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Introduction

Need for Intuitive Vocal Sound interfaces.

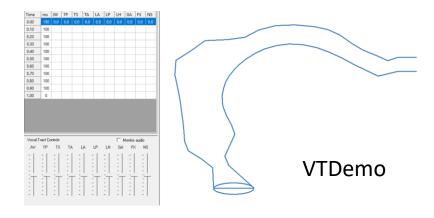
Due to complexity of Vocal tract articulators and Vocal fold.

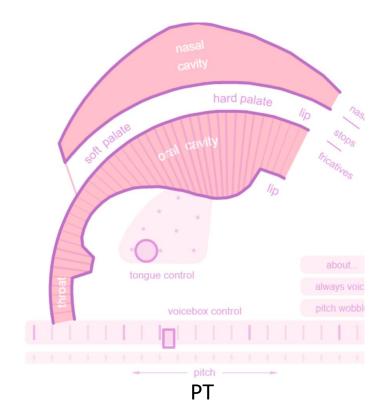
• Implement a 2D mechanically controlled tongue-like structure with a novel five DOF control scheme targeting vocal sound synthesis.

Related Works

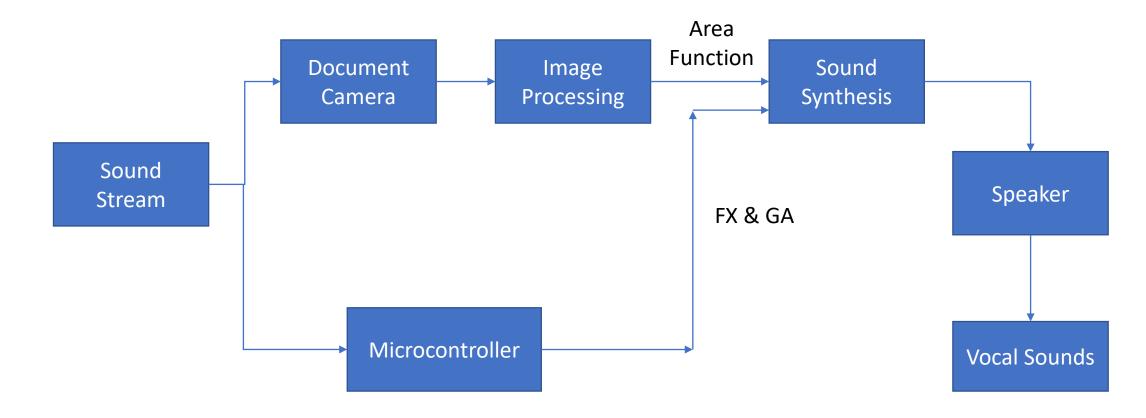
• Pink Trombone (PT)

Vocal Tract Acoustic Demonstrator (VTDemo)





System Design



Hypotheses & Research question

- Better physical interface through multiple degree-of-freedom control arrangement.
- 3 hypothesis to perform the quantitative analysis.
- **Hypothesis 1:** How many degrees of freedom could participants control simultaneously?
- Hypothesis 2: For ambidextrous control, Which interface participant will prefer to?
- Hypothesis 3: Could user make desired shape with the Sound stream interface?

Procedure & Tasks

- A training session for all the subjects prior to the task assignments.
- 6 set of tasks with different task complexity levels.
- **Task 1:** Controlling multiple degree of freedom simultaneously using all the three interfaces.
- Task 2: Creating a given shape using Pink Trombone, VTDemo and Sound Stream.
- Fill out an questionnaire form.
- Attend an interview session.

Results and Analysis

Hypothesis 1:

HO (Supported): There were not any significant difference in user preferences based on whether a user controls three DOF, five DOF or ambidextrous (AMB) control simultaneously using sound stream interface

F (F <i>crit = 3.40</i>)	p (α = 0.05)	
1.43	0.71	

Results and Analysis: Cont...

Hypothesis 2:

H1 (Supported): Users found significant differences in terms of complexity while controlling multiple parameters simultaneously across all the three interfaces (VT Demo, Sound Stream, Pink Trombone)

F (F <i>crit = 3.40)</i>	p (α = 0.05)	
10.16	0.0006	

Results and Analysis: Cont...

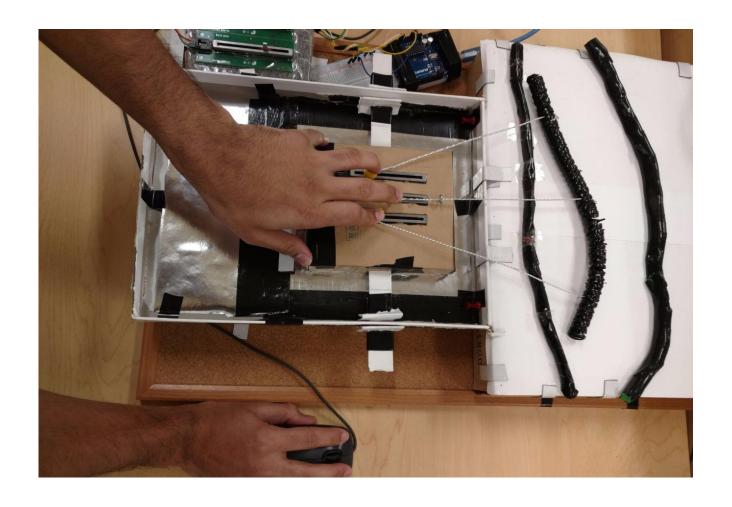
Hypothesis 3:

HO (Supported): There was not be any noticeable difference in the error ratios across all the three interfaces while creating a predefined tongue shape under a limited time

Task Complexity	η2	F	p (α = 0.05)
Simple	0.038	0.029	0.86
Medium	3.26	0.34	0.56
Complex	3.84	3.26	0.096

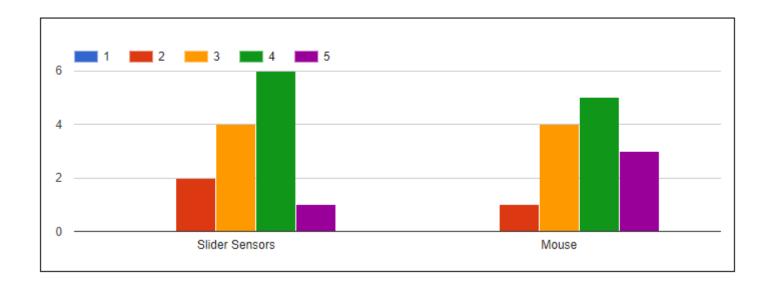
Novelty & Contribution

- Simultaneous, multiple DOF control
- Learnability
- Controllability
- Expressibility



Results and Analysis: Cont...

Participants preferred mouse control over slider sensors for glottal excitation



Limitations

• Friction while changing the tongue position.

• Eliminating sound as a measuring variable

System Latency

Conclusion

Effect of simultaneous multiple degree-of-freedom control of tongue-like structure in articulatory sound synthesis.

Based on, hypothesis proposed we assessed our interface with respect to Pink Trombone and VTDemo.

As per the user evaluation results, sound stream is better in terms of simultaneous control aspects.