

A STUDY ON LATVIAN CHOIR CONDUCTORS' PROFESSIONAL EXPERIENCE IN THE ASPECT OF VOICE ERGONOMICS

Ilze VALCE, Baiba TRINĪTE, Olga BLAUZDE, Mirdza PAIPARE, Dina BARUTE, Madara IVANE, Anete KRŪZA & Dina SLEŽE

*University of Liepaja, Latvia
e-mail: ilze.valce@liepu.lv*

Abstract

Voice ergonomics considers the load issues and identifies physical and emotional factors that affect voice quality. Therefore, voice ergonomics can be studied in the aspect of a physical load as well as in cognitive and organisational aspects.

This study aims to explore the choir conductors' unique individual experience obtained in their professional work with choirs within the context of voice ergonomics.

This study was qualitative research, where data were obtained by individual semi-structured interviews. The research involved six well-known choir conductors with a long professional experience conducting professional and non-professional choirs of different ages and a broad pedagogical work experience in music. The method of thematic analysis was employed for analysing interview outcomes.

Interview answers were structured and analysed in such thematic fields as use of voice and a vocal load, vocal fatigue, body posture, knowledge and understanding about voice ergonomics, organisation of rehearsal processes, and room environment. Conclusion: the main factors affecting the quality of voice sounding were an increased vocal load, fatigue, stress, body posture and air quality of rooms.

Keywords: *voice ergonomics, choir conductors, vocal load, vocal fatigue, stress, physical ergonomics, cognitive ergonomics, organisational ergonomics*

Introduction

The length of a human's life and capacity to work has considerably increased, and one of the critical issues of contemporary society is how to maintain good health, quality of life and work as long as possible. The responsibility for the quality of daily and working life lies on a person himself/herself, and the employer's understanding of employees' work environment conditions and factors impacting health and abilities to work. Any profession and work have specific factors that influence their employees' comfort and health. The branch of science, called ergonomics, is concerned with studying and analysing a human being at work.

Research on voice ergonomics was started in the 70s the previous century. The interrelations between voice and a working environment have been studied within the context of specific professions, factors influencing the vocal load and improvement of working conditions (Rantala & Vilkmann, 1999; Simberg et al., 2005; Ilomaki et al., 2008; Geneid et al., 2009; Holmqvist et al., 2013; Vertanen-Greis et al., 2020). The analysis of scientific literature in the field of voice ergonomics showed that there is a lack of studies about choral conductors. Some studies investigated vocal load in choir conductors (Rehder & Behlau, 2008; Geraldo & Fiorini, 2021). Furthermore, we did not find that these studies used the interview method to collect data.

The current study is a follow-up after the survey conducted in 2021, which analysed choir conductors' knowledge about voice ergonomics and risk factors of voice disorders (Trinite et al., 2021). The survey results provided a general outline of possible risks for conductors' voices but did not respond to how the voice ergonomics knowledge could be implemented in their working practice. Thus, the case study aimed to explore the choir conductors' unique individual experiences obtained in their professional work with choirs within the context of voice ergonomics.

The research problems were: (1) what factors of physical ergonomics do conductors face, and how do they affect their voices; (2) what is the role of psychosocial environment and voice ergonomic knowledge in conductors' professional life; (3) do organisation of rehearsals and physical environment of rehearsal rooms have an impact on conductors' voices.

Background

The term *ergonomics* was coined in the middle of the 19th century, and up to the present time in different fields, it is used most frequently concerning employees' working abilities and issues of labour safety in order to establish methods for maintaining employees' working abilities, improving their working conditions and labour productivity, as well as increasing work quality (Kaļķis, 2021). Ergonomics is a cross-branch science, which is frequently called the science of well-being and comfort, since its focus is a broad concept of health, embracing human's physical, mental and social health and its interaction with the environment.

The work environment observation from speaking, voice production, speech hearing and speech recognition aspects are studied by voice ergonomics, which is one of the fields of ergonomics and occupational health (Sala, Rantala & Simberg, 2019; Trinite et al., 2021). Knowledge about voice ergonomics and its daily use is essential for those who use voice as the main instrument of the work. Sala, Rantala & Simberg (2019) suggest using two terms – professional voice users (singers, actors) and occupational voice users (teachers, trainers, sales-persons). The voice itself is a message for professional voice users, an instrument whose sounding gives other people pleasure. However, for the occupational voice users, voice is an instrument conveying some message; it is a means of work and not the result. Choir conductors are between professional and occupational voice users since they simultaneously use speaking and singing voices during rehearsals. Ārijs Šķepasts, a Latvian conductor, singer and composer, considers that singing voice compensates what words cannot express. For example, the conductor first demonstrates the composition by voice and then explains his vision in words (Sarunas ar diriģentiem, 2022). Therefore, it gives good reason to consider that conductors represent speaking and singing voice professionals (Chitguppi et al., 2018).

Physical, cognitive, and organisational ergonomics study human functioning in a specific work environment (Kałkıs, 2021). Voice production is one of the activities necessary to carry out specific professional tasks; therefore, all these three aspects of ergonomics can be applied to the field of voice ergonomics.

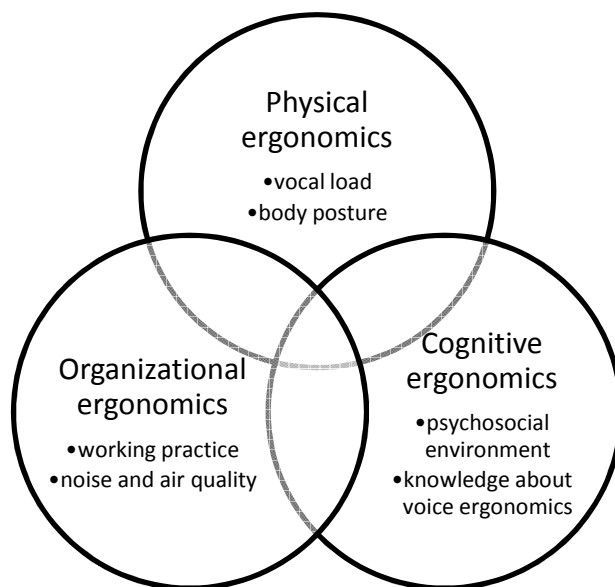


Figure 1. Types of voice ergonomics and its characteristics components

Physical ergonomics is about the human body's responses to physical work demands (Kałkıs, 2021). While fulfilling his/her job duties, the human's body adapts to specific working conditions, thereby loading substantial parts of the body and increasing the load of the functions related to this muscle-skeletal system.

Poor body posture and high vocal load during conducting are the factors that might contribute to losing the conductor's physical and psychological working abilities. The conductor's voice must be flexible; it must be like a well-tuned instrument. The transitions from speaking to singing take place many times during rehearsals. The spoken voice conveys instructions, explains style characteristics, and works on text pronunciation. The sung voice provides examples of different voice characteristics to the singers (Rehder & Behlau, 2008).

Moreover, to teach vocal parts to all voice groups in the choir, a conductor or a choirmaster demonstrates singing samples by the voice, switching between vocal registers, changing dynamics in the variation of loudness, and adapting different singing styles (Trinite et al., 2021). The choir conductors also improve diction and develop the ability to simultaneously form pitch and text in the given tessitura. A healthy voice is a necessary prerequisite to tolerate the multiformity of these vocal activities for a long time.

A physical load during conducting is related to body posture. The conductor's posture is his/her visiting card, and therefore it must be relaxed and at the same time also steady and stable. A conductor must have stable support on both feet, and the head must be held in a natural, free position with a look straight forward, without tensing cervical muscles (Lindenbergs, Baltiņš & Rasmanis, 2012; Marnauza & Bašs, 2012). Daley et al. (2020) consider that a critical element of a conductor's dynamic posture relates to the sense of sight. Head, shoulder, and upper body movements are constantly alternating

eye contact between an ensemble and a score. The score usually is positioned at a lower visual field, whereas the choir is at eye level or above (Daley et al., 2020). Alternately following singers and note materials, the conductor's body posture, including the position of a head, must be comfortable not to create tension in some muscular groups. The conductor's and singers' voice quality depends on body posture and head position during singing. The role of the body in voice production was studied by Vainio (2018), who collected the responses from teachers who completed the Voice Pilate course developing physical and mental associations between posture alignment and voice. The positive feedback from study participants confirmed that holistic awareness that voice is an integral part of the body improved vocal quality, at least at the level of subjective answers (Vainio, 2018). A conductor should take care also of singers whose dominant body positions during rehearsals or concerts are sitting or standing. Therefore, regular breaks with physical activities during rehearsals are highly recommendable for preventing singers' voices from fatigue or 'becoming squeezed'.

Prolonged, repetitive non-ergonomic postures negatively impact the body's muscular system (Daley et al., 2020). In addition, the tension in some parts of the body, such as shoulders or knees, leads to muscle imbalance. Thus, conductors may be susceptible to a musculoskeletal injury involving the back, neck and shoulders (Brandfonbrener, 1999; Smith & Sataloff, 2013). The vocal specialist and singer Zane Šmite maintains that for reaching a balanced vocal load, every singer must try to find one's best sound with the minimum of effort, effectively changing aerodynamic energy into the acoustic one (Šmite, 2020).

In the last decades, significant attention has been paid to the work environment's cognitive and psychosocial factors, including human knowledge, skills and competencies about workplace ergonomics, sociopsychological microclimate, and stress. Cognitive ergonomics analyses cognitive, psychological and behavioural processes during work (Kaļķis, 2021).

The conductor's professional duties are closely related to a tremendous mental load and involve various cognitive processes. Conducting is based on inner, intellectual processes. The voice is one of the conductor's work tools; another is the singers. Singing is the principal choir's working form, and it takes place during rehearsals and concert performances. Consequently, the conductor should have professional knowledge about vocal training, a good ear for music (melodic, harmonic, intonational, and timbral), a good memory, attention and ability to concentrate (Marnauza & Bašs, 2012). The conductor's activity at rehearsals and concerts is multi-modal. The conductor leads the singers by gestures, body and head movements, eyesight and facial expressions, and simultaneously the conductor has to follow the melody, rhythm, tempo and expressive intensity of the composition, the vocal balance and message of a musical piece (Ashley, 2000; Poggi & Ansani, 2017). Besides, conductors, like all other musicians and artists, must be competent in diverse styles of music and esthetics, which are an inseparable part of revealing the artistic content (Znutiņš, 2004; Lindenbergs, Baltiņš & Rasmanis, 2012; Batņa, 2015). The inability to manage and organise this great psychoemotional load can impact the voice quality. Stress increases the number of vocal symptoms and creates a risk of vocal disorders (Holmqvist et al., 2013; Vertanen-Greis et al., 2020).

Human health is tightly related to general well-being, which can be influenced by the internal sociopsychological microclimate of the choir and the conductor's communication with choral singers during rehearsals (discipline, mutual understanding, and general atmosphere). An outstanding and artistically emotional experience during

the performance depends not only on a perfectly prepared composition but also on mutual relationships between singers at the rehearsals. Daily engaging activities (e.g., informal gatherings) involving all singers enhance a positive atmosphere in the choir and create more cohesive singing in a concert.

Cognitive ergonomics includes the conductor's knowledge about voice ergonomics and applying this knowledge in daily practice. A conductor is the artistic leader of the choir, an authority, adviser, and inspirer. Comprehensive knowledge about voice ergonomics combined with an empiric conductor's experience raises awareness about the necessity of using this knowledge in practice. The observation of the effectiveness of ergonomic strategies in practice demonstrates that a definite action produces a definite result. The improving voice quality strengthens motivation to continue following voice ergonomics rules and transform healthy voice use as a habit. Moreover, if a conductor is convinced that these recommendations are effective, he/she will actively introduce them to singers. In some respect, a conductor is responsible for the quality of his/her own voice and singers' voices.

Organisational ergonomics refers to providing harmonised work environment. This issue is attributable to conductors because they are leaders of a choir who have to deal with artistic choices and organisational challenges. In addition, organisational ergonomics involves working practice during rehearsals and concerts and noise and air quality issues in the rehearsal or performance rooms.

The results of the conductors' survey about voice ergonomics demonstrated that quite often, choir conductors have more than one rehearsal a day, especially in cases when they are conductors of several choirs or work as music teachers in some educational institutions (Trinite et al., 2021). The schedule of rehearsals must be carefully planned and breaks between rehearsals should be provided to avoid voice overloading. Short pauses providing vocal rest should be envisaged during rehearsals. Overuse of voice caused by an intensive schedule of rehearsals neglecting vocal rest can impact the larynx's tissues and result in vocal fatigue. A voice user needs some time to recover the voice after the vocal load. According to Hunter and Titze (2009), after two hours of vocal loading, a 50% recovery occurred within 4–6 hours; 90 per cent recovery occurred within 12–18 hours. A conductor is supposed to take care of singers' voices and, therefore, must proportionate singers' vocal load to the duration and number of rehearsals and concerts while considering the age of singers (Batņa, 2015). When planning rehearsals, the conductor must carefully weigh up all methodological techniques that can be applied to achieve the desired outcome and singers' voices would not be overloaded.

Choir rehearsals and concerts are organised in rooms of different sizes and acoustics. Therefore, assessing rehearsal rooms from the point of voice ergonomics is necessary. The survey data show that the quality of the air in the rehearsal rooms rather than the noise affects the conductor's voice quality most of all (Trinite et al., 2021). Good indoor air quality is characterised by the right room temperature, proper relative humidity, cleanness and freshness (Sala & Rantala, 2019a). In addition, dry air and insufficient hydration affect the vocal folds' mucosa, causing changes in the vocal folds' vibrational quality and promoting a vocal overloading and consequent vocal fatigue (Geneid et al., 2009). The air quality issue in rehearsal rooms was highlighted during the coronavirus disease (COVID-19) pandemic since it became known that indoors this virus spreads as drops. As a result, conductors were recommended to organise rehearsals out-of-doors or, if possible, keep doors and windows open during the rehearsal and install effective

ventilation systems in these rooms (Naunheim et al., 2021). However, working under such conditions, cold and draught pose a significant risk to the vocal health since they create muscular tension in the body. Therefore, conductors have to think about clothing suitable for the conditions under which the rehearsals are held and about breaks and loudness of voice during rehearsals.

The room acoustics plays an essential role in the general sounding of the choir. Reverberation time is one of the parameters characterising the acoustic properties of rehearsal and performance spaces. According to the Norwegian standard, the reverberation time in rehearsal rooms and performance halls must differ depending on room volume (Norwegian Standard, 2014). Noises unrelated to the artistic process would be unwelcome in rooms where rehearsals are held since the increase in background noises increases the intensity of the conductor's voice and causes discomfort (Sala & Rantala, 2019b). At rehearsals, the activity noise most often is caused by singers' chatting. During rehearsals, the activity noise might be related to the choir's internal discipline or working culture and the lack of interest and attention. Therefore, a conductor has to carefully think over the work organisation at rehearsal so that all the singers would be interested and involved in the process.

Research Method and Sample

This was a qualitative study where the primary data gathering method was semi-structured individual interviews. The interview is an interaction-based personal dialogue between a researcher and a research subject, allowing obtaining information about the reflection of theoretical findings in real life. Moreover, the 'strength of alive word' allows the researcher to clarify previously unknown aspects of the researched problem and understand the nature of the problem under research.

The interview included the following predetermined question blocks:

- Demographic data (respondent's education and conductor's and singer's work experience);
- The role of voice in conductor's work;
- Vocal load and factors affecting it;
- Knowledge about voice ergonomics and use of this knowledge;
- Physical and psychoemotional work environment.

The interviewer was allowed to change the order of questions depending on the situation during the interview. These were remote-organised interviews using the ZOOM platform. The average time allotted for the interview was an hour and a half. The audio recording was made during the interview, and its transcript was made after the interview.

The method of thematic analysis was used for the analysis of the interview content. A modified thematic analysis model (Braun & Clarke, 2006) was applied to analyse the obtained data. The first step was familiarisation with transcripts of interviews. Then, due to the relatively small amount of data, the coding and themes generating steps were merged in one. The themes were generated on the basis of the theory about three types of voice ergonomics – physical, cognitive and organisational. Then authors provided a careful review of generated themes by organising the data. Finally, the organised and selected data were compiled, and themes were defined and named.

The criteria for the participants' selection were:

- A long experience of professional work with different choirs (children, adults, professional, non-professional);
- High recognition of professional activity at a national and international level;
- Involvement in teaching music in education institutions.

Six leading internationally recognised and experienced Latvian choir conductors were invited to participate in the study. The conductors were with a deep desire to self-educate and devote themselves to choral and vocal art, and all of the invited conductors were involved in maintaining the tradition of the Song Festival. Two of the participants also were composers and arrangers, well-known in the circle of conductors; one of the participants was a conductor of a professional choir and symphonic orchestra. All the respondents taught music in schools, colleges or universities. They were males, 36–60 years old. Table 1 shows respondents' educational and professional experience. All the participants had experience of conducting joint choirs (forged of many choirs) at the Song Festival.

Table 1. Educational and professional experience of respondents

Respondent	Education (highest level)	Professional experience (years)	Choirs				
			Children	Youth	Adult	Joint	Other
R1	Master's degree in choir conducting	>20	+	+	+	+	Mixed choir of people with visual impairments
R2	Master's degree in choir conducting Master's degree in symphonic orchestra conducting	>20	+	+	+	+	Professional choir
R3	Doctoral degree in pedagogy	17	+	+	+	+	
R4	Master's degree in choir conducting	>30	+	+	+	+	
R5	Master's degree in choir conducting	>20	+	+	+	+	
R6	Master's degree in choir conducting	42	+	+	+	+	Seniors' choir

The Ethical Committee for Clinical Research of the P. Stradins Clinical University Hospital (Riga, Latvia) approved the study (No. 171220-10L). All participants gave informed consent to participate in the study and were informed about the publication of their answers.

Results

A. Factors of physical ergonomics

Vocal load

The data analysis showed that all respondents acknowledged that voice plays a significant role in conductors' professional work. Respondent R3 considered that in most cases, the conductor's voice is a decisive factor for achieving a qualitative artistic performance of the choir, especially when working with children's choirs. Interviewee R5 said: *"No verbal explanation will ever be able to replace an emotional example given by voice. [...] The conductor has to demonstrate an example – to sing it emotionally and touchingly so that the singers could perceive it. If a conductor has a good voice, musical feeling and sings well, the choir also will sound well"*.

Respondents agreed that the voice is most involved in demonstrating examples for amateur choirs, mainly when the score is acquired in parts. The conductor has to demonstrate pronunciation, way of how the music of the respective epoch or style should be performed, how to do it vocally correctly and with what kind of sound articulation (*legato, non-legato or marcato*), how to reveal dynamic, culminating, emotional and content facets of the specific composition. All respondents admitted that they teach the music material to the choir basically by using their voice. For instance: *"I demonstrate a lot. Practically, I show everything by my voice. [...] This is the fastest way to show the pronunciation and how the respective music should be performed. [...] If I ask something from the singers, I think whether I can do it. I never ask things I cannot do"* (R2).

All respondents concurred that the singing voice is used less when working with professional choir singers. However, some artistic nuances always emerge that need the conductor's demonstration, so the singers should understand the conductor's wishes. Several respondents noted that the use of the conductor's voice might depend on the staff of the professional choir and its changeability: *"Creative potential of singers' voice is very high, but the speed of how they learn the material is extremely diverse, and therefore this requires much hard work. The conductor has to work with a choir and with a group of choir singers, has to work individually and with the new singers"* (R4).

Another respondent noted that *"professional choirs also need working on their vocal so that the sounding of the ensemble would comply with conductor's wishes. Time and work required to achieve a good sounding of an ensemble are tremendous"* (R4).

The respondents shared observations that some conductors use their speaking voice more often for describing musical ideas by figurative narratives, stimulating singers' imagination. The interviewees admitted that they also use the method mentioned above, although a more effective and quicker way to achieve the choir's desired sounding is the demonstration by one's voice.

Based on the previous studies (Smith & Sataloff, 2013; Trinite et al., 2021), we concluded that the conductor's vocal load should be discussed within the context of his/her general physical and mental load. The obtained data testified that respondents' mean vocal load per day has been different – within the range of two (R5) to eight hours (A2). For example, one of the respondents (R3) described his/her working day as follows: *"My day begins at 8 a.m. [...] with choir lessons, and then I teach other subjects. There is a school choir from 2 p.m. to 4.30 p.m. [...]. Every evening from 6.30 to 9.30 I also*

have rehearsals with the choirs. The schedule shows that I finish active singing and speaking at about 10 p.m. and the next morning at 8 a.m. Then, I begin it again”.

Since in Latvia, all conductors are participating in maintaining and developing the World Non-material Cultural Heritage phenomenon – the tradition of Song Festival, many conductors, including research participants, are involved in joint choir rehearsals with a vast number of singers. The obtained data showed that chief conductors admitted that just at the rehearsals of joint school choirs, they experienced an increased vocal load and vocal fatigue after them.

The interviews with the conductors were carried out when due to the COVID-19 pandemic in Latvia, strict assemblage restrictions were introduced, and choir rehearsals could no longer take place in presence. In their answers, the conductors maintained that the process of remote rehearsals had increased their vocal load: *“If previously (before the pandemic) we had rehearsals once a week, then now each day has its lesson schedule when we have to work with singers. This is a very heavy load, which I would not have been able to bear if I did not have the experience of many-year-long physical training”* (R2). The interviews also provided contrary opinions when the conductors stated that due to the initial restrictions of the epidemic situation, the long-established regime of the use of voice, enabling to keep a voice in a ‘good form’, was deranged. As a result, irregular use of voice has changed its quality (R1, R3).

Vocal fatigue

The indicator of vocal overload is vocal fatigue which reduces the vocal load endurance and the ability to control voice loudness and pitch. The respondents admitted that a fatigued, hoarse, or aphonic conductor’s voice impacts the general sounding of a choir, especially in cases if amateur choir singers are in the habit of copying or imitating their conductor’s voice. In addition, unlike the position of a choral or solo singer, where singers usually perform compositions in a range suitable for them and think basically about the quality of their voice, then working with the choir, conductors often demonstrate singing in tessituras that do not correspond to the range of their voice. Moreover, if the choral singer’s voice may have a short rest while other parts are rehearsed, the conductor’s voice participates in the rehearsal almost without any break and keeps switching from one diapason to another, speaking and singing voices interchanging. In the answers, respondents mentioned the possible reasons causing vocal fatigue: a forced sound, singing high register sounds, a prolonged singing on transitional notes, repeated demonstrations of an ideal sound variant, too high requirements to technical or artistic performance. Several respondents admitted that most frequently, vocal fatigue develops at the initial stage of learning the artistic program: *“Voice gets tired during the process of rehearsals when we work with different groups of voices. At the beginning of learning the program, voice is used more frequently, but later less and less until the choir guesses everything from conductor’s hands and eyes”* (R1).

Some conductors associated vocal fatigue with remote rehearsals. They considered that prolonged singing at the screen provoked vocal overload. Conductor (R5) said: *“Under the present conditions, I feel vocal fatigue much more, since I have to sing parts for choral singers in audio so that they would be able to learn them remotely, or I have a rehearsal with young people in ZOOM platform where I sing for them hoping that they also sing and learn together with me. I prepare recordings for the choir, but I feel that after singing more than an hour and a half, my ‘voice ends’, there appear until unprecedented defects,*

heaviness, the tension in vocal folds, and I feel bad before the singers because I suddenly cannot demonstrate what I would like to show”.

In another answer, a conductor revealed the principal vocal fatigue reasons caused by the process of remote rehearsals – increased vocal load, singing with each singer individually and singing in a soft voice not to disturb one’s family and neighbours.

Body posture

In the context of sustaining working abilities, conductors emphasised the significance of physical training (R2, R4, and R6). They noted that the sounding of a song and its emotional fullness is reflected in the conductors’ posture and gestures. Movements of the conductor’s body mobilise singers to achieve the best sounding: *“Physical posture certainly influences conductor’s voice. I am a very emotional and expressive conductor, actively using gestures and facial expressions. When I conduct, I also want to experience catharsis, to be inside the whole process. To my mind, this also helps my singers to open out emotionally, to evoke a response in themselves, and their voices become more sonorously. If there stands an unemotional conductor in front of the choir and only wastes time, choir’s response would be 40% lesser”* (R4); *“If I stand erect, my energy grows; if I stoop, I have less energy”* (R6).

B. Factors of cognitive ergonomics

Psychosocial environment

The conductor’s leading position and responsibility for singers include a significant mental load. Therefore, the conductor should work on character traits that motivate him/her to succeed. These traits are courage, confidence, attention, diligence, equability, mood stability, self-discipline, will. Such character traits contribute to developing the proper habits and achieving the desired target. The interviews showed that all conductors had the qualities necessary for an artist. For instance: *“I consider that a conductor is the one who manages energies. First, the conductor must get energy out of the singers and then must be able to manage it. It is much more difficult for chief conductors in conducting a big joint choir. The exchange of energies is easier if singers know songs by heart”* (R4). Another example: *“The conductor is the most important person, he/she must take responsibility, but he must enjoy this weight of responsibility. I believe that we can only create joy ourselves”* (R4).

Conductors are artists who are emotionally involved in the process of interpreting compositions. During the interview, the conductor asked rhetorically: *“Can anyone measure conductors’ emotionality, can anyone measure emotional experiences, how much any of us feels for others, does a greater emotional experience mean greater vocal load?”* (R5).

We found that conductors’ answers to the questions related to stress were quite similar to those received by the survey. The answers demonstrated a clear association between stress and voice problems (Trinite et al., 2021). People experience stress when they no longer can cope with their job duties and lose control of the situation. Excessive stress may impact physical and mental health.

The analysis of interviews showed that conductors were aware of the role of emotionality in singing and the impact of the emotional state on voice quality: *“Singing is emotionality, it is a language, and if it is a language, you want to say something. If you feel relaxed and emotionally open and positive, the body helps you feel less tired. To lessen the*

emotional depression, I tell the singers: "These are three hours of joy you must not steal from others, but sooner create them yourself. You must always be the Sun! The moon is beautiful at night, but it would never shine without the sun" (R4).

Many conductors considered that a choir and a conductor work like one organism, and negative emotions, stress, gloomy mood are conveyed from the conductor to singers and vice versa. Conductor R3 said: *"My voice gets affected when I feel that the choir is angry or dissatisfied with me"*. Conductors also mentioned positive examples when the rehearsal generated positive energy: *"Sometimes, at the beginning of the rehearsal it seems that I am emotionally tired and I tell it to my singers, but then during the rehearsal, you feel that the exchange of energy is taking place and you get emotionally loaded and can give the energy back to your singers again" (R4).*

During rehearsals, the singing effort should be balanced with the singers' abilities to perform the specific piece to avoid excessive psychoemotional load. Conductors stated that it is their responsibility to maintain a positive atmosphere during rehearsals and concerts: *"Conductor himself/herself must radiate positive energy and be active. If a conductor is depressive, it will impact the singers, their comfort, and a vocal load and singing comfort. I wish my singers inform me before the rehearsal if they have some health or emotional problems, then during the rehearsal, I know that I must not disturb them and I am glad that they have been able to attend the rehearsal" (R40).*

Voice ergonomics knowledge

There were specific questions in the interview about knowledge of voice ergonomics and implementation of the theoretical knowledge in working practice. For example, one of the interview questions was: *How do you interpret the concept of 'voice ergonomics'?* Answers we received were of both the emotional and rational type: *"The first thing I associate voice ergonomics with is the ability to sing eternally. The voice ergonomics is my singing comfort when I could sing the whole day from morning till evening, and I would not feel I am singing" (R1); "Ergonomics – it might be something related to a rational use of voice" (R2); "A correct use of voice, ensuring of its sustainability, distribution of a vocal load" (R3); "Voice ergonomics – to use as little energy as possible to achieve a better effect" (R6).*

Over time, the terminology has changed, and the term 'voice hygiene' has been replaced by a more comprehensive term 'voice ergonomics'. The conductors emphasised that the issues of taking care of voice have always been included in the professional education programs for conductors. All of them agreed on the necessity to continue this tradition. Conductor R4 stated: *"To my mind, the issue of voice ergonomics should be included in any study program related to a vocal art; anyone whose working tool is voice should know it. The conductors, music teachers, musicologists, and composition study programmes should include this knowledge in the curriculum. Debatable is whether this content would be considered a separate study course or be part of some other course. Practical knowledge of ergonomics would be useful for the students studying in the study programs mentioned above. If you are a professional you must know and understand what interferes with and hinders your own and your singers' voice" (R4).*

C. Organisational ergonomics

Working practice: The organisation of rehearsals

The conductor's ability to motivate singers and tune them to rehearsal is an essential element of rehearsal organisation. It is related to the discipline during rehearsals and, as a result, impacts the conductor and singers' vocal load (R6). There is a correlation between organisational processes during rehearsal and the loudness of the conductor's voice (Trinite et al., 2021). If singers are not involved in work during the rehearsal, they create activity noise, making a conductor speak louder and cause additional stress. During the interview, the conductors shared their experience: *"I always find a way how to involve the choir group not singing at that moment in work; I make them learn by heart the text of the next song, not a single moment must a choral singer feel unnecessary, they must always be involved in work. [...] While some are patiently rehearsing a complicated part in a composition, the rest must think good thoughts so that this complicated part be a success. We, as a choir, are a single organism. Every chorister must respect people with whom they sing together; otherwise, nothing productive could come out of it, and such a chorister has no place in the organism of a choir. Talking during a rehearsal shows disrespects to music. It is the opposite of our mission because we create music and serve it. Therefore, there is nothing to do in the choir for people demonstrating such behaviour. The deliberate involvement of each singer is important"* (R4).

The conductor's leadership qualities are beneficial at organising rehearsals. A conductor must be able to *"maintain discipline in a collective, [...] – with good management, a word said louder, with a more interesting repertoire"* (R5). Working with children's choirs is a challenge for any conductor, especially when working with joint choirs preparing for Song Festival concerts. In 2015, more than almost 13 thousand singers from 328 choirs participated in the Latvian School Youth Song and Dance Festival. The differences in choirs' internal culture and discipline are visible when the conductor works with a joint choir. Conductors admitted that sometimes, discipline becomes uncontrollable during rehearsal, and only the conductor's creativity or enthusiasm can help cope with it (R3, R4). In addition, after such rehearsals, a chief conductor has often lost his/her voice: *"It is not easy to work with 50 boys. While the conductor works with one group, the other begins to buzz. If the conductor is not aware of a pedagogical method to call singers to order, he/she has to raise his/her voice, and the activity noise grows. Working in this way, a conductor gets tired, and the voice becomes strained and tired. Only outstanding teachers can work with boys' choirs!"* (R6).

An equal distribution of a vocal load during rehearsals contributes to ensuring the sustainability of a conductor's and singers' voice: *"A conductor must plan an equal vocal load and envisage short breaks for rest at rehearsals. The conductor should know voice relaxing exercises that can be used after singing at the very high or very low vocal range. At rehearsals before concerts, it is not necessary to sing the whole program through because it is a too heavy load on singers' voices, and they still have a two-part concert to endure and sing"* (R3).

A physical environment of rehearsal rooms: Noise and air quality

The obtained data demonstrated that conductors noticed and fixed all interfering outside environmental factors that might impact vocal health. However, the important observation was that achieving artistic aims was a priority for them, and all their attention was primarily focused on it. When conductors were asked about different factors related to the indoor environment of the rehearsals room, most of them

emphasised room acoustics. They stated that the acoustics and location of the choir in the room are of great importance: *“I always carefully chose the place where the choir will be located, on the stage or platforms. Acoustics is of enormous importance. The room may help singing and may also ruin it completely. In rooms with bad acoustics, singers must learn to subject rooms to their own needs”* (R4).

Interesting was the answer given by conductor R6: *“Most of all I dislike working in a room with excellent acoustics, I cannot normally work in it. What does such acoustics do? It seems easy for the singers to sing in it, cord harmonies develop easily, but the conductor does not understand the singers’ contribution to this. Furthermore, when you find yourself in a room with different acoustics, you do not understand what to do or how to achieve the choir’s sonority. [...] I always tell my singers that any room is suitable for singing and can be filled. The better the room sounds, the less effort is needed; the worse acoustics in the room is, the more you must strain your voice. [...] However, the choristers must be able to sing in any environment, not only in the halls where acoustics is like in a church”*.

Answering the questions about the quality of air in rehearsal rooms, almost all conductors underlined the necessity to have fresh air, since *“as soon as the room has insufficient air, singers immediately feel drowsy, and in the result, there is lack of maximal emotionality and physical response for a qualitative rehearsal”* (R4). However, the interviews with conductors showed that rehearsal rooms not always were adequate for singing. Thus, for example, at characterising rehearsal rooms in a historical building, conductor R4 says: *“Rehearsals took place in the room on the ground floor, with no ventilation. As a result, we could not take in more than 40 choristers since there was not enough air to breathe, and sometimes people used to faint during rehearsals. We tried to solve it by opening the outer door and making several attempts to hold rehearsals in another room where windows could be opened”*.

Sometimes, a challenge to the voice of singers and a conductor was posed by the necessity to sing out-of-doors at public events. Conductors shared their experience, saying: *“Long rehearsals held outside are harmful to voice both in cold and hot weather”* (R3). *“Rain, wind and storm do not affect me; they sooner ‘enhance taste and sharpness’ to the phenomenon of joint singing. When we perform outdoors, I always remind my singers that they should bear in mind the feeling we usually have in our rehearsal room. The choir must not yield to the ‘outdoor’ feeling; the choir’s sounding will ‘go to pieces’ then. While singing, the choir must be like a single bright star which keeps tightly together to fill the space around, not trying to achieve results by singing louder”* (R4).

Conclusions

This study aimed to explore the choir conductor’s unique individual experience of professional work with a choir, thereby getting more detailed information about the practical implementation of voice ergonomics. The conductor’s voice ergonomics issues were discussed from physical, cognitive, and organisational ergonomics perspectives. The study allowed a deeper insight into the conductors’ profession. Open questions during interviews allowed the interviewees to express their opinions freely. It was essential for us because we analysed survey data in previous studies, which gave essential but limited information.

In summary, as expected, choir conductors mentioned the same risk factors of voice disorders, which were revealed in the previous questionnaire survey (Trinite et al., 2021). A high vocal load, fatigue, stress, body posture, air quality in rooms – these are

factors affecting vocal health in choir conductors. The interviews enabled us to discover the origins of vocal health impacting factors.

Respondents' answers demonstrated both rational and emotional explanations of voice ergonomics issues. For example, the vocal load is related to the intensity and duration of rehearsals and the complexity of acquired musical material. On the other hand, there is a vocal load related to fulfilling the conductors' artistic requirements and requires a specific psychoemotional affective condition of both conductors and singers. Therefore, vocal fatigue is more related to stress.

In the interviews, conductors also revealed those speaking and singing voice activities that are characteristic of them during the rehearsals with choirs, consisting of singers of different ages and having different professional training. All of the conductors had an opinion about working under the COVID-19 restrictions. They emphasised that changes in the usual organisation of rehearsals had influenced the vocal health and voice quality. Surprisingly, the interview answers showed two opposite experiences. The first, as choir rehearsals had been organised remotely for a long time by ZOOM, conductors' vocal load considerably increased. During the remote rehearsals when conductors worked from home, two approaches were used: prolonged singing in a full voice and demonstrating this singing on the screen, or, on the contrary, singing in a soft voice, because it was required by specific conditions (family in the next room or neighbours). The second, cancelled rehearsals and concerts created a situation when a voice was not used 'as previous' and was not 'kept in the form', and therefore when the rehearsals were resumed, a voice had lost its training and endurance, caused fatigue and exhaustion.

An essential conclusion was made based on interview data concerning the interaction between the artistic process and the rehearsal room environment. Although the conductors detect environmental factors such as acoustics, air quality, and in-door noise, the artistic and psychoemotional factors are priorities.

The conductors' initiative and motivation to promote voice ergonomic activities at the choir rehearsals and performances is tightly related to their attitude, knowledge and awareness. However, the conductor's personal example has a major significance. If the conductor highly values the importance of voice quality and is aware of voice fragility, he/she will teach the attitude to take care of the voice to singers. The choir sounding reflects the conductor's personal and professional attitude. Paraphrasing words said by one of the research participants (R5), we may conclude: *"A conductor serves to music. He/she is encouraged by greater things – to make the world more magnificent"*.

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