

AMERICA'S GOT STEM TALENT

Should We Include Persons with Disabilities?

National Diversity Equity Workshop 2013
Arlington, VA
April 14 - 16, 2013

Presentation Format

- Workforce Demographics
- Federal Initiative to Support Greater Inclusion of PwD
- Need for Assistive Technology
- National Science Foundation Approach
- Creating a Plan
- Final Thoughts

Has Diversity in the American Workforce Changed over the Past 50 Years?

YES!!!

Workforce in the Early 1960s

Workforce in 2013

What's Still Missing?

Persons with Disabilities?

***Persons* with Disabilities** (PWDs) represent:

* 19.6 percent of the U.S. population

* Over 60 Million Americans

* 65% of PWD are unemployed (Since 1986)

McNeil 1993; NSF 1996, 2000
Louis Harris Poll, 2004

Federal Initiatives

President's Initiative

"2010 was the 35th anniversary of the Individuals with Disabilities Education Act (IDEA). Across the United States, nearly 6.6 million students with disabilities and their families rely on this law to ensure that they enjoy the same educational rights as all children. The *initial* law, Education for All Handicapped Children Act (Public Law 94-142), was signed into law on November 29, 1975, by then-*President* Gerald Ford. The IDEA guarantees access to a free, appropriate, public education in the least restrictive environment to every child with a disability. "

*https://www.**disability**.gov*

Americans with Disabilities Act of 1990 (ADA Amendments Act of 2008)

Title I of the ADA defines a disability as a mental or physical impairment that prevents an individual from performing one or more "major life activities." The definition includes having a record of the impairment or "being regarded as having the impairment".

Major Life Function

"A major life activity, as defined by the U.S. Equal Employment Opportunity Commission (EEOC), includes the ability to care for self, walking, speaking, breathing, hearing, reaching, lifting, learning, sitting, standing, working, sleeping, thinking, concentrating and interacting with others. The U.S. Supreme Court included running."

ADA Amendment of 2008

Why Should the STEM Community Actively Pursue the Inclusion of Persons with Disabilities?

What traits are necessary for success in STEM fields?

Problem Solving Skills

Creativity

Persistence

Answer:

Underrepresented groups, especially the disability community, inherently possess fundamental traits necessary to be successful in STEM fields.

Problem Solving Skills

Creativity

Persistence

and

We bring our own **unique life experiences** *to the problem solving table which* **promotes innovation**.

How can this latent talent be recognized and fostered in Persons with Disabilities???

Assistive Technology

An Average Day in My Life

Using

Assistive Technology

What did you expect!!!

Additional Needs

Chronometer with a Mechanical Audio Frequency Generator

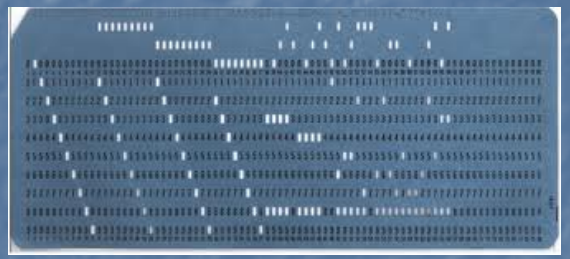
Temperature Controlled,

Pressurized Water Delivery System

Human Transport Mechanical Lifting Machine

Communication Device

Previous Computing Technology



Upgraded Computing Machine

What Assistive Technology could a Chemist possibly need?

(see checklist below)

Assistive Technology For Chemists

X-ray Diffraction

NMR

GC-MS

Statement of the Obvious!!!

Assistive Technology allows us to conduct and complete tasks that we would otherwise not be able to perform.

WE ALL USE A.T.

Why should we include Persons with Disabilities when we discuss Underrepresented Groups

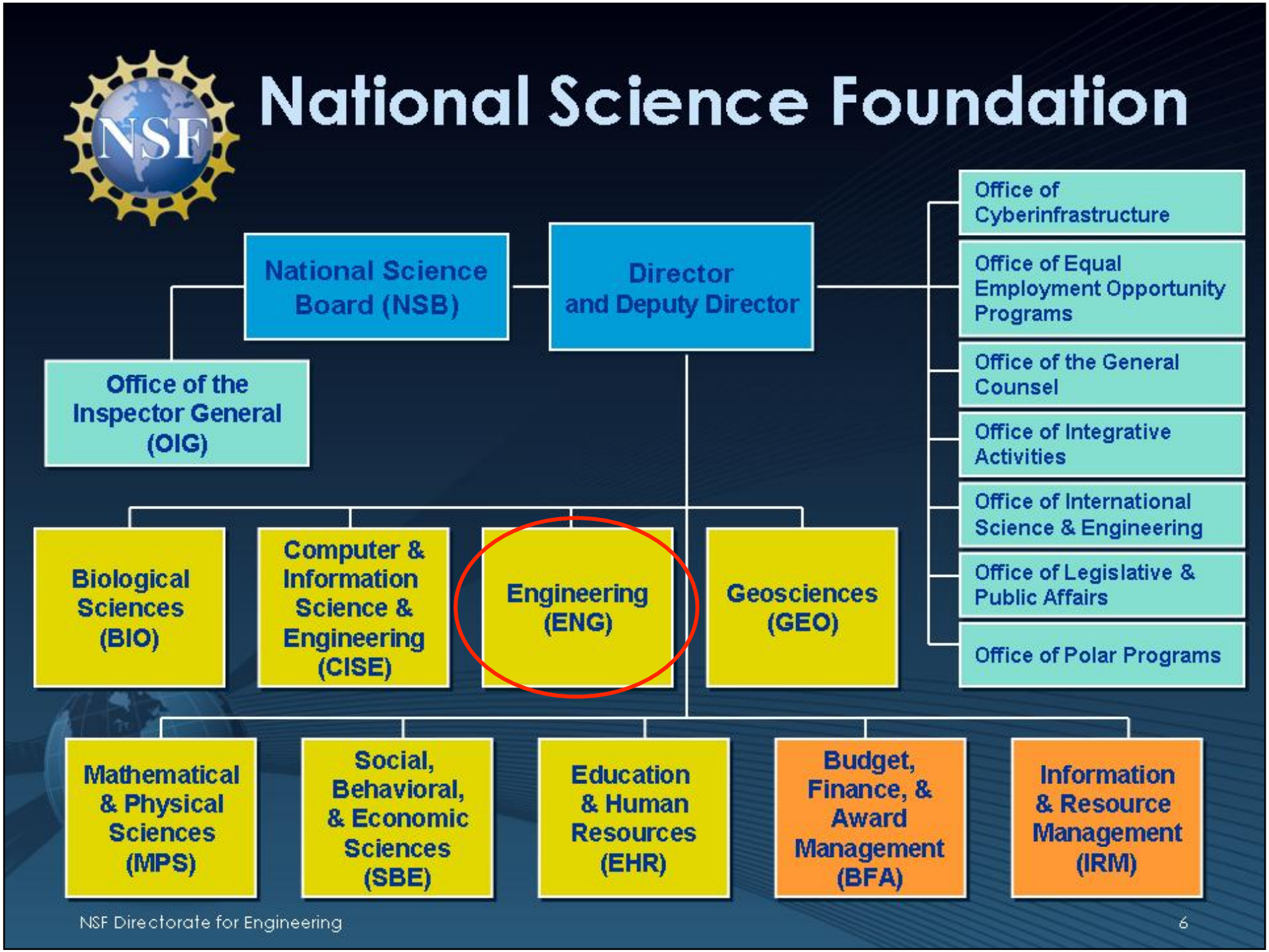
and

Broadening Participation?

TALENT

YOU MAY ASK

How can the National Science Foundation become PROACTIVE with respect to the facilitation and inclusion of Persons with Disabilities in all aspect of life, including the pursuit of higher education in STEM fields?


National Science Foundation
National Science Board (NSB)
Director and Deputy Director
Office of the Inspector General (OIG)
Office of Cyberinfrastructure
Office of Equal Employment Opportunity Programs
Office of the General Counsel
Office of Integrative Activities
Office of International Science & Engineering
Office of Legislative & Public Affairs
Office of Polar Programs
Biological Sciences (BIO)
Computer & Information Science & Engineering (CISE)
Engineering (ENG)
Geosciences (GEO)
Mathematical & Physical Sciences (MPS)
Social, Behavioral, & Economic Sciences (SBE)
Education & Human Resources (EHR)
Budget, Finance, & Award Management (BFA)
Information & Resource Management (IRM)
NSF Directorate for Engineering
6

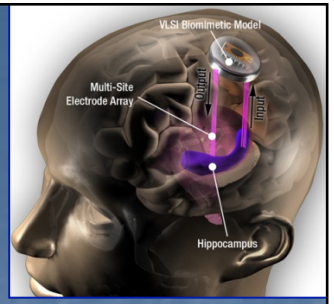
Support Transformative Research in Technologies, Devices, or Software

as

Tool for Greater Inclusion of ALL PwDs (Gen. & Age Related)

in all aspects of daily living

Including the Engineering Workforce



General & **A**ge **R**elated **D**isabilities **E**ngineering

GARDE

Program Director: Ted Conway

Engineering Directorate

National Science Foundation

Support Engineering Career Pathways Development

for PwDs

Support Technology Transfer

for PwDs by PwDs

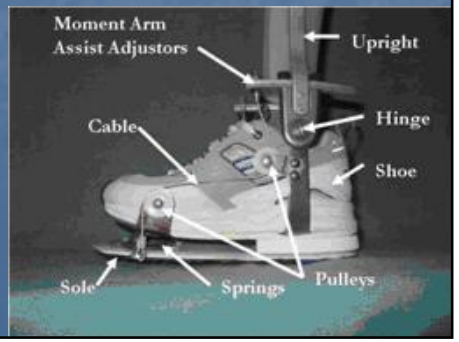
Continuous Evaluation of

Global State-of-the-Art in Assistive Technology

Research and Development

for

General & Aging PwDs



Biomechanics

Much of the research related to Human Biomechanics has focused on the Structure-Function of the various systems within the body. This "groundwork" is critical in developing analytical models that accurate predict human functionality.

With this "groundwork" established, future research can now evolve in the direction of Human-Machine Failure Analysis and Augmented Repair.

Bit of a Paradigm Shift

Mechanical Systems Failure Modes

Damage (Mechanical)	Fault (Electrical)	Disability (Biomedical)
Impact	Soft Errors	Trauma
Corrosion	Failure in Time	Degenerative Disease
Fatigue/Wear	Electromigration	Aging

We will all have the opportunity to experience one or more of these Disability Causing Events

NSF Review Criterion Broadening Participation

Why does NSF support Broadening Participation in the vast majority of it funding mechanisms?

Broadening Participation

"When I was young, … providing equal (educational) opportunities for everyone was a matter of social justice – part of the social contract in the United States. Now, … it is a matter of national survival. Any country that fails to encourage and develop the talent in each individual through its public school system will suffer greatly…."

Bruce Alberts, Editor-in-Chief of *Science*
Editorial, *Science* Vol. 323, 2 January 2009

Broadening Participation

"We take different approaches to problems, and the best solutions are achieved by the greatest diversity."

Doug Wilde, Professor Emeritus

Mechanical Engineering, Stanford University

Mechanical Engineering Vol. 132, February 2010

Question:

What has been one of the strongest “Best Practices” for Broadening the Participation of Underrepresented Groups, especially Persons with Disabilities, in STEM Fields?

Answer:

Active Recruitment

Retention

Mentoring

NSF BROADENING PARTICIPATION Evaluation Methodology (Create a Plan)

Formative Evaluation: Identify and monitor specific metrics that provide on-going feedback for the implementation and progress of the proposed plan.

Summative Evaluation: Use identified metrics to access the project success after the project has ended.

DON'T REINVENT THE WHEEL

1. Work with PwD to identify environmental and time management needs to perform job function

2. Work with PwD to identify appropriate Assistive Technology

3. Review websites that address hiring and management issues related to PwD
   (e.g. https://www.washington.edu/doit/)

4. A wealth of information already exists on websites addressing every aspect of employment of PwD

FINAL THOUGHTS

Captain Pike en route to Talos IV

FICTION

State of the Art Assistive Technology in the 23th Century (used to benefit from the talent which still existed in Captain Pike).

(as envisioned in 1968)

Talosians Provide Direct Neural Assistive Technology

Captain Pike is able to live out the rest of his life pursuing his goals and dreams

Jemma, who has cerebral palsy, uses a computer to communicate. (Courtesy of the Leech Family)

REALITY

Person of the Week – ABC News

Winner – Times Educational Supplement Write Away Competition (1600 Contestants)

Age: 10

"Many people can't imagine how there could be a brain in this body. *They see a broken child like a broken toy, simpler to dispose of than use for the few things it can still do. …* Few people suspect a city of people lies inside my fractured casing, with artists, musicians, politicians, teachers, priests and spacemen all vying with each other for airtime on Jemma FM." **Jemma Leech**

WHY GARDE AND SIMILAR PROGRAMS EXIST AT NSF

Jemma, and those possessing her level of talent, should have every opportunity to pursue their goals and dreams and not be limited by a "fractured casing".

There is much talent to be developed in historically underrepresented human resources.

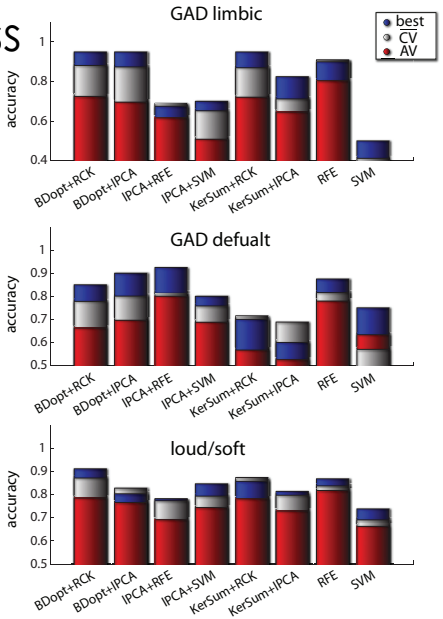
QUESTIONS???

Examples of Current Research Activities Funded by the GARDE Program

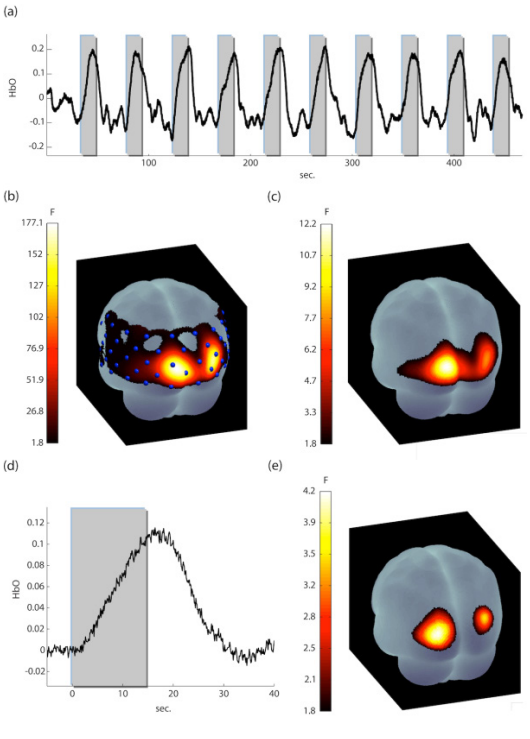
Stony Brook University

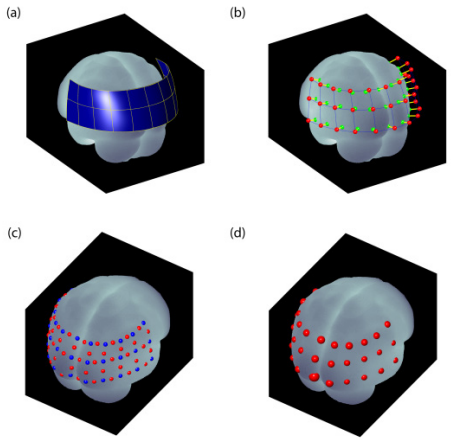
Software Development
NAP, NeuroClass

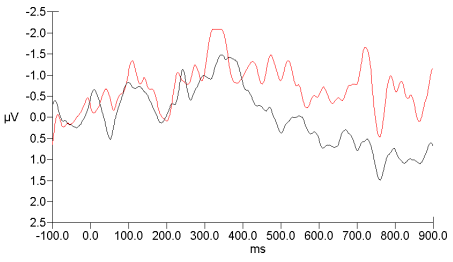
NeuroClass

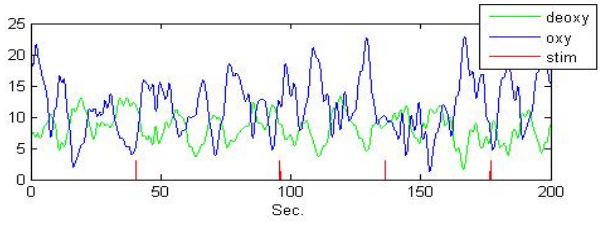


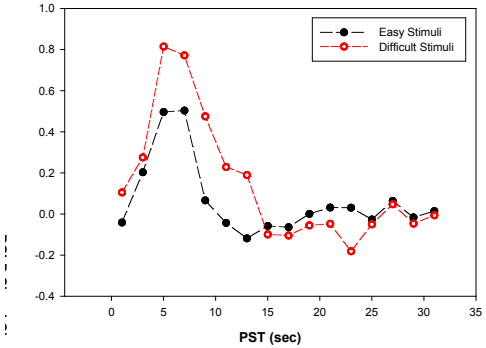
NIRS Analysis Package (NAP)











EEG 512 Hz (2ms)

NIRS 10 Hz (100ms)

fMRI .4 Hz (2500ms)

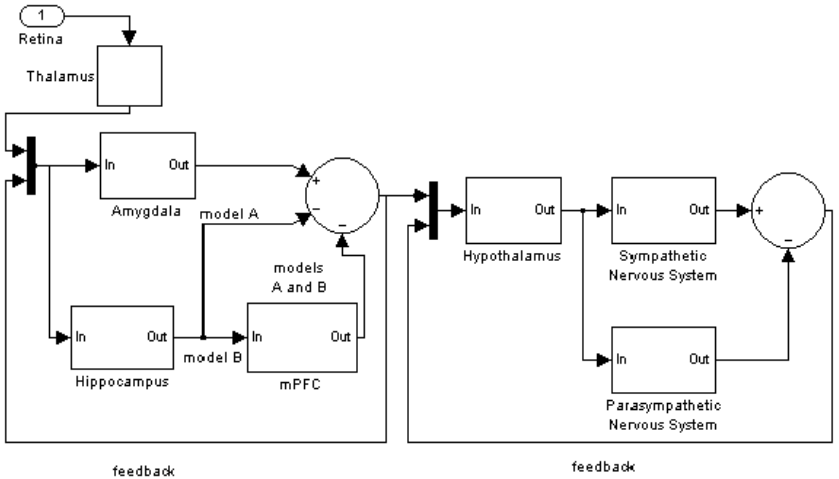
T. Conway at NDEW 2013

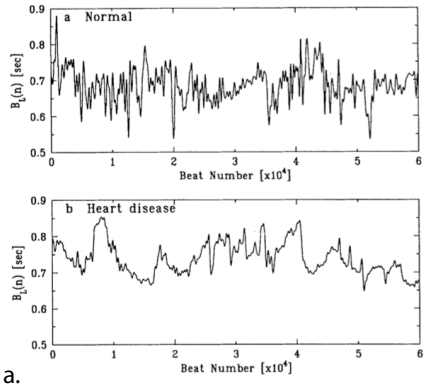
www.oxide.gatech.edu

Stony Brook University

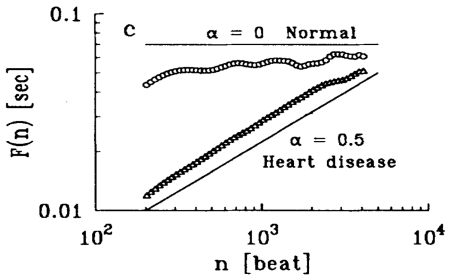
Dr. Mujica-Parodi

CAREER Grant No. 0954643





a.



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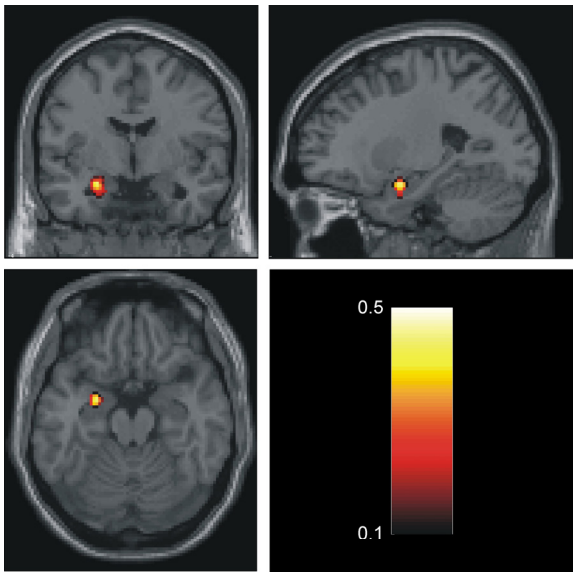
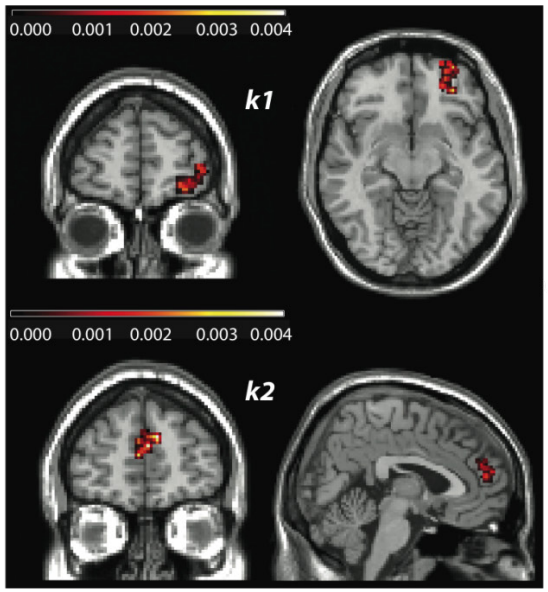


Trait Anxiety

r=0.49, *p*=0.000

Tolkunov D, Rubin D, Mujica-Parodi LR. *Neuroimage*. 2010.



Positive-symptom Schizophrenia

k_1: *Z*=4.3215, *p*=0.00002

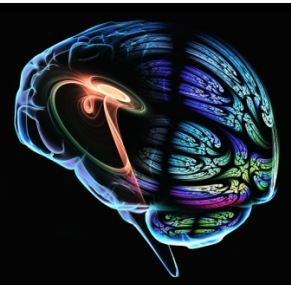
k_2: *Z*=3.9441, *p*=0.00008

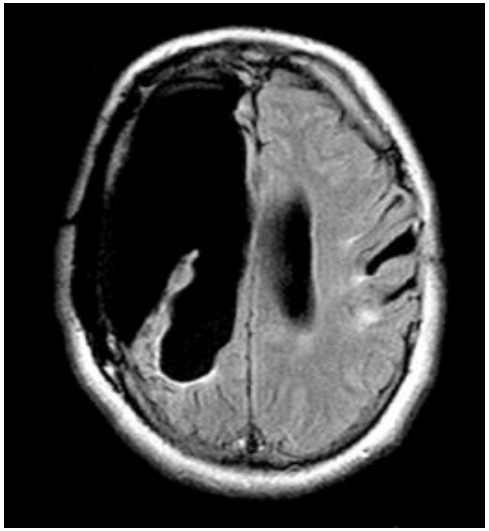
Radulescu A, Rubin D, Strey HH, Mujica-Parodi LR. *Human Brain Mapping*. 2011.

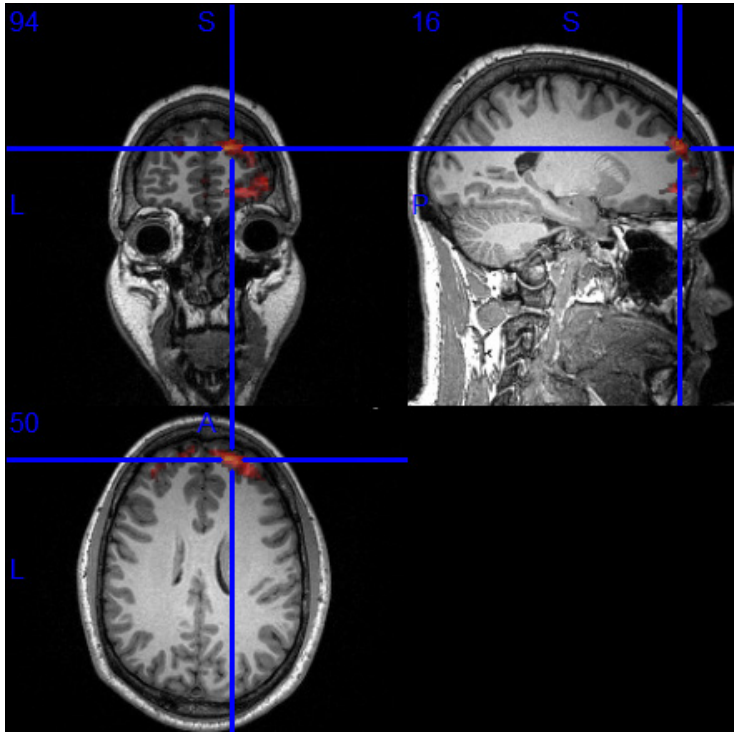
Stony Brook University

Dr. Mujica-Parodi

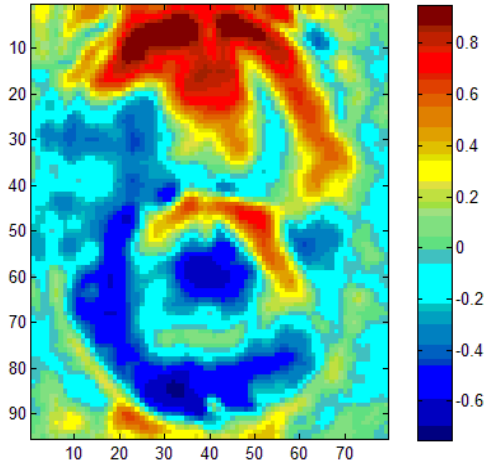
EAGER Grant No. 1141995



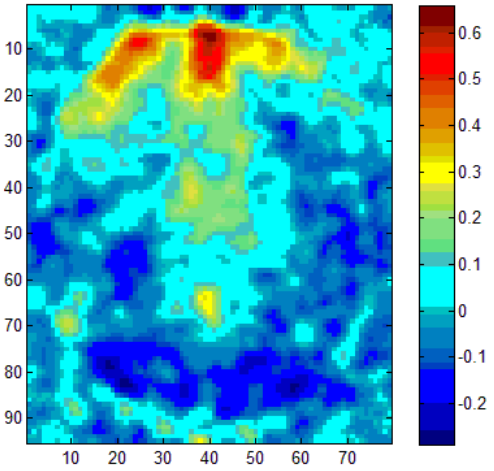




EP Patient



Matched Control



I. Well-Defined Foci (Lesions)
II. Well-Defined Foci EEG/Symptoms
III. Cryptogenic

All are validated with intra-cranial electrodes.

Wireless tracking of tongue movements for wheelchair control and computer access

Maysam Ghovanloo - **Georgia Tech** **CBET 0828882**

A team of engineers at the Georgia Institute of Technology, have developed a wireless and wearable assistive technology that can convert a user's tongue motions to specific commands, such as moving a mouse cursor or a powered wheelchair. The team was able to detect the position of a small magnetic tracer on an individual's tongue using an array of magnetic field sensors mounted on a headset near the person's cheeks. A novel signal processing algorithm running on a laptop wirelessly received the measured magnetic fields to associate the subject's tongue position to a set of 6 user-defined command positions within their mouth in real time. The average speed of information transfer between participants and the computer was twice the bandwidth of the fastest brain-computer interfaces that have been tested on human subjects. The subjects also had immediate and full control over the powered wheelchair to the extent that they were able to perform complex wheelchair navigation tasks, such as driving through an obstacle course.

Future Directions

- Brain-Computer Interface Research and Development for Persons with Severe Disabilities (Locked-In Syndrome)
- Exoskeletal Robotics for Assistance and Rehabilitation
- Sensory Organ Augmentation and Replacement
- Neuro-Imaging Applications in Disease Diagnosis and Treatment

National Robotics Initiative

- NSF, NIH, USDA, NASA
- Robotics for Assistance and Rehabilitation
- Goal: Accelerate the development and use of robots in the US that work beside, or cooperatively with, people.

- Small Projects: December 11, 2012 – 1-5 Years
- Large Projects: January 23, 2013 – 3-5 Years