Technology for clinical research in speech-language pathology

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IDEAS09


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Applying the study of language to language disorders

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- More than 3 million Americans stutter.
- Roughly 9% of preschool and school-aged children have a disorder of speech sound production.

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  - Autism Spectrum Disorder

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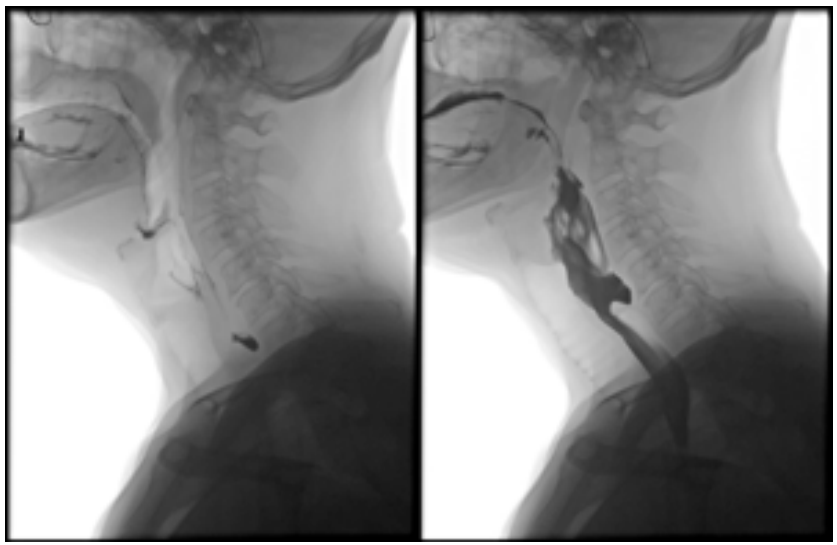
- In the hospital setting:
- Evaluation and treatment of language and cognitive impairment in individuals with aphasia or traumatic brain injury
- Evaluation and management of dysphagia (swallowing disorders)



What does a speech-language pathologist do?

- Accent modification

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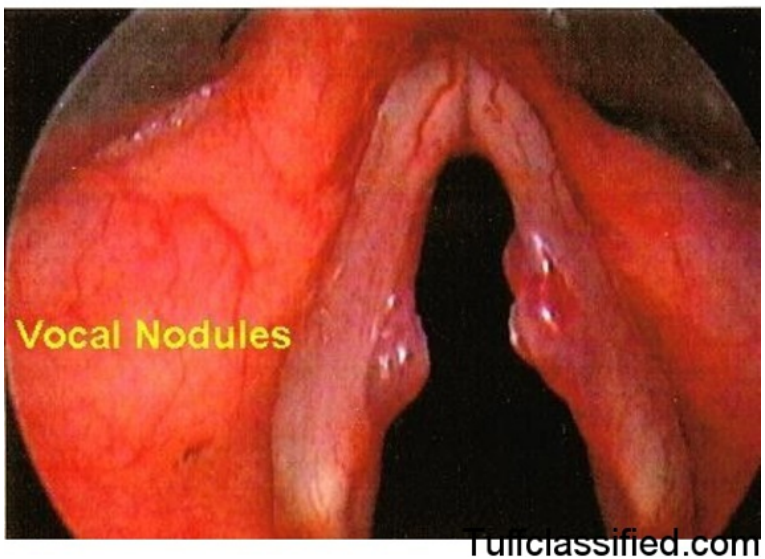
- Accent modification
- Diagnosis and management of voice disorders



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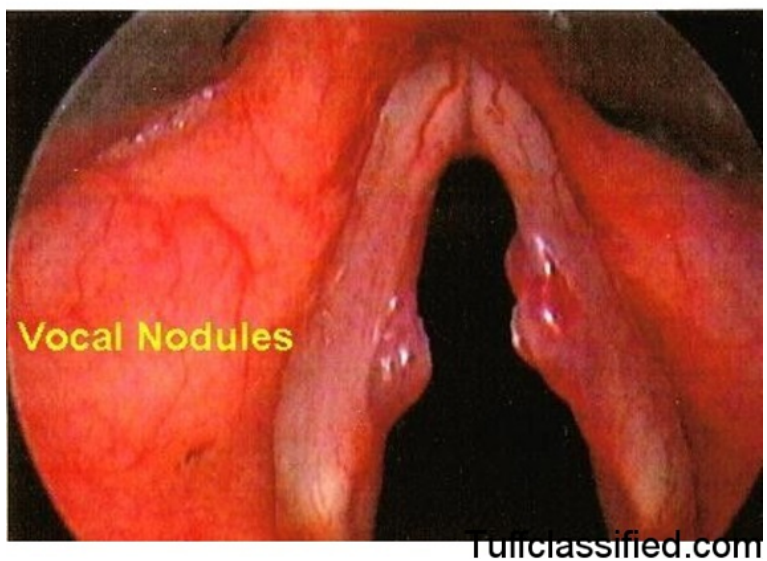
MGH Voice Lab



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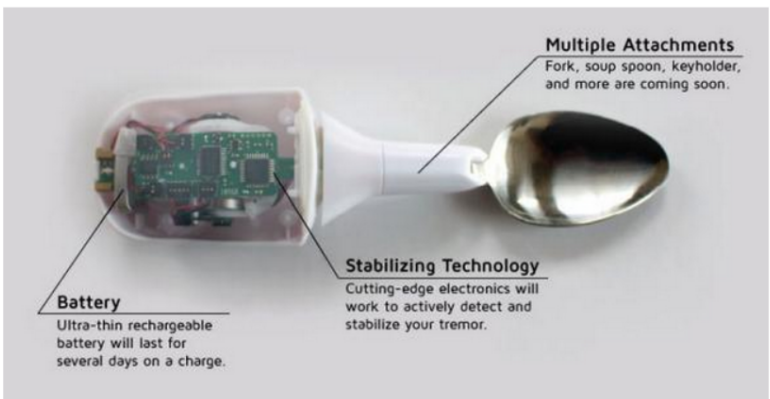
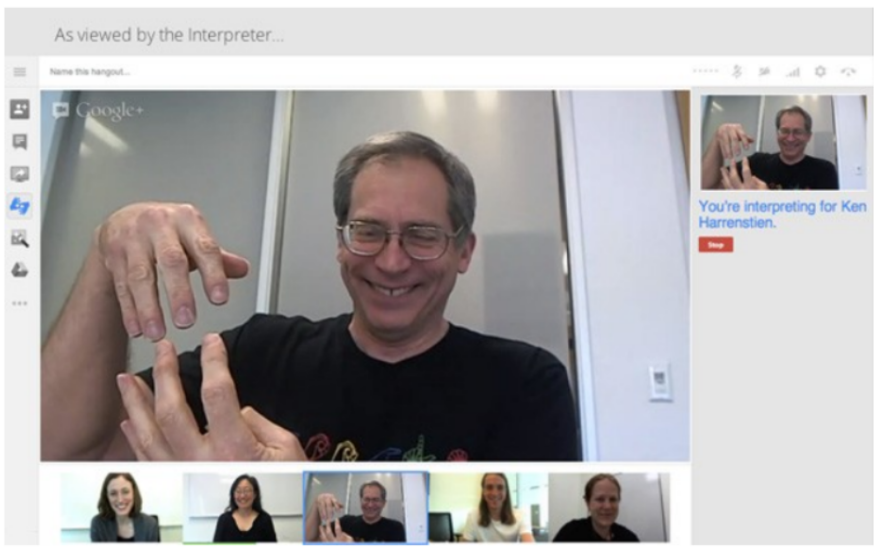
Google's High-Tech Spoon Could Help People With Parkinson's



As Reuters' Alexei Oreskovic points out, Google has been **taking a greater interest in health technology lately**, and Lift will be joining a growing Life Sciences group within the company. That group, **profiled recently in the *Wall Street Journal***, is working on a "**smart contact lens**" that monitors glucose levels for diabetics. Google also led a $130 million investment earlier this year in **a startup that produces cancer treatment software.**

Google Hangouts receive sign language interpreter support, keyboard shortcuts

by Jon Fingas | @jonfingas | March 2nd 2013 at 7:34 am



Byun Lab research

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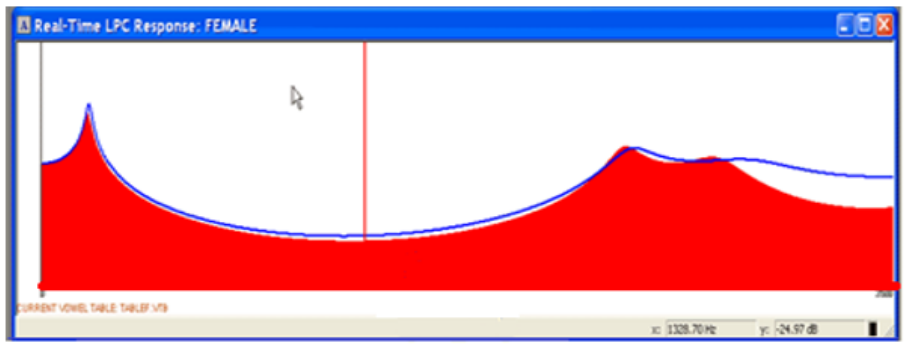
- Measure how speakers learn under different practice conditions.
- Focus is on how speech changes when the learner receives **enhanced feedback** (acoustic, ultrasound).

Acoustic biofeedback intervention

- Certain sound contrasts are signaled by different patterns of formants (resonant frequencies of the vocal tract).

→ “ee” →



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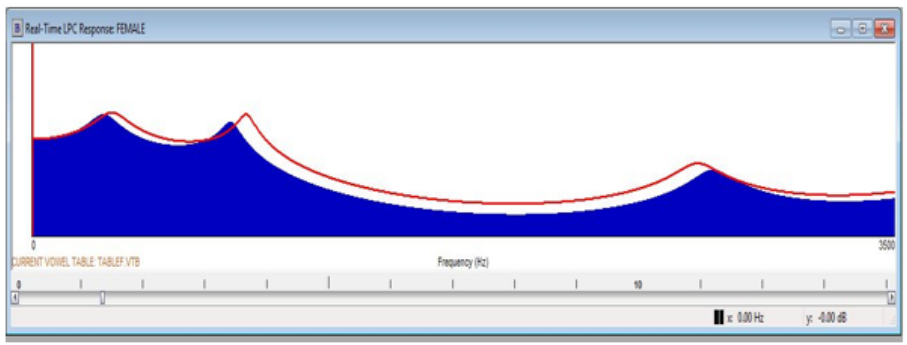

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- Display real-time LPC spectrum of speech.

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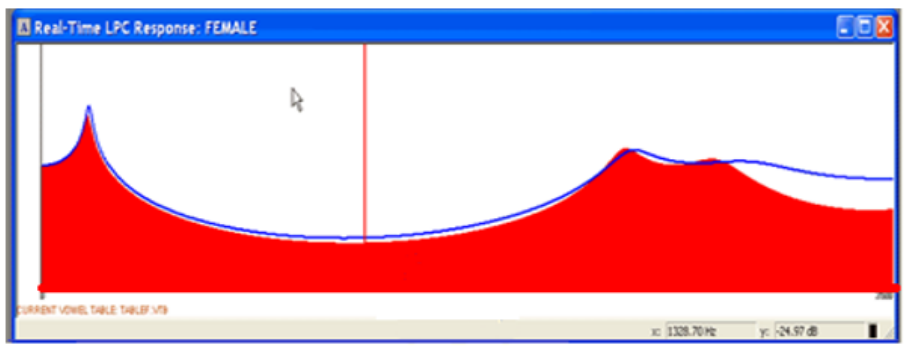

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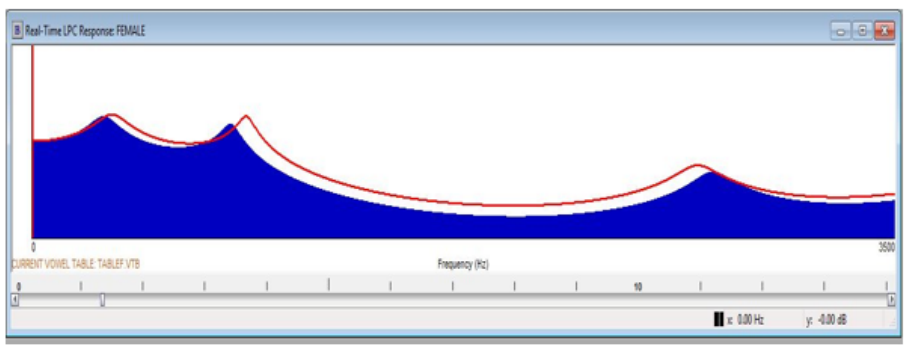

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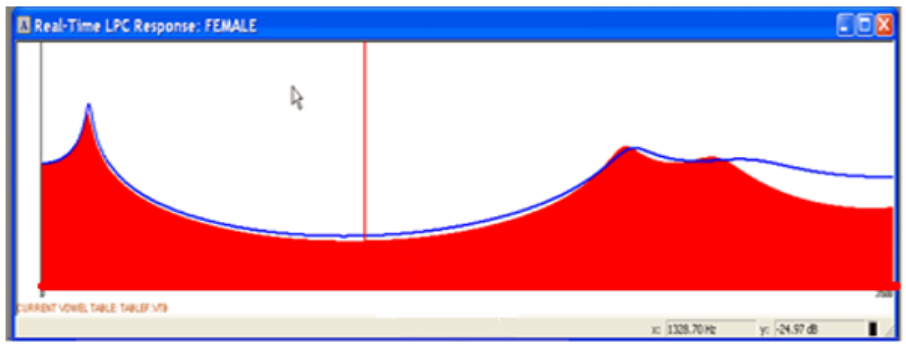

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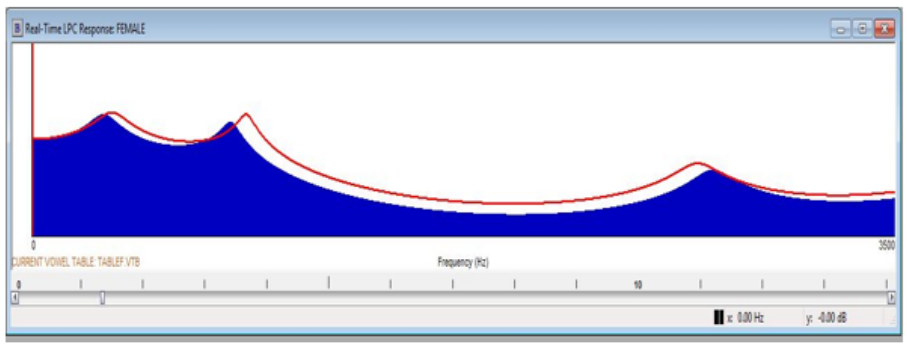
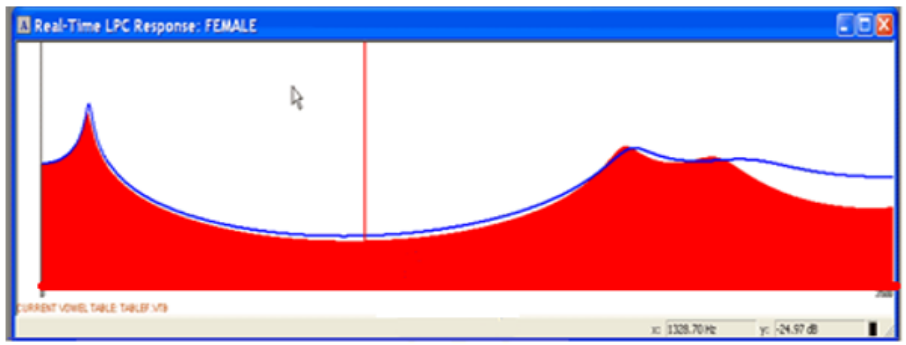


Acoustic biofeedback intervention

- Certain sound contrasts are signaled by different patterns of formants (resonant frequencies of the vocal tract).
- Display real-time LPC spectrum of speech.
- Compare to template representing correct production.
- The learner modifies his/her output in an effort to make the formants line up with the target.

→ “ee” →



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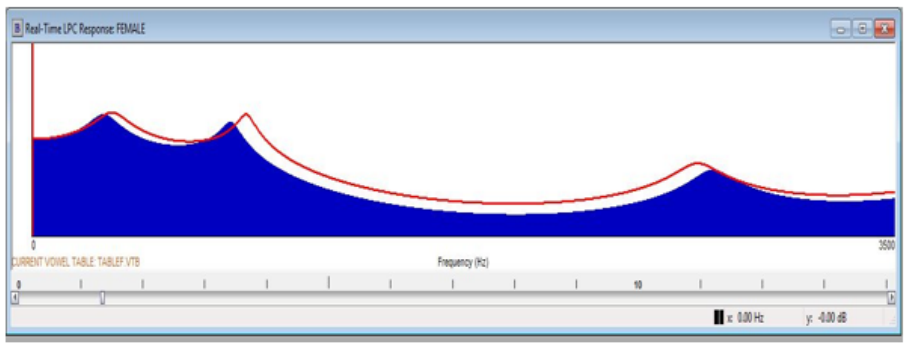

Acoustic biofeedback intervention

Ultrasound biofeedback intervention

- Ultrasound imaging for speech

Figure 2: Ultrasound tongue imaging (Bernhardt, Gick, Bacsfalvi, & Ashdown, 2003)

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Ultrasound biofeedback intervention

- Ultrasound imaging for speech
- Ultrasound biofeedback intervention: Show learner a model of a correct tongue shape for target sound (e.g. /ɹ/).
- Learner views shape and movements of own tongue in real-time; attempts to match the model shape.

Figure 2: Ultrasound tongue imaging (Bernhardt, Gick, Bacsfalvi, & Ashdown, 2003)

Ultrasound biofeedback intervention

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- What do we get out of it?
- Data, papers, real-world impact...

App development project

Initial team

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- Heather Campbell, PhD candidate in CSD
- Wendy Liang, MS candidate in CSD

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- Dalit Shalom
- Eddie Chen
- Hsuan Chang


IDEAS09

START

FACT:
AROUND 10% OF KIDS STRUGGLE SAYING SOME SPEECH SOUNDS LIKE: "R" and "S"

SOME KIDS RESPOND TO TRADITIONAL THERAPY...

"BRING YOUR TOUNGE BACK"

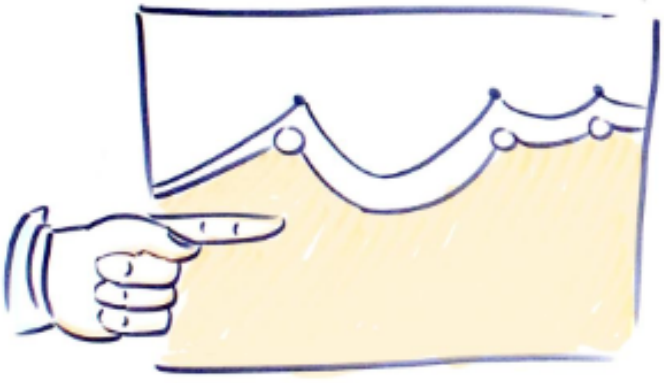
BUT OTHERS HAVE SEEN SPEECH LANGUAGE PATHOLOGISTS (SLPs) FOR A LONG TIME AND STILL HAVE TROUBLE...

...SLPs HAVE TO DISMISS THEM FROM THEIR CASELOADS...

"WOBIN" "THIS PEN IS WED"

IN THE MEANTIME...

TARA's BIOFEEDBACK LAB



"RESEARCH IS SHOWING THAT BIOFEEDBACK MAY BE AN EFFECTIVE METHOD FOR HELPING KIDS IMPROVE THEIR /r/ SOUND"

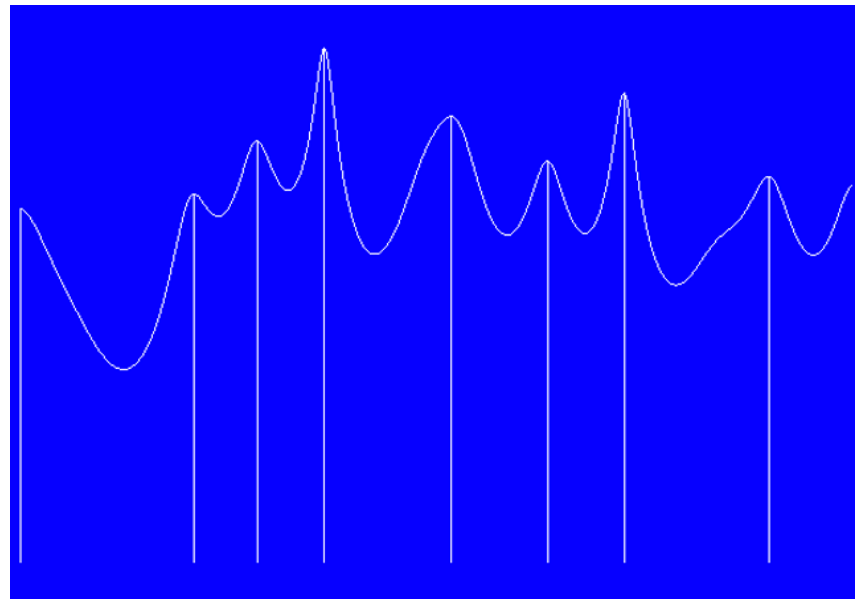
DID YOU KNOW?
THE /R/ SOUND IS ONE OF THE MOST PERSISTENTLY DISTORTED SPEECH SOUNDS

AN IDEA!

CO-INVESTIGATORS:

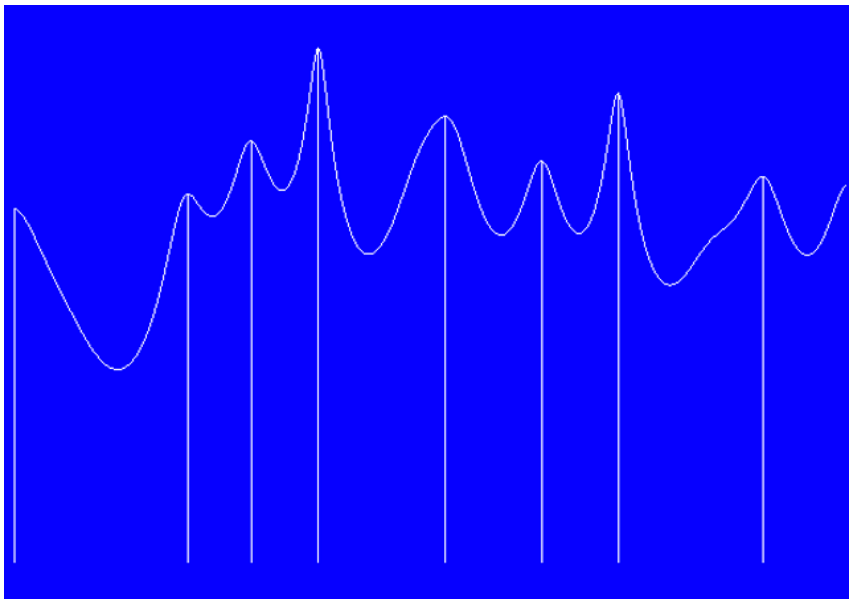
Steps in the process

- Develop core acoustic functionality (real-time LPC with peak detection)



Steps in the process

- Develop core acoustic functionality (real-time LPC with peak detection)
- Add ability to set an acoustic target



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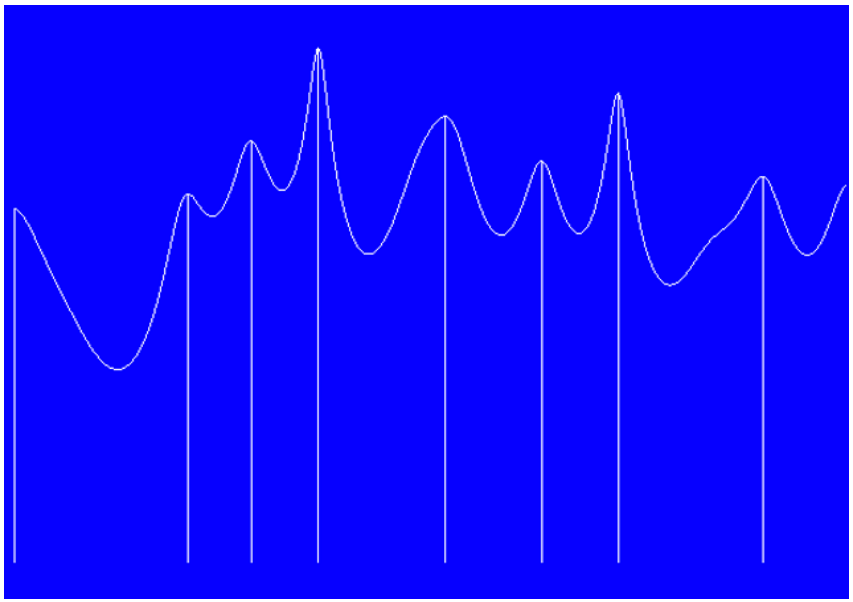
- Develop core acoustic functionality (real-time LPC with peak detection)
- Add ability to set an acoustic target
- Program user interface



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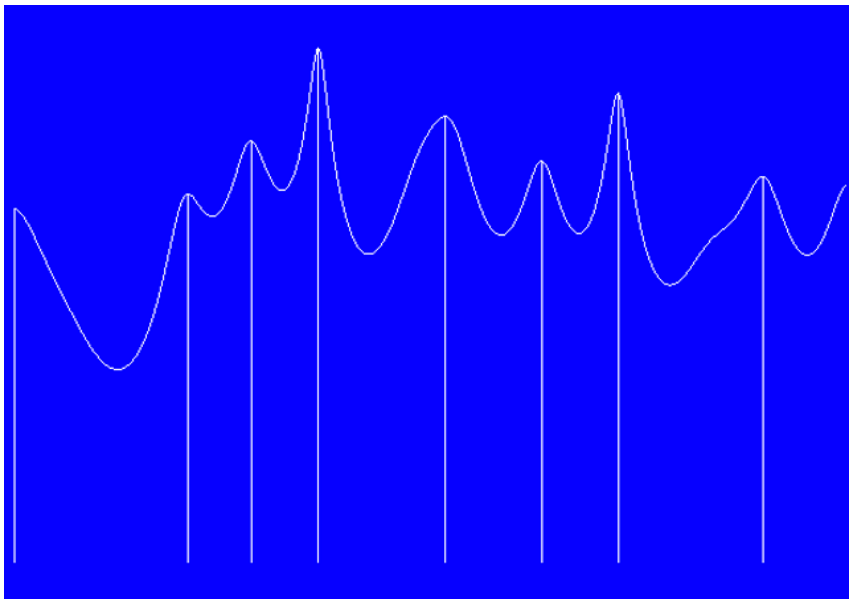
- Develop user modules



Steps in the process

- Develop core acoustic functionality (real-time LPC with peak detection)
- Add ability to set an acoustic target
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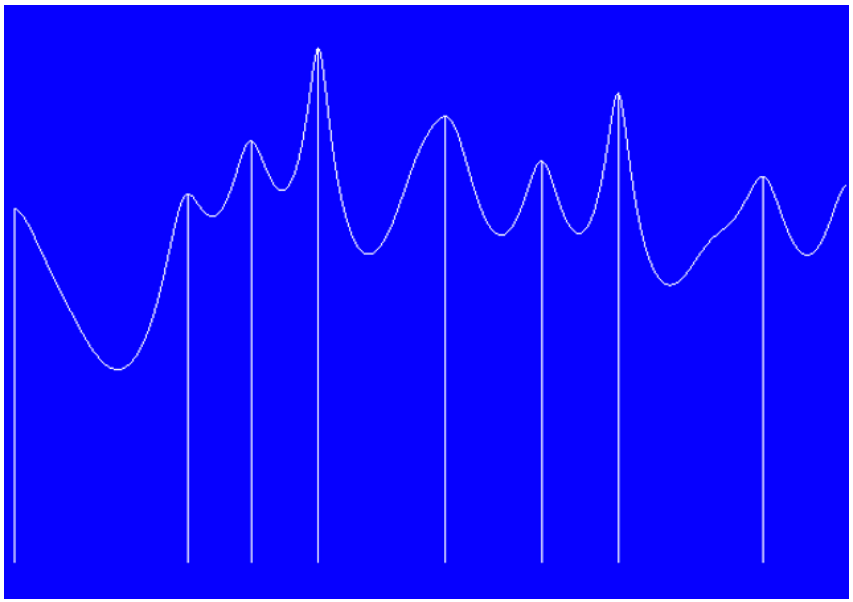
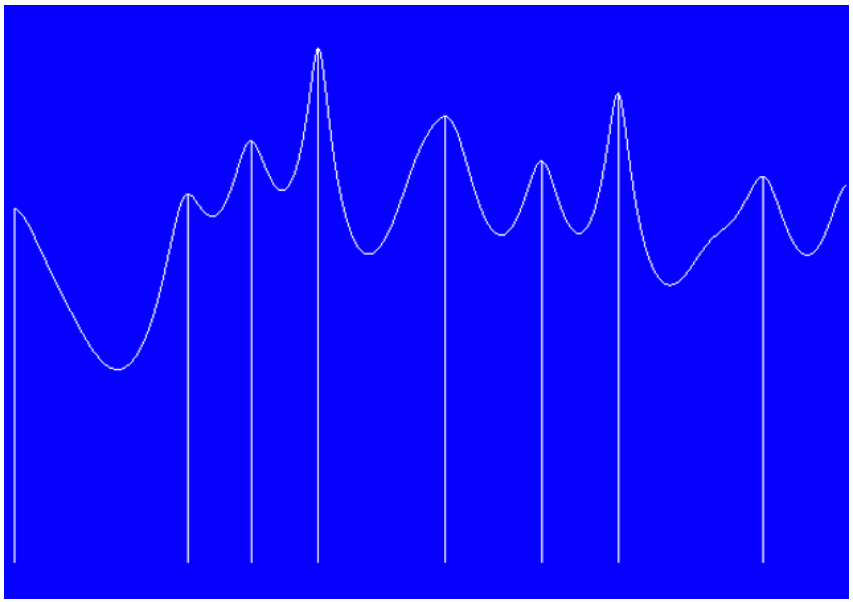
- Develop user modules
  - Introduction



Steps in the process

- Develop core acoustic functionality (real-time LPC with peak detection)
- Add ability to set an acoustic target
- Program user interface
- Develop user modules
  - Introduction
  - Structured practice



Steps in the process

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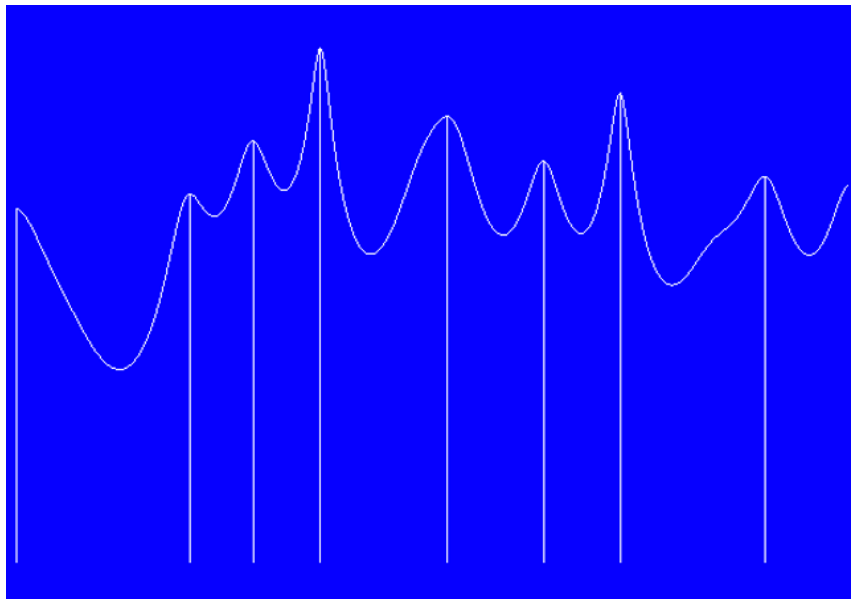
  - Structured practice
  - Performance tracking



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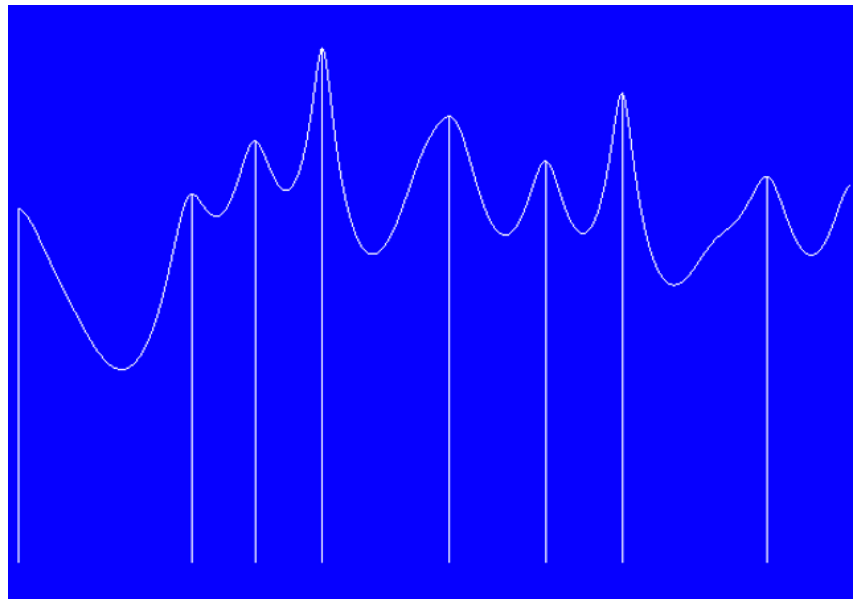
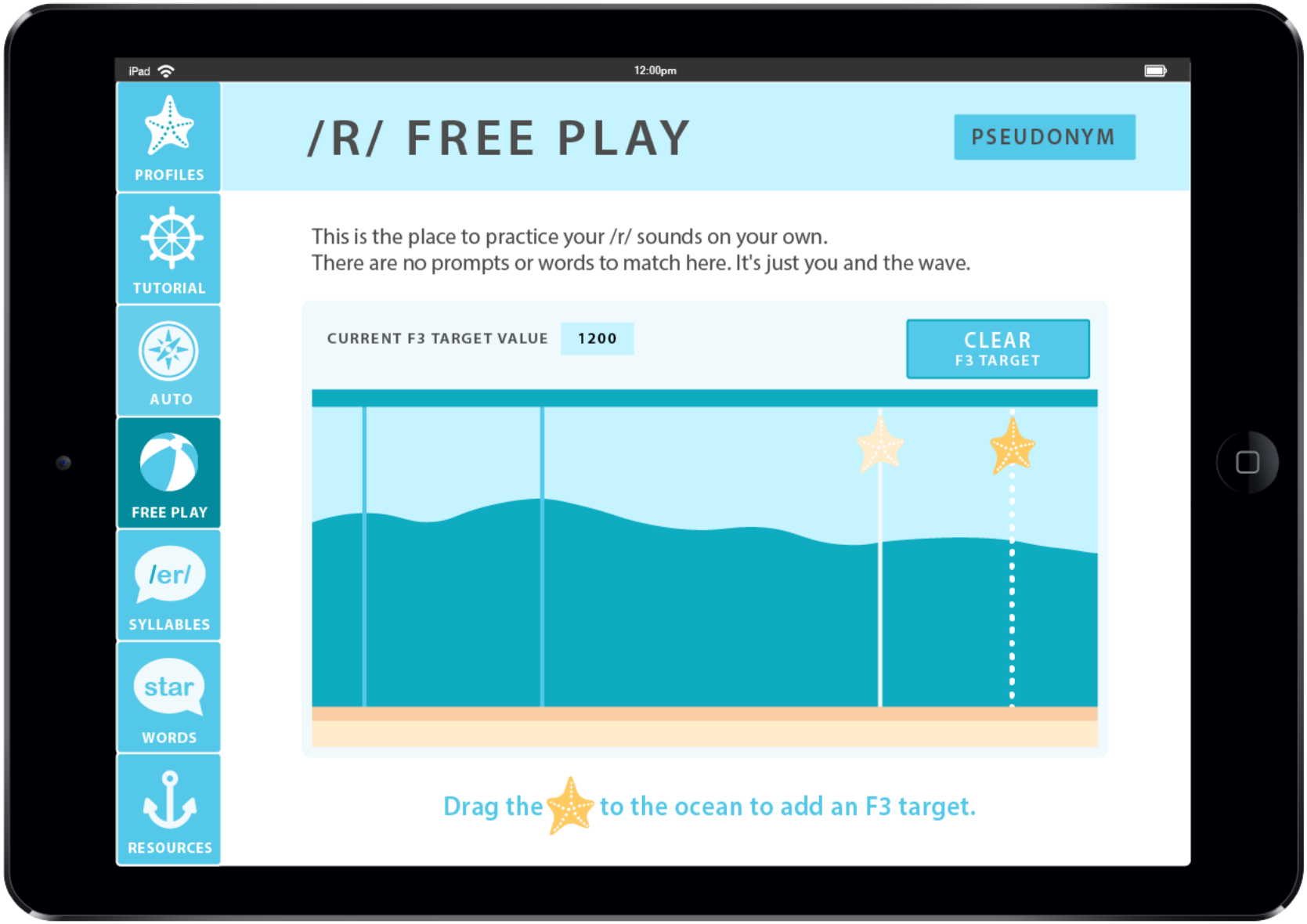


Current status



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  - Probe /r/ accuracy before, during, after treatment
  - 10% of session records checked for fidelity to protocol
  - Compare effect sizes of app-based versus lab-based treatment

Thank you!

Questions?

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@ByunLab

Acknowledgments

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