Assistive Technology for Cognitive Disorders

Attention Control Systems

brainaid.com
Company Origins

• NASA and Valley Medical Center - circa 1993

• NASA uses software to increase robot autonomy
• Software provides planning and executive functions
• Software on PDA can increase human autonomy

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Portable planning aids will increase independence for millions of people with cognitive disorders.
Cognitive Disorders

Causes
Brain injury, Stroke, Alzheimer’s, Multiple Sclerosis, Autism, Developmental disorders, Attention Deficit Disorder, others

Incidence
20 million in U.S.
• Seven percent of U.S. population
• Brain Injury - 5.3 million, 80k/yr, 2/3 younger than age 30
• Stroke - 4 million, 600k/year
• Alzheimer’s Disease - 4 million
• Growing population as baby boomers age
Cognitive Disorders

Effects

- Distractibility, Inflexibility, Perseveration
- Impaired attention, error detection and correction
- Poor time mgmt, planning, choice making, judgment
- Impaired ability to plan and execute daily activities
- Difficulty adjusting to changes
- Often do not start or stop tasks on time
- Lost independence and employment
Company History

NASA Ames – Autonomous systems
  • Autonomous failure recovery
  • Automatic planning & Robust execution

Serendipity & Eureka!
  • Accidental invite to neuropsychology course

Computer model of human frontal lobes
  • Computer simulated “executive functions”
  • Integrated planning and execution
  • Combination of AI and neuropsychology models
Company History

- Johns Hopkins National Search for Computing to Assist Persons with Disabilities
- Partial NASA funding
- Initial collaboration with Valley Medical Center (Grand Rounds, presentations)
- Peer-review articles in AI and Neuropsychology journals (AIJ, JHTR, NYAS)
Company History

Attention Control Systems, Inc.

• Incorporated 1996

• NASA Spinoff

• Who owns intellectual property?

• Who owns the company?

• What hardware platform?
Company History

- “Friends and Family” funding
- Conferences, Peer support groups, The TBI project
- Three U.S. Patents
- U.S. Dept. of Ed. funding for clinical trials with VMC
- Key customers: VA & Dept. of Rehabilitation
Hardware platforms

- Pre “PDA”
- Sony Magic Link
PEAT: Hardware Platforms

Magic Link Discontinued by Sony!

Which device to use now?

Pocket PC (windows) vs. Palm?

Form factor: clamshell vs. pocket sized?
Product Goals

Flexibility
• for operating in uncertain and changing situations

Real-world activities
• health, shopping, travel, school, work

Personal Assistant
• at home, school, work, community
**PEAT**: The Planning and Execution Assistant and Trainer

- Handheld Cognitive Aid
- Automatic Planning and Cueing
- Floating Tasks and Scripts
- Specialized User Interface
Cue Card

- Focus is only on current activity
- Automatically jumps to Cue Card
- Cues include pictures and sounds (from camera and voice recorder)
- Keeps cueing until user responds
- Different levels of cues from subtle to explicit

Demo
Executive Functions

- Floating tasks are put in time sequence based on priority
- Schedule is adjusted when task is delayed or modified
- Helps with detecting and correcting scheduling problems
Activity Model

Floating Tasks
- Flexible start times within a time window
- Lunch [12pm – 2pm], 45 min, Daily, priority 3
- Shopping [6pm – 9pm], 1 hr, Mondays, priority 2

Scripts
- Activity sequences break large tasks into smaller steps
- Examples: Morning routine, Yard work, Laundry

Choice Lists
- Prompts user to choose from activity lists
- Examples: Meal Choices (toast, eggs, sandwich), Exercise, Leisure, Housework
Integrated Planning and Execution

Cueing

- Start and Stop cues
- Cueing “levels”

Execution Monitoring

- Cue responses
- Calendar Changes
- Error detection and correction
Matching Individual Needs

User Interface

• Remove buttons & hide access to sections
• Personalized sounds, voice recordings, pictures
• Cueing Levels

Activity Model

• A model of the user’s daily living activities
• Floating tasks, scripts, repeating tasks
• Checklists, unscheduled tasks (“To Do” items)
Unique Features

- Patented methods for simulating executive functions
- Compensates for planning, error correction deficits
- Realistic daily activity models (floating tasks, scripts)
- For users with cognitive, visual, and motor deficits
- Highly customizable options for individual needs
- Individualized cues including digital pictures and voice recordings
Benefits

Better outcomes:

• Better fitting, more powerful cognitive orthotics

• Increased Independence

• Increased Quality of Life

• Decreased cost of care
Clinical Trials

Partnership with Valley Medical Center
• Leader in brain injury rehabilitation

Dept. of Education Grant
• $450K for 3 year study
• National Institute on Disability and Rehabilitation Research
Customers

Departments of Rehabilitation (25 states)

Hospitals and Rehabilitation Centers
- Santa Clara Valley Medical Center
- Palo Alto VA
- Spaulding Rehabilitation Hospital/Harvard

- Insurance Agencies
- School Districts
- Assistive Technology Centers
PEAT: A customizable cognitive aid

END
Patented Technology

Scheduling
• Temporal Constraints

Planning
• Choices and error correction
• Add and replace activities

Execution
• Cueing, Monitoring, Adjusting

U.S. patents
7,027,996 & 6,381,580 & 6,047,260

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