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Роль музыкального слуха в развитии просодии изучаемого языка

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Аннотация. Основная цель исследования – определить, следует ли рассматривать музыкальный слух среди факторов, влияющих на степень выраженности иноязычного акцента в изучаемом языке (L2) и насколько этот фактор значим при освоении перцептивного и продуктивного аспектов супrasegmentного уровня L2. По результатам исследования был сделан вывод, что музыкальный слух существенно влияет на развитие просодии изучаемого иностранного языка.

Ключевые слова: музыкальный слух, фонетика, фонология, перцепция интонации, продукция интонации, иноязычный акцент, просодия, фонетическая интерференция

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Original article

The Role of Musical Ear in Developing L2 Prosodic Phonology

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Abstract. The article presents the results of a study, the main objective of which was to determine whether musical ear should be considered among factors affecting the degree of a foreign language accent in the second language (L2) and how important this factor is in mastering perceptual and productive aspects of L2 suprasegmental level. Based on the study results it was concluded that ear for music affects L2 prosodic development significantly.

Keywords: musical ear, phonetics, phonology, intonation perception, intonation production, foreign accent, prosody, phonetic interference

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INTRODUCTION

The importance of perceptual skills in communicative language use has been heightened by the dependence on remote working and studying imposed by the COVID-19 pandemic. Taking into account significant traffic load, teleconferencing is more and more often conducted without visual support. Sociologists emphasize that refusal of visual aids means absence of non-verbal communication tools, which leads to the increasing significance of the auditory channel compared to the visual channel [France, Anderson, Gardner, 2001]. Thus, the topic is of great importance, especially in respect of interlingual communication. Neuroscience research has shown that music training leads to changes throughout the auditory system. Similar to physical exercise and its impact on body fitness, music is a resource that tones the brain for auditory fitness. Therefore, the role of music in shaping a phonetic and phonological ear deserves consideration [Kraus, Chandrasekaran, 2010].

Experts from different areas have carried out numerous transdisciplinary studies on the interrelation between music and language, especially neurologists, speech therapists, and musicologists. For instance, Kirnarskaya D. K. emphasizes the connection between music and speech but do not specify the degree of interaction between the two phenomena. In their article «The linguistic benefits of musical abilities», Aniruddh D. Patel and John R. Iversen point out the interrelation between musical abilities and specific phonetic and prosodic skills in language [Кирнарская, 2004; Patel, Iversen, 2007]. However, they focus on the underlying mechanisms of this interaction without considering its degree. R. Slevc outlines the link between language and music at three levels of analysis: sound, structure and meaning [Slevc, 2012]. Recent research provides evidence that musicians are more sensitive to emotional prosodic cues and are better able to detect small pitch changes in speech as well as in music than non-musicians [Thompson, Schellenberg, Husain, 2004; Lima, Castro 2011; Marques, Moreno, Castro, Besson, 2007]. Musical ability also predicts how well late learners acquire both perceptive and productive L2 phonology [Slevc, Miyake, 2006].

Though interest in the relationship between language and music has a long history, the topic has not been well researched from the perspective of linguistics. That fact might be explained by little consensus so far on what constitutes musical ability and how to best measure it [Hallam, Prince, 2003; Okada, Slevc, 2021]. Moreover, a great number of experts do not identify musical ability among

factors influencing second language acquisition due to the complexity of its nature and lack of a unified measurement system [Piske, MacKay, Flege, 2001]. They prefer to rely on those factors that can be unambiguously identified and measured. For instance, Siti Khasinah lists the following factors that significantly impact L2 learning: motivation, attitude, age, intelligence, aptitude, cognitive style, and personality [Khasinah, 2014]. There is also an approach that takes into account both internal factors, such as age, personality, motivation, experiences, cognition, native language and external factors, among which are curriculum, instruction, culture, status, and access to native speakers [Macaro, 2010].

Thus, we conducted experimental phonetic research at the Department of phonetics of the German language in 2020 to establish the degree of the influence of a developed musical ear on the L2 phonological competence in nonnatives. As musical ability has not been identified yet as an essential variable that influences the degree of L2 foreign accent, as it is we decided to investigate an ear for music that can be unambiguously defined and measured. As defined in the Cambridge dictionary, «if someone has an ear for music [...], they are good at hearing, repeating, and understanding these sounds»¹.

As there has been evidence for some degree of music to language transfer regarding discriminating differences in sounds [Slevc, Miyake, 2006; Sadakata, Sekiyama, 2011], we decided to investigate music to language transfer in prosodic phonology. Although speech does not primarily rely on pitch, the pitch signal includes pitch-based information. This fact is most apparent in tone languages where word meanings are conveyed through pitch patterns and modulations. However, in nonpitch-related languages, emotional and linguistic information can be represented by differences in intonation, which suggests that the ability to process lexical tone and prosodic changes might rely on the exact mechanisms involved in musical perception [Slevc, 2012].

MATERIALS AND METHOD

To test our hypotheses, we used the following methods in the practical part of the study:

1. Expert assessment of musical ear;
2. Questionnaire method;
3. Empirical study of auditory perception;
4. Statistical treatment (the Shapiro–Wilk test, the Mann–Whitney U test).

¹ URL: <https://dictionary.cambridge.org>

The *goal* of the study was to establish the role of trained musical ear in L2 phonetic and phonological acquisition in students of linguistics majors.

The study's *objectives* were formulated as follows:

- to establish whether musical ear can be considered among factors affecting the degree of a foreign accent in L2;
- to study the influence of trained musical ear on L2 prosodic phonology development on perceptual and productive aspects in students of linguistics majors.

The object of the study was phonetic interference that occurs while studying phonetics of the German language by students of linguistics majors.

The *subject* of the study was the dependence of prosodic phonology development in students of linguistic majors on trained or untrained musical ear.

The subjects in this experimental-phonetic study were 33 first-year students of the Faculty of the German Language of the Moscow State Linguistic University (23 young women and 10 young men) aged 17 to 20 years. The students had no theoretical knowledge on the subject «Intonation in the German language» and could rely exclusively on their ear by the time of the experiment.

The study was conducted in *three stages*.

The first stage was an expert assessment of a musical ear, during which a group of 20 students with a trained ear for music was identified by an expert and two professional musicians. It should be noted that the development degree of musical ear, pitch and timing abilities were not measured or classified. The main criterion of the audition was the exact imitation of a certain melody.

For the convenience of interpretation, we divided the subjects into two groups: Group 1 included subjects with trained musical ear, group 2 – with untrained musical ear.

In *the second stage*, the subjects were asked to complete a questionnaire with the following points: name and surname, age, sex, music education, and knowledge of the German language.

During *the third stage*, the subjects had to perform three tasks aimed at developing the skill

to intone affirmative and interrogative sentences according to the German pronunciation standard. The tasks were formulated in the following way:

1. Listen to the following sentences and mark graphically the word which sentence stress falls on. Repeat everything you have heard in accordance with your notes.

2. Listen to the following sentences, and then show graphically how the melody develops (falls / rises / remains unchanged).

3. Listen to the dialogue. Show the melody development graphically. Read the dialogue according to your notes.

The tasks were arranged on the principle «from easy to difficult»: in the first task there were simple sentences that consisted of no more than four short words; in the second task the subjects were to work with both simple and complex sentences; the third task contained a dialogue. The control of the tasks performed was carried out individually. All recordings were played twice with an interval of 10 seconds, which was enough for the tasks to be completed. All oral responses were recorded.

For a more detailed description of the results, a point system was introduced: one point was assigned to each correctly given answer. In the first task, the maximum total score to be achieved was 28 points (the students were able to get a maximum of 14 points for both perceptive and productive aspects). In the second task, the maximum score was 8 points; during the completion of the third task, the subjects could score a maximum of 12 Points, of which 6 points were given for the productive aspect, and 6 points for the perceptive aspect. Thus, the maximum total score was 48 points.

RESULTS

Based on the results of the Shapiro-Wilk test, a further analysis of the data was performed using the Mann-Whitney U test (see Table 1).

Table 1

THE MANN-WHITNEY U TEST RESULTS
(95 % Confidence Interval – CI)

		Statistic	p-Value	Mean Difference	Lower	Upper
Perceptual aspect	Mann-Whitney U	18.0	<.001	4.00	2.000	6.00
Productive aspect	Mann-Whitney U	50.0	0.003	2.00	1.000	3.00
Total score	Mann-Whitney U	13.0	<.001	6.00	4.000	9.00

According to *Table 1* subjects with trained musical ear show statistically more significant results in both perceptual (with p significance level $< .001$) and productive (with p significance level $= 0.003$) aspects. Below there are graphs with pairwise differences of both groups for each of the aspects according to the Mann-Whitney U test (see *Fig. 1*). *Figure 1* (left panel) depicts the mean and median values of both subjects groups regarding the assessment of the productive aspect with the confidence interval of 95 %. The mean difference between the two groups equals 2 points. The average total score of Group 1 is 18.5 points whereas the average total score of Group 2 is 16.2 points. *Figure 1* (right panel) demonstrates the mean and median values of both subjects groups regarding the assessment of the perceptual aspect with the confidence interval of 95 %. In contrast

to the productive aspect assessment the mean difference between the two groups regarding the perceptual aspect is even higher making 4 points. As the graph shows, the mean in Group 1 is 23.7 points whereas the mean in Group 2 equals 19.7 points. It is noteworthy that the data dispersion in the perceptive aspect is significantly less than in the productive aspect. The statistical significance is, therefore, increasing.

Figure 2 compares the total scores of both subjects groups for both aspects. From *Figure 2* it is clear that the total score in Group 1 is significantly higher than in Group 2. While the average total scores of the subjects' group with untrained musical ear (Group 2) is 35.8 points, the average total score of the group with the trained musical ear (Group 1) reaches 42.2 points. The mean difference equals 6 points.

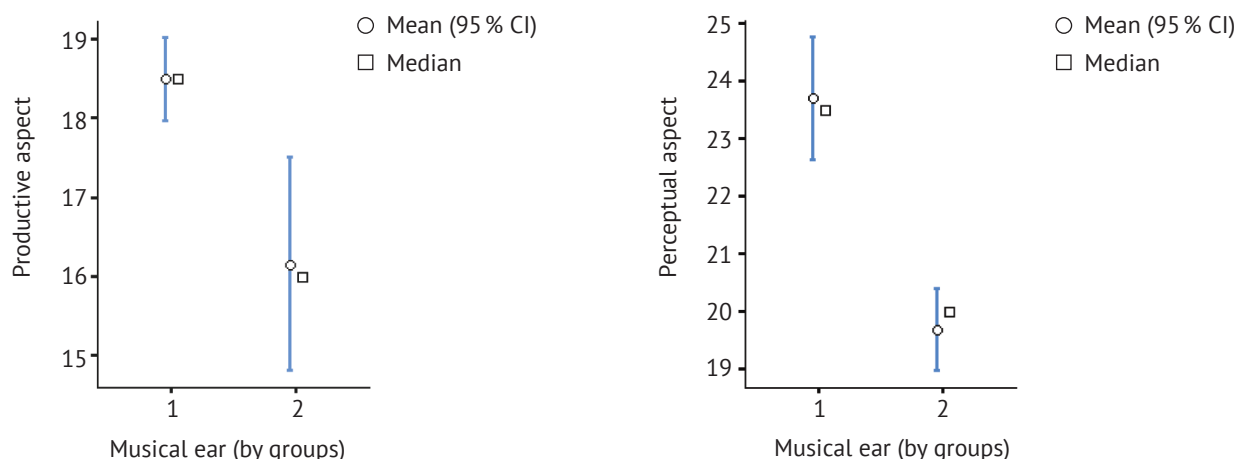


Fig. 1. The mean and median of Group 1 and Group 2 for the productive (left panel) and the perceptual (right panel) aspects (95 % CI)

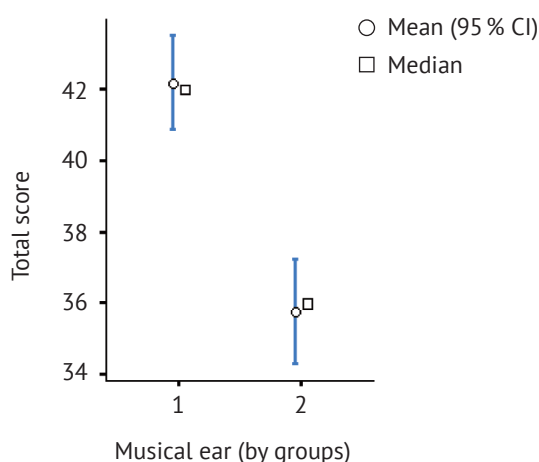


Fig. 2. The mean and median of Group 1 and Group 2 for perceptual and productive aspects (95 % CI)

DISCUSSION

According to our results, a trained musical ear has a statistically significant effect on both L2 productive and perceptual prosodic phonology. A more obvious degree of influence can be traced within the framework of the perceptual aspect, which can be explained by the fact that speech production is also influenced by a set of other factors, such as voice control, structure of articulatory apparatus, and others. Thus, a trained ear for music influences L2 phonetic and phonological acquisition, consistent with some of the results of already conducted studies in this area. In particular, A. O. Ilner emphasizes in his article «The link between musical and phonetic abilities in teaching foreign languages» that

components of speech and musical ear, which are responsible for intonation and accent-rhythmic organization, are related to each other. The author also notes that trained musical ear and sense of rhythm allow students to capture phonemic features (vowel length and brevity) more clearly [Ильнер, 2015].

However, further analysis of other materials on the research topic showed that there is paucity of studies examining aptitude factors in a controlled manner, making it impossible to draw firm conclusions regarding these factors. Hence, musical ability has not been found to significantly affect the degree of L2 foreign accent [Flege, 1995; Tahta, Wood, Loewenthal, 1981]. It should be mentioned though that many studies except for one [Flege, 1995] have identified mimicry ability as a significant variable affecting the degree of L2 foreign accent [Piske, MacKay, Flege, 2001]. Thus, we believe that important questions that should be addressed in future research are: in what relation to each other mimicry and musical abilities are as well as what constitutes musical ability. For now, we believe that musical ear as a key component of musical ability serves as a basis to mimicry ability as it is impossible to mimic without hearing something. Moreover, musical ear training increases perception accuracy, which helps avoid substituting L2 phonemes and intonemes by L1 ones [Kraus, Chandrasekaran, 2010].

Despite the fact that factors affecting degree of foreign accent by L2 acquisition are currently being actively studied, most of them are aimed at researching a limited number of variables such as age of L2 learning, length of residence in an L2-speaking country, gender, formal instruction, motivation, language learning aptitude, amount of native language (L1) use and presence or absence of pronunciation training [Combei, Marotta, 2019; Piske, MacKay, Flege, 2001]. Age of L2 learning appears to be the most significant predictor of degree of foreign accent. However, relative importance of other variables is uncertain. Some of the variables relating to subject characteristics tend to be overlooked due to the complexity of the analysis and lack of adequate experimental control in some studies. In addition, the phonetic aspect often fades into the background by second language acquisition, since vocabulary and grammar come to the fore even when studying in linguistic majors. Taking into account growing importance of the auditory channel in communication and social significance of a strong foreign accent as a result of underdeveloped phonetic and phonological competence, we consider it necessary to study musical ear among other factors affecting degree of foreign accent.

CONCLUSION

Based on the research outcomes, it can be inferred that the results of the subjects with the trained musical ear are significantly higher than those of the subjects with an untrained ear for music in all aspects, with a confidence level of 95%. Moreover, it should be pointed out that the difference between the results is much more noticeable in the perceptual aspect. Such a result is of particular importance for the study, as the successful performing of the tasks aimed at the perception is directly dependent on ear. As for the tasks aimed at the productive aspect, different factors can influence their successful completion: on the one hand, individual characteristics such as, for instance, peculiarities of the structure of the speech apparatus; on the other hand, some L1 articulation features may cause prosodic and phonological transfer. In other words, when studying the interrelation between musical ear and productive aspect, a more significant number of factors should be taken into account.

It should also be mentioned that although it has been established that the achievements of the two subjects' groups differ from each other significantly, the evaluation criteria for students should be considered when applying the obtained data in the pedagogical practice. Nevertheless, there are many reasons to assume that larger cohorts of learners will produce more accurate study results. It can also be shown in a more extensive study that the significant degree of the influence of the developed musical ear on perception and production can be different. Therefore, further research in this area is required to identify all factors that influence L2 phonetic and phonological development and determine the musical ear's role among other musical ability components in this hierarchy. We also believe that a study with a longitudinal design should be carried out to trace the gradient effects of various aptitudes and skills on the dynamics of L2 phonetic and phonological competence development throughout a training course.

We want to point out that most of the findings mentioned above are correlational and thus do not necessarily support a causal relationship between music and language. However, this concern is lessened given evidence that there are no preexisting neural, cognitive, or musical differences between children who do or do not undergo later musical training [Slevc, 2012]. In addition, some findings give considerable support for the transfer of musical training to language abilities: a longitudinal study showed that 8-year-old children who received musical training showed enhanced electrophysiological responses

to pitch variations and in music and in speech and also showed more significant improvements on a behavioural reading task after only six months of training in contrast to children who received painting training [Moreno et al., 2009].

In conclusion, our research results can raise awareness about the importance of an ear for music in learning L2, especially in developing listening

and pronunciation skills by those who study tone languages. In addition, the stated correlation might drive methodologists and language teachers to develop new original forms and methods of teaching phonetics based on musical art, to create auxiliary materials to develop a phonetic ear through a musical ear. So far, there have been few initiatives in this field.

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