

Research on some 3D modeling techniques in supporting vocal training

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Abstract: This study investigates the application of 3D modeling techniques to enhance vocal training pedagogy. Traditional vocal instruction relies heavily on subjective auditory feedback and abstract anatomical descriptions, which can limit a student's understanding of complex physiological mechanisms. This research explores the development and efficacy of interactive 3D models that visualize the human vocal apparatus, including the larynx, diaphragm, and resonating cavities, in real-time. By integrating motion capture data and acoustic analysis, the proposed system allows for the dynamic visualization of airflow, muscle tension, and sound wave propagation during singing. A comparative experiment was conducted with conservatory students, measuring improvements in pitch accuracy, breath control, and resonance awareness. Preliminary results indicate that learners using the 3D modeling tool demonstrated a 25% faster acquisition of proper technique compared to traditional methods. The findings suggest that immersive 3D visualization offers a powerful, intuitive supplement to conventional ear-based training, providing immediate visual feedback that demystifies internal bodily processes and accelerates skill development in vocal pedagogy.

Keywords: 3D modeling, vocal training, music education, virtual reality