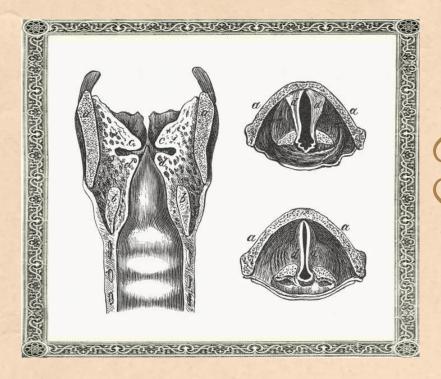


2 EGGceptional Vocals

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Introduction

EGGceptional Vocals is a project designed to help vocalists and vocal coaches gain deeper insights into vocal technique. By integrating hardware and software, **EGGceptional Vocals** offers a unique, non-invasive way to measure and improve vocal performance, making healthy singing more accessible to all.

Use Case

- For vocalists & vocal coaches
 - Providing hard data about internal vocal mechanisms
- Existing solutions
 - Many feedback apps for vocalists are based on audio signals, rather than physical measurements
 - Primary CQ-measuring app (VoceVista) doesn't provide analysis, training feedback, or data over time

• ECE areas

• Signals, software, hardware, circuits

Use Case Requirements

- 1. Quick setup
 - a. Within 3 minutes
- 2. Comfort for vocalists
 - a. 95% agree
- 3. Quick feedback
 - a. Within 1 minute
- 4. Accurate Identification
 - a. 90% accurate pitch identification
 - b. 90% laryngeal closed/open identification
- 5. Customizability of vocal goals
 - a. Style of singing
 - b. Level of proficiency (beginner and advanced)
- 6. Analytics over time
 - a. Range, date, song

Potential Ethical Challenges

Misguiding users

- App might output wrong feedback that misguides the singer into making bad changes
- Users receive good feedback from vocal guide when they are doing something wrong

Respect for Differing Styles of Singing

- App gives constructive feedback designed to strengthen vocal abilities not criticize
- App could give feedback that makes the singer self conscious about singing

Privacy of User

- App will be taking in voice feedback and generating data from it
- We will store to provide data to provide feedback over time periods

Technical Challenges

• Electroglottograph sensor

- Familiarizing with EGG hardware and understanding what a proper CQ range is for varying ranges and languages
- Comfort
 - Noninvasive methodology
- Integrating systems
 - Integrating EGG data
 - Integrating microphone data
 - Overlaying onto sheet music
- App presentation
 - Quantify & present accurate data to the user

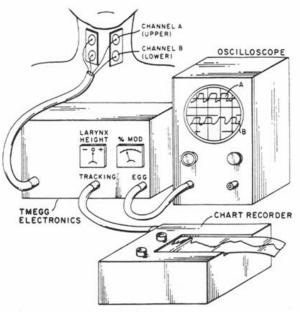


FIG. 2. A two-channel tracking multichannel electroglottograph (TMEGG) having indicators for larynx height and % modulation.

Solution Approach

Technical Challenges	Technology and Justification
Accurately flagging "improper" CQ	Recent research papers describe established ranges of CQ that are most common among trained singers and can therefore be considered "proper" ranges
Comfort	We needed to balance comfort versus data, options being computer vision, electroglottography, and surface myography.
Signals Processing	Voce Vista is a software application that processes audio into interactive recordings from the EGG sensor. Another option is PhaseComp, but Dr. Theresa Brancaccio, an expert in vocal pedagogy, has advised us that this platform is unintuitive.

Testing & Verification

Backend

- Identify correct pitch 90% of the time
- Identify proper and improper CQ 90% of the time from a set of test recordings
- Correctly match sheet music to recorded pitch and CQ 95% of the time

Client Surveys

- Time users on long it takes to learn how to use app
- Survey users on sensor comfortability and impact on singing, aiming for 90% agreeing that the sensor is comfortable and does not severely impact singing

Singers

- We will utilize 2 CMU college student opera singers (one high pitch one low pitch) as well as myself (true beginner) for testing
- Given that the EGG sensor is difficult to calibrate, we will start off limiting it to 3 people total, and we will potentially add more down the road

Tasks & Division of Labor

• EGG Sensor

- Setup & Calibration (Everyone)
- Signal Processing (Tyler)
- Frontend Desktop App (Susanna)
- Backend Systems
 - Microphone Signal Processing (Susanna)
 - Pitch Analysis (Melina)
 - Sheet Music Matching (Susanna)
 - EGG Integration (Tyler)
 - Database (Tyler)
 - EGG Analysis & Feedback (Melina)
- MVP Testing & Client Surveys (Everyone)
- Establishing Ground Truth Metrics (Melina)

Schedule

Task	Owner	Progress	Week 4	Week 5	Week 6	Week 7	SPRING BREAK	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15
			2/2 - 2/9	2/9 - 2/16	2/16 - 2/23	2/23 - 3/1		3/9 - 3/16	3/16 - 3/23	3/23 - 3/30	3/30 - 4/6	4/6 - 4/13	4/13 - 4/20	4/20 - 4/27	4/27 - TBA
Deliverables		-													
Project Abstract	(All 🔹	Complete •													
Project Proposal	(All 🔹	In Progress 🔻													
Design Presentation	(All 🔹	Not Started													
Design Report	(All 🔹	Not Started 💌													
Interim Demo	(All 🔹	Not Started 🔻													
Final Presentation	All 🔹	Not Started 🔻													
Final Video	(All 🔹	Not Started 🔻													
Final Report	All 🔻	Not Started •													
EGG Sensor															
Acquire sensor	(All 🔹	In Progress													
Order auxillary parts	Tyler 🔻	Not Started -													
Calibrate Sensor	All	Not Started -													
Learn Voce Vista	Tyler 🔻	Not Started -													
EGG Signals Processing	Tyler 🔹	Not Started •													
Frontend App				-			_								
Communication with backend	Melina 🔹	Not Started V													
Sheet music/audio matching view	Susanna 🔻	Not Started •													
EGG CQ Data Views	Susanna 🔻	Not Started •													
Data Analytics Views	Susanna 🔻	Not Started •													
Testing	Susanna 🔻	Not Started •													
												_			
Backend			_				_								
Microphone Signals Processing	Susanna 🔻	Not Started •			_										
Pitch Analysis	Melina 💌	Not Started •													
Match sheet music to signal/data	Susanna 🔻	Not Started •								-					
Database for signals data	Tyler •	Not Started •													
Integrate EGG Data	Tyler 💌	Not Started •													
Match microphone data to EGG	Melina 💌	Not Started -									-				
Detect/warn about improper CQ	Melina 🔹	Not Started •													
Testing	Melina 🔻	Not Started										-			
MVP Testing & Client Surveys															
Web App User Satisfaction Survey	All 🔹	Not Started 🔻													
Usefulness Survey from Singers	All 🔻	Not Started													
Slack															
Vocal Health Groundtruth Research															
Understand/identify improper CQ	Melina 🔹	Not Started •													
Create a "ground truth" metric	Melina •	Not Started V				-									

References

<u>Electroglottograph</u> - NC State University

EGG - UNED Vocal Lab

VoceVista Pro

Singing with an 'Open Throat': Vocal Tract Shaping - SingWise