Eye Gaze Technology (EGT): considerations for writing and implications for interface design

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Introduction

- Who we are
- What we do
- Why we are talking about this

We aim to consider…

- the development of skills to control eye gaze
- in parallel with developing literacy skills

- Implications for user interfaces (for writing and for AAC)
- Implications for developing eye gaze access skills

Context

- Exploring skills required to control eye gaze and the application of these for writing
  - separating access skills
  - from skills for the task

- Spoken communication is different to written communication
  - different purposes, more requirement to review and edit
- But, there are shared skills for writing and speaking
  - creating novel words, editing a message

- Children using eye gaze for communication should be taught literacy and have access to suitable user interfaces

Demands on the individual

Literacy Skills

Emerging	Developing	Independent
Words and some letters < 26	Letter and some editing 26<40	Full keyboard and functions >26

Selection set →

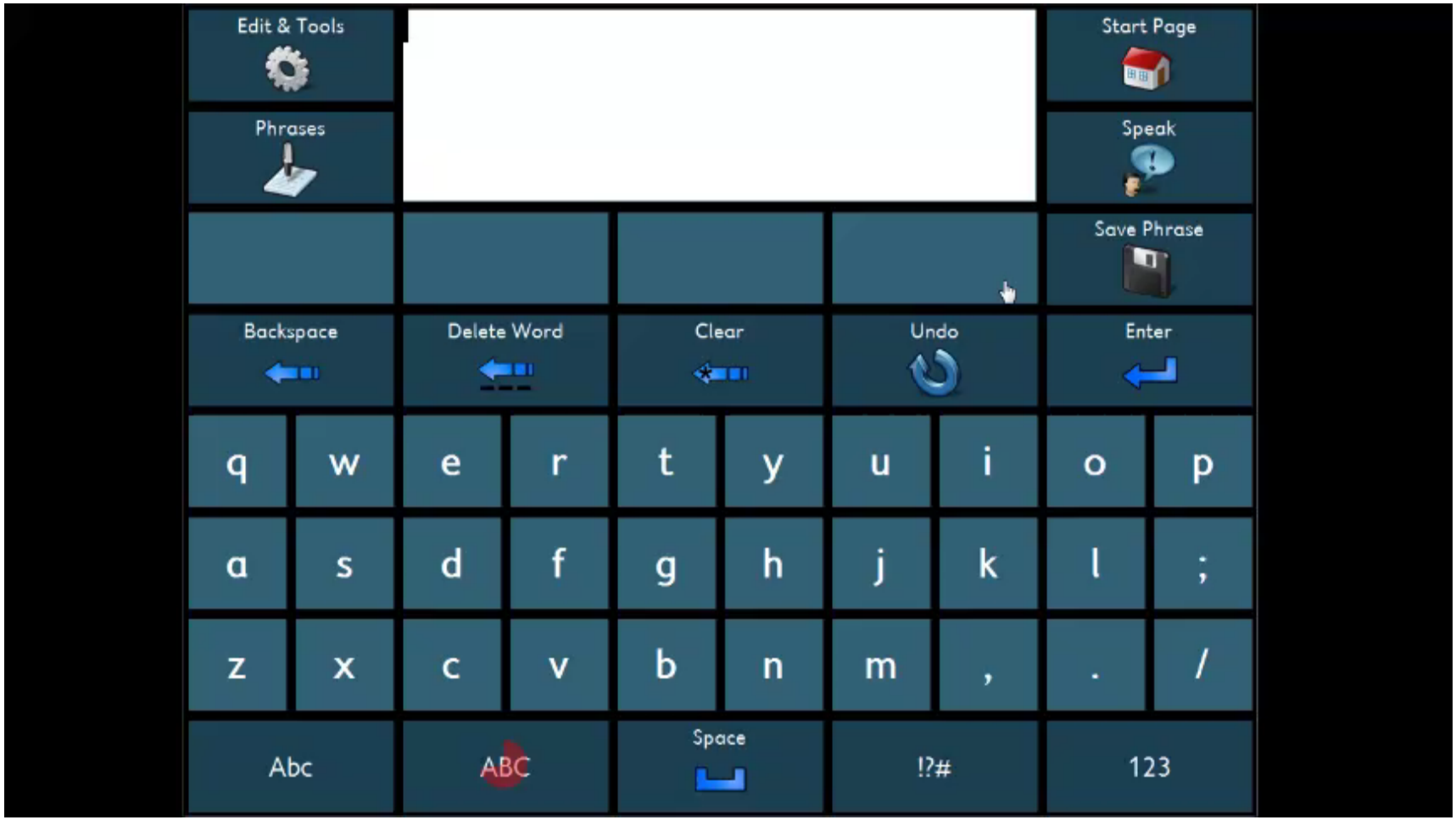
Writing volume →

Accuracy required →

Components for efficient text entry

- Control method
  - fixation, discrete and continuous
- Selection method
  - dwell, switch, blink
- Keyboard
  - design, organisation
- Writing area
- Efficiency techniques
  - abbreviation expansion, word prediction, auditory feedback

Control Method - Fixation

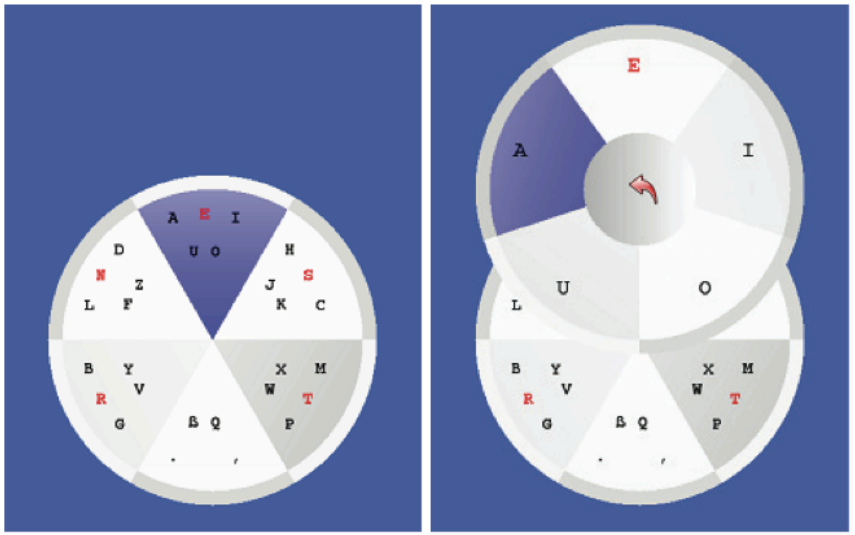


Control Method - Discrete

KKBoard

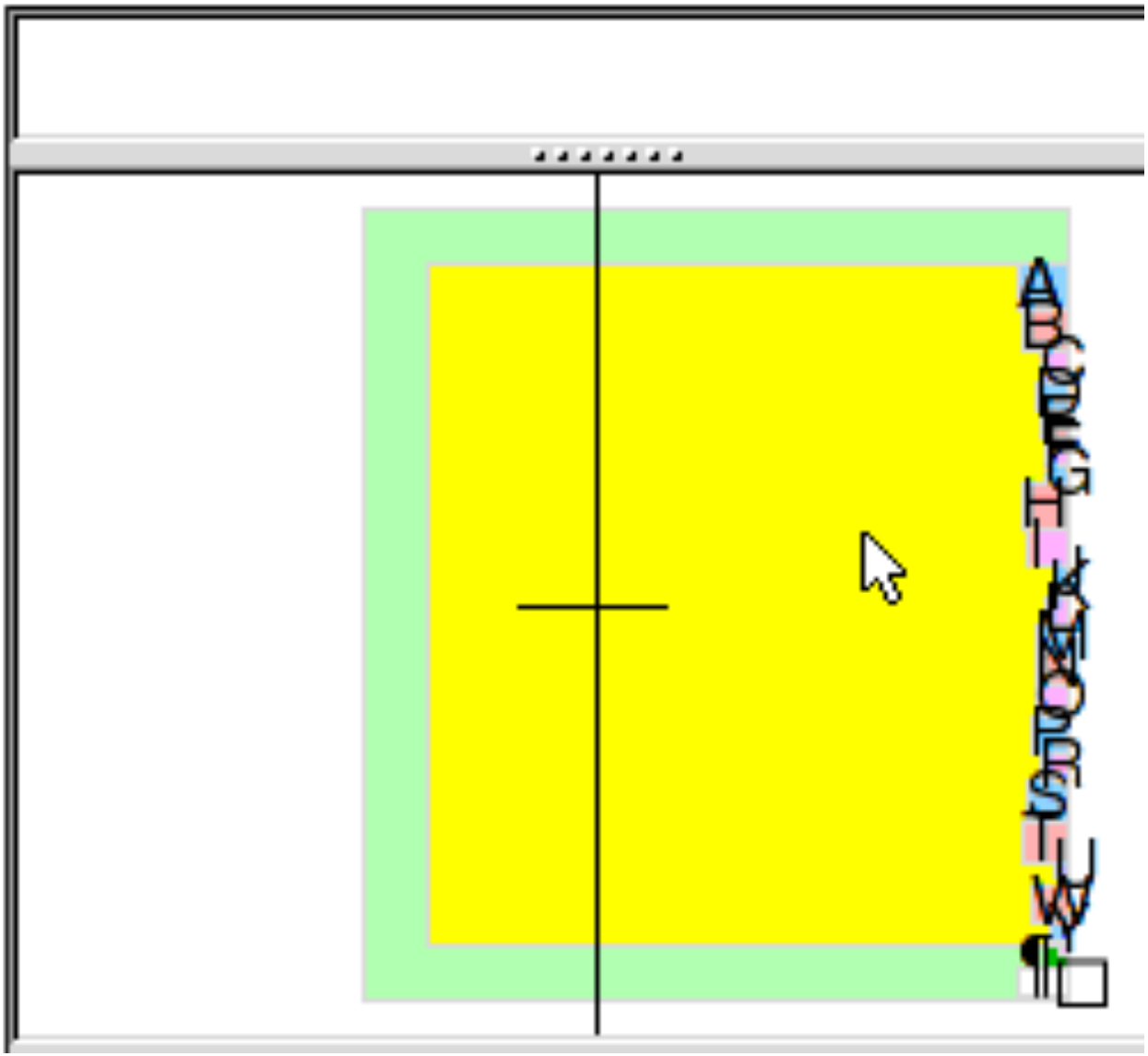
Figure 10. The KKBoard interface. Courtesy of C.H. Morimoto and A. Amir.

pEyeWrite

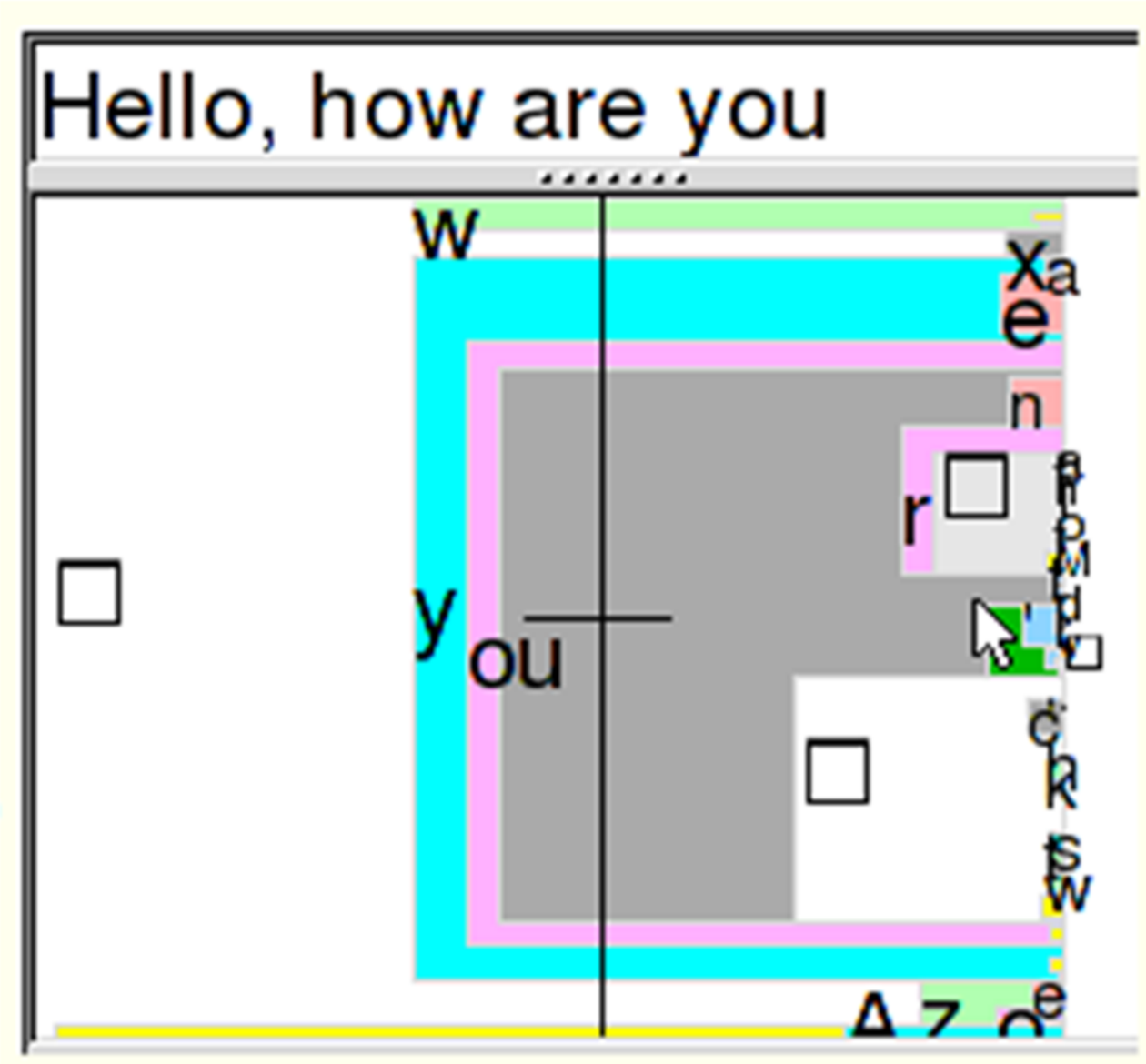


- Focus on one letter then focus on the other side
- Short saccades rather than dwell
- Not aware of being commercially available

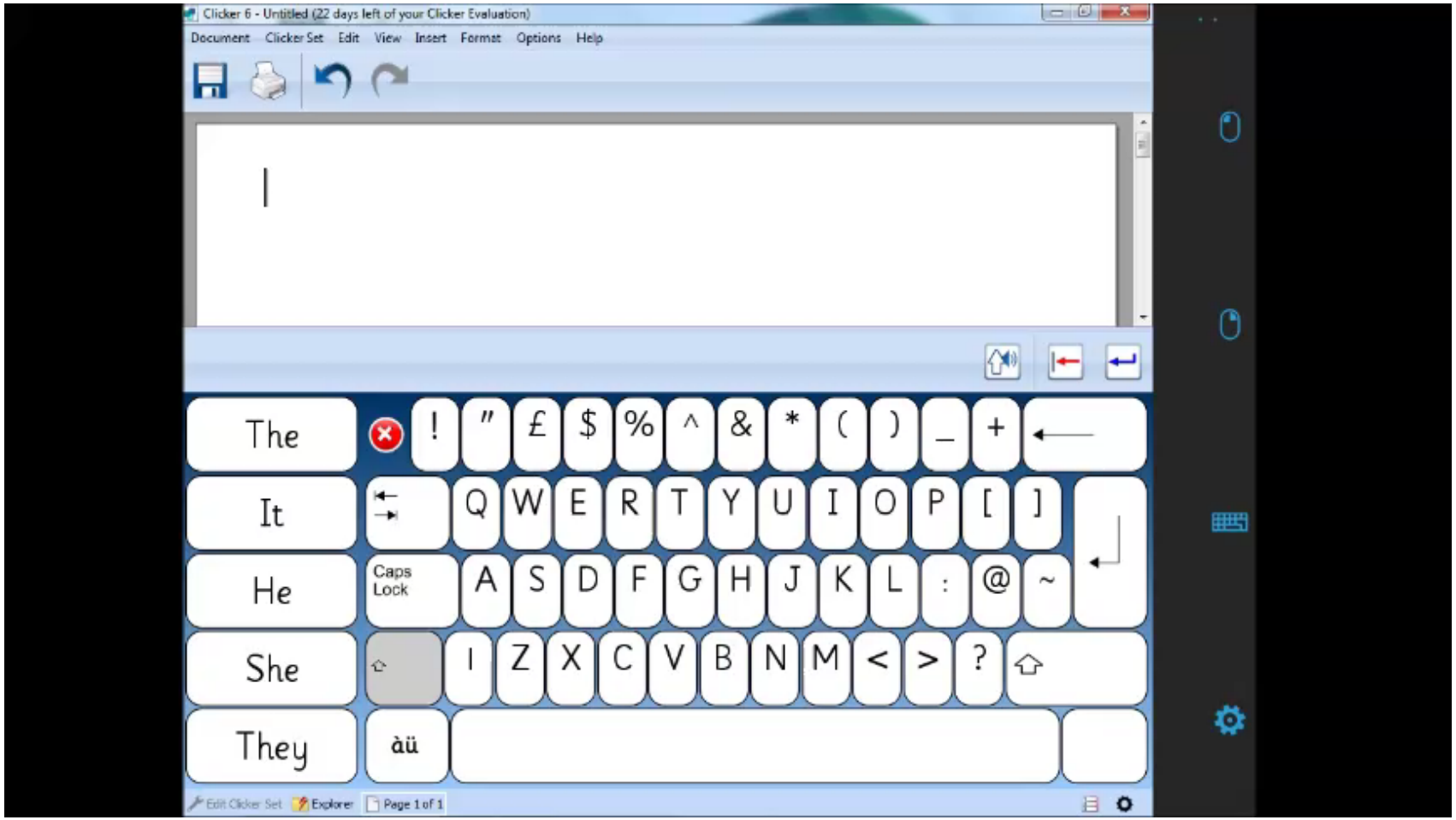
Control Method - Continuous (e.g. Dasher)



Control Method - Continuous (e.g. Dasher)



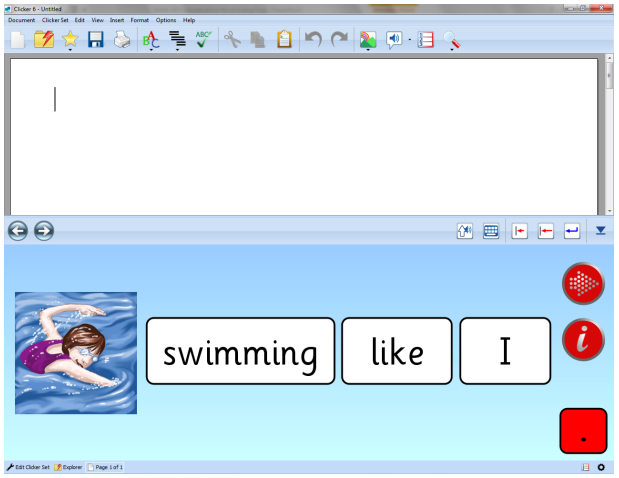
Control method - Continuous and Fixation (e.g. Gaze Selection)

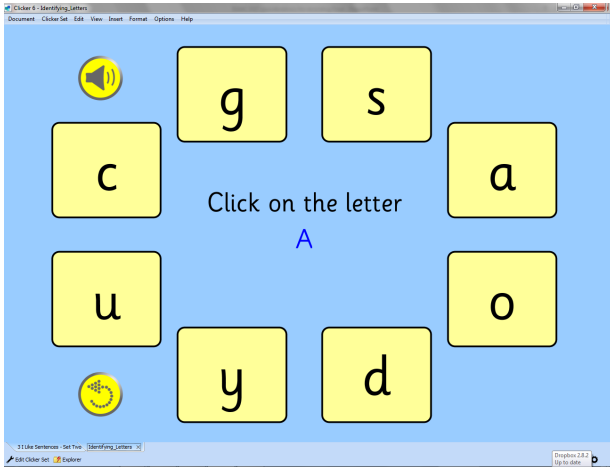


Early Literacy

- Playing with letters and sounds
- Access to alphabet / keyboard
- Spelling simple words
- Selecting high frequency words to create simple sentences
- Speech feedback – reading, matching pictures to words

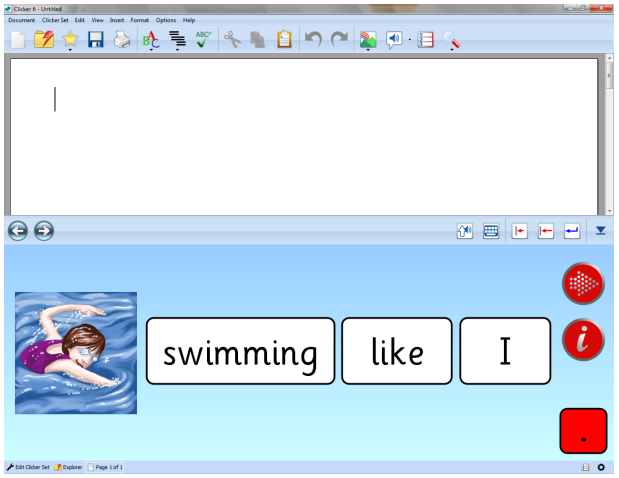
NB Selection set is generally small to target literacy skills

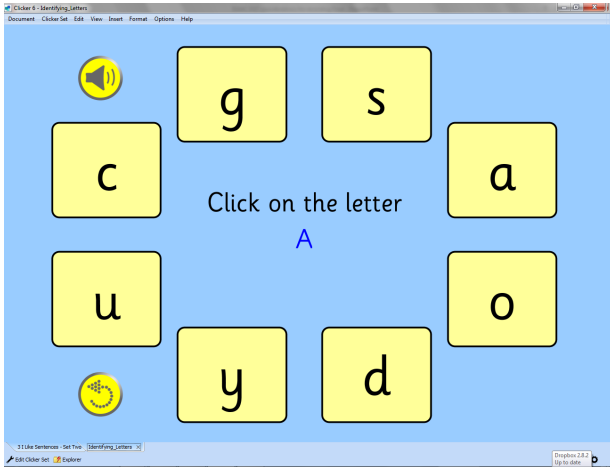




Control

- Looking at selection set
- Looking at entered text
- Selecting from keyboard
  - to listen
  - to choose
- Selecting from writing
  - to hear what's been written
  - to edit





The challenges

- Ability to *look* and to *select* as required
- Ability to *look* and to *hear* as required

Possible solutions:

With fixation

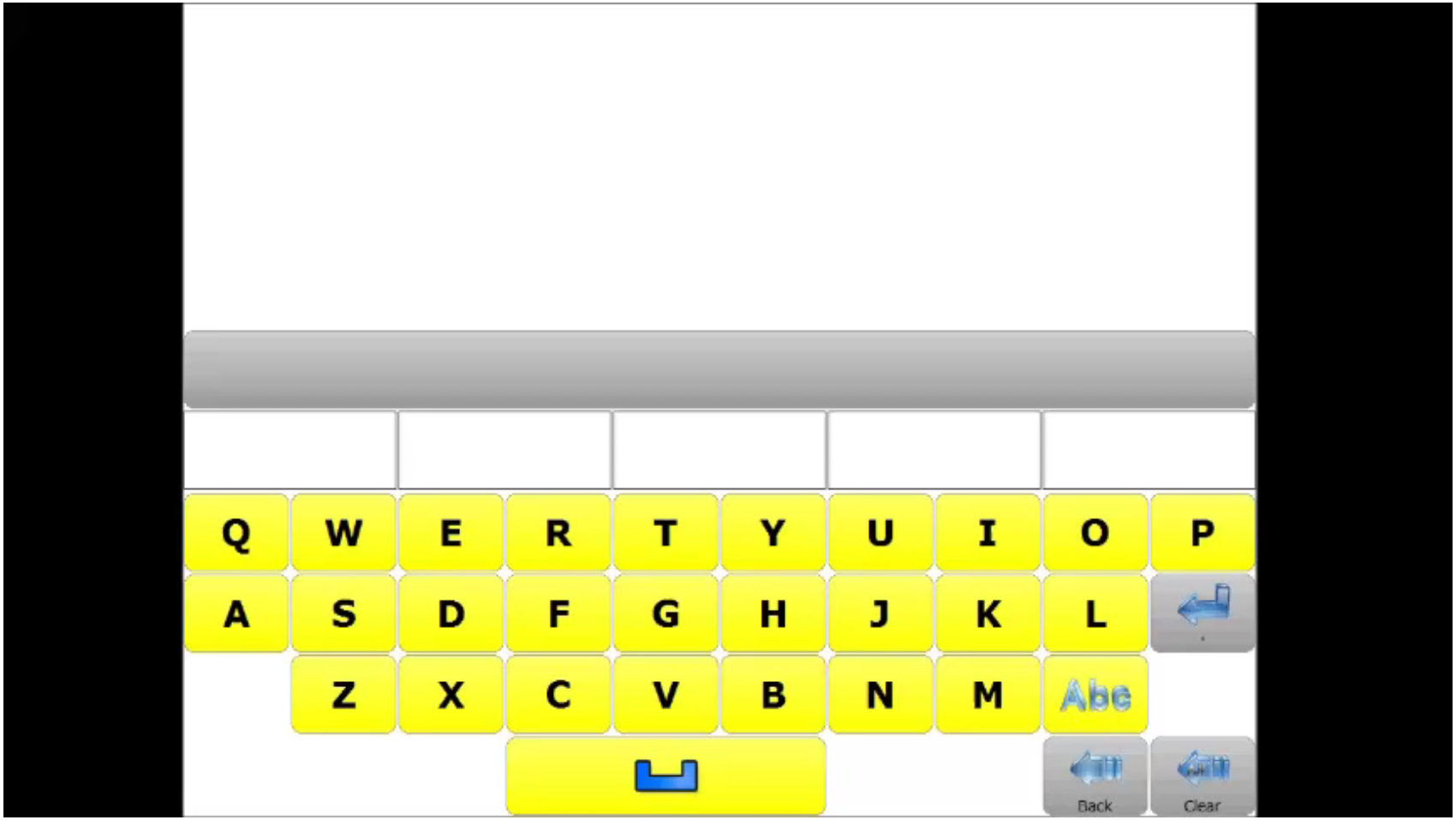
- short dwell to hear, longer to select
- but need to turn this on and off
- 2 stage selection (e.g. select action, then perform function)

With eye gaze selection (and mouse emulation)

- 2 stage selection: look to ‘left click icon’ then to selection

All solutions reduce speed

Will's Two Stage Keyboard

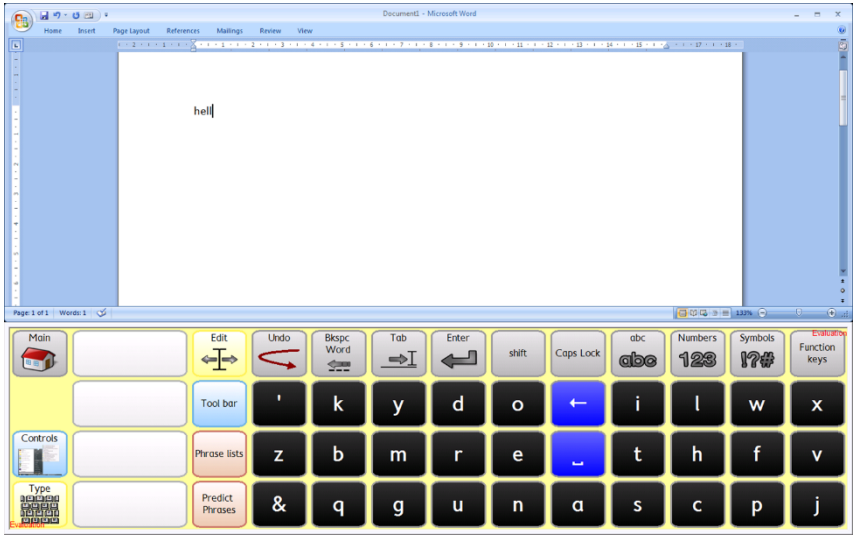


NB This is not a rest cell

General Considerations for Keyboard UI

- Choice of keyboard layout

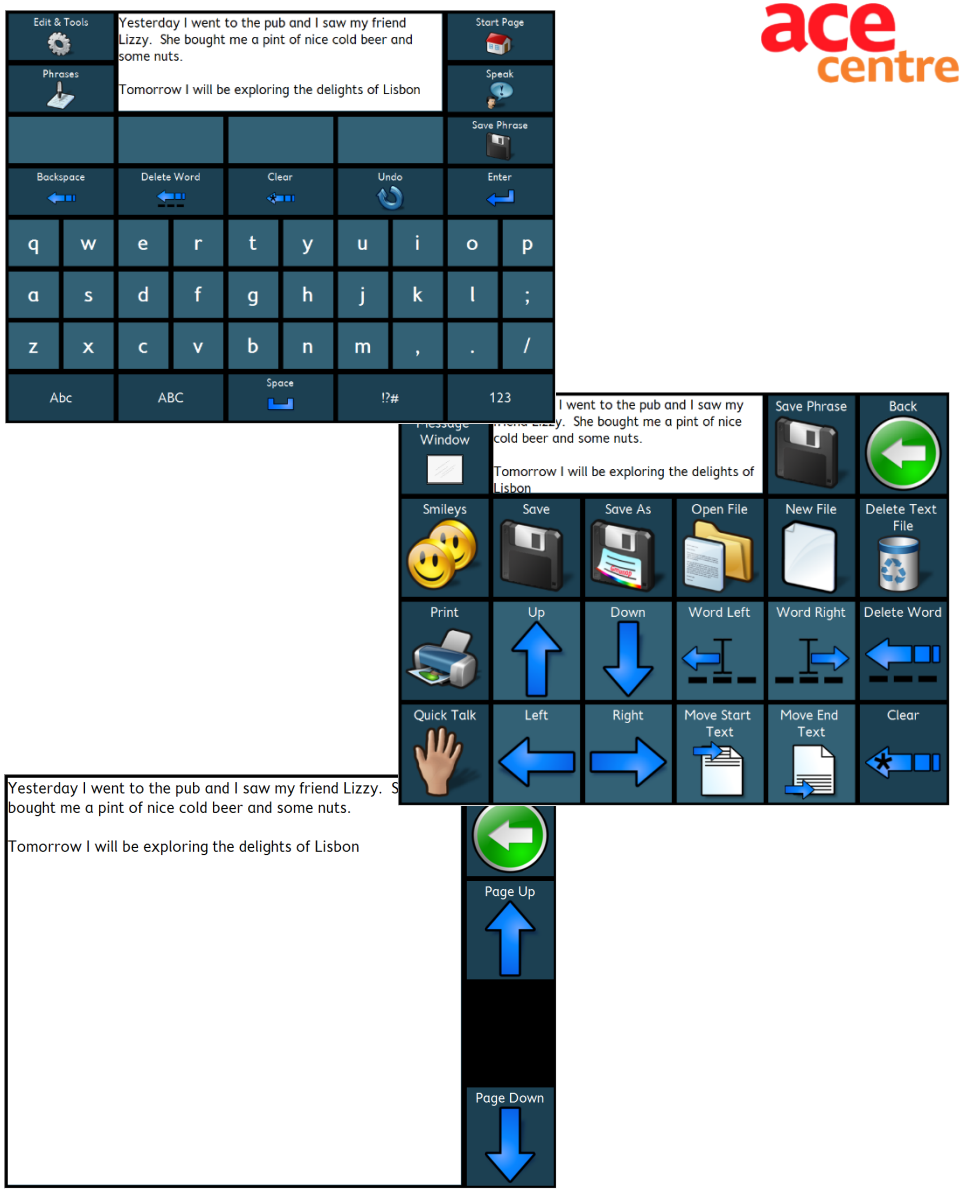
  e.g. Pointer control
  - Move away from norm
  - Concern for availability and longevity



- Specific individual requirements will dictate
  - Preferred area of screen for greater accuracy
  - Preferred colours, font size, type, upper/lower case

Literate

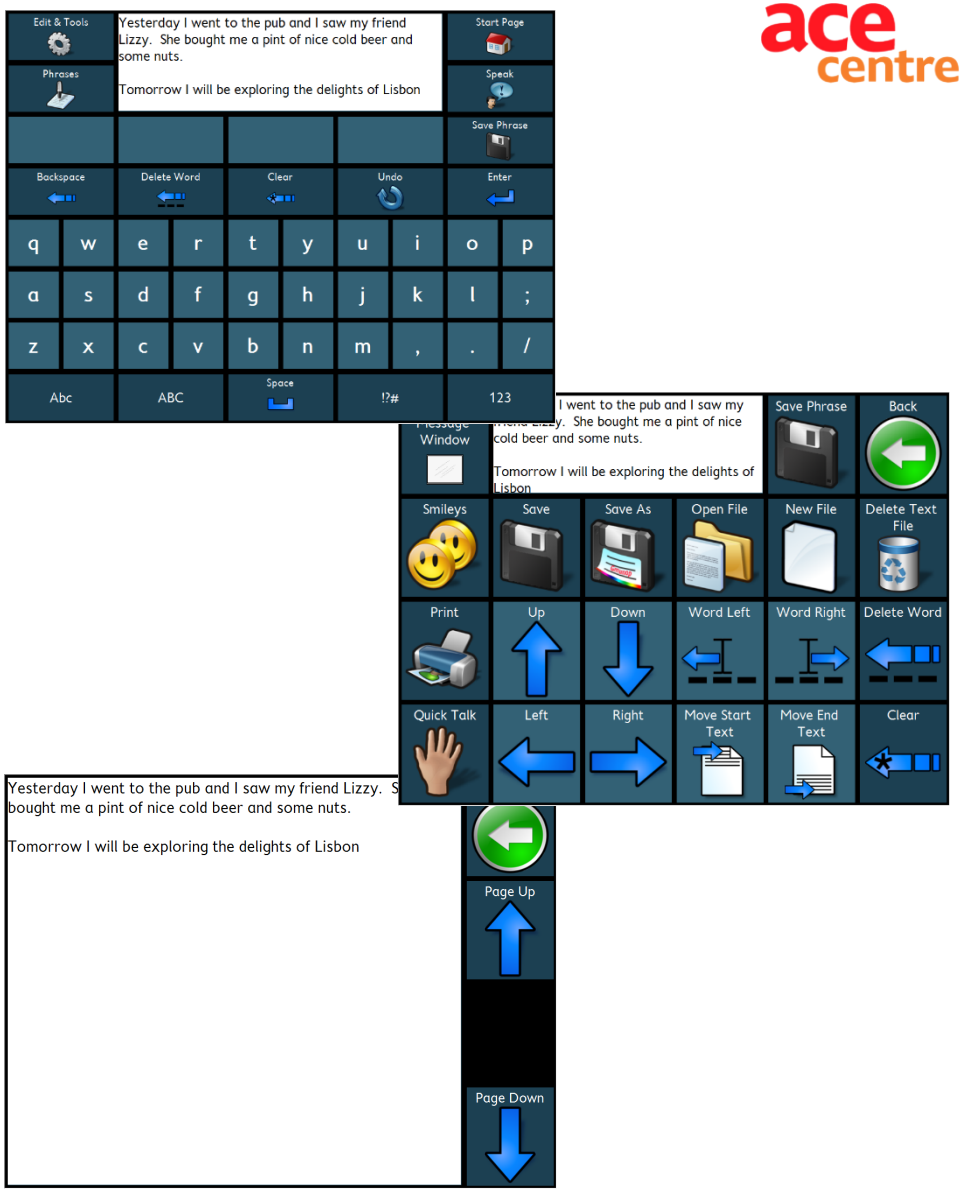
- Increase selection set
  e.g. punctuation, functions
- Increase in quantity of text on screen
- Text editing
  - Selecting letters or words on screen that have been entered
  - Adding to body of text
- Writing for different purposes
  e.g. May need to write in different applications such as web, email
- Speech feedback
  - proof reading



Control

- Looking at selection set
- Looking at entered text
- Selecting from keyboard
- Selecting from writing
  - to hear what's been written
  - to edit

NB Greater accuracy is required because selection set is greater or selection set needs to be organised to accommodate… not easy!



The challenges

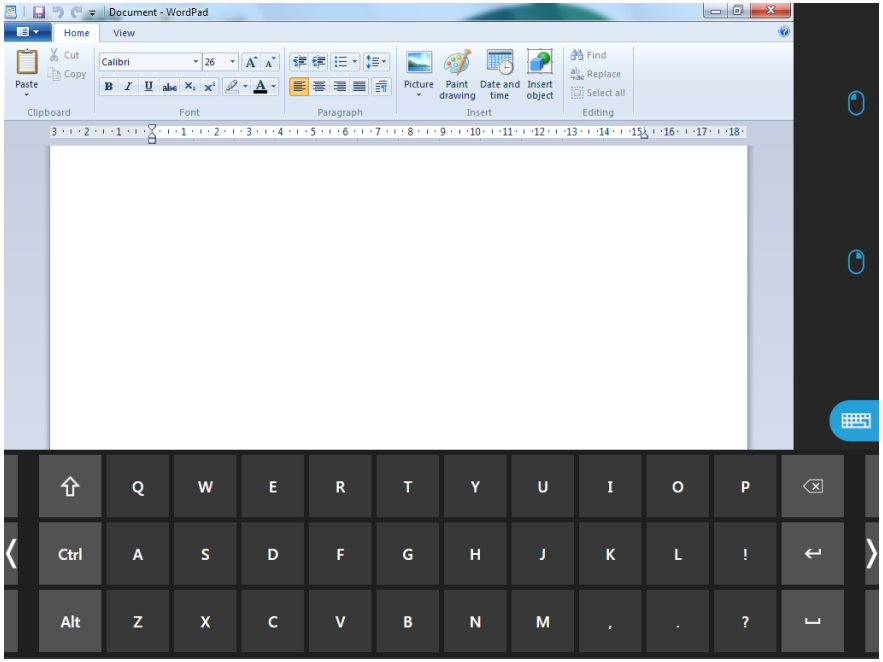
- Greater accuracy required because more in selection set
- More editing required
- Efficiency techniques are required
- Quantity of text entered onscreen increases – can't see it all at once

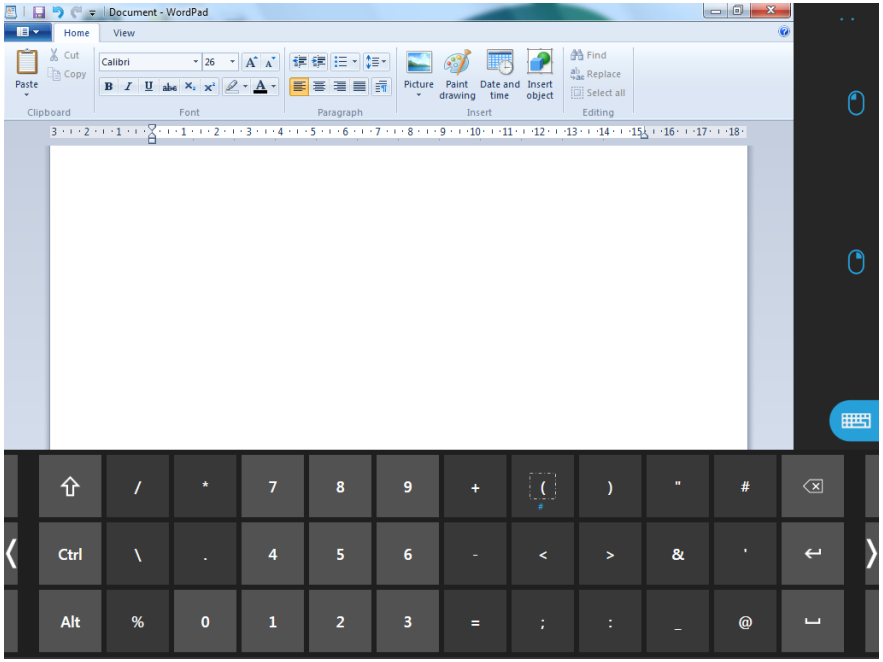
Possible solutions

With fixation

  - Scrollable keyboard
  - Two Hit keyboard
  - Keyboard shortcuts e.g. delete word, delete letter, Insert, End

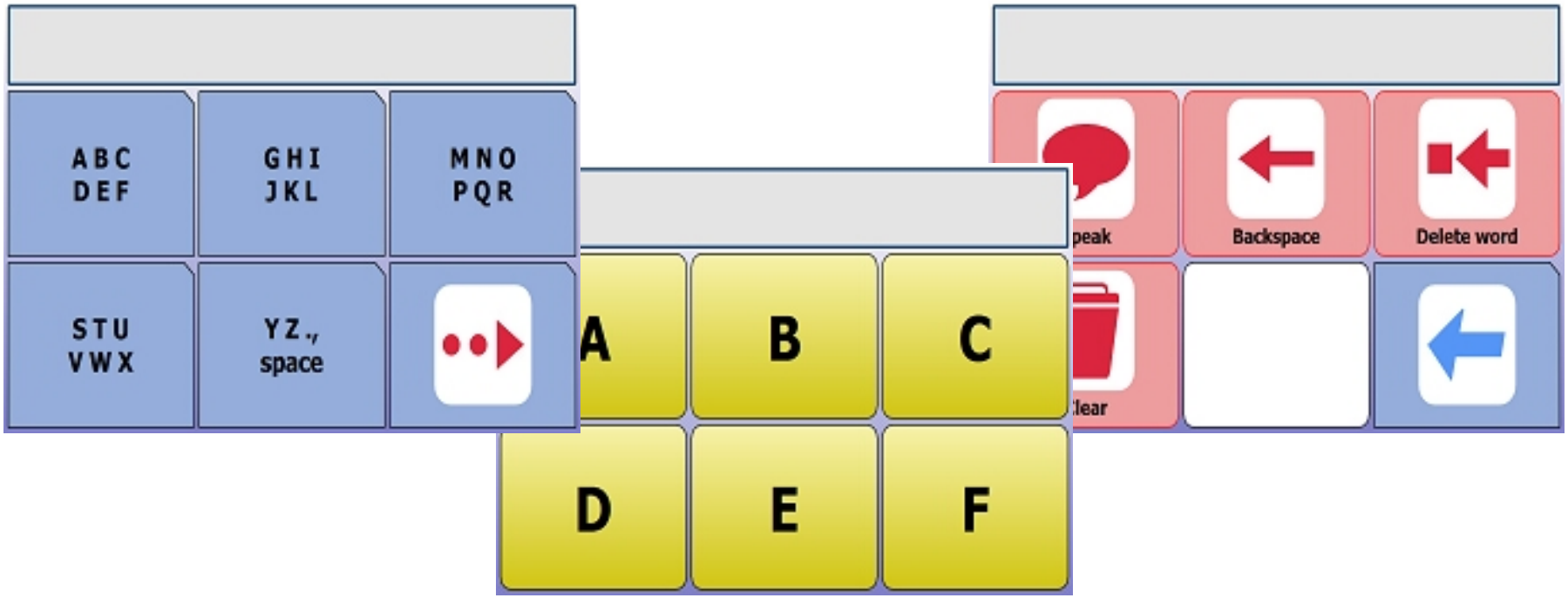
Scrollable Keyboard





- Improves accuracy with bigger target area
- Slows down process with two stage selection

Two Hit Keyboard



- Improves accuracy with bigger target area
- Slows down process with two stage selection
- May need multiple grids for additional keys and functions

The challenges

- Greater accuracy required because more in selection set
- More editing required
- Efficiency techniques are required
- Quantity of text entered onscreen increases – can't see it all at once

Possible solutions (cont.)

  - Two screens (extended desktop, computer control)
  - Larger screen
  - Smaller keyboard

Gaze selection / continuous control method to assist accuracy

Word prediction – useful with slower methods of control

Conclusions

Using eye gaze functionally with a large selection set is challenging

Using your eyes to *look* and to *select* is not straightforward

The demands are different depending on the *control method*, *selection technique* and *selection set* (keys, symbols, text)

More consideration should be given to the user interface for different tasks (AAC and writing). Should we consider more than fixation?

Why are we emulating mouse control when eye gaze works differently? If we provide access solutions “towards the norm” then what is the norm for eye gaze?

What resources are needed to develop eye gaze control skills?