

November 11, 2005

Dear Friends,

The October 14<sup>th</sup> meeting on Forward Engagement/Foresight in Governance was an excellent, intense discussion. I'm attaching a stripped down account of the main points, along with a couple of attachments that complete the record. This account is not meant to be verbatim, but rather an effort to present the kernels of participants ideas. If I have missed anything or failed to characterize ideas accurately, please let me know and I will correct the record.

I am really not sure whether detailed minutes of a meeting do much good for participants other than the chair: but they helped me greatly. In the process of revisiting our discussion, and of editing the record, it became clear to me that certain basic themes were present, and that these ought to be highlighted. The take-away points are:

- Attitudes towards forecasting ranged from skepticism based on some notorious failures to growing confidence, based on the increasing power and sophistication of models.
- Some of us are professionally engaged in the development of forecasting methodologies, but none of us regards this process as an end in itself. .
- The most we can demand of any forecasting system is to make it possible to develop alternative futures as inputs to policy analysis.
- Since error must always be considered possible, policy needs to be designed so as to resist catastrophic failure and if possible, to allow a damage-limiting transition to other policy approaches. This, by and large, is what participants meant when using the term "robust," as a descriptor for good policy design.
- We are all aware that the systematic combination of forecasting and policy-making is prescriptive rather descriptive. We are talking about how the process ought to be done, rather than about how it is done at present. There is room for skepticism that this approach can be made to work.
- On the other hand, there was no doubt among us that very profound societal challenges are on the way (or are under way), and that existing processes for anticipating and preparing for these are dangerously slow.
- Some participants expressed concern that the social sciences have become too narrowly specialized and need to be encouraged to take the risks of engaging in larger-scale thinking about the future. Others focused on the need to make sure that the ethical or moral dimensions of deep change should be dealt with early and as an integral part of any concerted effort to design future-oriented policy. All of us are concerned that the general

public is left out of this process. There was also an interest in reaching out to centers of work similar to ours, in other countries.

- All of us are willing to collaborate on ways to develop the theoretical foundations for future-oriented policy, and to broaden the base of the discussion so as to bring in from the margins not only specialists but the general public and political leadership.

In line with the above, there has been a decision in principle between Hans Bennendijk and myself (on behalf of the National Defense University and the Forward Engagement Project at GW), to develop a workshop for comparative analysis of advanced modeling and forecasting techniques. We are hoping to obtain greater insight about the evolving capacities of these systems and also to be able to characterize them in non-theoretical language, amenable to the interests of policy-makers. We are aiming to make this happen in mid-winter and will keep everyone posted.

With every best wish. Leon.

## **Forward Engagement/Foresight in Governance**

The meeting convened at 1000, October 14<sup>th</sup> in the Lindner Commons, at the Elliott School, The George Washington University. Attendees are listed in attachment #1. Professor Fuerth reviewed the objectives as follows: Dr. Don Lehman, Executive Vice President for Academic Affairs of The George Washington University, greeted attendees on behalf of the University (Dr. Lehman's comments are attachment #2).

At 10:12 AM, **Prof. Fuerth** began formal discussion. He said that the objectives of the meeting were: (1) to brief participants on the Forward Engagement project; (2) to promote discussion among participants; and (3) to look for possible areas of collaboration by reviewing the Project architecture (See "Project on FE, Flow Chart", attachment #3). The objective of the project is to influence the manner in which governance is conducted in the United States by building the case that the accelerating rate of major social change at home and in the world demands systematic attention to futurity and complexity in the formulation of public policy. The Project is designed to run until the spring/summer of 2007, during which period public and political receptivity will be greatest because of the political cycle.

The Project will operate on two tracks: one for general public education and one for expert/leadership opinion. The public track will employ two systems: (a) direct outreach to local groups of citizens who are strongly interested in public affairs; and (b) a "blogging" system designed to encourage discussion of foresight related issues among these individuals and groups. The expert/leadership track will use more conventional methods including a series of conferences, seminars, etc. designed to narrow the gap between professionals who specialize in advanced forecasting methods and policy makers whose decisions are critical for the shaping of future contingencies.

With respect to the public track, Prof. Fuerth said that he intended to work on direct outreach in cooperation with the World Affairs Council of America, whose President, Dr. Jerry Leach, was attending; and on creation of a blog site with Dr. Henry Farrell, Assistant Professor of Political Science at the George Washington University.

As indicated by the Project flow-chart, these activities are intended to come to a focus on the Congress. Prof. Fuerth said that he also plans to reach out to state governments and that he has had a preliminary discussion with the staff director of the National Association of State Governments .

General discussion began with **Dr. Jerry Leach**, who provided a summary description of the Word Affairs Council of America. WACA is an umbrella group, based in Washington, DC, representing upwards of 2500 local community councils, with a core membership of 86,000 persons. Its various outreach programs engage on the order of 500,000 persons a year. Outreach programs include the largest speakers' program in the country (2500 speeches a year), PBS television shows, and special services to educators.

WACA itself is a relatively small office and the organization's fundamental strength is in its field organizations, with infrastructure in many major cities around the US. The director of one of the most vigorous of these organizations – the Pittsburgh WAC – has agreed in principle to work with Prof. Fuerth on the creation of a test-bed Forward Engagement program for local use.

**Professor Farrell** offered brief comments about plans for creating a blog to back up hoped-for local interest in long-range issues and government foresight. He described the basic technology, noting that it permitted the blog-site to begin small, but to expand at will, as usage might indicate. Fuerth noted that he hoped that some of the persons attending the meeting would be future participants at the senior end of the blog.

**John Maegher** described a local application of Forward Engagement which he had undertaken in Manassas County, Virginia, with a group of politically engaged citizens. He described a two- step process comprising: (a) a preliminary discussion in which participants searched for areas of emphasis and consensus about longer-term contingencies; and (b) translated these points into policy options based on a prioritized scale. He noted that these discussions encompassed national, international and local issues. Prof. Fuerth then commented on the bi-partisan applications of this approach.

**Prof. Fuerth** said at this point that he is planning for a second conference in the series, to be held in January or February\*, focusing on major future contingencies of public concern. He stressed again, his plan to look for “champions” of the idea of foresight in governance, especially in the Congress, as a way of improving the odds that the Project will yield concrete results.

**Jonah Czerwinski** asked Prof. Fuerth what he is thinking about in terms of changes to processes of governance. The executive branch? Legislative? Prof. Fuerth replied that his attention was initially directed towards the executive branch, but shifted to the Congress, because it lags so far behind in upgrading its procedures. He said that studies prepared by his students try

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\* Note: As a byproduct of this conference, the National Defense University and the Forward Engagement Project have recently agreed to cohost a meeting in January or February 2006 for the discussion of advanced forecasting methods and modeling techniques.

to avoid proposals based on massive bureaucratic systems. They aim instead for simple, lightweight structures.

**Michele Flournoy** asked what changes need to be made in Federal Government for the President to receive these suggestions? Has there been work on changes in NSC structure, intelligence?

**Jim Dewar** described how RAND is working on the expert outreach area and academic area. We are creating tools to think about Forward Engagement; developing tools to think deeper; teaching young policy analysts how to approach short term analysis by means that include long-term consequences; and by using outreach to other people doing similar things.

**Bill Galston** identified practical and theoretical obstacles to the Forward Engagement approach, citing the “tyranny of the short term” (very heavy discount of the future, problems of constructing forward-looking institutions), that diminish the credibility of long-term forecasting in practice. What evidence is there about the capacity of different disciplines to accurately forecast? He mentioned how almost universally unquestioned estimates of global population growth have been upset by a slowing of the overall growth rate.

**Peter Heller noted that the major challenge relating to forecasting error is to construct robust policies that can adapt to it.**

**Dennis Pirages** acknowledged that estimates of world population had proven to be inaccurate, but said that one of the reasons may have been that the earlier assessment triggered a realization that the problem of population growth had to be addressed, and that our efforts towards shaping an alternative future might be part of the reason why the predictions in the 1960s were off the mark. He added that his own methodology for evaluating the impact of technology, for example, was socio-political and involved three drivers: technological innovation, demographic shift, and environmental constraints.

**William Bainbridge** added that in fact, population collapse had replaced population growth as a problem.

**Hans Binnendijk** said that there is a growing interest in forecasting and prediction in the Defense Department. Typically, applications of forecasting have a relatively narrow focus. However, the mission of the DoD is expanding to encompass subjects much broader than the traditional focus on selection of new weapons: preconflict and postconflict planning, requiring a sophisticated understanding of political and economic trends; planning for natural disasters; planning for terrorist attacks involving mass effects weapons. DoD needs a broader sense of forecasting. Interagency connections and coalition building is also important to DoD. There is more interest in the Pentagon in a much broader view of planning and forecasting

**Leon Fuerth** expressed the concern that there is not a matching growth of professionalism and interest in thinking about long-range contingencies in the civilian-side of

governance. Federal, State, and local government simply don't have a similar degree of competence. This analytic gap between the military and civilian sides of government isn't healthy for the government as a whole.

**Hans Binnendijk** noted that major trends are taking the military in the direction of broader-based planning, but said that teamwork between the military and civilian might allow better management.

**Dave Rejeski** said that the essence of the problem of incorporating foresight into government is whether or not an organization can act strategically. Some institutions aren't built to act strategically. It would then be not so much about the inaccuracy of the forecasts, but about the planning and the organizational aspects underlying government response.

**Michele Flournoy** responded that the entire subject of foresight is really about testing and figuring out how to work through alternative futures and risk allocation. There is little capacity on the civilian side to figure out how resource allocation works in applying these sorts of forecasts. Congress isn't structured to figure out how to deal with thinking about these complex problems; the committee structure forces Congress chop them up inter-locking issues into disconnected sections to facilitate funding.

**Leon Fuerth** said that we might try to think about this disaggregation process as if it were analogous to the internet; committees in Congress act as routers breaking up policy into "packets." But we don't have a place in Congress where we can reassemble these packets into coherent outcomes.

**John Meagher** responding to Bill Galston's earlier question about the credibility of forecasting methods, mentioned the most recent issue of *Futuring* which has some answers (see Attachment #4).

**Mark Notturmo** said that it might be better to not talk in terms of prediction. Isn't Forward Engagement about dealing even with in terms of multiple possibilities? If we too tightly define a problem we start ignoring what's outside and thus missing something; we need to be more alert to low probability, high-risk scenarios.

**Leon Fuerth** said that he is not interesting in forecasting as an end in itself, but as a way of getting ideas, as feedstock for policy-making.

**Tim Mack** said that we are looking for a structure that allows for adaptive, interactive flexibility, for "living on the balls of your feet." Scenarios are time consuming to construct. The insight he looks for is the ability to make value judgments about possibilities generated by forecasts. He said that it would be important to think about extending the concept of Forward Engagement to governance at the level of counties and large municipalities.

**Dave Rejeski** provided information about his "Complexity in Governance" program at the Wilson Center: 5-6 agencies have utilized its products: CIA, NIH, NASA, EPA, etc. Their

agendas are uneven in terms of quality of capacity building for foresightedness in policy. He noted ongoing work on the future of Technology Assessment; on the application of Video Games in public policy; and other issue papers. .

**William Bainbridge** remarked that there is too little thinking about the future, particularly within the social sciences. He hoped that Prof. Fuerth's effort might push these disciplines to reengage broader questions, with societal consequences. He said that one of the main problems with demographic theory for example is that it uses long established forecasting models that do not take into account the impact of possible alternative futures.

**Jonah Czerwinski** noted that the rigidity of the boundaries delineating the social sciences -- so-called "stove piping" -- is an obstacle to the growth of forecasting in these disciplines. He also provided a description of **Project Horizon** (See Attachment #5). Project Horizon has developed from an initiative that began in the State Dept. and now involves other departments of the executive branch. The project tries to identify drivers and objectives for creating and utilizing foresight in policy-making. Agencies work as teams to identify: drivers, things creating those drivers; scenarios derived from drivers; strategies from those scenarios; and ways to test these strategies looking for those which are most robust. It is a promising approach, with White House involvement.

**Henry Farrell** noted that we need to consider how to give policy-makers incentives to take action on forecasts.

**\*\*Break for Lunch\*\***

**Jim Dewar** pointed out that modeling in terms of getting something that the computer system can deal with is difficult; it's somewhat possible to get this done with climate models, it's a bit harder when we try to understand other models on the computer. We also need to consider how we go about getting policy makers' attention: we need to make sure that as they make short-term decisions they are also retaining a path which keeps open other options, i.e. we need to focus on the robustness of our models.

**Leon Fuerth** added that he is projecting a third Forward Engagement conference focused on the capacity of advanced models: some claim that predictive power is increasing; that some models are much better able to simulate underlying reality.

**Bill Galston** said that he is skeptical about our ability to predict the impact of new technologies, and challenged remarks made earlier by Dennis Pirages concerning methods for doing this. Galston said that if one appraises the actual impact of various technologies on civil society, it appears that most predictions about the prospect impact of these technologies were wildly off base. For example he pointed to the Internet, which has led to many things that people

never predicted. Perhaps the “state of the art” is better, but how can we be sure? Although basic forecasts about demography can be clear, isolating the societal “if-then” propositions necessary to move to certain possible futures is the hard part. Galston also observed that there can be instances when making policy choices about future events in ways designed to preserve flexibility may not be right or even possible.

**Jim Dewar** replied that the Internet can be looked at as similar to the printing press. Early on, it was very hard to see the social effects of the printing press. But we know that countries that over-regulated the printing press suffered in comparison to those that didn't. Even if we don't know what the social implications are, we can use historical analogies to make reasonable policies.

**Mark Notturmo** asked to what extent might thinking in possibilities rather than predictions allow us to respond appropriately?

**Bill Galston** added that even if it is possible to describe possible futures, that won't answer the question of what should be done. Preserving flexibility is not a panacea, its not a question of preserving flexibility, but of recognizing how limited it is.

**Leon Fuerth** responded that there are no final, optimal policies. Sooner or later they exhaust their benefits. One should be thinking of sunset clauses where policies are concerned, but this is hardly ever done.

**Henry Nau:** Perhaps the best we may be able to do is muddling through; perhaps we should keep this alternative concept available. The Forward Engagement project may improve the status of “muddling through.” Perhaps it's a matter of levels:

- **Level 1 – Local and state-level** – where teaching, discussion, and debate go on . How can we structure and help people better understand the interaction between short- and long-term?
  - Teaching to and learning from the general population.
  - Create incentive for politicians to think in long-term.
- **Level 2 – Expert groups in society** (World Future Society, etc.) Traditionally play into the process at the national level, perhaps they should focus in on the local level
- **Level 3 – Quasi-government role** – operate on the edge of public and private sector (interest groups, commissions, etc.), partisanship emerges
- **Level 4 – Institutions in government** which could act on Forward Engagement, begin to take advantage of ideas.
- **Level 5 – Policy and decision-making level** won't take account of these short and long-term trade offs, unless urged on by their constituents.
  - Media are going to squeeze out the long-term; its about making government both accountable to the long-term and to think about it.

- **Private Sector** – The private sector may also play an important role in developing an interest in foresight in government.

**Dennis Pirages** argued that social scientists need to perhaps move towards making predictions and not be so afraid of the consequences, although aware of them.

**Leon Fuerth** said that this seems to be the right moment to ask Bill Bainbridge to talk about work that he and his colleague, Mihail Roco, have been doing at the National Science on the societal implications of advanced technology. Fuerth mentioned the most recent in a series of publications: *Converging Technologies for Improving Human Performance: Nanotechnology, Biototechnology, Information Technology and Cognitive Science(NBIC).*

**William Bainbridge**, gave a presentation on convergence (See Attachment #6)

- Nanotechnology has Federal support at about \$1 billion a year, plus IT funding.
- Four (NBIC) large areas of S&T are converging :
  - Nanotechnology
  - Biotechnology
  - Information Technology
  - Cognitive Science – new technologies based on the convergence of computer science, psychology, neuroscience, philosophy, anthropology, economics, sociology, etc.
- Cognitive Science is opening up new vistas, and draws on an exceptionally broad range of techniques ideas and assumptions.
- The meaning of NBIC
  - Based on the unity of nature at the nanoscale.
  - A potential successor to the National Nanotechnology Initiative, and to the Information Technology Research Initiative
  - Not an official government (or NSF) activity, but an exploratory movement.
- NBIC Origins in Nanotechnology
  - Societal Implications of Nanoscience and Nanotechnology
  - What is now possible, that was impossible before:
    - Nanotechnology has the potential to allow us to unify the sciences across the board.
- Hatching an idea
  - Put together a conference to work on the first book, converging technologies
- Launching a general movement that has led to a series of books;
 

<http://mysite.verizon.net/wsbainbridge>
- Next book coming out – *Societal Implications of Converging Technologies*

- What are the implications for culture if there is a unification of science? Are current concepts unnecessarily complex?
- Principles of Convergence
  - Material unity of nature at the nanoscale.
  - Technology of the integration of technologies, etc.
- Social life is changing with this convergence as well
  - Will “Moore’s Law” end and innovation peak?
  - Nations that were innovators might no longer have the advantage, LDCs who can produce might be better equipped to handle the changes
- Henry Nau: Social world is given material underpinnings; material world is giving social underpinnings?
  - William Bainbridge: Shannon gave us a window into the dynamic connection between the social and biological in terms of information
- Nanotechnology could allow for the ability to engage both in breadth and depth
- Newt Gingrich, who contributed a major essay to the latest NSF book, suggests that we may be at a “phase-change” in science.
- The impact of convergence on human performance is so potentially deep as to raise the question of what is the human being?

**Henry Nau** remarked that some of the money going into NSF’s work need to be put into informing the public about what is happening, what all these sorts of changes mean. If that investment in public information is made, we might have a better reaction and absorption of the radical possibilities for change that this process indicates. There is a need for public discussion in order to reach some solutions.

**Bill Galston** remarked that the ethics of converging technologies seem to be an important question. Is there funding for it?

**William Bainbridge** responded, saying that there is such funding within the program for nanotechnology. Ethicists attend every meeting and have published already, but mostly nanotechnology, and not specifically for convergence

**Leon Fuerth** asked if clergy should participate?

**Bill Galston** replied that he didn’t think the religious background of an ethicist should be a factor.

**Henry Farrell** added that public debate is important – look at what happened to the Genetically Modified Organisms debate in Europe. Some of these technologies are fundamentally transformative to our sense of what it means to be human. It has to be an ethically informed conversation.

**Mark Notturmo** said that the issue of the accessibility of science has become a major concern, and dovetails with questions of scientific literacy. To what extent are things happening so quickly that we might not be able to appropriately adjust? Should we involve the various foundations concerned with science, such as the American Association for the Advancement of Science (AAAS)?

**Dennis Pirages** asked whether this kind of unlimited technological development shouldn't be considered inevitable?

**Henry Nau:** Its not a question of knowledge, but what we do with it when we know it... that's where the ethics are involved.

**Leon Fuerth:** We need to wrap up. What next?

- Create a listserv to connect us all for ongoing exchanges of ideas.
- Meet in this and smaller groupings in the future
- Meeting on major future developments perhaps in January (?), to draw upon NSF material, as well as others.

**Peter Heller** said that this been a very "domestic" dialogue. Would it be possible to bring in people from outside the United States? Stockholm, Finland's Futuring Institute, Oxford people, James Martin for Technology and Civilization @ the Said School of Business?

**Leon Fuerth** replied that collaboration is possible. We should map out a comprehensive idea of how to do this, design a collective plan to pool resources

**Tim Mack** said that WFS could help you with finding other futuring institutes.

**Dennis Pirages** added that we need to get into a dialogue with people who provide information on Sci/Tech. American Association of Science and Technology led by Don Kennedy. Pirages said he would get information on this to Prof. Fuerth.

**John Meagher** mentioned in this connection, Natalie Ambrose, Chair of the Council of Foundations and a former member of the World Future Society's board of directors.

**Adjourned (2:33)**

# **Attachment #1**

**List of Participants in “Foresight in Governance”**

October 14, 2005

William Bainbridge	Program Director (Digital Libraries, Science Informatics) <i>Directorate for Computing, Information Science, &amp; Engineering, National Science Foundation</i>
Hans Binnendijki	Director, Center of Technology and National Security Policy <i>National Defense University</i>
Jonah Czerwinski	Senior Research Associate <i>Center for the Study of the Presidency</i>
Jim Dewar (teleconference)	Director, Pardee Center for Long Range Global Policy and the Future Human Condition <i>RAND Corporation</i>
Henry Farrell	Assistant Professor Elliott School of International Affairs <i>The George Washington University</i>
Michele Flournoy	Senior Advisor, International Security Program <i>Center for Strategic and International Studies</i>
John Forrer	Executive Director GW Center for the Study of Globalization <i>The George Washington University</i>
Bill Galston	Saul I Stern Professor of Civic Engagement Director, Institute for Philosophy and Public Policy <i>University of Maryland</i>
Peter S. Heller	Deputy Director, Fiscal Affairs Department <i>International Monetary Fund</i>
Jerry Leach	National President <i>World Affairs Councils of America</i>
Timothy C. Mack	President <i>World Future Society</i>
John Meagher	Past President <i>World Future Society</i>

Henry Nau  
Professor of Political Science and International  
Affairs  
Elliott School of International Affairs  
*The George Washington University*

Mark Notturmo  
Fellow  
*Interactivity Foundation*

Dennis Pirages  
Co-Chairman, Board of Directors  
*World Future Society*

Dave Rejeski  
Director, Foresight and Governance Project  
*Woodrow Wilson International Center for Scholars*

Richard Sawaya  
Vice President for Government, International, and  
Corporate Affairs  
*George Washington University*

Conference Facilitators

Leon Fuerth  
Director, Forward Engagement Project  
Research Professor of International Affairs  
*The George Washington University*

T. Neil Sroka  
Research Assistant for Leon Fuerth  
Elliott School of International Affairs  
*The George Washington University*

# **Attachment #2**

Leon Fuerth's Conference on Forward Engagement  
Friday, October 14, 2005  
10:00 a.m.  
Lindner Commons, 1957 E

Good morning and welcome to The George Washington University. For those of you not familiar with our campus, I should point out that this building – the home of GW's Elliot School of International Affairs – is among our newest academic buildings, and is a reflection of what it is we value as an institution. The building, with the obvious advantage of proximity to the unparalleled resources and intellectual capital here in our nation's capital, has top quality classroom space. It has functional and pleasant office space in which our faculty and staff can find comfort and inspiration. It has designated space in which we can welcome members of the larger community to share their expertise and vision. It is our hope that events such as today's conference serve to both enliven and enhance discourse on topics of great importance, and provide the impetus for positive change.

Today's conference is the first meeting associated with the Project on Forward Engagement that Leon Fuerth has initiated with support from GW and the Rockefeller Brothers Fund. I find Forward Engagement a provocative concept in many levels. I think about it in the context of my own field of nuclear physics. I think about it in terms of current events including Hurricane Katrina. Perhaps most deeply, I think about Forward Engagement as it relates to the role of higher education in preparing an educated citizenry and future leaders. Are today's college graduates prepared to understand, engage in, and support the allocation of resources to the forecasting of events; the analysis of potential consequences; the interrelatedness of economics, science and technology, security, and governance; and the necessary link between theory and practice? At GW, we certainly recognize the growing complexity of the problems facing today's society, and the increasing speed with which events emerge to the point of demanding immediate attention. With that in mind, we are working to break the model of universities as umbrella organizations under which there are silos of discipline specific activity. I expect that as we focus on bringing a coherent, interdisciplinary perspective to the liberal arts foundation, to specialized training at the graduate level, and to our research and scholarship, what we really need to be doing at the same time is forecasting future events and addressing their potential consequences! It's a

challenging task, and one for which Leon Fuerth's work with graduate students provides some welcome inspiration.

In the interest of letting you get started on the substance of today's conference, let me conclude my remarks by stating, on behalf of the GW community, just how pleased we are to have you on our campus. I hope that one outcome of today's conference will be a continued commitment to the sharing of ideas.

Thank you.

# **Attachment #3**

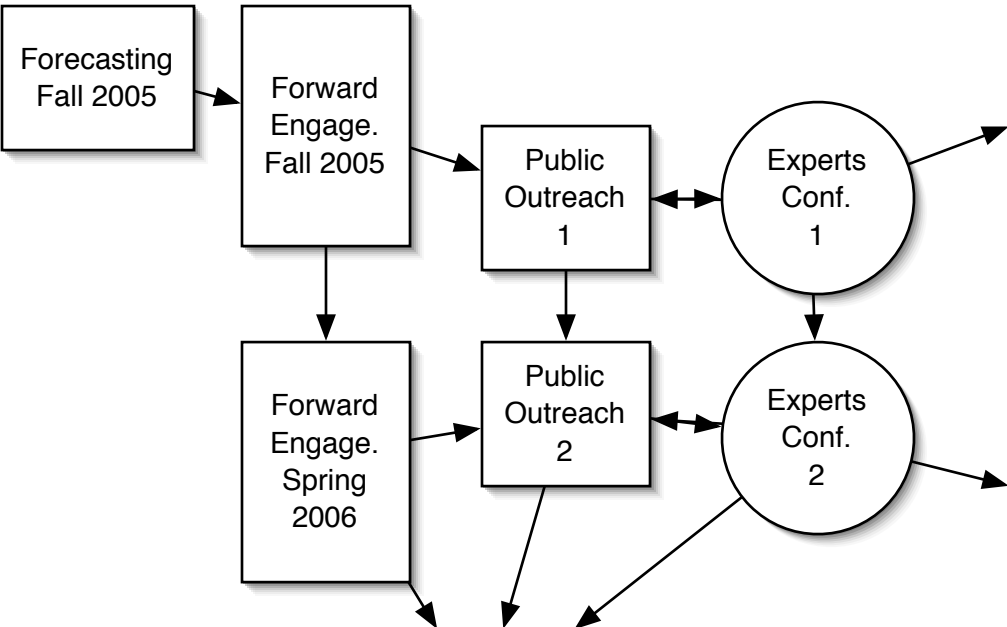
**GWU**  
Forecasting & Forward  
Engagement Classes

**Project**  
Track I  
(Public)      Track II  
(Expert)

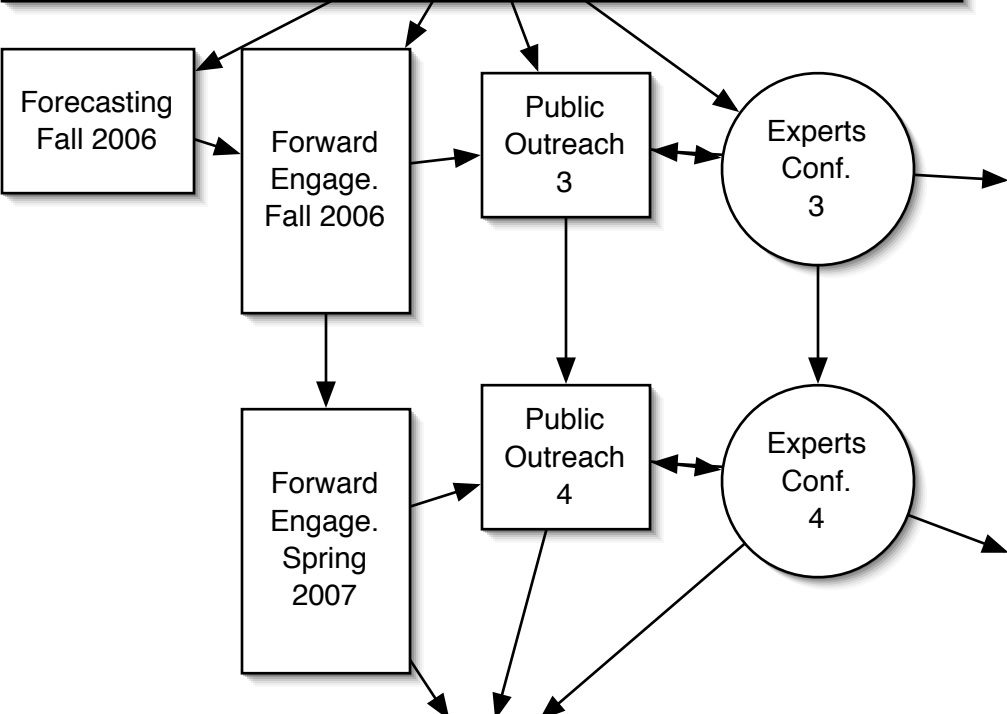
**Congress**

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Research & Program Design



Research, Program, Design, & Publish



Prepare Program Results for Publication

Recess
109th Session 1 ends (1)
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109th Session 2 (2)
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109th Session 2 Ends (3)
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110th Session 1 (4)
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## **Forward Engagement Project Schematic Key**

Public Outreach 1: Beginning Blog. Experimental local contact with nat. public affairs org.

Public Outreach 2: Establish formal blog-site: Experimental regional contact with nat. public affairs org.

Public Outreach 3: Expand formal blog-site: Work at national level with public affairs organization.

Public Outreach 4: Work at full extension.

Experts Conference 1: Exchange programmatic information with core group of associates.

Experts Conference 2: “Advanced” Future Contingencies of Interest.

Experts Conference 3: Forecasting/Policy-making dialog.

Experts Conference 4: Institutional proposals for integrating forecasting and policy-making.

Congress (1): Establish Staff contact, both houses, both parties.

Congress (2): Establish Member contact, both houses, both parties.

Congress (3): Develop legislative concept.

Congress (4): Introduce legislative proposal.

# **Attachment #4**

## EVALUATION OF FORECASTING METHODS

by

**William E. Halal and Gary Bojes**

The literature and practice on forecasting abounds with a rich variety of methods. Some are very popular while others are so exotic they are rarely used. Some are considered quite accurate and others have doubtful validity. And some have great intuitive appeal while others do not seem very useful. This diversity of methods often leaves forecasters unsure which methods to consider.

We conducted a small study to evaluate forecasting methods using a survey of experts in the field. Fifteen of the more prominent methods were selected and described briefly in a survey questionnaire. Respondents were asked to rate each method in terms of the "confidence" they placed in its ability to produce valid results and the "usefulness" of the method itself. The Professional Members of the World Future Society were asked to respond online. A total of 93 responses were received out of a total of about 1,500 members, for a response rate of 6%. The results cannot be said to accurately represent this population as a whole, therefore, but they do suggest what some professional futurists think about forecasting methods.

Results are presented in Table 1 and clearly indicate interesting distinctions between the 15 methods. At the higher end of the results, it seems that scenarios, interviews, Delphi, simulations, analysis of scientific literature, econometrics, systems dynamics, and regression analysis are generally considered the more highly valued methods. At the lower end, it appears that patent trends, times series, trend extrapolation, input-output matrices, morphological research, game theory, and historical analyses are less attractive generally. There also seems to be a rather strong correlation between "confidence" and "usefulness," although we did not test the relationship statistically. Variance among the sample is rather high, so there does not seem to be strong agreement on these points.

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*William E. Halal is professor of management at George Washington University, Washington, DC, and CEO of TechCast.org, a "virtual think tank tracking the technology revolution." He may be contacted at [halal@gwu.edu](mailto:halal@gwu.edu). Gary Bojes was a doctoral student at the time of this study, and now consults for SAIC Corporation and other companies.*

**TABLE 1 - EVALUATION OF FORECASTING METHODS (N=93)**

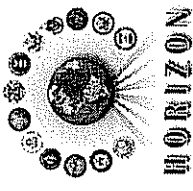
METHOD	CONFIDENCE		USEFULNESS	
	Mean (0- 100%)	Std. Dev.	Mean (0- 100%)	Std. Dev.
Scenarios create a story outline for possible futures.	76.3	19.1	75.4	20.2
Interviews are used to gain in-depth judgment of experts.	70.4	23.4	70	23.3
Delphi uses an iterative process with questionnaire responses from experts to produce a consensus.	66.2	24.7	67.9	24.2
Simulations use games to demonstrate how changes in inputs produce changes in outputs.	65	23	63.9	22.2
Scientific Literature Analysis uses publications to identify trends.	60.4	24.5	60.3	24.4
Econometrics bundles regressions into a model of interrelationships of estimated underlying trends.	58.9	24	56.5	23.2
Systems Dynamics models a system as a set of variables interrelated through feedback loops.	59.9	21.5	57.4	23.9
Regression Analysis estimates how explanatory variables relate to dependent variables.	58.5	23.9	59.6	24.2
Historical Analogies use historical data to estimate a value at some future time.	56.7	24.9	53.9	25
Game Theory defines relationships between competing parties subject to rules of action.	55.9	23.1	53	22.9
Morphological Research identifies different means by which various functions can be combined.	57	21.9	53.1	21.7
Input Output Matrices estimate the impact of changes in one industry on other industries.	54.8	23.6	49.2	24.8
Trend Extrapolation extends a trend to estimate its value at some future time.	54	21	56.9	25.4
Times Series Estimation analyses data observed sequentially to estimate its value in the future.	51.3	20.6	53.3	23.6
Patent Trends analyze patent information for trends.	45	25.3	47.5	26.1

This is a fairly simple study, so we do not claim to demonstrate striking findings. More sophisticated studies would include a larger sample and higher response rates, and would focus on a wider range of criteria to tease out the relative advantages and disadvantages that all methods entail.

Nonetheless, the results suggest which forecasting methods are generally considered more attractive to professionals who earn a living putting these methodologies to use. Hopefully, this information will prove a useful guide to forecasters as they attempt the difficult task of anticipating the wave of historic change now underway.

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# **Attachment #5**



## ***Project Horizon consists of three phases (cont.)***

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### ▪ **Scenario Development**

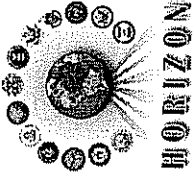
- Interviews are conducted to identify 200-300 key “drivers” and then the 4-6 “dimensions” of the target organizations’ operating environment
- All permutations of these dimensions create the initial broad set of scenarios from which the 4-5 scenarios are chosen

### ▪ **Strategy Workshops**

- Participants from multiple organizations or units are brought together into unified planning teams
- Each team develops strategies to address its assigned scenario
- Strategies of each team are then stress-tested across the other scenarios to identify those strategies that are most “robust” with respect to the full range of future uncertainty

### ▪ **Synthesis**

- Workshop strategies are then synthesized into an integrated strategic framework and execution approach



## ***Project Horizon Governance***

- **Structured to ensure interagency ownership and control of process and outputs**
  - Led and managed jointly by participating agencies in a governance model that includes the NSC
- **Senior Principals Board** is responsible for project direction
- **Project Core Team** is responsible for managing contractor resources and staffing the project's primary activities
  - State is providing a Government Project Manager and PMO resources

### **Senior Principals Board Responsibilities**

- Exercise oversight of the project
- Ensure their agency's contributions
- Contribute to critical substantive project decisions (such as scenario selection)
- Take a leadership role in strategy workshops
- Sponsor independent scenario planning work in their home agency as appropriate

### **Project Core Team Responsibilities**

- Guide/contribute to research, interviews, scenario selection, and scenario development
- Represent the views of their agencies
- Help design and facilitate strategy workshops
- Support home agency implementation

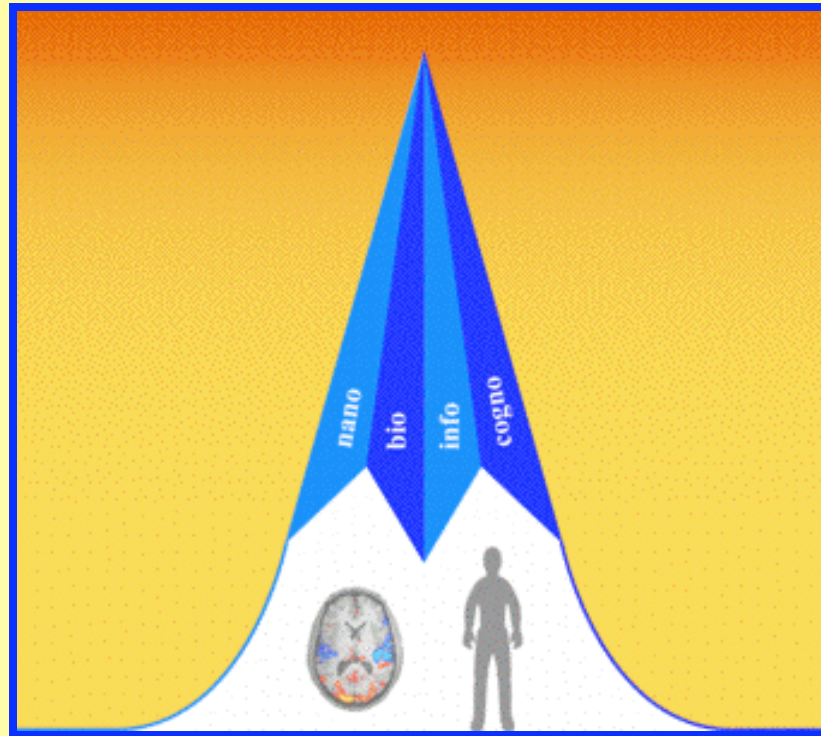


# Project Horizon Senior Principals Board

Organization Name	Senior Principals Board Member Names
National Security Council	Dr. Peter Feaver, Senior Advisor for Strategic Planning and Institutional Reform
Department of Agriculture	Ellen Terpstra, Administrator, Foreign Agricultural Service Nicholas Gutierrez, Associate Administrator, Animal and Plant Health Inspection Service
Department of Defense	Rear Admiral Frank Pandolfe, Deputy Director for Strategy and Policy, J-5, Joint Staff Barry Pavel, Principal Director for Strategy, OSD
Department of Energy	Bruce Carnes, Associate Deputy Secretary Steven K. Black, Chief Operating Officer, Office of Defense Nuclear Nonproliferation, National Nuclear Security Administration
Department of Health and Human Services	Dr. William R. Steiger, Special Assistant to the Secretary for International Affairs and Director of the Office of Global Health Affairs Dr. Julie Gerberding, Director, U.S. Centers for Disease Control and Prevention
Department of Homeland Security	Vice Admiral Thad Allen, Chief of Staff, U.S. Coast Guard Andrew Maner, Chief Financial Officer, DHS
Department of State	Henrietta H. Fore, Under Secretary, Management Sid Kaplan, Assistant Secretary for Resource Management and CFO (Acting), Deputy Assistant Secretary, Office of Strategic and Performance Planning
Office of the Director of National Intelligence	Deborah Barger, Assistant Deputy Director of National Intelligence for Strategy, Plans, and Policy Patrick Neary, Director of Strategy
USAID	Doug Menarchik, Assistant Administrator, Bureau of Policy and Program Coordination Walter North, Deputy Assistant Administrator, Bureau of Policy and Program Coordination

# **Attachment #6**

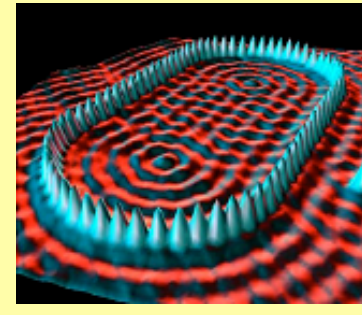
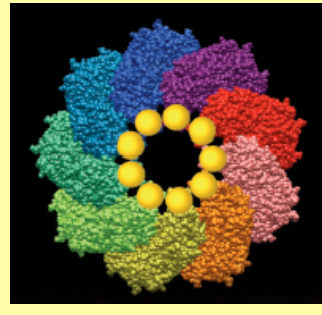
# Converging Technologies (NBIC)



**William Sims Bainbridge, Ph.D.**  
**National Science Foundation** <sup>1</sup>

# NBIC =

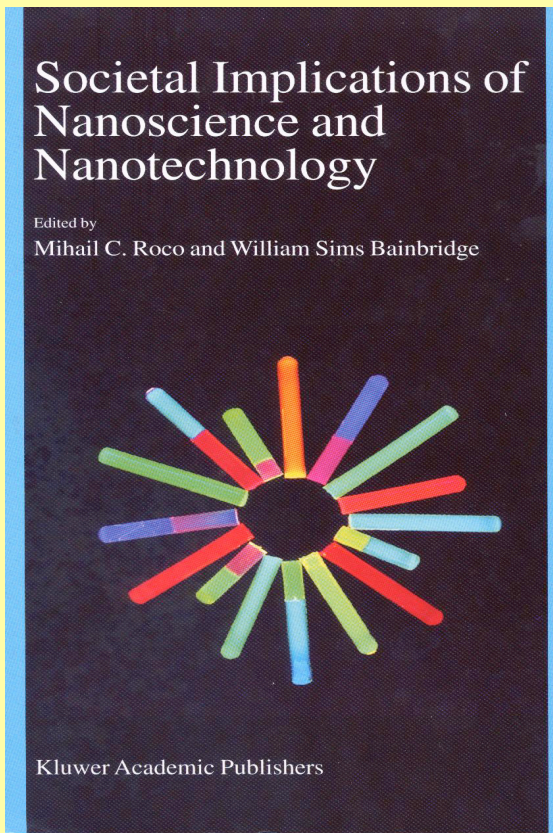
- **Nanotechnology**
- **Biotechnology**
- **Information Technology**
- **Cognitive Science - new technologies based on the convergence of computer science, psychology, neuroscience, philosophy, anthropology, economics, sociology, etc.**



# **The Meaning of NBIC:**

- **Based on the unity of nature at the nanoscale**
- **A potential successor to the National Nanotechnology Initiative, and to the Information Technology Research Initiative**
- **Not an official government (or NSF) activity, but an exploratory movement of scientists and engineers**
- **Arising when the unification of science has become possible through the use of transforming tools**
- **A natural extension of work on the societal implications of nanotechnology**

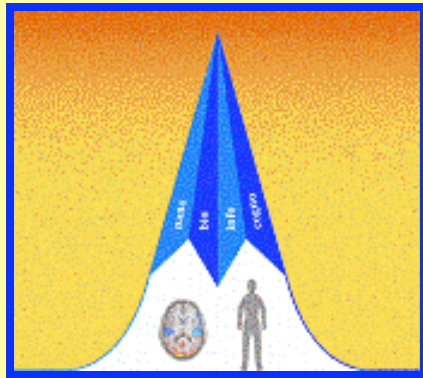
# NBIC Origins in Nano



**“A revolution is occurring in science and technology, based on the recently developed ability to measure, manipulate and organize matter on the nanoscale – 1 to 100 billionths of a meter. At the nanoscale, physics, chemistry, biology, materials science, and engineering **converge** toward the same principles and tools. As a result, progress in nanoscience will have very far-reaching impact.”**

# Hatching an Idea

**Converging Technologies  
for Improving Human Performance:  
Nanotechnology, Biotechnology,  
Information Technology and Cognitive Science**  
*NSF/DOC-sponsored report*



**Conference at NSF,  
December 3-4, 2001**

**<http://www.wtec.org/ConvergingTechnologies/>**

# Launching a Movement



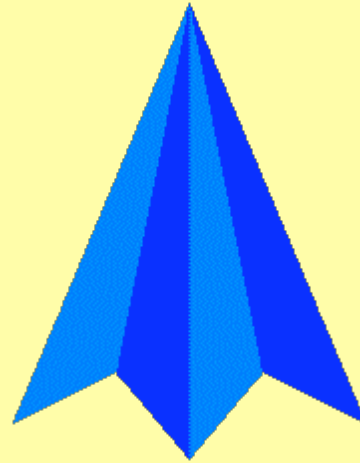
*Nanotechnology, Biotechnology, Information Technology, and Cognitive Science*

**NBIC CONVERGENCE 2003**

**Converging Technologies for  
Improving Human Performance**

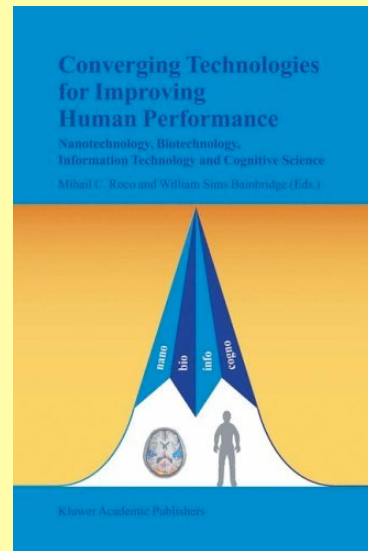
February 5-7, 2003 • UCLA • Los Angeles, CA

# Convergenist Publications



See:

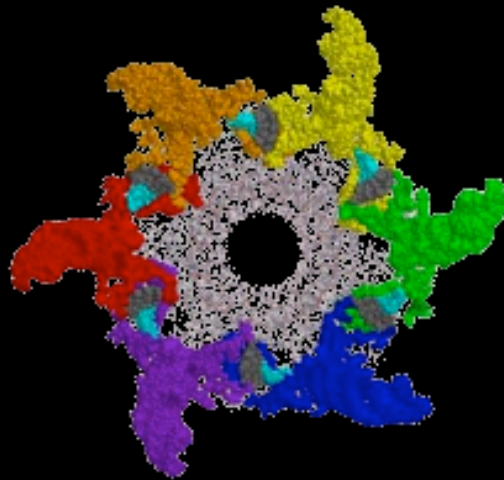
<http://mysite.verizon.net/wsbainbridge/>



# SOCIETAL IMPLICATIONS OF CONVERGING TECHNOLOGIES

MANAGING  
NANO-BIO-INFO-COGNO INNOVATIONS

William Sims Bainbridge and Mihail C. Roco (Eds.)



Springer Publishers

## Forthcoming 3rd NBIC Book (title is tentative)

Also, a new 2-volume report on the societal implications of nanoscience and nanotechnology is in press.

**And more  
to come  
in the future!**

# Unification of Technology



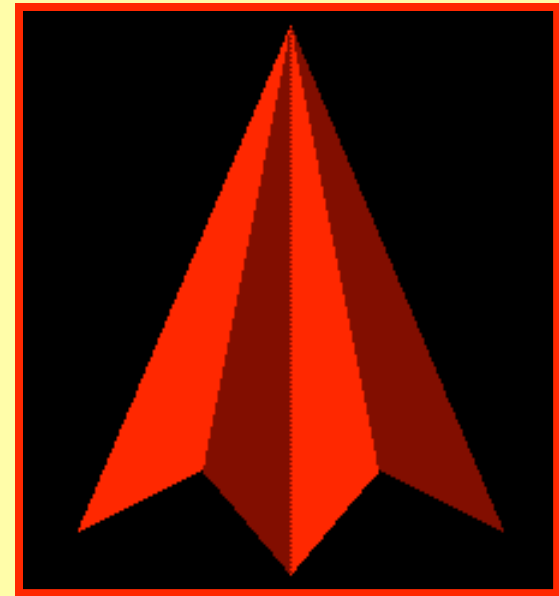
**Manuel Castells writes, "Technological convergence increasingly extends to growing interdependence between the biological and micro-electronics revolutions, both materially and methodologically. ... Nanotechnology may allow sending tiny microprocessors into the systems of living organisms, including humans." (Castells, Manuel. 2000. *The Rise of the Network Society*. Oxford: Blackwell, p. 72.)**

# Unification of Science



**In his influential book, *Consilience*, Edward O. Wilson wrote about the rapid unification of scientific knowledge that is taking place today, and he wondered whether the natural sciences would be able to unite with the humanities and religion that traditionally have claimed to understand humanity itself. (Wilson, Edward O. 1998. *Consilience: The Unity of Knowledge*. New York: Knopf.)**

# Principles of Convergence



**Convergence is based on:**

- 1. material unity of nature at the nanoscale**
- 2. technology integration from the nanoscale**
- 3. key transforming tools for NBIC**
- 4. concept of reality as closely coupled complex, hierarchical systems**
- 5. goal to improve human performance**

# Application Areas



- Expand Human Cognition & Communication
- Improve Human Health & Physical Capabilities
- Enhance Group & Societal Outcomes
- Strengthen National Security & Competitiveness
- Unify Science & Education

# One-way Convergence

Developments in one field are applied to another.

E.g.: Nanotechnology allows **Moore's Law** to continue in production of ever smaller, faster, and cheaper microelectronic components – enabling continued progress in Information Technology.

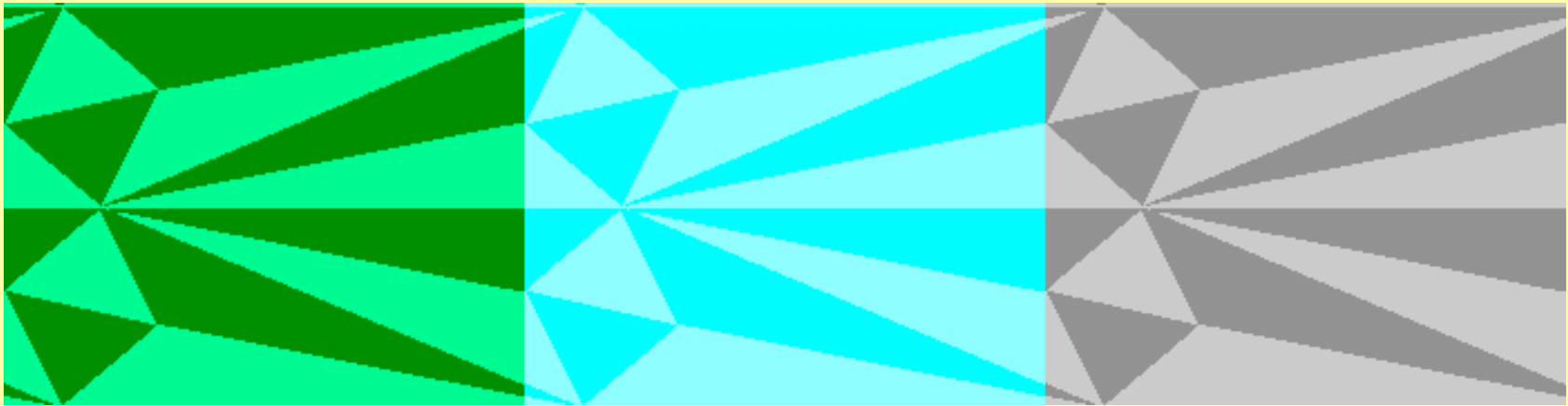
An end to Moore's Law could mean a shift to massive parallel computing, but cost and technical challenges have limited the use of parallel systems.

If IC chips become ordinary commodities, nations with low labor costs may mass produce them thereby destroying American (etc.) industries.



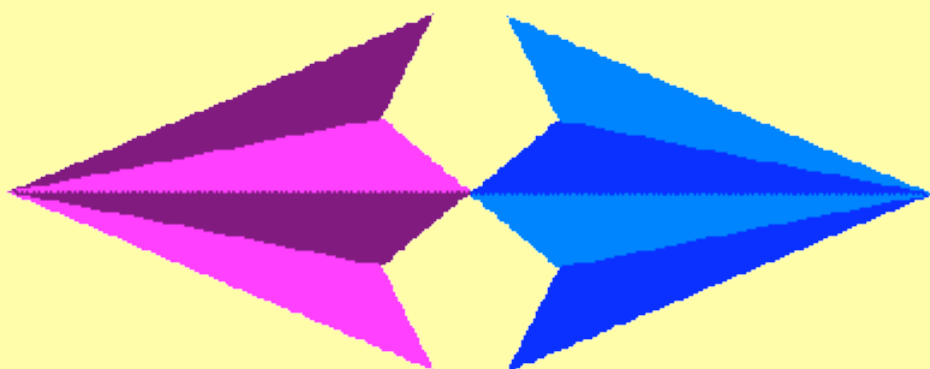
# Mutual Convergence

**Scientific theories and models are applied across many different fields, facilitating exchange.**



**Judith Klein-Seetharaman and Raj Reddy:  
“Biological Language Modeling”**

**William Sims Bainbridge:  
“Evolution of Semantic Systems”**



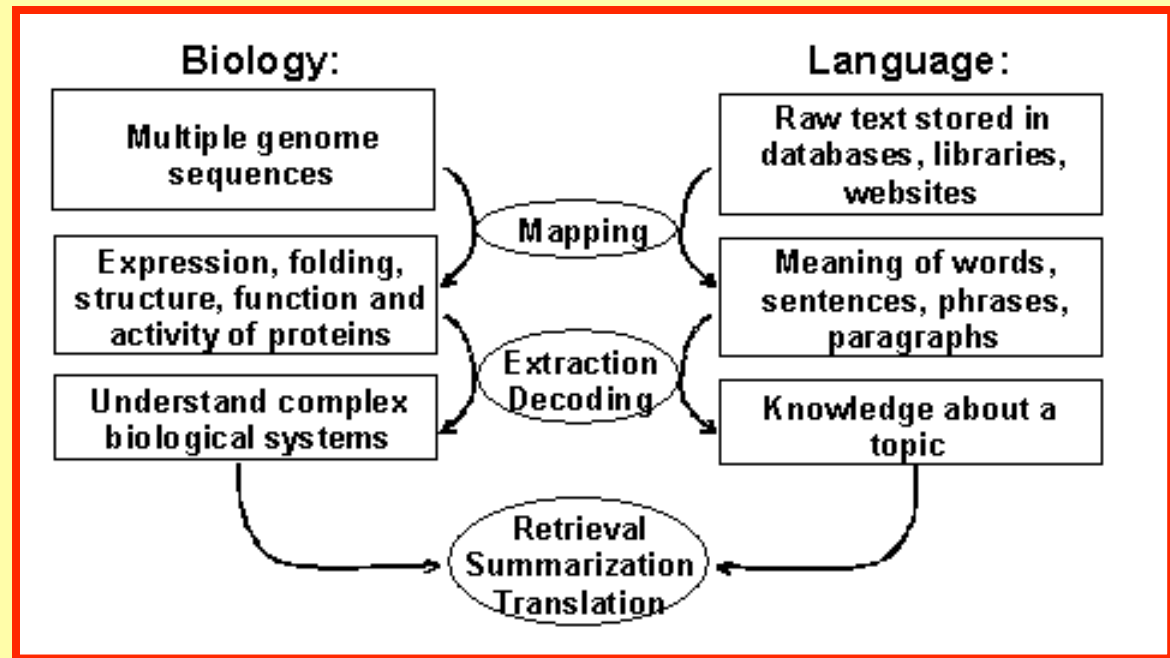
# **Information Technology Grants**

**NSF Awards 0225656, 0225636, 0225609, 0225607:**

**“Computational Learning and Discovery in Biological Sequence, Structure and Function Mapping” estimated total: \$8,840,267; Carnegie-Mellon, U Pittsburgh, MIT, Boston U**

**Computer scientists, together with biological chemists will collaborate using statistical and computational tools and methods that the computer scientists have been developing for dealing with human language to better understand the function of proteins.**

# Evolution



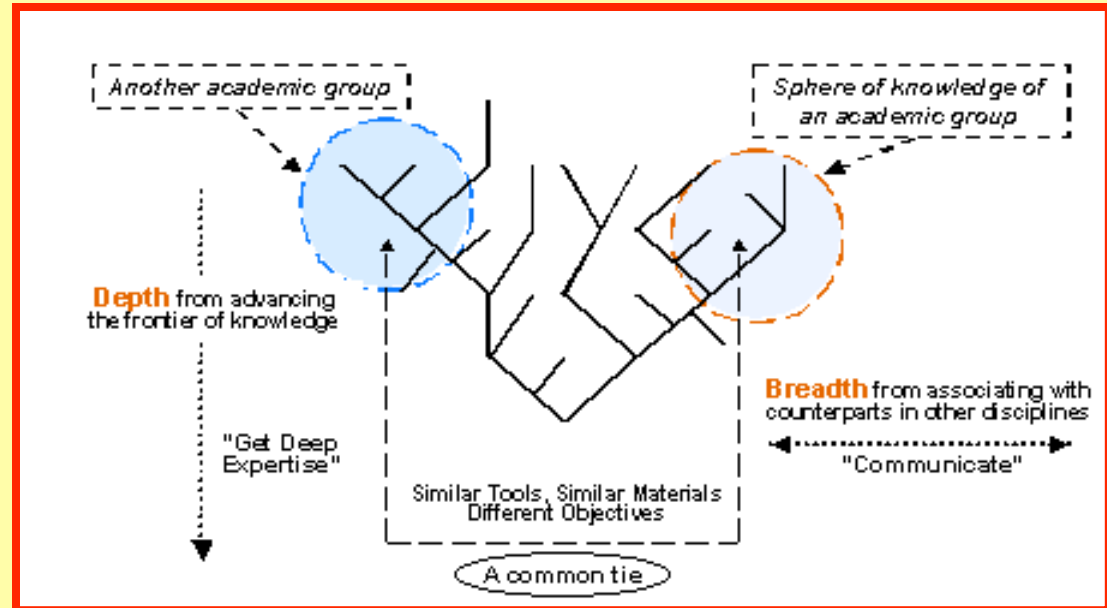
## Evolutionary biology to semantic evolution:

**Taxonomy:** Linnaean genus-species system,  
cladistics, numerical taxonomy

**Processes:** Gene, Sexuality, Transduction, Alleles,  
Natural Selection, Species, Stratigraphy, Catastrophism,  
Van Valen's Law, Character Displacement, Allopatric  
Speciation, The Cope-Stanley Law, Exaptation



# Depth with Breadth



**“Combining depth with breadth in NBIC education and research of various groups.”**

**“Nanotechnology offers hope of depth plus breadth”**

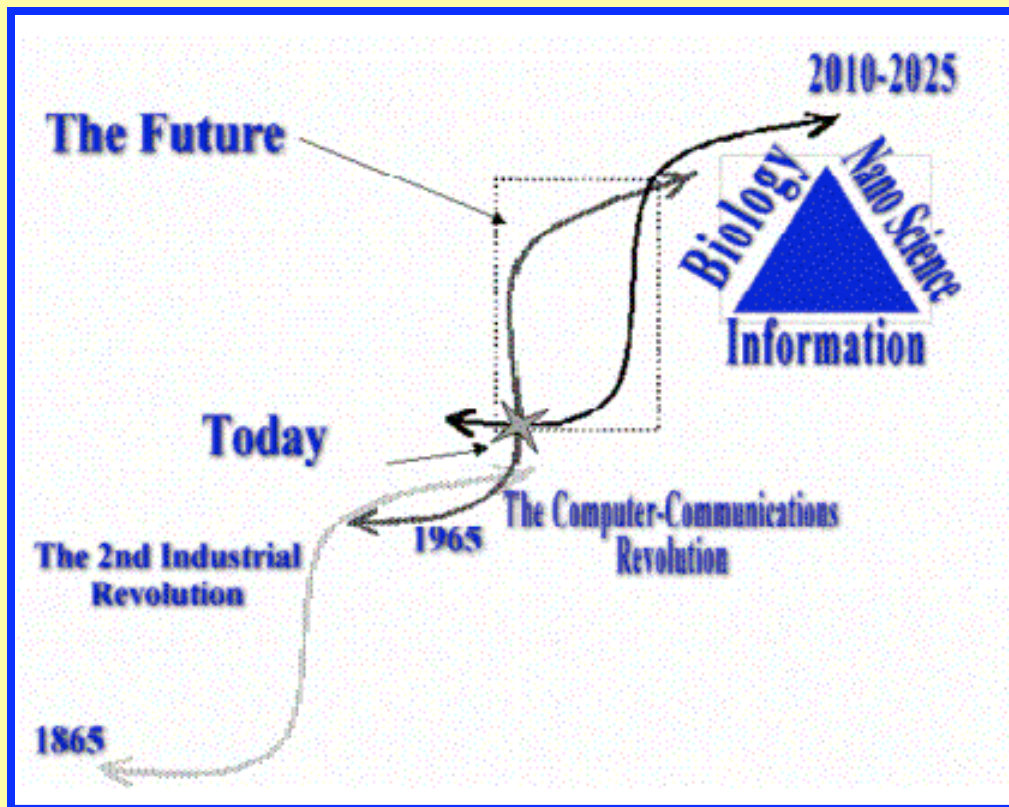


**(W. M. Tolles: “Breadth, Depth, and Academic Nano-Niches” - 1st report)**



# Sustaining Progress

Has progress stalled in aviation and spaceflight, energy production, artificial intelligence, social and behavioral science, health and longevity?

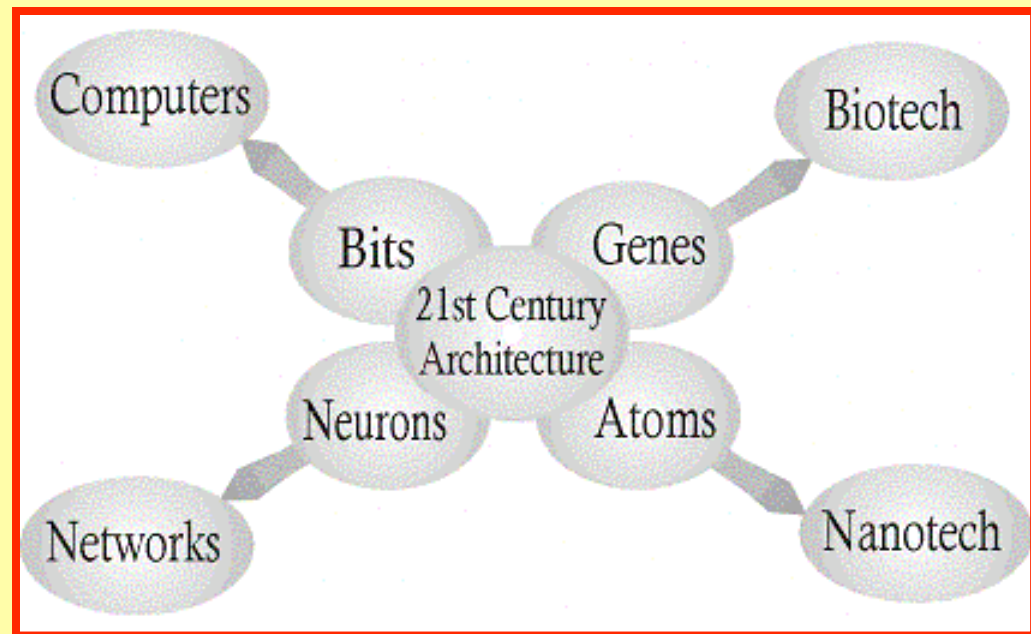


Succession of sigmoid (logistic) curves of progress (Newt Gingerich: “Age of Transitions”)

# Transforming Tools

Opportunity for science & technology convergence based on shared methodologies (e.g. mathematics, computation, nanoscale observation and experimentation, etc.) & theories (e.g. hierarchical structures, complex systems, evolution, etc.)

**Analogous structures in the different fields (James Canton: “Global Futures”)**

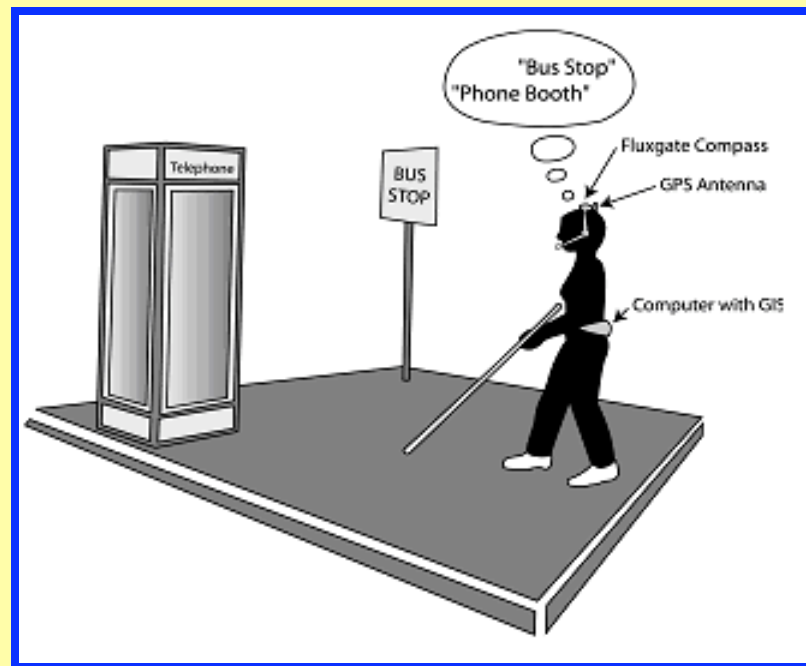


# Illustrative Application

Comfortable, wearable sensors and computers will enhance every person's awareness of his or her health condition, environment, concerning potential hazards, local businesses, natural resources, chemical pollutants, nearby people with shared interests.

**“Spatial Cognition  
and Converging  
Technologies”**

**(Reginald G.  
Golledge)**



# More Applications

National security will be greatly strengthened by light-weight information-rich war fighter systems, capable uninhabited combat vehicles, adaptable smart materials, invulnerable data networks, superior intelligence gathering systems, and effective measures against biological, chemical, radiological, and nuclear attacks.



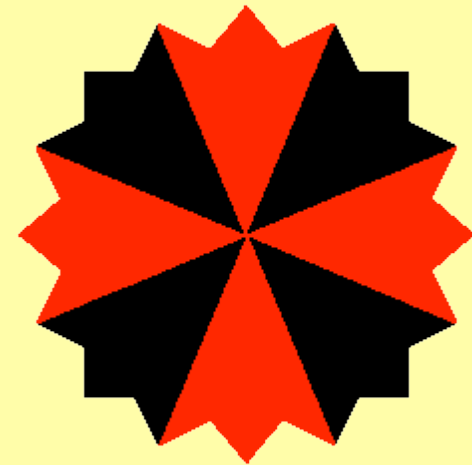
Agriculture and the food industry will greatly increase yields and reduce spoilage through networks of cheap, smart sensors that constantly monitor the condition and needs of plants, animals, and farm products.

# **Improving Human Performance**

**...offering individuals and groups an increased range of attractive choices while preserving such fundamental values as privacy, safety, and moral responsibility**

**...substantially enhancing human mental, physical, and social abilities**

**Technological civilization faces the very real danger of stasis or decline unless something can rejuvenate progress.**





Springbok jigsaw puzzle of “Convergence” by Jackson Pollock.