

Making Policy in a Moore's Law World

The accelerated rate of scientific discovery and technological innovation makes it difficult to keep up with the pace of change. What do policymakers know of nanotechnology and genetic modification? David Rejeski helps government agencies anticipate emerging technological issues.

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UBIQUITY: Tell us about the Woodrow Wilson International Center for Scholars.

REJESKI: The Center was set up in 1968 as a living monument to Woodrow Wilson. Rather than building another statue in Washington, Congress decided to build an institution that embodied Wilson's belief that there is a benefit to bringing together policymakers with scholars.

UBIQUITY: How many people are at the institution? Who are they?

REJESKI: It's a small institution of academics and scholars from all over the world. They're mixed together with other people, like myself, who run ongoing programs. An important quality of the Wilson Center is that it is non-partisan. We do not take ideological positions on issues or advocate or lobby. That doesn't mean we can't take on controversial issues, but we do it in an even-handed manner. That's quite unique in Washington.

UBIQUITY: Talk about your project on Foresight and Governance.

REJESKI: The project's goal is to get people out of the daily media cycle and their inboxes and into thinking about long-range issues. We help the strategic planning departments, or research and development offices, of a number of government agencies think about emerging issues. We study things that could have long-range policy implications. We're interested in developing better

analytical tools for building foresight capacity in the public sector, and identifying particular themes or topics that the government should be paying more attention to.

UBIQUITY: What role does information technology play as either a subject or a tool?

REJESKI: A large part of our portfolio on strategic issues focuses on science and technology. We're running a series of seminars on the future of computing. We do work on nanotechnology genomics, and cognitive neuroscience, and, increasingly on the convergence of these scientific and technological realms We believe that these are large, game-changing areas that deserve more attention. One of the things that's worrisome is that the institutional capacity in the government to think about and anticipate the possible implications of technological change has significantly decreased.

UBIQUITY: Why is that?

REJESKI: Well, the Office of Technology Assessment (OTA), an arm of the US Congress, was eliminated in 1996. Its job was to give Congress a heads-up on the social, legal and policy implications in emerging technologies. There used to be a caucus in the Congress called the Congressional Clearinghouse for the Future, with members such as Al Gore and Newt Gingrich. It was a meeting place for congressional people who were interested in getting, again, a heads-up on emerging issues. That group slowly dissolved at the end of the 1980s. In addition, a lot of the resources, both financial and human, for doing longer-range studies have been reduced in the policy offices in many government agencies. We live in a time when more foresight is needed in government, not less.

UBIQUITY: Why did that happen?

REJESKI: Foresight in the federal government tends to be episodic. We'll spend a few years working on particular issues and then the interest will go away or we believe that, by passing some piece of legislation, we have solved a problem. That is one part of the issue, but I believe there is more to it. Most studies show that the public's trust in government has decreased steadily in this country over the last 25 years. If that is the case, it raises a more troublesome question, "Why should the public trust the government with thinking about or planning for our future?" Given these multiple pressures, it is very hard in the government to maintain a broad, well-structured institutional focus on long-range issues, and this includes state and local government,

not just the federal system. I think that has significant implications, because the potential for surprise is very high.

UBIQUITY: What implications are you talking about?

REJESKI: We're in a time of high potential for major, disruptive change and surprise, driven by scientific discovery and technological innovation. I worry that surprised politicians may not make the best public policy. People generally don't operate well when they are surprised, so planning and constant rehearsing for a variety of possible futures is critical to public sector operation and effective management. This includes thinking about very low probability, but high impact, events.

UBIQUITY: Give an example of a scientific development that caught policymakers by surprise.

REJESKI: The one common characteristic underlying surprise over the past decades has been the speed of advance. Think of the sequencing of the human genome. When the project began it was viewed as nearly impossible, then we predicted it would be complete in 2005, then in 2004, and then it was done. In these compressed timeframes, we have less room for careful deliberation about the consequences (both good and bad) of our technological choices and far less time than needed to educate people about complex issues. I would also say that what will surprise us as a society in the future is likely to arise from the interstitial spaces between disciplines (for instance, at the intersection of biology and nanotechnology or nanotechnology and cognitive neuroscience) and we are ill-prepared to venture into and explore these spaces.

UBIQUITY: How do you make public policy in a Moore's Law world? How do you make public policy on a scientific and technological frontier that's moving very quickly?

REJESKI: Adaptation, co-evolution, agility and improvisation -- all things that come hard to government. My argument is that we have entered the next major industrial revolution. We are witnessing a major change in how we manufacture, where we manufacture, and even if we chose to manufacture (substituting information for things and extracting economic value from bits, not atoms). Most of what we call government was set up in the last 30 to 50 years. We have entered the 21st century with outmoded bureaucratic structures firmly in place -- structures designed to deal with the first industrial revolution and its aftermath, not proactively with the emerging knowledge economy. Attempts to "reinvent" government have focused mostly on improving what we already do, not on fundamentally changing how we think.

UBIQUITY: Would it be fair to say that government has always been behind in IT?

REJESKI: I think that's correct. In the past the government was dealing with sectors that were much slower in terms of their rates of product, process and organizational change. Our traditional governance structures worked fairly well when we were dealing with large rust belt industries (or slow-moving nation-state bureaucracies). But now almost every sector has sped up, not just IT. For example, the time required to reengineer and produce new models in the auto industry has dropped drastically, largely because of CAD/CAM and the ability to do rapid prototyping. The rate of chemical synthesis has grown exponentially because of combinatorial techniques integrating computation with robotics.

UBIQUITY: What strategies do you suggest to help government keep informed about and possibly influence IT developments?

REJESKI: It would require moving the policy dialogue much further upstream. I try to spend part of my time interacting with scientists in industrial and university research labs, for instance. I am interested in looking at their work from the standpoint of public policy and how we could use emerging technologies for significant public or social good. They may not have thought about these things because they often tend to be focused on market drivers or publishing their next paper. In most cases, by the time government begins to react to what's going on in industry, businesses have already invested hundreds of millions of dollars, developed business plans, filed for patents, ramped up production, and paid for K Street lobbyists. You end up throwing lawyers at each other for 20 years. That model is not very productive for government, for industry, or for other stakeholders in the political process. Ultimately, it is not very productive for our economy, and since we operate in a global economy, countries that develop more agile and adaptive industry/government interfaces will achieve comparative advantage.

UBIQUITY: Do you generally find the scientists are eager to share their ideas with people who make public policy?

REJESKI: I find that both scientists and technology people are very open to this. The closer you get to market applications, the more people become aware of where they might run amuck of regulations and whatnot. The worst place to try to change technological outcomes is in a congressional hearing because by then it's too late. Hearings sometimes can be valuable but they're largely theatrically staged events. There has to be a way of having the technology people

interact with the public policy people much earlier. That's not necessarily going to be easy or comfortable, but I do think it's possible, and increasingly necessary. If I ran a large, research-intensive company I would embed a few policy-savvy people into the research infrastructure just as Xerox PARC brought in artists to interact with their scientists.

UBIQUITY: Are there specific barriers that prevent the science and technology people from interacting with policy makers as much as they should?

REJESKI: The scientific community is far too insular and tends to organize itself into small niche organizations such as the American Association for the Advancement of Science (AAAS) or National Academies. The much broader think tank structure in Washington is mostly populated by political scientists, economists and lawyers. The scientists haven't done a good job of insinuating themselves into the fabric of the policy research infrastructure. In fact, there are few rewards, and more penalties, for scientists that leave their fields and academic institutions to engage in public policy. But when the impacts of science and technology are pervasive, we need pervasive scientific literacy in our governing institutions and our political leadership.

UBIQUITY: Using your two examples of genetic modification and nanotechnology, how enthusiastic are you about working out the problems culturally, politically and scientifically?

REJESKI: I'm optimistic in the area of nanotechnology. We have met with different types of stakeholders on nanotechnology including the government, environmental NGOs, trade associations and corporations. Those meetings are open and civil because people haven't taken hardened positions yet. That's the advantage of foresight in general -- the further you get ahead of the curve, the less you get into contentious no-win situations where people have made large investments of money and ego and simply won't bend. The debate on genetically modified organisms (GMO's), for instance, has become so polarized that it will be extremely difficult to work out.

UBIQUITY: Many people are quite nervous about nanotechnology. They believe that some areas haven't been thought through, which is the scenario of Michael Crichton's book "Prey". Can you comment on the impact of the book?

REJESKI: The book talks about the accidental release of self-replicating nanobots. Most scientists see this self-replication scenario as highly unlikely, or something that, if it does happen, might happen far in the future. However, the question becomes what is the impact of the

book (or film version of the book) likely to be on public perception, if the public knows virtually nothing about nanotech and no credible body fills that knowledge gap?

UBIQUITY: It doesn't take much for the media to overcome a great deal of scientific research.

REJESKI: Crichton, to his credit, has said the book is science fiction. But you never know how people are going to react or how many people have to develop negative perceptions of a technology to trigger significant public distrust and resistance. Because much innovation is globalized, this public resistance may occur in other countries and cultures and surprise us. The key question becomes, if people don't understand something, how does that lack of knowledge get filled and by whom? Is it the industry, the technology people or the government? Is it filled by people pushing disinformation for sensational purposes? Is it filled by Hollywood? Is it filled by museums? Is it filled by credible agencies of the government such as the National Science Foundation? The answer will have enormous impact in terms of whether people will perceive technologies in a positive or negative vein. It's often not enough to tell people that the government is spending money to think about the social, ethical or legal issues that concern them. You need to be able to answer people's questions and engage them in a constructive dialogue that anticipates issues, not just reacts to them.

UBIQUITY: Is part of the problem that there are too many information channels?

REJESKI: Yes. The number of channels available to people for getting information has multiplied exponentially. But you cannot "Google" your way to enlightenment on complex issues. The number of groups that are using technology, to inform or disinform, has also gone up significantly. The public has trouble trying to sort all the messages out. What is needed are more credible, mediating institutions that can help people sort, digest and understand information.

UBIQUITY: There are many organizations with a great deal of credibility. For example, the ACM, which is the sponsor of Ubiquity. What role does that kind of an institution have *vis-à-vis* other institutions?

REJESKI: I think it depends on the extent that the institution is seen as being an honest broker and not having an agenda. Those particular institutions are key to shortening the learning curves on new technology and helping with public understanding. Those institutions should get help and funding in terms of educating the public to keep us from getting into situations where people act emotionally on a lot of disinformation.

UBIQUITY: It sounds like that there is a certain amount of volatility and chancy-ness in the mood of the country or the mood of the people who think about these things.

REJESKI: There is volatility in the sense that there are always distractions. Will people worry about nanotechnology if the war in Iraq is going badly or if the economy takes a downturn? It is not something that would normally appear on the public's radar screen. But, historically, the public technological sphere tends to emerge when people feel threatened. This could happen quickly if nanotechnology becomes linked to other "hot button" issues such as weapons of mass destruction or genetic manipulation.

UBIQUITY: You also do work in the area of pervasive computing. How well is that understood by policy makers or the general public?

REJESKI: It is one of the hardest IT issues for policymakers to understand. How do you get people to understand computing that becomes embedded, invisible and nomadic? The reference point for a lot of public policy people remains the personal computer, this box on their desk. It's an incredibly powerful cultural icon, especially for people making policy, who are largely in the age range of 40 to 65. People usually are stunned to learn that most of the microprocessors made do not end up in computers, but in thousands of devices around us from our microwave ovens to our cars. The entire world is saturated with logic. The next great computer revolution will consist of connecting that logic up and making it work autonomously, a process that is rapidly underway. Within 10 years, we will be connected and interacting with hundreds or thousands of interconnected devices through autonomic control systems.. This is a real educational challenge for the IT sector. From my experience in trying to get policy people to think about the future of computation, it's very hard to get their minds "off of the desktop" and into the wider world of pervasive computing, a world that is invisible to the naked eye.

UBIQUITY: Tell us about your background. How did you come to your present views?

REJESKI: I started out as an artist. I suppose that's why I'm comfortable with the future because artists live in a world of evolving possibilities. I have a graduate degree in environmental design so I worked for a while as a designer. I ended up with a degree in public policy and came to Washington. I suppose I approach policymaking as a large design problem. I would say I'm a generalist. I'm very comfortable talking both to scientists and science fiction writers. We just

finished a paper on the intersection of art and science and how art can help us better understand the social and ethical issues that science may raise.

UBIQUITY: Where are you going to publish the paper?

REJESKI: Much of our work is available at a "virtual neighborhood" we created (www.foresightandgovernance.org) We do internal papers that we publish as think pieces. We do exploratory work in areas where we think people might have an interest and use the papers as "test balloons."

UBIQUITY: When you put out test balloons, do you find any raging controversies?

REJESKI: Some of them die on the vine; other ones get picked up and people become quite interested. We have a project on serious games, which started out as a white paper on the issue of using computer games to deal with challenges in the public sector. Incredible amounts of interest have grown around this idea from the policy side and also from the computer games industry. We just held the first DC Serious Games Day, in which we demonstrated and discussed computer games that were created to solve public sector problems, ranging from recruitment to first responder training to balancing a state budget.

UBIQUITY: What else are you working on?

REJESKI: We are doing a survey on emerging social behaviors. I have people tracking interesting behaviors that appear in society, everything from flash mobs to new schemes for online dating. We're interested in new ways that people are organizing themselves, where and why these behaviors start, and the technological infrastructure that enables these new types of social interactions. Importantly, we would like to think about whether these emerging behaviors might be useful for public policy at some point in time. We may come up with whole new ways of organizing people to do good things. Those are some of the wackier things I'm doing. Not wackier in a pejorative sense but probably from the standpoint of most people dealing with public policy in this town.

UBIQUITY: May we presume that, looking to the future, you predict surprises?

REJESKI: Yes, and significant disruptions. The government tends to deal well with linear progressions. Maybe we are "hardwired" to recognize these patterns. We can plan for conditions

where change is relatively predictable in terms of cause and effect, unintended consequences are minimal and largely controllable, and the rate of the change in the environment does not exceed the rate of government organizations to change and manage emerging issues. These are the underlying assumptions in our planning and budgeting systems, often unarticulated and unchallenged. As we enter the 21st century, I think you can throw almost all of these out the door.

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