

**ACOUSTICS2008/964**  
**Construction of MRI-based three-dimensional atlas of the human  
tongue for tongue modeling**

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The main purpose of this study is to build a MRI-based 3D tongue atlas for research on tongue morphometrics and physiological modeling of normal and disordered speech production. In this study, MRI data of 8 subjects (4 males and 4 females) were chosen from an orally-based MRI database of 20 male and 20 female college students without speech disorders. Sixteen landmarks were defined and selected from the 3D reconstructed MRI tongue images based on the subjects. Thin-plate spline analysis (TPS) was used to build a 3D tongue atlas for male and female subjects, respectively. Sagittal sections of the original MRI data were used to evaluate the accuracy of image registration and reconstruction. The resulted 3D tongue atlas was used to study subject-to subject, subject-to-atlas, and male-to-female morphometric variation. Preliminary results show the major difference among female subjects before and after the TPS analysis is in the area of tongue dorsum that is close to the velum and epiglottis, respectively. However, the major difference among male subjects is in the areas of tongue tip and body regardless of TPS analysis. In summary, our preliminary results imply that the 3D tongue atlas of female subjects show less subject-to-subject difference.