Work at the Human-Technology Frontier: Shaping the Future

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The World of Work is Changing

• On the cusp of a major transformation in work and the workplace
• Driven by combinations of
  – Artificial intelligence
  – Machine learning
  – The Internet of Things
  – Robotics
  – And more
• Toward an evolving human-technology ecosystem
The Pace of Technological Development is Accelerating

- Cost of computing dropping, computer power increasing
  - Computers ubiquitous & networked (Internet of Things)

- Software platforms facilitate new services

- Artificial Intelligence (AI) accelerates the impact of big data

Self-driving car

Bridge sensors

Cars maintaining distances
A Changing World of Work: Why it Matters

- Employment
- Opportunity
- Productivity
- Economic Growth
- Competitiveness
- National Security
- U.S. Global Leadership
Past Research Investments are Bearing Fruit Today

NSF projects foster human-technology partnership

Wearable robotic glove restores independence for stroke victims

Transformative advances in manufacturing enable a new model for small business

Using sound waves to keep sewer pipes clog-free
Work at the Human-Technology Frontier: Shaping the Future

• A bold initiative to catalyze interdisciplinary science and engineering research to...
  – understand and build the human-technology partnership;
  – design new technologies to augment human performance;
  – illuminate the emerging socio-technological landscape; and
  – foster lifelong and pervasive learning with technology
Changing the Traditional Design-Use-Impact Framework

From this:

Design → Use → Impact

To this:

Design → Use

Convergent Research:
- Engineering
- Computer Science
- Social and Behavioral Sciences
- Education

Create

Describe & explain

Iterate

Describe & explain

Impact
Theme 1. Understanding and Building the Human-Technology Partnership

Manufacturing “cobot”

Immersive 3D virtual environment

Computers reading facial expressions
Theme 2. Designing New Technologies to Augment Human Performance

- Smart prosthetic arm and hand with sense of touch
- Deep learning applied to brain tumor detection and segmentation
- Soft robotic exoskeleton for strength and endurance
Theme 3. Illuminating the Emerging Socio-Technological Landscape

**Benefits**
- New industries and jobs
- Labor Productivity
- Economic Growth
- Improved Quality of Life

**Risks**
- Lost industries and jobs
- Loss of Privacy
- Growing disparities in access to new technologies

**Values**
- Convergent Research: Engineering, Computer Science, Social and Behavioral Sciences, Education

Process:
- Use
- Design
- Impact
- Create

Describe & explain
- Iterate
Theme 4. Fostering Lifelong and Pervasive Learning with Technology

Dashboard for teachers

Virtual reality training simulation
Potential Activities and Investments

- Workshops and Planning Grants
- Research Coordination Networks
- Interdisciplinary Research Programs
- Use-Inspired, Human-Centered Research
- Infrastructure
- Center-Scale Activities

PROGRAM PROGRESSION TIMELINE
The Impact of Work at the Human-Technology Frontier

Research on Work at the Human-Technology Frontier

Outcomes

- Strong Human-Technology Partnerships
  - New Technologies to Augment Human Performance
  - Reduced Risks and Heightened Benefits
  - Lifelong and Pervasive Learning with Technology

Impacts

- Advance Knowledge and Innovation
- Drive the Economy
- Enhance National Security
- Sustain U.S. Global Leadership
Thank you!

- Comments?
- Questions?
- Suggestions?
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- Slide 4: Carnegie Mellon University (self-driving car); MicroStrain, Inc. (bridge sensors); U.S. Department of Transportation (distances)
- Slide 5: MIT Technology Review (How Technology is Destroying Jobs; The Atlantic (How to Protect Workers...)); Journal of Economic Perspectives (Why are There Still So Many Jobs); The Guardian (Technology has created more jobs...)
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- Slide 9: http://blog.robotiq.com/what-does-collaborative-robot-mean, What Does Collaborative Robot Mean? by Mathieu Bélanger-Barrette Aug 19, 2015 (Cobot); Lance Long for Electronic Visualization Laboratory, University of Illinois (physicians); Rosalind W. Picard, MIT Media Lab and Affectiva, Inc. (Faces)