ICT and Persons with Disabilities: The Solution or the Problem?

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Technology and progress

- Progress requires change
- Much change is accomplished through advances in technology
- Technology also creates problems:
  - over consumption,
  - environmental ruin,
  - separation of classes
- These are amplified for people who have disabilities => a "disability gap"
- Principle of distributive justice

Ronald Wright, *A Short History of Progress, Anansi Pub, 2004*

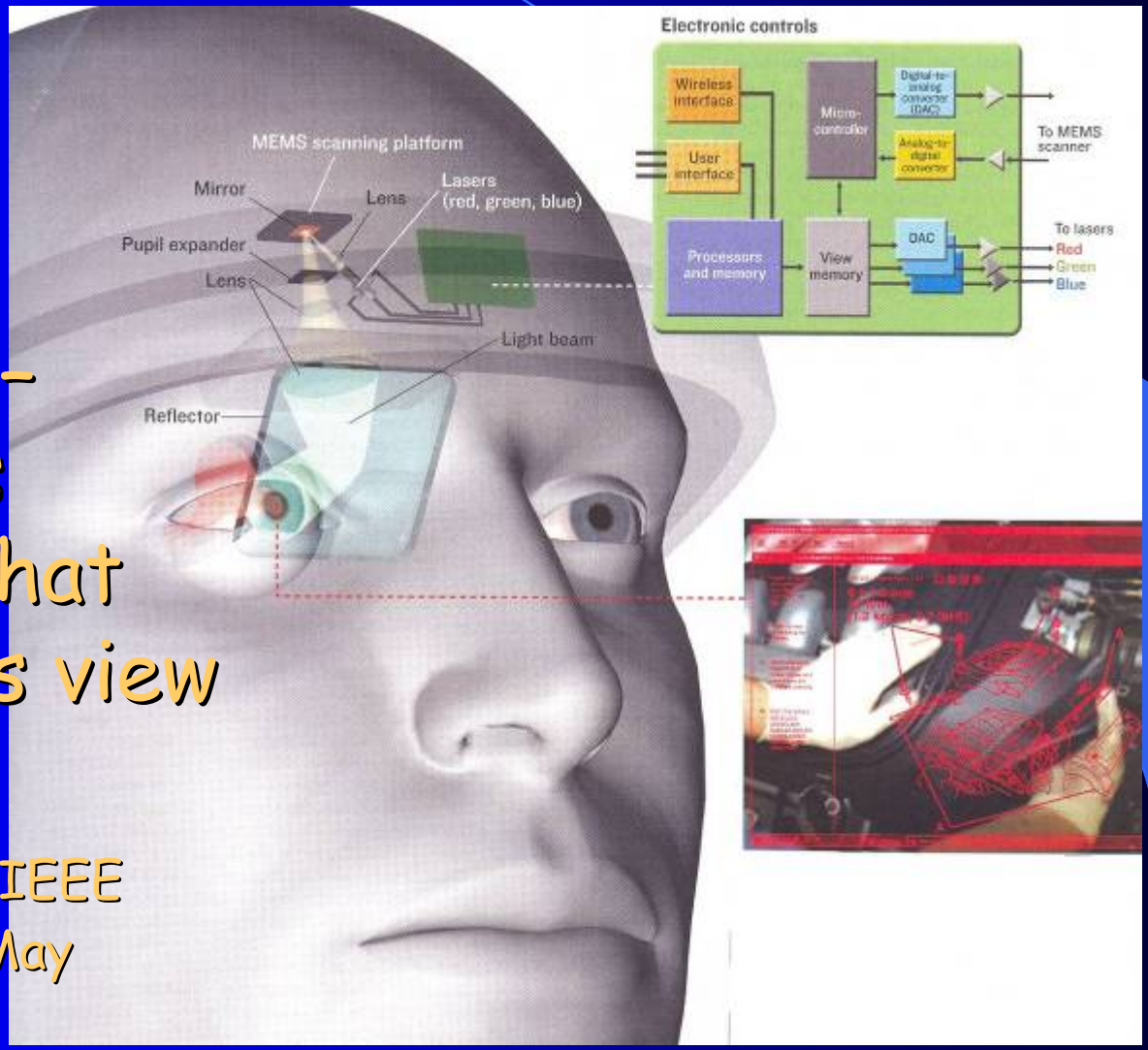
What can we expect from technology in the next 20 years?

- Automated transactions between individuals and organizations
- Equalized access to the web and information between developed and developing world
- Embedded systems – "intelligence in your doorknob or phone"
- Much greater understanding of the biological/physical interface for the control of ICT

Traditional display technology for communication devices

Examples of Emerging Mainstream Technologies with potential for AT

- Direct retinal display – creates image that overlays view of real object (IEEE Spectrum, May 2004)



Examples of Emerging Mainstream Technologies with potential for AT

- 3-D displays that create a more intuitive view of objects, events and activities
- Embedded ASR in PDA to reduce need for keyboards with more and more functions

Focus on People-the Rehabilitation Engineering Difference

Technology advances can increase the gap between people who have disabilities and those who don't

- *The ability to make tools is what distinguishes us as human, but …*
- *Our tools ultimately control us by making us dependent on them, and …*
- *This dependence is less optional for people who have disabilities*

Ronald Wright, *A Short History of Progress, Anansi Pub, 2004*

Implications for Assistive Technologies

- Constant challenge to keep tools and systems accessible to persons with disabilities (PWD)
- Must be driven by needs of PWD
- Must be functional in many contexts without technical support

Activities of Daily Living

Self-care

Recreation & Leisure

Productivity

Education/learning

Work

Physical Contexts

Public Park

Store

Crowded elevator

School classroom

Home

Public buildings

Social Context

Strangers

Co-worker

Teachers

Friends

Family

Institutional Context

- Societal organizations responsible for policies, decision-making processes and procedures
- World Health Organization ICF:
  - Services
  - Systems
  - Policies
- Funding is most influential element
  - eligibility to receive devices purchase assistance
  - devices that are supported in funding scheme
  - funding gatekeepers
- Governments also regulate and support environmental modifications for persons with disabilities

Access to capabilities of mainstream technologies: information systems

- Universal Design
- Individualized assistive technologies-customization

Universal Design

The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Access to capabilities of mainstream technologies: information systems

Universal Design for ICT

Features of Future Information Services*

- No clearly predefined service - Access to information involving communities of users
- Varied contexts of use
- Services are:
  - Highly interactive
  - Inherently multimedia
  - Sensory multimodal

* PL Emiliani, Tech Disab, 18, 19-29, 2006

Universal design for IT

- Barriers are technological
- Contrasts with architectural universal design which has political and economic barriers
- The goal is to have an environment with enough embedded intelligence to be easily adaptable

Expanded availability of embedded systems

- Open architecture that allows downloading profiles for AAC

Expanded availability of embedded systems

- Trainable hearing aids that adjust automatically to the environments in which they are used

Expanded availability of embedded systems

- Downloading instructions and grocery list to PDA for a person with intellectual disability based on sensing of location

A Working Definition of Assistive Technologies*

Any item, piece of equipment or product system whether acquired commercially off the shelf, modified, or customized that is used to increase, maintain or improve functional capabilities of individuals with disabilities.

*United States (Public Law (PL) 100-407)

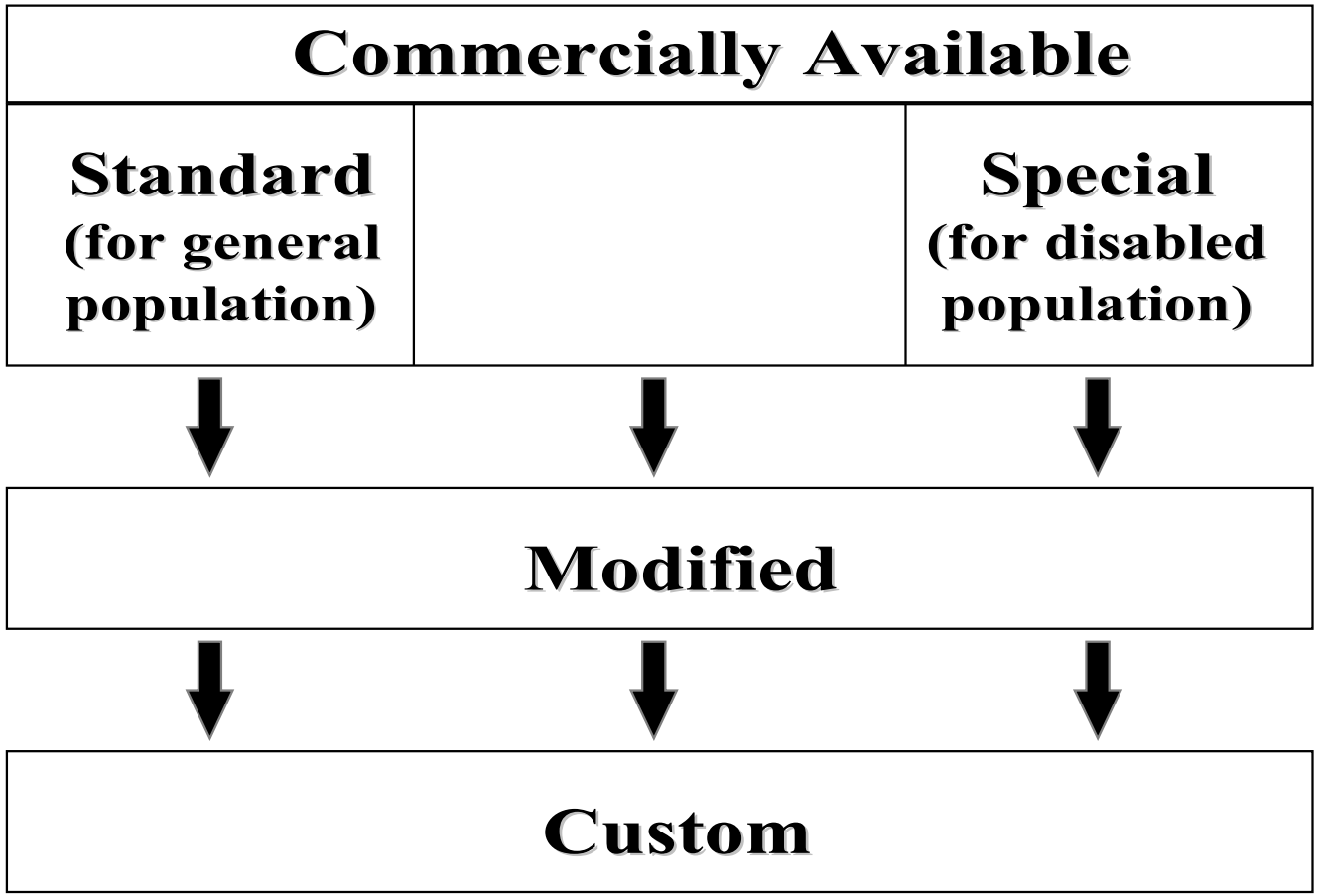
Hard and soft technologies*

- Hard technologies:
  - readily available components
  - can be purchased and assembled into assistive technology systems
  - main distinguishing feature is that they are tangible

- Soft technologies: human areas of decision making, strategies, training, concept formation

*Odor P: Hard and soft technology for education and communication for disabled people, Proc Int Comp Conf, Perth, Western Australia, 1984.

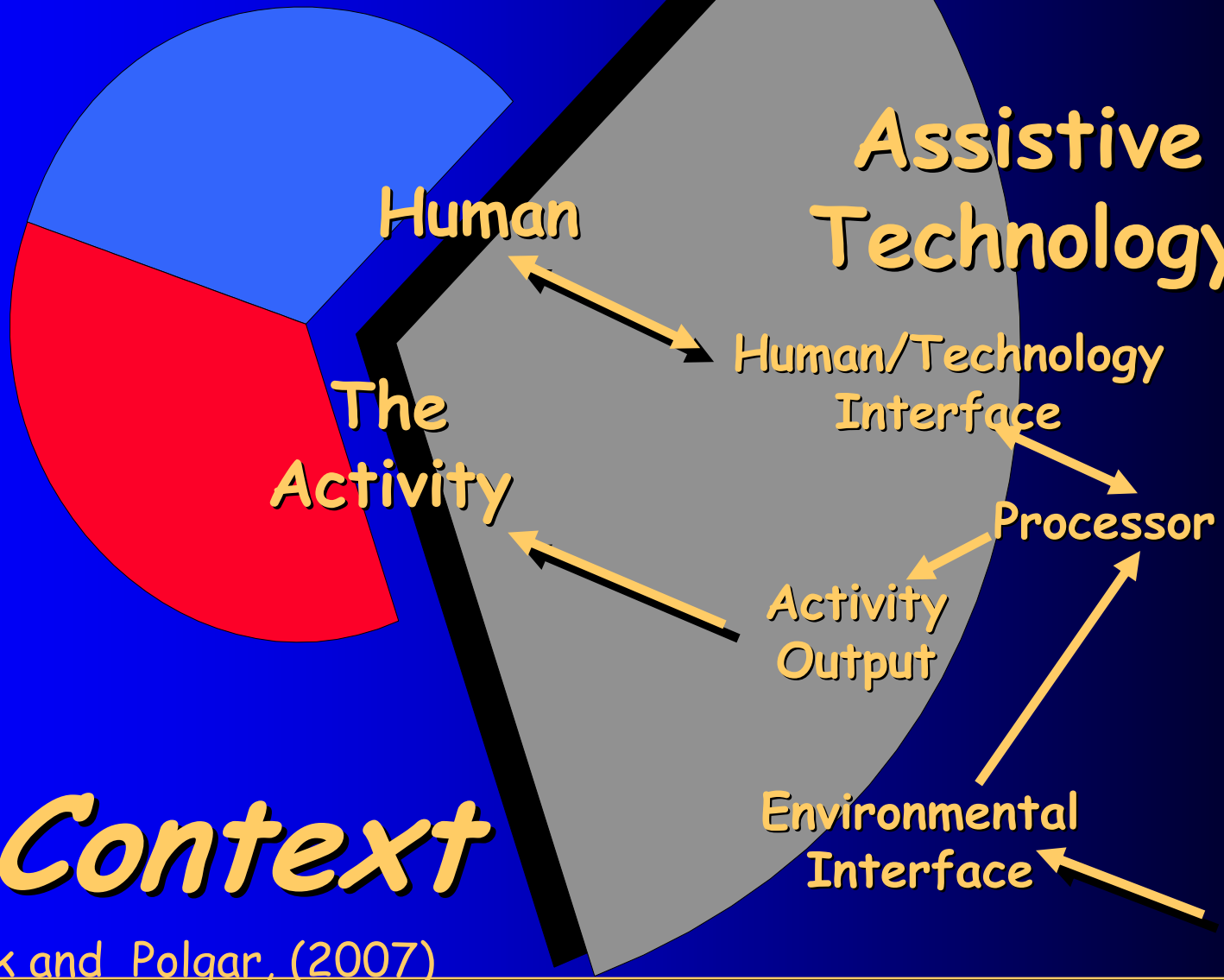
Approaches to AT devices: commercial, modified and custom



*From Cook and Polgar, (2007)

Human Technology Interface: *Technology* Access for individuals with motor limitations

HAAT Model*



*From Cook and Polgar, (2007)

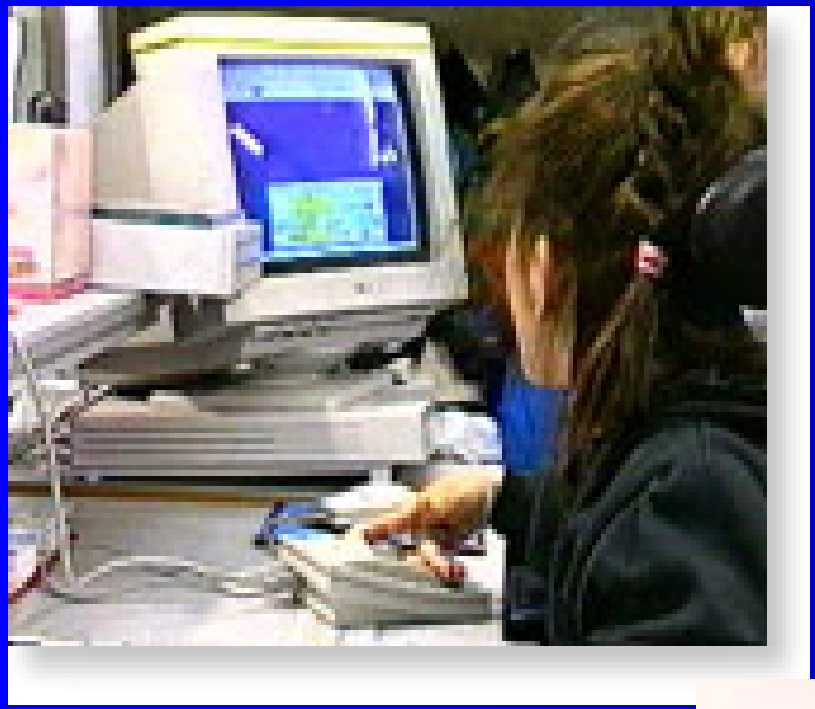
Keyboards for direct selection

Touch screen

Contracted keyboard

Enlarged keyboard

Alternative Mouse Devices

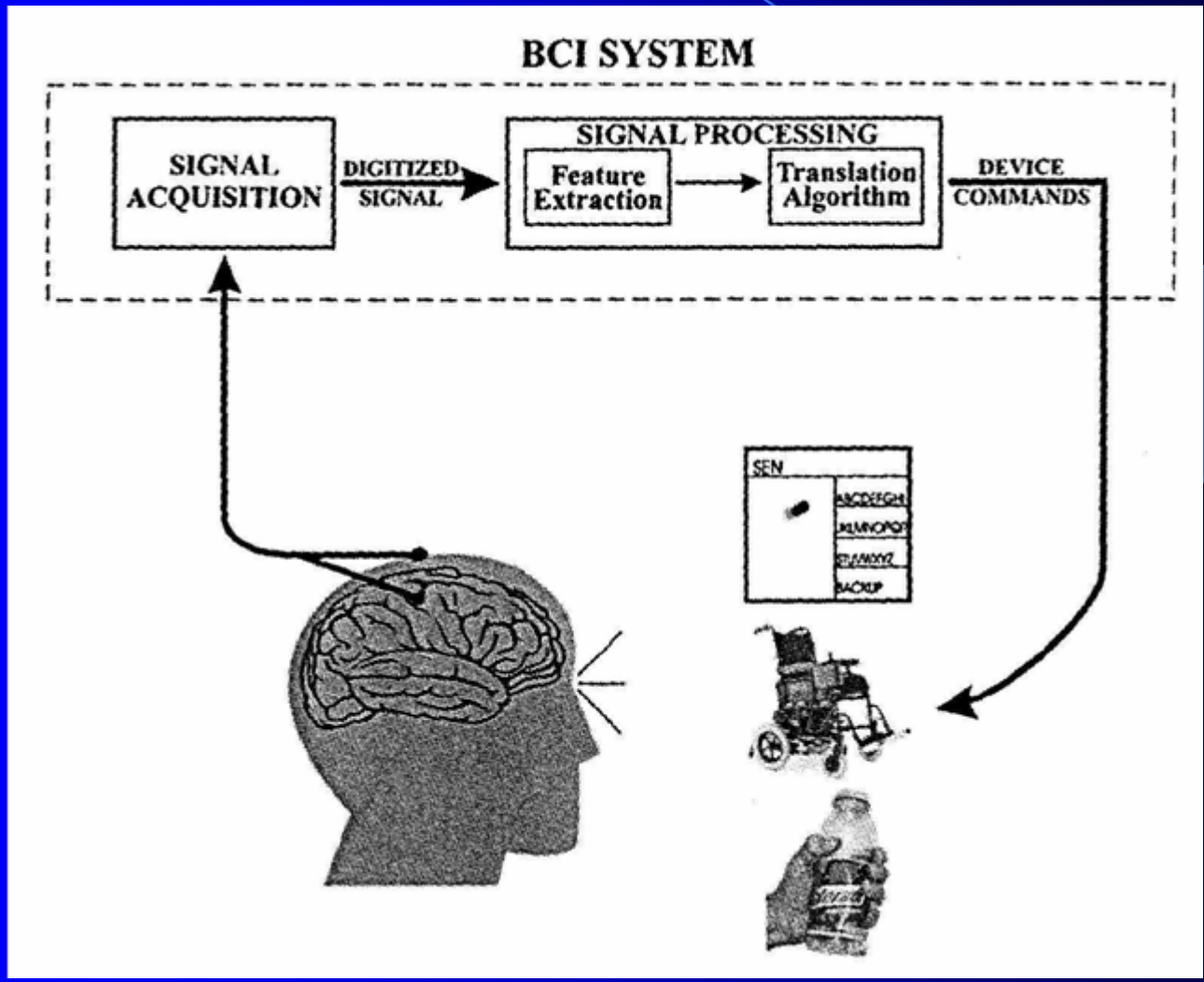


Trackball

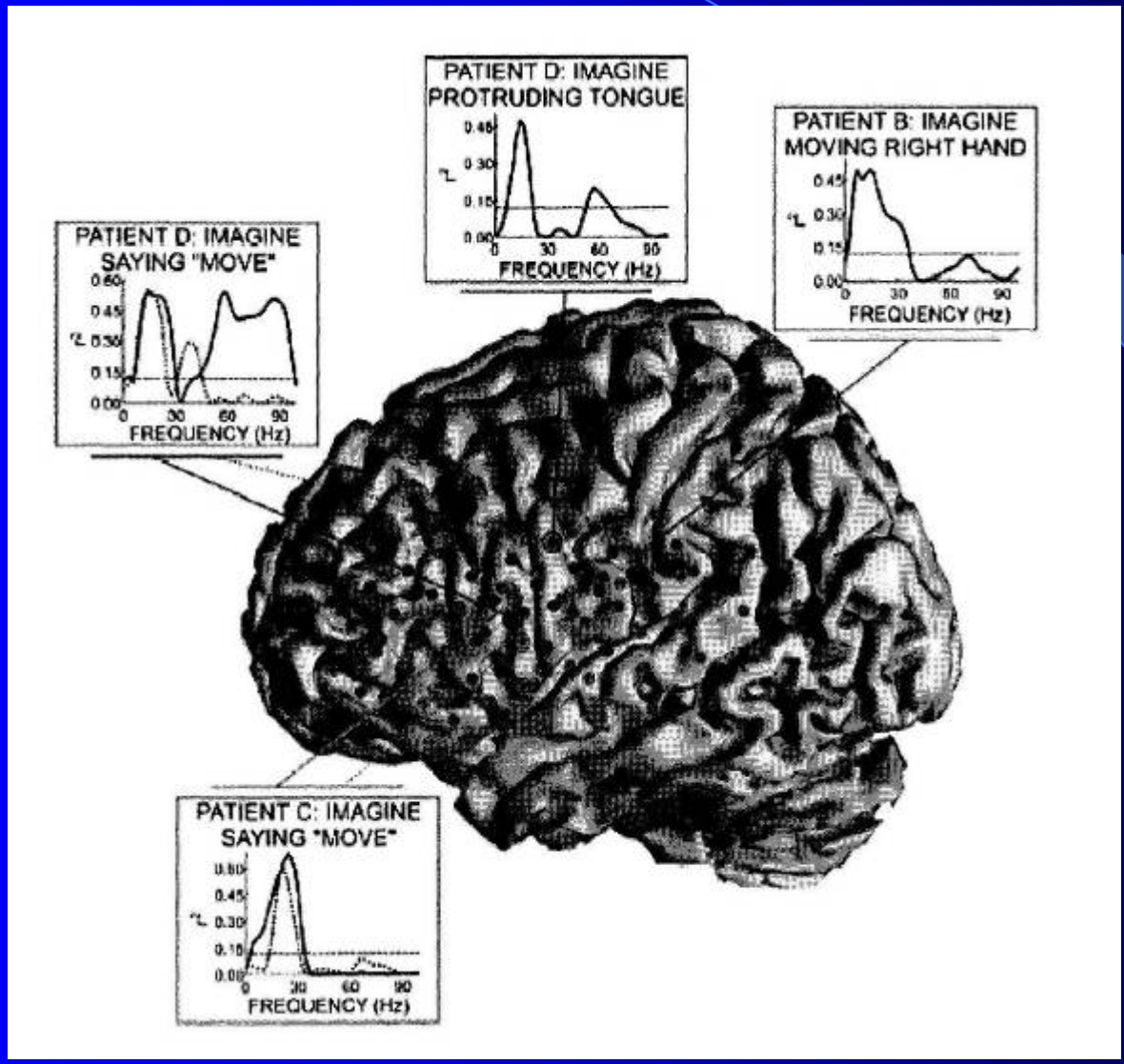
Mouth controlled (Jouse)

Head mouse- reflective dot

Brain Computer Interface

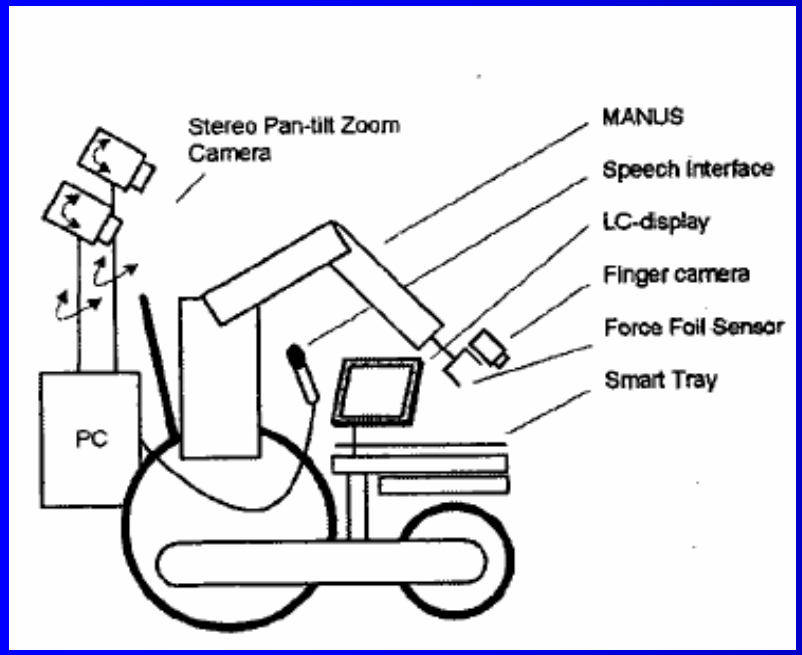


Brain Computer Interface



Rehabilitation robotics

Rehabilitation robot with vision



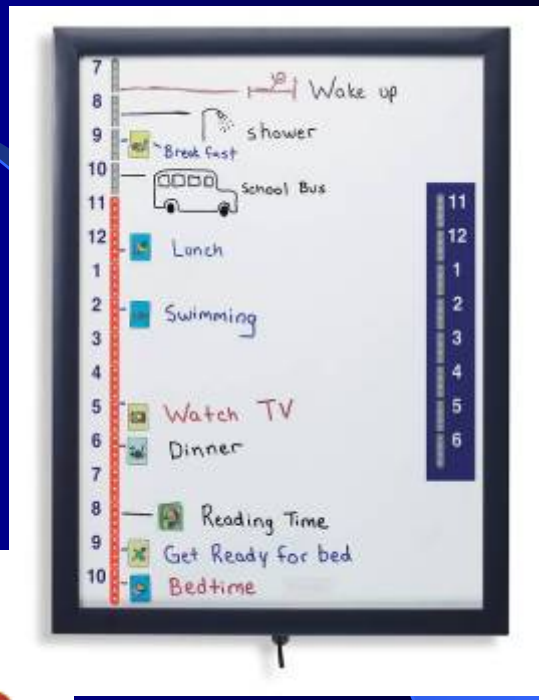
Cognitive Assistive Technologies

Assistive technologies that meet needs for participation by individuals with :

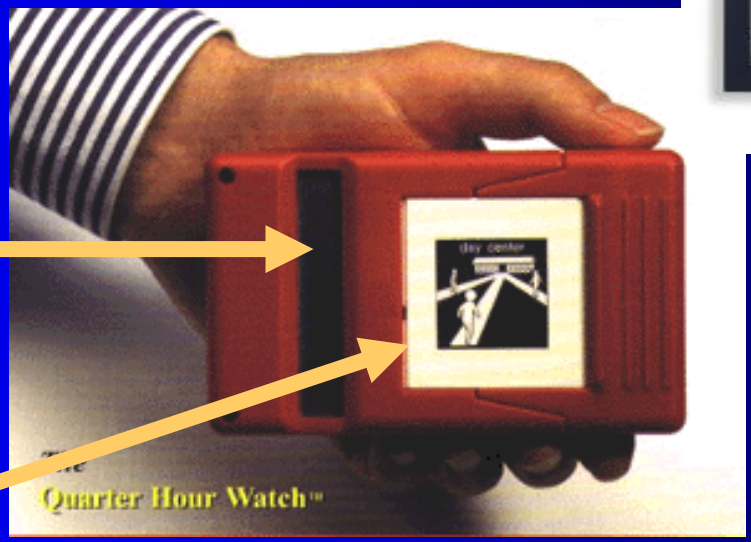
- Intellectual disabilities
- Learning disabilities
- Memory loss
- Dementia

Cognitive AT

PDA used as prompt for procedures



Alternative time system-1/4 hour watch- displays 15 minute increments to a pending event- shown on picture card



Wall mounted daily task planning aid

Cognitive AT

The Planning and Execution Assistant and Trainer (PEAT)*

PDA-based Artificial intelligence (AI) generates plans

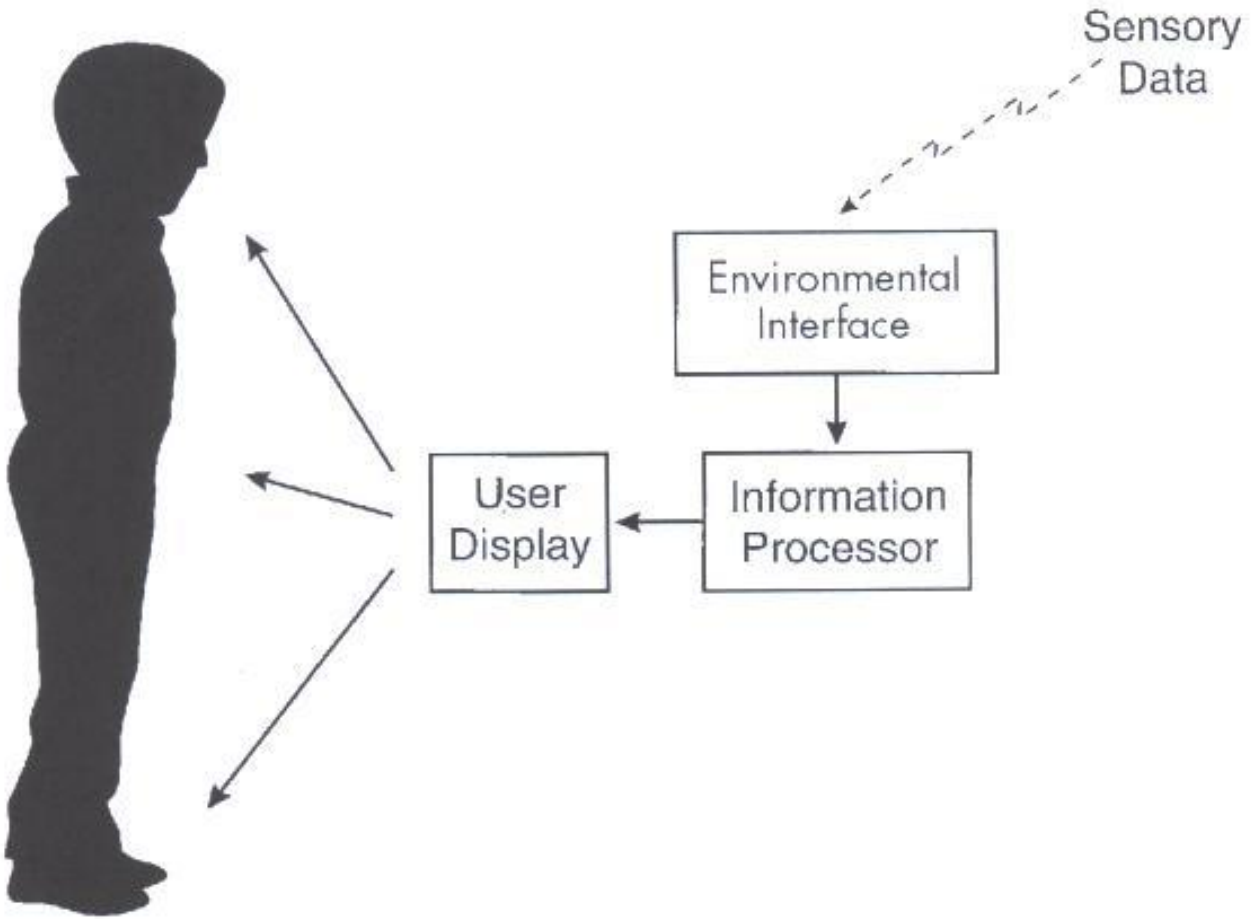
*Attention Control Systems, Mountain View, CA, www.brainaid.com/

Cognitive AT

- Processing & communication system linked to sensor array
- Assesses occupants current state and the state of various home utilities to aid with common ADLs
- Provides feedback should residents become disoriented or confused
- Automatic notification of medical problems based on physiological monitoring

Smart House

Sensory aids

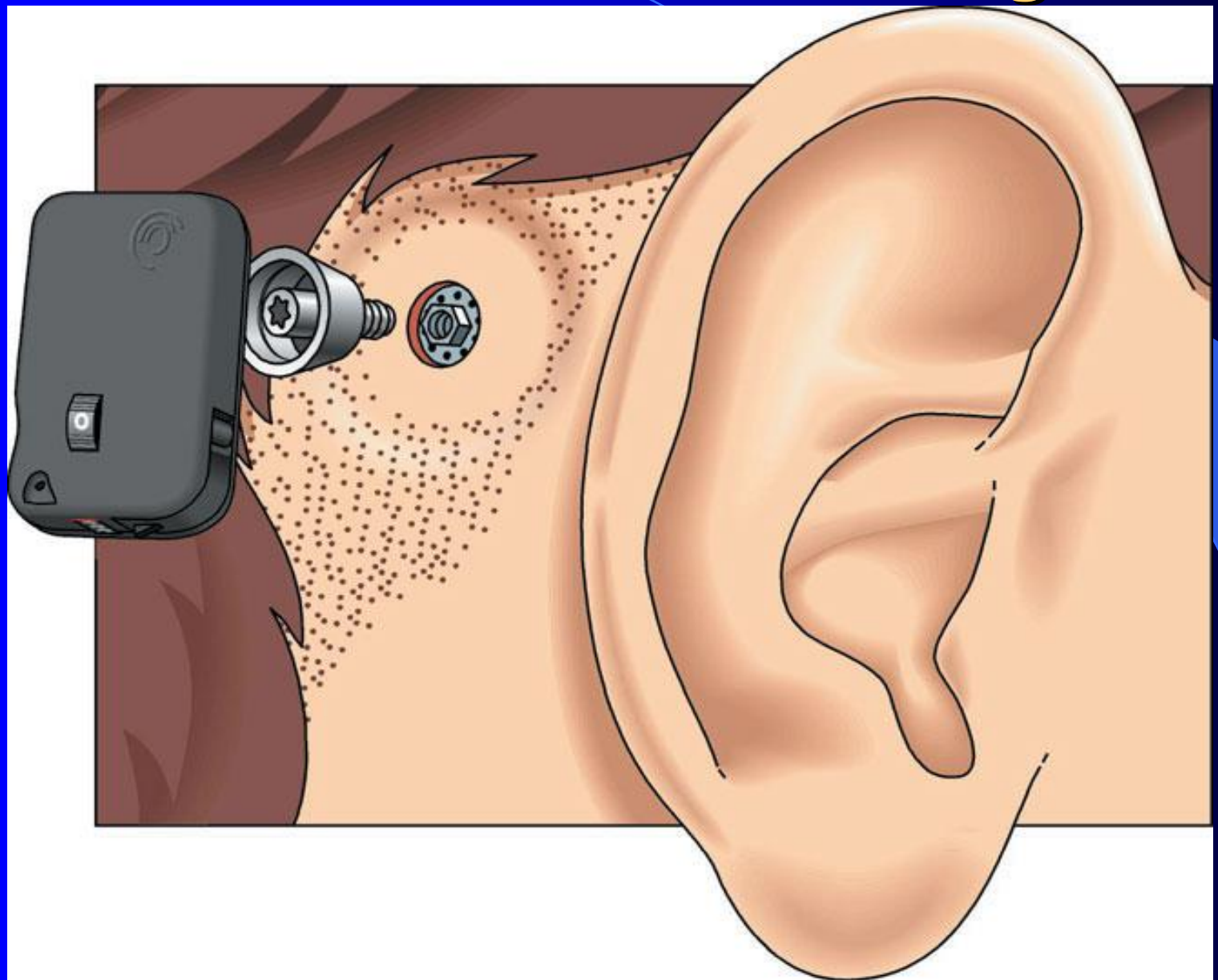


Sensory aids

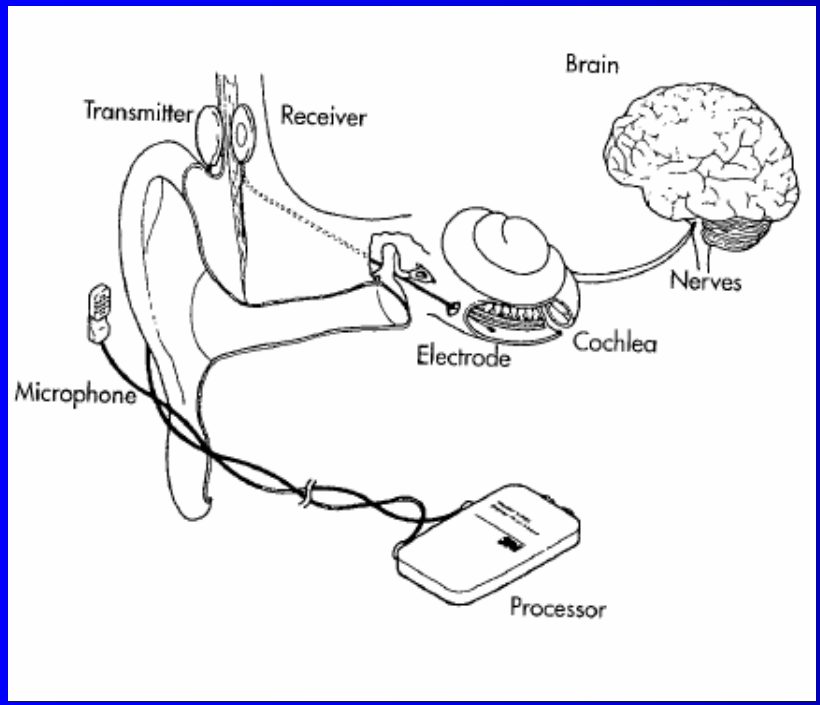
- Auditory
  - Hard of hearing
  - Deaf
- Visual
  - Low vision
  - Blindness

Conventional Hearing Aids

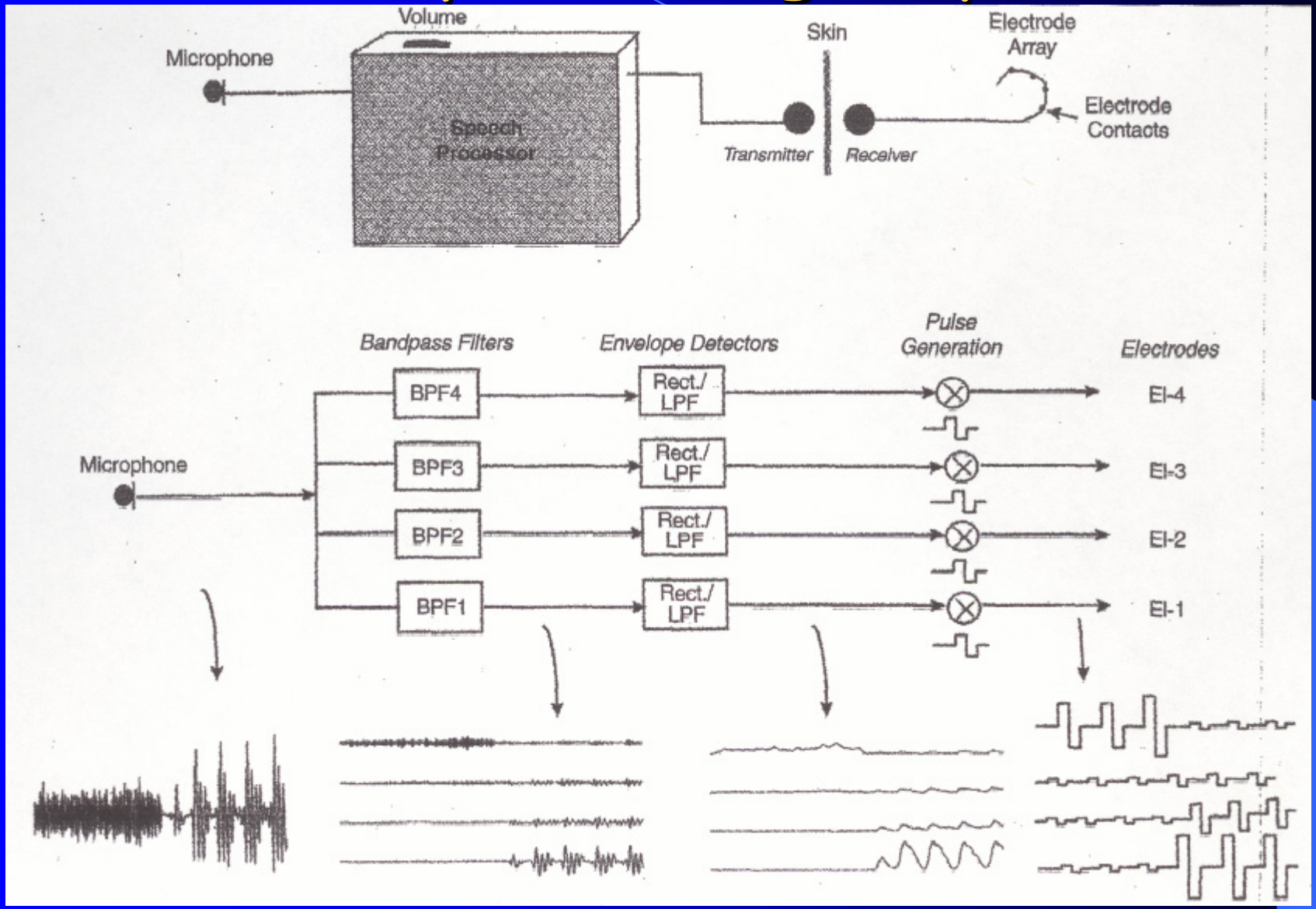
Bone anchored hearing aid



Cochlear Implant



Cochlear Implant – signal processing



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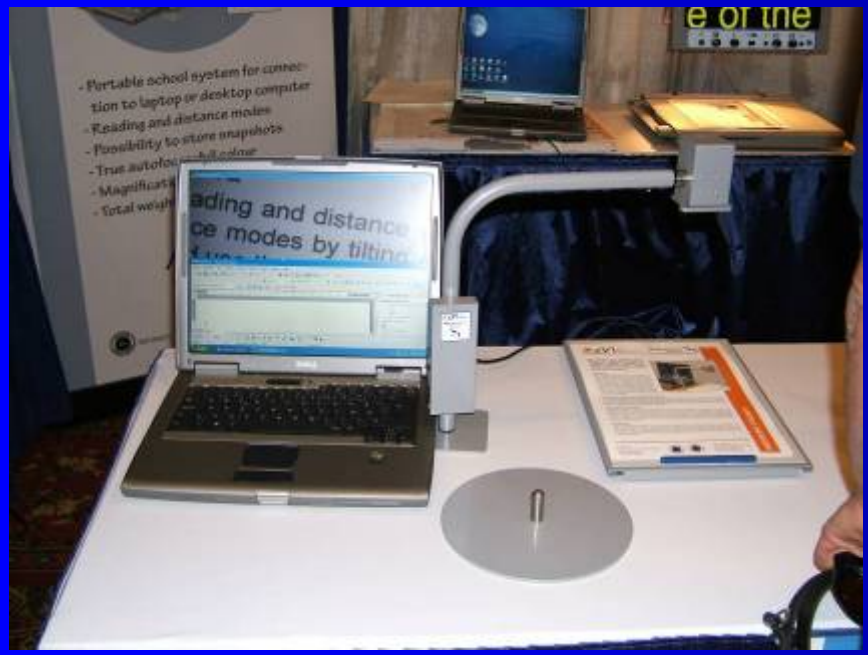
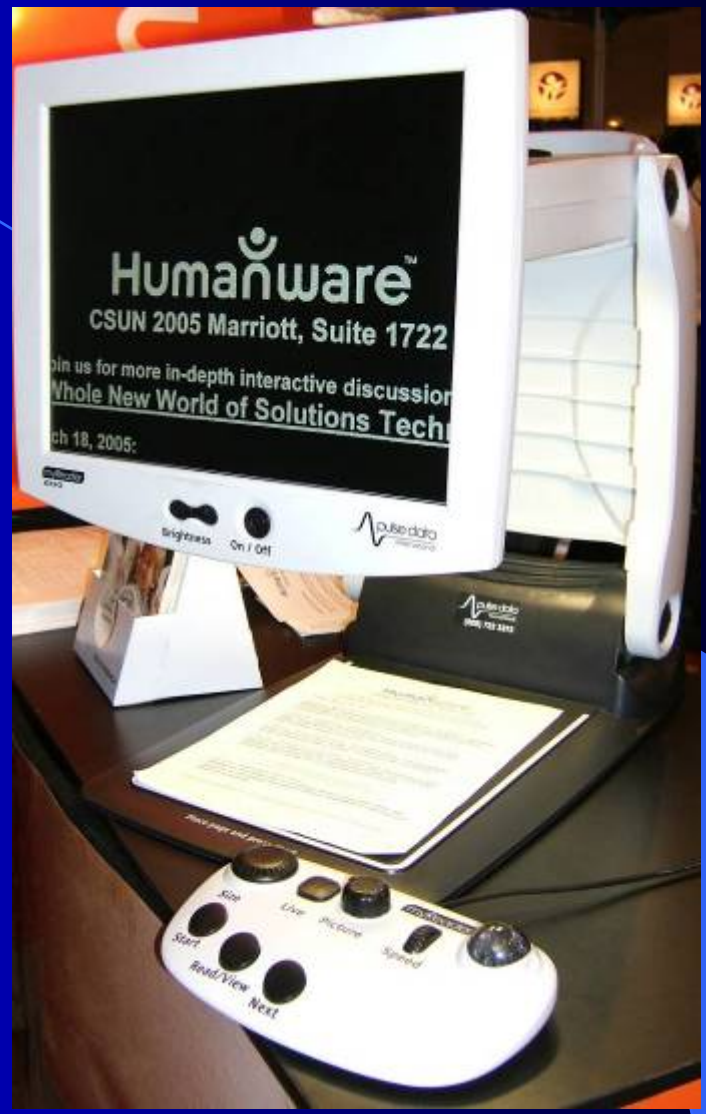
Readers for individuals with low vision



Portable unit



Digital desktop unit

Reading aids for people who are blind

Portable Braille note taker

Paperless Braille displays

Digitally recorded books

The Infrastructure for Future Accessibility

- Web-based virtual systems
- Home automation
- Universal design
- Alternatives for accessing information technologies
- Special-purpose assistive technologies

What We Know for Sure

- Systems will be faster, have more memory and be less expensive for the same capability
- Materials will continually be improved to be lighter, stronger and more durable
- System size will continue to shrink
- Communication channel bandwidth will continue to rise

What We Aren't So Sure About

- Whether accessibility will keep pace
- Whether the needs of persons with disabilities will be a driving force
- What the negative aspects of technologies will be in the long run

Future Options for Persons with Disabilities

- *Modify the tool - AT*
- *Modify the environment – universal design*
- *Modify the person - neural engineering*
- *It is less important to redistribute wealth than it is to redistribute opportunity- Arthur H. Vandenberg*

The future for persons with disabilities

Will not be driven by advances in technology, but rather …

by how well we can take advantage of those advances for the accomplishment of the many tasks of living that can benefit from technological assistance