Piranhas with a single switch

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Figure 1 is taken from http://www.youtube.com/watch?v=O1tNXWpmA5I. Two phrases were copied with an infrared camera called TrackerPro from Ablenet that looks at the stick in the subject's mouth. This stick was combined with a sip and puff switch. The performer, a speaking individual paralyzed from his shoulders downwards, entered in the Guinness Book of Records.

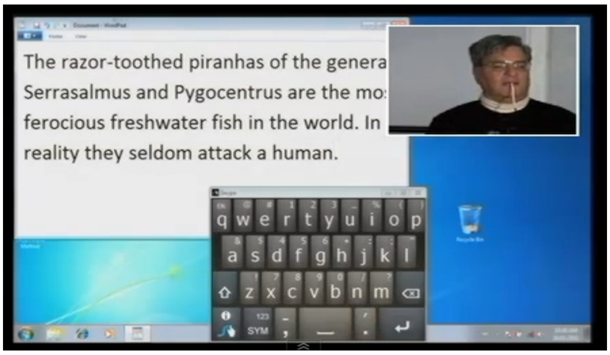

Figure 1. Screen image. This text was selected in 83.09 seconds by a speaking test subject on January 28, 2011, and on his third try.

Word prediction was used a few times but selected only a few words of the 160 characters that constitute the text. No abbreviations were used and we may compute 60 * 160/83.09 = 115.7 characters per minute. This is faster than writing but is slower than professional telegraphers of the past who achieved about forty words per minute for short stretches of time (King, 1998).

Comparison

Curious how fast switch access would be with this same copy task, I entered the same phrase repeatedly with Figure 2 and a single switch.

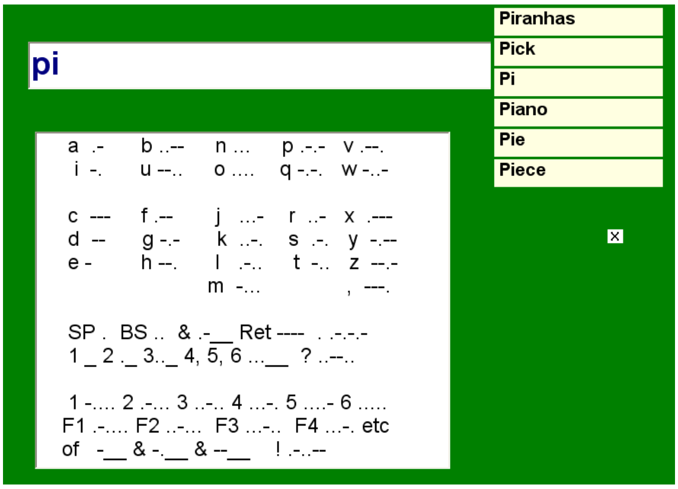

Figure 2. Alternative Code with word prediction after ‘pi’. A sustained dash or _ will now select ‘piranhas ’, either ..._ or _... or ____ will select ‘piano ’.

Because the word predictor puts recently used words on top, in Figure 2 ‘pick ’, ‘pi ’, ‘piano ’ and ‘pie ’ were used more recently than was ‘piece ’. In a *repeated* copy task ‘piranhas’ will be suggested after entering ‘pi’, as is shown, and can be selected by '_'. Therefore *repeated* copy tasks might be faster due to higher efficiency of the word predictor.

Test

Errors had to be corrected, but small ones such as an extra space before the period or repeating a word were accepted. Figure 3 displays results with a single switch and pause time of 180 milliseconds, as does Table 1. The t-test if the mean value of [1st] = mean value of [2nd followed by 3rd][1] has result $p < \cdot 01$ and therefore is significant, as can be expected on inspection.

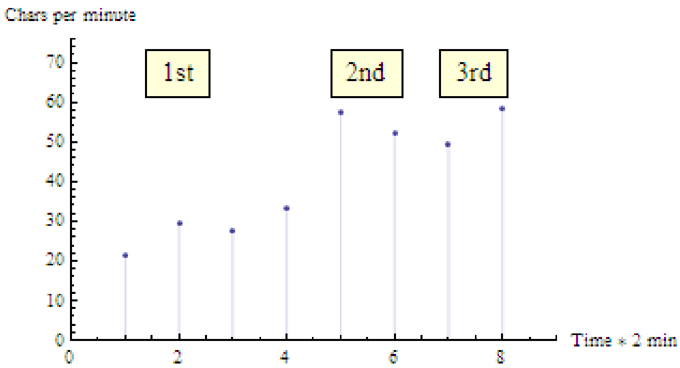

Figure 3. Input rate against time with a single switch and Alternative Code. Duration of the last datapoints of every session were shorter than 2 minutes.

Test	Average rate in cpm	BackSpaces given	Total time
1st	27,1	34	437 seconds
2nd	54,8	10	204 seconds
3rd	53,8	12	189 seconds

Table 1. Average input rates in characters per minute of different sessions, each one consisting of copying the text in Figure 1. In the second test some long words were entered twice.

Interpretation

With switches a lower input rate should be expected than with eye-tracking or pointing, and Table 1 agrees with that. Table 1 and Figure 3 also illustrate a clear effect of recency first word prediction when the same text is entered repeatedly. As to repeat oneself is not infrequent during normal conversations and supposedly is not infrequent during assisted conversations either, word prediction for use during conversations might well be more useful than has previously been thought (see Koester and Levine, 1996, 1997).

Criticism

The author, who practiced a lot, does not represent the average handicapped switch-user, if an average handicapped switch-user exists at all. His results have not been reproduced by able-bodied test subjects, he did not use a condition *without* word prediction and one may wonder if learning Figure 2 will ever end. Therefore, several methodological problems are present and results are *not* convincing as to the value of word prediction in assisted conversations. Repeating with, say, n=6, might change that, but is costly if much training is to be paid for and is not necessarily representative either because one would like to know what happens after *long* training and in assisted conversations. This raises several other methodological questions.

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[1] The command is TTest [{ {21.63, 29.25, 27.50, 33.24}, {57.50, 52.14, 49.50, 58.26} }] in Mathematica with the datapoints of Figure 3. This is an unusual application of the t-test.

Clinical Relevance

Interesting switch based input techniques are classical Morse Code, ordinary Row-Column Scanning, Minspeak (see www.prc.com), Nomon (Broderick and MacKay, 2009), Single Key Disambiguation (MacKenzie, 2009), Dasher (MacKay, 2004), Two-bit Quartering (Verrips, 2003) and Oriented Scanning (Verrips, 2012). One would like to also document input rates with the same text and eye-gaze (see Majaranta, 2009) or stylus. Word prediction can be varied in many ways and is routinely combined with abbreviation expansion. There is a sizable amount of literature on word prediction, but almost *nothing* on assisted conversations. Therefore, several years might be spent on research along these lines and more years to study clinical relevance of switch based input techniques. An old saying comes to mind. "If you think that research is costly, try disease".

References

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The software of Figure 2 is called WriteEasy, see www.depratendecomputer.nl.

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