

National Robotics Initiative

Jeff Trinkle

Dept of Computer Science, RPI
Program Director, CISE/IIS, NSF

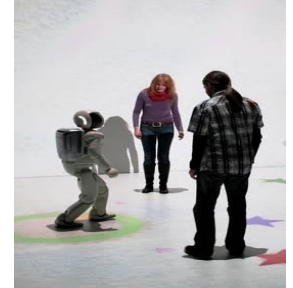
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The National Robotics Initiative

*The next generation of robotic companions that work seamlessly with humans to **enhance personal safety, health and productivity***

- A nationally coordinated robotics technology R&D program across multiple government agencies
 - Multi-agency commitment: NSF, NASA, NIH, USDA
 - About \$40M per year
 - Jan 2014: Received ~260 proposals requesting ~\$300M
- Serves key national priorities: increased personal productivity in manufacturing, healthcare and security
- Strong coupling with industry and startups, through SBIRs
- Emphasizes common platforms & standard interfaces
- Will sponsor national competitions, outreach & education



NRI: The Technology Space

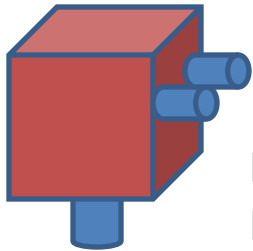
Cognition: Learning,
Knowledge representation,
Planning, Navigation



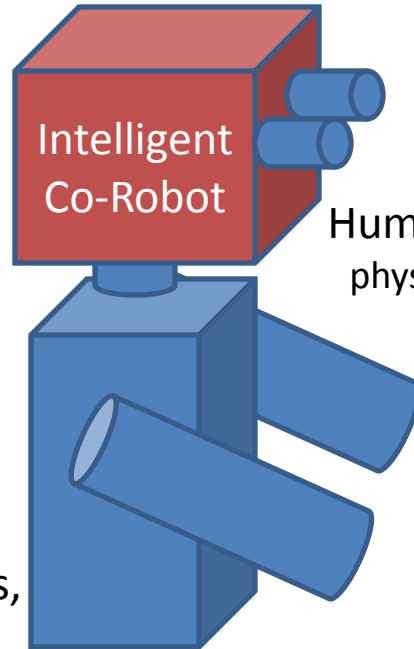
Smart structures and
environments

Sensors &
perception

Cognitive prosthetics

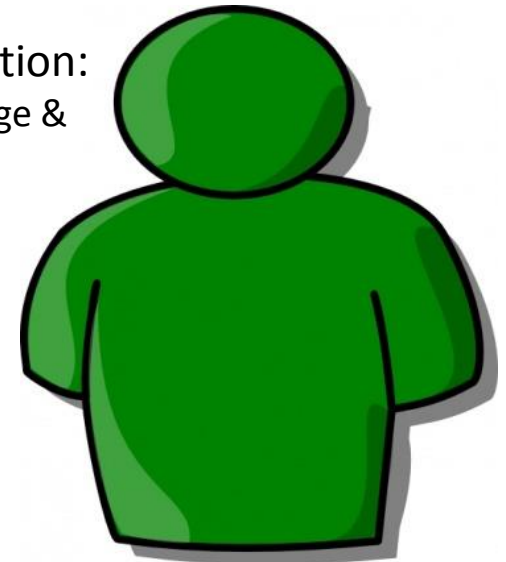


Networked
Multi-Agent



Intelligent
Co-Robot

Human-robot interaction:
physical & social, language &
communication



Manipulation:
Haptics, Tactile

HW/SW Architecture
Platforms – Mechanisms,
Control, Modeling

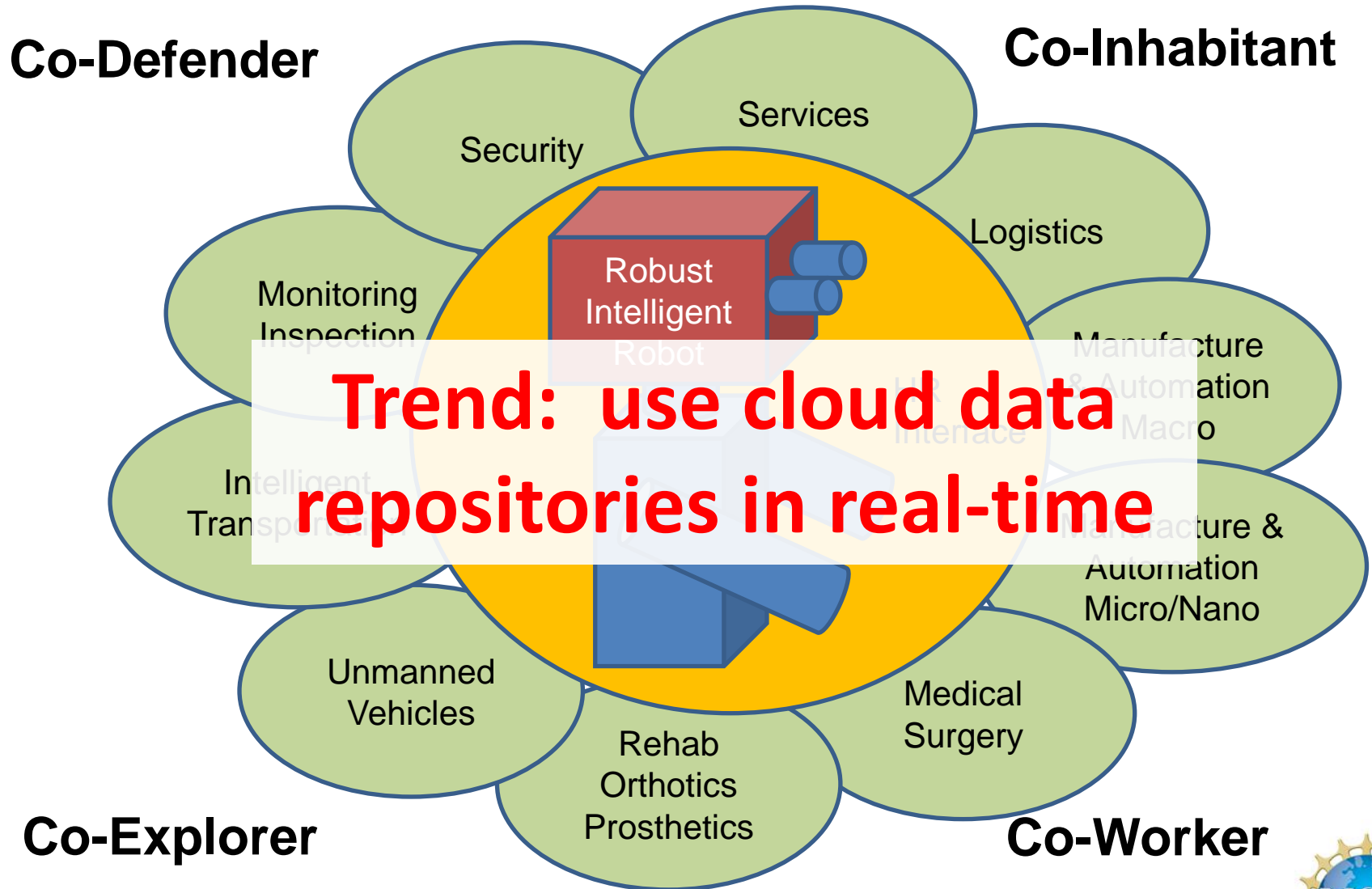
Mobility: legged, wheeled, aquatic, aerial

Exo-skeleton
augmentation

Soft
structures



NRI: The Application Space



NRI Education Initiatives



- Goal of developing the technical abilities of the US workforce
 - Elementary Schools
 - High Schools
 - Universities

- Robotics is a proven way to engage kids in STEM
 - Fun
 - Demystifying
 - Confidence-building
 - Evolve robotics-centric pedagogy and outreach



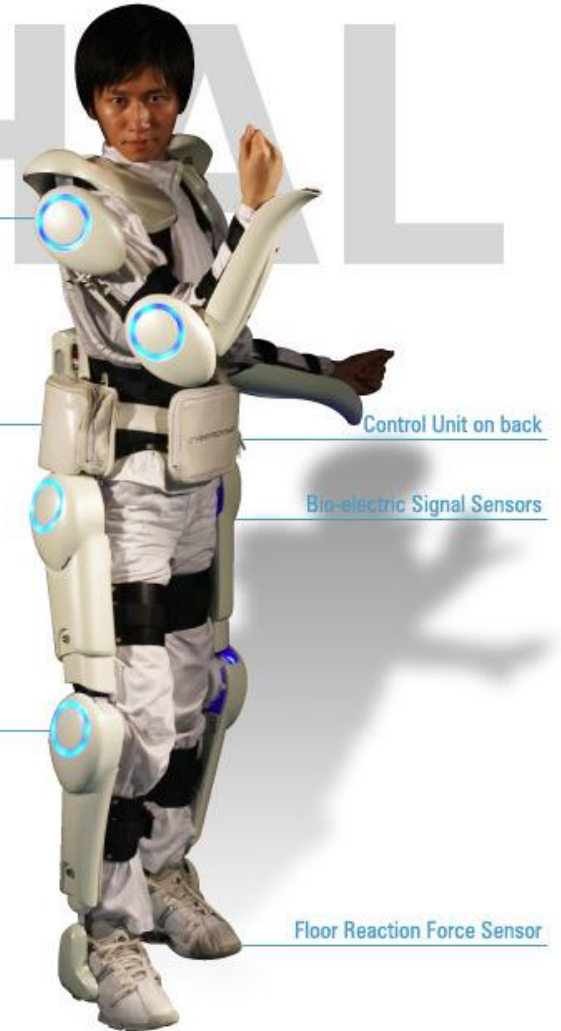
NRI Precursor Co-robots



Power Units
for upper limb
(+ Angle Sensor)

Battery Pack

Power Units
for lower limb
(+ Angle Sensor)



Control Unit on back

Bio-electric Signal Sensors

Floor Reaction Force Sensor

NRI Research Areas (1)

- Fundamental research in robotics science and technology and supporting disciplines
 - Machine perception & cognition
 - Learning & planning
 - Natural language understanding and production
 - Human-robot interaction
- Controls and dynamical systems
 - Optimization, design, and decision algorithms
 - Analysis of complex engineered robotic systems
- Computational models of human cognition, perception, and communication for commonsense or specialized domains
- Use of robotics to facilitate and motivate STEM learning across the K-16 continuum



NRI Research Areas (2)

- Platform specific topics that are unique to micro- and nano-robotics, neuro-robotics, humanoid robotics, and networked multi-robot team coordination and cooperation
- Understanding of the long term social, behavioral and economic implications of co-robots across all areas of human activity.
 - Models of uptake, diffusion, and use among different demographic and social groups
 - Incentives, disparities and ethical implications; workforce participation
 - Models of human-robot collaboration
- Application-inspired topics - intelligent and assistive robotics for healthcare, mobile, marine, aerial, exploratory; and rescue applications, advanced manufacturing, and social robotics.



NRI Unifying Mechanisms (1)

- Establish open system robotics architectures and common hardware and software
- Create repository of software, hardware, and data to encourage sharing and coordination of efforts
 - Create the cyber-infrastructure to enable cloud robotics
 - Standardize test sets and specifications for common performance measures
- Create testbeds for integration of the outputs of multiple activities and their testing, demonstration and evaluation on high level and complex tasks.
- Coordinate with a separately funded companion SBIR effort leading to commercial products



NRI Unifying Mechanisms (2)

- A range of projects from small to multi-faceted collaborative efforts
 - Include academic and industrial scientists in the core technologies;
 - Domain application specialists;
 - Educators; and social, behavioral and economic scientists.
- Transfer new platforms and/or functional capabilities to agency mission applications and demonstrations
- Establish competitions among funded projects
 - Option of partnering with unfunded collaborators from academia or industry



NRI Proposal Process

- All information: www.nsf.gov/NRI
- Next due date – Nov 2014
- Small projects
 - \$100,000 to \$250,000 per year direct costs; 1-5 years
- Large / Collaborative / Multidisciplinary teams
 - \$250,000 to \$1,000,000 per year direct costs (max \$1.5M); 1-5 years
- Expecting **about 40** awards per year
- Organizational eligibility: broad, see Grant & Proposal Guide
- Max 2 proposals per PI per solicitation year
- Okay to communicate with program managers



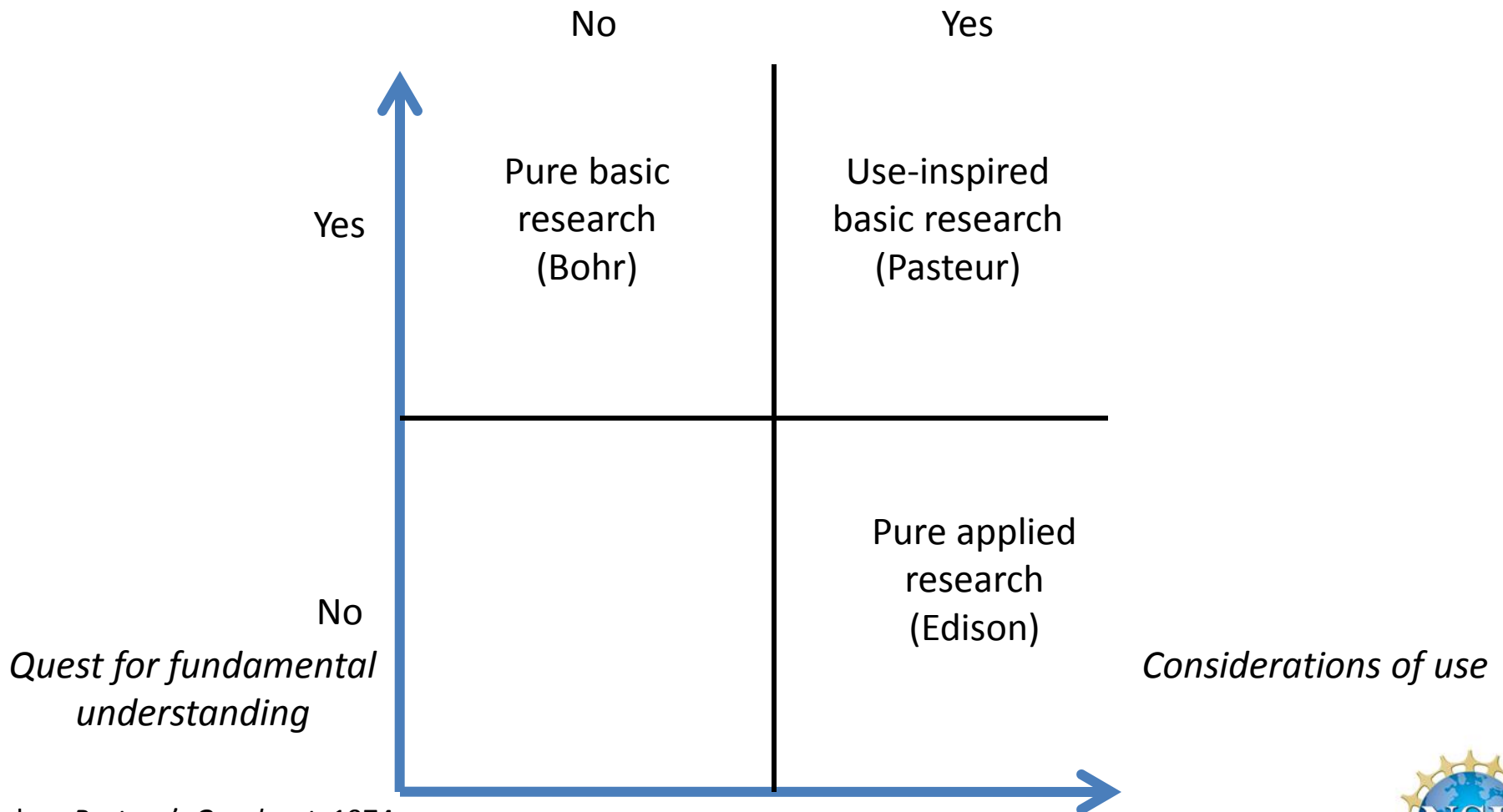
NRI Review Process

- Peer review
 - Academics, Industry, Government
- Review criteria
 - **What is the intellectual merit of the proposed activity?**
 - **What are the broader impacts of the proposed activity?**
 - integration of research and education
 - integrating diversity into programs, projects and outreach activities
 - Special
 - interoperability, scalability, extensibility
 - plans for commercial transfer, support, exploitation
 - means of software sharing
 - adaptability to common platforms
 - protection for human subjects where applicable



NRI Research Space

Quadrant model of scientific research



Stokes: *Pasteur's Quadrant*, 1974

