



Visualizing articulatory data with *VisArtico*

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Abstract

During this *show & Tell* event, we present the latest version of our new software *VisArtico*. The software allows visualizing electromagnetic articulography (EMA) data. It is intended for researchers that need to visualize the data acquired from an articulograph with no excessive processing. This software is very useful for the speech science community, makes the use of articulatory data more accessible and improves the understanding of speech production.

Index Terms: articulography, visualization, speech production

1. Introduction

A small collection of programs are already available to inspect and visualize EMA data, including EMATOOLS [1], MVIEW [2], Carstens *JustView* [3], and a few others. Unfortunately, some of the existing software tools are no longer maintained or even available for download. Others can be used only on computers running certain versions of Windows, or require a (fairly expensive) license of the commercial MATLAB computing and simulation platform. The latter prerequisite involves significant initial effort with a steep learning curve, and can intimidate or frustrate the non-technically minded user who is interested only in analyzing articulatory speech data.

For these reasons, we have developed *VisArtico*, a lightweight, easy-to-use software tool which allows visualizing EMA data, and which can be run on any computer that supports Java. The software has been designed so that it can directly use the data provided by the articulograph [4] to display the articulatory coil trajectories, synchronized with the corresponding acoustic recordings. Moreover, *VisArtico* not only allows viewing the coils but also enriches the visual information by indicating clearly and graphically the data for the tongue, lips and jaw, and offers some advanced functionality. In the following sections, we describe the software and its main features.

2. Presentation

VisArtico is a user-friendly software which allows visualizing EMA data. We recall that EMA acquisition technique using an articulograph tracks the positions of small electromagnetic coils attached to the speech articulators. The positions and orientations of these coils are calculated by measuring the electrical currents produced within multiple low-intensity electromagnetic fields. This technique is known to present no risk to the health of the speaker.

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The first announcement of the software was at Interspeech 2012 [5] during the session "Speech Tools". We presented a first version that supports only Carstens AG500 articulograph. Participants showed interest in *VisArtico* and asked for additional features. For this reason, we improved the software in addition to the support of the NDI Wave articulograph. During Interspeech 2013, we are presenting the latest improvements of *VisArtico* and taking this opportunity to exchange with attendees and getting their feedback about the software. A perfect presentation of the software will be a live demo on a machine next to a poster presenting the goal and the main features.

3. *VisArtico* main features

The current version presents several new features and improvements. The main features of *VisArtico*, which are presented in figure 1., are the following:

- Supporting Carstens and NDI articulographs (AG500, AG501 and NDI Wave). These are currently the two existing family of articulographs widely used.
- Displaying the raw data (as provided by the articulograph). The basic feature of *VisArtico* is to display the data as provided by the articulograph, which is the Cartesian coordinates (x, y, z) and spherical coordinates (ϕ, θ) , as well as the reported RMSE for each EMA coil.
- Visualizing the tongue shape, the lips, the jaw and the palate. The tongue contour is shown as a spline interpolation through the coils on the tongue. a front view of the lips is also available to observe the degree of lip opening. The accuracy of the displayed shape of the lips depends on the number of corresponding coils (between two and four). The angular shape of the jaw is provided as an approximation. The palate contour can also be displayed if the palate trace data is available.
- Determining automatically the midsagittal plane of the speaker, allowing a better interpretation of the midsagittal view.
- Determining automatically the contour of the palate. When that information is not recorded, *VisArtico* can then calculate an approximation of the missing palate contour, using a simple but effective algorithm, which predicts the contour from the convex hull of the tongue coil positions.
- Providing several possible views: (1) temporal view, (2) 3D spatial view and (3) 2D midsagittal view

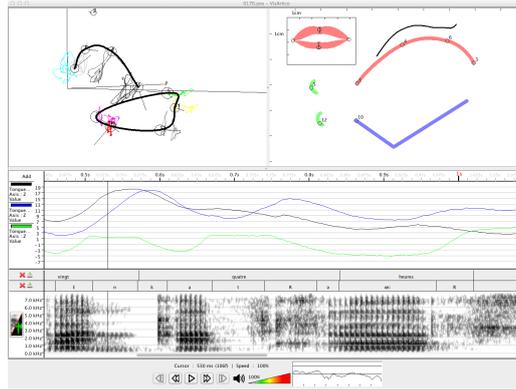


Figure 1: Main user interface of *VisArtico*. Three different views: (1) the 3D-view (top left panel), (2) the midsagittal view (top right panel) with the tongue contour (red), jaw (blue), and lips (green, and in the front-view insert, red), (3) the temporal view is shown in the lower half of the window, displaying several channel trajectories, a phonetic segmentation, and the acoustic spectrogram

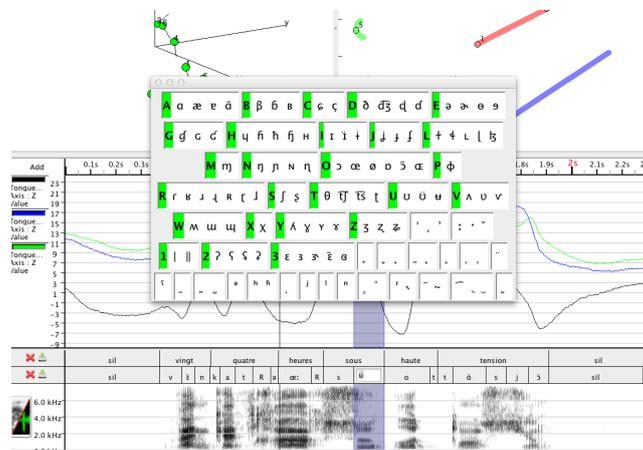


Figure 2: Visualizing and editing phonetic labels. It is possible to display, edit or create segmentation files.

- Animating and playing the three views synchronously with audio and in realtime.
- Displaying different articulatory trajectories in addition to the acoustic signal (spectrogram) and eventually phonetic labels.
- Providing coil velocity and acceleration (displaying first and second derivative of a giving trajectory).
- Providing meaningful articulatory information.
- Displaying segmentation information at several levels (see figure 2). It is possible to create, read and modify a segmentation file in *emphVisArtico*. It is possible to display several levels of labeling (for instance, one for phonemes, one for words, etc.). Currently, *VisArtico* can read the *ali* format (Winsnorri), *textGrid* format (Praat) and *lab* format (x-lab). An additional simple format has been added *seg* (each line has : *start_iimeend_iimelabel*).
- Improving the quality of the data by providing tools to filter out some outliers. It is possible to remove noise using low-pass FFT filter, or based on RMSE threshold.
- Using a playlist to make it easier to handle several files at the same time.
- Exporting graphic and text files of the data. The exported graphic is a vector-graphic file of the 2D view or the 3D view that can be customized. The text file is a selection of all or part of the data to export in readable format.

4. Conclusion

Until today, 48 researchers from 10 countries have downloaded *VisArtico*. This interest shows that the community was waiting for such application. In fact, *VisArtico* is very useful for the speech science community and makes the use of articulatory data more accessible. It will expand the user base for electromagnetic articulography to researchers who are not necessarily computer experts.

A dedicated website, <http://visartico.loria.fr/>, is online, where a presentation of *VisArtico* and detailed user guide are available. The software is written in java and, thus, is a cross-platform application (i.e., running under Windows, Linux and Mac OS). It is freely available to researchers and students.

5. References

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