

Dasher

Information-Efficient Text Entry

Hanna Wallach

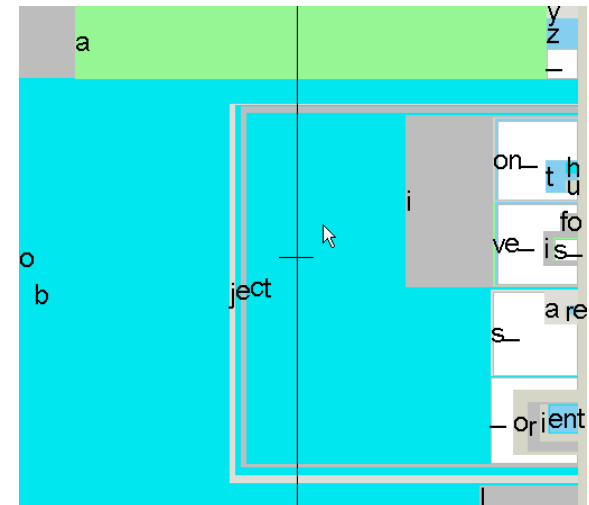
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Dasher was designed by David MacKay and David Ward in the Inference Group at the Cavendish Laboratory, University of Cambridge. The current project manager and developer is Phil Cowans. See <http://www.dasher.org.uk/>

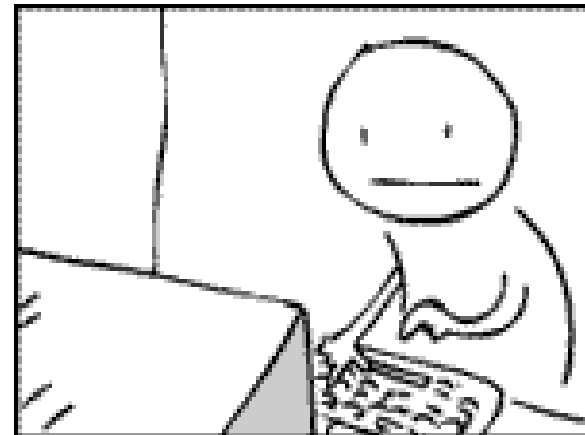
The Next 30 Minutes...

- Current text entry systems
- Writing and text compression
- Dasher: a novel text entry system
- Evaluation and performance
- Case study



Communicating with Computers

We communicate with computers
all the time...



Communicating with Computers

We communicate with computers
all the time...

... but it's not as easy
as it should be



What's wrong with keyboards?



- Bulky: efficiency depends on key size
- Have to type 1 or 2 gestures for every character
- Digital not analog: can't register fine motor movements

Mobile Text Entry

Reduced keyboards:



Slow (many key-presses),
don't use fine motor movements

Mobile Text Entry

Gestural alphabets:

A B C D
N O P Q

↑	↵	↶	↷
a	b	c	d
↶	↷	↷	↷
n	o	p	q

Faster, use fine motor movements, but often unreliable

Text Entry Using Prediction

- Write ambiguously, disambiguate later
- Word completion
- T9 (e.g., on a cellphone)
- Shorthand (e.g., “dsmbgu8 l8r”)
- ... all of these involve two “modes”

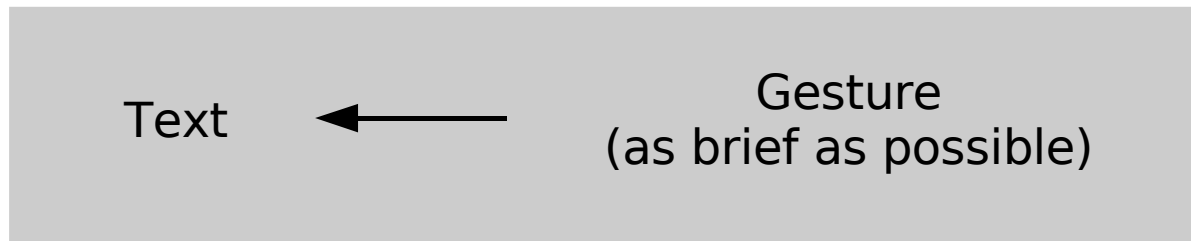
What's Missing?

Four important things:

- Continuous fine motor movements
- Use of the redundancy of language
- Language independence
- Single mode: write and disambiguate at the same time

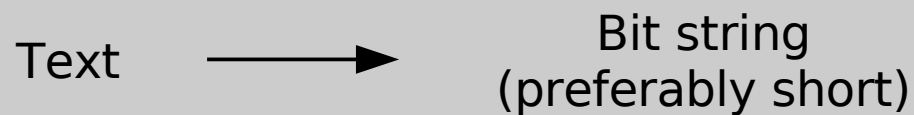
Writing and Text Compression

- Muscles can be very information-efficient
- Keyboards throw away this information
- Want to go from as small a gesture as possible to as much text as possible



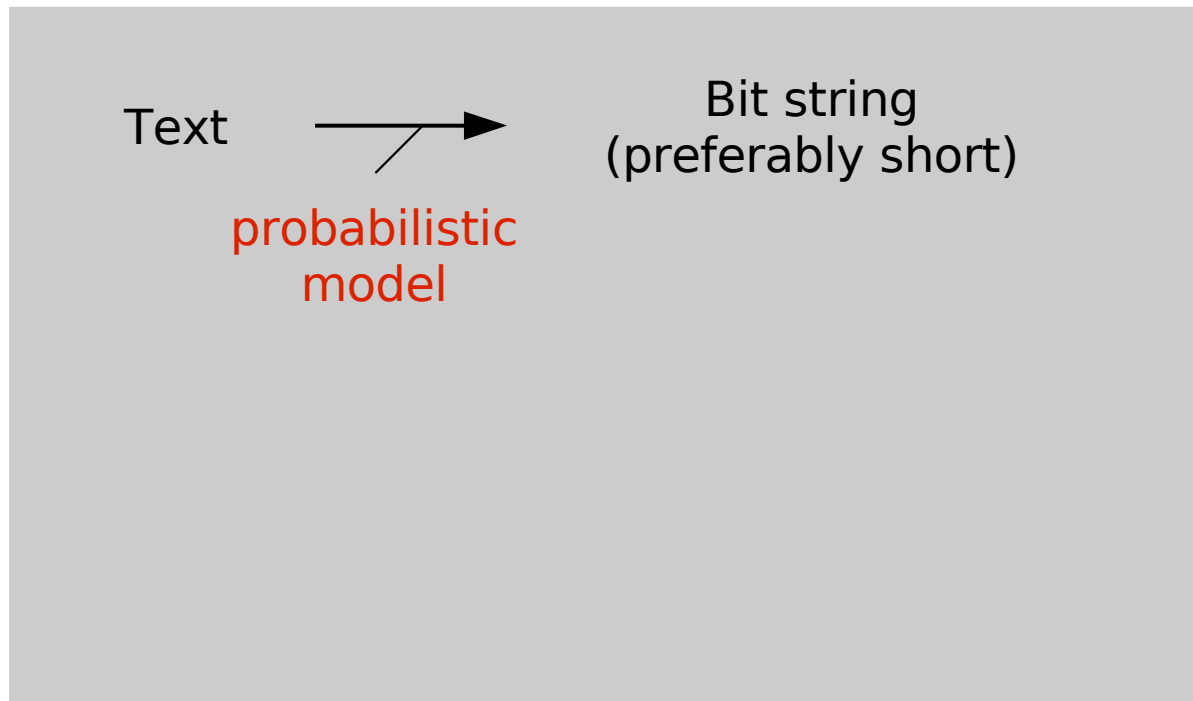
Writing and Text Compression

- This is like the reverse of text compression
- Want to go from as much text as possible to as small a representation of it as possible



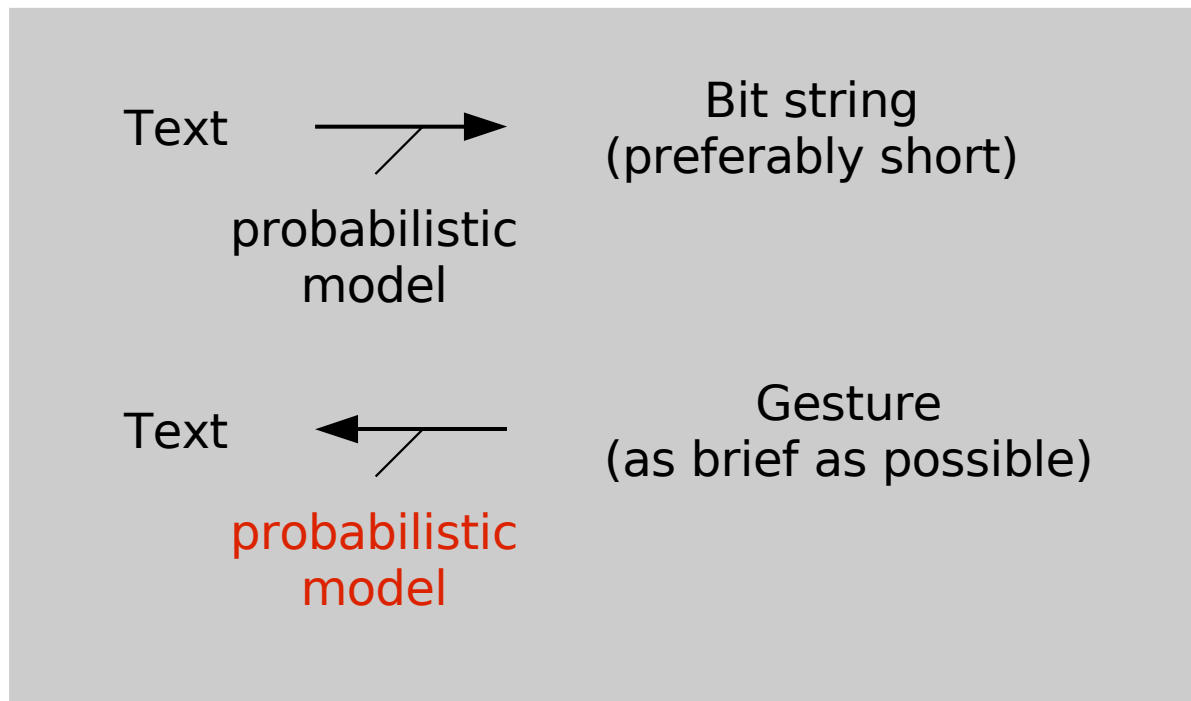
Writing and Text Compression

- **Optimal** text compression



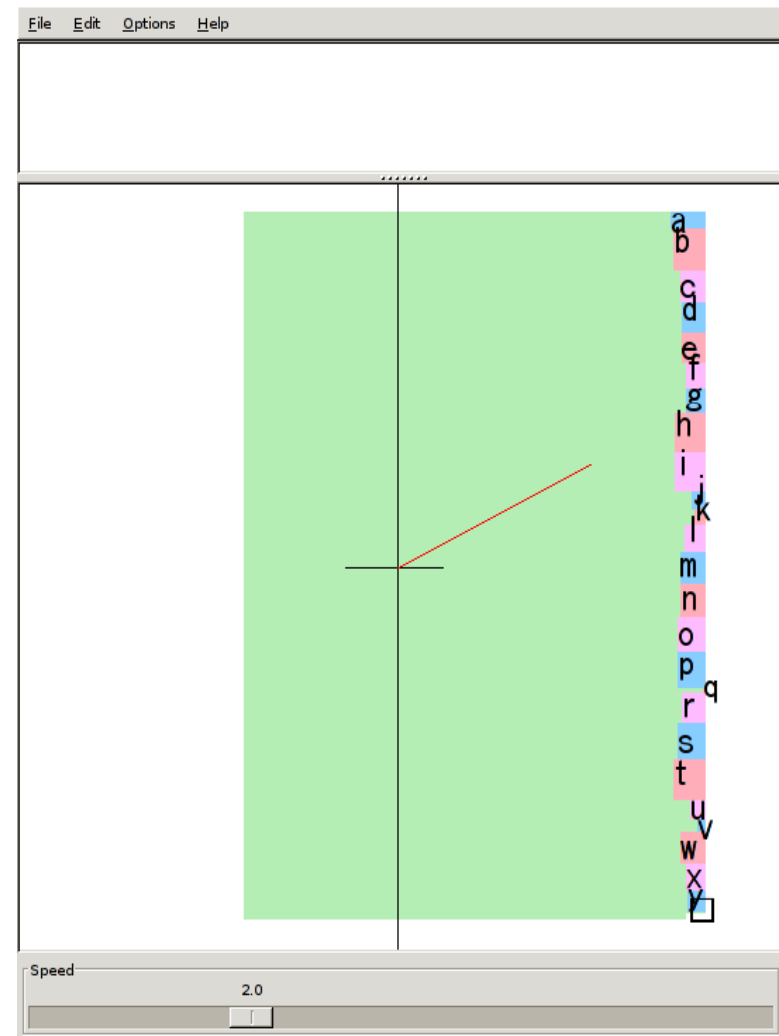
Writing and Text Compression

- Optimal text compression and writing with **Dasher**



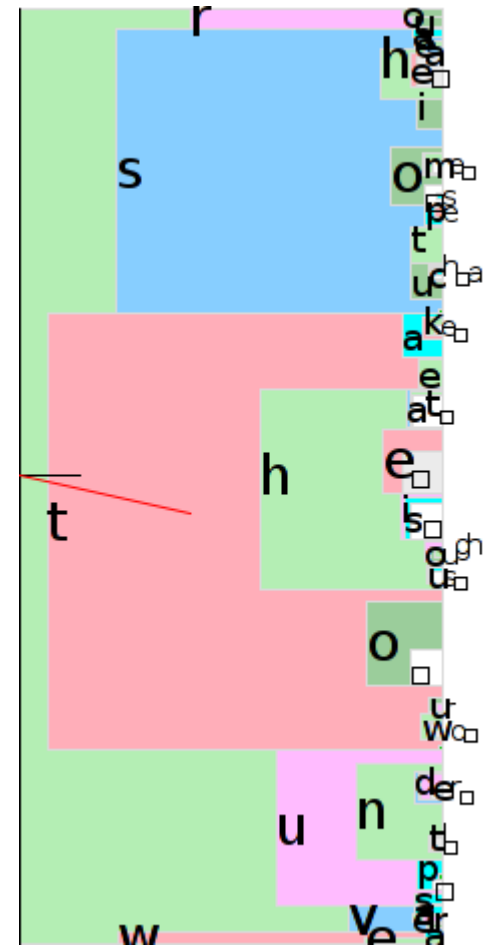
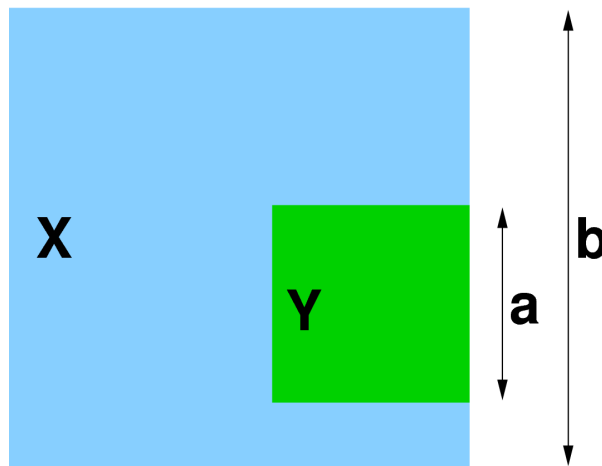
Dasher <http://www.dasher.org.uk>

- Driven by 2D continuous gestures
- Uses a language model
- Available for
 - Windows
 - Linux
 - Mac OS X
 - Pocket PC
 - etc.



Screen Layout

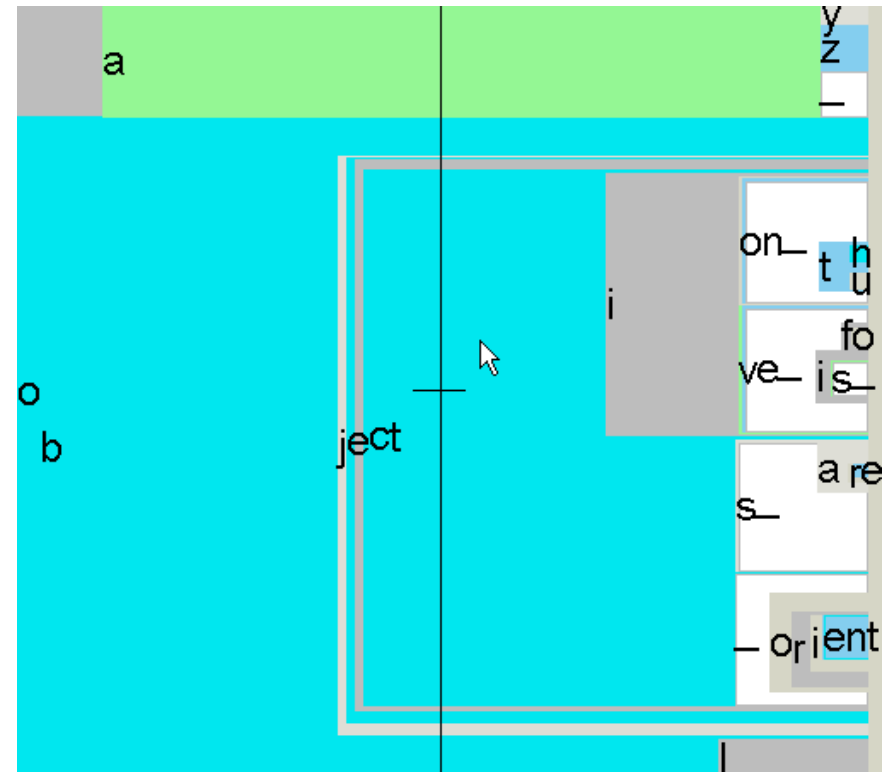
- Box sizes are proportional to probabilities
- Probabilities come from a letter-based language model
- $P(X) = b$
 $P(X, Y) = a$



Dynamics

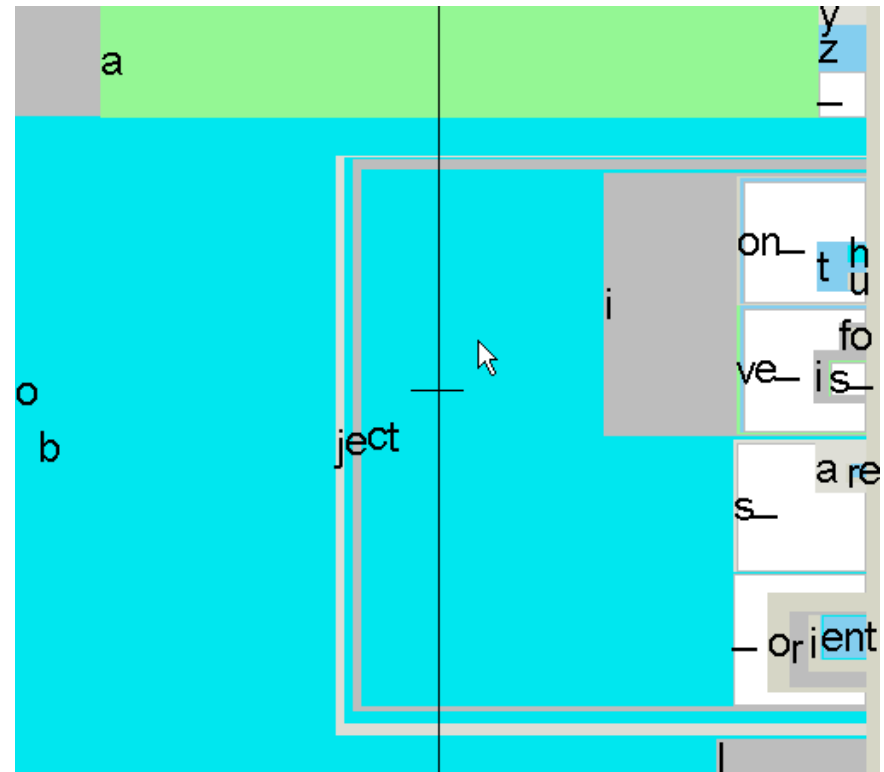
Point where you want to go

- Like driving a car
- Motion sickness?
- Not if you're driving!



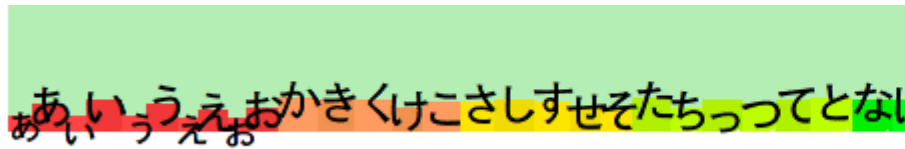
Benefits

- Keyboards: one gesture per character
- Dasher: some gestures select many characters
- Mode-free
- Inaccurate gestures can be compensated for by later gestures



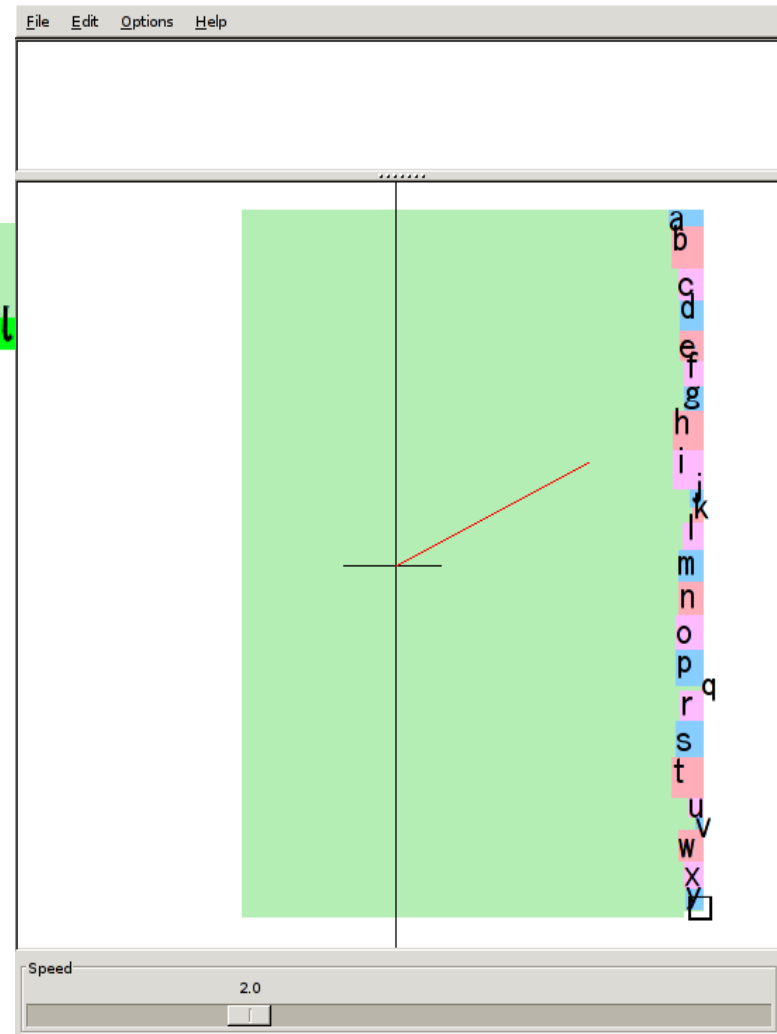
Benefits

- Can be used with any alphabet



あいいうえおかきくけこさしすせそたちっつてとなし

- Requires no special learning (knowledge of chosen alphabetical order is helpful)

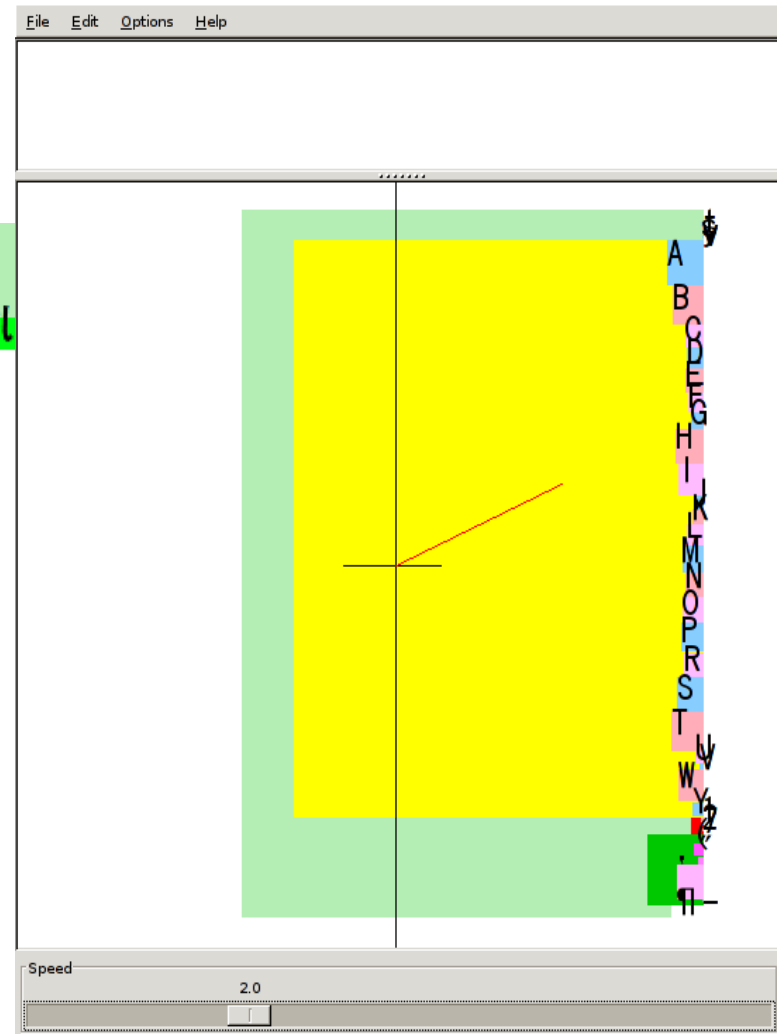


Benefits

- Can be used with any alphabet

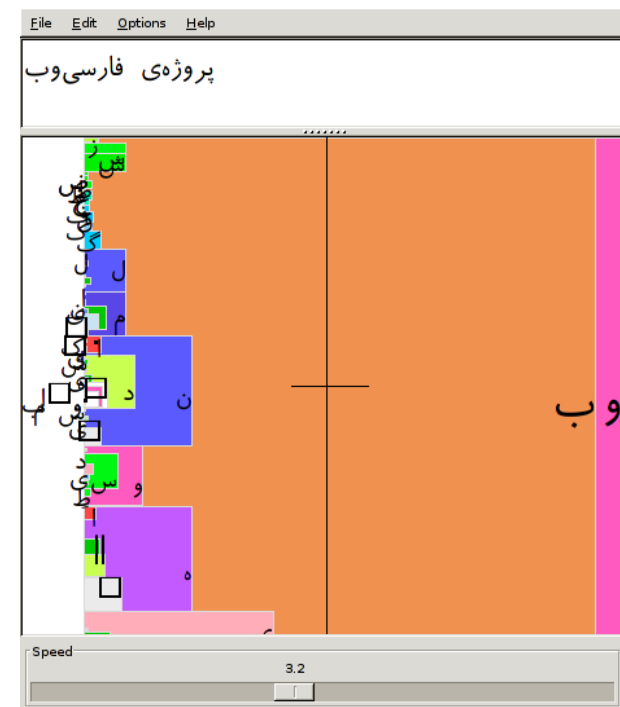
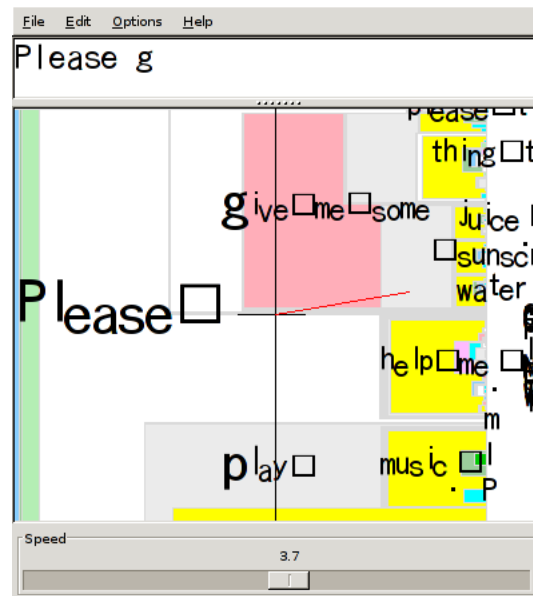
あ い う え お か き く け こ さ し す せ そ た ち っ っ と とな
あ い う え お

- Requires no special learning (knowledge of chosen alphabetical order is helpful)
- Can add extra characters to alphabet without any extra learning



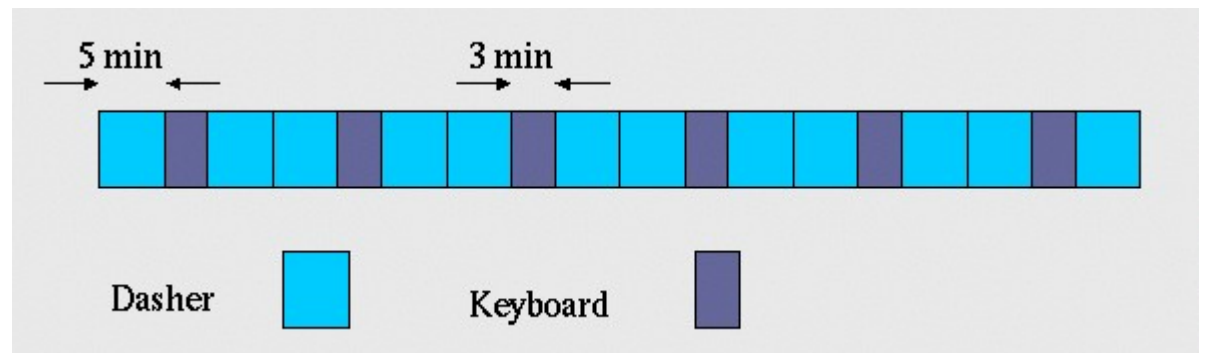
The Language Model

- “Prediction by partial match”: uses last 5 characters
- Compresses most English to about 2 bits per character
- Works with any language
- Fast
- Adaptive



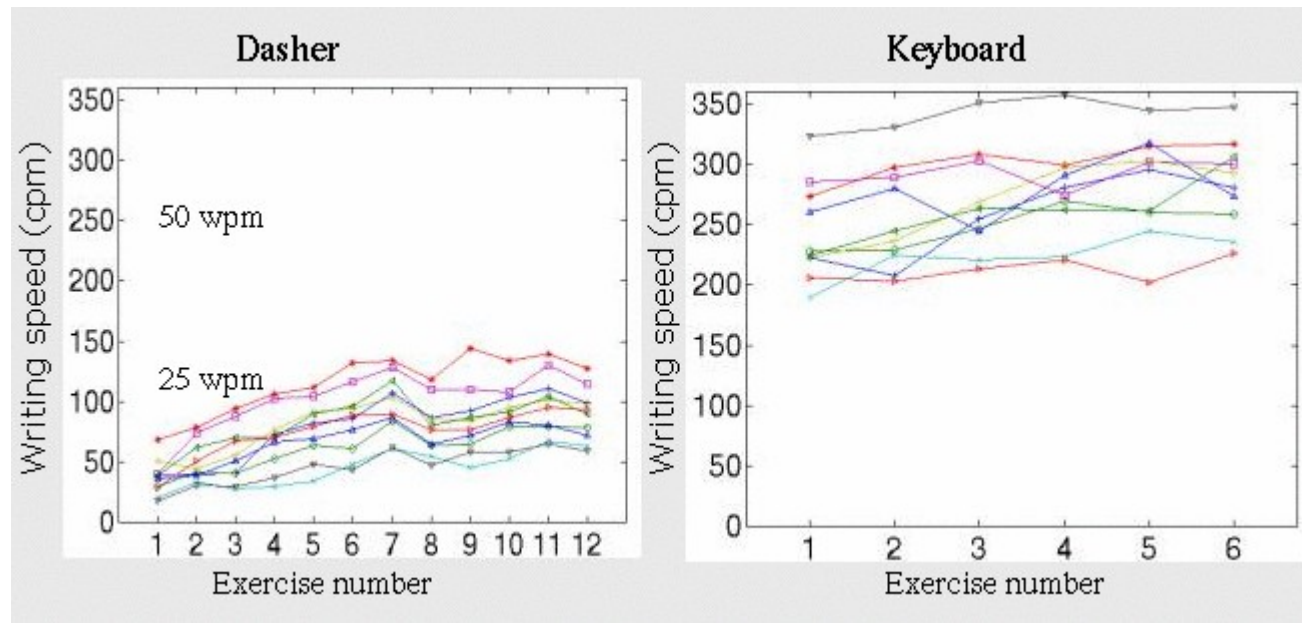
Evaluation

- 10 volunteers
- Dictation (“Emma” by Jane Austen)
- 12 Dasher exercises, each 5 minutes long
- Keyboard exercises between Dasher sessions
- Measured:
writing speed,
word error rate



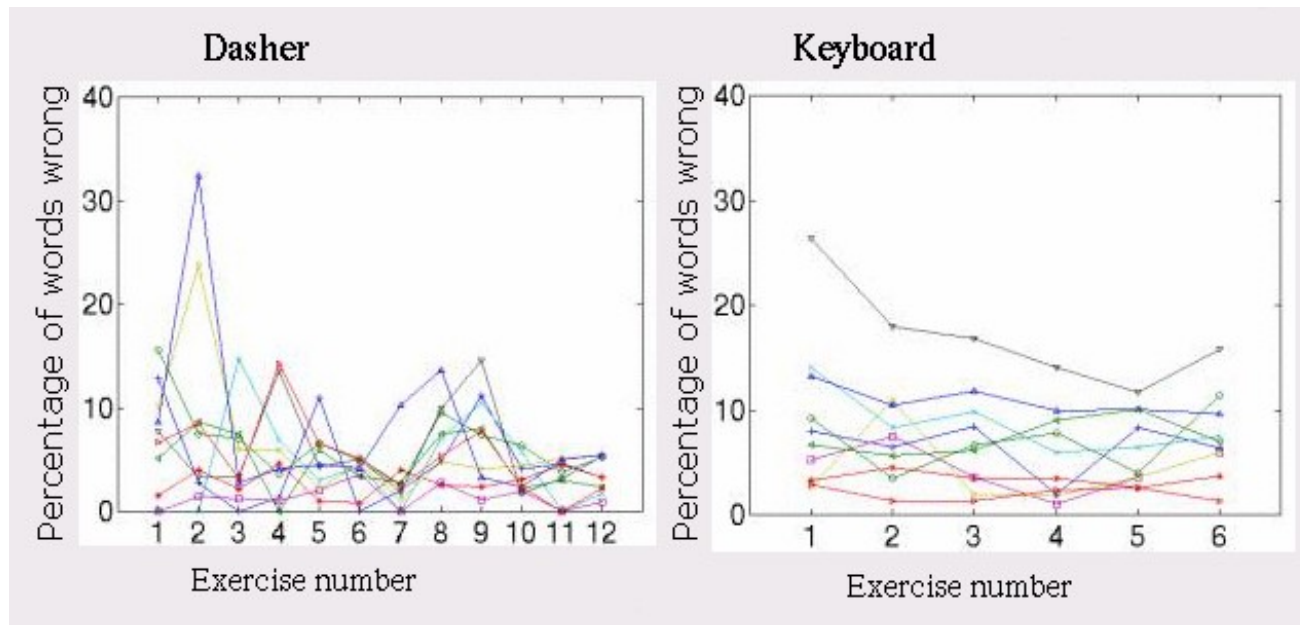
Results

Writing speeds (characters per minute):



Results

Errors (percentage of words wrong):



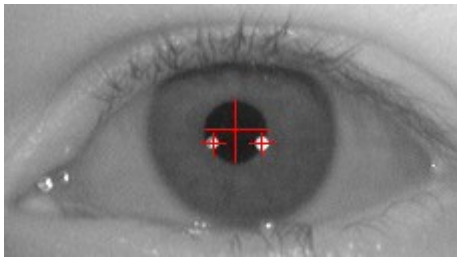
The Main Defect

Dasher demands visual attention,
like any predictive system.

But...

Hands-Free Writing

... we can use this to our advantage:

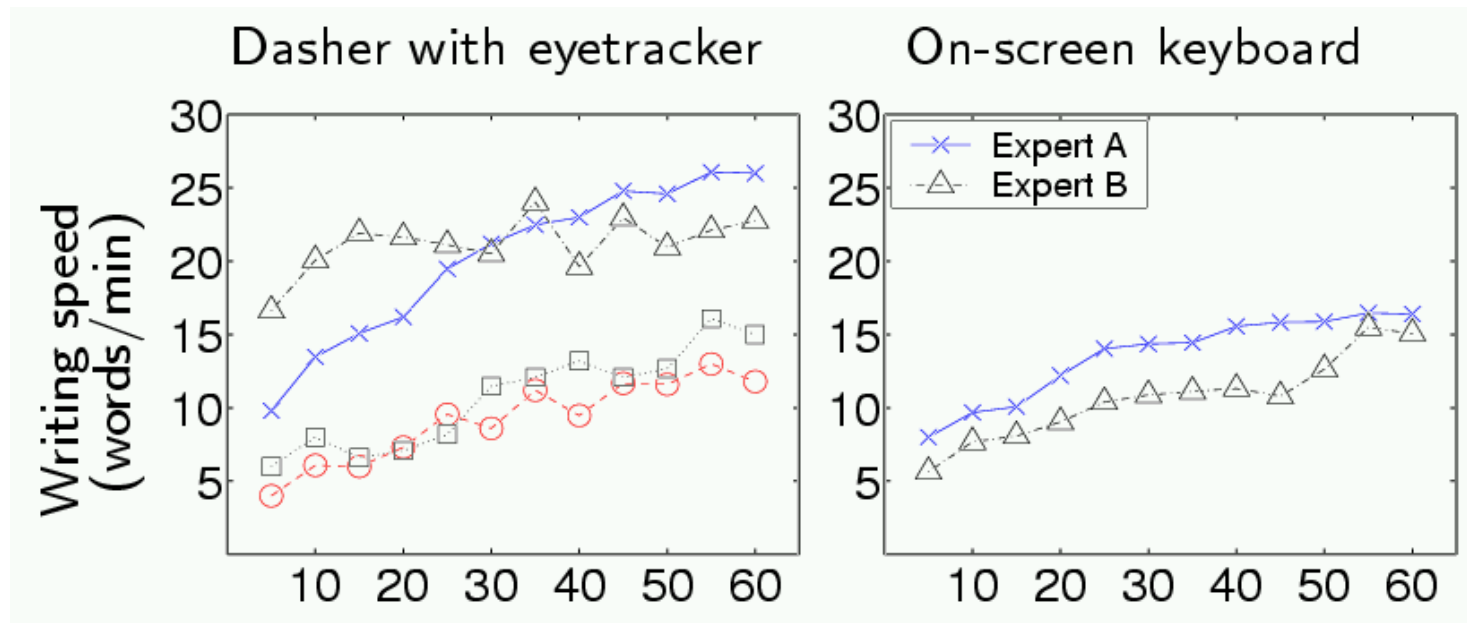


Works with many
eyetrackers



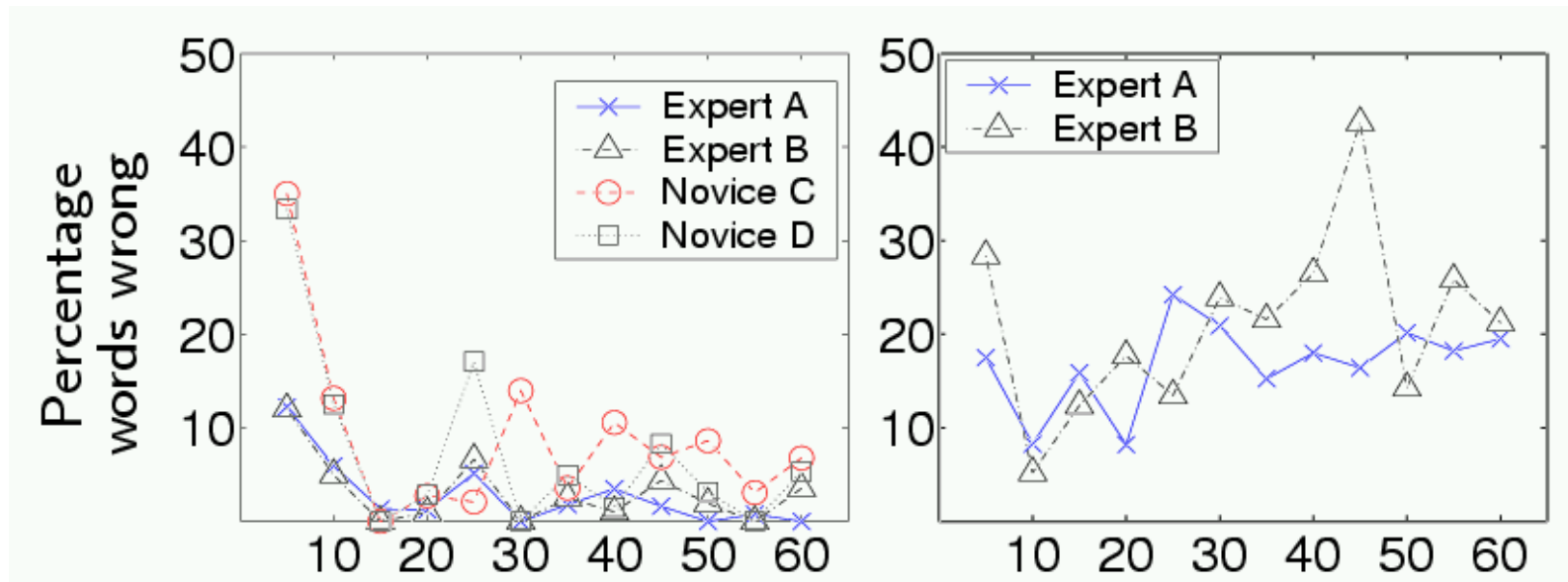
Eyetracking Results

Writing speeds (characters per minute):



Eyetracking Results

Errors (percentage of words wrong):



More Hands-Free Writing

- Head-mouse
- Also works as a foot-mouse
- High precision is not required with Dasher



Case Study (By Mick Donegan, ACE Centre)

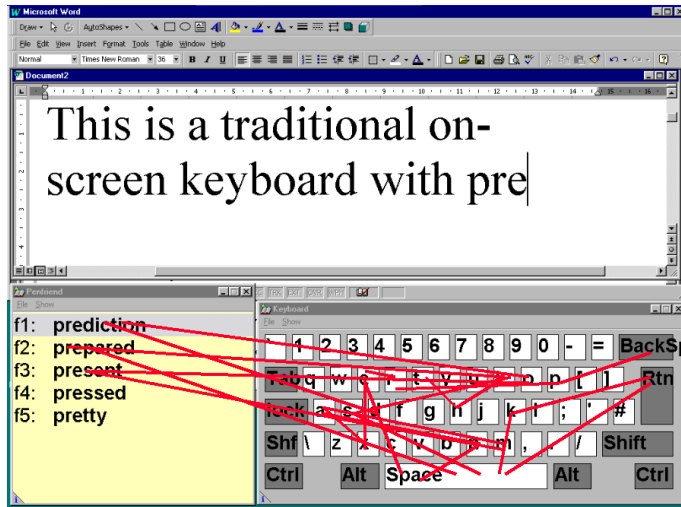


Paul:

- Cerebral palsy, aged 23
- On-screen keyboard
- Headmouse

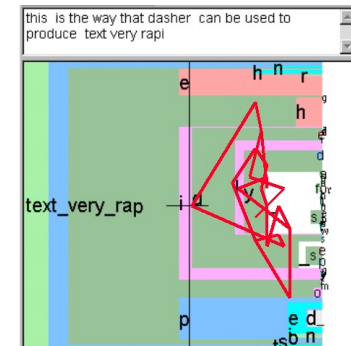


What Paul Thinks



On-screen keyboard:

- Requires tiring head movement

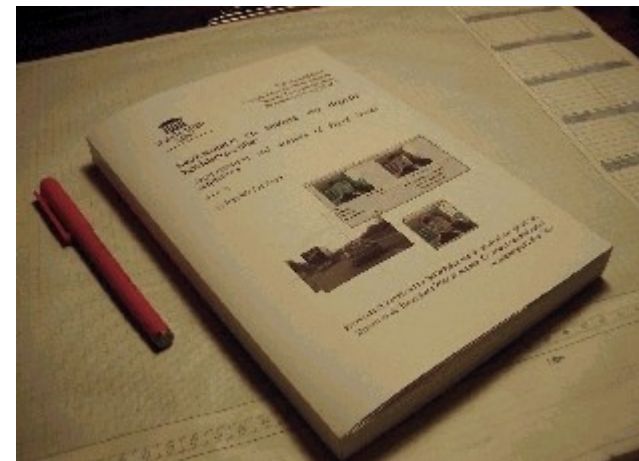


Dasher:

- Less head movement
- No need to click or dwell
- About 4 times faster
- Fewer spelling mistakes

Paul Now Uses Dasher

- Final thesis written with Dasher
- Bachelor of Science in Business Studies and IT, 2004



Mobile Text Entry

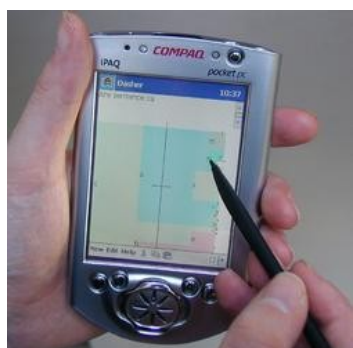
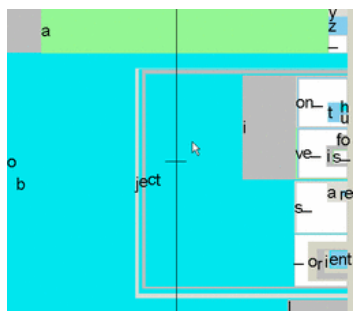
Touch screen:



No keyboard, but no unreliability!

Write With Any Muscle!

Just point where you want to go:



Questions?

<http://www.dasher.org.uk/>