

A New Age of Exploration

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Advances in science and engineering have the potential to increase our security and economic prosperity, and improve the quality of our lives. But they also dismay many of us. In part, we are unnerved because we know far too little about the role we ourselves play in bringing about these transformations, and how new knowledge and technology in turn will affect our daily lives, our families, our institutions, and the future of our planet.

In these changing times, we need a renaissance in the study of humankind. The social, behavioral, cognitive and economic sciences can help us make the well-informed choices that will guide us down the path to a successful future. New knowledge in these areas can vastly increase our menu of options, and give us the power to foresee and predict the consequences of our decisions and actions.

Rapid change and increasing complexity are hallmarks of our 21st century world. The ways we live, work, and educate our children have all changed in what seems like the blink of an eye. Technology permeates every corner of our world, holding out possibilities for healthier, more satisfying lives.

The greatest question of our times may be how we can avoid the pitfalls, and still grasp the opportunities that science and technology hold.

With these opportunities have come increasing vulnerabilities, reminding us that some of the changes we humans bring about are not for the better. The events of September 11 have left with us a vivid portrait of human thought and action gone horribly awry. The ozone hole that now appears over Antarctica every year is a reminder that the cumulative effect of billions of individual human actions can have far-reaching, though unintentional, consequences. We are daily witnesses to the need – in our own communities as in far-off Afghanistan – for deeper understanding of how the human spirit is bolstered or broken.

The time is right for the social, behavioral, cognitive, and economic sciences to join the great synthesis of knowledge that marks our new age of exploration. As the familiar and well-tried give way to a less certain future, we need the fresh perspectives and new approaches in research that these sciences can offer.

Advances in science and engineering are powering many of today's transformations, and they are transforming science in turn. Our new tools – information technology, nanotechnology, and genomics foremost among them – are expanding our vision, from the minute to the global, and beyond.

We stand at the very threshold of a new age of scientific exploration, one that will give us a deeper understanding of our planet and allow us to improve the quality of people's lives worldwide. Today, advances in science and engineering and technological change are the driving forces of economic growth. Groundbreaking discoveries have stimulated one of the most productive periods of

technological innovation in U.S. history. New knowledge is now the principal source of wealth creation and new jobs in the U.S. and globally. Advances in science and engineering have initiated lasting changes with profound implications for society – from health to agriculture, and from supercomputers to the Internet.

At the same time, our world is shrinking. National economies are more tightly linked through burgeoning trade, increasing cross-border investment, and a mobile and global workforce. Powerful computers and high-speed Internet have made communication with anyone, anywhere in the world, nearly instantaneous. These capabilities open new doors for collaboration that were unworkable only 10 or 15 years ago. We can collect, store, and manipulate vast quantities of data. We can begin to understand and predict global phenomena. Good ideas can be found anywhere in the world, and research is increasingly international in scope.

In this new age of exploration, borders of all kinds are shifting and dissolving. Embracing complexity, not spurning it, will help us gain new insights across disciplines, and deeper understanding through the integration of knowledge. Research that spans many disciplines and brings researchers together in innovative partnerships is opening new paths through complexity and change. As our tools allow us to gather and analyze more and more data, we are better able to deal with the complexity we discover.

The social, cognitive, behavioral and economic sciences have an increasingly important role to play in all areas of frontier science and engineering. We need to integrate them into our research programs.

We now have the tools to bridge the borderlands that divide the natural sciences from the territory of human thought, behavior, and action. The new information technologies, nanoscale science and engineering, and genomics are opening new frontiers that could revolutionize our approach to understanding humans and our institutions. A better understanding of how humans learn, make decisions, solve problems, evaluate risks, even how we adapt to change itself – quintessentially human capabilities – can increase our capacity for prediction, prevention, and detection. Advancing our fundamental understanding of human thought and behavior will bring us benefits in a number of areas.

- Education, backed by the science of learning, is a *sine qua non* of our future vitality and progress as a nation and a society. As we grasp the nuances of human learning, we will be better able to explore how educational institutions at all levels foster or inhibit that process.
- We have a broad range of technologies with which to respond to our increasing security needs and the emerging challenges that biological and chemical warfare present. We also need better understanding of the human and institutional causes of terrorism, and the human response to it.
- Technological change is occurring today at a faster pace and over a broader scale than ever before in history. We face a substantial challenge in understanding how people respond and adapt to these changes. Looking more closely at the process of innovation is one place to start. We know that innovation, fueled by knowledge, is key to economic growth. Understanding what stimulates and what hinders innovation could help us realize the full potential of technology to increase prosperity worldwide.
- Along the same lines, research on learning and cognition can help us increase the benefits of technology. Understanding how people process information could help us design computers that fit human needs like a well-worn glove. That would make the benefits of information technology more widely accessible, and it will help us realize its full power to transform education.

- And we often know too little about the potential consequences of adopting new technologies. Illuminating the social and economic effects of new technologies would give us a better guide to the potential risks and benefits.

All of these efforts can benefit from improved methodologies throughout the behavioral and social sciences.

An African proverb cautions, “Smooth seas do not make skillful sailors.” Our nation now faces stormy weather, and is stronger for it. Our research and innovation enterprise will also be stronger if we reach across disciplinary boundaries, explore new paradigms, and shed academic divisions that are outmoded.

Breaking down barriers and building bridges will not be easy. But a big tent that welcomes diversity – among disciplines and cultures, and across national borders – is as important in science and engineering as it is in politics and in foreign affairs. We will enlarge our intellectual horizons greatly by doing so, and improve our prospects for charting a future worth our best efforts.