

The Theory of Lateral Pressure
Highlights of Quantification & Empirical Analysis

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Summary

Lateral Pressure refers to any tendency (or propensity) of individuals and societies to expand their activities and exert influence and control beyond their established boundaries, whether for economic, political, military, scientific, religious, or other purposes. Framed by Robert C. North and Nazli Choucri, the theory addresses the sources and consequences of such a tendency.

Lateral Pressure theory seeks to explain the relationships between state characteristics and patterns of international behavior. The theory addresses the sources and consequences of transformation and change in international relations and provides a basis for analyzing potential feedback dynamics. To the extent that states expand their activities outside territorial boundaries – driven by a wide range of capabilities and motivations – they are likely to encounter other states similarly engaged. The intersection among spheres of influence is the first step in complex dynamics leading hostilities, escalation, and eventually to conflict and violence. These processes are contingent on the actors' intents, capabilities, and activities.

The causal logic in lateral pressure theory runs from the *internal* drivers, that is, the *master* variables that shape the *profiles* of states -- through the *intervening* variables, namely, aggregated and articulated *demands* given prevailing *capabilities* -- the outcome often generates added complexities.

This paper proceeds as follows: First we highlight the basic features of lateral pressure theory, its core components, and their interconnections. Some aspects are more readily quantifiable than others. Some are more consistent with conventional theory in international relations. Others are based on insights and evidence from other areas of knowledge, thus departing from tradition in potentially significant ways. Second, we summarize the phases of empirical investigations and the evolution of theory over time. Third, we return to basics and focus on the refinements of metrics and quantification of the core concepts. All of this pertains to the world, as we have known it prior to the construction of the Internet, the core of cyberspace. Fourth, we then turn briefly to results so far of our research on lateral pressure in the cyber domain. The Endnote highlights some emerging imperatives.

Keywords: *Lateral pressure theory, cyberspace and traditional international relations, cyber challenges to the state system.*

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I. Introduction

Lateral Pressure refers to any tendency (or propensity) of individuals and societies to expand their activities and exert influence and control beyond their established boundaries, whether for economic, political, military, scientific, religious, or other purposes (Choucri and North, 1972; 1975; Ashley, 1980; Choucri and North, 1989; North, 1990; Lofdahl, 2002). Framed by Robert C. North and Nazli Choucri, the theory addresses the sources and consequences of such a tendency.

Lateral Pressure theory seeks to explain the relationships between state characteristics and patterns of international behavior. The theory addresses the sources and consequences of transformation and change in international relations and provides a basis for analyzing potential feedback dynamics. The causal logic runs from the internal drivers, the master variables that shape the profiles of states -- through the intervening effects of socially aggregated and articulated demands and institutional capabilities -- toward modes of external behavior designed to meet demands given the capabilities at hand (Choucri and North, 1989). To the extent that states expand their activities outside territorial boundaries – driven by a wide range of capabilities and motivations – they are likely to encounter other states similarly engaged. The intersection among spheres of influence is the first step in complex dynamics leading hostilities, escalation, and eventually to conflict and violence. These processes are contingent on the actors' intents, capabilities, and activities.

Lateral pressure is a relatively neutral concept similar to what Sorokin (1957: 565) called economic expansion and Simon Kuznets (1966: 334-348) referred to more broadly as outward expansion. The strength of a country's lateral pressure is generally taken to correlate positively with its power as conventionally understood. The theory of lateral draws on the level of analysis or Image perspective in international relations (Boulding, 1956; Waltz, 1979) largely as an initial framing and then extends this traditional perspective in specific ways.

When Choucri and North (1972; 1975) formulated the theory of lateral pressure in qualitative as well as quantitative terms, they signaled that, in general, the strength of a country's lateral pressure correlates positively with its capabilities and power, (a concept that is almost universally used but defined with difficulty). Lateral pressure theory provides a more detailed and nuanced view of the sources of power, the types of leverages used, and the behaviors that can be inferred. It suggests how certain types of international behaviors or activities appear to be more prevalent in some countries than others. Among the notable reviews of lateral pressure theory are Levy (2005); and Schweller and Pollins (1999).

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This paper proceeds as follows: First we highlight the basic features of lateral pressure theory, its core components, and their interconnections. Some aspects are more readily quantifiable than are others. Some are more consistent with conventional theory in international relations. Other aspects are based on assumptions that depart from tradition by adopting a multidisciplinary perspective, thus drawing on insights and evidence from other areas of knowledge. Second, we summarize the phases of empirical investigations and the evolution of theory over time. Third, we return to basics and focus on the refinements of metrics and quantification of the core concepts. All of this pertains to the world, as we have known it prior to the construction of the Internet, the core of cyberspace. Fourth, we then review briefly the work to date on lateral pressure in the cyber domain. The End-Note highlights some emerging imperatives.

We cannot assume the portability of theory and of methods from the traditional physical domain to the cyber arena. Nor can we assume a one-to-one correspondence of metrics and measures. Fourth, we turn to empirical evidence of propensity for state expansion in the cyber domain compared to expansion tendencies in the kinetic, or traditional international arena. Finally, we ask: where do we go from here? What are the major theoretical and empirical challenges? In today's world, the state remains the dominant, but not the only significant entity in world politics. How relevant is the theory of lateral pressure for other actors in world politics, both private and public? What are generic features of international relations in an increasingly complex world where the cyber and the "real" arenas are increasingly interconnected, and where the natural environment is "endogenized" in theoretical, empirical, and policy analysis?

II. Basics of Lateral Pressure Theory

Drawing on insights and evidence from the social sciences (as well as natural sciences and more recently engineering), lateral pressure theory can be understood in terms of its basics assumptions, its components and their interconnections. The key features, highlighted below, signal some of the most important departures from conventional theory in international relations.

Systems of Interaction

The theory assumes all human activity is embedded in three distinct but closely coupled systems, that is, the *social* domain of human interactions, the *natural* environment of life supporting properties, and now the constructed environment, namely *cyberspace* -- an assumption that holds within and across all levels of analysis, as defined below. While the logic of lateral pressure theory argues for their joint or co-dependence (even co-evolution), only social systems are characterized by fully articulated decision systems, as we understand them. Clearly, humans make decisions that have impacts on life supporting properties, directly or indirectly, and the feedback effects are subject to the decision mechanisms of nature. The cyber arena, created by human intelligence, assumes properties of its own that are seldom entirely subject to social decision or control. Early on, lateral pressure dynamics were considered largely in terms of social interactions in an international context. It gradually became apparent that the propensity to expand is manifested in environmental traces of all human activity and, more recently, in the cyber arena.

Levels of Analysis

The notion of Images or levels of analysis -- so fundamental in international relations theory -- is an important element of lateral pressure theory, subject to major three departures from tradition. First is the introduction of a fourth level of analysis, namely the overarching global

system encompassing the individual, the state, and the international levels. Second is the situation of the levels within three distinct but interconnected systems of interaction. And the third relates to the aggregation issue. The conventional practice is to point to the levels of analysis --beginning with the individual and moving up the level of aggregation -- a practice we shall follow in the remainder of this section in order to illustrate the logic of lateral pressure theory. However, feedback effects may generate “reversal effects”, that is, from the global system, to the international the state or the individual level. While not fully articulated, the theory highlights the potentials and possibility of generativity, a feature that remains to be explored in international relations theory.

Individuals and Aggregates

At the base of the social order are the core activities undertaken by individuals in their efforts to meet their needs and demands. Aggregated at the level of the state, the international system and the global context, the most fundamental individual needs and wants are driven by the quest for security and survival. This is consistent with tradition in international relations theory. But the view of the individual differs from that posited by convention for First Image.

First, lateral pressure theory sees the individual as an information processing and an energy using entity. Second, the theory is anchored in the assumption that homo individualis – in contrast to homo economicus and to homo politicus – is situated in an overarching social and natural, and now cyber, environment. Also, it is at odds with the conventional view of economic man, the isolated individual entering an impersonal market at a particular point in time. Both the market and the polity are well understood with respect to properties and modes of behaviors, they retain an exclusively social view of man. Embedded in the interactive social, natural, and cyber domains, homo individualis is at once a economic, social or political man, even a homo cybericus – depending on role and context at any point in time.

Demands and Capabilities

The concepts of *demands* and *capabilities* provide the transition from the individual to the broader social entity, notably, the state.

A demand is a determination that derives from a perceived (or felt) need, want, or desire for the purpose of narrowing or closing the gap between a perception of fact (what is) and a preference or value (what ought to be). Basic demands are usually for resource access, better living conditions, physical safety, and security, all of which are generally considered under the rubric of utility by economists. To meet demands -- and to close the gap between the is and the ought to-be, and possibly approach or establish a preferred condition -- individuals and societies must possess the required capabilities.

Capabilities consist of the set of attributes that enable performance and allow individuals, groups, political systems, and entire societies to manage their demands. Given that states extensively in their capabilities, their environmental effects will also vary, as will the attendant pressures on the integrity of social systems, or the viability of the natural environment.

Master Variables

The theory assumes that the critical drivers of social activity - in all contexts and at all levels of development -- can be traced to the interaction among three master variables-- population, resources, and technology. Measurement of the master variables is usually a first step in quantitative analysis and grounds the theory in an empirical context. *Population* refers to the size,

distribution, and composition of people, and to changes thereof. Each of these variables can be differentiated along a number of sub-factors or variables – depending on the issues at hand or the interest of the analyst. The same can be said about resources and technology. *Technology* refers to all applications of knowledge and skills in mechanical (equipment, machinery, etc.) as well as organizational (institutional) terms. This concept of technology encompasses both soft and hard dimensions, and often the former is as important as the latter. *Resources* are conventionally defined as that, which has value to include all elements critical to human existence (such as water, air, etc.), provides a perspective on the concept of resources intimately connected to requisites for basic survival. The specific metric or metrics used in any investigation is usually driven by the research design and its purpose.

State Profiles

Lateral pressure theory further argues that all states can be characterized by different combinations of population, resource and technology – the master variables – and that different combinations yield different state profiles – and different impacts on the natural environment. The theory assumes that interactions among these variables within states affect power distributions and relations among states. In other words, different state profiles – characterized by different population/resource/technology relationships -- manifest different propensities for external behaviors (Choucri and North, 1989; North, 1990; Wickboltd and Choucri, 2006). The state profile is also a good predictor of power-indicators on the one hand and, as we have shown, patterns of environmental impacts, on the other (Choucri and North, 1993a).

The formal specification of state profiles in the Table 1 below presents the definitional inequality. For convenience, state profiles are displayed in terms of a technology-driven perspective, indicated by the T-variable along the diagonals. But this is not a necessary feature of the theory or of the concept of profiles.

Table 1: Definition of state profiles.

Profile 6	<i>Technology</i> > Population > Resources
Profile 5	<i>Technology</i> > Resources > Population
Profile 4	Resources > <i>Technology</i> > Population
Profile 3	Population > <i>Technology</i> > Resources
Profile 2	Population > Resources > <i>Technology</i>
Profile 1	Resources > Population > <i>Technology</i>

Source: Choucri, 2012:32

The theoretical point is this: Different profiles generate different propensities for expansion. Here is the direct connection between internal attributes and external behavior – thereby leading to a wide range of international consequences. We shall turn to the measurement of profiles later in this chapter and as well as the empirical basis for this proposition. The reorganization of each profile location in this table yields, by definition, a population-driven display, or alternatively, a resource-driven display (each with the P- or the R- variables along the

diagonals). See Choucri and North (1993b) and Lofdahl (2002) for the original specification; and Wickboldt and Choucri (2006) for extension of the logic to differentiate empirically among countries within each profile group.

Governance and Government

In this context, governance refers to legitimate structures and processes, through which societies are managed. Government refers to the specific mechanisms for management. Simple as this might seem, we shall note further along how important they are for interactions in the cyber domain. Government is the lead decision and policy and enforcement entity. Initially framed in the context of the sovereign state, these definitions are generic in form, applicable to all countries, at all levels of development, and in all periods of time. Some similar mechanisms operate in other contexts and entities, such as corporations and non-profit entities.

We define government as the lead decision and policy and enforcement entity. Initially framed in the context of the sovereign state these definitions are generic in form, applicable to all countries, at all levels of development, and in all periods of time. By analogy, similar mechanisms operate in other contexts and entities, such as corporations and non-profit entities.

Here we return to the notion of *capabilities* introduced above. Especially relevant are the contributions of Almond and Powell (1966) who defined government activities as extractive, distributive, responsive, regulative and symbolic in nature. It is not difficult to see the connection between this view of capabilities and most of the variables in the state's national budget. Less obvious, is the reconciliation of these capabilities with one of the most fundamental functions of government, not explicitly addressed by Almond and Powell, namely the provision of national security.

In efforts to meet demand -- or to expand capacity for purposes of meeting demands - often creates unintended consequences that may undermine the government's own position. Thus, the management of demands and capabilities is the intervening process relating state profiles and their characteristics features to propensities for external behavior. The generic governance challenge is how best to manage two counter prevailing processes (a) pressures emanating from societal demand creating loads on the system and (b) capacities of government to manage the loads, respond to pressures, while avoiding any conflict and large-scale disruptions.

Expansion and Intersection

In the management of loads and capabilities, and/or in the protection of its national interests, the state may find it necessary (or it may have the capacity) to extend its behavior outside territorial boundaries. To the extent that states extend their behavior outside territorial boundaries, they are likely to encounter other states similarly engaged. The theory of lateral pressure signals the *intersection of spheres of influence* as a significant point at which interactions are likely to evolve into competition, which in turn shapes hostilities that set in place that can rapidly evolve into spiraling conflicts, leading to military competition, and eventually to violence and warfare – usually triggered by an overt act that is perceived as a provocation.

Clearly not all expansion leads to intersections of interests, not do all intersections of interests harness a conflict spiral. This stylistic sketch is remarkably consistent with the historical record of the industrial west and the narratives developed over time to explain the outbreak of World War I and World War II. The quantitative investigations of lateral pressure theory,

highlighted later in this chapter, signal the challenges as well as the opportunities and contentions inherent in, and surrounding, quantitative empirical analyses.

International Relations

By definition, international relations consist of interactions among sovereign entities, intergovernmental organizations, non-state entities for-profit and not-for-profit, non-governmental organizations, and many others. As a result, the sovereign state is embedded in a wide range of networks, formal and informal. Given that competition for power and influence is a generic feature of politics among nations, lateral pressure theory points to intersections among spheres of influences as a mechanism for setting hostility, potentially setting in place the dynamics of military competition lead to the well-known phenomenon of arms race.

Here the theory draws on four important concepts in international relations theory. These are the (a) the *conflict spiral* (such as Holsti, 1967), (b) the *arms race* dynamics (pioneered by Richardson, 1960), (c) the *security dilemma* (notably Herz, 1950; Jervis, 1997), and (d) the *peace paradox* (Choucri and North, 1975) – namely, when initiatives by one of the adversaries to reduce hostilities, and de-escalate violence, are considered by the other as a sign of weakness and thus an opportunity for taking the offensive and making a move to gain advantage. In this connection, while everyone acknowledges the importance of deterrence and deterrence theory, there is less agreement about the underlying conditions that enable deterrence or the relevance of deterrence in the 21st century cyber arena – which we shall turn to later on.

Less fully developed in lateral pressure theory are the dynamics of international cooperation, which we shall refer to, later in the context global accord on the environment (Choucri, 1993). The theory draws upon concepts of multilateralism, as a form of coordinated behavior among states designed to reduce disorder and anarchy in the international system. Stated differently, as coordinated action among sovereign states, multilateralism emerged as a means of protecting the interests and activities of states in the international system –in their pursuit of core goals, namely wealth and power (Gilpin, 1987).

Much of the foregoing is applicable at the regional level, however defined, and is relevant to any delineation or aggregation of entities.

Corporate Behavior and Non-State Actors

Lateral pressure theory argues that the relationship between corporate entities and the sovereign state is framed by the characteristic features of the state's profile, on the one hand, and the dynamics of corporate expansion of investment activity. For example, in early phases of development, a country generates neither outward nor inward and organizational capability. Over time, as a country increases its capabilities and its private organizations, it generates a range of cross-border activities and may even become a net outward investor.

Eventually, the capabilities of corporate entities, rather than the power and the profile of the home country, become more significant. In this process, the firm's strategies are increasingly decoupled from the home state and its profile. Corporate policy is now framed largely within the firm's "organizational field", (Fligstein, 1990: 5-11), a concept that carries much of the expansionist core of lateral pressure.

The *horizontal* reach of the traditional commercial private sector is well known, as are the various transformations in response to changing market and other conditions. These features are embedded in emergent *vertical linkages* – connecting global and local – for information,

communication, and knowledge building to and from the grass roots. By definition, these actors assume a physical presence in different jurisdictions—the nature of which depends on the nature of products, processes, and services. Unless closely held, these entities are controlled by *stockholders* – at least in principle. Again, all of this falls largely in the domain of tradition. The same cannot be said of the private sector for the cyber arena – largely due to the salience of the not-for profit segment and the consolidation of the *stakeholders*.

The Global System

Recall that lateral pressure theory extends the traditional levels by positing the global system as an overarching concept that encompasses its constitutive features -- the individual, the state, and the international system – embedded in social system and the natural environment and, more recently, in the cyber domain. The theory also views globalization in overarching terms -- as fundamental transformations in economic and social structures and processes worldwide shaped by the large-scale movements of people, resources, and technologies across boundaries, and all of attendant bi-products.

Such cross border mobility influence the nature of national societies and economies and, under certain circumstances, may even alter them in fundamental ways. Inevitably, they also shape and reshape international exchanges and interactions. To the extent that these processes are sufficiently pervasive and call for changes in dominant policy thrusts, it is reasonable to argue that the essence of globalization lies in the forging of common and overlapping policy spaces.

The globalization process generally leads to new arenas of interaction. Earlier globalizations, which had created new spaces of interaction due to control or conquest (colonies, the Polar Regions, outer space, for example), provided opportunities for the few and the powerful. Over time the globalization processes became more complex and assumed new properties of unprecedented scale and scope. Later in this essay, we shall turn to the cyber domain, and illustrate the ways in which lateral pressure theory addresses and helps analyze actors and activities in, and of, cyberspace.

Among the many challenges associated with understanding the global system and the globalization process, at least four are especially compelling (Choucri, 1993: 1-40). First, the basic biogeochemical characteristics of the global environment are broadly recognized, but uncertainties about *feedback effects* on both the geophysical and social processes remain daunting. Second, the social, environmental and cyber-based processes operate at unequal and sometimes overlapping *time frames*, thus complicating notion of temporality and the role of time. Third are the *intergenerational impacts* of environmental change, whereby future generations incur the environment burden created by the actions of past and present generations, with the challenges associated with long lead times. Fourth are uncertainties due to *irreversibility*. Patterns of environmental alterations cannot readily be “undone”. Underlying sources are not easily controlled or “eliminated” on short order – if at all. Needless to say, the construction of cyberspace creates its own pervasive challenges.

III. Empirical Analysis & Theory Development

Lateral pressure theory assumes that each statistic is an indicator of – and consequence of – a discrete decision by an individual human being governed by his or her preferences. The larger the size of the community the greater is the demands, wants and needs. Population growth, for

example, is in fact the outcome of a large number of discrete private decisions (due to volition or to coercion) over which policy makers or national governments are not likely to have direct control. In this connection, if there is any “determinism” in this logic, it is one driven by individual decision. Indicators of technology, like those of population, are also the observed outcomes of a number of widely dispersed decisions by individual actors such as developers, inventors, scientists, investors, manufacturers, etc. The same holds for resource access and uses. Statistics involve descriptions of and generalizations about aggregates. Empirical analyses of lateral pressure theory have gone through several phases with each phase providing grounds for added developments in theory and new challenges for quantitative analysis.

The earliest studies were completed in the decade of the 1970s. Until very recently the theory dwelt in the physical realm of traditional world politics – along with all other theoretical and empirical analysis in international relations. The construction of cyberspace created new challenges pertaining to quantification of the master variables, state profiles, and patterns of behavior. This section focuses on empirical theory and analysis in the conventional realm, necessary prerequisite for understanding measures and metrics for the cyber domain.

In retrospect, we now appreciate that our quantitative work and empirically based inferences have evolved over time. We can now point to distinct phases, each with its theoretical and methodological features.

Major Power Interactions, 1870-1914

The first phase, reported in *Nations in Conflict*, is a large-scale cross-national multi-equation econometric investigation of the 45 years leading to World War I (Choucri and North, 1975). The quantitative work includes a set modeling and simulations that yield empirical connections between the master variables and the behavior of states. Choucri and North developed an econometric simulation model of six major powers over the span of 45 years leading to World War I. In each case, they found the causal connection between the master variables and the overt international behavior. The traditionally dominant power during this period, Great Britain, viewed any significant growth in other powers as a source of threat and these perceptions were translated into specific policies intended to retain an advantage over the other powers, most notably a rapidly growing and newly unified Germany. The discussion of each of the equations in the overall model of jointly estimated dependent variables is contextualized in a historical narrative that enriches the analysis, the results, and the inferences drawn.

The theory of lateral pressures, then in its infancy, was readily mapped onto a set variables and processes that represented growth, expansion, intersections of interests, conflict and violence. Below shows the logic of empirical investigation at that time. All variables, dependent and independent, other than the ultimate dependent variable, *violence*, were derived from existing statistical record, adjusted appropriately for comparison across countries and over time. The final dependent variable was constructed based on a 15-point international interaction scale developed for that purpose. This was long before measuring intensities of hostility in world politics became common practice in the field. In retrospect, it is clear that this study preceded the development of formally framed state profiles, as it did the quantitative articulation of the propensities for expansion, rather than the actual behavior.

Shortly thereafter, *The Political Economy of War and Peace* (Ashley, 1980) extends the lateral pressure logic, as well as the measures and metrics, into a system of simultaneous equations representing conflict dynamics among competing powers in the post-World War II era. Ashley

focused on the interactions generated by differentials in growth of population, resource access, and levels of technology focusing on the United States, the Soviet Union, and China. This book demonstrates the close interconnections among national growth, bilateral rivalry, and multilateral balance of power. It is also the first quantitative analysis of these three Powers in world politics.

The study shows how the dynamics of insecurity and the antagonizing processes contribute to the globalization of military competition, which in turn, creates serious impediments to the collective management of many dimensions of growth itself. Careful model development, empirical grounding and parameter estimation as well as simulation of sensitivity analysis revealed the overall security problematic surrounding major power interactions. Despite changes in world politics since 1914, and the processes modeled in *Nations in Conflict*, some fundamental features of lateral pressure retained powerful resonance during the post-World War II period.

In retrospect, despite the end of communism and the dissolution of the Soviet Union, the analysis as well as the results shed important light on the emergent challenges to global and national security in the 21st century. The unquestionable dominance of the United States in world politics does little to dampen perceptions of threat due to China's growth given its rapid expansion in the global economy, nor perceptions of Russian threat given its period encroachment on the sovereignty of select neighbors.

Japan Growth and Expansion: 1868 – 1970

The *second* phase of empirical analysis of lateral pressure consists of a detailed analysis of Japan over the span of more than one hundred years (Choucri et al. 1992). Focusing on growth, development, competition, warfare, and reconstruction, this case illustrated the ways in which Japan sought to manage its resource constraints, adopt internal and external policies to meet its core demands, and find itself engaged in competition with other states leading to conflict it viewed as essential for its survival. The concept of state profile, introduced in an earlier study (Choucri and North, 1989), was operationalized and put to the empirical test in the Japan case across three historical periods -- before World War I, during the Inter-War decades, and following the Second World War. Aptly termed, *The Growth of Japan Before World War II and After*, this empirical study grappled “before” and “after” dynamics created by sharp system breaks due to war (that is, after World War I and after World War II), as well as the subsequent transformations in the 1950s, 1960s, 1970s and the early 1980s.

The Japan case indicates how a country's profile can change over time and how these changes are associated with different patterns of international behavior. Each period demonstrated different structural features and alternative pathways for adjustments to internal and external constraints. Nonetheless, Japan's profile continued to demonstrate powerful resource scarcities, and thus the necessary dependence on external trade. The demand for imports could only be met by the supply of exports, thus shaping a vicious cycle of reliance on external resources. Japan was caught between a rock (invariant resource levels) and a hard place (external constraints on resource access). In the decades preceding major international conflicts Japan fostered its eventual technology-dominant profile enabling it to engage in a wide range of expansionist activities to reduce its resource constraints. The book was long completed before analysts recognized the declining birth rate of Japan and the leveling of its population growth – that potentially affecting the country's profile.

Highlighting Complexity: Econometrics – System Dynamics – Fuzzy Logic

The *third* phase of lateral pressure modeling builds on exploratory system dynamics modeling for the period from 1970s onward, and introduces investigations based on fuzzy logic. Early system dynamics models of lateral pressure such as Choucri et al. (1972) addressed the interconnections among the master variables that create internal sources of external conflict. Extending this work, Choucri and Bousefield (1978) developed a model of the economy anchored in the master variables, and then located sources of lateral pressure and propensities toward modes of external behavior.

Later, in a comparative analysis of 20 countries (industrial and developing) Wils et al. (1998) extended the analysis of internal sources of international conflict, and examined the nature of the feedback effects, namely how international conflict in turn influences and even alters the master variables of the state and changes the internal sources of conflict as well as propensities for particular modes of external behavior. Subsequently, Lofdahl (2002) modeled the relationship between internal dynamics of growth and development rooted in the master variables, on the one hand, and propensities toward particular patterns of international trade and their environmental impacts, on the other. Lofdahl's work departed from previous investigations by adopting a worldwide perspective and positing the all-encompassing global system

This phase concentrates on basic changes in the master variables across states and over time -- and implications for international relations. Introducing the use of fuzzy logic, the analysis generated empirically based distributions of states both within and across profile groups (Wickbolt and Choucri, 2006). The use of fuzzy logic facilitates more systematic and more accurate specifications of the distribution of states throughout the international system. This could be an important step in visualizing shifts in state "location" over time and, to some extent, helping to anticipate conflict-prone behavior.

Global Environmental Change

All of these investigations were undertaken with reference to the "real" traditional international system. Incorporating the natural environment is an important development in empirical analysis of lateral pressure theory – and in quantitative analysis generally. These studies are all informative in their own right. Each one provides important insights and evidence about internal dynamics state attributes, external behavior and the antagonizing processes that lead to system-threatening dynamics and, in some cases, to overt conflict, violence and war. And they all focus on the "real" international system.

Of importance in empirical analysis of lateral pressure theory are efforts to endogenize the natural environment by taking tracking the impacts of human activity on nature. Stated thus, the challenges become near-overwhelming. By necessity, we have selected to begin with first principles, that is, to focus on anthropogenic sources of greenhouse gases. Early on we began to examine the specific activities that are most dominant in generating specific green gases and to take note of the salient properties of these gases. Then we identified the states most engaged in the activities in question. This provided a "mapping" of social impacts on nature. Greenhouse gases generated in the course of creating human products and processes can be viewed as environmental lateral pressure, or lateral pressure in the environment mode. This is a propensity intimately tied to and created by the nature of products and processes – without explicit consideration of nature's life supporting properties (Choucri and North, 1993c).

Sustainable Development

In many ways, we have found the concept of sustainable development to be an important addition to international relations theory, policy, and practice – and to the lateral pressure logic by helping to provide system boundaries for framing the problems at hand. *Mapping Sustainability: Knowledge e-Networking and the Value Chain Sustainability* (Choucri et al., 2007) draws on the work of Marvin Minsky – the founding Director of MIT’s Artificial Intelligence Laboratory – it is useful to think of a frame as “a sort of skeleton, something like an application form with many blanks or slots to be filled” (Minsky, 1986: 245). Focusing on the master variables as critical drivers of lateral pressure. The framing challenge is to provide the skeleton within which to fill knowledge materials central to sustainable development. Based on visualization technologies, utilizing geographical information systems (GIS) technologies, Ortiz (2007), shows the distribution of state profiles in 2-dimensional and 3-dimensional maps of the global system. These maps show the global patterns of greenhouse gas emissions, as well as the emissions by profile type, Ortiz illustrates the geographic distribution, temporal evolution, and cross-sectional inter-relationships of relevant variables, the categorical proxy of country profiles, and related variables of growth and development across all countries over a time frame of over several decades. These maps visually convey the basic message embodied large datasets with complex inter-relationships between variables, across a geographic space. Visualization contributes to our overall understanding of the lateral pressure dynamics in ways that transcend the econometric or system dynamics methodologies. In many ways, visualization can expedite the process of hypothesis generation and testing.

We now turn to the characteristic features of the constructed domain, cyberspace, and to how the *fifth* phase of theory development and empirical analysis in international relations responds to the new realities created by the construction of cyberspace and interactions with the traditional international order.

IV. Lateral Pressure and Cyberspace

The construction of cyberspace creates new challenges and new demands for theory development and empirical analysis. The Internet, with the billions of computers it connects, its management, and the experiences it enables – has become a central feature of 21st centuries and has created a fundamentally new reality for almost everyone in the developed world as well as for rapidly growing numbers of people in the developing world.

Cyberspace and International Relations

Lateral pressure theory views *cyberspace* as a global domain of human interaction. This domain is (i) created by the interconnections of billions of computers by a global network, today the Internet, and all of its derivatives (ii) built as a layered construct where physical elements enable a logical framework of interconnection; (iii) permits the processing, manipulation exploitation, augmentation of information, and the interaction of people and information; (iv) enabled by institutional intermediation and organization; and (v) characterized by decentralization and interplay among actors, constituencies, and interests.

Until recently cyberspace was considered largely a matter of *low politics* – the term used to denote background conditions and routine decisions and processes. By contrast *high politics* is about national security, core institutions, and decision systems that are critical to the state, its

interests, and its underlying values. Nationalism, political participation, political contentions, conflict, violence and war are among the most often cited aspects of high politics. But low politics do not always remain such. If the cumulative effects of normal activities shift the established dynamics of interaction, then the seemingly routine becomes increasingly politicized. Cyberspace is now a matter of high politics.

This new domain of interaction is a source of vulnerability, a potential threat to national security, and a disturber of the familiar international order. At this writing, the influence of cyberspace is evident in all aspects of contemporary society, in almost all parts of the world. The result is a powerful disconnect between 20th century international relations and the realities of the 21st century. It goes without saying that all of this forces us to re-assess the conventional perspectives on security, as threats to cyber security become more and more salient. But this is only one side of the proverbial coin when seen in an international perspective. The other side of the equally proverbial coin is about cooperation and the challenges associated with international governance, especially governance of cyberspace.

Framed in this broad context, two books exploring the interconnections of cyberspace and world politics provided a solid basis for articulating the lateral pressure perspective on the cyber domain in international relations. The first book, entitled *CyberPolitics in International Relations* (Choucri, 2012), concentrates largely on the impacts of cyberspace at different the levels of analysis in international relations and points to some ways in which traditional theory and practice require reassessments and reframing.

The second, *International Relations in the Cyber Age* (Choucri and Clark, 2016) takes the position that the ubiquity of cyberspace calls for a meta-analysis, an overarching investigation of *contours and interconnections of cyberspace and international relations* (and international cyber relations) in order to identify the linkages between the international system (and international relations) on the one hand, and technological change (and cyberspace), on the other – in analytical, empirical and observable terms. Each of these two domains – the cyber and the international – is defined by core principles and characterized by specific features of structure and process; these enable and are enabled by a wide range of actors and activities.

The increasing interconnections between the cyber and the “real” domains is shown by the development of practices surrounding *e-government*, for example, as well as evidence state expansion in the cyber arena (addressed below). Examples such as these create notable challenges for empirical analysis that take center stage in more recent analysis in quantitative international relations.

Cyber Challenges to the State

If we take into account the salience of cyberspace – especially the dramatic expansion of cyber access in all parts of the world, the growth in “voicing” and cyber participation, or the new opportunities provided by uses of cyber venues – then we can appreciate the fundamental departures from tradition in international structures and processes, and that the world is now much more complex⁵.

A central feature of in relations, jurisdiction in international relations –a corollary of sovereignty-- is tied to location-centric rules that depend on the nature of the actors and the issues,

⁵ The state system, created by the Peace of Westphalia in 1648, was designed more by necessity -- as a response to the challenges of the time -- than by the power of human ingenuity.

and the willingness of sovereign states to accommodate differences in the internal laws for managing the private sector, while conforming with the practice that external activities are governed by the rules of jurisdiction in public international law. The territorial principle dominates, with the attendant distinction between territoriality of country of origin vs. territoriality of country of destination.

Such simple rendering notwithstanding, it is clear to see the potential disconnects between these basic principles and the character and ubiquity of cyberspace. There are inherent tensions that are yet to be addressed. If there is international law for cyberspace, it is still in the making. One analyst argues that there is a “simple choice”, that is between “[m]ore global law and a less global internet” (Kohl, 2007). Especially important here is that characteristic features of cyberspace stand in sharp contrast to our traditional conceptions of social systems, generally, and to the state system in particular.

We now turn to six critical disconnects between essential features of cyberspace and traditional features of social systems, shown in Table 2. To be clear, these are properties of cyberspace from a user perspective generally, as seen from the perspective of politics at all levels, from local to global (Choucri 2012).

Table 2: Characteristics of cyberspace

<i>Temporality</i>	Introduces near-instantaneity into “high politics”
<i>Physicality</i>	Transcends physical constraints
<i>Permeation</i>	Penetrates boundaries & jurisdictions
<i>Fluidity</i>	Sustains shifts & reconfigurations
<i>Participation</i>	Reduces barriers to political expression
<i>Attribution</i>	Obscures actor identity & links to action
<i>Accountability</i>	Bypasses established mechanisms

Source: Choucri, 2012:4.

All of this becomes more and more important given that *who gets what, when, and how* is influenced by cyber access but also by the growth and diversity of actors, each endowed with differential levels and distributions of traditional power and capability. By definition, all entities generate *demands* (they seek to meet) and are endowed with *capabilities* (they chose to deploy). They all are able to participate in one way or another in the international forums and all seek venues for shaping the evolving international political agenda – but only states have the final vote.

Early in the 21st century it was already apparent that the cyber domain shaped new parameters of international relations and new dimensions of international politics. Among the most salient new features is the above-noted creation of new actors—some with formal identities and others without – and their cyber empowerment, which is altering the traditional international decision landscape in potentially significant ways. Concurrently, we see the growing use of cyber venues by non-state groups whose objectives are to undermine the state or to alter its foundations.

Dimensions of Security

Interactions in cyberspace have shifted the balance of power among different actors, including the traditional state powers, and enabled weaker actors to influence or even threaten stronger actors (such as press reports of anonymous penetration-incidences of the US government computer systems). This sort of shift has little precedence in world politics. We might view this as the emergence of new symmetries. However framed, we are witnessing a potentially powerful shift in the nature of the game, especially when the actors are state-based as well as non-state entities. The increased influence of the latter may well undermine the sanctity of sovereignty as the defining principle for the international system. The forgoing calls into question that the effectiveness of traditional policy tools and responses crafted to deal with state-to-state interactions in a geopolitical world -- with known threat-actors and an arsenal of expected diplomatic or military responses – remains unclear.

One of the most important effects of cyberspace for empirical analysis of lateral pressure theory analysis is the creation of a new arena of interaction characterized by its own and distinctive its dynamic *as well as* the spillover effects on the other domains of interaction, the geopolitical (social) and the environmental (nature and its life supporting properties). Figure 1 below illustrates in stylistic but realistic fashion the types of spillover effects. The figure presents some notional conditions, but the record to date would readily support many of the observations.

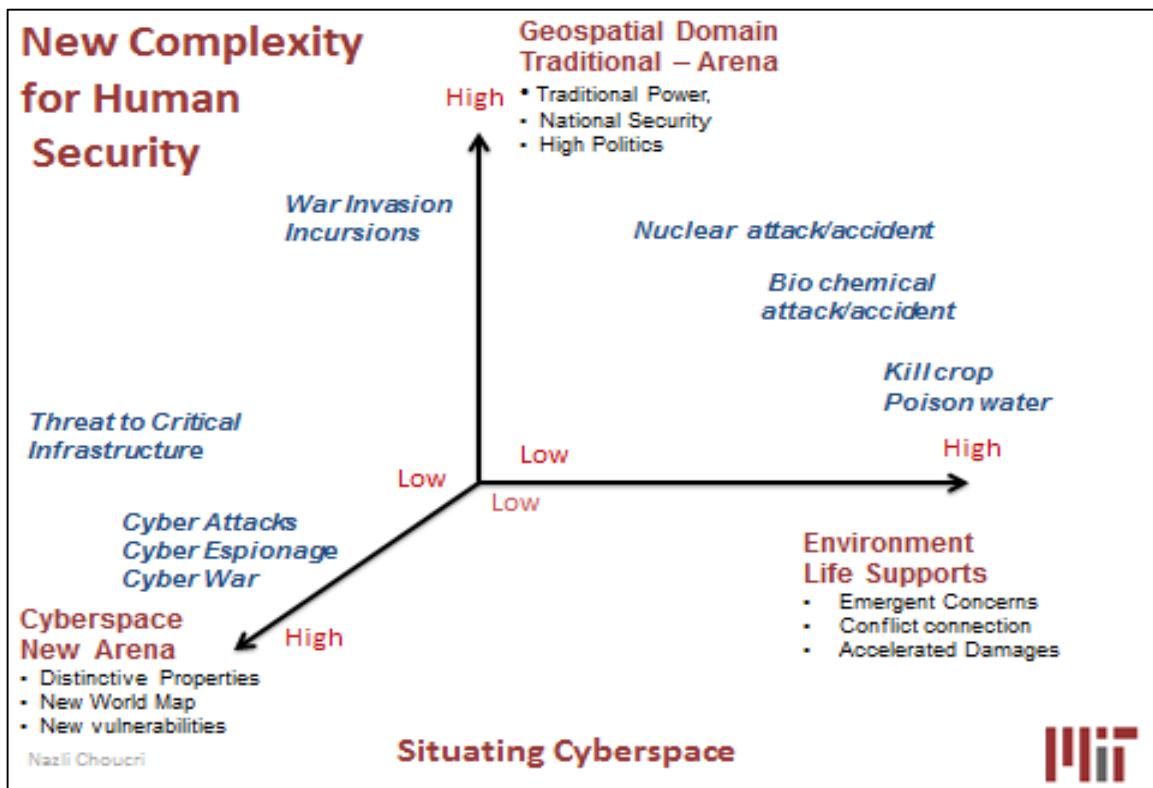


Figure 1: Systems of interaction – illustrating the security dimensions

Source: Choucri, 2015.

This figure points to a somewhat distinct proposition, namely that human security cannot be reduced to security within the geopolitical domain alone. Not only must security prevail in the cyber domain and the natural environment, but also spillover effects from less-than-secure conditions are integral to any security calculation.

State Profiles – “Real” and Cyber

All of this creates an overarching and inescapable challenge for the state, the state system, and international relations. The challenge is how to manage the entire security complex given the emergence of unprecedented forms of threat to security (cyber threats) that signal new vulnerabilities (undermining cybersecurity) and – most vexing of all – emanating from unknown sources (a feature which we refer to as the attribution problem). All of this inevitably reinforces the politicization of cyberspace and its salience in emergent policy discourses.

It may well be that changes in one domain -- cyberspace or the international system -- induce changes in the other. It is unlikely that any change can be attributed entirely to system-specific or endogenous factors. It goes without saying that *differences* in speed are foundational in any consideration of co-evolution. This is taken for granted, yet to be developed are methods for measuring the incorporating such differences. We do not anticipate, nor hypothesize mirror-image dynamics across physical and cyber domains, nor can we even consider the possibility of identical adjustments over time. But we posit that temporal differences go a long way in shaping the nature of co-evolution – the leads and lags, the feedback, and other critical systemic features.

The complexities at hand are exacerbated by differences in *rates of change*: cyberspace is evolving much faster than are the tools the state to regulate it. They both change, but at different rates. Also important is the “nature” of the evolutionary drivers, that is, whether they are endogenous, that is generated by the R&D system or exogenous to the R&D system and even the domain at hand.

This leads us to two questions: first, do state profiles in the cyber domain mirror those in the traditional or “real” world? Are the observed patterns of change in a state’s location in the “real” profile “space” similar to those in the cyber domain? These questions are now at the core of lateral pressure theory. This means that cyber-metrics must be developed and, to the extent possible, carry the same “meaning” as in the traditional domain. Once resolved, we can raise the same questions with respect to indices of lateral pressure. Given the recent construction of the cyber domain and the absence of compelling precedents, the matter of metrics will remain with us for some time to come.

The “new normal” in world politics in the cyber age involves the state system, to be sure, as well as wide range of non-state entities – known and unknown – all of whom operate in a highly dynamic and volatile international context. It is a context that limits the efficacy of traditional notions of deterrence – the concept and the practice. Tradition assumes knowledge of the identity of the adversary. This is seldom the case in at this point. In short, the “new normal” is hardly consistent with the standard textbook of international politics anchored in a state system that has a monopoly over the use of force, where force is defined in kinetic terms.

This new domain of interaction is a source of vulnerability, a potential threat to national security, and a disturber of the familiar international order. It goes without saying that all of this forces us to re-assess the conventional perspectives on security, as threats to cyber security become more and more salient. But this is only one side of the proverbial coin when seen in an international

perspective. The other side of the equally proverbial coin is about cooperation and the challenges associated with international governance, especially governance of cyberspace.

In lateral pressure theory, the master variables constitute the basis for identifying the state profile and to calculate a state's profile type. At each point in time, a state is characterized by one set of "master variables" that define the empirical parameters of the polity and provide the basis for policy agenda as well (Choucri and North: 1987, 205-208). Normalization of the selected indicator ensures that the master variables are (1) of same order of magnitude, and (2) independent of their units of measure. This step ensures that lateral pressure profiles of different states are comparable and meaningful. The normalization technique used is the fractional share of a state s in the global aggregate value ("world" total) of the indicator in year t .

Thus, we define the master variables as follows:

$$Master\ Variable_s^t = \frac{Indicator_s^t}{Indicator_{world}^t}$$

where,

$Master\ Variable_s^t$ is the value of a master variable of state s at time t ;

$Indicator_s^t$ is the value of an individual indicator of a state s in year t ;

$Indicator_{world}^t$ is global aggregate value ("world" total) of the indicator in year t .

For the cyber domain, we have used a different set of variables that reflect access to and participation in the cyber arena (see Appendix 1 for details).

Do states retain their "real" profile type when interacting in the cyber domain? Table 3 shows the states that retain their profile; these are states with *similar* real and cyber profile types. Appendix 2 shows the states with *different* real versus cyber profiles. Unfortunately, cyber data are missing for a number of small states. See Appendix 3 for a list of these states.

Lateral Pressure in "Real" vs. Cyber Domains

Most of the empirical work on lateral pressure theory address the propensity for expansion of behavior outside territorial boundaries with reference to actual behavior (rather than propensity). While this is entirely consistent with the theory, it bypasses the thorny problem of metricizing the *propensity* variable and then examines its connections to actual behavior. More recently we developed the Lateral Pressure Index in order to quantify *propensity for expansion* and to the extent possible, to highlight the relative salience of individual drivers. After some experimental, we framed the Lateral Pressure Index as a function of the geographic mean of its master variables:

$$LP_Index_s^t = \sqrt[3]{Population_MV_s^t \times Resource_MV_s^t \times Technology_MV_s^t}$$

where,

$LP_Index_s^t$ is Lateral Pressure Index of a state s in year t ;

$Population_MV_s^t, Resource_MV_s^t, Technology_MV_s^t$ are the values of master variables of a state s in year t .

Table 3: States with similar “Real” and “Cyber” state profiles.

Cyber State Profile					
R>P>T (I)	P>R>T (II)	P>T>R (III)	R>T>P (IV)	T>R>P (V)	T>P>R (VI)
Afghanistan (1)	Albania (2)			Norway (5)	Cyprus (6)
Algeria (1)	Azerbaijan (2)			Sweden (5)	Czech Republic (6)
Belarus (1)	Bosnia and Herzegovina (2)				Hungary (6)
Botswana (1)	Cabo Verde (2)				Mexico (6)
Brazil (1)	Ecuador (2)				Seychelles (6)
Cameroon (1)	Gambia, The [#] (2)				Slovak Republic (6)
Congo, Dem. Rep. (1)	Jordan (2)				Trinidad and Tobago [§] (6)
Georgia (1)	Kenya (2)				
Guinea (1)	Kiribati (2)				
Guinea-Bissau (1)	Macedonia, FYR (2)				
Kazakhstan (1)	Malawi (2)				
Madagascar (1)	Micronesia, Fed. Sts. (2)				
Mali (1)	Morocco (2)				
Mauritania (1)	Nepal (2)				
Mongolia (1)	Nigeria (2)				
Mozambique (1)	Pakistan (2)				
Nicaragua (1)	Rwanda (2)				
Niger (1)	Sao Tome and Principe (2)				
Papua New Guinea (1)	Senegal [§] (2)				
Russian Federation (1)	Swaziland (2)				
Solomon Islands (1)	Tajikistan (2)				
	Tonga (2)				
	Tunisia (2)				
	Uganda (2)				
	Ukraine (2)				
	Vietnam (2)				

Notes:

1. States listed alphabetically by cyber profile. Unless noted “cyber” state profile data is for year 2013. Symbol next to State name indicates year: # 2012; § 2011; ^ 2010.
2. Number in parenthesis refers to “real” state profile type. Unless noted “real” state profile data is for year 2014. Symbol in parenthesis indicates year: * 2013; # 2012; § 2011; ^ 2010.
3. See Appendix 3 for a list of states with missing data.

This leads us to the question: Is the state’s propensity to expand in the traditional domain similar to, or congruent with, the expansion propensity in the cyber arena? Some inferences can be derived by comparing expansion in these two domains, but differences in indicators and metrics make it difficult to compare the indicators, and force us to focus on the within-domain inferences as well as the differences in states posture, both within and across domains.

When we consider the ranking of states by expansionist tendencies, in Figure 2 below, several results stand out: China has the greatest propensity for expansion in the real and the cyber domains, the United States ranks second, and third is India. We can identify the leading master variable in each case, which for space limitations, we do not discuss here. When we come to the ranking states situated from the fourth position onward, we find notable differences in cross-domain postures. Note the differences in rankings of Russia and Italy in the real vs. the cyber lateral pressure.

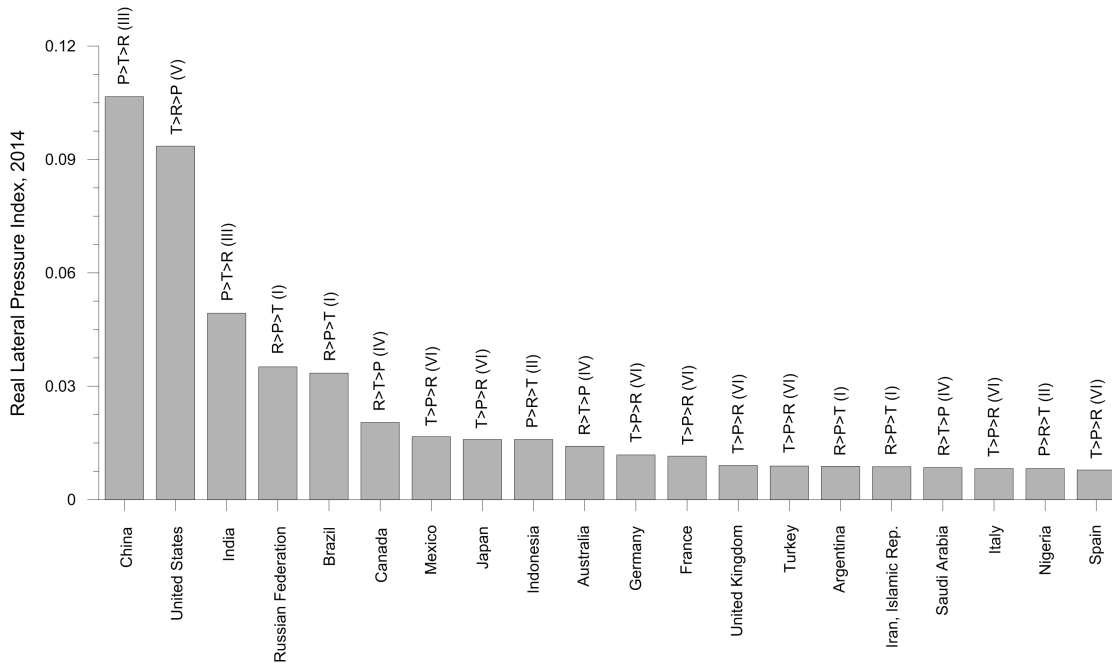


Figure 2: Top-ranking states ordered by "real" lateral index and identified by "real" state profile type.

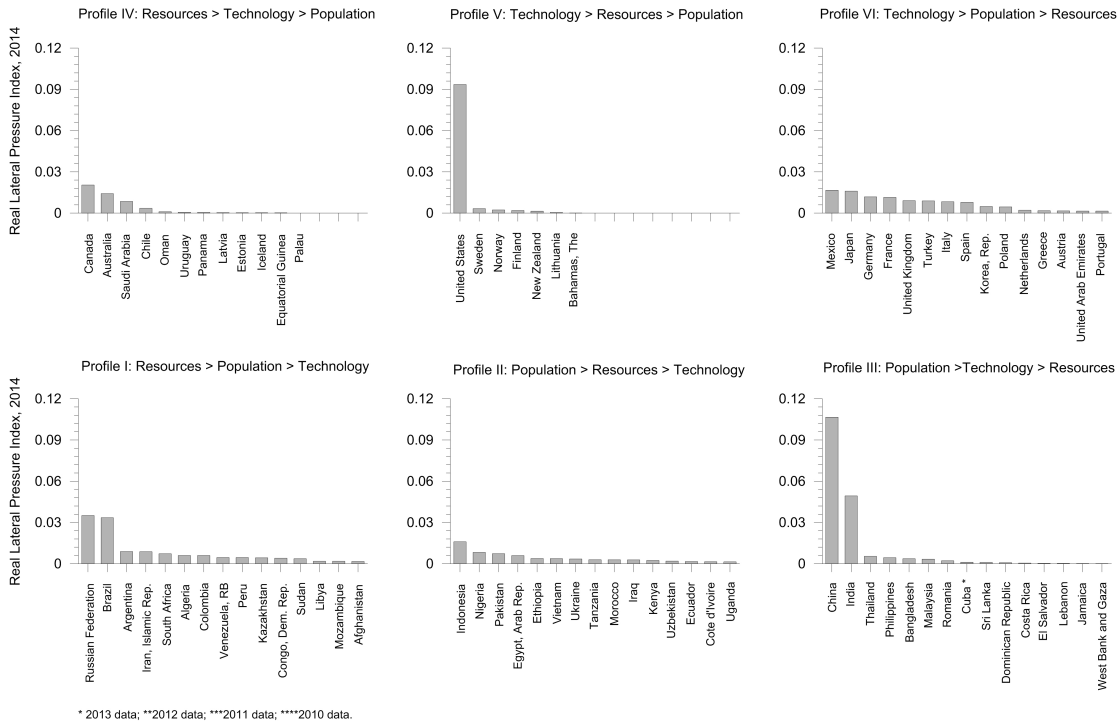


Figure 3: Top-ranking states ordered by "real" lateral index for each "real" state profile type.

In the Figure 3 below we display states along their real lateral pressure Index differentiate in terms of profile type defined in Table 1 above (with technology in the diagonal).

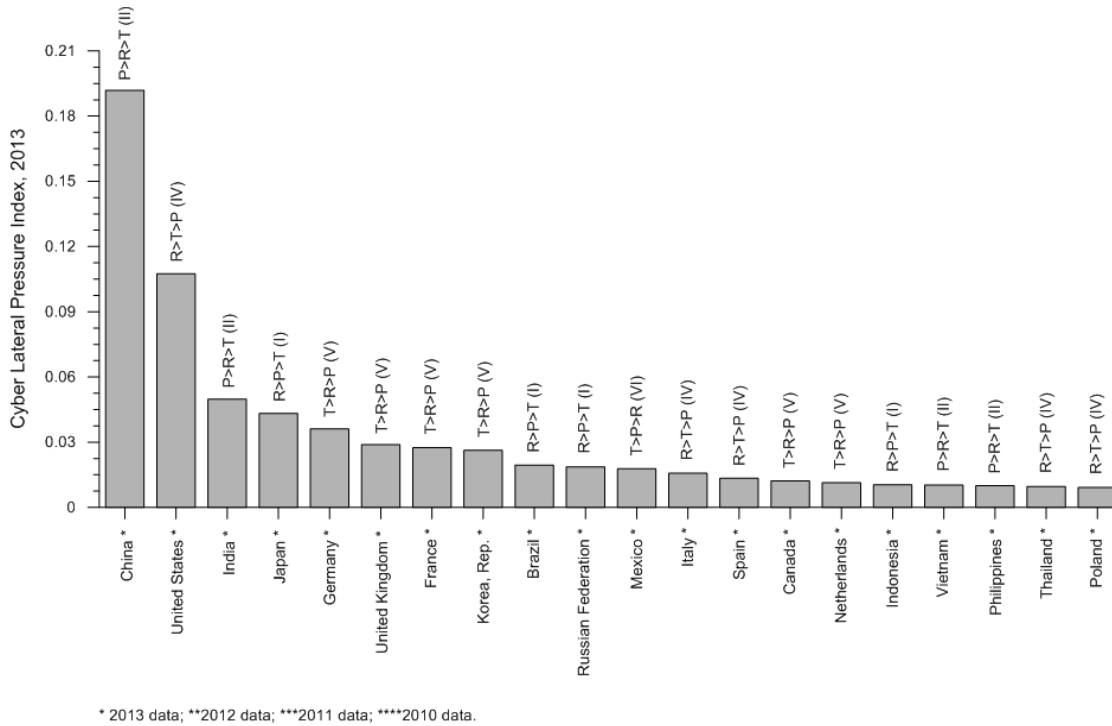


Figure 4: Top-ranking states ordered by cyber lateral index and identified by cyber state profile type.

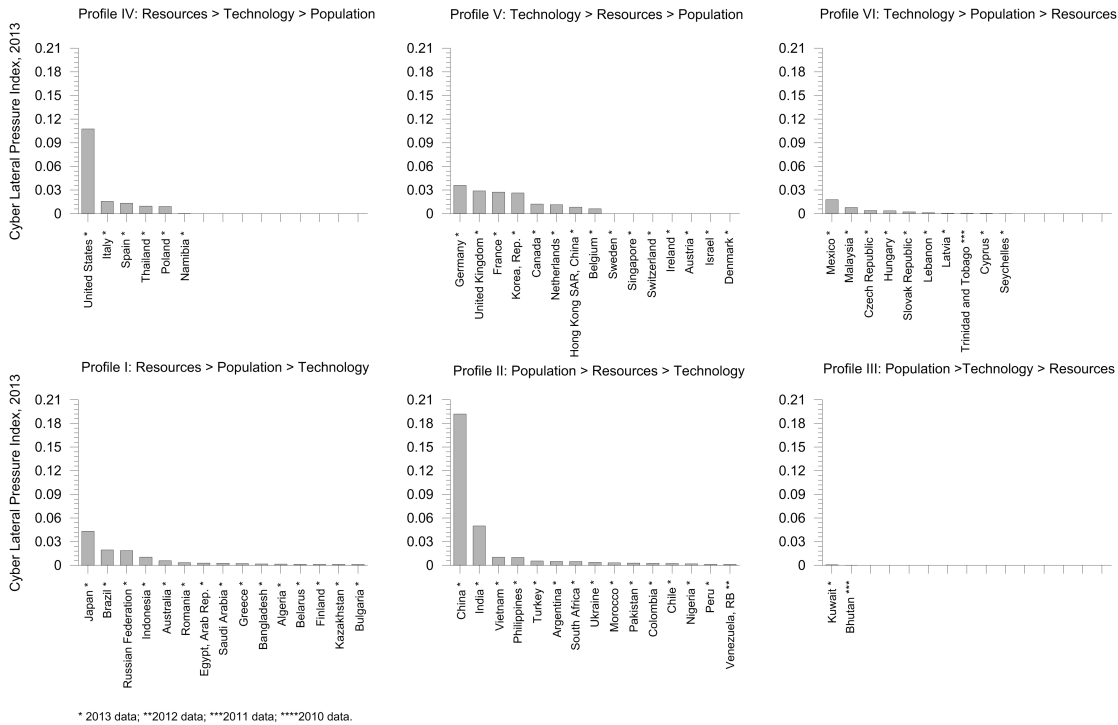


Figure 5: Top-ranking states ordered by cyber lateral index for each cyber state profile type.

We now turn to propensity for expansion in the cyber domain. The Figure 4 displays the top 20 states with the highest propensity for cyber-domain expansion, as well as their cyber profile type. In this connection, clearly Vietnam has a notable cyber presence. Iran, by contrast, shows no visible propensity for expansion in the cyber domain.

The Figure 5 shows states ordered by the cyber profile and differentiated in six profiles. Note. The case of Saudi Arabia, relative to its real lateral pressure index the Kingdom demonstrates little if any propensity for expansion in the cyber arena.

This still leaves us with the question: are the *overall* lateral pressure patterns similar or different when they are manifested in “real” versus “cyber” contexts? The figures above suggest that when viewed at the state level, the answer is: it depends on the state, but in general there are variations across the two domains. The Figure 6 below provides a system-wide view and on this basis alone, it is fair to infer that, at the the international level of analysis, the trends are generally similar. China still retains its position aof greatest propensity for expansion in the real and the cyber arenas.

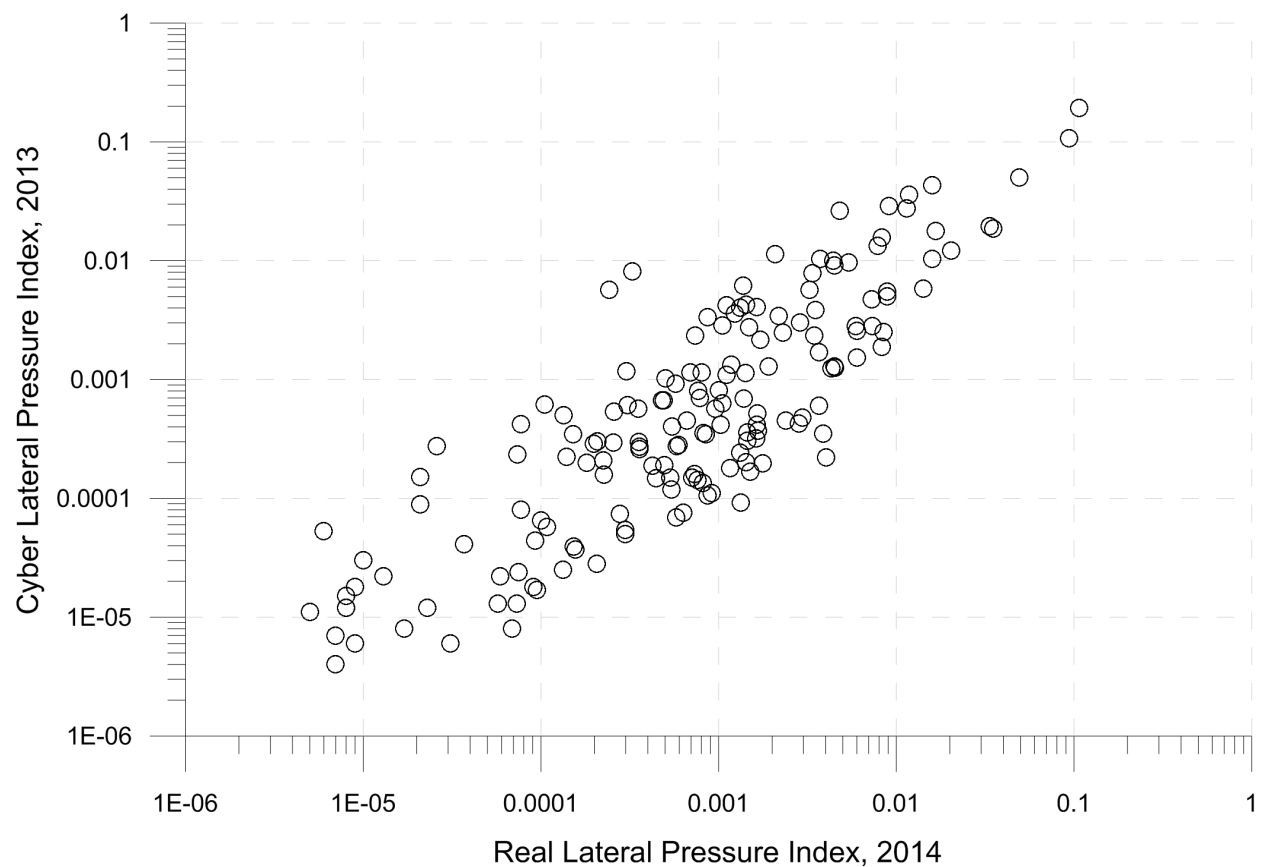


Figure 6: Comparison of “real” and cyber lateral pressure index for states (logarithmic scale).

At this point, these patterns appear fairly robust. We have remained as close to the empirical data as possible, without resorting to added assumptions at the basis of statistical inferences or dynamic modeling. The reason is this: It is important to obtain an empirically based

view of the new domain of interaction. We have encountered the same challenge when we considered the impacts of states on the natural environment. At that time, scholars of international relations had not yet begun to address the environmental aspects of world politics—how the state system affects the natural environment, and how the natural can influence power and politics among states. At this point, no one considers the natural environment to be invariable. Thus the development of environmental metrics many years ago enabled our understanding of the state-environment interactions. The same may well hold for our understanding of the cyber domain.

V. End Note: What Next for Lateral Pressure Theory?

It should come as no surprise that the next steps in lateral pressure theory and quantitative analysis amount largely to connecting the dots, closing the loops, and addressing critical imperatives of the 21st century. Quantitative analysis will follow this general trajectory as we began to appreciate the implications of the constructed domain, the endogenization of the environment, the salience of sustainability and, increasingly, the inevitable imperatives of cybersecurity.

In many ways Figure 6 above signals a major new challenge for international relations theory and policy. This figure displays some notable “spillover effects” across the three domains. The next challenge is to gain better understanding of (a) the dynamics of lateral pressure in each of the three domains, (b) the ramifications for the international system as a whole in terms of conflict and cooperation; (c) the internal effects (if any) of the forgoing of lateral pressure and attendant ramifications, (d) the impacts of and for state-firm interactions and, to the extent possible, (e) assessments of system sustainability at all four levels of analysis and across the three domains of interaction – the human system, cyberspace, and the natural environment.

Appendix 1

Table below lists the indicators used for calculating Master Variables for “real” state profiles. By necessity, for the cyber domain, we have used a different set of variables that reflect access to and participation in the cyber arena as shown in the table below.

Table A1: List of variables used for “real” and cyber lateral pressure index

Master Variable	Real	Cyber
Population	Population, total	ICT Population, total
		Fixed-telephone subscriptions
Resource	Land area (sq. km)	Mobile-cellular telephone subscriptions
		Fixed (wired)-broadband subscriptions
		Wireless-broadband subscriptions
Technology	Gross Domestic Product	ICT Goods Exports
		ICT Service Exports

In order to standardize the Lateral Pressure methodology, and add consistency and convenience for data extraction, following two sources:

- *World Development Indicators* (The World Bank, 2016), and
- *World Telecommunication/ICT Indicators database* (International Telecommunications Union, 2015).

All price data used for calculating master variables are in constant US dollar. Normalization of the selected indicator ensures that the master variables are (1) of same order of magnitude, and (2) independent of their units of measure. This step ensures that lateral pressure profiles of different states are comparable and meaningful.

Appendix 2

Table A2: States with different “real” and cyber state profiles.

		Cyber State Profile			
R>P>T (I)	P>R>T (II)	P>T>R (III)	R>T>P (IV)	T>R>P (V)	T>P>R (VI)
Antigua and Barbuda (6)	Argentina (1)	Bhutan [§] (1)	Italy (6)	Austria (6)	Latvia (4)
Armenia (2)	Bahamas, The (5)	Kuwait (6)	Namibia (1)	Barbados (6)	Lebanon (3)
Australia (4)	Belize (1)		Poland (6)	Belgium (6)	Malaysia (3)
Bahrain (6)	Bolivia (1)		Spain (6)	Bermuda (6 [*])	
Bangladesh (3)	Brunei Darussalam (6)		Thailand (3)	Canada (4)	
Benin (2)	Chile (4)		United States (5)	Costa Rica (3)	
Bulgaria (2)	China (3)			Denmark (6)	
Burkina Faso [^] (2)	Colombia (1)			Estonia (4)	
Burundi (2)	Djibouti [^] (1)			France (6)	
Cambodia (2)	Dominica (3)			Germany (6)	
Comoros [#] (2)	Dominican Republic (3)			Hong Kong SAR, China (6)	
Cote d'Ivoire (2)	Fiji (1)			Iceland (4)	
Croatia (6)	Guyana (1 [*])			Ireland (6)	
Egypt, Arab Rep. (2)	India (3)			Israel (6)	
El Salvador (3)	Jamaica (3)			Korea, Rep. (6)	
Ethiopia [#] (2)	Kyrgyz Republic (1)			Luxembourg (6)	
Finland (5)	Montenegro (1)			Malta (6 [*])	
Ghana (2)	Oman (4)			Mauritius (3)	
Greece (6)	Panama (4)			Netherlands (6)	
Grenada (3)	Paraguay (1)			Portugal (6)	
Guatemala (2)	Peru (1)			Singapore (6)	
Honduras (2)	Philippines (3)			Slovenia (6)	
Indonesia (2)	Qatar (6)			Switzerland (6)	
Iraq [#] (2)	South Africa (1)			United Kingdom (6)	
Japan (6)	St. Kitts and Nevis (6)				
Lesotho (2)	St. Vincent and the Grenadines (3)				
Lithuania (5)	Sudan (1)				
Macao SAR, China (6)	Suriname (1)				
Moldova (2)	Turkey (6)				
New Zealand (5)	Tuvalu (3)				
Romania (3)	Vanuatu (1)				
Samoa (2)	Venezuela, RB [#] (1)				
Saudi Arabia (4)	West Bank and Gaza (3)				
Serbia (2)	Yemen, Rep. (1 [*])				
Sierra Leone (2)	Zambia (1)				
Sri Lanka (3)					
St. Lucia (3)					
Tanzania (2)					
Togo (2)					
Uruguay (4)					

Notes:

1. States listed alphabetically by cyber profile. Unless noted “cyber” state profile data is for year 2013. Symbol next to State name indicates year: # 2012; § 2011; ^ 2010.
2. Number in parenthesis refers to “real” state profile type. Unless noted “real” state profile data is for year 2014. Symbol in parenthesis indicates year: * 2013; # 2012; § 2011; ^ 2010.
3. See Appendix 3 for a list of states with missing data.

Appendix 3

Note on Missing Data.

States with missing data to generate a “real” state profile include:

American Samoa; Angola; Aruba; Cayman Islands; Channel Islands; Curacao; Faeroe Islands; French Polynesia; Greenland; Guam; Isle of Man; Korea, Dem. Rep.; Liechtenstein; Monaco; Myanmar; New Caledonia; Northern Mariana Islands; San Marino; Sint Maarten (Dutch part); Somalia; South Sudan; St. Martin (French part); Syrian Arab Republic; Turks and Caicos Islands; Virgin Islands (U.S.)

States with missing data to generate a cyber state profile include:

American Samoa (n/a); Andorra (6*); Angola (n/a); Aruba (n/a); Cayman Islands (n/a); Central African Republic (1); Chad (1); Channel Islands (n/a); Congo, Rep. (1); Cuba (3*); Curacao (n/a); Eritrea (1§); Equatorial Guinea (4); Faeroe Islands (n/a); French Polynesia (n/a); Gabon (1); Greenland (n/a); Guam (n/a); Haiti (2); Iran, Islamic Rep. (1); Isle of Man (n/a); Korea, Dem. Rep. (n/a); Kosovo (3); Lao PDR (1); Liberia (1); Libya (1); Liechtenstein (n/a); Maldives (3); Marshall Islands (3); Monaco (n/a); Myanmar (n/a); New Caledonia (n/a); Northern Mariana Islands (n/a); Palau (4); Puerto Rico (6*); San Marino (n/a); Sint Maarten (Dutch part) (n/a); Somalia (n/a); South Sudan (n/a); St. Martin (French part) (n/a); Syrian Arab Republic (n/a); Timor-Leste (2); Turkmenistan (1); Turks and Caicos Islands (n/a); United Arab Emirates (6); Uzbekistan (2); Virgin Islands (U.S.) (n/a); Zimbabwe (1)

Notes:

Number in parenthesis refers to “real” profile type. Unless noted “real” state profile data is for year 2014. Symbol in parenthesis indicates year: * 2013; # 2012; § 2011; ^ 2010.

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