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WHEN THE FIXED "DO" TENDS TO MOVE: THE AMBIGUITY OF THE SOLFÈGE SYLLABARY[1]

Izvirni znanstveni članek/ Original Scientific Article

Abstract

The aim of this study is to discuss the features of various systems of solfège syllables used in professional music education and to determine the correlations between the participants' hearing system, the syllabic system used for denoting pitch, the perception of tonal relationships and other relevant factors in order to improve the awareness of their impact within solfège-based ear-training processes. A survey conducted among 196 students of music who participated in listening exercises showed that most participants use solfège syllables in their everyday professional activities. Their comprehension of tonal processes (such as modulation and mode mutation) in ambiguous contexts relies as heavily on the nature of the solfège system they were exposed to in their previous music education, as on the internal logic of the musical material as such.

Key words: solfège, solmization,[2] absolute, relative, pitch, listening, cognition

Izvleček
Ko se nepremični (fiksni) "DO" začne premikati: večpomenskost intonančnih zlogov

Namen pričujočega prispevka je razprava o značilnostih različnih sistemov intonančnih zlogov, ki se uporabljajo v glasbenem izobraževanju in določitev odnosov med subjektivnim slušnim sistemom, sistemom zlogov za določanje višine tona, zaznavanjem tonalitetnih odnosov in drugih relevantnih faktorjev, z namenom večjega ozaveščenja procesov, ki se odvijajo med urjenjem posluha in temeljijo na uporabi zlogov. Opravljena je bila empirična raziskava na vzorcu 196 študentov glasbe, ki so sodelovali v slušnih vajah. Rezultati kažejo, da večina njih uporablja intonančne zloge v svojih vsakodnevnih dejavnostih. Njihovo dojemanje tonalitetnih procesov (kot sta npr. modulacija in mutacija) v večpomenskih kontekstih sloni v veliki meri na značilnostih sistema intonančnih zlogov, ki so jim bili izpostavljeni v času dosedanjega glasbenega izobraževanja, kot tudi na notranji logiki glasbenega materiala kot takšnega.

Ključne besede: intonančni zlogi, solmizacija, absolutno, relativno, višina tona, poslušanje, kognicija

1 This chapter is an extended version of the paper presented at the 15th International Conference on Music Perception and Cognition (ICMPC)/10th Triennial Conference of the European Society for the Cognitive Sciences of Music held at the University of Graz, Austria, 23-28 July 2018. Its contents have not been previously published nor submitted for publication. This survey is a part of a larger project involving the research, classification and standardization of basic contemporary Croatian musical terminology, Conmusterm (www.muza.unizg.hr/conmusterm/, 2014–2018), financially supported by the Croatian Science Foundation (www.hrzz.hr).

2 Due to significant terminological variety in theoretical and practical usage, it should be brought to our reader's attention that the term 'solmization' within this study refers to all syllabaries indicating scale degrees that are based upon Guidonian syllables, which will be described in detail later.

Introduction

Although ubiquitous in music pedagogy worldwide, the repercussions of various systems of mnemonic syllables are rarely the subject of systematic empirical research in professional music education. The same could be stated about the research of mnemonic syllabaries in general. Even when these topics are addressed to, only a handful of surveys involve musicians or students of music (e.g. Rogers 2007; Mikumo 1992 compared two groups of students with different training levels), while others dealt with non–musicians (e.g. Cassidy 1993). Let us briefly discuss selected results of the former research category that could contribute to our topic.

An early comprehensive study (Silvey 1937) has shown that, according to the users' opinions, solmization has no higher priority in their music education. Solmization has been rated as only fourth, fifth or sixth factor that may contribute to music reading. Silvey argues that the emphasis put onto solmization in general education cannot be justified by its results. However, these results have not been verified by an external criterion and can thus not be taken into account as definite.

The premise that verbal strategies could enhance melody processing was tested by Mikumo (1992), who suggested that highly trained subjects could use verbal encoding strategies (such as labelling tones by their names[3]) to enhance pitch discrimination in 'high–tonality structures' (tonal contexts). Verbal strategies, however, turned out to be less useful in 'low–tonality structures' (atonal contexts). Expectingly, less well trained subjects were unable to use verbal (or any other) encoding strategies in melody processing.

In a series of sightsinging exercises Cassidy (1993) proved that subjects using solfège scored significantly better than those using musical alphabet or a neutral syllable, which again confirms the importance of solfège syllables as carriers of meaning in conceptualizing music.

Rogers (2007) conducted a survey with university students enrolled in a high–levelled course in music theory. The examinees, which did not possess absolute pitch, scored significantly better when they employed verbal encoding in comparing two pitch series. Rogers considers solfège syllables to be a part of the musical vocabulary together with other musical terms (2007, 149). She also emphasizes that vocabulary training should include careful observation of the cognitive function of syllabic systems as "a means for recalling and recognizing music beyond the extremely brief limits of sensory memory" (*ibid.*).

Beside the mentioned examples, the existing research on the role of syllabary in music perception and cognition is still considerably rare. None of the studies offers satisfying answers on the question of syllabary in professional musical contexts. Most studies use

3 The tone names Mikumo used were solmization syllables. In this study the syllables were used during a spoken interference, i.e. they did not *a priori* bear either relative or absolute meanings.

short, context–deprived sequences of equal–length tones played on the piano or an electronic instrument that included neither excerpts from musical literature nor comparisons with external criteria (e.g. Mikumo 1992, Cassidy 1993 or Rogers 2007). Furthermore, the number of examinees is often low (for instance, Mikumo 1992 used two groups with n=26, and Rogers 2007 had a group with n=15 and another one with n=19)[4]. Luckily, even if the existing research on the topic lacks correlation with real professional situations and leaves many questions unanswered, there is still a certain corpus of findings and results music pedagogy could rely upon. However, it seems that pedagogy somehow missed the opportunity to seize the full potential of the results of experimental research so far. The issue of choosing a suitable solfège syllabary too often remains a matter of pedagogical tradition and is seldom examined experimentally, although even expert subjects such as Huron (2006) confirm the importance of mnemonic syllables in conceiving and understanding pitch relationships.

Huron also devised a theory of conscious interval recognition as a reconstruction from a scale degree representation which includes verbal labels (i.e. relative solmization syllables) as carriers of meaning (2006, 117–120). It is not surprising, though, that some authorities even define solmization as "the use of syllables in association with pitches as a mnemonic device for indicating melodic intervals" (Hughes and Gerson–Kiwi 2001).

A recent study (Kiš Žuvela 2017) has shown that mnemonic pitch syllables, especially solmization, can play a major role in quotidian professional activities of music students within high education. Almost three fourths of the examined students reported that they spontaneously pronounce solfège syllables while listening to, playing, singing or reading tonal music. Moreover, this research has shown high correlation of this phenomenon with external criteria: the frequency of the spontaneous appearance of pitch syllables during musical activities was positively related to the students' last exam grade in their Ear Training courses.

This paper is an attempt to establish a new approach to the research of the impact that solfège systems used in the ear training of professional musicians have on their understanding of music. It aims to give a critical insight in the state of art, to examine the consequences of using a particular solfège syllabary used in ear training of professional musicians on their ability to comprehend music played in real time, in a genuine context (original recordings of symphonic music). Finally, the author hopes that this study could open new avenues of research, as well as prepare ground for new, research–based educational strategies.

Solfège syllables: terminology, definition and information value

Although often considered to be a device originating in Western music tradition, solfège syllables (or solmization in a wider sense) have been used worldwide since the ancient times as labels denoting tones "as single entities which form the basic material of music" (Hughes and Gerson–Kiwi 2001). In a narrower sense, most contemporary authors

4 A rare exception in this respect is Silvey 1937, with a sample of 1804 subjects.

recognize the Guidonian system of mnemonic syllables to be the origin of solmization as we know it today (e.g. Hughes and Gerson–Kiwi 2001). Guidonian system of syllables, just like the earliest staff notations, did not determine absolute pitch values, but rather intervallic relations within the system of hexachords. The Guidonian syllables were only brought into connection with absolute pitch values centuries later, probably in 12th century (*ibid*.), when the former started to be used as a substitute for notation. Parallel development of systems of solfège syllables that included relative and absolute solmization variants could be assumed to have appeared back then, introducing ambiguity into the didactic syllabary. Martin (1978, 21) claims that movable Guidonian system has replaced with a fixed–*do* system first in Italy, in the 17th century.

Solfège syllables: musical alphabet and solmization

Since there is no general consent on the scope and meaning of the terms 'solfège syllables' and 'solmization', the author will propose her own set of terms and their respective definitions for the purpose of the present study.

Solfège syllables are *any mnemonic syllables denoting pitch, either in absolute terms or in terms of degrees of a musical scale*. Contemporary systems of solfège syllables include the musical alphabet and different systems of solmization. The *musical alphabet* is a *syllabic system based upon the names of the letters of the Latin alphabet* which are used as the *labels for fixed, absolute pitches.* The basic alphabetical set consists of the following labels: *A*[5], *B*, *C*, *D*, *E*, *F* and *G*. It can be expanded with further labels denoting pitch alterations such as *sharp* (for an ascending alteration in reference to the basic pitch) or *flat* (for a descending alteration).

On the other hand, the term *solmization* in this paper encompasses *all syllabaries indicating scale degrees that are based upon Guidonian mnemonic syllables* (*ut*, *re*, *mi*, *fa*, *sol*, *la* and *si*), together with their regional variants. This study will address several variants of solmization based upon Guidonian syllables which are in use within the system of professional music education in Croatia. Taking into account enormous terminological variety in the field literature and local languages worldwide, the author proposes her own explanation of basic terms related to systems of solmization which will be examined in this paper.

As mentioned in the footnote 1, solmization can either be:

1) a *relative* or 'movable–*do*' system, where the syllable *do* always denotes the tonic of a major key,[6] or
2) an *absolute* or 'fixed–*do*' system (also known as fixed solmization), where the syllable *do* always denotes the pitch *C* (as well as its altered versions like *C sharp*, *C flat* etc.).

5 The syllable *A* denotes the main reference tone in Western music tradition, the so–called *concert pitch*, whose contemporary frequency standard is generally considered to be 440 Hz.

6 Some authors refer to relative systems of solmization as to 'functional', claiming that the position of the labelled tone within the scale provides it with a specific function. As the function cannot be generalized and considered to be inherent in the tone position, but is strongly influenced by tonal context, style and other circumstances, the author will sustain from using this terminological solution.

Relative systems can further be divided into two major categories: *tonic do* systems, where the syllable *do* denotes the tonic in both major and minor keys,[7] and *tonic do–la* systems, where the tonic is solmized *do* in major and *la* in minor keys.

The information value of solfège syllables

Different syllabaries contain different semantic contents. A solfège syllable which responds to all questions about the pitch in absolute terms, as well as in relative, contextual terms does not exist, because the total number of such syllables in the 12–tone equal temperament would be at least 144 (disregarding enharmonic variants!), and it is quite unlikely that such a system could be of any use in teaching music. A music pedagogue is thus usually forced to choose a single syllabary which would be his permanent teaching tool while being aware of its inconsistency, or, even worse, a syllabary is a matter of tradition or the school policy, and the teacher is unable to adjust his teaching tools to the repertoire they want to approach. In order to shed light on special features of each syllable system discussed in this study, Table 1 brings a short overview of the information values they are capable of communicating.

Table 1: ***The information value of solfège syllables***

syllable system / information value	**movable-*do* solmization**		**absolute (fixed-*do*) solmization**	**musical alphabet**
	tonic *do*	**tonic *do-la***		
absolute pitch value	no	no	questionable / partially (giving the notational position within the staff, rather than the absolute pitch value, regardless of accidentals)[8]	yes
relative pitch value (scale degree: relative position of a tone within a context – key, mode…)	yes	yes	no	no
alteration / accidentals (lowered or heightened scale degree)	yes	yes	no	yes
in case of **modulation**, the **tonic**:	shifts & keeps the same syllable	shifts & keeps the same syllable	changes the syllable	changes the syllable
modulation visible	yes (shifting all syllables)	yes (shifting all syllables)	no	yes (indirectly, altered syllables)

7 In Croatia and Bosnia and Herzegovina this approach to solmization is colloquially addressed to as *functional solmization* (a part of the approach called Funkcionalna muzička pedagogija [Functional Music Pedagogy]; for more details see Kazić 2013, 110–119). Please also cf. footnote 6.

Each system of syllables *offers some* semantic pitch information and *lacks other*; not a single one contains *all* relevant meanings. Every possibility of multiple encoding of pitch information, as well as its underdetermination due to the incapability of a syllable system to encode certain information (such as the insensitivity to accidentals in the case of absolute solmization), may contribute to the ambiguity of a musical passage, which can in addition cause difficulties in the cognitive process. While relative solmization systems offer most information on scale degrees and tonal centre changes, it lacks the information on the absolute pitch values. The musical alphabet shows absolute pitch values, but contains tonal information only encoded in (altered) syllables. The absolute solmization offers no information on either alterations (accidentals) or tonal changes due to its fixation to the "empty" staff, i.e. it offers only the information on the staff position of a note denoting a particular tone. This is the reason why advocates of the absolute solmization claim that this system enables easier transition towards singing with neutral (or any other) syllables. However, its contribution in acquiring the fine intervallic structures and tonal relationships is doubtful outside the realm of the diatonic C major.

A conscious teacher should be aware of the informational capacity of the chosen syllabary while preparing their teaching strategies. Many authors debated about the advantages and disadvantages of particular syllabic systems, but most of them did not rely upon any empirical data except their own subjective teaching impressions. Moreover, they usually advocated only one approach, without trying to compensate its disadvantages by using different strategies for different musical contexts.

Systems of solmization: advantages and disadvantages

The advantages and disadvantages of both solmization systems are by no means a recent or contemporary issue. Early examples of dispute could be traced back to the 19th century.[8] An anonymous author (most probably the editor of the volume), writing in the *Musical Times and Singing Class Circular* back in 1848, shared a doubt and an opinion that may still be considered up–to–date (p. 3):
"We have had several letters from friends in reference to what they consider the proper way of adapting the well–known syllables, do, re, mi, fa, so to vocal exercises. The opinions are about equal as to whether Do should remain as the permanent representative of C, or whether it should be considered as representing the key–note of the major scale irrespective of pitch. To the latter opinion we decidedly adhere ourselves, because we have generally found the firmest sight readers to be those who have studied upon this method, which is prevalent in Lancashire and the west country of Yorkshire, and in these counties good chorus singers especially abound. On the contrary, we have seldom found the adherents to the fixed system are to be trusted out of the key of C."

Most authors who advocate the use of relative solmization emphasize its significant role in early stages of training. Studies such as Reifinger 2012 proved that even if used during a

8 An inspiring overview of lively discussions on different systems of solmization and pitch notation systems in 19th century America is offered in Eisenstadt Blum, B. (1971). Solmization and Pitch Notation in Nineteenth–Century American School Music Textbooks, *Journal of Research in Music Education 19(4)*, 443–452. Most topics are still relevant today.

limited period of time (only 16 teaching sessions), solmization may significantly improve the accuracy of pitch–related musical activities. Furthermore, movable solmization systems are valuable help in transposition, either in terms of shifts in tonal space (e.g. in modulation or in scores with transposing parts), or in cases of frequent clef changes. McPherson and Gabrielson (2002, 110) recommend the use of solfège to reinforce the transition from mere memorization (e.g. singing to a neutral syllable with no inherent meaning) to comprehension (singing using sol–fa syllables or using similar devices which carried semantic content) as a useful prenotation phase activity. However, some studies suggest that using solmization in advanced stages of music education could inhibit the development of comprehensive listening abilities (e.g. Silvey 1937) and instead suggest switching onto a more suitable syllable system when leaving tonality (c.f. More 1985, 17–18).

The musical alphabet (also known as the 'letter names' system) is a set of syllables indicating absolute pitch, in spite of its main disadvantages, the dependence on the standard Western notation and insensitivity to the internal tonal relations. The alphabet is irreplaceable in non–tonal contexts, since any application of a relative, tonality adjusted system would inhibit the user in acquiring non–tonal, pure intervallic relationships. Some teachers avoid the usage of musical alphabet in ear training courses since some combinations can be difficult to pronounce. However, in its German variant,[9] which was used by many authoritative teachers such as Kodály, the musical alphabet can be cordially recommended to be used in a parallel manner together with a relative syllabic system in order to capture more relevant meanings of musical materials from the very beginning. In a later phase of musical education solmization is often being abandoned in favour of either alphabet or neutral syllables when switching to a non–tonal material. Even then solmization should not be completely excluded from training; it should be repeatedly addressed to whenever it corresponds with the internal nature of the musical material.

Absolute solmization, as used in music pedagogy, is the least determined syllabic system. With a high level of ambiguity, absolute solmization can barely be used for any purpose except as a "shortened" substitution for the alphabetic names (and, when so, there is no reason for not using the alphabet, which is completely determined, itself). The semantic underdetermination of the 'absolute' solmization syllables, as well as its inconsistency (homonymy originating in labelling different tones such as *F, F# and Fb* with the same name, *fa*) may discourage possessors of absolute pitch ability, while those with relative hearing will be likely to use the 'absolute' alphabet in a relative manner anyway (if they do not consult the reference tone). In that case a syllable tends to lose any meaning because it cannot operate as a referent to recall a suitable meaning in all contexts.

The following experiment will shed more light on the relation between the hearing system, syllabary used and the cognitive results in music dictation.

9 Unlike the one used in English speaking countries (where heightened and lowered tone names are created by adding the word *sharp* and *flat*), German variant of the musical alphabet (where the altered tone names are created by adding suffixes *–is* for an ascending alteration and *–es* for a descending one) consists almost exclusively of monosyllabic tone names (except the ones bearing double accidentals, which are rare) and is definitely not too difficult to pronounce.

Empirical research

The research was conducted between the 11 and 17 October 2016 among the students of the Academy of Music at the University of Zagreb who participated in two listening exercises.

Aim

The aim of the survey was to determine correlation between the participants' hearing system (absolute or relative pitch), the syllabic system used (relative or absolute solmization, alphabet), the perception of tonal relationships (parallelism, relatedness etc.) and other variables (general data) in order to increase awareness of the consequences of solfège–based ear–training processes in professional music education.

Participants

The sample consisted of 196 undergraduate students of the Academy of Music in Zagreb, Croatia. The participants filled in a general data questionnaire at the beginning of the procedure. The general data collected were age, sex, year of high–level study, last exam grade achieved in Ear Training course, and self–estimated perfect pitch ability.

The structure of the sample roughly corresponded with the general structure of students at the Zagreb Academy of Music. Among the total *n=196* there were 120 female (61.23 %) and 79 male students (38.77 %) with an average age of 21.3 years. Their average Ear Training grade was 3.86 (very good) out of 5 (excellent), and the average duration of their parallel music education[10] together with their professional music education was 12.2 years (the span was between 3 and 24 years). The structure of the participants by the study major, year of study, the self–estimated absolute pitch ability, the last achieved grade in Ear Training courses and the syllabic system mostly used in their previous education is given in tables 2–6.

10 In the Republic of Croatia there is a state–funded system of parallel music education, independent of the mandatory, general education system. Within the system of parallel music education pupils and students are, among other things, being prepared for professional music education on a high school level.

Table 2: ***The structure of participants by their study program major***

study program major	***n***	%
composition	4	2.04
conducting	1	0.51
guitar	5	2.55
harp	3	1.53
musicology	23	11.73
pedagogy	35	17.86
percussion	4	2.04
piano, organ, harpsichord	29	14.80
string instruments	34	17.35
theory	7	3.57
vocal performance	17	8.67
wind instruments	34	17.35

Table 3: ***The structure of the sample by years of high–level education in music***

year of high education	***n***	***%***
1st	24	12.25
2nd	65	33.16
3rd	45	22.96
4th	26	13.26
5th	36	18.37

Table 4: ***The structure of participants by the possession of absolute pitch (self–estimated)***

absolute pitch (***self–estimated)***	***n***	***%***
yes	12	6.12
partially	26	13.27
no	142	72.45
doesnt't know	16	8.16

Table 5: ***The structure of participants by their last exam grade in Ear Training***

last achieved exam grade	***n***	***%***
excellent (5)	71	36.22
very good (4)	52	26.53
good (3)	50	25.51
sufficcient (2)	21	10.71
insufficcient (1)	2	1.02

Table 6: ***The structure of participants by the syllabic system mostly used in their previous education***

syllabic system used	***n***	***%***
relative solmization *tonic do–la*	96	48.98
relative solmization *tonic do*	21	10.71
absolute solmization	29	14.80
musical alphabet	44	22.45
other	1	0.51
none	5	2.55

Testing procedure

Following the collection of general data, the participants were asked to recognize and write down the didactic syllables which appeared in their mind while listening to excerpts of the recordings of tonal, common–practice symphonic literature.
The excerpts were the following:

A: Tchaikovsky, Symphony No 5 in E minor, Op. 54:
- 1st theme of the 2nd movement (bars 8–16)

B: Beethoven, Violin Concerto in D major, Op. 61:
- 2nd theme of the 1st movement (bars 43–64)

The recordings were performed in their full symphonic setting, and the participants were asked to concentrate on the leading melody.

The listening experiment consisted of two stages: self–observation and musical dictation.

1. Self–observation consisted of notating the spontaneous appearance of mnemonic syllables while listening to the excerpts of recordings. Each recording was played three times, and the participants had to notate the appearance of the syllables in real time. The results of this stage were published earlier in a separate study (Kiš Žuvela 2017).
2. Musical dictation: Following the procedure described in no. 1 (above), each recording was played three times with a four–bar intermission between the repetitions. The participants were asked to notate the leading melody of the

theme using solfège syllables they felt most comfortable with. A fully correct notation of each excerpt was awarded with 8 points (16 points total for both excerpts), regardless of the notational system used.

Each category of results was analysed separately in qualitative and distributional terms. Linear regression analysis was performed with the variables of the participants' *age, sex,* the *duration of musical training, major subjects, solfège systems* they were exposed to and the *most recent grades achieved in their ear–training courses*. The listed variables were considered to be possible predictors of the *notation accuracy*. Two statistical models were fitted to the listed data: a model for normal distribution and the Poisson model (since the dependent variable is in fact a counting variable). The models were tested using adequate ANOVA tests: the F–test in case of normal distribution and the Chi Square test in the case of Poisson model. The dependence of the acquired data was first examined on each predictor separately. After fitting the data to the model, the significance test was conducted in order to determine the statistical significance of the influence of each predictor. Finally, the optimal model was found by adding one by one variable. The choice between reduced and wider model was again made by performing the adequate ANOVA test.

Results and discussion

In quest of an optimal statistical model

The results indicated that the following variables were statistically irrelevant for the accuracy of the notational test: *sex, age, study program* and the *solfège system* the participants were exposed to in their previous education[11]. They have been excluded from our model.

The relevant variables, i.e. predictors of the accuracy of notation, were the following: the *duration of musical training*, the *syllabary used* during the test, the possession of *absolute pitch*, and the *last achieved Ear Training grades* as an external criterion. Their estimated probability values are listed in Table 7.

Table 7: ***The probability values of the notation accuracy predictors***

predictor	***p***
syllabary used during the test	0.0440
possession of *absolute pitch*	0.0347
duration of musical training	0.0272
last achieved Ear Training grades	0.0003

11 The relevance of the *solfège system* the participants were exposed to in their previous education was probably rejected as irrelevant due to the high share of erroneous answers achieved by the subjects that do not possess absolute pitch, but were using absolute solmization in a relative manner; see Table 11.

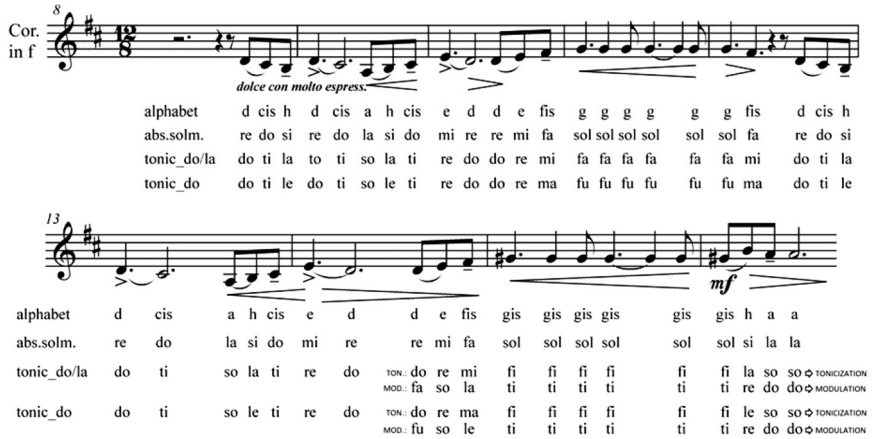
The external criterion, the *last achieved Ear Training grades*, turned out to be the strongest predictor of notation accuracy. The model consisting of the predictors 'the possession of absolute pitch' and 'the *syllabary used* during the test' showed low probability value, p=0.358. The combination of 'the *syllabary used…*' and the 'Ear Training grades' showed a high probability value, p=0.0015. By inclusion of the predictor '*duration of musical training*' together with 'the *syllabary used…*' and 'the Ear Training grades' the estimated probability value was p=0.09073. To conclude, the accuracy of notation can best be predicted by examining 'the *syllabary used* during the notation test' and the 'Ear Training grades' as an external criterion.

Hearing ambivalence

As mentioned in paragraph 3, the participants were asked to notate two examples from the common practice period using solfège syllables by their own choice. If applicable, they were recommended to use the system of syllables that appeared in their mind involuntarily while listening to music.[12]

Modulation or tonicization?

In case of example A the participants were asked to notate an excerpt of the leading melody taken from the 1st theme of the 2nd movement of Tchaikovsky's Symphony No 5 in E minor, Op. 54, bars 9–16. Picture 1 displays possible correct notations of the melody using four sets of syllables most common in the Croatian professional music education: the musical alphabet, the absolute solmization and two sorts of relative solmization, tonic *do–la* and tonic *do.*



Picture 1: ***Possible correct encodings of an excerpt of the 1st theme of the 2nd movement of Tchaikovsky's Symphony No 5 in E minor, Op. 54, bars 8–16***[13]

12 The results of the test of involuntary appearance of mnemonic syllables during musical activities were discussed in Kiš Žuvela 2017.

13 Pictures 1 and 2: The author uses German musical alphabet note names since it is commonly used in Croatia, where the survey was performed.

The theme is a period which begins with a D major antecedent, but it changes its tonal centre in the second bar of the consequent (bar 15) and proceeds towards F# minor. Without listening to the rest of the piece (from bar 16 on), a listener can perceive the tonal change either as *modulation* (a permanent tonality change confirmed by a final cadence), or *tonicization* (a brief, temporary establishment of a tonal centre other than the tonic). Almost a half of all examinees (n=97, 49.74%) did not notate anything. Another 8 examinees (4.10%) provided answers that could not be brought into relation with the music heard; their answers were discarded as unusable. The rest of the answers contained enough information to reconstruct the subjects' attitude towards the inherent tonal change (Table 8).

Table 8: ***The distribution of positive answers to the tonal change in bars 14–16***

tonal content in bars 14–16	***n***	**%**	**syllabaries used**
modulation	41	45.56	relative solmization: tonic *do–la* (n=34); tonic *do* (n=7)
tonicization	39	43.33	relative solmization: tonic *do–la* (n=34); tonic *do* (n=5)
absolute syllable values	9	10.00	alphabet (n=5), absolute solmization (n=4)
modulation *and* tonicization[14]	1	1.11	tonic *do–la* (n=1)

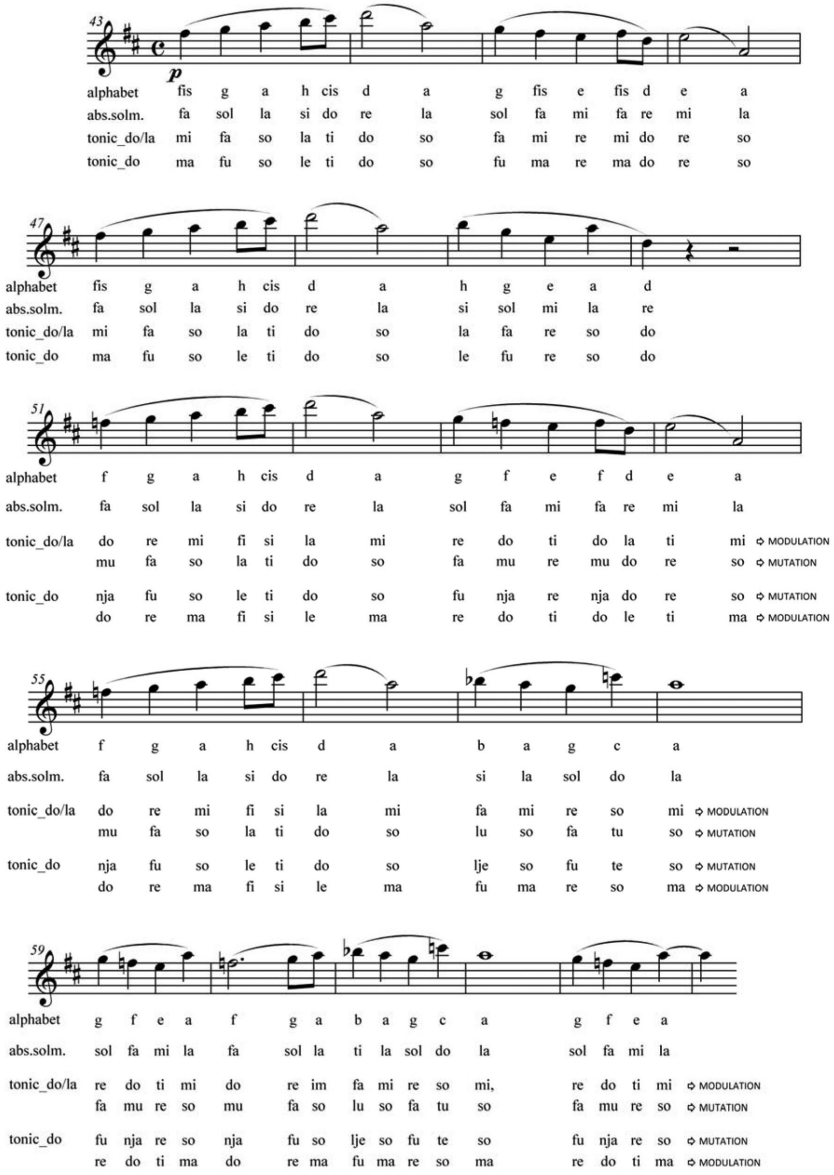
Nine absolute pitch possessors completed the task successfully using the alphabet and absolute solmization syllables in an approximately even rate (5:4). It should be mentioned that, even in case of correct notation, both syllable systems leave the tonal context undetermined. The alphabet provides the information on pitch alteration in the consequent (*G#*, bar 15, compared with a *G* in bar 11), which indicates change of the tonal centre, but the syllables do not reveal if the listener experienced this change as a modulation or a tonicization. The absolute solmization does not have capacity to show any alteration between the bars 11 and 15 (both *G* and *G#* are pronounced *sol*) and it is quite likely that the subject using such syllabary experiences a certain cognitive dissonance.

The examinees that employed relative solmization syllables were also evenly distributed. Out of 80 correct notations, 41 participants recognized the tonal change as modulation, while the rest of them (39) experienced tonicization. The theme turned out to be highly ambiguous, and the share of examinees using different syllabaries (tonic *do–la* and tonic *do*) was almost equal, which confirms that their decision did not depend upon the chosen syllabary. Even if the listeners could hear the rest of the theme, one could expect different answers depending on a subject's experience, theoretical background or subjective judgment.

14 This participant provided two different correct answers.

Modulation or mode mutation?

In the next exercise the participants were asked to notate the leading melody of an excerpt of the 2nd theme of the 1st movement of Beethoven's Violin Concerto in D major, Op. 61, bars 43–64. Picture 2 shows possible encodings using four different syllabaries.



Picture 2: ***Possible correct encodings of an excerpt of the 2nd theme of the 1st movement of Beethoven's Violin Concerto in D major, Op. 61, bars 43–64***

The theme is also a period with an antecedent in D major. The consequent (bar 51) surprisingly begins with a strong modal contrast, with an *F* in the tonic chord, instead of the previous *F#.* Other scale degrees remain unchanged (i.e. the same as they were in the diatonic D major antecedent) until the appearance of the subdominant chord in bar 57 (the introduction of *B flat* instead of a *B*). Various mode changes follow till the end of this section. The modal change can be interpreted as either a modulation to the key of D minor (which is obvious when one employs the tonic *do–la* syllabary, because the name of the tonic, *D*, changes from a *do* to a *la*, together with the rest of the syllables), or a mode mutation (which would be more typical for a tonic *do* approach, because the tonic would keep the same syllable, *do*, and the changes would be evident as alterations of scale degrees). Again, both musical alphabet and absolute solmization lack information on this ambiguity, and the absolute solmization does not even record the modal change between the bars 43–48 and 51–56 (which are otherwise the same in terms of scale degrees, but differ in accidentals).

This example, which is even more complex that the first one (because the tonal centre remained the same, only one tone changed, and in spite of that the change was far more radical), left a majority of examinees astonished. A hundred of them did not provide an answer, and further 32 responded too incorrectly to be taken into account. The structure of the correct answers follows in Table 9.

Table 9: ***The structure of positive answers to the tonal change in bar 51***

tonal content from bar 51 onwards	***n***	**%**	**syllabaries used**
modulation	39	61.90	relative solmization: tonic *do–la* (n=37); tonic *do* (n=2)
mode mutation	14	22.22	relative solmization: tonic *do–la* (n=5); tonic *do* (n=9)
absolute syllable values	8	12.70	alphabet (n=7), absolute solmization (n=1)
modulation *and* mode mutation[15]	2	3.17	relative solmization: tonic *do–la* (n=2)

In this example the syllabary experienced in previous education substantially influenced the cognitive processes of the examinees. Expectingly, those who were trained using tonic *do–la* syllabary mostly (37:42 = 88.09%) changed the tonic syllable from *do* to *la*, although its pitch remained unchanged, and shifted the syllabary by an ascending third. On the contrary, the majority (9:11 = 81.82%) of those trained in tonic *do* system recorded the change as mutation by altering the syllable *ma* into *nja* without shifting the tonic syllable. However, there were exceptions in both groups, and two participants recorded both modulation and mutation using the tonic *do* syllabary.

15 These participants provided two different correct answers.

The structure of the notation test: 'absolute' aspects of hearing and solmization

The results of the notation tests brought to attention some interesting features that shed light on the nature of melody comprehension in a tonal context.

First, the subjects that displayed possession of absolute pitch used various syllabaries to notate the given melodies, as shown in Table 10. All of them achieved fairly high scores, but interestingly enough, those using relative solmization syllables notated the given melodies with an accuracy of 100%.

Table 10: ***The structure of answers provided by the possessors of absolute pitch***

system of syllables used	***n***	***%***	**average score (notation accuracy) %**
musical alphabet	6	50	95.8
relative solmization	4	33.3	100
absolute solmization	2	16.7	93.75

The statistics revealed further interesting facts about the limitations of systems of absolute solmization discussed in the paragraphs 2.2 and 2.3. Most students trained with absolute solmization used their syllabary in a relative manner: although both excerpts begun in D major, they notated them as if they were in the C major key. Only the subjects possessing absolute pitch used the absolute solmization syllables accurately in terms of the absolute pitch values.

Table 11: ***The use of the absolute solmization syllables during listening tasks***

the use of the 'absolute' solmization syllables	***n***	***%***
absolute (fixed *do*)	4	10.81
relative (movable *do*)	33	89.19

Such an outcome discredits a fallacy pretty common among music pedagogues, i.e. the surmise that the use of fixed–*do* systems of syllables in music education encourages the acquisition of perfect pitch. Table 11 shows that vast majority of highly skilled students of music trained in absolute solmization failed to develop absolute pitch ability, and even for those who really used the syllables as expected from an absolute pitch possessor, one cannot claim that the use of a certain syllabic system played a decisive role in developing absolute pitch ability.[16]

16 Deutsch (2013) leaves the question of the role of the pedagogical approach in ear training unanswered, offering some pros and cons extracted from the existing research on the topic. Other factors that might encourage the acquisition of absolute pitch are an early age of onset of musical training, the toneness of the mother tongue, relationships between language and music, some neuroanatomical features, as well as genetics. Whatever the case might be, not a single factor has been explored in terms of more 'musical' material (such as the recordings of symphonic music, which are the object of this study); most researchers avoid resemblance of their material to the one present in real musical activities, insisting on 'ecologically valid conditions'. The question of the relevance of such ecological research for musical practice thus remains open, reviving the old rivalry between the so–called psychology of tone and the so–called psychology of music.

The accuracy and nature of the answers corresponded closely with the nature of the applied solfège system and the internal logic of the musical material heard in the excerpts. On the one hand, relative hearers could not develop absolute pitch and have thus employed their 'absolute' solmization in a relative manner. On the other hand, even absolute pitch possessors showed better results if their training included relative solfège systems in tonal contexts. It is thus appropriate to call into question common attitudes towards methods of relative intonation such as Hallam's who claims that "teaching practices which encourage relative pitch with a tonic that changes but retains the same name – for example, Solfa – are likely to discourage the acquisition of perfect pitch." (2006, 42–43) Deutsch challenges such attitude by listing controversial results of studies in different countries, concluding that "the argument in favour of fixed–*do* training based on prevalence of AP in a few selected countries [where fixed–*do* training is quite common] is a problematic one" (2013, 149). The present research also refutes the preference for fixed–*do* methods of ear training. The participants with relative pitch displayed significantly poor results in music dictation tasks if trained by methods based upon absolute solmization syllables. A majority of them, while declaring to be using absolute solmization, actually used the syllables in a relative manner (referring to the tonic as to *do* and changing the position of the *do* while notating modulating melodies), unconsciously. In addition, even if the melody was notated correctly using absolute solmization syllables (which was most frequent with subjects who possessed absolute pitch), the evaluator was not able to discriminate whether they noticed alterations within a passage they perceived as non–modulating (because they used the same syllable, e.g. *sol* for both *G* and *G#*).

It is worth mentioning that Hallam (2006, 43) continues her discussion with a doubtful thought "whether it is desirable to promote the acquisition of absolute pitch" as an education goal at all. The author of the present study stands by the opinion that it should not be treated as priority in music education. The low percentage of students possessing absolute pitch in this sample (which is composed exclusively of future music professionals) also indicates that this extraordinary ability should not be regarded as a prerequisite for any professional (or amateur) music activity. The share of the possessors of absolute pitch among the participants of the present study, who are mostly going to become professional musicians, amounts at 6.12% (n=12 / 196). If one choses to include the participants with only partial (or border) absolute pitch ability, the total share would not be higher than 19.39 % (n=38 / 196). Harris (1918, 190) mentions a study from 1889 which included 340 students of the Royal Academy of Music in London; "only 50 – one in seven – had anything but a remote idea of absolute pitch. Obviously", Harris concluded, "therefore, the vast mass of people can sing only by some form of relative pitch – the Movable Doh, or Intervals" (*ibid.*). The share of these students who, "being embryo professionals, represented far more that the average capacity for music", was about 14.7% (n=50 / 340). The phenomenon seems to be (at least according to these two examples), global and has not undergone substantial changes in the last 130 years. Both shares, low in percentage, speak in favour of the attitude that, to paraphrase Hallam, it should not be desirable to promote absolute pitch acquisition as an educational goal, even within professional music education. There is at least no evident reason for such practice.

Conclusions

The present study revealed several levels and aspects of ambiguity hidden in different solfège syllabaries commonly used in the Croatian music pedagogy and worldwide. Generally, the results of this investigation speak in favour of relative approaches to intonation when dealing with tonal repertoire. Subjects who were exposed to relative solmization systems in their previous music education displayed superiority in pitch discrimination in tonal contexts regardless of their hearing system (absolute or relative pitch). Their understanding of tonal processes such as modulation and mode mutation relies heavily on the nature of the solfège system they were exposed to in their earlier music education.

However, this is an isolated example of a survey in this field in terms of method, instrument and aims; it is confined to simple tonal contexts and does not answer any questions about the nature of music perception and cognition in the posttonal age. An experimental study with more complex tonal and non–tonal repertoires could be a possible avenue for further research.

In spite of the numerous advantages of relative solmization, especially in early stages of ear training, one should keep in mind that the intensive use of relative pitch syllables might discourage users in their approach to non–tonal repertoires, where relative solmization obviously loses any substantial meaning. On the other hand, one should not forget that both historical and contemporary tonal repertoire still exists and gets performed regularly. Relative approaches to solmization thus still deserve their honourable place within professional musical education.

However, even tonal music cannot be encoded equivocally; users of different solmization systems will respond differently to the same sample, as was the case with tonal change in Beethoven (*4.2.2*), which could be encoded with either minor or major changes of syllabary. This study has shown that dealing with ambiguous material demands a combination of multiple approaches order to reveal its full semantic potential, which should have repercussions not only for perception and cognition of music, but also for its interpretation.

Greater awareness of the consequences of choosing a solfège system in music education could contribute significantly to students' understanding of both tonal and non–tonal repertoires. Only an attempt of a systematic ear–training program which would include several different approaches to solfège syllabaries in separate, combined and control groups of students could provide reliable answers to the question of repercussions of the use of different syllabaries. A flexible combination of approaches in accordance with the implicit logic of concrete musical material could prevent difficulties originating in the limitations of individual solfège systems and raise the level of comprehension of pitch relationships in general.

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Povzetek

Posledice uporabe različnih sistemov didaktičnih zlogov pri poučevanju solfeggia so le redko predmet empiričnih raziskav na področju glasbenega izobraževanja profesionalnih glasbenikov (npr. Mikumo, 1992; Rogers, 2007). Večina tovrstnih raziskav je bila izvedena na populaciji neglasbenikov. V predhodnih študijah se je pri raziskovanju uporabljalo predvsem kratke dekontekstualizirane serije tonov enakega trajanja, ki so bili zaigrani na klavirju, ali na elektronskem inštrumentu, brez primerov iz glasbene literature ali primerjav z zunanjimi kriteriji. Zdi se, da je vprašanje izbire primernega sistema intonančnih zlogov še vedno primarno vprašanje pedagoške tradicije, ki le redko izhaja iz sodobnih znanstveno–raziskovalnih dognanj, čeprav tudi strokovnjaki, kot je Huron (2006) potrjujejo pomen didaktičnih zlogov pri zaznavanju in razumevanju tonskih odnosov. Naš prispevek predstavlja poskus vzpostavitve novega odnosa do vpliva sistemov intonančnih zlogov, ki se uporabljajo pri izobraževanju posluha profesionalnih glasbenikov, do njihovega razumevanja glasbe.

Namen pričujočega prispevka je razprava o značilnostih različnih sistemov intonančnih zlogov, ki se uporabljajo v glasbenemu izobraževanju profesionalnih glasbenikov, in določitev odnosov med subjektivnim slušnim sistemom (absolutni ali relativni posluh), sistemom zlogov za določanje višine tona (intonančnih zlogov – glasbene abecede in različnih vrst solmizacije), zaznavanja tonalitetnih odnosov (vzporedne, sorodne, isto zveneče tonalitete itd.) in drugih relevantnih dejavnikov. Cilj našega prispevka je povečati zavest o kognitivnih procesih, ki se odvijajo med urjenjem posluha in temeljijo na uporabi zlogov pri glasbenem urjenju profesionalnih glasbenikov.

V raziskavi je sodelovalo 196 študentov glasbe, ki so bili udeleženi v slušnih vajah, sestavljenih iz samoopazovanja in glasbenega diktata. Udeleženci so morali prepoznati in zapisati didaktične zloge, ki so se jim pojavili v mislih med poslušanjem odlomkov posnetkov tonalitetne klasične simfonične glasbe. Vsako kategorijo rezultatov smo analizirali ločeno v kvalitativnem in distribucijskem smislu. S pomočjo linearne regresijske analize smo skušali ugotoviti napovedno vrednost starosti in spola udeležencev, skupnega števila let njihovega glasbenega izobraževanja, glavnih študijskih predmetov, intonančnih sistemov, ki so jim bili študenti izpostavljeni, in najnovejših ocen, doseženih pri predmetu solfeggio, na uspešnost pri glasbenem diktatu.

Rezultati kažejo, da večina študentov glasbe uporablja intonančne zloge v svojih vsakodnevnih dejavnostih. Njihovo dojemanje tonalitetnih procesov (kot sta npr. modulacija in mutacija) v večpomenskih kontekstih v veliki meri sloni na značilnostih sistema intonančnih zlogov, ki so jim bili izpostavljeni v času dosedanjega glasbenega

izobraževanja, kot tudi na notranji logiki glasbenega materijala kot takšnega. Tudi poslušalci z absolutnim posluhom so pokazali boljše rezultate, če je njihovo glasbeno izobraževanje vključevalo relativne sisteme intonančnih zlogov v tonalitetnih kontekstih, medtem ko so osebe z relativnim posluhom pokazale znatno slabše rezultate, če so bile poučevane z metodami absolutne intonacije.

Naša raziskava je pokazala, da obdelava večpomenskih glasbenih materialov zahteva kombinacijo različnih pristopov, da bi razkrila svoj poln semantični potencial. Ta kombinacija različnih pristopov nima posledic le za percepcijo in kognicijo glasbe, temveč tudi za njeno interpretacijo. Večja ozaveščenost o posledicah izbire ustreznih intonančnih sistemov v glasbenemu izobraževanju bi študentom znatno olajšala razumevanje tonalitetnih in atonalitetnih repertoarjev. Fleksibilna kombinacija pristopov v skladu z implicitno logiko konkretnega glasbenega materiala bi lahko preprečila težave, ki izvirajo iz omejitev posameznih sistemov poučevanja intonančnih zlogov.