Pre-Presentation Notes

Slides and presentation materials are available online at:

karlwiegand.com/csun2013

CSUN 2013:
Novel Approaches to Icon-Based AAC

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Outline

1. Why Icons?
2. Current Systems and Questions
3. SymbolPath
4. RSVP-iconCHAT
5. How You Can Help

Why Icons?

Bad:

- Not fully generative
- Vocabulary requires screen space
- Letter-based research is often inapplicable

Good:

- Supports limited recall
- Doesn't require literacy
- Often faster

On Speed of Communication

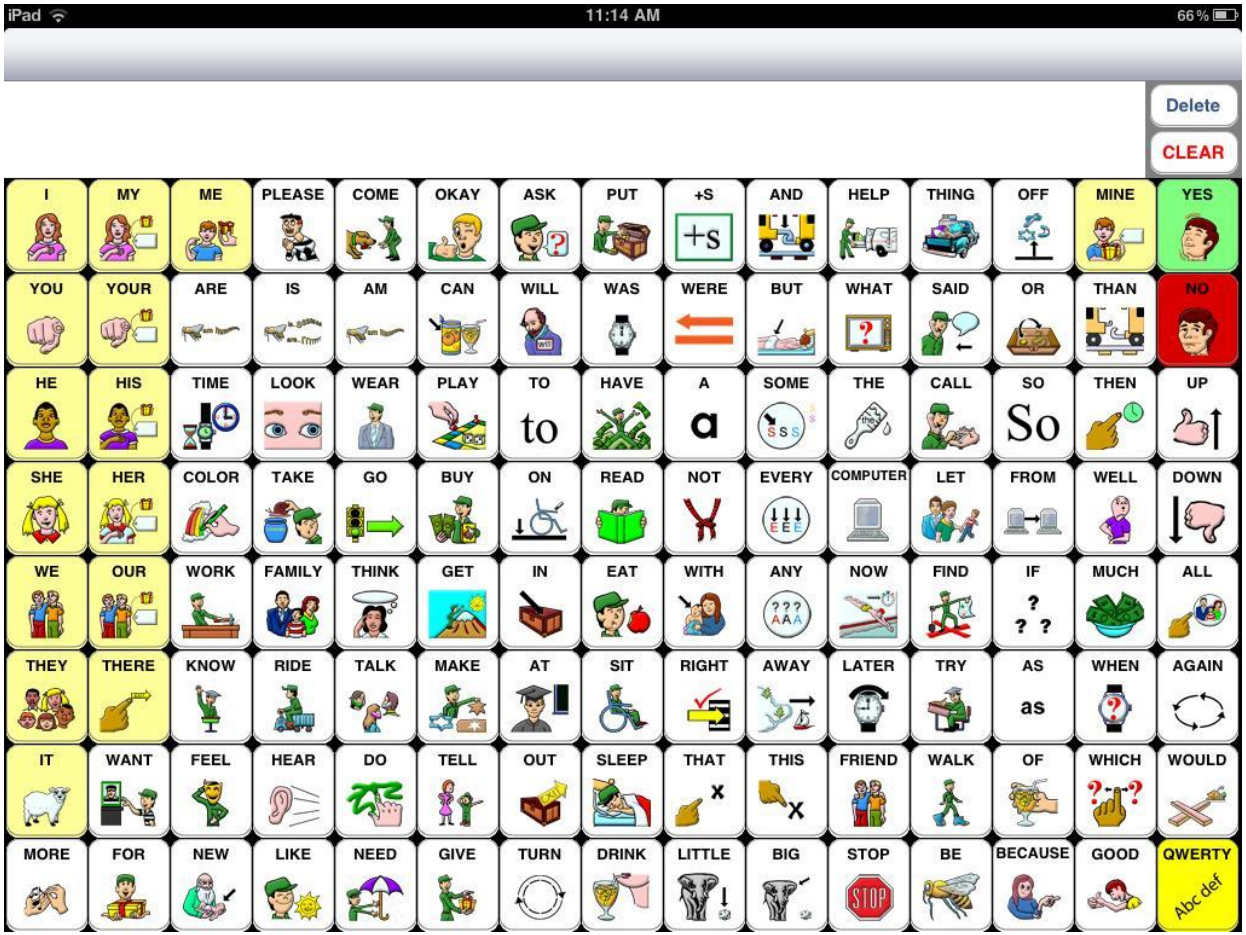
Typical AAC is **< 20** words per minute

vs.

Speech is often **150 - 200** words per minute

Higginbotham, D. J., Shane, H., Russell, S., & Caves, K. (2007). Access to AAC: present, past, and future. AAC: Augmentative & Alternative Communication, 23 (3), 243-257.

Current Icon-Based AAC



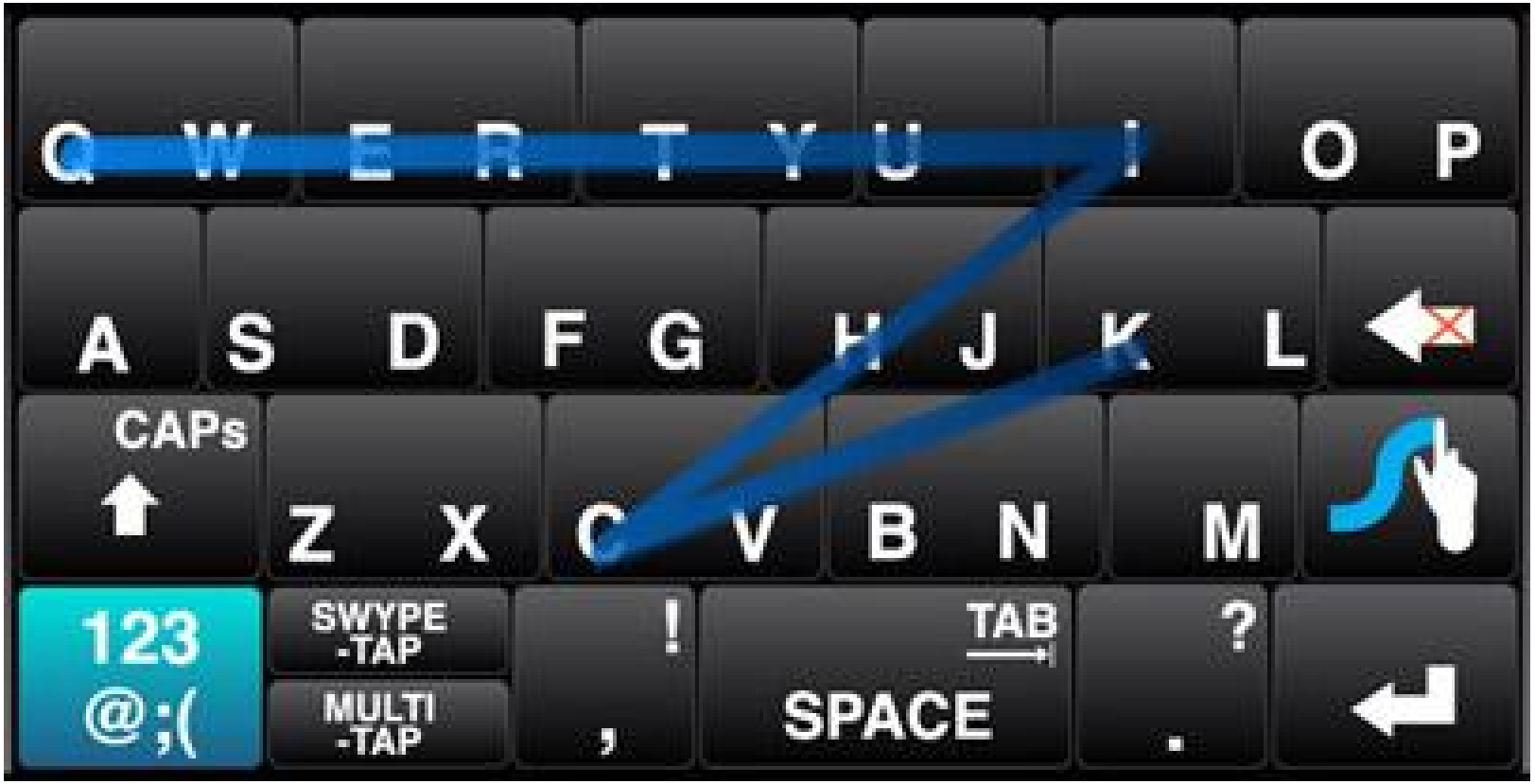
http://www.speakforyourself.org/

Some Questions

1. Can we handle accidental selections?
    - Upper limb motor impairments (e.g. tremors)
2. Can we handle syntax and word order?
    - Pre-literacy or aphasia from stroke
3. Can we make communication even faster?

One Idea: Continuous Motion

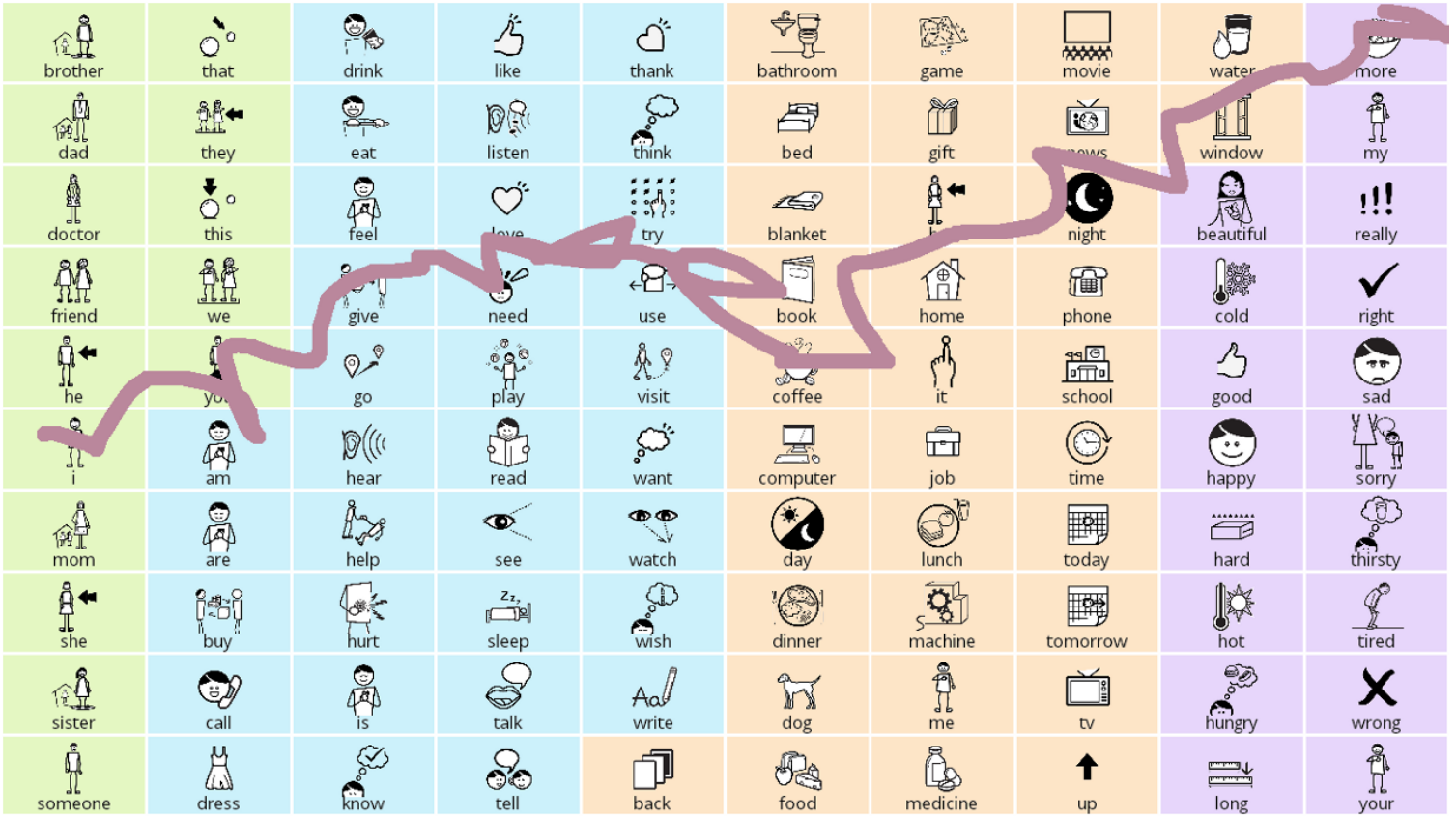
"QUICK"



http://www.swype.com/

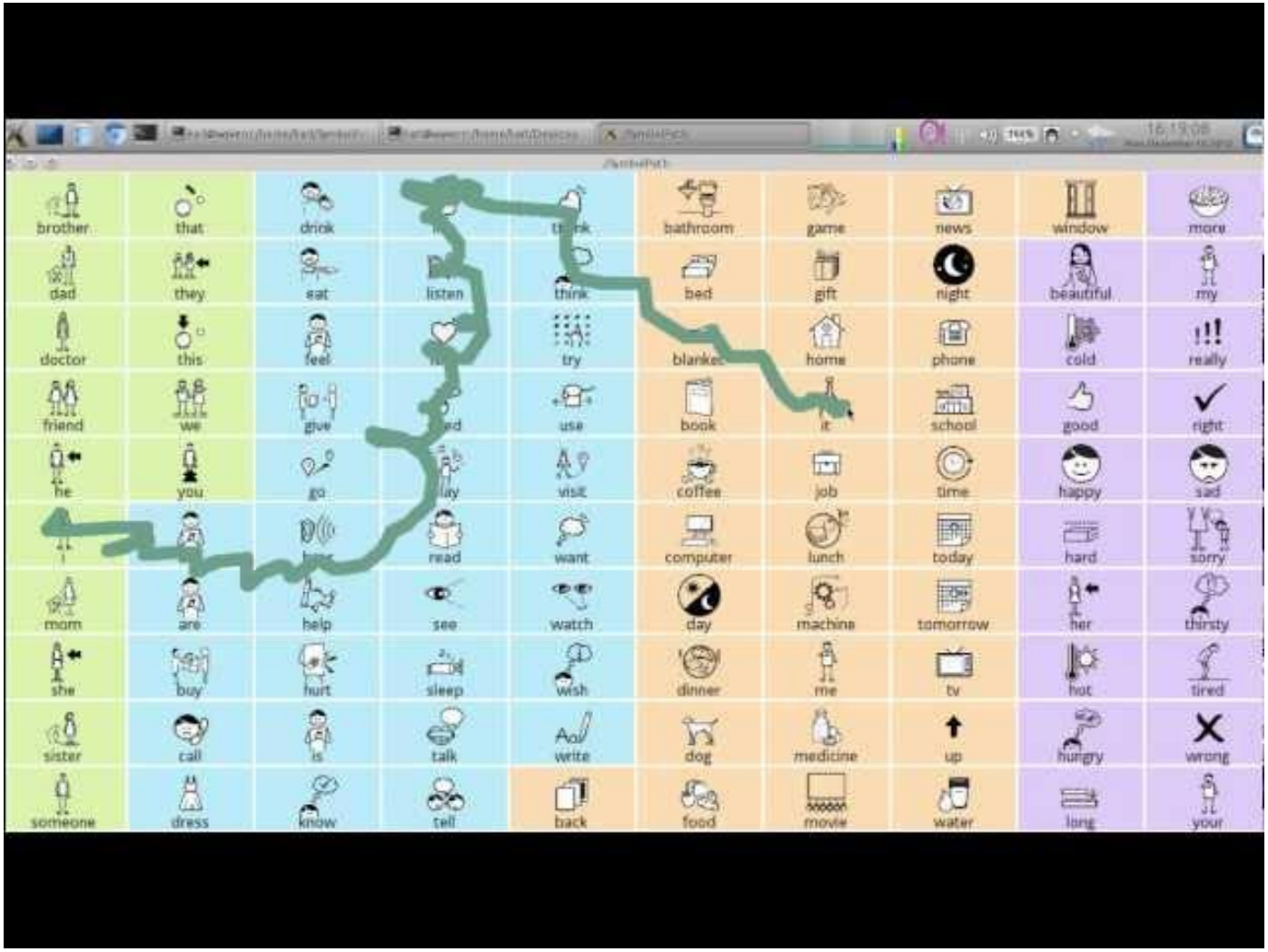
SymbolPath: A Prototype

"I need more coffee."



Wiegand, K., & Patel, R. (2012). SymbolPath: a continuous motion overlay module for icon-based assistive communication. ASSETS '12, (pp. 209-210). New York, NY, USA: ACM.

SymbolPath in Action



How It Works: Language Model

- Semantic frames
  - Verbs have "frames" that take certain "roles"
  - Each word can fill certain "roles"

Give (Agent, Object, Beneficiary)

- Free-order word statistics (co-occurrence)
- Display the final sentence choices (for now)

Fillmore, C. J. (1976). Frame semantics and the nature of language. Annals of the New York Academy of Sciences, 280 (Origins and Evolution of Language and Speech), 20-32.
Wiegand, K., & Patel, R. (2012). Non-Syntactic word prediction for AAC. In Proceedings of the Third Workshop on Speech and Language Processing for Assistive Technologies, (pp. 28-36). Montréal, Canada: Association for Computational Linguistics.

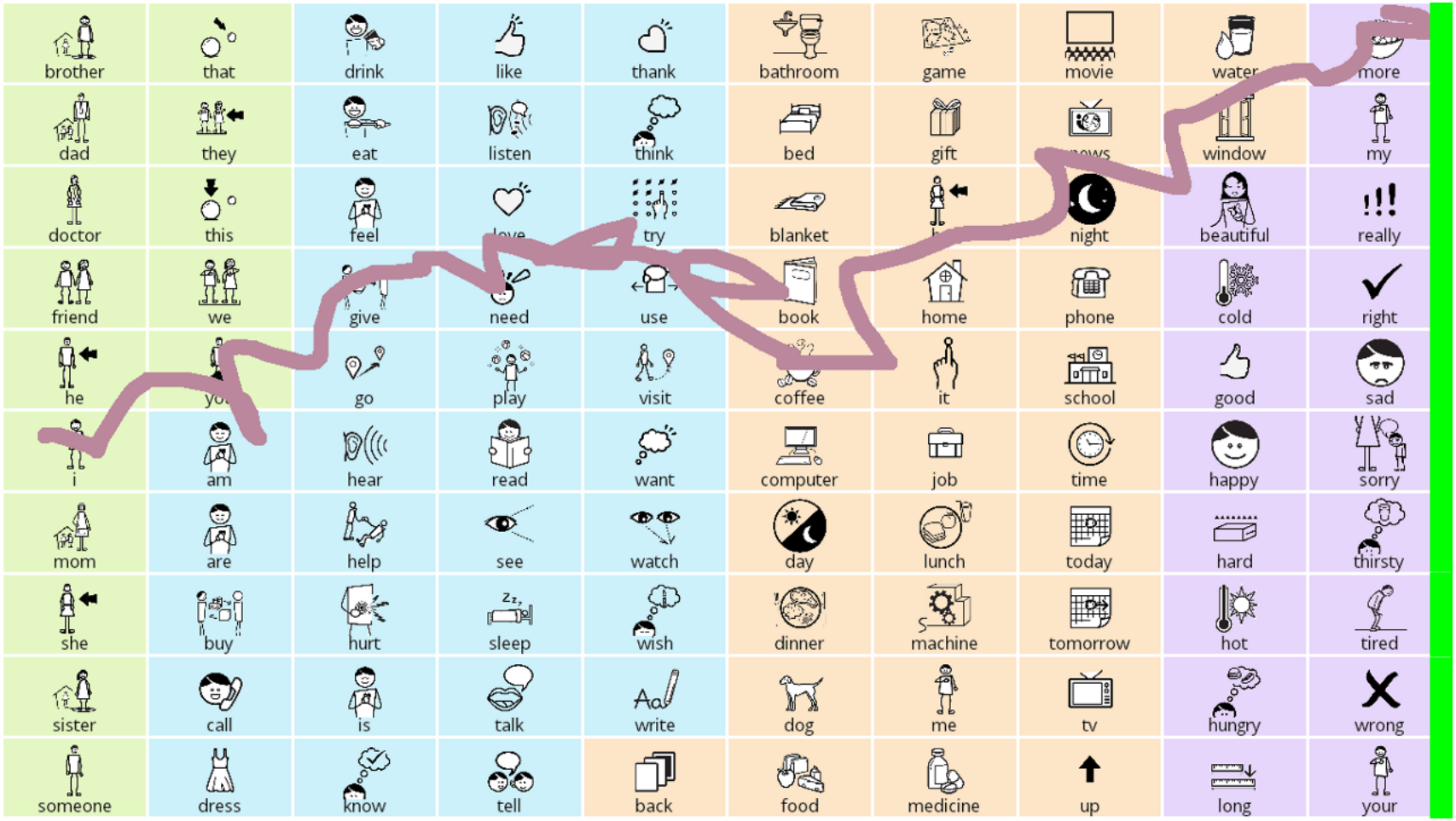
Initial User Questions

1. Who are the intended users?
    - Current users of icon-based AAC
    - Especially users with upper-limb motor impairments
    - Meant for integration with other systems
2. Which boards does it have?
3. When can we try it out?

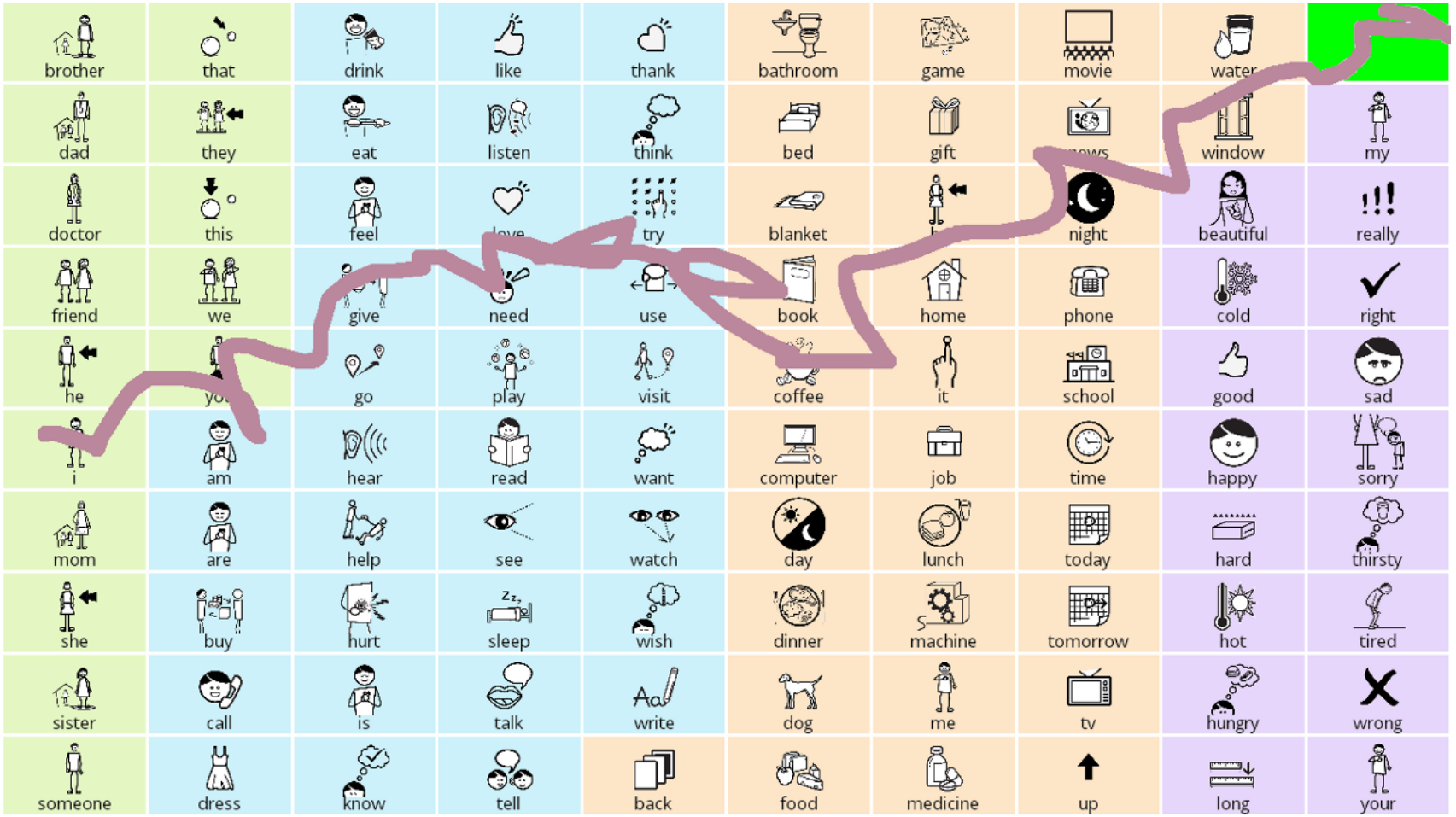
What We've Learned So Far

- Two adults with speech and motor impairments: "It's fun!"
- Suggested sentences can be amusing (i.e. "wrong")
- It doesn't actually require touch input:
  - Broad/flat stylus, joysticks, paddles, etc.
- It doesn't work well for people with spasms

Future Addition: "Finish Line"

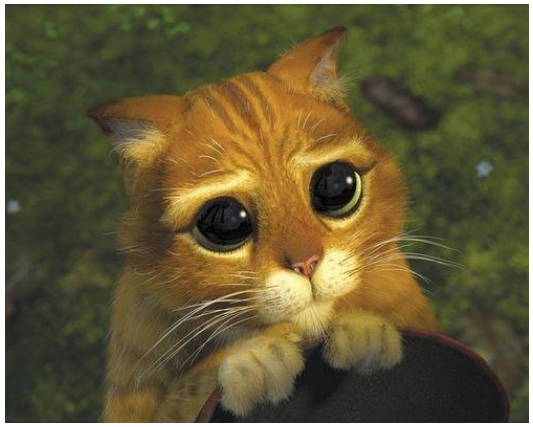


Future Addition: "Finish Area"



Other Planned Additions

- Support for multiple and individualized boards
- Prediction problem:
  - Statistics from real AAC users provide better prediction
  - Help, please?



Let's Dream Together a Little Bit...

From the mother of a young AAC user:

> *I want my daughter to be able to say everything. Every single thing that pops into her head -- from "I want water" to "That rhinoceros is purple" to "Yellow pineapple makes my lips itch."*

My Response

"YES!"

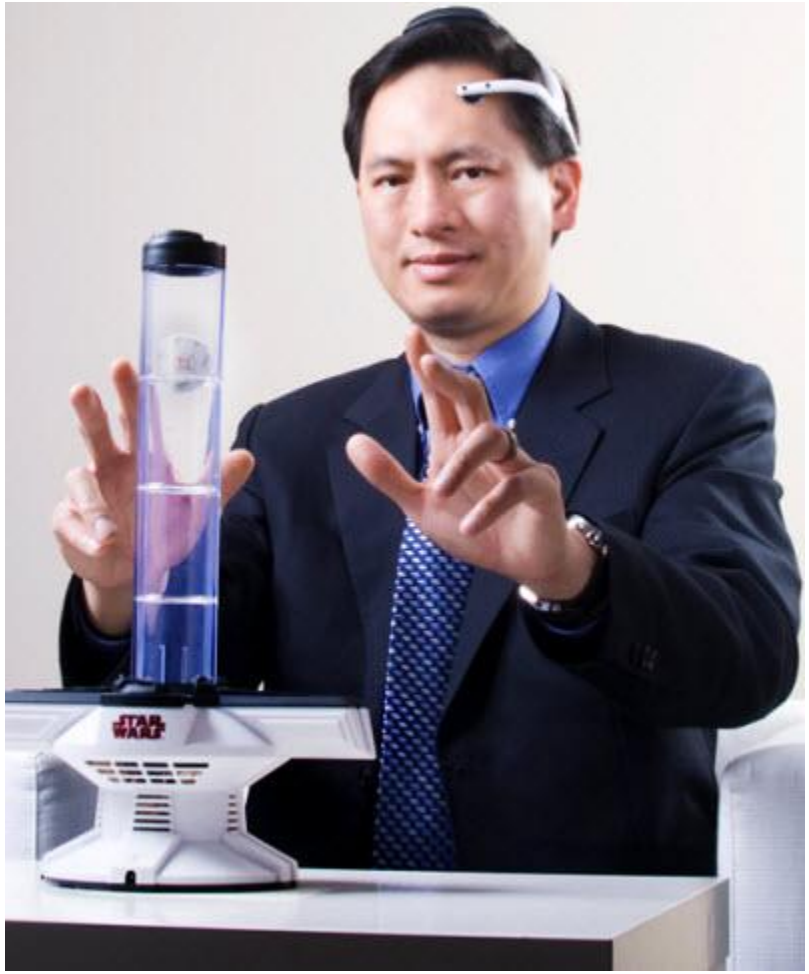
...But How?

- One obvious solution: use letters
- What if we can't or don't want to?
- Problems we need to solve:
  - How to display the vocabulary?
  - How to navigate the vocabulary?
  - How to do all of this stuff quickly?

Back to the Drawing Board

- What if we actually knew what just popped into the user's head?
- Brain-Computer Interfaces (BCI) or Brain-Machine Interfaces (BMI)
- Often designed assuming a minimal number of input signals
- Primarily used for people with Locked-In Syndrome (LIS)

...But Also for Novelty

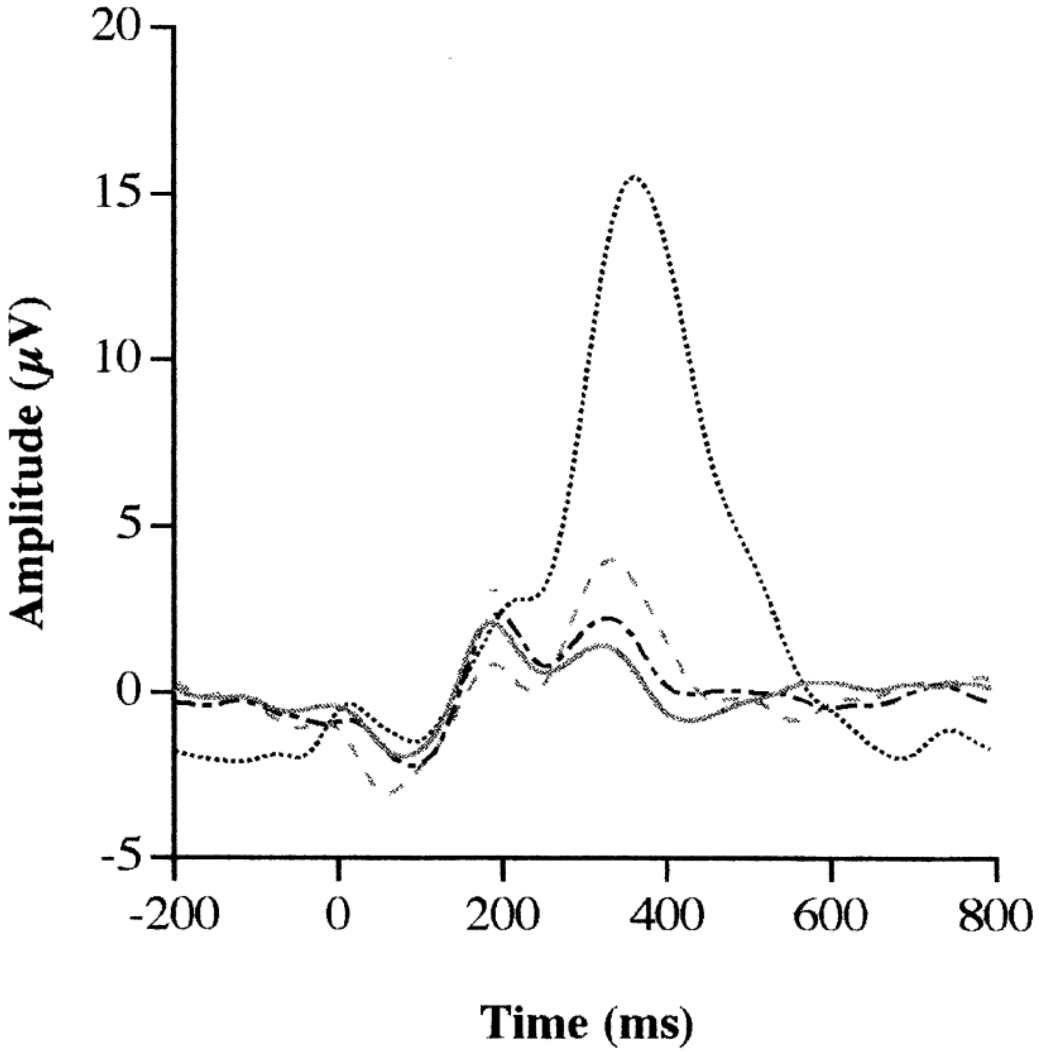


http://www.emotiv.com/
http://www.neurosky.com/

On Brain-Computer Interfaces

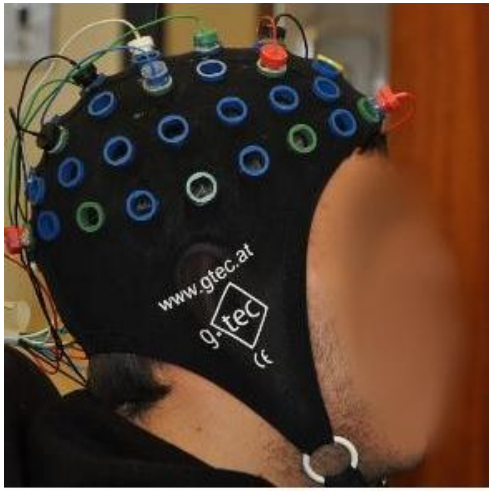
- Different signals:
  - Electroencephalography (EEG)
  - Functional Magnetic Resonance Imaging (fMRI)
  - and many others...
- Different techniques and approaches:
  - Motor imagery
  - Steady state visual evoked potentials (SSVEP)
  - P300 and Event Related Potentials (ERP)
  - and many others...

The P300 Wave

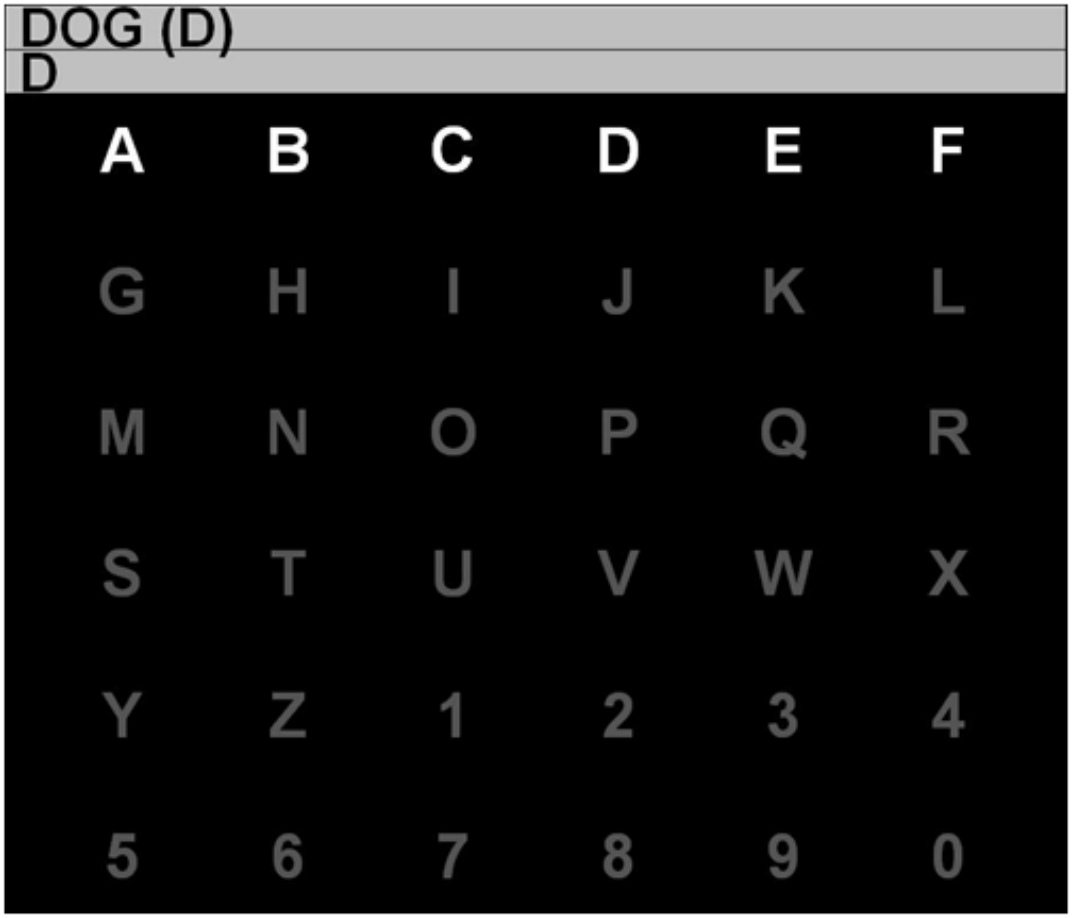


A Letter-Based Example

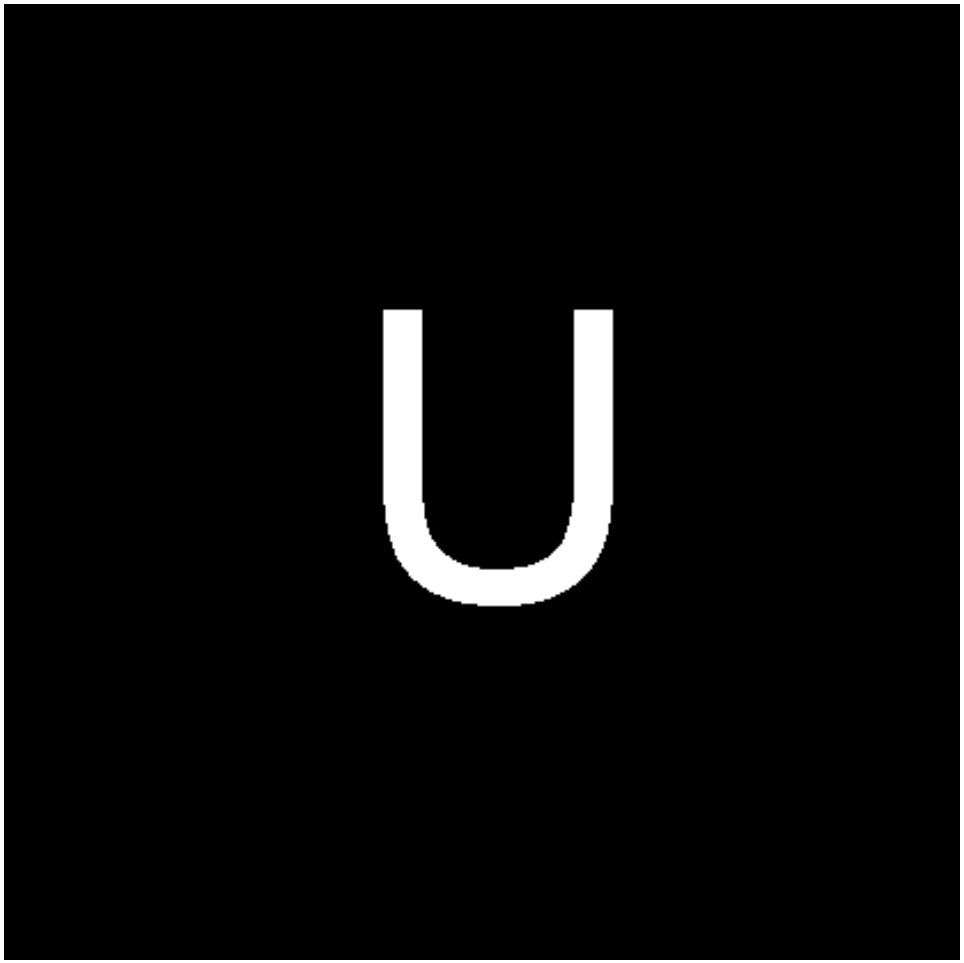
P300 Speller (or Matrix Speller)



http://www.etsu.edu/cas/bcilab/

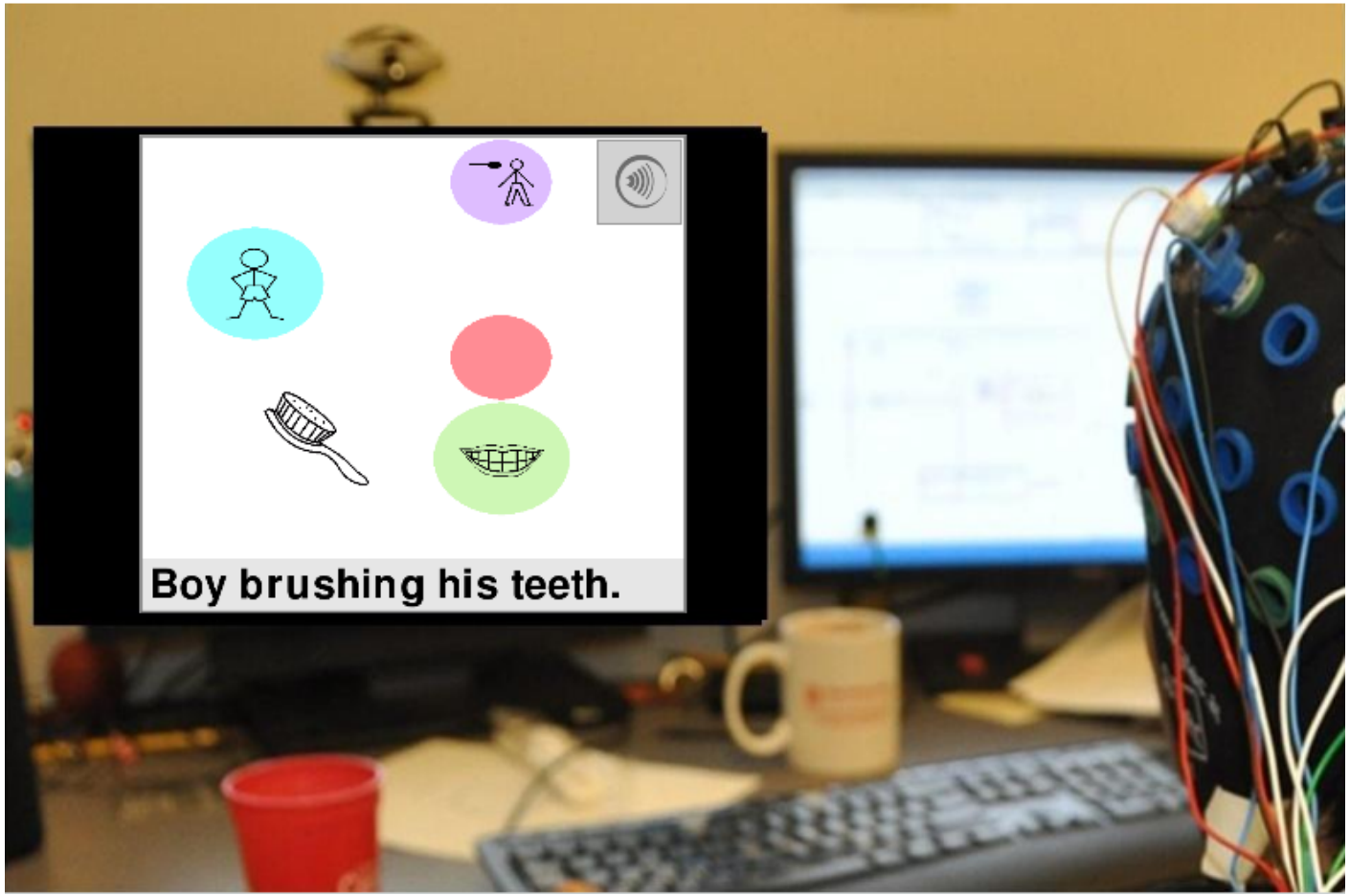


Related Project: RSVP-Keyboard



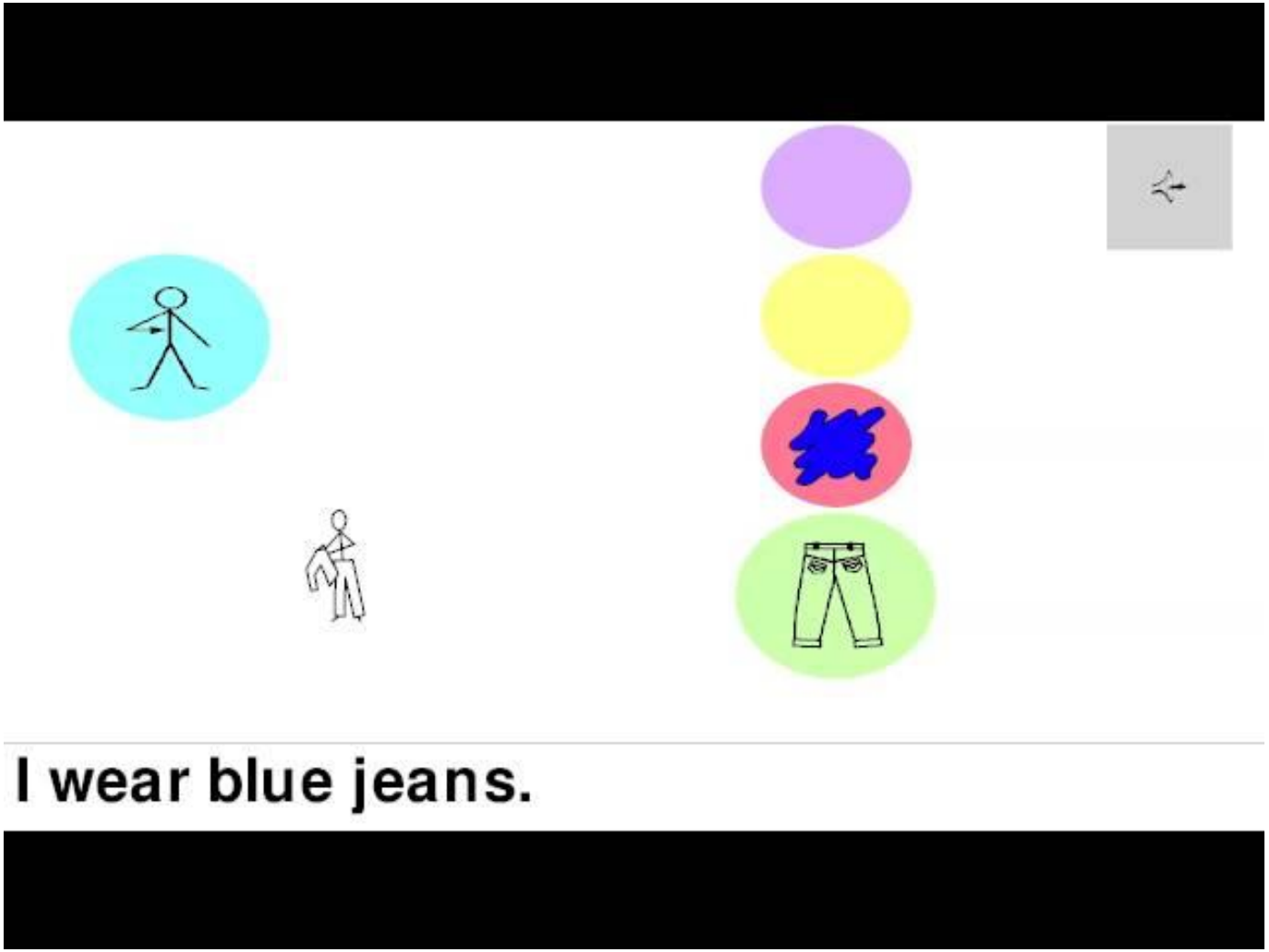
Orhan, U., II, K. E. H., Erdogmus, D., Roark, B., Oken, B. & Fried-Oken, M. (2012). RSVP keyboard: An EEG based typing interface.. In *ICASSP* (pp. 645-648) . IEEE . ISBN: 978-1-4673-0046-9

RSVP-iconCHAT



Wiegand, K., Patel, R., & Erdogmus, D. (2010). Leveraging Semantic Frames and Serial Icon Presentation for Message Construction. ISAAC Conference for Augmentative and Alternative Communication, Barcelona, Spain, July 2010.

RSVP-iconCHAT in Action



Initial User Questions

1. Who are the intended users?
    - Primarily people with locked-in syndrome (LIS)
    - Users of BCI-controlled wheelchairs
2. Do I have to concentrate?
    - Not exactly, but some users are "better" than others
3. What does it feel like?

What We've Learned So Far

- Experiments with non-AAC users and letter-based RSVP (RSVP-Keyboard)
- Non-AAC users get frustrated (surprise!)
- Staying attentive can be tiring
- Prediction is extremely important for speed and comfort
- It doesn't work well for people with spasms

Future Directions

- Improve the signal detection and word prediction
- Begin testing with current AAC users
- Translate the system and approaches into a portable package

http://www.emotiv.com/

Why We Need Help

- Prediction is extremely important
- Prediction is primarily based on data
- More realistic data is better
- There isn't a lot of real AAC data out there
- We need to train our algorithms on realistic AAC data

How You Can Help

- Getting ideal data creates privacy concerns
- Asking current AAC users is a good start
- We'd like to ask the families, friends, and teachers of real AAC users
- What do you talk about? How? When? What would you **like** to talk about?
- Boards, logs, or word lists would be great!

CadLab Corpus Project

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For the following questions, please think of only one AAC user that you know:

1. How are you related to the AAC user?

   ○ Family ○ Teacher ○ Caretaker ○ Friend ○ Coworker ○ Other

2. Approximately how old is the AAC user?

   ○ 0 - 5 years ○ 6 - 10 years ○ 11 - 20 years ○ 21 - 40 years ○ 41+ years

3. How impaired is the AAC user's speech?

   ○ A little ○ Medium ○ A lot ○ Doesn't speak

Survey Demographics

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4. How impaired is the AAC user's hand and arm movement?

   Left: ○ Not applicable ○ A little ○ Medium ○ A lot ○ Uncontrollable
   Right: ○ Not applicable ○ A little ○ Medium ○ A lot ○ Uncontrollable

5. How does the AAC user typically communicate? Please check all that apply:

   - ☐ Electronic system with letters
   - ☐ Electronic system with pictures
   - ☐ Electronic system with a combination of letters, words, and pictures
   - ☐ Physical letter board
   - ☐ Physical word/picture board
   - ☐ Picture cards
   - ☐ Speech

The Core of the Survey

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6. In the following text box, please type as many sentences, phrases, or questions as you can think of, that are:

   - things you **usually say to, or ask of**, the AAC user
   - things the AAC user **usually says or asks**

7. In the following text box, please type as many sentences, phrases, or questions as you can think of, that are:

   - things you think the AAC user **would like to** say
   - things you think the AAC user **should be able to** say

8. If you would like to upload a text file or Microsoft Word document of sentences or phrases, please select that file here (we accept any file format):

   Choose File No file chosen

Thank you for listening!

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cad laboratory

Grant #0914808