A thermoplastic head-probe stabilization device

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When collecting ultrasound tongue images it is necessary to stabilize the ultrasound transducer along the midsagittal plane to avoid deviations in measurement data. Many methods exist for holding the probe in a stable relationship relative to the head. One of the most used technique has the transducer attached to a helmet that extends under the speaker`s chin, which is also the preferred solution for field work. Probably the most used head-probe stabilization headset is the one designed, manufactured and sold by Articulate Instruments [1, 2]. Over the years, the system has been refined and produced in different shapes and materials, including polycarbonate to allow co-registering ultrasound and electromagnetic articulometry data.
In this poster, we present the preliminary results of a research aimed at testing if the head-probe stabilization headset can still be improved. We consider the following areas of possible improvement:

Manufacturing: The production of metallic headsets made of rigid aluminum and of non-metallic headsets made of polycarbonate is cost and time consuming. Typically, head-probe stabilization helmets are made of more elements that need be cut, bent, milled, finished, glued and manually assembled. Here we propose a 3D printing procedure to make an easily assemblable three-dimensional object made of a limited number of thermoplastic components with no metallic inserts. The additive manufacturing methods we propose eases the production of curved elements. On the one side, this allows implementing a truss structure for the head-mount, thus characterized by both stiffness and lightness. On the other side, the 3D printing procedure permits molding shapes that are more anatomical. Both solutions guarantee more *comfort* to the speakers wearing the headset.

Usability: The headset set up can be lengthy and stressful for the informant as multiple adjustment are required to find the better tuning. In order to abbreviate and simplify the procedure, we propose to use buttons instead of lock screws. Buttons are installed on the probe-mount. The probe-rest is detached from the head-mount, but the two components can easily be connected to each other using linear guides. On the one side this design allows stiffening the headset. On the other side, it permits splitting the function of the two elements: only the inferior part of the headset has buttons to control the four degrees of freedom of probe adjustment. As the head-mount and the probe-rest are detached, it is possible to combine head-set that fit different head shapes with the same probe holder.

In our poster we will present advantages and disadvantages of the proposed solution, as well as its reliability for data collection, and contrast it with other solutions on the market.

Fig. 1: Sketch of the headrest

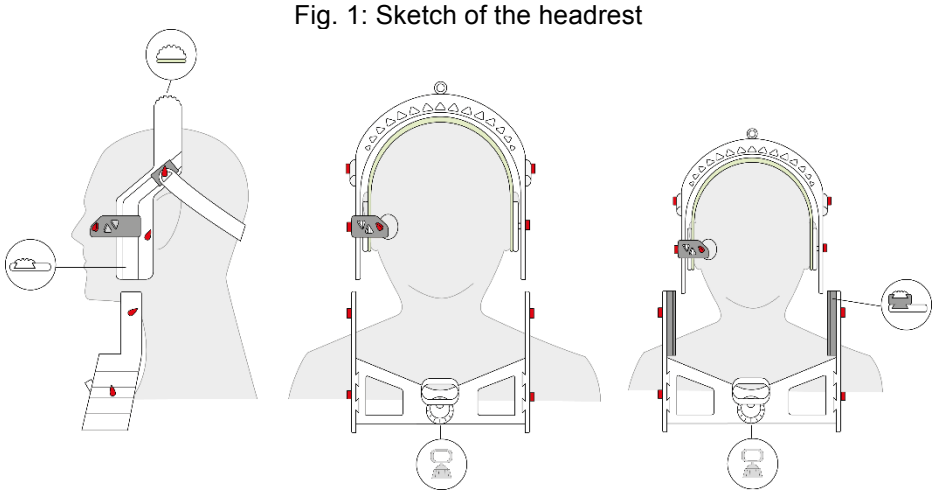
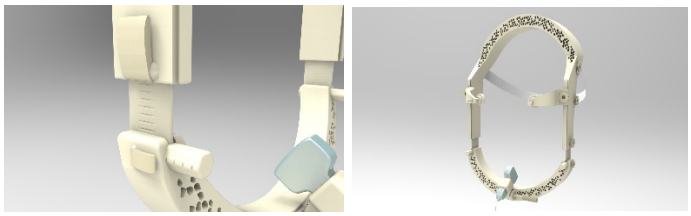


Fig. 2: Render of the headrest



[1] Scobbie, J.M., Wrench, A.A., and Linden, M. van der, (2008), *Head-Probe Stabilisation in Ultrasound Tongue Imaging Using a Headset to Permit Natural Head Movement*, Proceeding of 8th Internation Seminar on Speech Production, Strarbourg.
[2] Sigona, F., Stella, A., Gili Fivela, B., Montagna, F. Maffezzoli, A. Wrench, A, Grimaldi, M., (2013) A New Head - Probe Stabilization Device for synchronized Ultrasound and Electromagnetic Articulography recordings. Ultrafest VI, Edinburgh.