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# The Effect of Varying Sound Intensities on Phonotactic Selectivity in Female *Acheta domesticus*

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# The Effect of Varying Sound Intensities on Phonotactic Selectivity in Female *Acheta domesticus*

## INTRODUCTION

Female cricket *Acheta domesticus* recognize and respond to the call of the conspecific male by walking towards it (phonotaxis). Such phonotactic response has been described as selective, e. g. females are more likely to respond phonotactically to calls with syllable periods typical of the males' calling song than they are to respond to calls with unattractive syllable periods (Stout *et al.*, 1983). A previous study by Popov and Shuvalov (1977) concluded that phonotaxis can be altered by internal and external conditions. One internal condition that can modify selective phonotaxis is age (Henley *et al.* 1992; Stout *et al.* 2010). Here we demonstrate that sound intensity is an external condition that can also modify selective phonotaxis.

The recognition of the call of the male by the female has become an important model to evaluate the nervous system processing that underlies the encoding and recognition of signals which communicate information regarding the behavioral state of the sender.

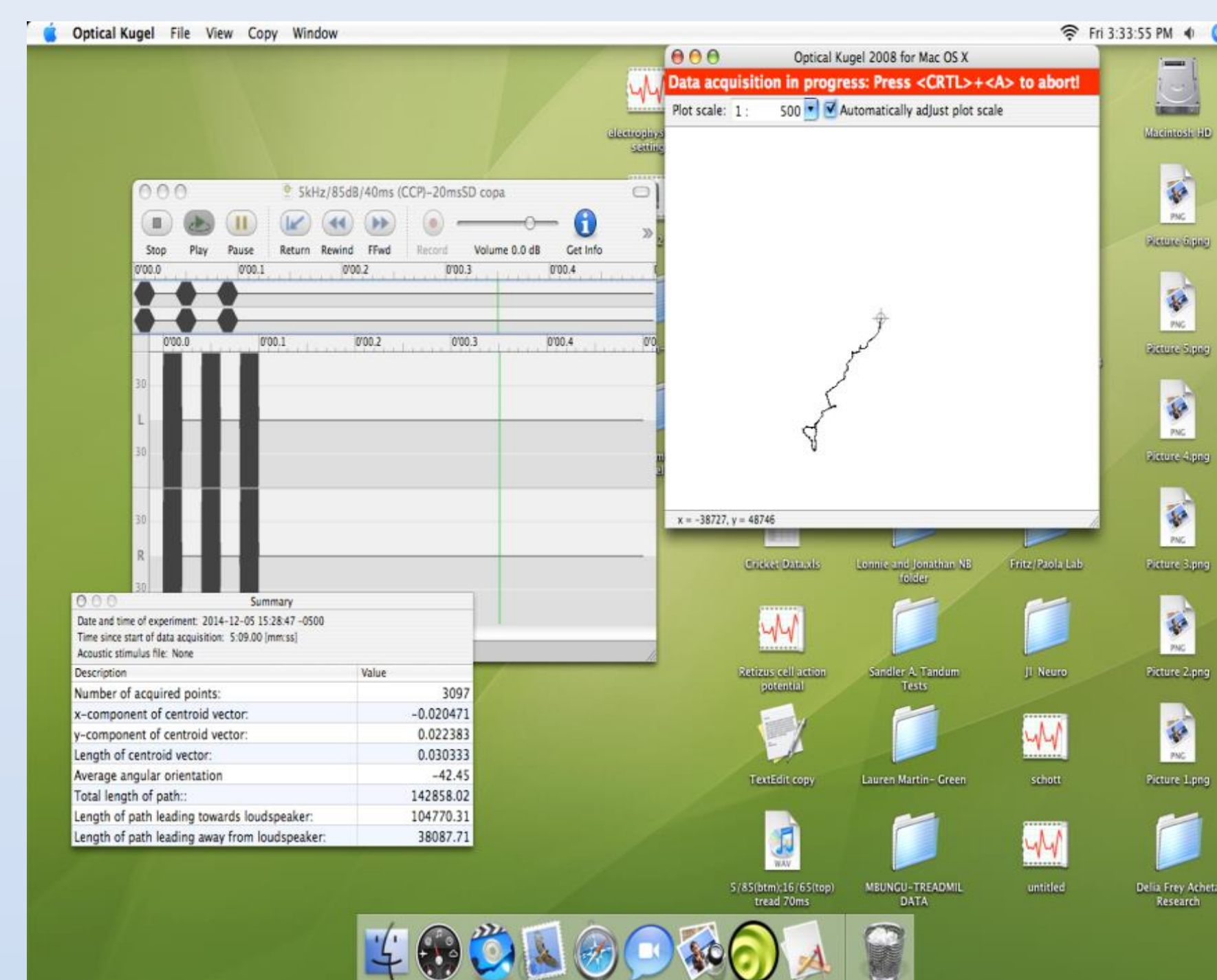
## METHODS

- 5-7 day old females were used for the study.
- Crickets were raised and kept in containers with cricket chow, water, and egg carton for shelter.
- Temperature of growth chamber ranged from 21-23 °C.
- Crickets were on a 12/12 light-dark cycle (on at 06:00 hrs)
- Phonotaxis was tested on a spherical treadmill (see picture below).



- Auditory stimulus consisted of synthetically produced calling songs (5kHz; produced by a iMac OS X) with syllable periods ranging from 30-90 ms.

- Calling songs were played in a standard nonsequential order (50ms, 90ms, 70ms, 30ms, 60ms, 80ms, 40ms), for 5 minutes with 2 minutes of silence in between.
- Sound intensities used were 60 and 85dB.
- Optical Krugel application (2008: Version 0.5 beta) was used to record and quantify data (see picture below).



## RESULTS

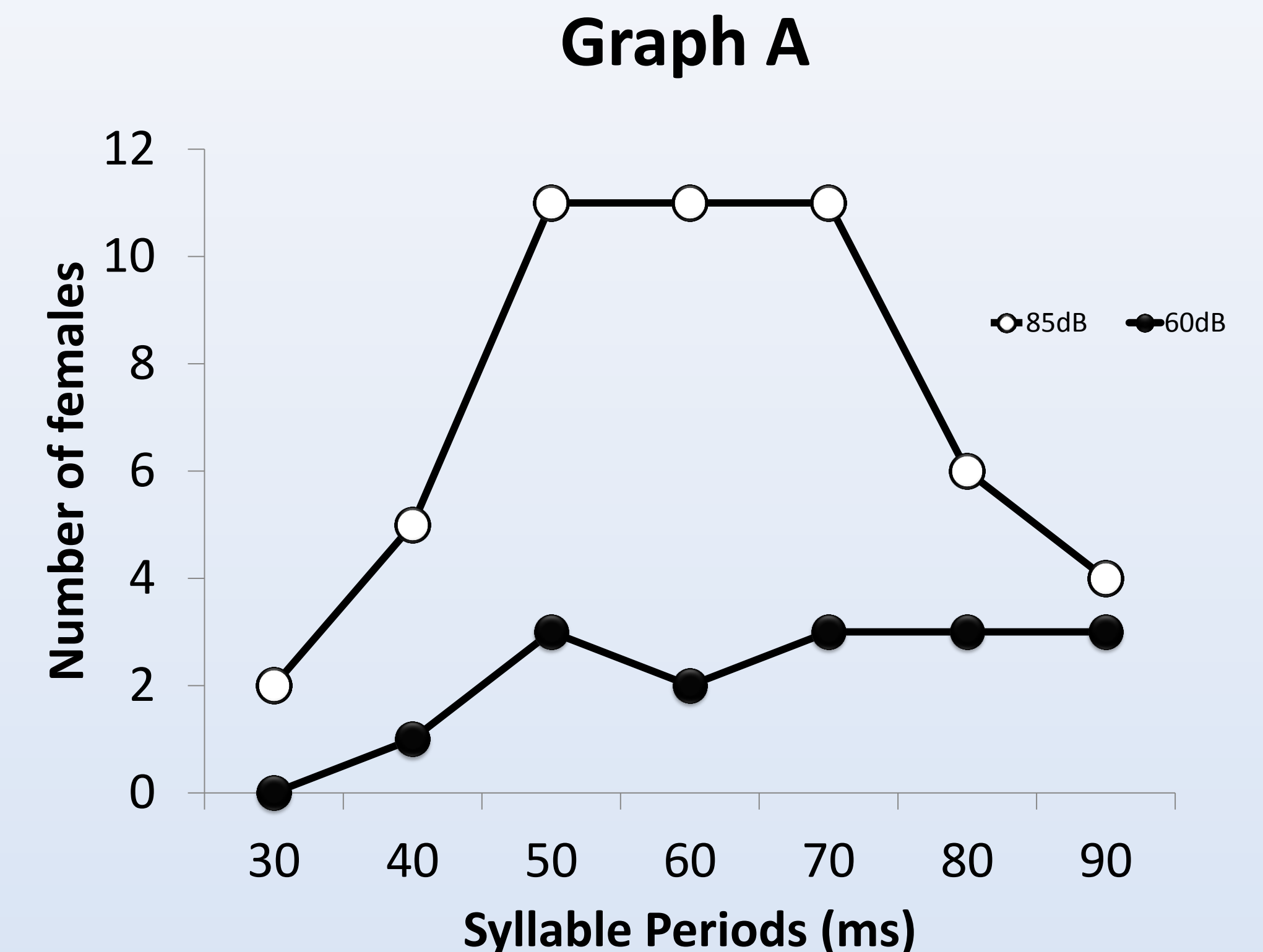
Table 1: 60dB

|    | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|----|----|----|----|----|----|----|----|
| 1  |    |    |    |    |    |    |    |
| 2  |    |    |    |    |    |    |    |
| 3  |    |    |    |    |    |    |    |
| 4  |    |    |    |    |    |    |    |
| 5  |    |    |    |    |    |    |    |
| 6  |    |    |    |    |    |    |    |
| 7  |    |    |    |    |    |    |    |
| 8  |    |    |    |    |    |    |    |
| 9  |    |    |    |    |    |    |    |
| 10 |    |    |    |    |    |    |    |
| 11 |    |    |    |    |    |    |    |
| 12 |    |    |    |    |    |    |    |
| 13 |    |    |    |    |    |    |    |
| 14 |    |    |    |    |    |    |    |
| 15 |    |    |    |    |    |    |    |
| 16 |    |    |    |    |    |    |    |
| 17 |    |    |    |    |    |    |    |
| 18 |    |    |    |    |    |    |    |
| 19 |    |    |    |    |    |    |    |
| 20 |    |    |    |    |    |    |    |
| 21 |    |    |    |    |    |    |    |
| 22 |    |    |    |    |    |    |    |

Table 2: 85dB

|    | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|----|----|----|----|----|----|----|----|
| 1  |    |    |    |    |    |    |    |
| 2  |    |    |    |    |    |    |    |
| 3  |    |    |    |    |    |    |    |
| 4  |    |    |    |    |    |    |    |
| 5  |    |    |    |    |    |    |    |
| 6  |    |    |    |    |    |    |    |
| 7  |    |    |    |    |    |    |    |
| 8  |    |    |    |    |    |    |    |
| 9  |    |    |    |    |    |    |    |
| 10 |    |    |    |    |    |    |    |
| 11 |    |    |    |    |    |    |    |
| 12 |    |    |    |    |    |    |    |
| 13 |    |    |    |    |    |    |    |
| 14 |    |    |    |    |    |    |    |
| 15 |    |    |    |    |    |    |    |
| 16 |    |    |    |    |    |    |    |
| 17 |    |    |    |    |    |    |    |
| 18 |    |    |    |    |    |    |    |
| 19 |    |    |    |    |    |    |    |
| 20 |    |    |    |    |    |    |    |
| 21 |    |    |    |    |    |    |    |
| 22 |    |    |    |    |    |    |    |

Females become more selective in the range of syllable periods they respond to as a result of increasing sound intensities. **Table 1 and 2.** Each row represents the response of one cricket (n=22) to a 5kHz calling song with intensities of 60dB and 85dB, respectively. Shaded boxes represent positive phonotaxis for that syllable period. **Graph A** (top right) shows the change in response to the same stimuli as in tables 1 and 2. When presented with 5kHz/60dB calling songs, females are more likely to respond unselectively to most syllable periods tested. However, in response to 5kHz/85dB calling songs, the same females are more likely to respond to syllable periods that fall within the most attractive range (i.e. 50 – 70ms) of the male's call.



## CONCLUSIONS AND FUTURE RESEARCH

- Phonotaxis by females is unselective in response to calling songs with syllable periods at an intensity of 60dB.
- When the same females are presented with calling songs of 85dB, phonotactic response is tuned to the syllable periods produced in the male's calling song (50 – 70ms).
- These results suggest the underlying neuronal mechanism controlling selectivity of phonotaxis is dependent on the intensity of the call.
- Neurophysiological studies which evaluate the response of auditory neurons (previously identified and that have been proposed to influence phonotaxis) are necessary in order to support their role in selective phonotaxis

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