ABSTRACT

This thesis presents a new software tool for the visualisation of EMA data, using 3D animation in a game engine. This tool displays the movement of articulators in real-time, extrapolating from point-tracking data to a basic representation of tongue and lip movement, as well as being able to induce a palate trace from streamed data, with plans to include more accurate tongue models in the future. The tool is written in Python and reads data into Blender, an animation and game engine, in real-time. In addition, Blender game-like resources have been developed, so that a face 'scene' is provided, of which the user can fully customise the appearance and behaviour to their own needs.

It is both compatible with displaying pre-recorded data from various data formats, which may be of use in demonstrating recorded data from different speakers, as well as streaming live data from an NDI WAVE machine, which could be adapted to provide online feedback for pronunciation training. In both modes, game controls allow the user to choose their preferred viewpoint and set game parameters, whilst the researcher can set other parameters before the streaming commences.

Furthermore, effort has been taken to incorporate several modalities: in static data mode, simultaneously recorded ultrasound videos can be overlaid on the image, and synchronised sound recording and playback is supported from live data.

The accuracy of this software's visualisation was tested in an online experiment that involved more than 110 participants: the subjects were challenged to 'speech read' three types of vocal tract visualisations to identify the prompt and whether they were displaying matched or unmatched stimuli. In this experiment a competing two-dimensional visualisation (VisArtico) was found more effective, though this 3D system performed comparably to a third system that showed the data as dots, and well as gathering valuable feedback about aspects of the software.

The open-source nature of both this package and Blender as well as the ease of scripting with Python mean that this software would be ideally adapted for experimenting with real-time feedback for pronunciation training or speech therapy, both by applying changes to its manipulation of the raw data and experimenting with visual adaptations and feedback in the Blender GUI.