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:

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

Diagram:

```
| Text | → | Bit string (preferably short) |
```
Writing and Text Compression

- Optimal text compression

![Diagram](Text → Bit string (preferably short) via probabilistic model)
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

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

• Can be used with any alphabet

• 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):

![Graphs showing writing speeds for Dasher and Keyboard.](image)
Results

Errors (percentage of words wrong):

![Graph showing errors in Dasher and Keyboard text entry]

Exercise number

Percentage of words wrong

Dasher

Keyboard
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):

![Graph showing writing speeds for Dasher with eyetracker and on-screen keyboard.](image)
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 Center)

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/