Long Term International Security:
the International Futures Simulation and Emerging Global Order

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Short Abstract

This paper discusses the National Intelligence Council's "2020 Report," the publicly available computer simulation employed, the nature of its alternative national security futures, and the need for greater public education about this work.

Abstract

The National Intelligence Council's website features its 2020 Project report*, Mapping the Global Future*. This report employs a global model available to the public and provides a glimpse of several alternative futures and their national security implications. This paper discusses the computer simulation employed Hughes' IFs (International Futures simulation), the nature of IFs' alternative futures constructs in a national security context, the vital need for the production of this type of information about long term trends and options at all levels of politics from the global to the local, and the need for widespread education of the public in the application of such models. It is noted that while more than thirty years of global modeling efforts involving all major international actors has yielded substantial progress in organizing our knowledge of global dynamics and trends, the ability to use such models effectively is limited by inadequate biosocial theory, political philosophy, understanding of interlaced paradigms embedded in the construction and application of global models, and the inadequate application of decision sciences to policy analysis. A promising approach to the decision sciences issue, namely Tom Saaty's analytic network process, is discussed.

Introduction

Dated December 2004, the NIC publication, *Mapping the Global Future*, is unlike the two previous reports in that it was associated with the use of the *International Futures simulation (IFS)*, a global model designed by Barry Hughes. Hughes' has worked for about a human generation on this model; and he involved dozens of scholars (and students that became scholars) and researchers from many if not most social sciences. It was only with such steady, systematic, and painstaking work that he could even begin to encompass just some of the key features ("drivers" in the current vernacular) of human biosocial[1] systems. These presently include components of demographic, economic, agricultural, energy, environmental, social value change, science and technology, and domestic and international political systems. IFs remains very much a work in progress, yet to my knowledge it is the most valuable such work in existence today, and certainly the only one publically available.

The collaboration of Hughes and Hillebrand with the IFs model on the 2020 Project, and the construction of scenarios and sharing of the data, model and results with the world via an Internet website, represents I believe a remarkable paradigm shift. It strengthens enormously the case for constructing a new form of globalized policy analysis. I suspect that this Kuhnian (1962) paradigm shift or exemplar is due ultimately to the pressures on

governments in this century to adapt to continually changing technologies of economic production and communication as well as shifting distributions of these capabilities across geographic regions, and with their myriad implications for cooperation, competition, and conflict at all levels of our globalizing civilization.[2] For the security and survival of political elites and political systems, existing complex change requires an intelligence community that can assimilate information about complex change, anticipate implications, and most critically, acculturate leaders to the realities of change in their power to shape their future and the future of those on whom they depend and who depend on them.

As with most paradigm shifts, a major change in how we view problems is at its core. Hughes has regularly visited three questions: Where are we headed? Where do we want to go? What leverage do we have for changing direction? He has focused primarily on the first and third questions, leaving the second to those who would use IFs to construct and evaluate alternative futures. But who are the intended users? In the NIC 2020 report, it is fairly clear that the intended users are national and international policy analysts and those that rely on them for "intelligence." The dissemination of the model and applications to construct alternative futures, however, confirms their stated intention to be far more inclusive, to broaden both the domain of users and the issues addressed at all levels from global to local,[3] as well as to encourage participation in the further development of the model and global modeling in general.

In the process of exploring this paradigm shift, three problem areas emerged that require attention:

1. Absence of adequate theory to guide the development of global models,
2. Absence of an organizational network and institutional system capable of evaluating, developing and applying global modeling to practical political and social problems, and
3. Inadequate understanding of the nature of interlocking paradigms in the social sciences, in social and political philosophy, and in the actual practice of politics.

I have addressed some of the general theory construction issues elsewhere (Chadwick, 2000). In this paper, I will address the second and third, and offer some suggestions.

Why a Global Modeling Approach?

Why was it that the CIA and NIC would turn to global modeling as an intelligence source that might prove useful for constructing and analyzing alternative futures? Hughes, a professor, and Hillebrand (2006), recently from the CIA's Strategic Assessments Group, do not discuss this matter directly. However, in *Global Trends 2015*, mention is made of the "seven key drivers of global change: demographics, natural resources and the environment, science and technology, the global economy and globalization, national and international governance, future conflict, and the role of the United States."[4] Since all of these "drivers" are represented as variables or parameters in the IFs model, it isn't difficult to see why the interest would develop.

For those already convinced of the value of a global modeling paradigm for decision making, the core reason is straightforward enough: forecasting trends, designing alternative futures, and assessing their relative desirability and feasibility, is best accomplished with global models because of their capacity to represent complex biosocial system mathematically and hence to produce specific quantitative statements

about alternative futures. It would be presumptuous, however, to leave this statement unexplicated and unchallenged. Global modelers themselves have indicated their own perplexity regarding the state of their art (Meadows et al., 1972, 1982). The history of global modeling suggests that there is a long way yet to travel to address such fundamentals as data reliability, theory validity, and cultural comprehensiveness; the old adage “trust but verify” applies.

Early in the development of global modeling, one could even question the whole enterprise or "project" on grounds not only of technical error, data unreliability, and theoretical validity, but also its philosophical underpinnings and political motivation. It was even suggested that the first Club of Rome sponsored global model (World3) was motivated by the messianic zeal of its developers as modern environmental "chiliasts" pursuing an environmentalist agenda (Harvey Simmons, in Cole et al., 1973, 207).[5] It is fairly well recognized that this sort of criticism is often explainable as a characteristic response rooted in the fear people experience when encountering a disorienting paradigm shift.[6] It is noted elsewhere (Chadwick, 2000) that the *Limits to Growth* (Meadows et al., 1972) model, World3, excited many of the major powers to replicate and extend their work because of the fear that the Meadows' team just might be right in their anticipation of a global economic catastrophe near the middle of this century. Reports on these modeling activities in various countries include Barney (1980) on the USA, Brecke (1995) reporting on the USSR's modeling in the 1980s, Bremer (1987) in Germany reporting on the GLOBUS model, Herrera's (1976) reporting on the Latin American World Model, LAWM, developed at the Bariloche Institute, the UK SARUM model (1976, 1978) developed by Peter Roberts and Kim Parker, the Australian adaptation of SARUM, rechristianed AREAM (Poldy, 1986), Gigengack's (1987) reporting on Dutch adaptation of AREAM and my own contribution to embed L.F. Richardson's "arms race" model in AREAM, Onishi's (1977) development of the FUGI model, and others. All can trace their roots to the Club of Rome's World3. Hughes and Hillebrand (2006) similarly acknowledge the origins of Hughes' work in the Club of Rome's WIM model (Mesarovic and Pestel, 1974) and in the many modeling works that followed it such as Mesarovic's Globesight model.

After a review of the early spread of global modeling efforts by governments for applied policy analysis to assess the likelihood of global threats to survival and security, and to avert such disasters, one might conclude that no significant paradigm shift has in fact occurred. However, note that the IFs model and the original World3 model have continued to be both publically available and kept up to date. Most of the rest have been either neglected or supplanted by rather tightly held if not classified versions.[7] The practice of having a major instrument of public policy analysis and strategic thinking available in the public domain for the general reader to access is pathbreaking, a true paradigm shift. It is analogous to the open source movement in the software industry. As Hughes and Hillebrand (2006, 4) put it, "One of the best decisions ever made in the IFs project was to make the system freely available for users and thereby to create a huge network of participants in its development." It is precisely this openness that is unique and rises to the level of a paradigm shift in practice. One can certainly also point to the rise of the Internet, the exponentially growing capacity of computers, and the evolution of software, as factors that have amplified the importance of this shift. But without this critical, perhaps one time, change in intelligence community's practices, one can infer by comparison with other global modeling efforts what the effect of not being open would likely have been.

To better appreciate the predicament intelligence communities find themselves in regarding the openness of global modeling, and why global modeling is gaining ground despite the complex of problems attendant to it, consider first the intelligence community's core problem as proposed by Sherman Kent in 1951 (quoted by Donald Steury):

> If we think of a national security strategy (or policy) as a blueprint for preserving the life and health of a nation, then there must be some idea of what that nation is: why does it function, how does it function, and what is essential to its survival? Conversely, a strategy to confront another nation in conflict--be it in war or cold war--must consider the strengths and weaknesses of a potential opponent in detail. Central to both lines of thought is a general conception of national existence: what comprises the nation-state, what makes it strong, and what is necessary to its survival and prosperity.
> ……
> In its most elevated form, it considers the nation-state to the depth and breadth of its being. This is what Sherman Kent called a nation's strategic stature: not just the means it possessed to wage war, but its total potential for war--the resources that are available, or might be made available; the population, industrial plant, and transportation net; the political and social structure, their stability, and the "moral quality of the people and their strength of values"--their willingness to be mobilized for war and the reasons for which they would fight--and, lastly, the political leadership, their strength and "genius (or want of it) for organizing men and materials into a community of life and strength." [8]

Kent's understanding of the core purpose of an intelligence community for a nation state shaped the evolution of the CIA for several decades, in part through his leadership in producing NIEs. His leadership experience gave him an acute awareness of a need for the development of a collective history of intelligence gathering, analysis, and utilization, a kind of "house organ literature" as he called it.

> The sort of literature I am talking about is of the nature of house organ literature, but much more. You might call it the institutional mind and memory of our discipline. When such a literature is produced, it does many things to advance the task.
> The most important service that such a literature performs is the permanent recording of our new ideas and experiences. When we record we not only make possible easier and wider communication of thought, but we also take a rudimentary step towards making our findings cumulative. We create a stock of relatively imperishable thinking that one man can absorb without coming into personal contact with its originator and against which he can weigh and measure his own original ideas. His large or small addition to the stock enriches it. The point is reached where an individual mind, capable of using the stock, can in a day encompass the accumulated wisdom of man-decades of reflection and action.

Kent goes on to discuss the character of such a literature regarding "first principles" (missions and methods), conceptual frameworks ("definition of terms"), and ongoing "elevated debates" regarding mission, methods and conceptual frameworks. Regarding the cost of producing such a literature, Kent states that "so far, we of the Western tradition have found no faster or more economical way of advancing our understanding. This is the way by which the Western world has achieved the knowledge of nature and humanity that we now possess."[9]

At the time of his writing, Kent could not foresee the development of biosocial theory and computer technology that would revolutionize how data could be gathered, analyzed, and used for his intended purposes. In retrospect, one can envision global modeling providing the core technology for his "house organ literature." Every equation in global models represents a "bottom line" assumption accepted in some demographic, economic, political, agricultural, environmental, or international system theory. Every datum represents some feature of the world system as best estimated as the modeler knew how to or had the time to acquire. And every use of a global model represents some choice of one or more analysts to provide a best estimate of one or more alternative futures given some tasking by some relevant political-military community or leader. Global modeling is certainly consistent with the need to "create a stock of relatively imperishable thinking," and to "encompass the accumulated wisdom of man-decades of reflection and action."

So what are the "drivers" or motivators for global modeling itself? First, intelligence failures that are threatening security and even survival, and which are attributed to a failure of comprehension brought about by inappropriate use or nonuse of human and technical resources. Ever since the Club of Rome advanced the idea that the "world problematique" was too complex for anything but a formal modeling approach to cope with, even for such a relatively limited application as estimating change in the price of oil for a few decades (Meadows, 1972), global models have been on the one hand sought after, and on the other hand, all but ignored by top level national leadership communities.

Second, misuse or disuse of existing intelligence. Even when global models clearly indicate problems ahead, as was the case with the Russian global modeling team,[10] their use is far from certain. Their work can be derided as it was in Russia *before* the collapse, or a modeling team can be faced with outright hostility as it was in Argentina.[11]

A similar type of problem is rooted in the inability of anecdotal evidence, in contrast with systematic analysis, to provide specific, quantitative, inferences. A variation on this general problem is epitomized by the following type of interesting and almost self-evident assertion (this one, ironically enough, drawn from the inaugural workshop of the 2020 Project itself).

> Many argue that the current wave of globalization will continue to spread unchecked because we live in a world connected by telecommunications and mass media. This is fallacious. The world of the early twentieth century was connected by the new inventions of telegraph and telephone, and yet World War I stalled the spread of globalization.[12]

Here, an implicit analogy is made between the emergence of telegraph and telephone pre-World War I and the emergence of computers and the Internet today, both of which contributed to globalization trends. This observation is coupled with the implication that a large war could halt current globalization processes just as, putatively, World War I did (usually based on radical reduction in trade flows and GDP growth). A global modeler might note the exponentially bigger modern communications networks compared with pre-World War I, and further, contrary to the hypothesis, that globalization may have been given a boost not only by World War I but also World War II and the Cold War because all these conflicts (1) stimulated scientists and engineers to increase communications capabilities and (2) radically reduced colonizers' control of colonized

territories (the colonizers' version of "globalization") while at the same time decreasing the economic value of and increasing the cost of maintaining colonies. The modeler would have the distinct advantage of being able to assess such trends quantitatively and execute interrupted time series analyses to ascertain whether and to what degree each assertion was empirically correct.

Failures in international politics over the last century are frequently attributed to prejudices of leaders, biases in decision making practices, personality disorders and misperception. I suggest that a better explanation may lie in the overwhelming variability and complexity of our emerging global system. By contrast, Stoessinger (2005) theorizes that misperception of relative power is a primary factor in losers starting wars. Janis (1983) theorizes that groupthink (the substitution of consensus seeking behavior for critical thinking) biases leadership groups to adopt unchallenged the whims of a leader. Jervis (1968) asserts that people have a preference for cherished beliefs, even when confronted with dissonant facts. All these hypotheses are fairly well accepted in modern political analysis. Alternatively, consider that perhaps it is just too painful to admit the contrary rival hypothesis that we are collectively over our heads, that we are beyond the point where habit and instinct are helpful, but not yet at the point where we can adequately reason our way through the world problematique. In this sense, global modeling offers a path to reason, one that L.F. Richardson (the first modern systems modeler) recognized in the value of his "arms race" equations. In a Socratic dialog between himself and a king, Richardson (1960) reasoned that his equations, simply because they were deterministic in form, by no means implied that we were mere creatures of habit and instinct. Rather, the equations implied that if we did not make a sufficiently determined, moral effort to use our reason, our habits and instincts would take over and we would be either their victims or beneficiaries depending on circumstances. Perhaps in the end, the principal "drivers" for global modeling are the complexities of the world problematique, our growing capacity to comprehend the "problem complex" through collective modeling efforts, and the growing realization that sociopolitical catastrophes are avoidable if we seriously use global modeling to construct complex alternative futures for decision making.

Interlaced Paradigms in Global Modeling

Global modeling is not simply about constructing equations interrelating variables and estimating parameters and constants by employing statistical techniques with sufficient data. It is just as much about directly embedding cultural norms and values, and the ultimate concerns[13] we have, hence even our faith.[14] Barney and others (1993) have addressed this issue in some depth.

Consider, for example, the use of a global model to infer consequences of a particular set of alternative policies being considered for adoption by a major power. Policies are usually embedded in a global model by altering parameters in equations interrelating variables which a decision making community wishes to influence, for instance, taxing a population to pay for a military buildup. Both tax rate and allocation of taxes to military spending are "parameters" subject to policy manipulation.[15]

This simple illustration can be dissected into three distinct paradigms corresponding to the disciplines from which they emerge.

- The "science" paradigm produces the variables, equations, and initial parameters, based on the collection and analysis of data believed to represent essential features of the global system.
- The "applied" paradigm is used to select parameters for manipulation.[16] Such selections are based on the desires of leaders to construct futures more to their liking than the one represented by initial conditions and trends. Note that the selection of parameters to manipulate is a distinctly different operation from the construction of the model by a scientist. The scientist as empiricist is concerned about getting an accurate representation of a real world system.[17] The practitioner is interested in nudging the to model to produce desired changes which could be reproduced in the real world system. The relationship between the two is analogous to, say, a piano builder vs. a songwriter using a piano. The parameters are the piano keys.
- The third paradigm is that of the philosopher, whose orientation it is to inquire into the practitioner's visions and beliefs, and the scientist's theories, then to note dissonances or inconsistencies and suggest new lines of inquiry and alternative future constructs. To continue the armaments illustration, the philosopher might look at the practitioner's manipulation of parameters such as a reaction coefficient, and inquiry as to why one is changing it. It may be that the assumption(s) the practitioner is making about the consequences of altering it are fallacious, or at least inconsistent with the scientist's.

Each paradigm has a different mode of relating to reality. The scientist's mode is to seek understanding, the practitioner's is to seek change, and the philosopher's is to seek transcendence of conceptual frameworks that produce dilemmas, paradoxes, irrationalities and so on. Correspondingly, each paradigm makes assumptions the others question. For the scientist, culture is a given, not subject to change. For a practitioner, theory is a given. For the philosopher, data is a given. Thus within the framework of their own paradigms, communications between scientists, philosophers and practitioners are easily derailed or deflected into arguments over what to take for granted or assume, and what to hold up to question.

What this boils down to is that the global modeler as scientist will be concerned with making the model more comprehensive, more valid, and more reliable in the sense of accurately describing reality. Once the parameters are estimated, the modelers work is essentially done. What policies to represent and why are the concerns of the practitioner. Similarly, the practitioner is concerned with the model only to the extent there is some suspicion that it produces unreliable or invalid results leading to lost opportunities at best or disaster at worst. The philosopher is less concerned with the descriptions of alternative futures than with the thought process that produced them, i.e., why some parameter changes were done to the model and not others, and the underlying constraints or habits of thought and action that produced them.

Note that as we move from the science paradigm to the practice paradigm to the philosophy paradigm, we distance ourselves increasingly from the decision support system that the IFs provides. The effort to produce IFs has focused primarily on getting the best grounded (scientific) theory and empirical data into the model while minimizing errors of commission and omission. The secondary effort but still critical for application, has been to improve the decision support for the model, i.e., the user interface that makes the parameters available for policy alternatives analysis and the results of parameter changes. The tertiary effort, yet still critical for the widespread dissemination,

understanding, and qualitative improvement of IFs, has been to inject value-focused thinking[18]

These differences in orientation have some fairly obvious implications for IFs. For instance, at present the four NIC 2020 scenarios are represented ("Cycle of Fear," "Davos World," "New Caliphate," and "Pax Americana") on the website and textbook only in passing reference. A detailed comparison of parameter variations and their underlying philosophy and assumptions would seem an obvious thing to lay out, but I haven't been able to locate such. What is vital to a practitioner is trivial to a scientist. Similarly, a discussion of just why one would make the "New Caliphate" assumption (a new Mideast leader arises who unites the Arab world), what likelihood is attached to this "wild card" scenario, and what the implications would be in the IFs context, are not discussed. These limitations are symptomatic of the general problem of communication across paradigms.

A Modest Proposal for Decision Aids and Theory Construction

How can one organize the parameters in IFs so as to make the model more accessible for policy analysis purposes? Hughes and Hillebrand feature what is referred to as framing assumptions and a "scenario tree" (credited to Mohammod Irfan) for constructing unique runs of the model. A goal specification is possible now in the model to track relative success of scenarios for achieving a goal. However, little attention is paid to the interface problem of matching parameters with policies and goals. Saaty (2005) developed the "analytic network process" which provides a vehicle enabling the representation of such matches, and a mechanism for recording preferences for a variety of alternative policies, goals or criteria. It is hard work is to sift through the parameters for those that could reasonably represent particular policies and goals, establish priorities, and specify the meaning of policy alternatives in terms of benefits, opportunities, costs and risks. Saaty's framework makes it possible to construct and share such complex considerations and choices.

Saaty's analytic network process provides us with a set of useful categories for evaluating the consequences of IFs parameters changes. Answers are sought to the following questions.

- What are the benefits to implementing particular parameter changes?
- What are the costs associated with the parameter changes?
- What are the risks incurred?
- What are the opportunities created?

In reviewing these questions, it would seem that the decision analyst is called upon to specific basic needs and the means available to attaining them. IFs does not provide a theory of means and ends as it were. The parameters are there, defining if you will a set of unknown risks and opportunities.

There are social science theories that could help an analyst clarify what benefits, risks and so on, are present, by providing a checklist of basic needs--what Hughes points to as sources of "leverage" and "drivers." For instance, considering goals, Maslow (1954)--well known to Hughes--developed a hierarchy of basic needs. This hierarchy could be used to order the value of benefits, costs, opportunities and risks attendant to any particular parameter change.[19] Considering what means may be available to the ends specified by Maslow, Lasswell and Kaplan (1950) provided a checklist of values, means

to ends as it were. They divided values into two categories, attributes and relations (they used the terms "welfare values" and "deference values" respectively). Attributes were wealth, health ("well-being"), skill, and knowledge (enlightenment)--essentially capabilities possessed by the individual, group, or community. Relations between people were classified as power (coercion), affection (attraction or repulsion), respect (socially expected), and moral (what is perceived to be of ultimate good). IFs parameters could be evaluated in terms of changes to each of these values and their implications for basic needs. Which needs are put at risk, benefited and so on, given a particular parameter change? How are values affected in terms of wealth or power? IFs already is used to answer such questions, but in the absence of such analytic frameworks as Maslow's and Lasswell's, perspective may be lost because questions are not asked.

Conclusion

Considerations of long term international security push us to the limits of our social science knowledge, understanding of decision making, and how our various forms of collective decision making work or fail to work. The International Futures simulation as applied to scenario construction around particular "what ifs" is a large step forward in grasping the long term, large scale implications of decisions taken in the here and now. Nevertheless, for all its strengths--and there are many--there are fundamental questions that can and should be raised and addressed. One of these is the paradigm interlacing that takes place between the science paradigm embedded in modeling social system dynamics, the practice (*praxis*) or social engineering paradigm embedded in constructing decision making situations or scenarios, and the philosophy paradigm which transcends both science and *praxis* to raise questions of perspective so vital to envisioning alternative futures. IFs is strongest in its science paradigm application, in need of substantial development in the praxis or decision making dimension, and weakest in embedding philosophical analysis in its framework.

A second major set of questions relate to the needs of the target "user community." "Leverage" is a key concept in IFs development, but "leverage" (or advantage) for whom, for what? Analyzing "leverage" into its useful components would be helpful. Saaty's analytic network process would dissect leverage into benefits, costs, opportunities and risks, and interpret the causal model structure of IFs in terms of means and ends. Maslow's basic needs model illustrates "ends" analysis, and Lasswell's value checklist illustrates means analysis. Hughes has pioneered indefatigably the development of IFs, and the Hughes-Hillebrand team has brought IFs and global modeling generally back into the light of day and right where it belongs, in the national security intelligence mix, doing its part to evaluate the implications of a variety of alternative futures scenarios (the "New Caliphate," "Davos World" and so on). Looking at the state of parameter organization and the near absence of decision aides, both in terms of logical reconstruction Saaty style, and in terms of basic needs and values as illustrated by Maslow's and Lasswell's works, it is clear that while we're on the right track, we have miles to go before we can rest.

Abbreviations

AREAM - Australian Resources Environmental Assessment Model (Poldy, 1986)

CIA - Central Intelligence Agency, US Department of State
FUGI - Future of Global Interdependence (Onishi, 1977, 1994)
IFs - International Futures simulation (Hughes' model, various years)
LAWM - Latin American World Model (Bariloche Institute model, Herrera, 1976)
NIC - National Intelligence Council
NIE - National Intelligence Estimate
SARUM - Systems Analysis Research Unit Model (UK government model)
WIM - World Integration Model (Mesarovic, 1974)

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Endnotes

[1] For those who might be wondering, this is not a neologism. Cf. *The Journal of Biosocial Sciences*. For a brief historical review of global modeling, its promise, limits, and needs if its core paradigm is to be developed further, see Chadwick (2000). The IFs model is available through the CIA's website, www.cia.gov/nic/, and directly at the University of Denver's website www.ifs.du.edu.

[2] Cf. the Executive Summary, NIC (2004).

[3] Local level application is not my focus here. For such, see my paper applying IFs to Hawaii, available at www.hawaii.edu/intlrel/IstanbulRevision2.doc .

[4] NIC (2004), p. 5. The quotation is from Robert L. Hutchings' cover letter to the document.

[5] The reality as I understand it was that the Club of Rome in the late 1960s and early '70s--mostly constituted by Alitalia Airlines, Volkswagen of Germany, and Fiat Motors--were interested in the availability of oil and its cost in the early 21st century because of plans to build huge airliners and concerns with operating costs of such aircraft. Forester's (1971) draft of a global model looked so promising that the Meadows' team was funded to bring it to completion.

[6] Cf. Kuhn (1962). Festinger (1957) explains this rejection as the consequence of "cognitive dissonance."

[7] The major exceptions are (1) the Mesarovic WIM model which became the Globesight Model with Pentagon support, and under UNESCO auspices has found use in university classes; and (2) the World3 model which has been revised, published and distributed once a decade since 1972.

[8] Quoted by Donald P. Steury, “Introduction” in Kent (1975), The original source of the quoted remarks is footnoted as HS/HC-7 CIA Progress Report; Office of National Estimates (ONE) Section I "Intelligence and the Problem of National Foreign Policy," 26 December 1951, p. 2; this document is also noted as not yet declassified. See http://www.cia.gov/csi/books/shermankent/intro.html#rft16.

[9] Kent (1955) quoted in Kent (1975), p. 15. See http://www.cia.gov/csi/books/shermankent/2need.html

[10] See Brecke (1995) for a review of the Russian global model developed in the 1970s and '80s.

[11] See Herrera (1976). My understanding is that the Bariloche team that created the LAWM model ran into trouble with the military junta because of particular implications of their model for economic development of Latin America when the price of land was set to zero. This could be an "urban legend" since I have no way to verify it at the moment; but it is consistent with the general pattern of modelers and leadership communities not really understanding one another (cf. Raju and MacRae, 1981). Many other examples exist. For instance, the Meadows' team was, in my opinion, smeared in the Cole et al. (1973) text mostly because of the fear that the Meadows might be right, that the global economy was headed for collapse with all the domestic political turmoil and international instability that might imply, unless action was taken to avert the collapse and soon, with all the attendant turmoil and instability that would entail.

[12] Harold James (2003) "The Lessons of History" quoted in "National Intelligence Council NIC 2020 Project: Inaugural Conference 6 November 2003" available at http://www.cia.gov/nic/PDF_GIF_2020_Support/2003_11_06_papers/2003_11_06_summary.doc

[13] See Paul Tillich (1957) for concept and usage; for a critical appraisal in the context of terrorism post 9/11, see Sam Harris (2004). Harris' cutting but not incisive critique of Tillich's view of faith, in my judgment simply reflects a secular worldview that disables an understanding of Tillich's insights. Nevertheless, Harris' focus provides a useful alternative light on those whom Eric Hoffer (1951) dissected in his one of a kind book, *The True Believer*. As such, Harris' insights provide an interesting focus for values modeling.

[14] IFs relates to values primarily through the World Value Survey (Inglehart, 1997); see Figure 10.8 for a summary of IFs built in value dynamics. Value change current in the model is pegged to GDP/capita growth and refers to average social value orientations, not to a leadership or policy analysis group attempting to benefit from IFs by constructing and evaluating scenarios and alternative futures.

[15] See Tables 4-4 and 4-5 in Hughes and Hillebrand (2006) for lists of about 72 and 56 IFs parameters of those most commonly and less commonly used respectively, to represent policies.
[16] This description of each of the paradigms and their meaning for various facets of a global model and its use, is necessarily simplified. For instance, the selection of parameters for manipulation is only one of many possible strategies for adapting a global model to explore a particular alternative future. Adding or subtracting variables, relations between variables, and altering data values are additional methods. Each method has its own framework for justification.

[17] The implicit contrast here is between the two major branches of the science paradigm, the empiricist and the theorist, the former being concerned with description that rises to theoretical significance, the latter being concerned with theory construction the rises to empirical testability.

[18] Cf. Keeney (1992, 2001). Saaty's latest framework, the analytic network process, implicitly incorporates Keeney's core points.

[19] We are all familiar with the hierarchy. In order of priority when threatened, survival comes first, security second, identity communities third, self-respect fourth, and self actualization last. What is not usually noted is the implications for sacrifice. What are the conditions under which individuals and societies are willing to give up a basic need? For instance, is self actualization sacrificed when self respect is threatened? How is this choice represented in IFs? The point is that a theory of goal formation and goal sacrifice is needed.