

AUDITORY FEEDBACK IN THE BENGALESE FINCH ANIMAL MODEL

By Jake McGrath

Program in Neuroscience

Department of Zoology & Physiology

AUDITORY FEEDBACK: HUMANS

- ▶ Delayed Feedback
 - ▶ Musicians and auditory feedback

- ▶ Choral Speech
 - ▶ Useful in cases of stuttering (Kalinowski & Saltuklaroglu, 2003)

ANIMAL MODEL: BENGALESE FINCH

- ▶ Establishment of the Bengalese Finch Animal Model
 - ▶ Deafening reveals necessity for active auditory feedback in songbirds
 - ▶ Most sensitive songbird to changes in auditory feedback
(Woolley & Rubel, 1997)



PREVIOUS STUDIES

- ▶ Deafening studies and effects on bird song
- ▶ Reversible changes in auditory feedback
 - ▶ Use of gas to produce change in auditory feedback

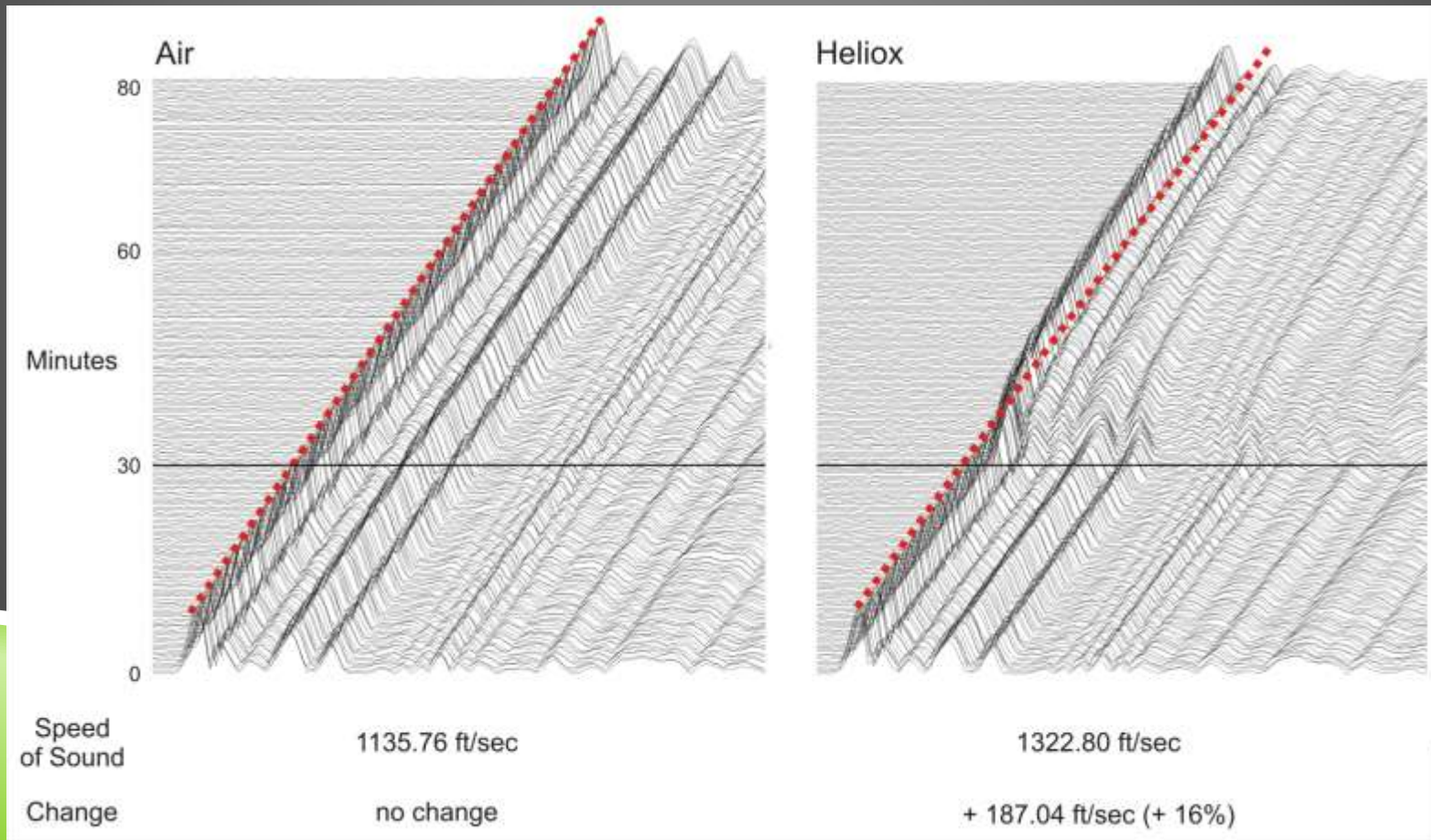
(Yamada & Okanoya, 2003)

CURRENT RESEARCH: MY PROJECT

- ▶ Utilization of gasses to change auditory feedback
 - ▶ Heliox (Helium 70% + Oxygen 30%): research in progress ↑
 - ▶ Sulfox (Sulfur Hexafluoride 70% + Oxygen 30%): soon underway ↓
- ▶ Our Goals:
 - ▶ Understand the role of auditory feedback in vocal control
 - ▶ Instructive: change in vocal output is *specific* to feedback error
 - ▶ Permissive: change in vocal output is *not specific* to feedback error

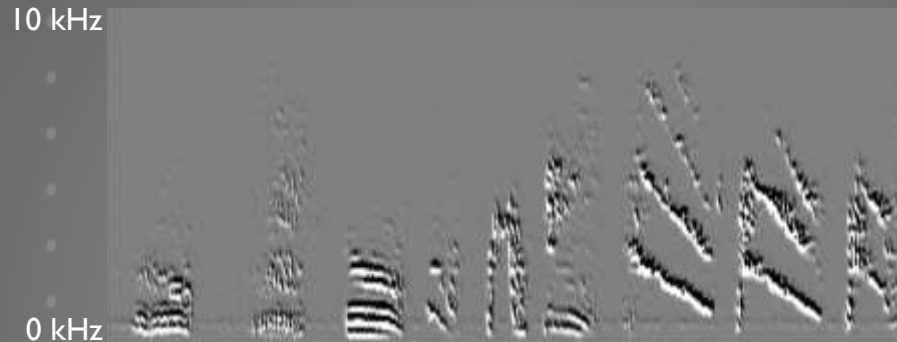
ESTABLISHING ATMOSPHERIC CHANGE

- ▶ Testing for chamber saturation – the “click test”
 - ▶ Heliox – increase in the speed of sound due to lower density

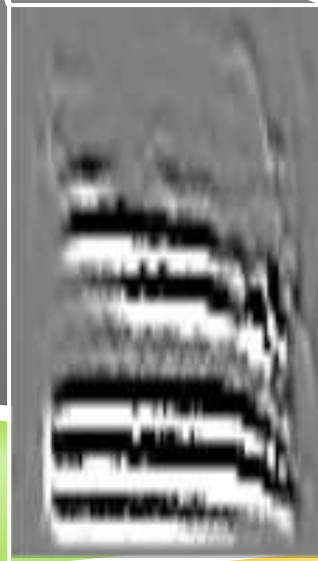


DID HELIOX RAISE PITCH?

- ▶ The Bengalese Finch song:

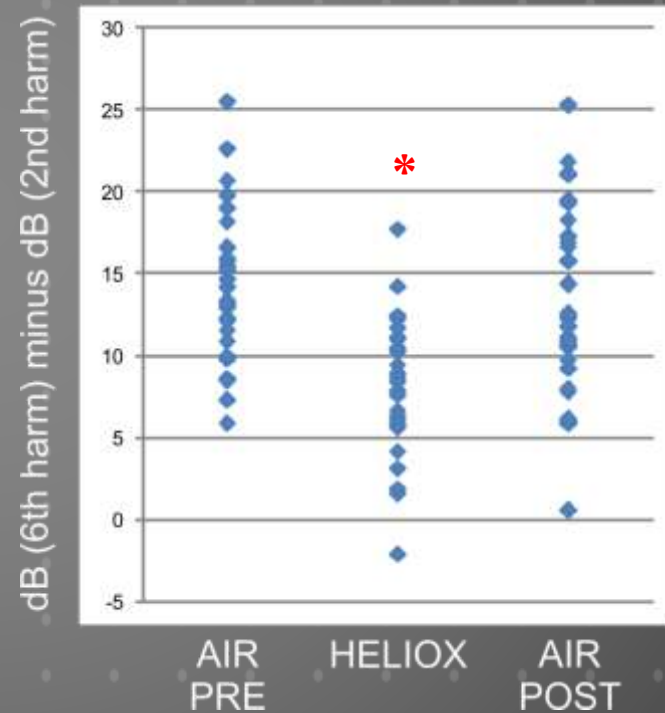
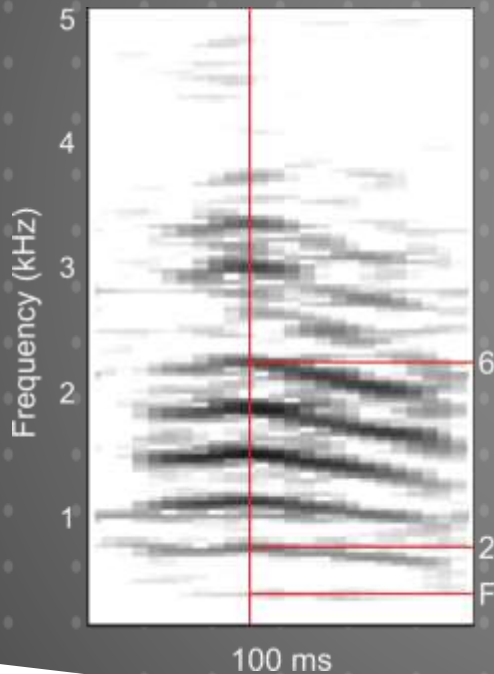


- ▶ Harmonic “stacked note”:



POWER IN HARMONIC NOTES

- ▶ Ratio of high frequency (6th harmonic) to low frequency (2nd harmonic)
 - ▶ Prediction: Ratio high/low will be greater in heliox
 - ▶ Initial results indicate *opposite* change



SUMMARY

- ▶ Despite change in feedback induced by heliox, no change in syntax
- ▶ Reveals *active* role in online vocal control based on auditory feedback
 - ▶ Counterintuitive opposite change suggests *active compensation* to overcome error
 - ▶ Consistent with recent results from other groups
(Sober & Brainard, 2009)

RELEVANCE

- ▶ Importance of auditory feedback
- ▶ Bengalese finch: an important animal model
 - ▶ Compensation suggests auditory feedback plays an *instructive* role in vocal output
- ▶ Heliox and sulfox experiments will continue in Summer 2011
- ▶ Future research will investigate the neural mechanisms underlying sensorimotor integration to shape vocal behavior

ACKNOWLEDGEMENTS

- ▶ INBRE
- ▶ Jonathan Prather, Ph. D.
- ▶ Margaret Flanigan, Ph. D.
- ▶ Sean Reid



QUESTIONS?