Testing the temporal accuracy of keystroke logging using the sound card

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Testing the temporal accuracy of keystroke logging using the sound card

**BACKGROUND**

• Writing research has seen an increased use of keystroke logging
• Keystroke logging programs log the writing process in a continuous and non-obtrusive way
• They enable researchers to collect fine-grained data because they log every keystroke in relation to a timestamp (in milliseconds), which indicates the time that a specific key was used.
• For the researcher interested in for example word-internal processing it’s important to know the degree of precision and accuracy that can be achieved by the program.

**METHOD**

• We propose a method of measuring the accuracy of keystroke timestamps using a recording of the sounds made by key presses.
• Sound cards fit the purpose well since they typically have much better temporal resolution than computer keyboards and they are readily available in most computers.
• Key presses produce noise patterns that are easily temporally located in an acoustic waveform.
• The timestamps of the noise patterns can then be compared with the corresponding timestamps reported by the keystroke logging program.
• Specifically, the differences between the two timestamps of each keystroke, provides an estimate of the accuracy of the program.

**RESULTS**

<table>
<thead>
<tr>
<th></th>
<th>point-by-point$^3$</th>
<th>interval$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>s$^2$</td>
<td>range$^1$</td>
</tr>
<tr>
<td>ScriptLog</td>
<td>0.005</td>
<td>0.023</td>
</tr>
<tr>
<td>JavaScript prototype (Firefox)</td>
<td>0.003</td>
<td>0.012</td>
</tr>
<tr>
<td>Java prototype</td>
<td>0.003</td>
<td>0.012</td>
</tr>
<tr>
<td>C++ prototype</td>
<td>0.003</td>
<td>0.010</td>
</tr>
<tr>
<td>SoundCard$^4$</td>
<td>0.19E-05</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

$^1$point-by-point compares the individual timestamps of one keystroke.
$^2$interval compares the length of the interval between two consecutive keystrokes.
$^3$s$^2$ is the standard deviation of the distribution of all differences between a program measured and sound measured timestamp. range and maxdiff are other properties of this distribution.
$^4$This tests the accuracy of the soundcard with a sine wave at 377 Hz ± some noise.

• We find significant differences between the variances of the prototypes and ScriptLog (example: for Java: F=0.287, p<0.001)
• This implies that a reimplemented version will provide improved timing accuracy
• This method can be implemented as part of any keystroke logging program in order for the user to test the accuracy in his/her own computer environment.

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