Dasher – an efficient keyboard alternative

Dasher is a text-entry interface driven by continuous two-dimensional gestures, delivered, for example, via a mouse, touch screen, or eyetracker; the user writes by steering through a continuously expanding two-dimensional world containing alternative continuations of the text, arranged alphabetically. Dasher uses a language model to predict which letters might come next and makes those letters easier to write. The language model can be trained on example documents in almost any language, and adapts to the user's language as she writes. Dasher is free software.
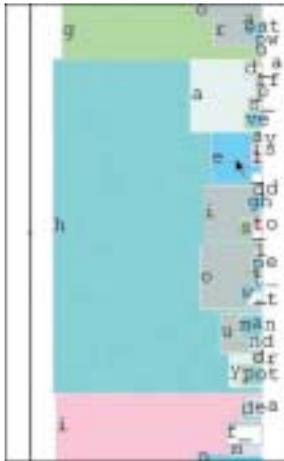

Figure 1. A screenshot of Dasher when the user starts writing hello. The shelf of the alphabetical `library' is displayed vertically. The space character, '_', is included in the alphabet after z. Here, the user has zoomed in on the portion of the shelf containing messages beginning with g, h, and i. Following the letter h, the language model makes the letters a, e, i, o, u, and y easier to write by giving them more space. Common words such as had and have are visible. The pointer's vertical co-ordinate controls the point that is zoomed in on, and its horizontal coordinate controls the rate of zooming; pointing to the left makes the view zoom out, allowing the correction of recent errors.

How Dasher works

Imagine writing a piece of text by going into the library that contains all possible books, and finding the book that contains exactly that text. In this way, writing can be turned into a navigational task. What is written is determined by where the user goes. In Dasher's idealised library, the 'books' are arranged alphabetically on one enormous shelf. When the user points at a part of the shelf, the view zooms in continuously on that part of the shelf. To write a message that begins 'hello', one first steers towards the section of the shelf marked h, where all the books beginning with h are found. Within this section are sections for books beginning ha, hb, hc, etc.; one enters the he section, then the hel section within it, and so forth.

To make the writing process efficient we use a language model, which predicts the probability of each letter's occurring in a given context, to allocate the shelf-space for each letter of the alphabet, as illustrated in figure 1. When the language model's predictions are accurate, many successive characters can be selected by a single gesture. With Dasher, it is easy to spell correctly and hard to make spelling mistakes.

Potential of Dasher for rehabilitation

The user steers using any convenient pointing system. The simplest is an ordinary mouse attached to an ordinary PC. Using a mouse, typical novice users reach a writing speed of 25 words per minute after 60 minutes of practice, and expert users can write at 35 words per minute. Some disabled users prefer using a roller-ball or trackpad to control the mouse. Dasher can also be driven more directly using a computer with a touch-screen; an elegant and cheap communication solution for rehabilitating patients who cannot speak might be to use Dasher on a Pocket PC (videos are on the Dasher website, www.inference.phy.cam.ac.uk/dasher/). Dasher does not need great pointing precision.

For users who cannot point using a conventional mouse or touchscreen there are two ways in which Dasher can be used hands-free with a PC. The cheapest solution (about £150) is a head mouse: a reflective dot is attached to the user's head (or whatever piece of anatomy they wish to move) and a small camera tracks the dot to control the mouse. For severely paralysed people, the direction of gaze can be tracked using an eyetracker (£2000 upwards). After 60 minutes' practice, novice users can drive Dasher using an eyetracker at a speed of about 15 words per minute; expert users can write at 25 words per minute. Not only is this speed much faster than alternative hands-free systems such as on-screen keyboards; Dasher users make far fewer spelling mistakes. Furthermore, whereas staring at on-screen buttons is exhausting, navigating through the Dasher landscape is a natural activity for the eyes, comparable to driving a car.

The future of the Dasher project

Dasher was created by David MacKay and David Ward in the Physics department of the University of Cambridge. The project is supported by the Gatsby charitable foundation. Dasher currently works on PCs running Windows or GNU/Linux and on Pocket PCs; other computer platforms should be supported soon. Over the next year we aim to enhance Dasher for disabled users. Version 3.2 will feature a steering method for users who have only one dimension of motor control rather than two.

Most users find Dasher is quick to learn, just like a video game - 'attack of the killer alphabets', it's been called. We encourage you to try it out (it's free!) and send us your feedback.

www.inference.phy.cam.ac.uk/dasher/
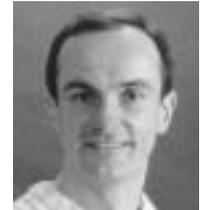
David MacKay is a Reader in the Department of Physics at Cambridge University. He obtained his PhD in Computation and Neural Systems at the California Institute of Technology. His interests include machine learning, reliable computation with unreliable hardware, the design and decoding of error correcting codes, and the creation of information-efficient human-computer interfaces.

Figure 2. Dasher can be driven by eyetracker or by pointing on a touchscreen, as well as with a regular mouse.

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