Electroglottography for voice analysis

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What is EGG?

- Measures amount of current between electrodes
- Reflects the amount of vocal fold contact:
  - More VF contact → more EGG current

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Linguistic applications of EGG

- Confirm presence of voicing
- Determine the fundamental frequency (f0)
- Measure voice quality (phonation type)
  - During consonants (Garellek et al. 2016)
  - Avoid interactions with other articulations, such as nasality (Carignan 2017).

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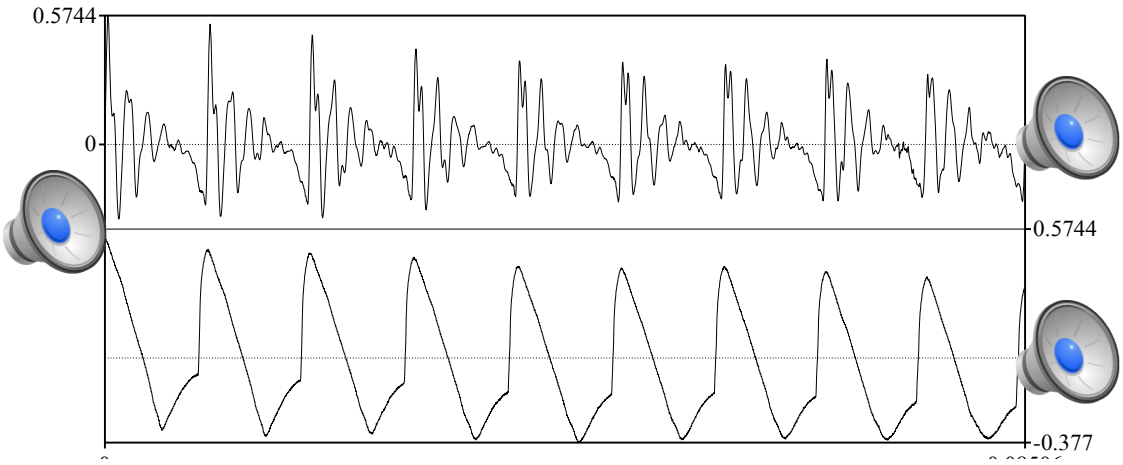
Audio and EGG waveforms



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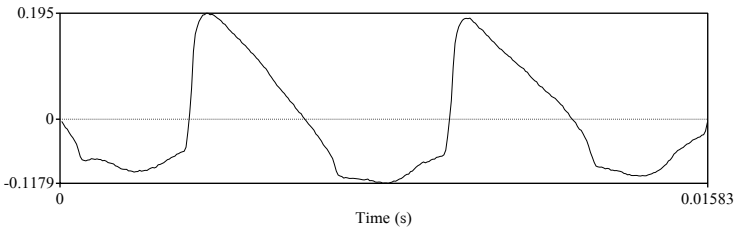
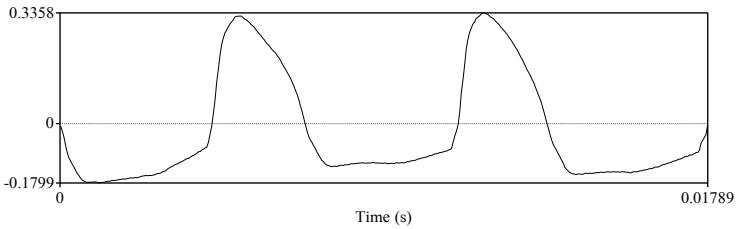
Voice quality: tense vs. lax in Bo

TENSE



LAX



UCLA Voice Project: http://www.phonetics.ucla.edu/voiceproject/voice.html

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EGG contact vs. VF contact

- http://voiceresearch.free.fr/

For other comparisons, including EGG with flow & PGG:

- Rothenberg (1979)
- Howard et al. (1990)
- Holmberg et al. (1995)
- Baken & Orlikoff (2000)
- Granqvist et al. (2003)
- Herbst et al. (2017)

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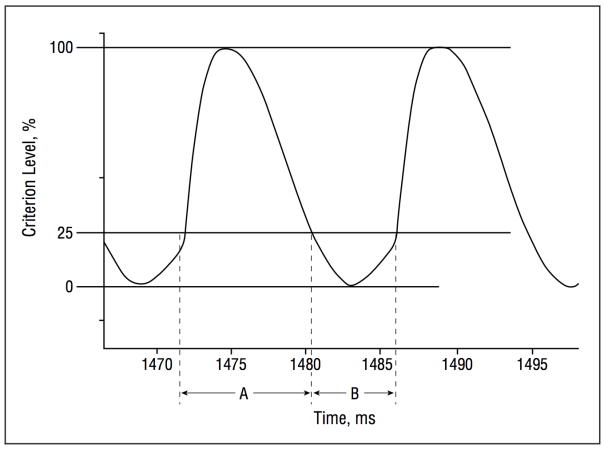
Contact quotient (CQ)

- Sometimes called 'closed quotient'
- % of time during which EGG contact is greater than a particular level



Kania et al. (2004)

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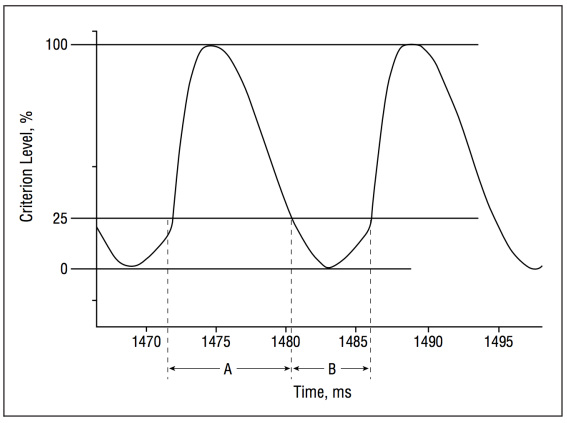
CQ measured using threshold



Kania et al. (2004)

- Arbitrary
- See Kania et al. (2004) for different thresholds, but no decision made as to which is best

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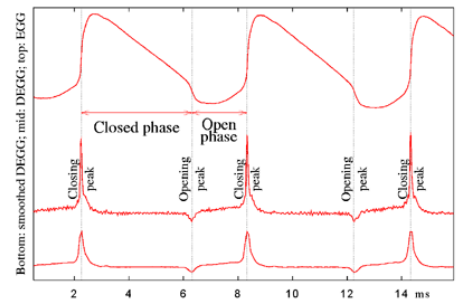
CQ measured by derivative



Example of EGG and DEGG signals, with indication of glottis closure and opening

- Opening peak is often hard to define
- Pulses can have more than one peak

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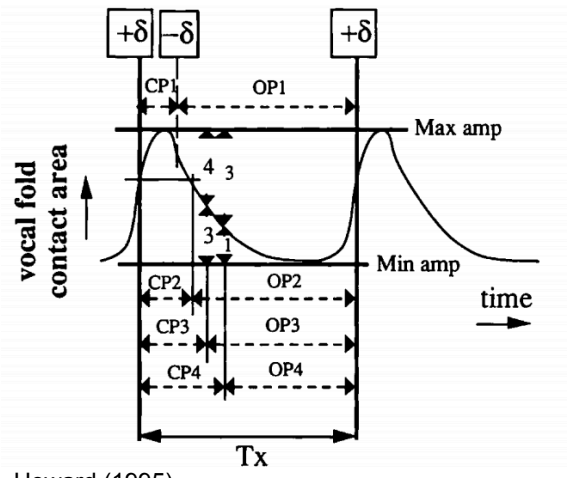
Hybrid method: dEGG + threshold



Howard (1995)

- Threshold is still arbitrary, no agreed-upon value
- But at least contacting peak is well-defined

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Other EGG measures

- Speed of closing
  - Orlikoff (1991)
  - Baken & Orlikoff (2000)
  - Garellek et al. (2016)
- Pulse symmetry
  - Childers & Lee (1991)
  - Mooshammer (2010)
- Overall shape of pulse
  - Mooshammer (2010)
  - Kuang & Keating (2014)

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Using an EGG: EG2-PCX

- 2 batteries, which should already be charged (connect to the AC adapter several hours before recording)
- Switch battery to OFF while charging, and then use EGG while disconnected from AC.
- Turn the BATTERY switch to A or B and see if light turns green. If another color, then battery is weak.

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Using an EG2-PCX: audio

- Audio can be recorded by connecting to microphone jack (in front) or XLR (in back), or separately if preferred.
- Set the "Mic Input" switch (in back) to the input you want to use.

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Using an EG2-PCX: computer interface

- To record, computer must recognize the EGG as USB audio device
- Adjust the audio device's properties to ensure that the format is 2 channel, 16-bit, and 44.1 kHz
- Signal strength can be manipulated using computer's recording settings and the OUTPUT LEVELS switches on the EGG

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Using an EG2-PCX: electrodes

- Electrodes are held against the neck by a collar. They should be attached to the collar so that the spaces between the electrodes run parallel to the collar.
- Place collar so that each set of electrodes rests on both sides of the neck just below the thyroid prominence (Adam's apple). Wires should point downwards. The closer the electrodes are to pointing at each other, the better.
- If signal is weak, you can coat electrodes with a thin layer of gel, or use a saline solution.

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Using an EG2-PCX: electrodes

- You can see whether the vertical height of the electrodes should be adjusted with the LEDs labeled ELECTRODE PLACEMENT. Should be green and in center of the meter, without too much variation.
- I ask speaker to say a vowel and then talk a bit, all the while watching the meter to ensure good placement of the electrodes.

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Gua tongue root contrasts

- +ATR vs. −ATR sometimes differ in voice quality (Stewart, 1967; Guion et al. 2004, Remijsen et al. 2011)
  - +ATR usually described as breathier (though often not in such words).

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Getting CQ and other measures

- EGGWorks (by Henry Tehrani, UCLA): http://www.appsobabble.com/functions/EGGWorks.aspx
  - Integrates well with VoiceSauce, used for voice quality analysis of audio recordings
- Praat script by Chris Carignan, Jeff Mielke, and Marc Brunelle for measuring CQ via dEGG: https://phon.wordpress.ncsu.edu/lab-manual/electroglottograph/

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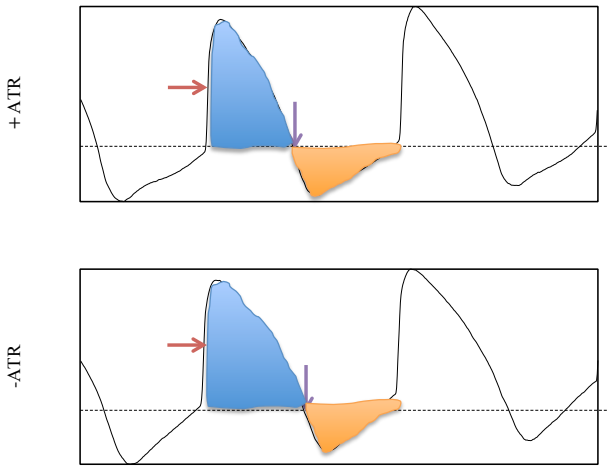
Sample EGG pulses for Gua /e,ɛ/



	CQ (threshold)	CQ (hybrid)	CQ (dEGG)
+ATR	.50	.47	.42
-ATR	.54	.50	.46

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Links to learn more about EGG

- http://voiceresearch.free.fr/egg/
- https://phon.wordpress.ncsu.edu/lab-manual/electroglottograph/
- http://phonetics.linguistics.ucla.edu/facilities/physiology/egg.htm
- Also check out references →

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References

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