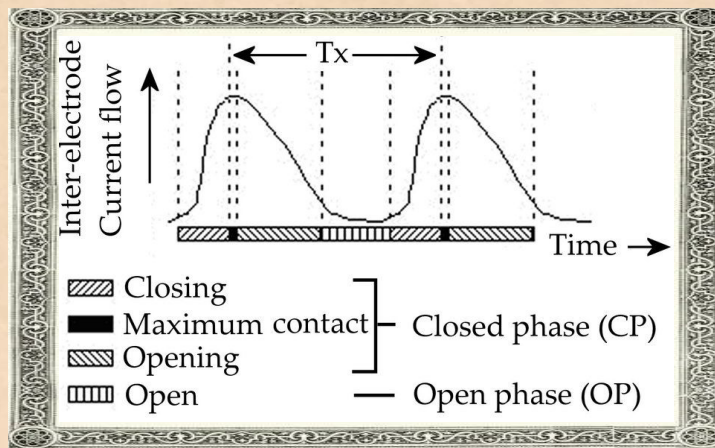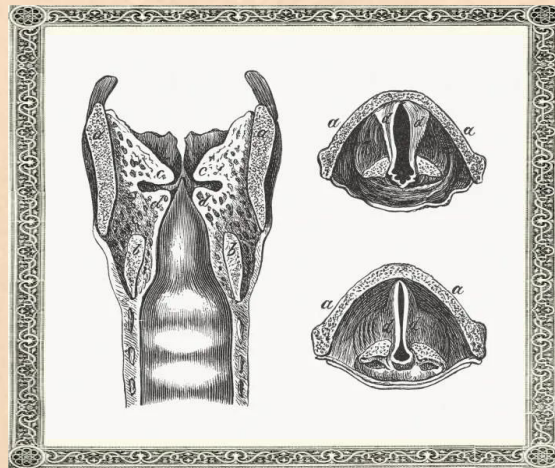# Use Case & Requirements

- **For advanced vocalists & vocal coaches (utilizing a shared lab space)**
  - Use an **Electroglottograph (EGG)** to measure Laryngeal **Closed Quotient (CQ)** while singing, and display this in a user-friendly desktop application
- **Use Case Requirements**
  - Quick setup
  - Comfort
  - Quick & accurate feedback
  - Customizable for **tessitura**
  - Provide analytics over time

Design Requirements

- **EGG Sensor**
  - Weight attached to vocalist is 6 ounces or less
  - Consistently detect clear CQ signal
- **Application**
  - Analysis ready to be viewed in <1 minute
  - Sheet music syncing matches audio and CQ to music within 1 beat of accuracy
 - CQ accuracy is at least 90% across **tessitura**

Solution Approach

Work Collaboratively with Vocalists & Coaches
- In collaboration with the School of Music (57652)
- Promoting vocal health & better knowledge

Trade-offs
- Surface electromyography
- Computer vision
- PhaseComp versus VoceVista
- Inform of changes in CQ over time
- Focus on opera singers rather than other styles
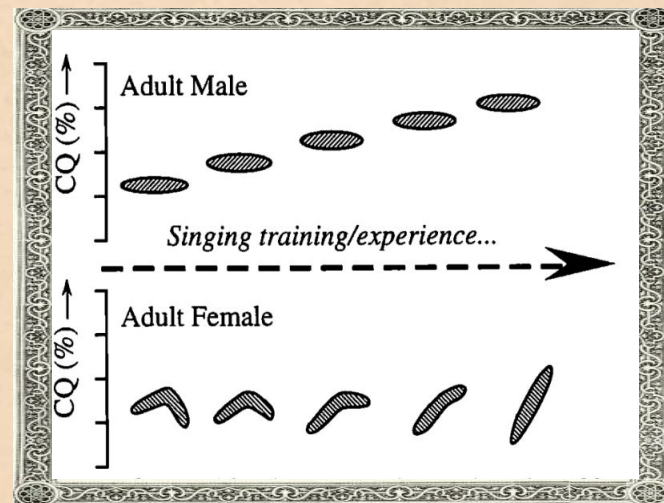
Ethical Implications

Misguiding users
- Overly harsh feedback could misguide singers
- Data is a supplement to vocal coaching, not a replacement
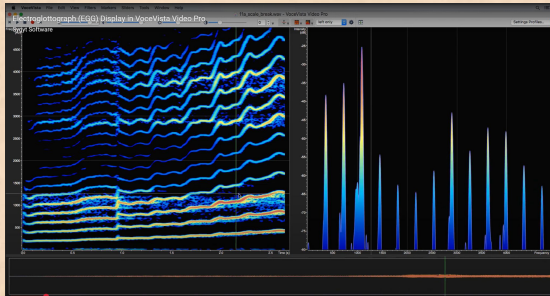- Avoid making singers self-conscious

Respect for Differing Styles of Singing
- Different voices will have different ideal CQ's
  - Consider CQ differences in male and female singers
- Narrowing our focus to primarily advanced opera singers

Privacy of User
- Storage of CQ data over time

Implementation Plan - EGG

EG2-PCX
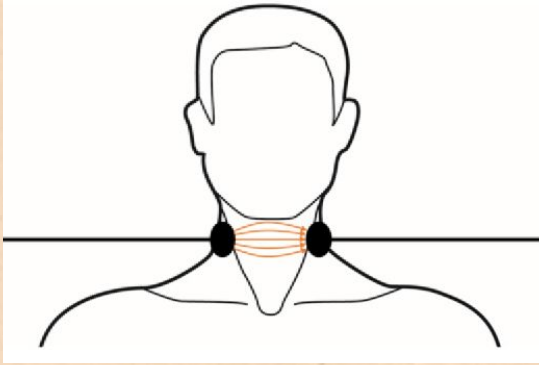
Electroglottograph Specification
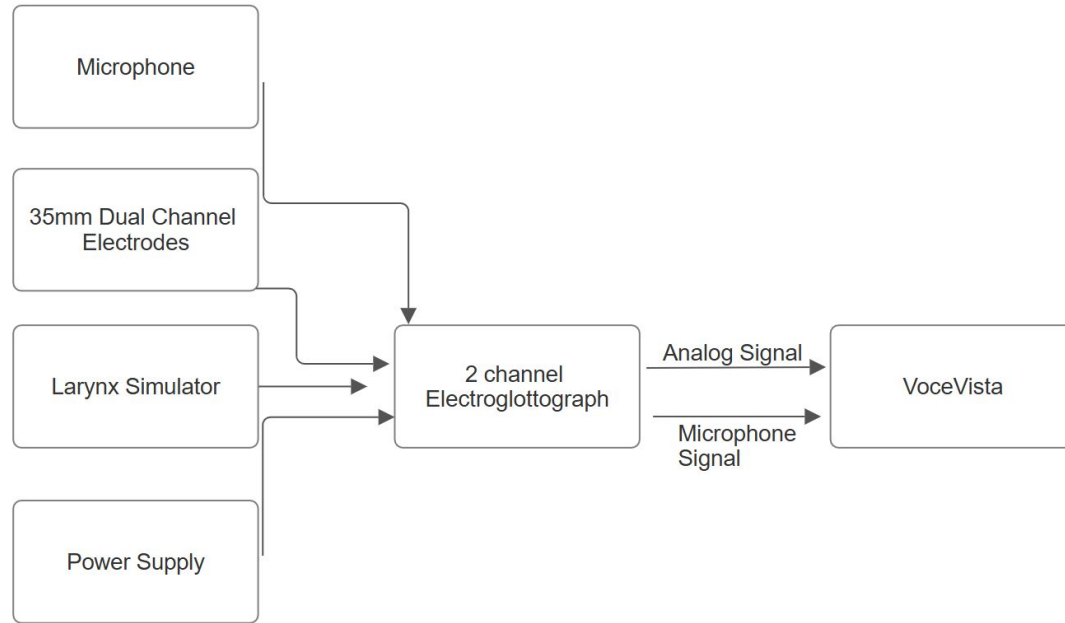
Implementation Plan - Software

EGGceptional Vocals

CQ Warm-up | Repertoire | Playback Library

CQ Warm-Up Recording

1. ASCENDING

When you hear the tone, sing on an "Ah" vowel.
Press the Stop button when you are finished.

CQ Warm-Up Analysis
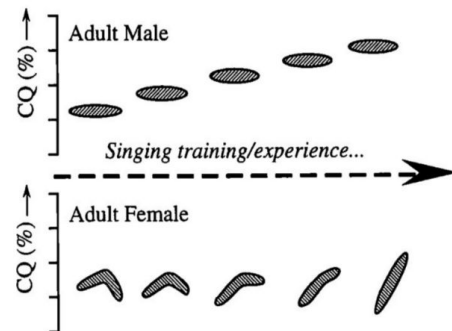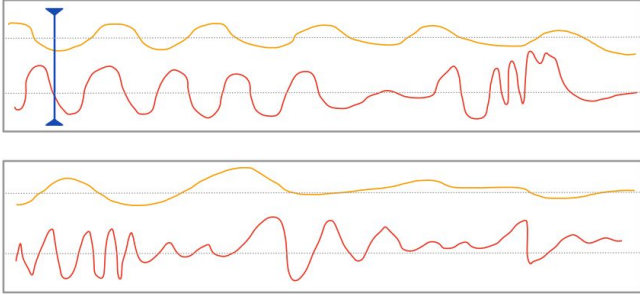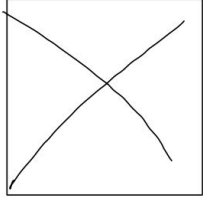
Adult Male

CQ (%)

Singing training/experience...

Adult Female

CQ (%)

Implementation Plan - Software

System Specification - Software
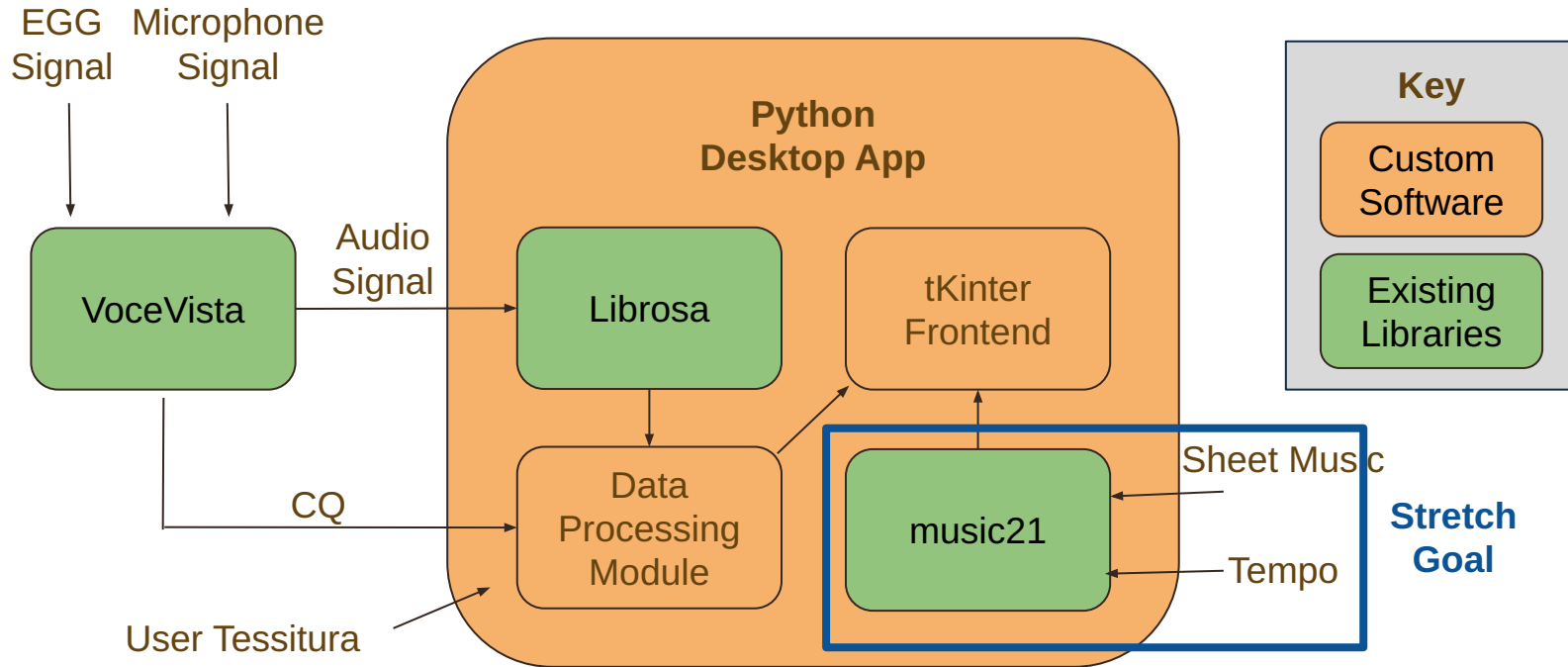
Test, Verification, and Validation

Sensor Accuracy and Ground-Truth for Analytics
- EGG passes calibration test with the **laryngeal simulator** before and after usage
- Use built-in Larynx Tracking & Signal-Strength indicators
- CQ measurement must be at least 20% to be considered detected

User Feedback Study
- 90% agree on comfort
- 90% agree on ease of usage
- 90% agree information provided is useful (**formant tuning**)

Project Management

Task	Owner	Progress	Week 4 2/2 - 2/9	Week 5 2/9 - 2/16	Week 6 2/16 - 2/23	Week 7 2/23 - 3/1	SPRING BREAK	Week 8 3/9 - 3/16	Week 9 3/16 - 3/23	Week 10 3/23 - 3/30	Week 11 3/30 - 4/6	Week 12 4/6 - 4/13	Week 13 4/13 - 4/20	Week 14 4/20 - 4/27	Week 15 4/27 - TBA
Deliverables															
Project Abstract	All	Complete													
Project Proposal	All	Complete													
Design Presentation	All	In Progress													
Design Report	All	In Progress													
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	Complete													
Order auxillary parts	Tyler	In Progress													
Calibrate Sensor	All	In Progress													
Learn Voce Vista	Tyler	In Progress													
EGG Signals Processing	Tyler	Not Started													
Frontend App															
Communication with backend	Melina	Not Started													
Playback View	Susanna	In Progress													
EGG CQ Data Views	Susanna	Not Started													
Data Analytics Views	Susanna	Not Started													
Testing	Susanna	Not Started													
Backend															
Microphone Signals Processing	Tyler	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													
Inform about change in 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	Cancelled													
Create a "ground truth" metric	Melina	Complete													

References

Electroglottograph - NC State University

EGG - UNED Vocal Lab

VoceVista Pro

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

Results from pilot longitudinal study of electrolaryngographically derived closed quotient for adult male singers in training - Howard & Rossiter

Variation of Electrolaryngographically Derived Closed Quotient for Trained and Untrained Adult Female Singers - Howard

Musical Theater and Opera Singing—Why So Different? A Study of Subglottal Pressure, Voice Source, and Formant Frequency Characteristics - Björkner

Idealized EGG Waveform Image - Howard