

WebTEM

WebTEM is a Web application to record text entry metrics. It is developed with common Web technologies, such as HTML5, CSS3, JavaScript, and PHP, thus works on any device with a modern Web browser, and with any keyboard.

It processes all user interactions on the client side, but periodically pushes all data to the server using PHP for faster performance and to reduce data loss. Upon completion of a study, it automatically **emails** all logs to the researcher, and then **deletes** all data from the server

Performance Metrics

WebTEM can record all commonly used metrics, including

- Words per Minute (WPM)
 - Characters per Second (CPS)
 - Error Rate (ER)
 - Minimum String Distance Error Rate (MSD ER)
 - Keystrokes per Character (KSPC)
 - Corrected Error Rate (CER)
 - Total Error Rate (TER)
- } Speed
- } Accuracy

It can also record the following performance metrics:

- Visual Scan Time (VST) is the time to visually scan a completed phrase
- Cursor Control Count (CCC) is the total # of cursor repositioning via keyboard, mouse, touch
- Backspace Count (BC) is the total # of backspaces
- Prediction Rate (PR) is the % of chars entered by the predictive system

In the future, it will provide support for novel performance metrics

Phrase Sets

WebTEM includes the three most popular phrase sets, two for adults:

- MacKenzie & Soukoreff's (2003) 500 Short English Phrases
- Vertanen & Kristensson's (2011) 200 Memorable English Phrases

and one for children:

- Kano et al.'s (2006) 500 Children's English Phrases

It also includes the "the quick brown fox jumps over the lazy dog" pangram, which is frequently used in quick evaluations, since it contains all letters of the English alphabet

In the future, it will include corpora for smartwatches and non-Latin text entry

Study Options

WebTEM also allows researchers to customize a study condition by selecting from the following options:

- Disable predictive features
- Present all phrases in lowercase
- Ignore letter case and extra spaces in metrics calculation
- Present all phrases without special characters
- Display the number of phrases entered
- Display performance summary
- Hide presented text when users start typing
- Force error-free submissions (included auditory feedback)

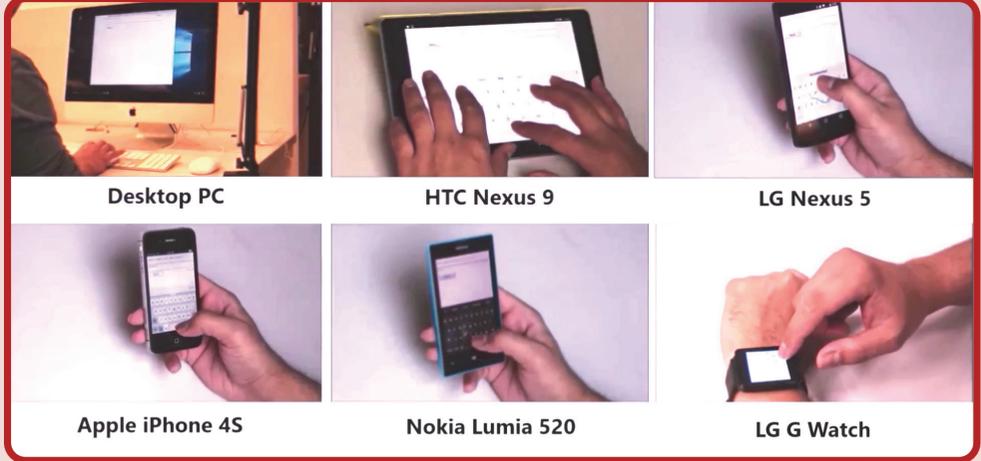
In the future, it will include additional settings and evaluation approaches

Log Files

WebTEM generates an information (.INFO) and two tab-delimited files (.TSV) to record all settings, timestamped events, and metrics, respectively. Each row of the metrics log represents a phrase and each column a metric. The last row holds average values. Events are recorded as:

[time,text,event,duration,insertion,deletion], where

- *time* is the number of milliseconds since Jan 1, 1970
- *text* is the current state of the transcribed text
- *event* is a user or a system action, such as a tap, an autocorrection
- *duration* is the time for the action in milliseconds
- *insertion* and *deletion* are character/s entered and deleted by the action, respectively

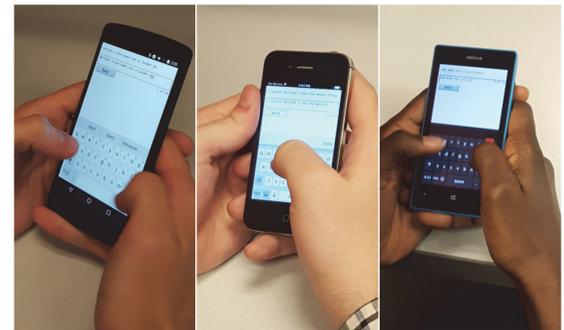


User Study

We tested WebTEM's effectiveness in a user study that compared the default Apple iOS, Google Android, and Microsoft Windows Phone keyboards.

The design was:

- 12 participants (average age 24.6, 8/4 male/female, all right-handed) ×
- 3 conditions (the three keyboards) ×
- 10 phrases (MacKenzie & Soukoreff, 2003) = 360 phrases in total



Results

There was a significant effect of keyboard on WPM, ER, TER, and PR. Android was significantly **faster**, while Apple was significantly **more accurate**. PR was significantly **lower** for Apple, most likely because users did not realize that it too augments predictive features (due to the absence of a prediction bar) thus were more careful

84%, 17%, and 8% selected Android, Apple, and Windows as one of their most preferred keyboards, respectively. Many preferred Android due to familiarity (84% were Android users) and its predictive system (60%). 25% picked an unfamiliar keyboard as one of their most preferred, primarily for its superior **predictive system** (67%), secondarily for its **design** (33%)

Performance Metrics	Android	Apple	Windows
Words per Minute (WPM)*	30.31*	29.87	24.98
	$\sigma = 10.9$	$\sigma = 11.7$	$\sigma = 8.8$
Error Rate (ER)*	6.8	1.86*	4.75
	$\sigma = 13.9$	$\sigma = 4.6$	$\sigma = 2.9$
Total Error Rate (TER)*	10.29	9.72*	13.9
	$\sigma = 9.5$	$\sigma = 11.5$	$\sigma = 9.9$
Prediction Rate (PR)*	37.98*	6.62	29.32*
	$\sigma = 30.2$	$\sigma = 8.6$	$\sigma = 37.1$

" σ " signifies standard deviation, while "" marks statistically significance*

Results of the study validated WebTEM's effectiveness and highlighted mobile users' increased dependency on predictive features, particularly autocorrection

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