2nd Symposium:
The Acoustics of Ancient Theatres
July 6-8, 2022,
Palazzo Gran Guardia, Verona, Italy

CHOIR CONDUCTORS: VOICE AND ACOUSTIC ENVIRONMENT

Baiba Trinite – baiba.trinite@liepu.lv
Voice and Speech Research Laboratory
Liepaja University, Latvia

FLPP
FUNDAMENTĀLIE UN LIETIŠĶIE PĒTĪJUMU PROJEKTI

KORDIRIĢENTU VOKĀLĀS SLODZES NOTEIKŠANA BALSS ERGONOMIKAS KONTEKSTĀ
Projekta Nr. lzp-2020/2-0250

The Acoustics of Ancient Theatres

SCIENTIFIC GROUP







INTRODUCTION

- Project “An investigation of vocal load in choir conductors in context of voice ergonomics”
- Choirs in Latvia – 425
- Choir conductors represent a voice profession and have a high risk of voice disorders
- Specific working environment: rehearsal rooms of different sizes and acoustics
- The conductor’s voice is produced in response to a particular rehearsal conditions

STUDY DESIGN

I
Voice ergonomic survey

- N = 155
- Questionnaire:
  - Voice ergonomics (noise & reverberation)
  - Vocal health self-assessment scales (VSS, VHI-10, SVHI-10)

II
Vocal load study

- N = 18
- Voice dosimetry: vocal doses ($D_{t\%}$, D_c, D_d) , LA_{eq}, LAF90
- Acoustic measurements (T_{30}), ISO 3382-1:2009

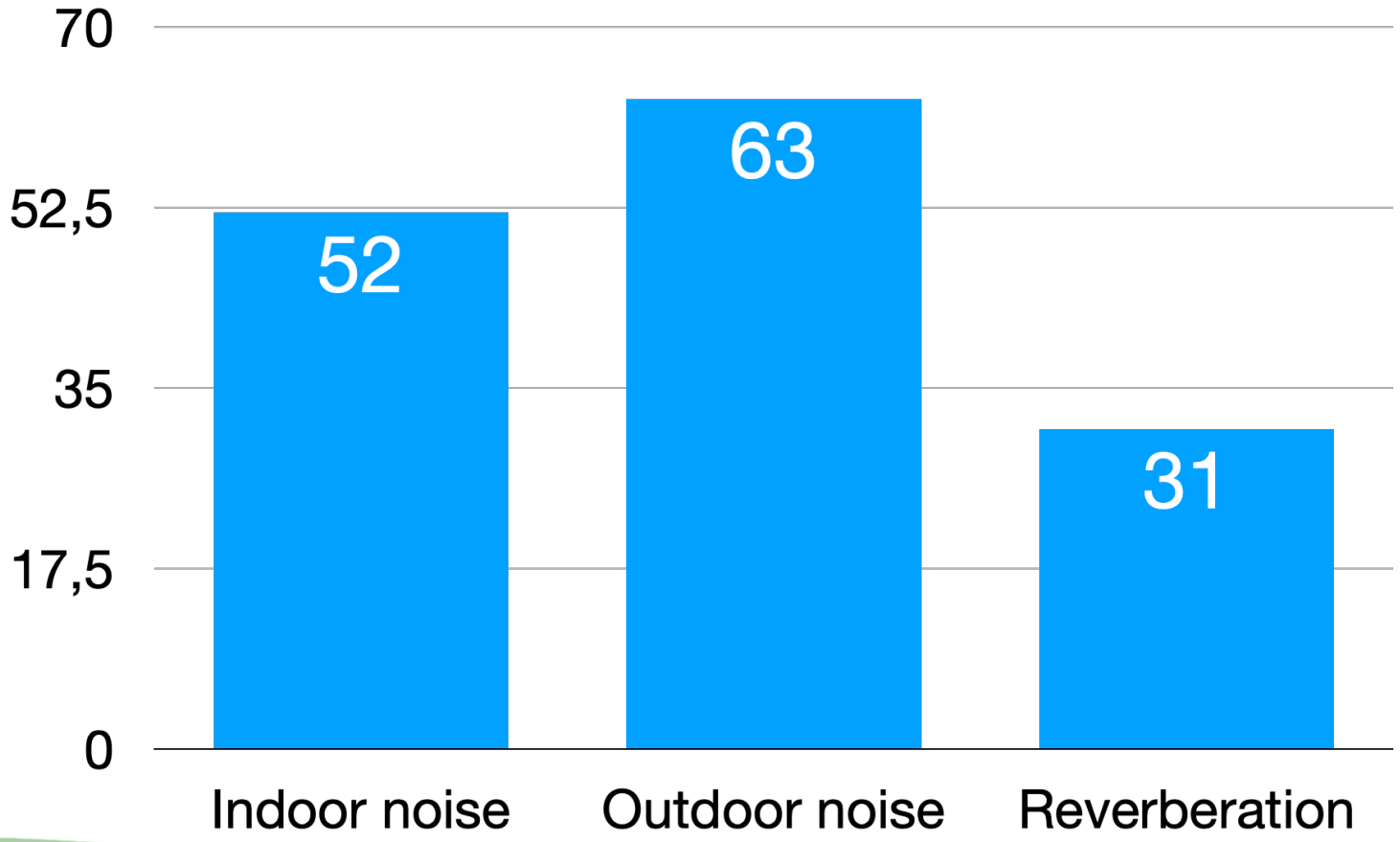
III
Interviews

- N = 6
- Aim: to investigate the choir conductor's unique individual experience of working with the choir within the context of voice ergonomics

SURVEY RESULTS

SUB-STUDY I

NOISE & REHEARSALS ROOM ACOUSTICS (% OF RESPONDENTS)



Indoor noise sources
Ventilation 26%
Lamps 24%
Air conditioner 11.5%

Outdoor noise sources
Traffic 31.6%
Adjacent rooms 29%
Corridor 29%

INDOOR/ OUTDOOR NOISE & ACTIVITY NOISE

- Indoor noise & activity noise during rehearsals

  $r_S = .165$, $p = .04$

- Outdoor noise & activity noise

  $r_S = .272$, $p = .001$

RELATIONSHIPS BETWEEN ACTIVITY NOISE AND VOCAL EFFORT, VOCAL FATIGUE DURING REHEARSAL, AND RESULTS OF SELF-ASSESSMENT OF VOCAL HEALTH

Variables	Activity noise	Vocal effort	Vocal fatigue	Vocal Symptom Scale	Voice Handicap Index
Activity noise	1				
Vocal effort	.399**	1			
Vocal fatigue	.344**	.659**	1		
Vocal Symptom Scale	.254**	.458**	.506**	1	
Voice Handicap Index	.267**	.325**	.300**	.467**	1
Singing Voice Handicap Index	.318**	.213**	.374**	.444**	.683**

** Correlation is significant at the 0.01 level (2-tailed)

RESULTS: VOCAL LOADING EXPERIMENT

SUB-STUDY II

REHEARSAL ROOMS ACOUSTICS (N = 21)

Small (N = 7)
45-200 m^2

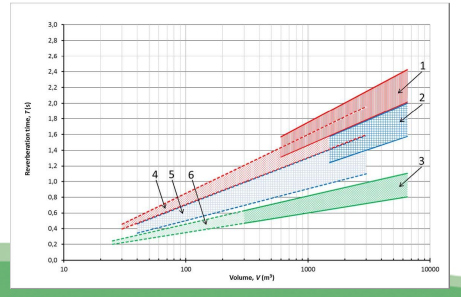
$T30_{0.5\text{-}1kHz}$ = 0.88 s (SD = 0.47)

Medium (N = 4)
> 200 m^2

$T30_{0.5\text{-}1kHz}$ = 1.43 s (SD = 0.29)

Large (N = 10)
> 700 m^2

$T30_{0.5\text{-}1kHz}$ = 1.86 s (SD = 0.72)



The RT complied with the normative for quiet music in rehearsal rooms according to the NS 08178 in 33% of rooms

3 (43%)

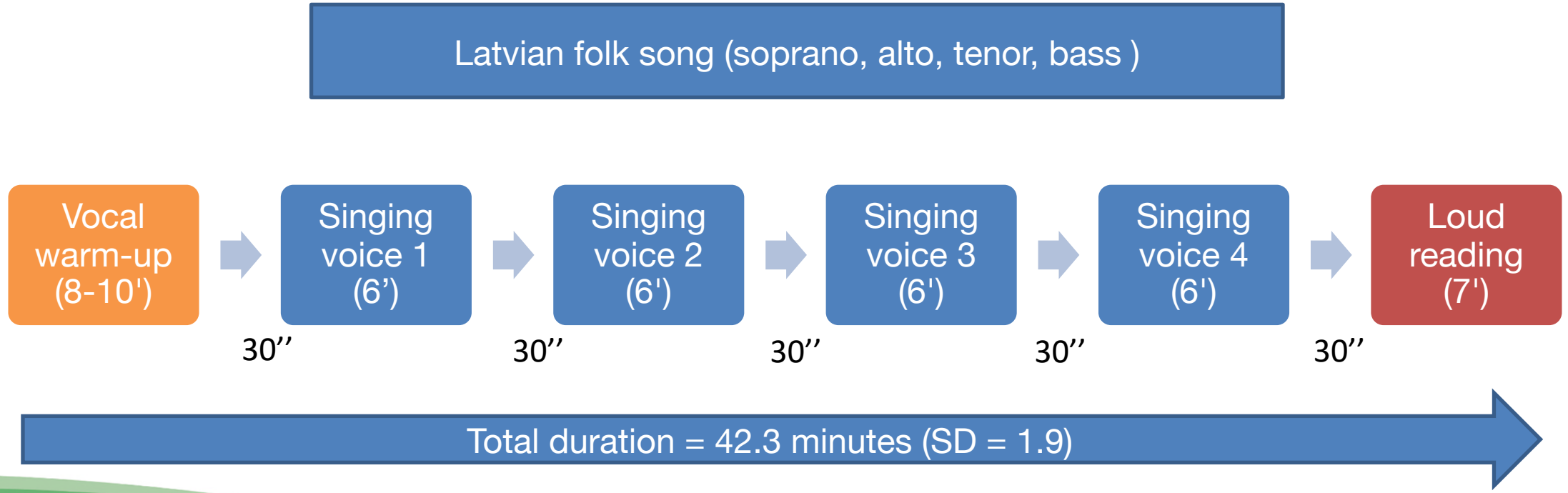
2 (50%)

2 (20%)

NS (Norwegian Standard). *NS 8178:2014. Acoustic Criteria for Rooms and Spaces for Music Rehearsal and Performance*; 2014

VOICE DOSIMETRY IN CONDUCTORS

- Vocal load expressed in $D_{t\%}$, D_c, and D_d was investigated during different vocal loading tasks



RESULTS. VOICE DOSIMETRY IN CONDUCTORS

- There were **no associations** between the average amount of vocal doses during different vocal loading tasks and LA_{eq}, T_{30}, and rooms' volume
- Females:

  r = .648, p = .017 between LAF90 and $D_{t\%}$ (singing)

  r = .643, p = .018 between LAF90 and D_c (singing)
- Males:

  r = .900, p = .037 between LAF90 and D_d (singing)

RESULTS: INTERVIEWS WITH CONDUCTORS

SUB-STUDY III

QUOTES FROM INTERVIEWS

- “Any room is suitable for singing”
- “In rooms with bad acoustics, singers must learn to subject rooms to their need”
- “It is easy to sing in rooms with good acoustics, but the conductor does not understand the singers’ contribution to the singing”
- ”The singing technique and professionalism of singers is important for giving performances in all kinds of rooms”
- “The better the room sounds, the less effort is needed; the worse acoustics – more strain in a voice”

Listeners' perspective

A choir can compensate for bad acoustics and improve the quality of performance by singing technique, singers' professionality, and choir location

Room acoustics

Conductor's perspective

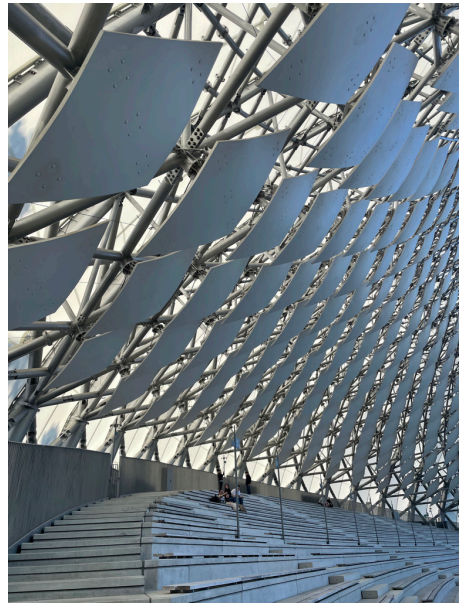
Artistic ambitions and goals were priorities for conductors leaving behind the acoustical and health factors

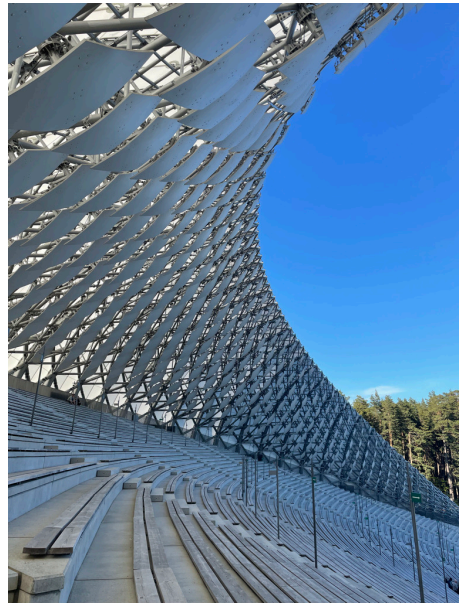
Singers' perspective

The worse is room acoustic, the more effort during singing is perceived to be required

CONCLUSIONS

- A partial discrepancy between objective and subjective results regarding interaction between vocal load and rehearsal rooms acoustics
- The subjective measurements confirmed that high background noise and long reverberation time increase vocal effort and cause fatigue in choir conductors
- The rehearsal room volume and length of reverberation time did not impact vocal parameters during vocal loading
- The reverberation time in many rehearsal rooms does not meet the norms specified in the NS 8178:2014
- The basics of voice ergonomics and room acoustics should be included in choir conductors' educational programs.





SILVER GROVE ON SONG HILL

Stage height 35.8 m; 510 acoustic sheets

12 870 singers, 30 000 < seats

Latvian Song Festival – 30.06-9.07.2023