UltraTrace: A free/open-source cross-platform tool for manual annotation of ultrasound tongue imaging data

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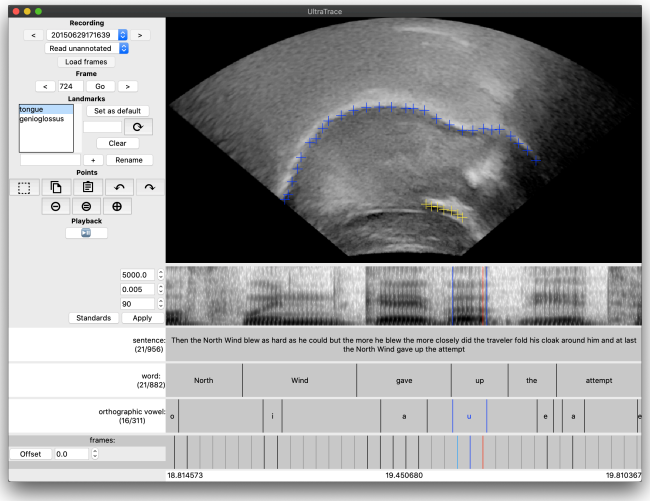
Introduction: UltraTrace is a new free/open-source tool for manual tracing of ultrasound (US) tongue imaging data that runs on multiple platforms. Its main features include an interface for manually tracing and aligning US images with audio and text annotations, support for a variety of file formats and directory structures, and a modular coding design. It is released as free/open-source software, which makes it more accessible and more easily maintainable than comparable software (Streiter et al. 2006). UltraTrace—including source code, documentation, and complete commit history—is publicly available at https://github.com/SwatPhonLab/UltraTrace/.

Features: UltraTrace, written in Python, runs on recent GNU/Linux, macOS, and Windows releases. Tracing functionality allows different named sets of traces across a project (e.g., "tongue", "palate"). US and audio data may be aligned, and alignments adjusted. Alignment of audio and annotations with US data is stored in Praat TextGrids. Corresponding audio, US, and TextGrid files are matched automatically based on file (or link) name, providing for simple project management.
US images can currently be loaded from standard DICOM pixel data, "native" Philips DICOM data, or ULT files exported from Articulate Assistant Advanced (AAA). Images may be zoomed and panned arbitrarily for more precise tracing, touch screens are supported, and (groups of) trace points may be copy-pasted. Metadata and trace data are stored in project-level `json` files. Trace points are stored as percentages across images (to facilitate zooming functionality), and plotting software (such as that developed by Washington & Washington 2018) may easily be adapted to read the trace data. A recent screenshot is provided.

Contrast to other products: The included table highlights some of the advantages UltraTrace offers in comparison to its main alternatives: WASL (Lulich 2017a,b),[1] Palatoglossotron (Baker 2006), and Articulate Instruments' AAA (Wrench 2017).

Future work: In the future, we plan to add functionality for direct manipulation of interval annotations, and improve the UI. We also hope to integrate into UltraTrace automatic tracing software or algorithms, like AutoTrace (Hahn-Powell & Archangeli 2014), EdgeTrak (Li et al. 2005), more recent neural approaches (Zhu et al. 2018), or others discussed by Xu et al. (2016).



		UltraTrace	WASL	Palatoglossotron	AAA
freedoms	Freely available	✔	✔	✔	✘
	Source code available	✔	✔	✘	✘
	Free license	✔	✘	✘	✘
	Free dependencies	✔	✘	—	—
platforms	Windows	✔	✔	✔	✔
	macOS	✔	✔	✘	✘
	GNU/Linux	✔	✔	✘	✘
formats	DICOM images	✔	✔	✘	✘
	native Philips	✔	✔	✘	✘
	AAA-exported	✔	✘	✘	✔
features	Text annotations	✔	✘	✘	✔
	Adjust audio sync.	✔	✔	✘	✘
	Tracing completion status	✔	✘	✘	✘
	Aribtrary zoom and pan	✔	✘	✘	✘

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