

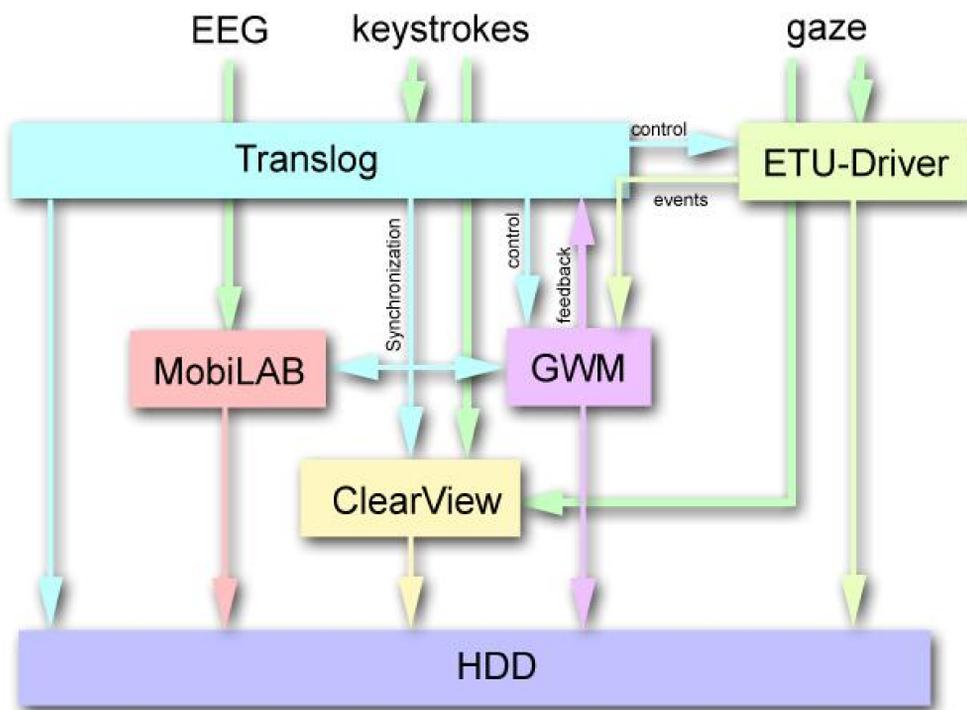
# Combining eye tracking, key logging, and electroencephalographic data: towards an integrated tool for translators

## Introduction

The process of translating from a source language into a target language is a highly demanding cognitive task involving a number of processes such as sensory processing, memory access, decision making, and motor output. The retrieval from semantic long-term memory and the mapping of words (or concepts) between the languages plays an important part in that context. Comprehensive studies of such complex processes including the reading of words or sentences and the typing of the translation require a number of signals to be recorded, namely the electroencephalogram (EEG), the electrooculogram (EOG), the electrocardiogram (ECG), the tracking of the eye gaze direction, and the logging of keystrokes. Therefore, an integrated monitoring system for studying language translation is introduced, comprising the simultaneous recording of EEG, EOG, ECG, eye gaze, and keystrokes.

## Data recording

Different data streams are recorded with three independent systems: 1) **Translog 2006** with integrated **GWM** (Gaze-to-Word Mapping) and **ETU-Driver** (Eye Tracking Universal Driver) modules, 2) **Matlab** and C++/Qt-based recording software, and 3) **ClearView** by Tobii Technologies.



### Translog

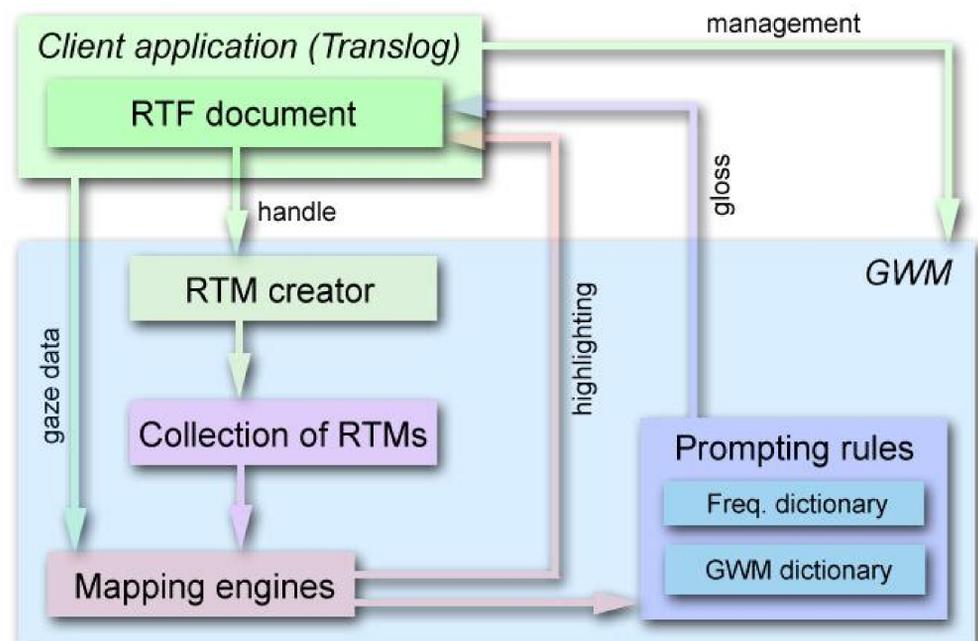
- central unit that synchronizes other units (sends out every 10 seconds time stamps over the network using either UDP or TCP/IP)
- shows stimuli (source text) and receives keystrokes (target text), transmitted every ten seconds.

### ETU-Driver

- provides the access to the data from various eye-tracking devices and logs it in raw (samples) and filtered (fixations) formats.

### GWM

- creates rectangular text mask (RTM) from variety of text containers (RTF, HTTP in IE, PDF in Adobe Reader, etc)
- maps gaze fixations (transmitted from ETU-Driver) onto words (visible in Translog) both from source and target texts using advanced mapping algorithms resistant to the inaccuracies in gaze data
- prompts translations when reading difficulties are detected (uses reading behaviour analyzer based on observed gaze-path)
- generates file with many reading statistical variables



### MobiLAB

- captures data from either a multichannel or portable EEG amplifier.

### ClearView

- logs raw eye tracking data (like ETU-Driver).

## Visualization

### Translog

- shows progress of text typing in details.

### ClearView

- replays the gaze data over video captured from the screen
- produces heat map visualizations

### KiEV

- visualizes the data recorded by Translog, GWM, ETU-Driver, and the EEG tools
- has five horizontal panels on the same timeline: word focuses (in source and target texts), the target text production, pupil size dilations and EEG data.
- high customization of graphical objects
- highlighting of data that requires attention

