Ideally, richer geographic mental models among policymakers would emerge from better foundational geography education in the population in general. As Grygiel writes, “the inability of a country to maintain a highly skilled population may lead to a gradual fraying of the material foundations of its power and an enfeebled global position.”¹⁸³ However, low geographic literacy among Americans is an intractable problem and beyond the scope of this study. Looking more narrowly at how the members of the national security enterprise develop their expertise offers some more achievable options.

There is a clear need for stronger grounding in basic geographic facts and concepts, as well as the art and science of cartography in the civilian and military academic institutions of higher learning that shape senior policymakers. Just as the war colleges emphasize critical thinking skills to turn successful operational-level leaders into effective members of the interagency at the strategic level, these institutions would be ideal places to evolve the practical

¹⁷⁹ Harrison, “The Geographical Sense,” 10-12.

¹⁸⁰ Harrison and Strausz-Hupé, 40.

¹⁸¹ Harrison and Strausz-Hupé, 43.

¹⁸² Jakub Grygiel, “Educating for National Security,” *Orbis*, 3 February 2013, 204

¹⁸³ Grygiel, “Educating for National Security,” 201.

navigation skills of pilots, sailors, and battalion commanders and build their strategic mental map.

Students receiving a master's degree in national security or international relations—civilian or military—ought to receive both education and training for using geography. The differences between education and training are subtle but tremendously important: if training is learning how to perform a specific task and education is learning how to think, then both are required for thinking in space. National security professionals, on a military staff or at the NSC, should have the basic, practical skills to develop and edit original geographic content. They should be able to make their own maps, their own geographic arguments, and know what went into them. These practical skills, though mechanical in many ways, are potentially as valuable as the mechanical skill of proper citation in academic writing that is so heavily emphasized at the war colleges. Civilian graduate programs and Professional Military Education institutions rightly require students to master clear and effective writing. But they would also benefit from a basic investment in resources to train future decision makers in the modern tools available for analyzing and presenting geographic information. Extensive curriculum exists for such training, but is largely assigned to subordinate support offices or a priesthood of cartographers and graphic designers who can be tasked as needed. A near-term solution would be the creation of a geography advisor to aid students in incorporating geography and cartography into their work, not as a mapmaker on call, but a mentor who can provide resources and help students gain practical skills with tools like GIS software.

Over the longer-term, curriculum changes could create a broader reservoir of geographic expertise at senior levels. The Georgetown SFS “Map of the World” class, mentioned earlier, is one model that could be adapted to other graduate programs that produce large numbers of

young foreign policy practitioners eager to serve their country in Washington. But graduate study should involve more than remedial map knowledge and should emphasize critical thinking skills. War colleges could offer an elective program on “thinking in space,” or the Joint Staff could introduce spatial thinking as part of the Joint Professional Military Education requirements.

Skilled cartographers are in surprisingly short supply within the Department of Defense, despite massive budgets. The Pentagon leadership should undertake a broad survey of the distribution of DOD cartographic resources and study the possibility of shifting resources from DOD-subordinate parts of the Intelligence Community to policy making offices and planning staffs. Shifted resources could potentially hire new cartographic consultants who would fully embed with action officers, not to give them reference material, but to help craft their documents and presentations.

Techniques, Tactics, and Procedures for Geographic Staff Work

Aiding leadership through more sophisticated thinking in space cannot stop with a master’s degree or JPME certification. Adjustments to the institutional processes by which the national security bureaucracy provides geospatial resources to decision makers also offers opportunities. Some of the barriers to better use of geography are decidedly tactical and technical, and broader sharing of simple techniques and procedures could elevate the geographic game of the average staff officer.

ArcGIS, produced by ESRI, is the overwhelmingly dominant GIS software suite, with a market share akin to that which PowerPoint enjoys among presentation software. The US Government is ESRI’s largest customer and ArcGIS licenses are widely available throughout different parts of the National Security Enterprise. Where licensing costs are prohibitive, the leading open-source alternative to ArcGIS, QGIS, can serve most conceivable geospatial

analysis and cartography needs of a typical military officer or foreign policy generalist. The sophistication of software like ArcGIS and QGIS can present steep learning curves to novices and have capabilities in excess of the needs of those seeking to merely incorporate effective cartography into their communication. There are several other free and user-friendly options available for quickly generating base maps tailored to the purpose required. The ArcGIS online portal provides basic GIS services and a library of base maps in different styles, with more powerful services available through subscription.¹⁸⁴ The “Natural Earth” project, sponsored by a consortium including the North American Cartographic Information Society, provides an extensive set of well-curated public domain data for use in map making.¹⁸⁵ The cartographer Cynthia Brewer, who has published several practical guides to effective cartographic design, also maintains a website for effective and reliably-reproduced color schemes that can quite literally help the amateur cartographer or designer to “paint by numbers.”¹⁸⁶ Within the space of an hour or two, and at no cost, a reasonably skilled computer user can learn to create custom maps, choosing among appropriate projections in QGIS and layering data from Natural Earth.¹⁸⁷

Grant McDermott, an economist, has argued against GIS software for thematic mapping in favor of the statistical package R, which can interface with many of the same open-source GIS software behind QGIS.¹⁸⁸ McDermott has developed materials to learn these techniques and is working on a book on the topic, but the argument in favor of R is more compelling for those who

¹⁸⁴ Esri, Inc., “ArcGIS—My Map,” <https://www.arcgis.com/home/webmap/viewer.html>.

¹⁸⁵ “Natural Earth,” <https://www.naturalearthdata.com>.

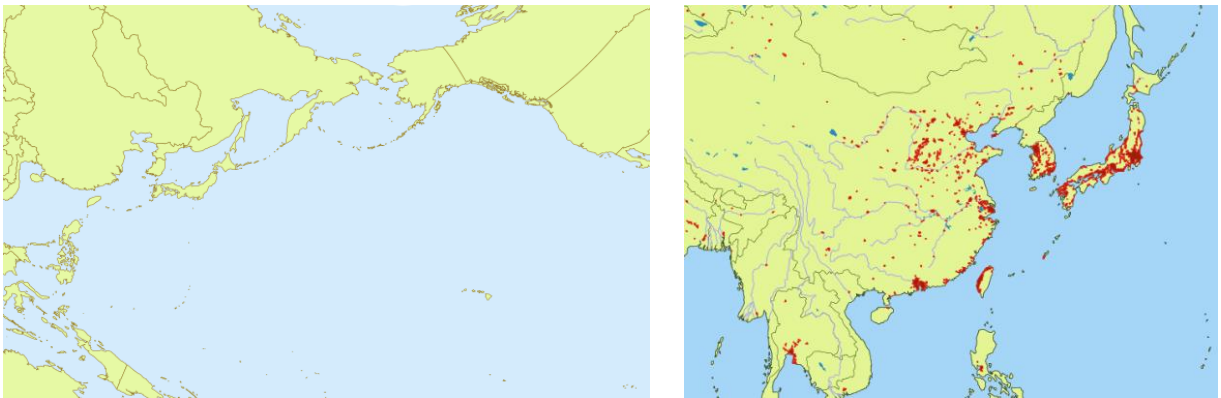
¹⁸⁶ Cynthia Brewer, *Designing Better Maps: A Guide for GIS Users*, Redlands, CA: Esri Press, 2015. Cynthia Brewer, Mark Harrower and The Pennsylvania State University, “COLORBREWER2: Color Advice for Cartographers,” www.colorbrewer2.org.

¹⁸⁷ “Projection Wizard” is an excellent tool for amateur cartographers needing assistance selecting a projection and importing it to software like QGIS. See <http://projectionwizard.org/#>

¹⁸⁸ Grant McDermott, “Spatial Analysis in R,” <https://raw.github.com/uo-ec607/lectures/master/09-spatial/09-spatial.html>

have already learned R, like social scientists, than a military staff officer. To be certain, many parts of the US Government produce and engage with statistical data at the highest levels, but the national security enterprise may be no more conversant in statistics than geography.

Launching fully into the GIS world can be a daunting task (or a dangerously-immersive hobby) for the national security professional and there are other options for quickly creating ready-to-use base maps. “World Map Creator” is one remarkably powerful tool with an intuitive interface for creating regional base maps from a variety of perspectives in less than five minutes.¹⁸⁹



Two maps created with worldmapcreator.com, February 2019. Left: Pacific Ocean (Albers Conic Projection), Right: Urban areas in East Asia (Azimuthal Equal Area Projection)

The azimuthal equidistant projections preferred by “air-age globalists” like de Seversky to depict ranges of aircraft and missiles are also popular among amateur radio operators who have created a number of useful sites for generating maps showing direct paths across the globe.¹⁹⁰ When area comparison is the more important geographic message than distance or direction, a simple but compelling tool is the overlay of a known extent onto a distant and unknown area. The free,

¹⁸⁹ Bern School of the Arts, “World Map Creator,” <http://worldmapcreator.com/#!/home>.

¹⁹⁰ Tom Epperly, “Request an Azimuthal Map,” <https://ns6t.net/azimuth/azimuth.html>.

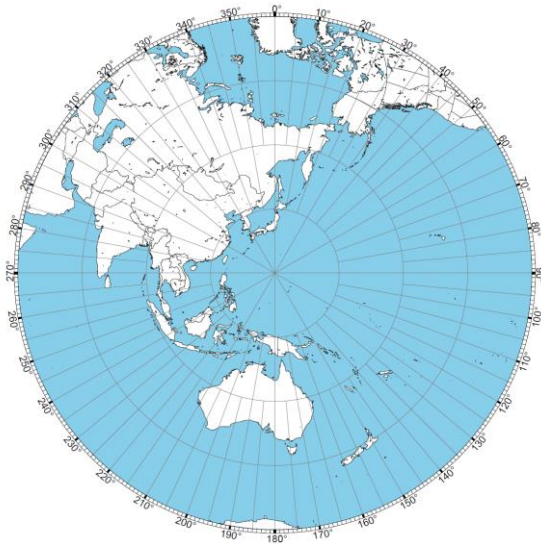
online tool “thetruesize.com,” although very limited in its functionality, can quickly highlight, for example, the size of Indonesia relative to the continental United States, or comparing the South China Sea relative to California.¹⁹¹



Courtesy of thetruesize.com



Courtesy of thetruesize.com



Courtesy of nsbt.net

¹⁹¹ James Talmage and Damon Maneice, “The True Size Of,” <https://thetruesize.com>

Once staff officers and decision makers are able to create and edit better maps, they still face practical challenges to sharing and displaying them. PowerPoint has many shortcomings, but the program serves well for the organization and display of high-quality graphic content generated outside of the program. PowerPoint can remain part of the delivery system as long as it does not drive users to downgrade the quality of the original product through compression or senseless “slideology.” To support necessarily large files of quality geographic products, government IT departments should seek better integration and widespread adoption of simple and secure transfer systems to support alternatives to email attachments. Once the digital form of the data rich geographic product gets where it needs to go, it must still cross the last essential distance from a display medium to the recipient’s eyeballs. As discussed above, any display on paper or an electronic screen entails limitations of size and resolution. Digital displays have advantages in cheaply and easily displaying an array of content and can even support animation and dynamic content. The quality of digital displays has improved dramatically in recent years, accompanied by falling prices in high-resolution displays, but screens still struggle to compete with paper for resolution, a major factor when rendering the fine details that the human eye can pick out of a good map. Standard color laser printers produce sheets at 600 dots per inch (dpi), so a map on a standard 8.5”x11” sheet with one-inch margins would have a resolution of 4500 x 6000 dots. The screen on the iPhone X compares favorably at 458 pixels per inch (ppi), but size restrictions allow the display of 1125 x 2436 pixels.¹⁹² The iPad Pro 11 has a larger screen, but a comparable resolution at 1668 x 2388 pixels, or 264 ppi. A high-definition (1080p) LCD projector, like those in many US Government conference rooms would likely have a resolution

¹⁹² <https://www.sizescreens.com/apple-iphone-x-screen-specifications/>

on the order of 1920 x 1080 pixels, spreading out depending on the distance to the screen.¹⁹³ If the conference room is equipped with a large monitor instead of a projector, perhaps a 55" 4K screen, then the available resolution would be 2160 x 3840 pixels.¹⁹⁴ A National Geographic world map of the same dimensions as the 55" monitor displays 18,000 x 28,800 dots.

Large format paper maps have some downsides despite their clear advantages in resolution. Paper maps are static, paper is expensive and (heavy in large quantities), and printers are notoriously fickle. But paper are easily transportable, roll out easily on any table, and work even when computers, networks, and projectors do not. DOD and national security organizations should consider shifting some resources for large digital displays and projectors into large format printers, for at least 11" x 17" sheets if not a 36" width plotter.

As discussed earlier, technology is a decidedly two-sided sword when it comes to spatial thinking. But despite the risks of spatial deskilling from reliance on smartphone navigation, technology offers tremendous opportunities for visualizing and communicating geographic information. Presentation of dynamic graphics in the PDB on an iPad could be an early indicator that a support to senior leaders will evolve to include study of sophisticated geographic problem through interactive digital geographic interfaces on a regular basis. A very early glimmer of such a possibility appeared in the use of animated terrain models through a program called PowerScene during the 1995 negotiations for the Dayton Accord.¹⁹⁵ US officials, led by Richard Holbrooke, reportedly used PowerScene to great effect with Slobodan Milosevic to demonstrate

¹⁹³ For example, <https://epson.com/For-Work/Projectors/Portable/PowerLite-1795F-Wireless-Full-HD-1080p-3LCD-Projector/p/V11H796020>

¹⁹⁴ For example, <https://www.dell.com/en-us/work/shop/dell-55-4k-conference-room-monitor-c5519q/apd/210-arev/monitors-monitor-accessories>

¹⁹⁵ Mark W. Corson and Julian V. Minghi, "Powerscene: Application of New Geographic Technology to Revolutionise Boundary Making," *IBRU Boundary and Security Bulletin*, Summer 1996, 34-37.

the advantages or infeasibility of different proposed border demarcations.¹⁹⁶ The Dayton experience has a direct parallel to Isaiah Bowman's efforts nearly eight decades earlier at Paris, where the delegation with better maps enjoyed more negotiating power.

Visualization of detailed three-dimensional models is widely employed by the US military for mission planning, but the promise of systems like PowerScene to support national-level decisions or multilateral diplomacy, as seen at Dayton, has not materialized. The technology demonstrated at Dayton is now widely available for free: the desktop edition of Google Earth supports fly-through control with a joystick or gamepad. If deployed more widely and users develop a natural facility with the interface, future government officials might use such a tool for studying a problem or presenting policy options. The technology is even easily available to employ a virtual reality headset for an immersive geographic experience, although the low level of geographic literacy and unsophisticated employment of cartographic tools detailed above suggest that simpler and more straightforward solutions would pay greater dividends in the near term. Further, those employing and using this kind of geographic decision aid should do so conscious of the dangers of spatial deskilling.¹⁹⁷

Calling for more resources, new tools, and larger budgets to increase capability is always the quickest answer, but when it comes to improving the use of geography in the national security enterprise the financial costs should be minimal. The technologies and techniques have been proven in the commercial world and many are tools and processes that originated in the government and need help to migrate back. Modifying JPME curriculum would entail minor

¹⁹⁶ Ethan Watters, "Virtual War and Peace," *WIRED*, March 1996, <https://www.wired.com/1996/03/virtual-war-and-peace/>

¹⁹⁷ Eric Van Rees, "AR, VR and GIS have finally found each other," 10 October 2017, <https://www.spar3d.com/blogs/all-over-the-map/ar-vr-gis-finally-found/>

tradeoffs and opportunity costs for other subjects, but GIS has developed a solid academic footing that can ensure time spent on cartographic skills still satisfies academic accreditation standards. JPME is also only a partial solution, as there are no comparable institutions for educating and training civilians on nearly the same scale. Nevertheless, the benefits are too great not to make a modest investment in developing a national security workforce that can think and communicate in space.

Conclusion

Decisions made by complex bureaucratic organizations can be neither understood nor predicated without a careful specification of the processes that produce those decisions.

-Andrew Marshall¹⁹⁸

The United States faces daunting challenges to its national security and the international order that it has helped build. Some of the threats to the United States and its interests are unique and novel, while some threats are familiar and traditional. But all national security threats have a geographic and spatial dimension: in many, or even most, cases thinking in space is an essential component of effective decision making. The costs of ineffective spatial thinking can be concrete and fatal at the tactical level: a ship runs aground, an airplane crashes, or a battle is lost. The danger of failing to think effectively in space at the strategic level is more abstract can prove far more costly in blood and treasure. This paper began from the hypothesis that the US national security enterprise is operating at something less than its full potential to think in space. It may be that the United States is “emerging from a period of strategic atrophy” not only with the lethality of its conventional forces, as highlighted in the recent NDS, but also with its employment of geographic information in defense of the nation.¹⁹⁹ At a minimum, the nation’s senior leaders and those who support them must hone their geographic skills to keep pace with the evolving security environment.

¹⁹⁸ Andrew Marshall, “Long-Term Competition with the Soviets: A Framework for Strategic Analysis,” US Air Force Project RAND (R-862-PR), April 1972. Declassified 30 March 2010.

¹⁹⁹ *National Defense Strategy 2018*, 1.

Too much of this paper's discussion of US government institutional practices has relied on personal perspectives, anecdotes, and individual hypotheses because of a lack of real data. More research is needed to know how bad the problem truly is, where the strengths and weakness are, what credible options for improvement exist, and what barriers inhibit their employment. Despite the breakneck pace of technological development and major geopolitical shifts in the last two decades, the fundamental processes of national security institutions have changed little. The circulatory system continues to rely on strategy documents, memos, email, briefings, and PowerPoint with anemic geographic content. If the current configuration and communication habits of the system are causing spatial deskilling, the enterprise needs to sharpen its understanding of the problem and consider different processes.

Succeeding in a long-term strategic competition requires a deep understanding of the thought processes, priorities, and blind spots of the other party in the competition. If the way the US national security apparatus uses geography is indeed important, then we must also study how our potential adversaries think in space. What persistent distortions exist in their world view, what inefficiencies endure in the ways they process new and ambiguous geographic information, and what cartographic messages will resonate best with their national security system?

Thinking in space is only one tool available to decision makers and is no panacea to crafting successful strategies and avoiding tragic blunders. But geographic thinking and communication are tools that sharpen analysis of national security decisions. The national security enterprise must be a learning and adaptive organization. It must evaluate the effectiveness with which it employs geographic information and seek every opportunity to sharpen its tools for thinking in space.