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## Quantitative Approaches to Computer Access

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## Overview

- Brief Introduction
  - Computer Access Intervention Process
  - Evidence-based Practice (EBP) and Its Role
- Use of Evidence in Computer Access Process
  - Pointing Devices
  - Text Entry
  - Switch Use

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## Access Intervention Process

- Goal: to find the best computer access solution for an individual's needs
- Determine client needs and goals
- Assess characteristics of:
  - Client
  - Environment
  - Task
- Compare possible solutions for input & output
- Recommend particular solution
- Implement recommendation
- Measure outcomes (did we meet the goal?)

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## Evidence-based Practice (EBP)

- Make decisions based on clear evidence related to the client
  - External or field evidence
    - What are published outcomes for similar clients with similar needs?
  - Knowledge and skills of the providers
    - What's worked well for similar clients that I've worked with?
  - Individual evidence
    - Functional skills assessment
    - Discussion with client
    - Trials with potential interventions

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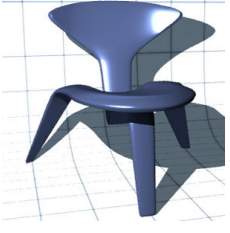
## Clear Evidence uses

- Setting goals – Therapy, IEP, ...
  - Identifying needs
  - Justifying areas of work
- Funding support
- Choosing methods and techniques
- Tracking progress
- Measuring outcomes

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## Evidence-based Practice (EBP)

- Observation
- Feedback
- Measurement



PKO by Poul Kjaerholm, 1952

## Computer-Based Tools for Gathering Internal Evidence

- Focus on assessment of client abilities
- Present repeatable computer-related tasks in a realistic setting
- Aid in data collection and report generation
- Ideally – get the information you need, in less time!

## Pointing Device Use

- Select best pointing method
  - Mice, trackballs, trackpads, head-controlled mice, keyboard-based approaches, etc.
- Configure for user's needs.
  - Location, splinting, device behavior, etc.
- Follow-along

## Skills & Measures for Pointing

- Target Acquisition
  - Dwell, click, double-click
- Dragging
- Menu selection
- Speed & accuracy
- Complements observations and feedback

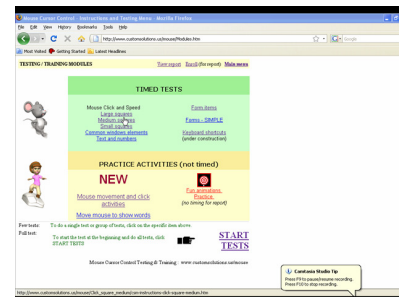
## Gathering Pointing Device Evidence

- First, full disclosure...
- List of tools:
  - Custom Solutions website
  - REACH assessment tests
  - Compass software
  - Pointing Wizard

## Custom Solutions website

- <http://www.customsolutions.us/mouse/>
- Free, but with some major flaws
- 8 timed tests

## Custom Solutions website



### REACH Assessment Tools

- Included in REACH Interface Author
- 4 timed tests for pointing
- Validity problem: mouse cursor doesn't respond properly until a few seconds into each trial, so timing data are inaccurate.

### Compass Software

- Aim, Drag, and Menu tests specifically for pointing device skills
- Text entry tests with on-screen keyboard
- Setup is highly customizable, if desired
- Validity has been demonstrated
- Compatible with alternative inputs and outputs
- Reports and data are stored for easy review and retrieval

### Compass Example

- Young adult with CP performed Compass Aim tests with three different pointing devices
- Test set-up was identical for each device
- All 3 tests completed within 5 minutes

### Compass Example

	Trial Time (sec)	Entries
Mouse	2.6	1.4
Trackpad	4.9	1.3
Trackball	5.4	1.3

- Control looked similar, qualitatively
- But performance was about 2x faster with the mouse
- Provides user with means of making an informed decision

### Pointing Wizard Example

- Adjusting Windows settings to meet user's needs
- Double-click settings:
  - Double-click time
  - Double-click distance
- Demo

### Pointing Wizard Example

- Adjusting Windows settings to meet user's needs
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## Pointing Wizard Example

- 57 year-old man with history of stroke
- With default double-click settings:
  - About 70% of double-clicks required multiple attempts
  - 7 or 8 attempts not uncommon
- With wizard-recommended settings:
  - Only 3% of double-clicks required multiple attempts
  - Double-click distance was the most important change

Double-Click Condition	% Error-Free
Def1	30
P1Wz	95
Def2	35

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## Text Entry Device (Keyboard) Use

- Select best text entry method
  - Physical keyboard
  - Morse code
  - On-screen keyboards
- Configure for user's needs
  - Control stabilizers
  - Control extenders
  - Positioning
  - Device behavior
- Follow-along

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## Skills & Measures for Text Entry

- Reliable and efficient access to all characters and functions
- Words/characters per minute (overall and with errors removed)
- Errors
- Complements observations and feedback

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## Gathering Pointing Device Evidence

- List of tools:
  - “Standard” Typing tests
  - Compass software
  - TextTest and StreamAnalyzer
  - Keyboard Wizard

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## TypingTest.com

- [www.typingtest.com](http://www.typingtest.com)
- Free
- Available on any computer with web access

- Choice of trial length and sample text

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## TypingTest.com

The test screen has the potential to introduce distractions

Accelerate Your Typing with TypingMaster Pro Typing Tutor

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## TypingTest.com

- Limited results provided
  - WPM
  - Characters
  - Errors
  - Adjusted speed
  - Comparison to norm
- Can't save results
- Accuracy of results?

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## Other mainstream options

- Speedtest
  - speedtest.10-fast-fingers.com/
    - Choice of 21 languages
    - 60 seconds per trial
    - Random list of common words
    - Fewer distractions
- Mavis Beacon Teaches Typing
  - www.broderbund.com/c-33-mavis-beacon.aspx
    - Typing tutor with "personalized" tests
    - About \$20

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## TextTest and Stream Analyzer

- <http://faculty.washington.edu/wobbrock/>
- Free
- Research tool
- Practice and test modes
- Two phrase included sets or create custom set

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## TextTest

- Define number of trials or end manually
- Limit acceptable characters

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## TextTest

- Log file
  - Target text
  - Every character entered
  - ANSI keycodes
  - Time
  - Transcribed text

```

-<task number="1" testing="False">
  <presented-monkey see monkey do>/presented>
  <entry char="m" value="109" time="63412970107.155" />
  <entry char="o" value="111" time="63412970107.389" />
  <entry char="n" value="110" time="63412970107.654" />
  <entry char="k" value="107" time="63412970108.044" />
  <entry char="e" value="101" time="63412970109.906" />
  <entry char="v" value="121" time="63412970110.103" />
  <entry char="l" value="92" time="63412970110.360" />
  <entry char="i" value="98" time="63412970113.02" />
  <entry char="s" value="115" time="63412970110.898" />
  <entry char="e" value="115" time="63412970111.148" />
  <entry char="l" value="101" time="63412970114.393" />
  <entry char="e" value="101" time="63412970113.426" />
  <entry char="m" value="109" time="63412970115.079" />
  <entry char="o" value="111" time="63412970115.282" />
  <entry char="n" value="110" time="63412970115.518" />
  <entry char="k" value="107" time="63412970115.765" />
  <entry char="e" value="101" time="63412970116.436" />
  <entry char="v" value="121" time="63412970116.67" />
  <entry char="l" value="92" time="63412970116.951" />
  <entry char="i" value="100" time="63412970118.386" />
  <entry char="o" value="111" time="63412970119.192" />
  <entry char="n" value="111" time="63412970119.603" />
  <entry char="l" value="9" time="63412970120.133" />
</transcribed-monkey see monkey do>/transcribed.

```

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## StreamAnalyzer

Num	Testing?	Time	WPM	AdjWPM	CPS	KSPS	GPS	Intra	Inter	StrDist	M
1	0	34.188	11.583	11.293	0.965	1.258	1.293	0.6309546	0.1598864		
2	1	21.532	14.49	13.997	1.208	1.393	1.489	0.531258	0.1834839		

- Trial number
- Test or practice
- Total time for trial
- WPM
- WPM adjusted with errors
- Characters per second
- Keystrokes per second
- Gestures per character
- Average time per character
- Average time between characters
- Plus 24 more

## StreamAnalyzer

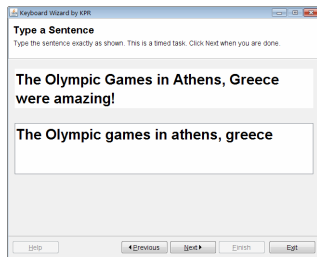
- Two character-level tables with insertions, substitutions, omissions, and deletions all showing both uncorrected and corrected
- Confusion matrix showing intended and produced characters

## Compass Software

- Letter, word, and sentence tests specifically for text entry skills
- Setup is highly customizable, if desired
- Validity has been demonstrated
- Compatible with alternative inputs and outputs
- Reports and data are stored for easy review and retrieval

## Keyboard Wizard

- Recommends adjustments to Windows settings to meet users' needs
- StickyKeys
- Repeat settings
  - Rate
  - Delay



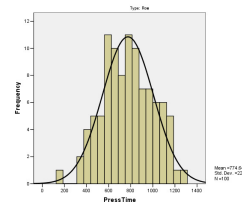
## Text Entry Example

- 68 y/o woman with multiple sclerosis
- Reports some difficulty with typing
- Run through Keyboard Wizard (demo)
- Adjusting auto-repeat setting:
  - Improved typing speed 50% (from 2.2 to 3.2 wpm)
  - Reduced errors 32 pp (from 60% errors to 28%)

## Single-Switch Scanning

- Select best switch
  - Activation method
  - Location
- Configure scanning software
  - Scan rate

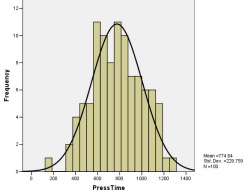
## Choosing the Switch



- Goal
  - Consistent activation time
  - Normal distribution

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## Setting the Scan Delay



- Precise method
  - Scan delay = mean switch press time + (2 \* std dev)
- .65 rule
  - Scan delay = mean / .65
- Both accommodate about 97.5% of switch presses

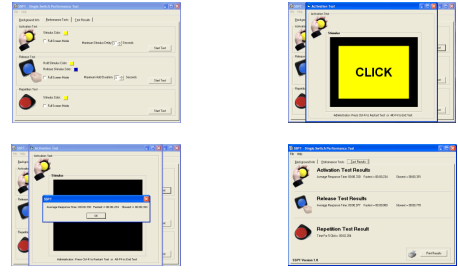
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## Single Switch Performance Test

- Free!
  - [www.aacoinstitute.org](http://www.aacoinstitute.org)
- Three tests
  - Activation
  - Release
  - Repetition

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## Single Switch Performance Test



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## REACH Assessment Tools

- Included in REACH Interface Author
  - [www.ahf-net.org](http://www.ahf-net.org)
- Three tests
  - Click
  - Double-Click
  - Release

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## REACH Interface Author



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## Compass

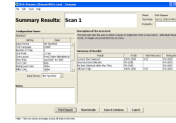
- Two tests
  - Click
  - Scan



## Compass



## Compass



## Benefits of using Quantitative Methods

- With the right tools, it requires no extra time
- Stronger basis for decisions → Better decisions
- Clearer justification for decisions
- More “power” to the user - clients themselves often really appreciate seeing data about their performance
- Give one of these tools a try, if you haven’t already



## Contact Information

### Quantitative Approaches to Computer Access

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