


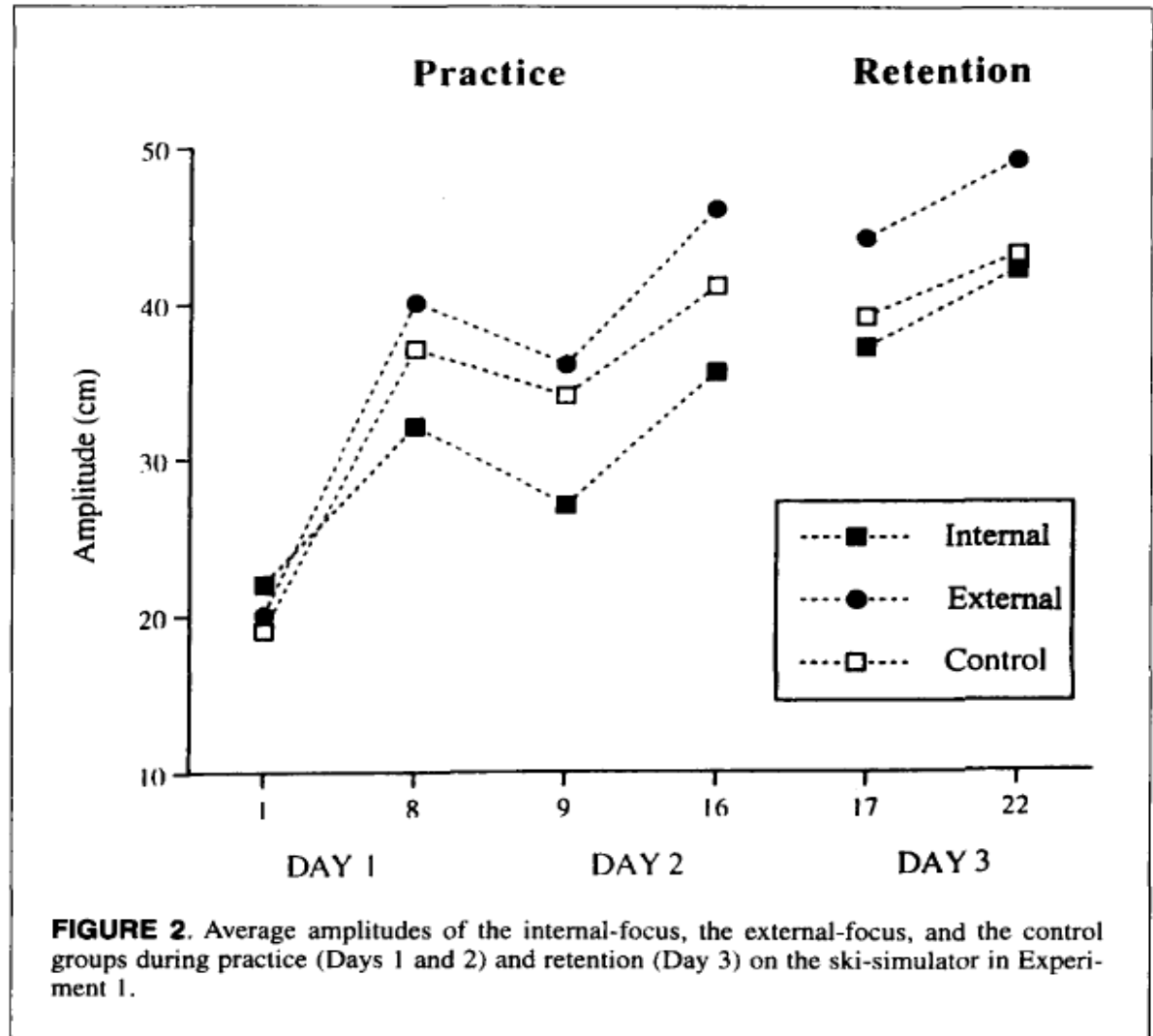
*Evaluating trained singers tone quality and the effect of  
changing focus of attention on performance*

Rebecca L. Atkins  
University of Tennessee at Chattanooga  
Music Department



**RCIO 2015: Performance (good, bad, and ugly)**  
11th Annual River Cities I-O Psychology Conference  
October 23 and 24, 2015  
The University of Tennessee at Chattanooga

The University of Texas at Austin  
 Butler School of Music  
Center for Music Learning



**FIGURE 2.** Average amplitudes of the internal-focus, the external-focus, and the control groups during practice (Days 1 and 2) and retention (Day 3) on the ski-simulator in Experiment 1.

Wulf, G., Höß, M., & Prinz, W. (1998). Instructions for motor learning: Differential effects of internal versus external focus of attention. *Journal of Motor Behavior*, 30(2), 169-179.

# Constrained-Action Theory

Task	Internal (Body)	External (Effect)
Balance (Wulf et al., 1998)	Moving the Feet	Moving the Platform
Jump- Reach (Wulf et al., 2007)	Focus on your finger	Focus on the rung
Swimming (Freudenheim et al., 2010)	Pushing hands back	Pushing water back
Golf putt (Bell & Hardy, 2009)	Movement of your hands	Movement of the putter head

## **Focus of Attention Studies in Music**

Duke, R. A., Cash, C. D., & Allen, S. E. (2011). Focus of Attention Affects Performance of Motor Skills in Music. *Journal of Research in Music Education*, 59(1), 44–55.

Atkins, R. L., & Duke, R. A. (2013). Changes in tone production as a function of focus of attention in untrained singers. *International Journal of Research in Choral Singing*, 4(2), 28–36.

# Purpose

In what ways and to what extent is the tone quality of trained singers affected by their focus of attention while singing?

How do I measure the changes in tone quality?

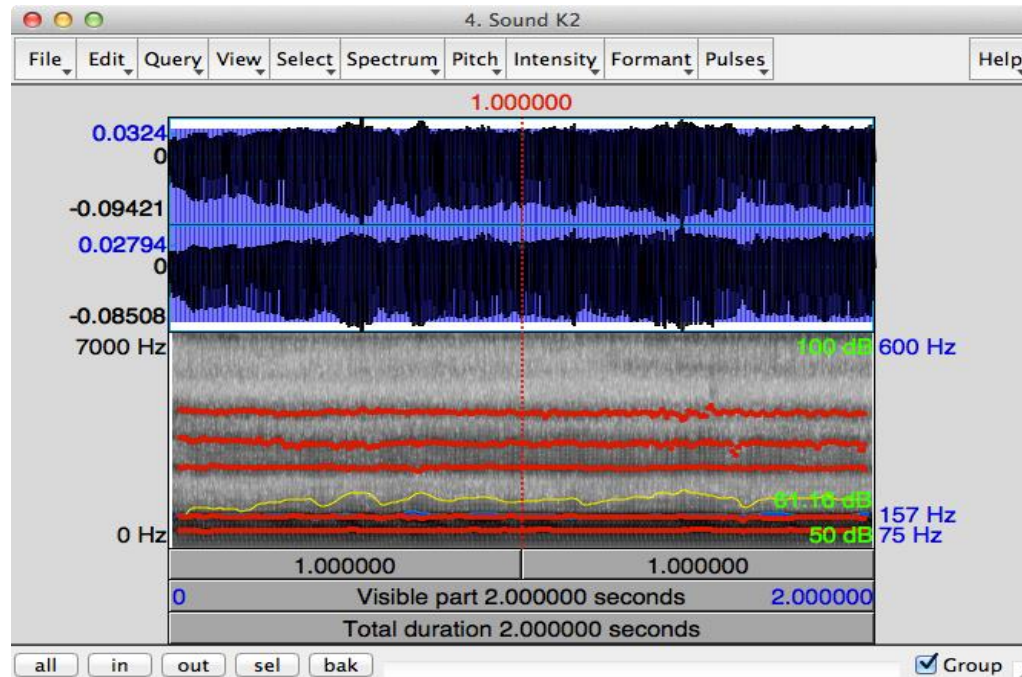


Method:  
( $N = 11$ )  
[ $\alpha$ ] vowel  
Solo piece

Conditions  
Baseline  
Soft Palate  
Vibrato  
Microphone  
Music Stand  
Point on wall

# Acoustic Analysis

- Harmonic-to-noise ratio
- Decibel level
- Formant Measurements: F5-F4, F5-F3, SPR (Singing Power Ratio)



Boersma, P., & Weenink, D. (2011). Praat (Version 5.2.26). Retrieved from <http://www.praat.org>

**Resonance/ring**

good ring (+)  
 more ring (+)  
 warmth (+)  
 resonance (+)  
 balanced tone (+)  
 full voice (+)  
 energized (+)  
 supported (+)  
 round (+)  
 some ring (n)  
 no deep overtones (-)  
 no firm tone (-)  
 thin (-)  
 less resonance (-)  
 less ring (-)  
 consistent (+)\*  
 inconsistent (-)\*

**Intonation**

consistent (+)  
 good (+)  
 problems (-)  
 sharp (-)  
 flat (-)  
 wobble (-)  
 scooping (-)  
 inconsistent (-)

**Freedom**

open (+)  
 relaxed (+)  
 natural (+)  
 free (+)  
 strident (-)  
 tight (-)  
 nasal (-)  
 pressed (-)  
 forced (-)  
 pushed (-)  
 harsh (-)

**Support**

undersupported (-)  
 less supported (-)  
 weak (-)  
 tentative (-)  
 softer (-)

**Breathiness**

less breathy (+)  
 breathy (-)

**Noise**

less noise (+)  
 less buzz (+)  
 gravelly (-)  
 hiss (-)  
 noisy (-)  
 scratchy (-)  
 less clear tone (-)  
 buzz (-)

**Air Flow\***

consistent (+)  
 inconsistent (-)  
 wavery (-)

**Expression\***

legato (+)  
 nice line (+)  
 choppy line (-)

**Vibrato**

consistent (+)  
 inconsistent (-)  
 straight tone (-)

**Color**

bright (+)  
 over bright (-)  
 less bright (+)  
 bright (n)  
 dark (n)  
 dark (+)  
 darker (-)  
 swallowed (-)  
 hollow (-)  
 over-covered (-)  
 dropped soft palate (-)

**Diction**

consistent vowel (+)  
 good vowel (+)  
 dark vowel (+, -, n)  
 bright vowel (+, -, n)  
 over-bright (-)  
 elongated vowels \*(+)  
 over-enunciated\* (-)  
 vowel problems\* (-)  
 vowels pop out\* (-)  
 shadow vowels\* (-)



*Number of positive, neutral, and negative descriptors in each condition for every participant in the solo piece performances*

	Baseline	Vibrato	Soft Palate	Mic (near)	Stand (middle)	Point (far)
Participant	+ N -	+ N -	+ N -	+ N -	+ N -	+ N -
A*	3 2 1	3 1 2	1 3 1	2 3 4	5 2 0	6 1 2
B	8 4 2	2 1 5	3 1 2	3 2 6	8 1 0	2 1 4
C	2 1 5	9 0 0	4 0 2	4 0 4	1 1 6	0 2 5
D	1 2 6	5 2 2	7 3 1	2 1 3	2 1 9	2 1 6
E	2 0 6	0 0 6	6 0 2	3 1 3	6 1 4	10 1 3
F*	1 1 7	0 1 5	3 2 4	4 2 4	4 3 2	5 0 2
H*	0 3 7	1 1 8	3 0 4	3 3 3	3 1 1	10 1 0
I	1 0 7	2 0 5	8 0 1	1 1 6	3 1 4	2 1 3
J	4 3 3	1 2 3	1 1 6	8 0 3	3 2 3	2 0 6
K	1 2 6	5 0 2	2 1 7	0 0 6	4 1 2	7 1 0
L	2 1 4	1 1 5	5 0 4	0 0 7	8 1 1	5 0 3

\*Listeners commented that performances in all conditions were highly similar. Boxes indicate predominately positive assessments in overall tone production. Shadowed boxes indicate predominately negative assessments in overall tone production. Numbers only (no boxes) indicate the WAV files in which the listeners' assessments were not predominately positive or negative.

## Number of times positive descriptors were used in the solo piece descriptions

Tone Quality Descriptor	Baseline	Internal Focus		External Focus		
		Vibrato	Soft Palate	Mic (near)	Stand (middle)	Point (far)
<b>Positive Descriptors</b>						
resonance/ring	1	4	1	2	4	8
free	1	0	0	0	1	0
less breathy	0	0	1	0	0	0
better supported	0	0	1	0	0	0
consistent air flow	0	0	0	0	3	0
consistent vibrato	0	1	1	0	1	2
elongated vowels/legato	0	1	2	2	2	2
balanced	1	0	2	0	1	0
<b>Total Positives (<i>n</i> = 44)</b>	<b>3</b>	<b>6</b>	<b>8</b>	<b>4</b>	<b>12</b>	<b>12</b>

## Number of times negative descriptors were used in the solo piece descriptions

Tone Quality Descriptor	Baseline	Internal Focus		External Focus		
		Vibrato	Soft Palate	Mic (near)	Stand (middle)	Point (far)
<b>Negative Descriptors</b>						
tight/strident/pushed	2	2	1	3	2	4
buzz noise	0	0	0	1	0	0
breathy	3	0	0	0	0	0
less resonance/ring	3	1	1	1	0	0
undersupported	1	0	3	2	0	0
darker/swallowed	2	2	2	2	0	0
over-bright	1	2	0	1	0	1
inconsistent intonation	3	1	1	1	0	0
inconsistent vibrato/straight	2	1	1	1	1	0
inconsistent air flow	0	0	0	2	0	0
inconsistent resonance	2	0	1	1	1	0
choppy/non-legato	0	0	0	0	0	1
overarticulated	0	1	0	0	0	1
<b>Total Negatives (n = 65)</b>	<b>19</b>	<b>10</b>	<b>10</b>	<b>15</b>	<b>4</b>	<b>7</b>

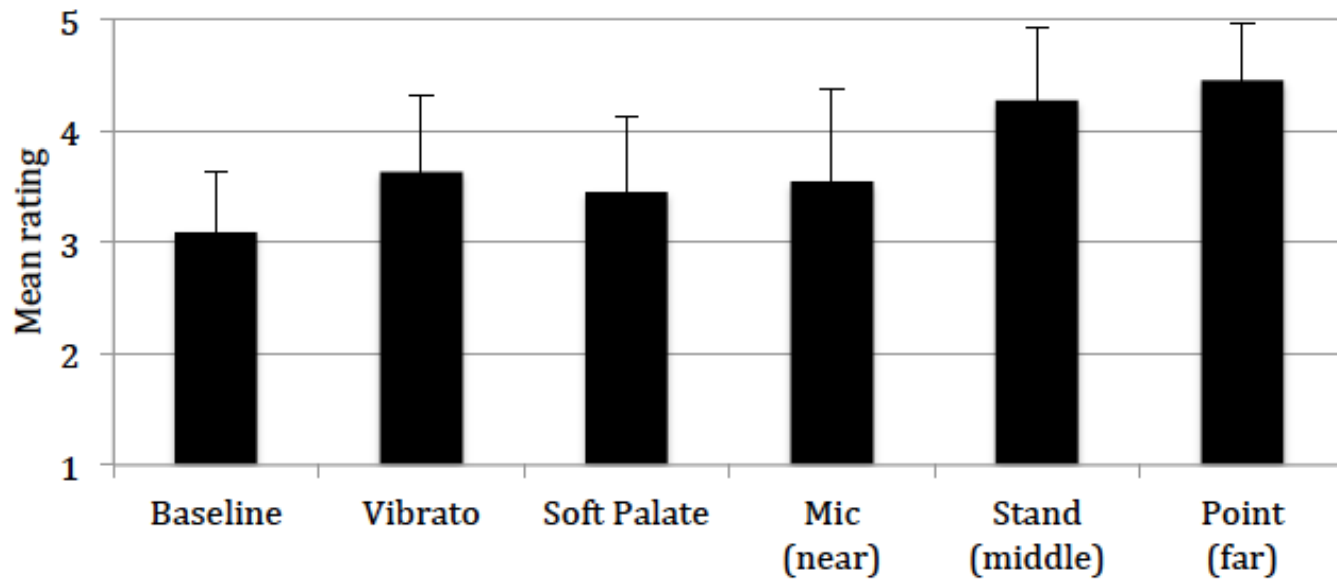
Total number of positive and negative descriptors were used by expert listeners in the solo piece descriptions

Tone Quality Descriptor	Baseline	Internal Focus		External Focus		
		Vibrato	Soft Palate	Mic (near)	Stand (middle)	Point (far)
Total Positives ( <i>n</i> = 44)	3	6	8	4	12	12
Total Negatives ( <i>n</i> = 65)	19	10	10	15	4	7

<b>Ring (brilliance of tone)</b>				
1	2	3	4	5
No Ring				Nice Ring
<b>Evenness throughout the range (ability to sing freely throughout the pitch and dynamic range without inappropriate change in voice quality) SOLO PIECES ONLY</b>				
1	2	3	4	5
uneven air/resonance				even air/resonance
<b>Freedom of Tone (voice quality that is free and natural, without strain)</b>				
1	2	3	4	5
pressed/pushed				natural/free
<b>Color</b>				
1 (-)	2	3 (+)	4	5 (-)
over-dark/covered	dark	balanced	bright	over-bright
<b>Intonation (singing in tune) SOLO PIECES ONLY</b>				
1	2	3	4	5
inconsistent				consistent
<b>Vibrato (regular and smooth undulation of frequency of the tone)</b>				
1	2	3	4	5
inconsistent				consistent
<b>Overall Vocal Quality (an overall rating of the aesthetic and technical quality compared to the other 6 conditions – there may be ties.)</b>				
1	2	3	4	5
poor				superior

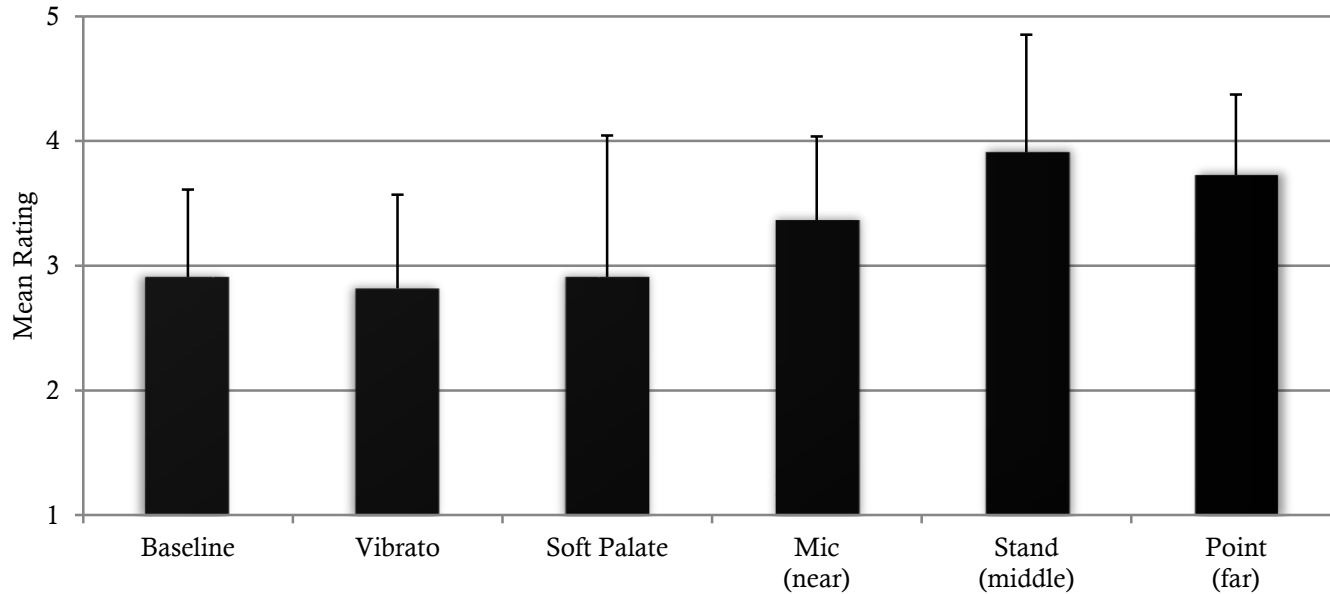
**Figure 4.1. Rating instrument**

## Ratings for *Ring* in the Solo Performances



*Figure 3.5.* Mean solo piece performance ratings for *Ring* in the 6 focus of attention conditions. Errors bars represent  $\pm 1$  standard deviation. Scale anchors: 1 = no ring, 5 = nice ring.

## Ratings for *Overall* in the Solo Performances



*Figure 3.6.* Mean solo piece performance ratings for *Overall* in the 6 focus of attention conditions. Errors bars represent  $\pm 1$  standard. Scale anchors: 1 = poor, 5 = superior.



Conditions:

Baseline

Vibrato

Soft Palate

Near distance (Tripod 18")

Middle Distance

(Chair/Stand)

Far Distance (Point)

Fill the Room



# It's All About Ring/Resonance!

Method:

( $N = 20$ )

[ $\alpha$ ] vowel (lower pitch)

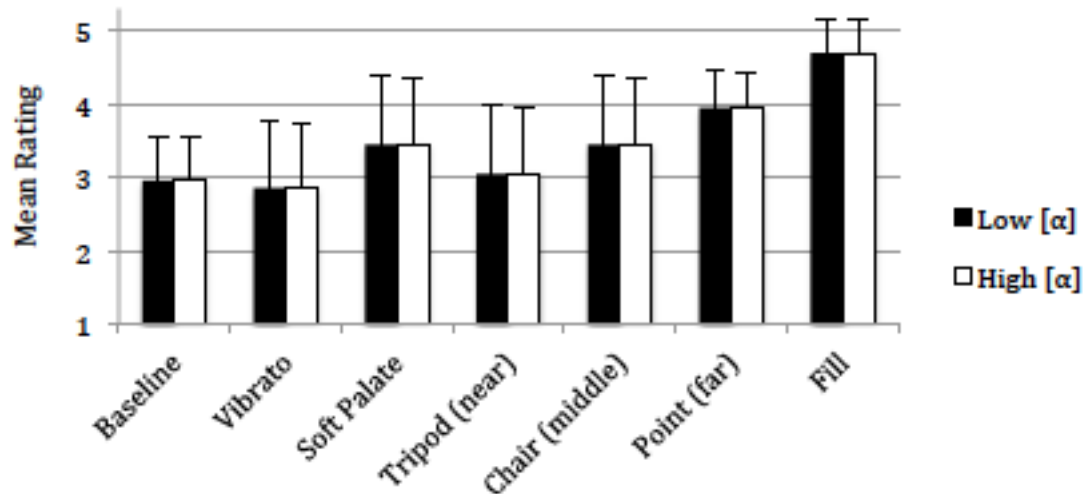
[ $\alpha$ ] vowel (higher pitch)

Solo piece

“My Country Tis of Thee”

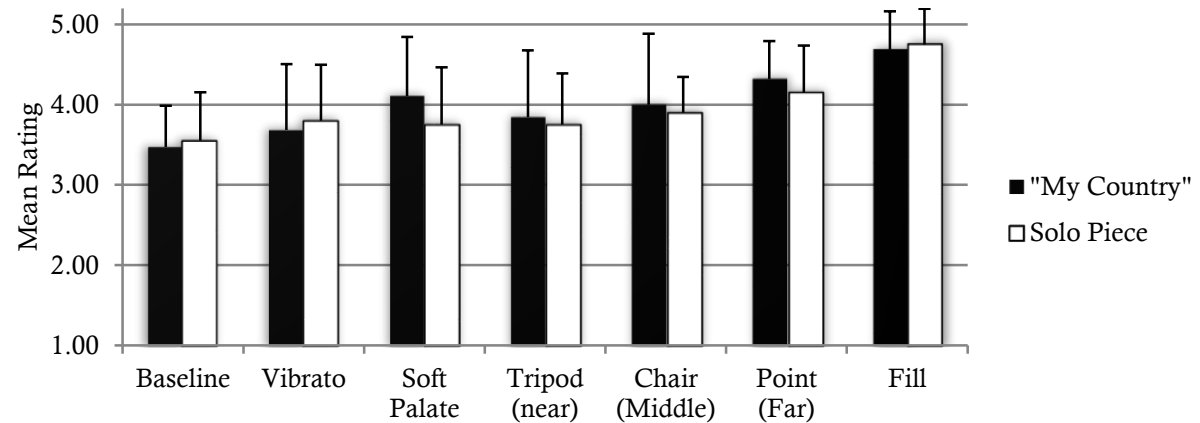
Evaluations of *Ring* and *Overall Vocal Quality* were significantly affected by conditions.

## Exp 2: Vowel Evaluations of Ring



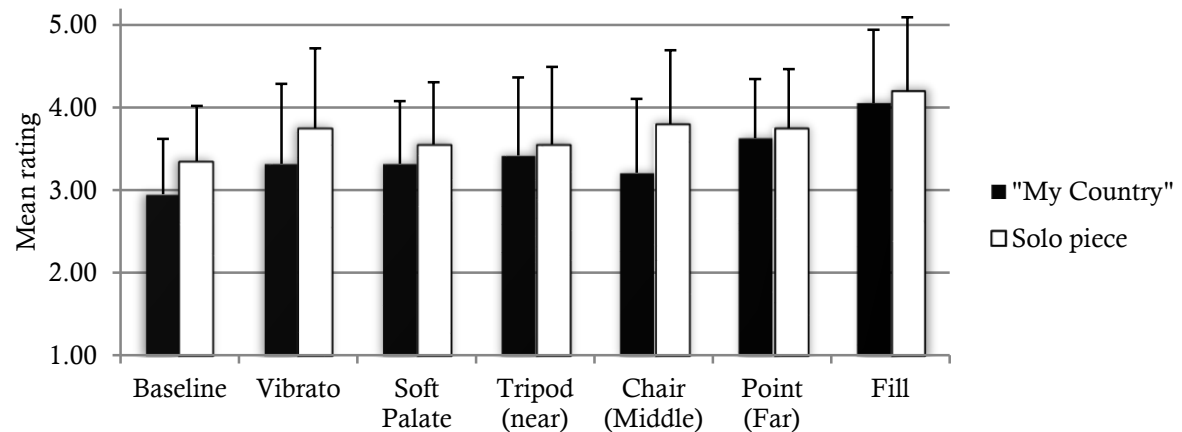
*Figure 4.2.* Mean low and high pitch [α] vowel performance rating for *Ring* in the 7 focus of attention instructions. Error bars represent  $\pm 1$  standard deviation. Scale anchors: 1 = no ring, 5 = nice ring.

## Exp 2: Solo Piece and “My Country...” Evaluations of Ring



*Figure 4.4.* Mean “My Country Tis of Thee”(black) and the Solo Piece (white) performance variable for *Ring* in the seven focus of attention instructions. Error bars are  $\pm 1$  standard deviation. Scale anchors: 1 = no ring, 5 = nice ring

## Exp 2: Solo Piece and “My Country...” Evaluations of Overall Vocal Quality



*Figure 4.5.* Mean “My Country Tis of Thee”(black) and the Solo Piece (white) performance variable for *Overall* in the seven focus of attention instructions. Error bars are  $\pm 1$  standard deviation. Scale anchors: 1 = poor, 5 = excellent

**Trained Singers: (N = 20)**

[α] vowel:- *Ring, Overall*

Solo piece – *Ring, Overall, Vibrato, Evenness*

“My Country Tis of Thee” – *Ring, Overall, Vibrato,  
Intonation, Color*

## It's All About Ring/Resonance!

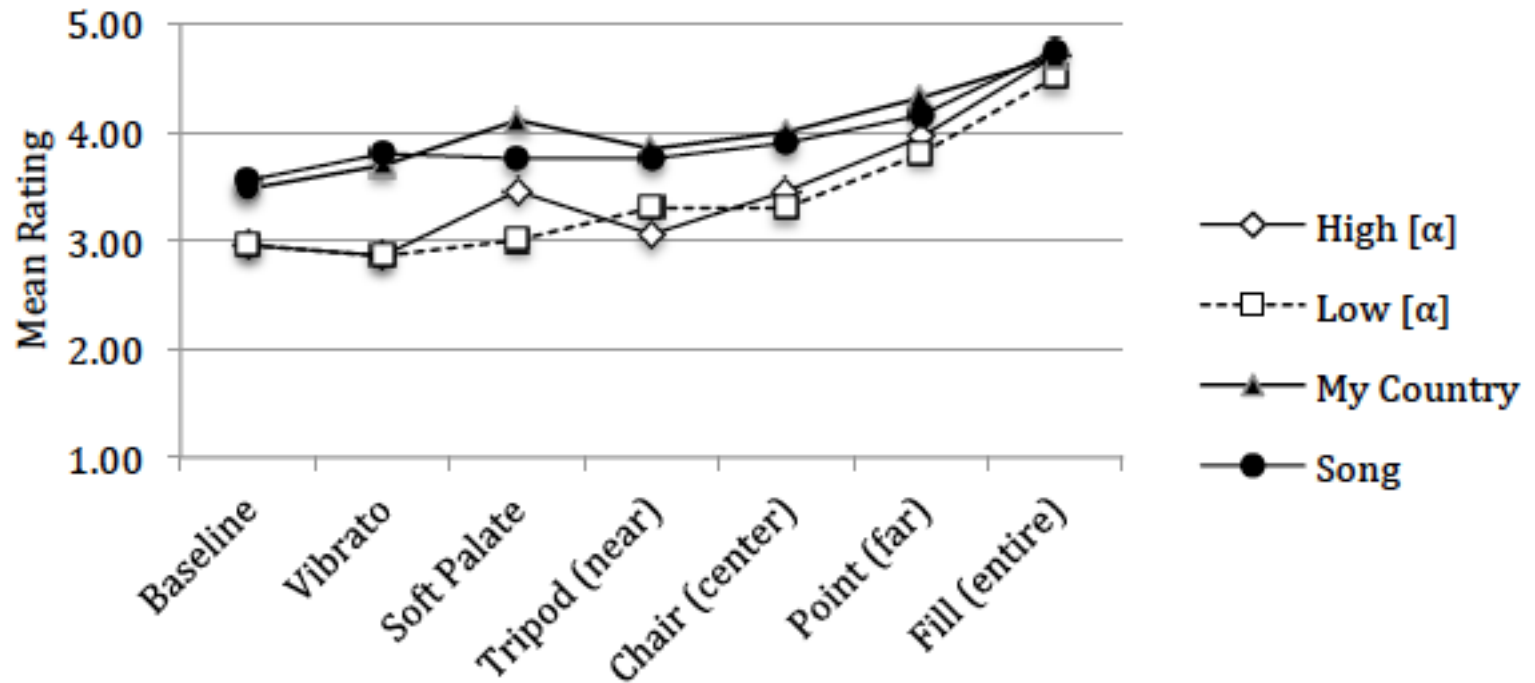


Figure 4.13. Mean ratings for *Ring* in all singing tasks.

*Evaluating trained singers tone quality and the effect of  
changing focus of attention on performance*

Rebecca L. Atkins  
University of Tennessee at Chattanooga  
Music Department



**RCIO 2015: Performance (good, bad, and ugly)**  
11th Annual River Cities I-O Psychology Conference  
October 23 and 24, 2015  
The University of Tennessee at Chattanooga

