

# Assistive Technology for Cognitive Disorders

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## Attention Control Systems

**brainaid.com**



ATTENTION CONTROL SYSTEMS, INC.

COMPUTERIZED PLANNING FOR PEOPLE WITH COGNITIVE DISORDERS

# Company Origins

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- 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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# Company Vision

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Portable planning aids will  
Increase independence  
for millions of people  
with cognitive disorders



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# Cognitive Disorders

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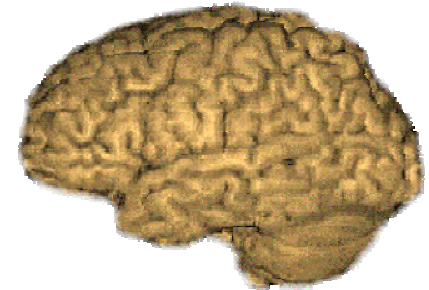
## Causes

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



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# Cognitive Disorders

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## 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



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# Company History

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## **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



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# Company History

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- 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)



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# Company History

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## Attention Control Systems, Inc.

- Incorporated 1996
- NASA Spinoff
- Who owns intellectual property?
- Who owns the company?
- What hardware platform?



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# Company History

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- “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



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# Hardware platforms

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- Pre “PDA”
- Sony Magic Link



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# PEAT: Hardware Platforms

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## Magic Link Discontinued by Sony!

Which device to use now?

Pocket PC (windows) vs. Palm?

Form factor: clamshell vs. pocket sized?



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# Product Goals

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## Flexibility

- for operating in uncertain and changing situations

## Real-world activities

- health, shopping, travel, school, work

## Personal Assistant

- at home, school, work, community



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# PEAT: The Planning and Execution Assistant and Trainer

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

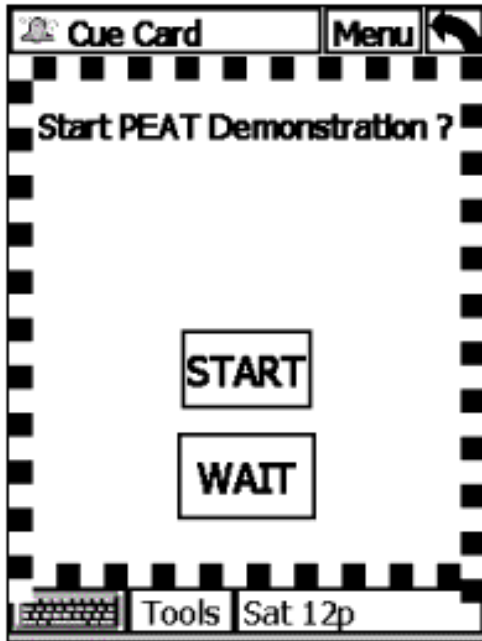


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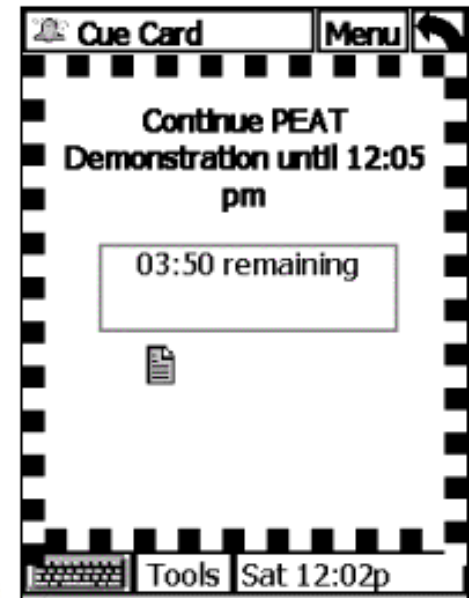
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# Cue Card



- 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](#)

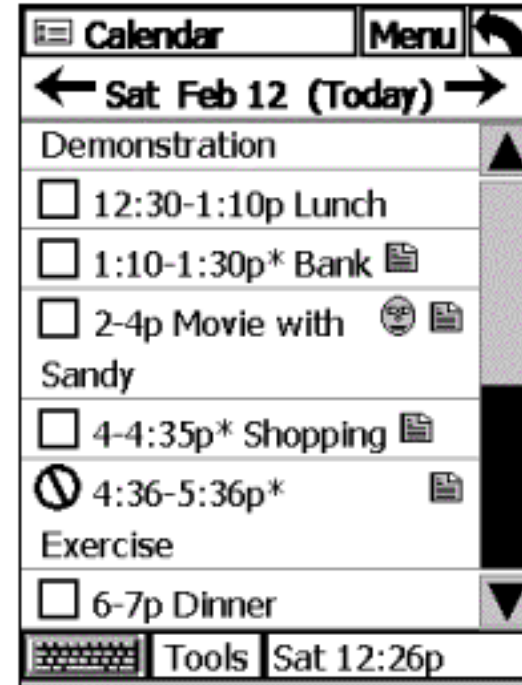
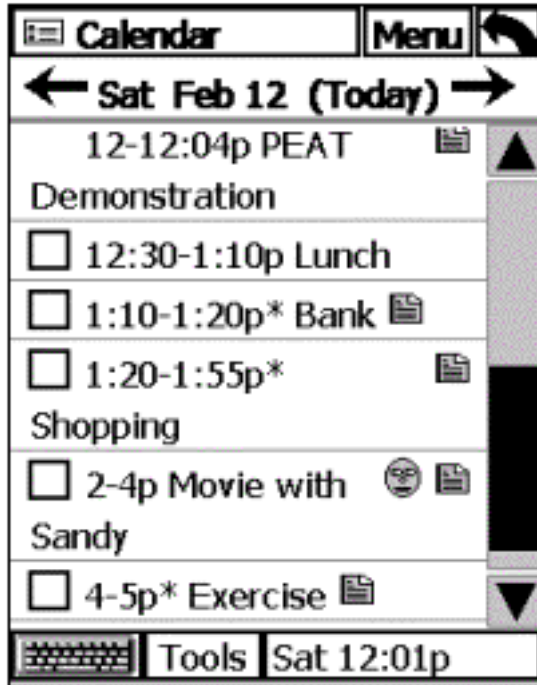


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# Executive Functions



- 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



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# Activity Model

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## ***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**



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# Integrated Planning and Execution

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## Cueing

- Start and Stop cues
- Cueing “levels”

## Execution Monitoring

- Cue responses
- Calendar Changes
- Error detection and correction



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# Matching Individual Needs

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## 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)



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# Unique Features

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- 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



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# Benefits

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## Better outcomes:

- Better fitting, more powerful cognitive orthotics
- Increased Independence
- Increased Quality of Life
- Decreased cost of care



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# Clinical Trials

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## 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



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# 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



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# PEAT: A customizable cognitive aid

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**END**



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# Patented Technology

## Scheduling

- Temporal Constraints

## Planning

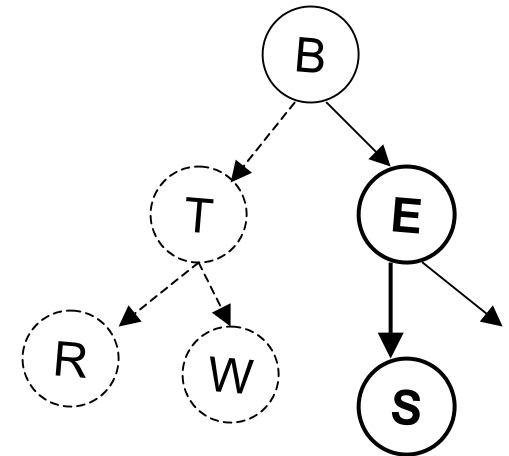
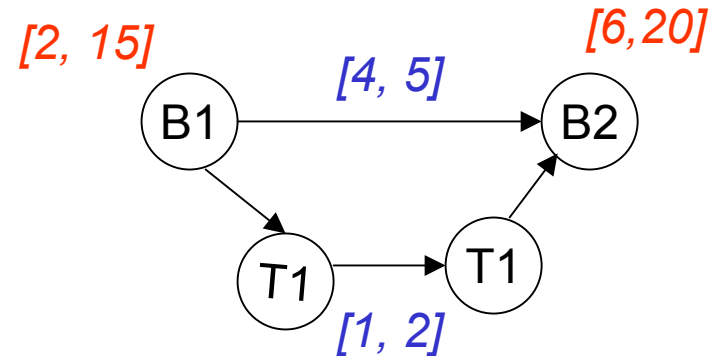
- Choices and error correction
- Add and replace activities

## Execution

- Cueing, Monitoring, Adjusting

## U.S. patents

7,027,996 & 6,381,580 & 6,047,260



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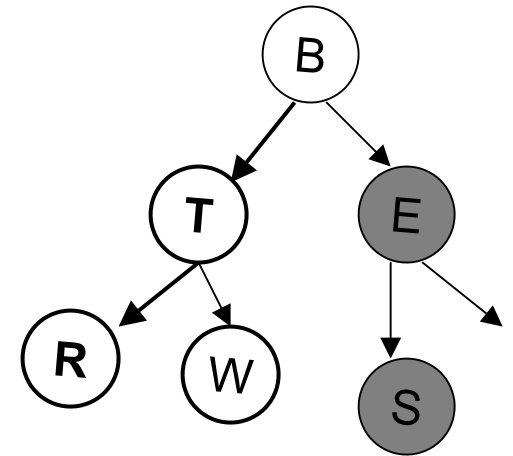
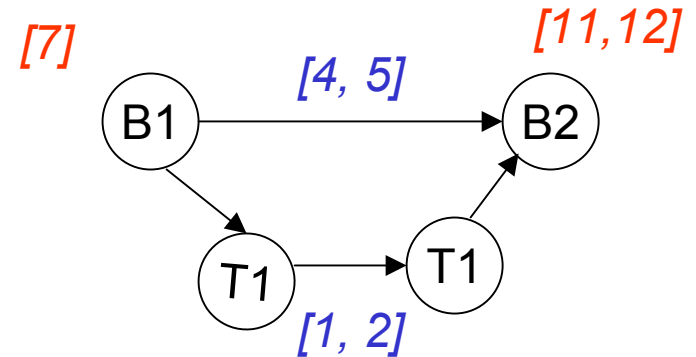
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