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To: "Dr. Baruch Fischhoff - Chair, National Academy of Sciences Study on Social & Behavioral Science and Improving Intelligence for National Security" <baruch@cmu.edu>

From: Lloyd Etheredge <lloyd.etheredge@policyscience.net>

Subject: Data-Intensive Discovery for US Leadership: Global health + Archimedes methodology

Dear Dr. Fischhoff and Colleagues:

Using mathematical models to improve rationality in international politics might seem to be a waste of time. But we are slowly achieving success by investing in scientific models to enroll people and achieve agreement about the environment. And there is at least one additional area - global public health - where extraordinary breakthroughs may be possible.

Would you be willing to include the Archimedes model in your review? And if you agree to suggest, to the DNI, evaluating its application for better data-intensive analysis, knowledge integration, and fast American leadership in global health?

Archimedes and Knowledge Analysis/Integration

Archimedes is an inclusive, large-scale computer simulation model that creates virtual people, beginning at the molecular/cellular level and integrates human physiology, diseases/disease processes, behavior, interventions, and healthcare systems (including population characteristics, health economics, tests, treatments, hospital admissions, physician behavior, and follow-ups). The designer, David Eddy, MD, Ph.D., is a distinguished member of the Institute of Medicine.

Unlike regression equation techniques that skim along the surface [a first-generation technology that still is used in economics and other social sciences], the mathematics used in the hundreds of equations of Archimedes are specifically grounded, as nearly as possible, in the actual mechanisms and pathways that nature herself uses. <1>

Archimedes handles data-intensive knowledge integration and complex analysis more rigorously and systematically than human decision makers. There

have been extended validation studies for different conditions. It been tested successfully [using large N electronic health record databases] by Kaiser, the Robert Wood Johnson Foundation, and other users to create more individualized prevention and treatment guidelines for patients with major diseases and co-morbidities; it can improve health and save money.

The Website is <http://www.archimedesmodel.com>, which includes information about the model and validation studies. A good introduction is Eddy's talk, Rx: Mathematics 30 mg b i d: Refill as Needed at the Health Affairs conference in 2007: It is online at the Archimedes model Website (under Newsroom and Recent Coverage).

Applications to Global Health & Enrollment in US Leadership/Plans

There are so many shortfalls of resources and problems in UDCs that investments in further rational analysis may seem secondary to activist organizing. However, it is precisely because of resource constraints that rationality and efficiency are even more important in most of the world's countries and for the Obama Administration's international leadership.

It might be worthwhile for Admiral Blair's staff to contact Dr. Eddy for a discussion of questions that Archimedes could answer. Here is one possible question that a customized Archimedes analysis might answer: If the Obama Administration adopts a CCC model for UDC youth, what levels of medical training - health educators, nurses and nurse practitioners, medical corpsman, physicians, etc. - and disease prevention/treatments would be most cost-effective to improve the population health in rural sub-Saharan Africa? Could Archimedes help the DNI's \$75 billion/year system analyze and integrate everything that we know (somewhere) about population characteristics and diseases in this region, the training of barefoot doctors in China, from the experience of rural health clinics in Africa, from the World Bank/WHO/USAID experience, etc. to send a draft strategic plan and options to President Obama's desk?

The DNI and Social Science Methodology for the 21st century?

There will be additional work required to develop Archimedes, especially as the growth of new biomedical and other knowledge continues (including large N databases of electronic health records and genomic and other data for each patient). But we have seen what Pixar and the entertainment industry have achieved since 1979 - beginning at the pixel level - in bringing reality to life.

- The Archimedes model also is worth exploration by the DNI because it is an obvious vision/analogy for data intensive discovery and knowledge cumulation in the social/behavioral sciences. This probably could be done (to steal a line from David Eddy) for less than the budget that Peter Jackson was given for King Kong.
<1>

Lloyd Etheredge

<1> For broader, visionary discussions: The Fourth Paradigm: Data-Intensive Scientific Discovery edited by Tony Hey, Stewart Tansley, and Kristin Tolle .
downloadable from <http://research.microsoft.com>

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