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THE IMPACT OF MUSICAL BEAT PERCEPTION ON STRESS PRODUCTION BY L1 SPANISH EFL LEARNERS

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Table of Contents

ACKNOWLEDGEMENTS....5

ABSTRACT....5

1. INTRODUCTION....6

2. LITERATURE REVIEW....7

2.1 WORD STRESS IN SPANISH, CATALAN, AND ENGLISH....7
2.2 STRESS PERCEPTION IN THE L1 AND THE L2....9
2.3 PERCEPTION AND PRODUCTION IN NON-NATIVE PHONOLOGICAL PROCESSING....9
2.4 TASK EFFECTS IN L2 PRODUCTION....10
2.5 STRESS AND RHYTHM IN MUSIC AND LANGUAGE....10
2.6 PEDAGOGICAL APPROACHES TO TEACHING STRESS AND RHYTHM....13
2.7 MUSICAL TRAINING AND L2 PRODUCTION....14
2.8 BEAT ASSESSMENT....16

3. RATIONALE....17

4. OBJECTIVES & RESEARCH QUESTIONS....18

5. METHOD....19

5.1 RESEARCH DESIGN....19
5.2 PARTICIPANTS....19
5.3 TASKS AND MATERIAL....20
5.4 PROCEDURE....22
5.5 ANALYSIS OF RESULTS....22
5.6 STATISTICAL ANALYSIS....23

6. RESULTS....24

6.1 STRESS PERCEPTION RESULTS....24
6.2 STRESS PRODUCTION RESULTS....25
6.3 STRESS PRODUCTION PERFORMANCE IN RELATION TO STRESS PERCEPTION PERFORMANCE....27
6.4 STRESS PRODUCTION AND PERCEPTION RESULTS COMPARED WITH MUSICAL SELF-PERCEPTION....30
6.4.1 EFFECT OF RHYTHM PERCEPTION ON STRESS PRODUCTION AND PERCEPTION TASKS RESULTS....31
6.4.2 EFFECT OF SINGING ABILITY ON STRESS PRODUCTION AND PERCEPTION TASKS RESULTS....33
6.4.3 EFFECT OF INSTRUMENTAL TRAINING VERSUS STRESS PRODUCTION AND PERCEPTION TASKS RESULTS....34
6.5 WORDS PRODUCED WITH WRONG STRESS....35

7. DISCUSSION 36

7.1 OBJECTIVES AND RESULTS 36
7.2 RESEARCH QUESTION AND RESULT 37
7.3 RESULTS IN PREVIOUS LITERATURE 37
7.4 IMPLICATIONS FOR TEACHING 38
7.5 LIMITATIONS AND DIRECTIONS FOR FURTHER RESEARCH 39

8. CONCLUSION 40

9. REFERENCES 42

APPENDIX I 45

APPENDIX II 47

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ABSTRACT

The present study analyses the relation between musical beat perception and stress production in English words by Spanish L1 English students. A group of elementary English students (n=22) undertook a validated beat perception test and two elicitation tasks, a naming task and a reading task respectively, based on stress production of A1 English words that had previously been heard in class. The results of this test show that there is no significant correlation between a good performance on beat perception and a good stress production on English words.

1. INTRODUCTION

The following investigation has as a starting point many years of observation of primary and secondary education students during private lessons in a bilingual context (Spanish and Catalan) for more than 10 years. Such students presented serious problems while trying to identify the stressed syllable in each word studied in either language. In both Spanish and Catalan, all words show only one stressed syllable, which mainly falls in 3 different positions. As my students struggled to identify where the stress fell, the clapping of the hands would help us separate the syllables and a louder clap would help to emphasize the stressed one each time it was pronounced. Those students who failed to follow an on-beat rhythm seemed to also struggle to identify the correct stressed syllable. Through my EFL teaching over the last six years at the Official School of Languages (EOI) with teenager and adult students ranging from the age of 15 to their 60s, I have also observed the same behaviour.

English and Spanish are both rightward stress languages meaning that the primary stress falls in the final three-syllable window (Goedemans & van der Hulst, 2009). Although this is a similarity, while Spanish has only one stress per word, English can present different types of stress. It is as well worth remembering that stressed syllables in English are characterized for presenting a longer duration, a higher intensity, and a higher pitch, which make them stand out when heard.

It has long been known that the phonological properties of a learner's native language influence speech perception (Best & Tyler, 2007) and that the phonetic categories of the L1 and L2 phonetic subsystems interact with one another dynamically. These are updated every time the statistical properties of the input distributions defining L1, L2, and composite L1-L2 categories change (Flege & Bohn, 2021). It is then not surprising that stress in English is a big challenge to students of all levels, and even L1-Spanish advanced students still face it when learning new vocabulary in English.

2. LITERATURE REVIEW

In this section, I intend to review word stress placement in the languages targeted: Spanish and Catalan as the L1 languages for the participants of this study and English as the FL learnt and being the language of the items scored in the tests. We will continue with a comparison of stress perception in the L1 and L2 to later link perception and production. Second, there will be a discussion on the effects of naming versus reading aloud tasks. Third, we will talk about stress and rhythm in music and language and their pedagogical approaches when teaching them as well as the relationship between musical training and L2 production. We will finally learn how musical beat is assessed.

2.1 Word stress in Spanish, Catalan, and English

Word stress or lexical stress is a feature by which a syllable is more prominent than the rest (Gutiérrez Díez, 2005) regardless of how the prominence is achieved. According to Cutler (2005), word stress is described as 'the accentuation of syllables within a word, or of words within sentences' (p. 264). However, stress cannot be described as a single structural feature common in all the languages. Instead, it refers to a feature produced and perceived through several cues different for each language (Beckman, 1994).

In English Spanish and Catalan, stress alone can distinguish lexical meaning, it has a contrastive use. Hence its importance in both productive and receptive processes.

However, stressed syllables in English are longer than in Spanish or Catalan because the vowels have a longer duration. Vowel quality in fact plays a part in the perception of stress in English because full vowels are more likely to be perceived as stressed ones rather than as reduced ones (Fry, 1958). And this is what might be causing a challenge to L1 Spanish learners of English as there is no vowel reduction in Spanish (Hualde et al., 2008). Research suggests that L1 Spanish speakers may not stress words correctly as they fail to reduce a vowel (Flege & Bohn, 1989).

Stress and rhythm are two suprasegmental features of the Spanish and English phonological system. Hence, we cannot talk about stress without mentioning rhythm, often defined as a strong pattern of sounds, words or musical notes that is used in music, poetry, and dancing.

While Spanish often uses stress to disambiguate words (E.g.: *marco* vs. *marcó*), English instead carries other syntactic differences in words that differ in stress. English is a stress-timed language (Pamies Bertrán, 1999) which presents an isochronous rhythm, based on the use of stressed syllables which occur at regular intervals in the stream of speech whether they are separated by unstressed syllables or not. This theory states that the time from each stressed syllable to the next will have a tendency to be the same. This pattern contrasts with Spanish, because of it being a syllable-timed language where the syllables have equal force, what some authors describe as a marked *rat-a-tat-a-tat* effect. The production of every syllable is through an expulsion of air from the lungs where the movement of the muscles depend on the emphasis that has been given to the syllable. However, as English is a stress-timed language, it is often described as having a regular beat, the basis of its natural rhythm, with equal intervals of time between the stresses.

In the case of the English language, we have a specific particularity with short and long vowels, a feature which is not present in Spanish or Catalan. The grouping of multiple consonants in the English language too, makes the division of syllables complicated for Spanish L1 learners and hence, an obstacle for their correct pronunciation. The study of these differences is key for the improvement of new acquisition techniques.

Due to these crosslinguistic differences, Spanish learners of English make every syllable count, and thus experience difficulties producing English rhythm. It is also worth noticing that English is presented with many cognates with stress-patterns that might not match the Spanish stress pattern: *mission* vs. *misión*, *government* vs. *gobierno*, etc.

2.2 Stress perception in the L1 and the L2

Previous research findings on stress perception suggested that only F0 is important for signalling stress in Spanish. For instance, Bouchon & Peperkamp (2011) tested the perception of 30 native speakers of Spanish to find that no single cue was responsible for the perception of stress. Instead, the combination of F0, vowel duration as well as F0 and intensity contributed to stress perception. When talking about word stress, a listener will perceive its loudness (intensity), its length (duration) and its pitch (F0) respectively (Cutler & Pearson, 2018).

The extent to which non-native speakers can perceive and produce stress has been investigated in the field of psycholinguistics. The mental representations of stress in a speaker's L1 can heavily influence how the speaker perceives and hence produces stress in L2. Some authors suggest that language typology can help to make predictions regarding both L2 speech perception and production (Altmann, 2006).

One model claims that speakers who do not use stress in their first language will experience 'stress deafness', and there are in fact studies that can conclude that native speakers of French exhibit stress deafness (Gussenhoven et al., 2002) as they follow their L1 stress pattern.

2.3 Perception and production in non-native phonological processing

It is generally thought that how word stress is perceived and identified in the L2 will have consequences in the production and processing of this language, hence, a direct relationship between individuals' capacity to perceive and produce foreign sounds is expected. The relationship between these two processes has been investigated through different methodologies. The *Speech Learning Model* (Flege, 1995) assumes that the accuracy with which non-native sounds are produced is limited by how accurately they are perceived. But according to some researchers (Peperkamp & Bouchon, 2011), evidence has been yielded both for and against such hypothesis.

Some authors (Cutler & Clifton, 1984) found that 'mis-stressing a word hinders its recognition just as would mispronunciation part of its segmental structure' (p. 194). Other authors (Goldstein & Fowler, 2011) believe in a common representation for both processes, of an articulatory nature, whereas there is also room for those who believe in a separate representation with complex links mapping one onto the other (Flege, 1995).

2.4 Task effects in L2 production

The present study uses two different tasks to assess stress accuracy in L1 Spanish students of English: a picture naming task and a reading task. It is well known that the time required to name an object is greater than the time required to read aloud its name when written. Few studies suggest that factors such as the modality of presentation of stimuli influences adaptation. Some studies tried to investigate whether the choice of these two modalities affected the speech transfer and their conclusion was that the magnitude of adaptation was not different between modalities, and picture naming and word reading rely on sensory-motor representations that may be related to contextual characteristics (Caudrelier et al., 2018).

Although most people would agree that orthography is only activated in a word-naming task, researchers have reported evidence for the automatic activation of orthography even when a target is a picture. In fact, a study on naming and reading production (Yoshihara et al., 2020) concluded that orthographic activation occurred in the participants' mind equally in both tasks.

2.5 Stress and rhythm in music and language

Some research suggests that an improvement in the use of lexical stress could positively influence the learner's speech rhythm. Studies that show a positive correlation between musicality and the learning of foreign languages are not so scarce (Vangehuchten et al., 2015). Languages, as well as music, present a series of dynamic characteristics from the prosodic perspective. In fact, some authors suggest

that tonal and temporal features are part of music and spoken language because of how their speech is organized (Trofimovich & Baker, 2006).

Patel & Daniele (2003) compared rhythm in language and music. They found that, depending on the mother tongue of the musical composer, the rhythms created in their melodies were different. This research proved that certain languages have a particular rhythm and that the L1 stress pattern of our language will even have an impact on how our brain processes musical melodies.

One year later, the same author conducted a study that would explore the parallels and differences on rhythm in language and music (Patel, 2003). Linguistic rhythm is widely explored in this study as well as its diverse expressions with a main finding: it cannot be demonstrated that a language has a periodical structure as music does, but length may be worth analysing. It is a factor that culture inherits from language so that it can also be found in musical rhythm, even in music compositions with no lyrics.

What is of great interest is that a similarity in rhythm among languages does not necessarily mean that those languages are phonologically and/or grammatically similar. A future study could dig into which languages present similar rhythm patterns and whether that would have an impact to imitate a native accent in other languages.

Probably, to resolve many of the questions of the study mentioned above, the author designed the *Beat Alignment Test* (BAT) (Iversen & Patel, 2008) which will later be explained, and which inspired the CA-BAT beat test used in the present study to measure beat perception in the participants of studies where beat and rhythm are assessed.

Other studies have focused on language-specific and/or individual differences of the processing of rhythm (Magne, 2005). The impact of his article in the world of science lays on the fact that all their participants were solely right-handed. Some studies regarding left and right-handedness show that there might be differences in the subject depending on their preference as the brain processes rhythm differently

depending on which area is activated (Zapala et al., 2020) Neurology is, then, a field that must also be considered when doing research on rhythm and language.

Christiner & Reiterer (2013) investigated the imitation performance of foreign language production with a sample of sex-balanced singers with different musical education levels. The chosen language, Hindi, was unfamiliar to all the participants. After the study, the authors concluded that the ability to sing shared similarities with speech imitation, and so did the rhythm perception of each participant. There was a clear correlation between the ability to sing and the speech imitation capacity, which showed to be stronger than the musical ability.

In a subsequent study the same authors (Christiner & Reiterer, 2015) found that instrumentalists developed quite distinct skills when compared to vocalists. The authors recruited 96 participants, among them instrumentalists, vocalists and non-musicians/non-singers and were tested on their abilities to imitate foreign speech in an unknown language, Hindi, a second language, English, and their musical aptitude. The results revealed that both instrumentalists and vocalists had a higher ability to imitate speech and foreign accents compared to non-musicians/non-singers. Vocalists, once again, outperformed instrumentalists significantly. They concluded that 'adaptive plasticity for speech imitation was not reliant on audition alone but also on vocal-motor induced processes, and also that vocal flexibility of singers went together with higher speech imitation aptitude' (p.1).

In a later contribution, the same authors (Christiner & Reiterer, 2016) showed that musical aptitude had a positive impact in the processes of language acquisition. However, there was no information related to the mechanisms that triggered the detection, imitation, and memorization of foreign languages. The main objective of the study was to check what skills allowed vocalists to imitate a speech in a foreign language. The result was that singing aptitude worked as a good predictor for accent imitation. Another objective was to find out whether there were any significant differences among the varied abilities to imitate accents based on the performance

of instrumentalists or vocalists. Participants with knowledge on none of those abilities, instrumental or vocal, were also included. The results were as follows: vocalists did present better aptitude to imitate accents among all groups. However, both vocalists and instrumentalists presented similar scores in those tests that evaluated musical skills. Those participants with none of those aptitudes would present worst results.

In the abovementioned article, the authors also analysed the link between music and language. Auditory processing seems to be relevant when it comes to speech perception and music (Oechslin et al., 2010) , although some authors claim that more research is needed to broaden the understanding of such bidirectional effects, as are music and language (Asaridou & McQueen, 2013). The same authors argue that experience with spoken language has some effects on music perception, and vice versa.

2.6 Pedagogical approaches to teaching stress and rhythm

Learners need to be aware of the potential issues they will encounter in terms of intelligibility loss if their word stress is not correct. Some authors (Dalton & Seidlhofer, 1994) argue that lexical stress is easier to teach than other suprasegmental features such as tone and can play a more important role than some phonemes in terms of contribution to the general intelligibility of speech.

What might be often discussed is whether the pronunciation materials are often presented as nursery rhymes, and with overgeneralizations of certain patterns that do not prepare students for the realities of the English rhythm.

As strengthening the instruction of stress in the English language is a potential need, some authors suggest practical approaches. The following are approaches aiming at informing multiple aspects of oral production that can be used at any level (Kaiser, 2013). A new approach should focus on strong and weak syllables. The author suggests the following approaches:

- Identifying how many syllables are in a word.
- Marking strong syllables with an accent mark.

- Using body movement and other physicalizations to point out strong syllables.
- Showing the difference between syllable-timed and stress-timed rhythm.

2.7 Musical training and L2 production

Stress and rhythm are both features of the Spanish and English phonological systems. As previously mentioned, English is a stress-timed language which presents an isochronous rhythm, based on the use of stressed syllables which occur at regular intervals in the stream of speech whether they are separated by unstressed syllables or not.

In the case of English, we have a specific particularity with short and long vowels, a feature which is not present in the Spanish or Catalan languages. In English, the grouping of multiple consonants makes the division of syllables complicated for Spanish L1 learners and hence, an obstacle for their correct pronunciation. These two facts make the English language difficult for our specific students with Spanish as their L1, and the study of these differences is key for the improvement of new teaching techniques. Because of all this opposition, Spanish learners of English make every syllable count, and thus cannot produce the expected English rhythm.

Music and words share similar cognitive processes (Chobert & Besson, 2013). After the revised literature, it makes sense to suspect that both languages (spoken and musical) are closely related and that the practice of them at the same time can be beneficial for the learners of spoken language. Some studies do prove the benefits of learning a second language through musical activities in class.

(Pastuszek-Lipińska, 2008) explored the influence of music education on second language acquisition. In this study, the authors chose a combination of stimuli of up to six different foreign languages because they all presented differences regarding their phonemic nature, phonetic style, and length. Two groups of participants with and without musical knowledge were tested. The aim was to prove the hypothesis that musical education played a relevant role in speech perception and production.

As expected, the results showed that those people with musical knowledge scored higher in a foreign language lexical imitation task.

But the question of whether certain languages might be easier to imitate than others because of their rhythmic nature remains unanswered. For instance, (Yoshida et al., 2014) introduced the element of the song as a very important cultural identification of Japan. They observed how singing in English was a challenging task for Japanese learners, because of the phonetic difference between English and Japanese. Their investigation led to an automatic measuring assessment device of singing voices with interesting results and similar to those of the previous studies mentioned. Singing voices scored higher than voices in speech. It seems only right to conclude that the exercise of singing improves English pronunciation.

That study is the answer to what we might have observed before: people who are noticeably unable to speak foreign languages but when asked to perform a song in any other than their L1s, are able to pronounce and stress correctly as if they were advanced users of that language.

Along the same line, (Good et al., 2015) focused on the efficacy of singing in foreign-language learning. Early learners were asked to learn a poem through a song. This study was motivated by the lack of evidence of benefits of singing in the learning of foreign languages. Through the learning of part of a novel, those students who had learnt it while singing, showed not only more motivation, but memory also benefited from that experience and hence they would pronounce English vowels better, among other improvements. Those students who learnt it while singing the poem obtained better pronunciation scores than those who learnt it as prose. The gains of musical training extended to six months after testing.

Wallace (1994) proved that a group of students who had heard verses from a song remembered the stressed syllables of the words better than a group of students who had just heard them while reading them aloud. The melody and rhythm of a song that

becomes familiar makes structural information immediate. Hence, there is clearly a benefit in the use of songs, which boosts the rhythm in words.

Could sound typology of languages predict individual differences in musical and phonetic attitude?

(Christiner et al., 2018) investigated the ability of nine- and ten-year old's ability to imitate words in two foreign languages: Chinese and Tagalog. The reason why these two languages were chosen for the experiment was because Chinese is a tonal language whereas Tagalog, in absence of tone, has a very stressed rhythm. The authors, based on some of the articles shown in this literature revision, concluded that the ability to imitate new words depends very much on the language learnt. There are clear differences between tonal and non-tonal languages. In fact, musical aptitude is hence not always a guarantee for success. When it comes to tonal languages, different skills will be required, the same happening with a rhythmic one. What makes this study particularly interesting is the fact that a memory test was carried out, a variable that has been mentioned in previous studies as something to be considered when learning new words in new languages and evaluating tasks of that nature.

Overall, the studies just reviewed show that musical skills and aptitude are good predictors of native accentedness in L2 speech learning.

2.8 Beat assessment

Beat perception is increasingly being recognized as a fundamental musical ability. The CA-BAT test by Harrison and Müllensiefen (2018) is a variant of the Beat Alignment Test (BAT) of Iversen & Patel (2008). The latter was initially designed to check the aptitudes of general population, that is, untrained individuals. Both tests examine beat perception in isolation from beat synchronization. It is also a useful tool to search for 'rhythm deaf' individuals who have trouble with beat processing in music. The first authors created the BAT test to assess general population on the ability to detect whether a beat follows the rhythm of a given melody. It helps measure rhythm

perception. Other previously available tests they had considered resulted too complicated for people without musical knowledge to be carried out.

Although the authors of many previous studies mention other tests to measure certain aspects of musical abilities, it is of utmost importance to analyse what needs to be measured and choose one test or another accordingly, and if the results of that test will be useful to be implemented in our investigation.

A number of psychometric instruments have been developed to assess this ability, but these tests do not take advantage of modern psychometric techniques. CA-BAT tries to fill the literature gap in this field, which leverages recent advances in psychometric theory, including item response theory, adaptive testing, and automatic item generation. Four empirical studies have constructed and validated this test, whose results support its reliability and validity for laboratory testing.

Having gathered all this information through different studies and papers, the focus of this present study is on one of the musical aspects, beat, and somehow its equivalent in language: word stress.

3. RATIONALE

While pronunciation is important, sometimes it is just as important to get the word stress correctly. English words stress has two levels, primary and secondary. Correct primary stress helps the listener to understand the speech, whereas wrong stress placement might compromise intelligibility. If a word is slightly mispronounced, but the primary stress is correct, hence perceived, communication between the speaker and the interlocutor will be successful. So, stress is important, especially for words that have a high functional load. The primary stress can change the meaning of words with the same spelling (e.g.: address, permit, record…); hence, not only intelligibility but also communication are compromised.

4. OBJECTIVES & RESEARCH QUESTIONS

Our primary objective is to investigate to what extent word stress placement might have a perceptual basis. Specifically, we will attempt to address the following research question:

Is there a link between the aptitude to perceive a musical beat and the aptitude to produce the stressed syllable correctly in previously learnt words in English?

Our prediction is that the better the beat perception performance, the better results in stress production. Those students who score higher in the beat perception test are expected to make fewer mistakes in the stress production tasks.

Additionally, I would like to look for significant differences in the results of the stress production tasks, since one is a naming task in which an image is the input, and the other is a reading task, and there is evidence that orthography may trigger pronunciation errors.

The main objectives of this study are:

1) To compare the performance scores of production tasks in those participants with a higher beat test performance and those with a lower beat test performance, and to relate musical beat perception with word stress production.
2) To assess possible differences between task 1 and task 2 performance for each participant.
3) To compare the performance scores of production tasks and the musical beat perception scores in participants according to their self-rhythm perception aptitude, singing ability aptitude and instrumental training history.

5. METHOD

5.1 Research design

The research is designed with a total of three tasks and a self-assessment questionnaire on their rhythm perception aptitude, singing ability aptitude and instrumental training history. The first task, called beat test, is a computer based one (CA-BAT test) to test the musical beat perception of the participants. The following two tasks are based on an experimental design to test the performance of word stress through a naming task and a reading task. The variables are manipulated as the participants do not just speak English freely, but they produce only the chosen speech samples. These word samples are obtained from their textbook as the idea is to work with vocabulary they are familiar with. Although they may take guesses, the words chosen for the production tasks have been heard in class and should be known by all participants.

We are presented with three dependent variables in this study: the beat scores as the results of the beat perception test, and the other two dependent variables are derived from the score obtained by each participant for each one of the two production/elicitation tasks: task 1-image naming task and task 2-reading task.

All participants provided information about their age, L1, own perception of their sense of rhythm, own perception of their singing ability and instrumental training history through a self-assessment questionnaire.

5.2 Participants

Inclusion criteria: A1 English L1-Spanish students. Students would have been excluded when presenting speaking disorder history or a different L1 after the critical period hypothesis age limit.

Some participants reported that they had a family history of dyslexia, stuttering, etc. but none of the participants had been diagnosed with any speech/hearing disorder. The total number of participants was 22 students of the EOI of Palma, 17 females and 5 males from a class of a total of 30 students. They had enrolled the A1 level of English

in last year's 2020/21 course and, due to COVID restrictions, they only attended in-class lessons once per week for a duration of 1h and 50' (instead of 3h 40'). Their lessons were mainly conducted in English, and Spanish was only used to clarify exercise instructions and other relevant information. As for their nationality, 13 were from Spain, two from Ecuador, two from Colombia, one from Honduras, one from Venezuela, one from El Salvador, one from Bolivia and one from Morocco.

All the participants took part in the tests voluntarily. All of them signed an agreement form before they started the tests, and no economic compensation was given for their participation.

The age range was from 19 to 59 years of age and their L1 was mainly Spanish (19) or Catalan (2), except for one student who had French as his L1 and Spanish as a second language before the age of 6, being the reason why he was not excluded from the study. As for their education level, 50% of the participants had carried out vocational training studies, whereas 25% presented only secondary studies. It is a very varied sample also in terms of the country of origin of the participants.

5.3 Tasks and material

The first task (called beat test) carried out was the CA-BAT TEST, (Harrison, P. & Mullensiefen, D., 2018) a *Computerised Adaptive Beat Alignment Test*, which assesses the ability of the participant to recognise the beat in a piece of music. This test adapts to the performance of the participants: if they do well, the difficulty level increases. In the first part, the participants are familiarized with the method with two simple tasks where they are played some music clips together with a beep track. Their task is to decide whether the beep-track is on or off beat. There is no score for this task although they are given feedback on correct or incorrect.

Participants hear a total of 10 music clips consisting in music tunes with a beep-track. Each music clip has two versions (first and second) that are played one after the other. One version will have beeps on the beat, and the other will have beeps off beat. The task is to decide whether the clip with beeps on the beat came first or second. If the

participants do not know the right answer, they are encouraged to give their best guess. The total duration of the test is of approximately four minutes. During the performance of task 1, the researcher was making sure the instructions were clear while translating them and the students were asked to inform when they were ready for each of the music clips and encouraged to keep focused and use hand claps or feet stamps to be able to follow the beat. No participants reported difficulty when performing the task, although some reported that some trials were more difficult than others.

The second and third tasks were elicitation tasks (called task 1 and task 2). In both tasks, the students reproduced the same words. The target words included nouns, adjectives, and a preposition. There were words that would present difficulty when being stressed because they had a cognate in Spanish although there was a cross-linguistic difference in stress placement (eg: *móvil vs. mobile*). Each task did not last more than 1 minute. They were recorded with the *Praat* software (Boersma & Weenik, 2021) on a MacBook Pro computer.

In the elicitation task 1 (naming task), students were asked to first identify images with a concept in Spanish, to make sure they did understand the representation of the image (Appendix 2). Students were corrected when necessary (eg:*chino, no japonés*) to make sure they would name the picture correctly. Then, they were told they would be recorded and asked to say the word in English. The images were given one at a time, so that students would not rush their answers.

In the elicitation task 2, students were asked to read the list of the corpus added in Appendix 2. The 14 items were the same ones used in task 1 and they were delivered in the very same order. As it will be discussed later, some students rushed their answers, as it was a reading task of a list of items. However all students were encouraged to keep a quiet pace when reading to ensure a natural production of the word.

5.4 Procedure

Prior to the test, the participants were administered a language background questionnaire that also included specific questions about their musical training (Appendix I) and was completed by the researcher to ensure accuracy in the answers. This form was based on the one used by Li and DeKeyser (2017) with some added questions.

After completing it, the participants performed a total of three tasks: first a beat perception test and then two production tasks. The tasks were performed in a quiet room at the EOI premises. All tasks were carried out face-to-face, although the first task, the beat test, was an online task. The reason was that the task itself could have resulted complicated for English elementary students to do online as all the instructions were given in English. Participants could practice as there was a warmup task before the assessed task. Controlling these factors was crucial to ensure the success of the task.

As the tasks were performed in the same room with closed windows and no air conditioning during the end of May in the hot Majorcan weather, most students seemed overheated and tired after the tasks, although they were kept short. They were asked to sit comfortably and to relax. They were also reassured as they were only participating in a study and all the results were welcome.

In the second task, the participants were asked to simply read the words written in a document in capital letters (to ease the reading task) at a normal pace. Extraneous variables were considered and reduced as much as possible. Participants were tested individually and without sanitary facemasks for a better quality of the recording.

5.5 Analysis of results

In the first test, the beat test, a final score is given automatically. Scores are plotted on an item response theory metric, where the mean score in the general population

is approximately 0, and the standard deviation in the population is approximately 1. Scores may range from -4 to +4.

In the elicitation tasks 1 and 2, two teachers from the EOI in Palma rated the participants' productions as "right" (correct stress placement) or "wrong" (wrong stress placement). The raters were instructed to ignore mispronunciation or any other issues other than the word stress. All data was collected in an Excel document and the answers were compared to make sure there was an agreement between the raters. Each participant was given two scores for each of the two elicitation tasks. The maximum score was 1 for 14 right answers, each correct answer being 0.071. There was no penalization for wrong answers.

As for the independent variables, for questions 14 (own rhythm perception) and 15 (own singing ability perception) of the language background questionnaires, the participants were given 1 point if they marked any answer between 3-5. For question 19 (instrumental knowledge) they were given 1 point if the answer was affirmative. These are the only variables that were made quantitative.

5.6 Statistical analysis

The three dependent variables are reported as mean ± standard deviation or percentage when corresponding. Differences between groups were analysed using U Mann-Whitney test for continuous variables, and Fisher's exact test (two-tailed) or chi-squared test for categorical variables. Spearman's correlation tests examined correlations between variables. The comparison of paired samples was performed using the Wilcoxon test, the alternative paired test for non-parametrical continuous variables or when $n<30$. The statistical software SPSS v.26 was used and the alpha decision level was set at $p < 0.05$.

6. RESULTS

As for the treatment of the results, the variables are expressed in mean and standard deviation and category variables. The age of the participants was 38,9 ± 11,1.

6.1 Stress perception results

The participants' stress perception was assessed through one task only. Find in table 1 the scores for each participant in their performance of the CA-BAT test (beat test) which assessed their musical stress perception.

CA-BAT test scores

Participant	CA-BAT test score
1	-0.95
2	0.984
3	-0.619
4	-2.944
5	-0.756
6	-0.003
7	0.394
8	-0.212
9	-1.337
10	-0.292
11	-0.279
12	**0.317**
13	-0.434
14	**0.715**
15	-0.776
16	-1.775
17	-1.573
18	**0.034**
19	-3.5
20	**0.269**
21	**1.395**
22	-0.133

Table 1. Participants and CA-BAT test score.

The results vary from a range of -4 to +4. The score was calculated automatically by the online test that was carried out. Five of the 22 participants got a positive score (scores marked in bold). The mean score was -0.52 ± 1.17, the lowest score being -3.5 and the highest +1.4. Table 1 below shows the scores.

6.2 Stress production results

Table 2 shows the results of the two stress production tasks: task 1 (T1)-picture naming task and task 2 (T2)-reading task. The second and third columns show the correct answers of each participant whereas the two latter show the final score. The maximum score is 1, each correct answer has the same value.

Scores of stress production tasks

Participant	T1-right answers	T2-right answers	T1-score	T2-score
1	9	9	0.64	0.64
2	**9**	11	**0.64**	0.79
3	9	9	0.64	0.64
4	12	12	0.86	0.86
5	8	8	0.57	0.57
6	**11**	12	**0.79**	0.86
7	11	**10**	0.79	**0.71**
8	**8**	9	**0.57**	0.64
9	**10**	11	**0.71**	0.79
10	10	10	0.71	0.71
11	12	12	0.86	0.86
12	**8**	9	**0.57**	0.64
13	**11**	12	**0.79**	0.86
14	10	10	0.71	0.71
15	9	9	0.64	0.64
16	12	12	0.86	0.86
17	**6**	8	0.43	0.57
18	11	11	0.79	0.79
19	9	9	0.64	0.64
20	12	**10**	0.86	0.71
21	13	13	0.93	0.93
22	10	10	0.71	0.71

Table 2. Participant, right answers for task 1 and task 2 and final score for task 1 and task 2.

The figures marked in bold show the lowest number of correct answers and lowest score respectively for those participants who performed differently in each task. A total of 7 participants scored less in task 1-picture naming compared to 2 participants scoring less in task 2-reading task.

Find below two histograms (figure 1) that show the different scores and the participants that scored it. The mean task 1 was 0.71 ± 0.12. The results for task 2 resulted in 0.73 ± 0.022. As shown, both distributions followed a non-parametric distribution.

Histograms of frequency for tasks 1 and 2

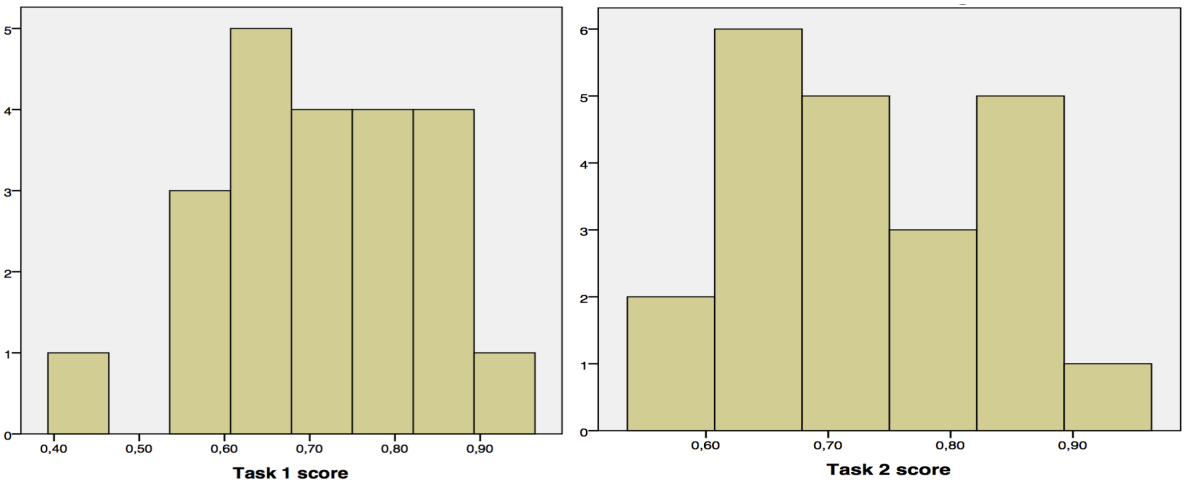

Figure 1. Number of participants distribution of scores for tasks 1 and 2.

Figure 2 below shows the Wilkoxon test comparison of results among the two different word stress production tasks in each of the participants: task 1-naming task and task 2-reading task. The red line shows the mean scores for both tasks.

Relation of results of tasks 1 and 2. All participants

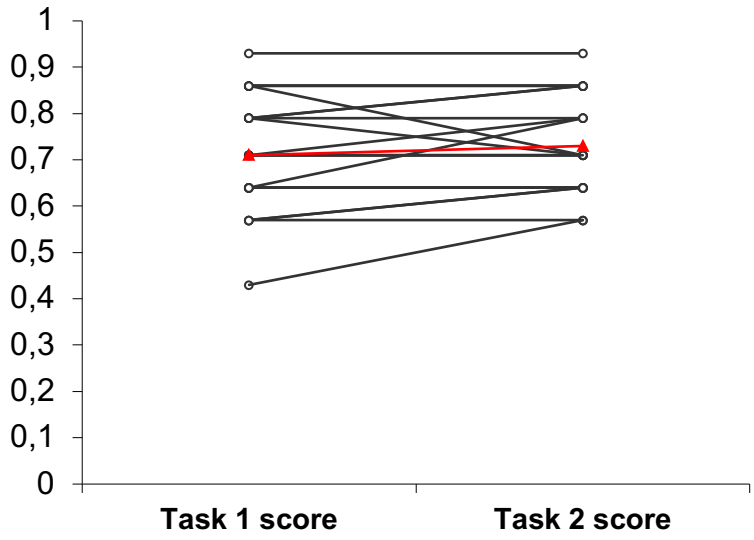

Figure 2. Scores for task 1 and 2 per participant.

No significant differences were found, as observed in figure 2 in the production of either task.

6.3 Stress production performance in relation to stress perception performance

This section shows the performance scores of the participants in the two production tasks-task 1 and task 2-through two different divisions.

In the first analysis, the participants were split into two groups: one group shows 50% of the participants with a lower perception performance (beat test) and 50% of the participants with a higher perception performance (beat test). Although figure 3 shows a slightly higher value for both tasks 1 and 2 in those participants with a better score in the beat test, the differences did not reach statistical significance.

Specifically, as shown in figure 3 A, the mean score in task 1 for those participants with lower values and higher values were as follows: 0.68 ± 0.13 and 0.75 ± 0.12 respectively. As shown in figure 3 B, the mean score in task 2 for those participants with lower values and higher values were as follows: 0.71 ± 0.11 and 0.76 ± 0.09 respectively.

In the second analysis, the participants were split into two groups: one group shows the participants who got a negative score (15) and the other the participants with a positive score (7). The CA-BAT test that was used has a range of values from -4 to +4. Although the differences did not reach statistical significance either in this case, figure 3 shows a slightly higher value for both tasks 1 and 2 in those participants with a better score in the beat test.

Specifically, as shown in figure 3 C, the mean score in task 1 for those participants with negative values and positive values were 0.69 ± 0.12 and 0.75 ± 0.12 respectively. As shown in figure 3 D, the mean score in task 2 for those participants with negative values and positive values was 0.72 ± 0.11 and 0.75 ± 0.09 respectively.

Stress production and stress perception

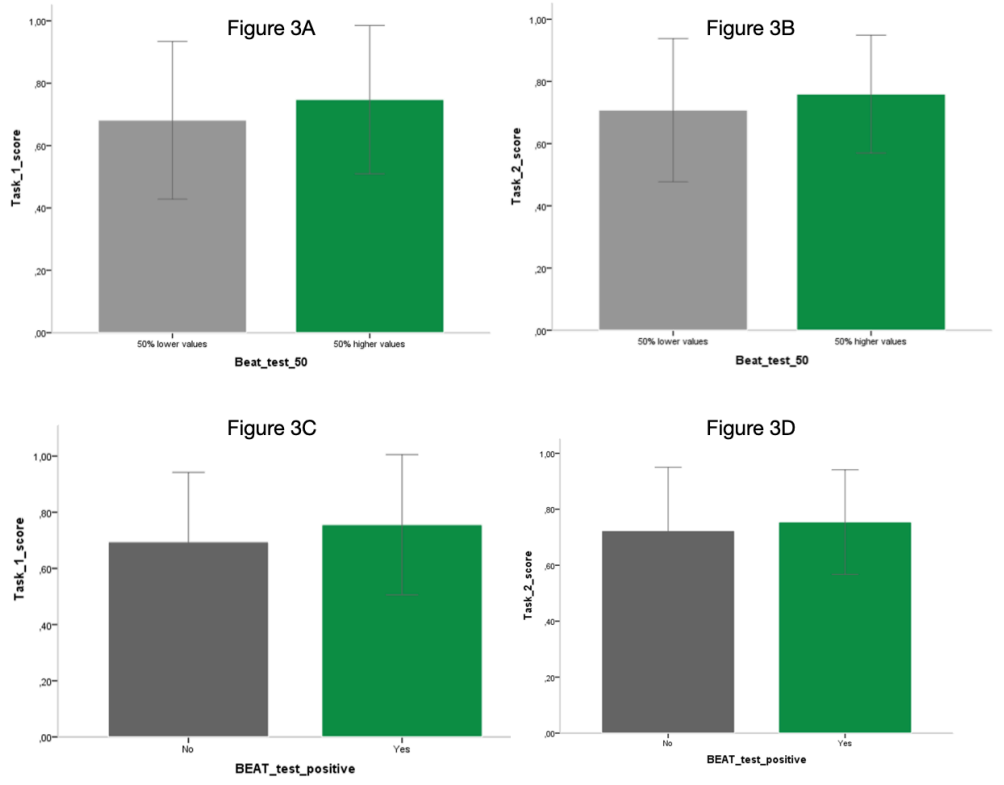

Figure 3. 3A and 3B: task 1 and task 2 results respectively depending on the beat test performance. 3C and 3D: task 1 and task 2 results respectively compared to a negative (No) or positive (Yes) beat test score.

Figure 4 below shows the comparison of results among the two different word stress production tasks for the 50% of the participants with the lowest score (left) in the CA-BAT perception test and 50% of the participants with the highest score (right). The red line shows the mean scores for both tasks. No significant differences were found as observed in figure 4 in the production of either task in this subgroup analysis.

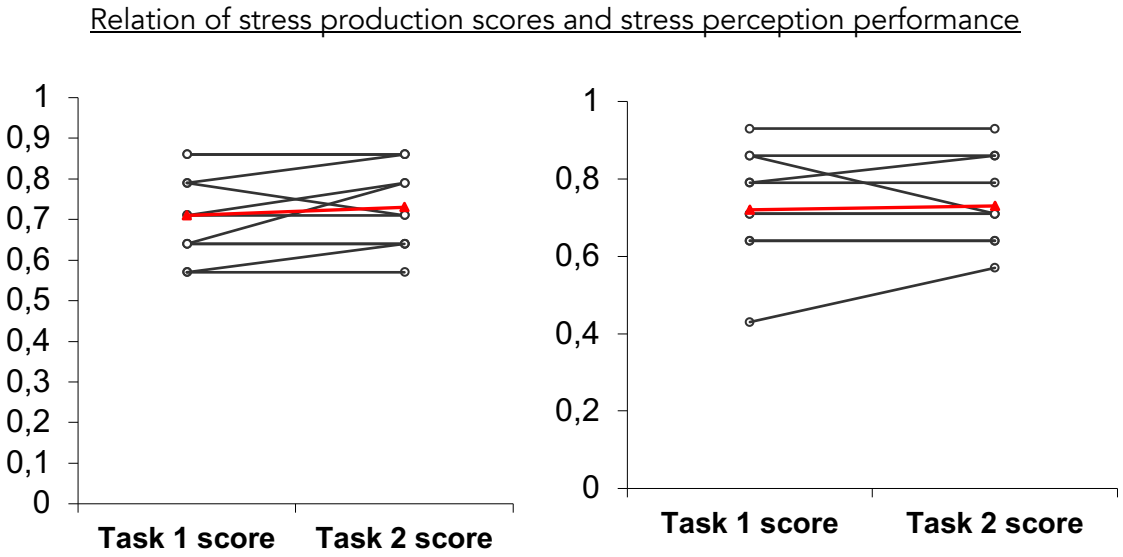

Figure 4. Scores for task 1 and 2 per participant. Left shows 50% of participants with the lowest score in the perception test and right shows 50% of participants with the highest score.

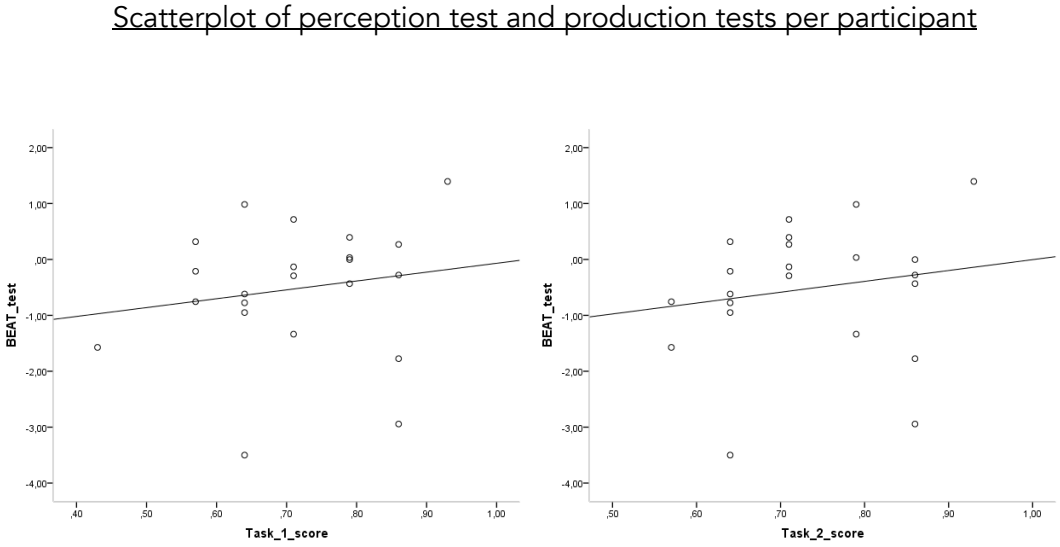

Figure 5. Left: beat test score and task 1 score. Right: beat test score and task 2 score.

Figure 5 shows two scatterplots of the relationship of the beat test task and the two stress production tasks separately.

There was no significant correlation between stress perception and stress production through the tests that were carried out in this study. No correlation was observed either between the perception test (beat test) and task 1-naming task and the perception test (beat test) and task 2 (Rho=0.20, p=0.38, and Rho=0.24, p=0.28 respectively).

6.4 Stress production and perception results compared with musical self-perception

The questionnaire carried out by the participants covered three aspects regarding musical self-perception that were answered in a subjective way with a 'yes' or 'no'.

The three variables that were studied were:

-rhythm perception (*Do you consider yourself as having a good sense of rhythm-you can dance and follow the beat)?*,

-singing ability *(Do you believe you sing well-rhythm and in tune?,* and

-instrumental education (*Have you received any sort of instrumental training?).*

Table 3 shows the results for each participant. Only five participants answered *yes* to the three questions (marked in bold).

Musical self-perception

Participant	Rhythm	Singing	Instrumental
1	Yes	No	No
2	Yes	Yes	No
3	Yes	No	No
4	No	No	No
5	Yes	No	No
6	**Yes**	**Yes**	**Yes**
7	**Yes**	**Yes**	**Yes**
8	Yes	Yes	No
9	**Yes**	**Yes**	**Yes**
10	Yes	No	No
11	Yes	Yes	No
12	Yes	No	No
13	No	No	No
14	**Yes**	**Yes**	**Yes**
15	**Yes**	**Yes**	**Yes**
16	No	No	No
17	Yes	Yes	No
18	Yes	Yes	No
19	No	No	No
20	Yes	Yes	No
21	No	No	No
22	Yes	No	No

Table 3. Participant, rhythm perception, singing ability and instrumental training respectively.

6.4.1 Effect of rhythm perception on stress production and perception tasks results

Figure 6 shows the rhythm perception results compared to each task carried out: task 1-naming test, task 2-reading test and beat test.

Rhythm perception and tests scores

P=0.039 P=0.03 P=0.13

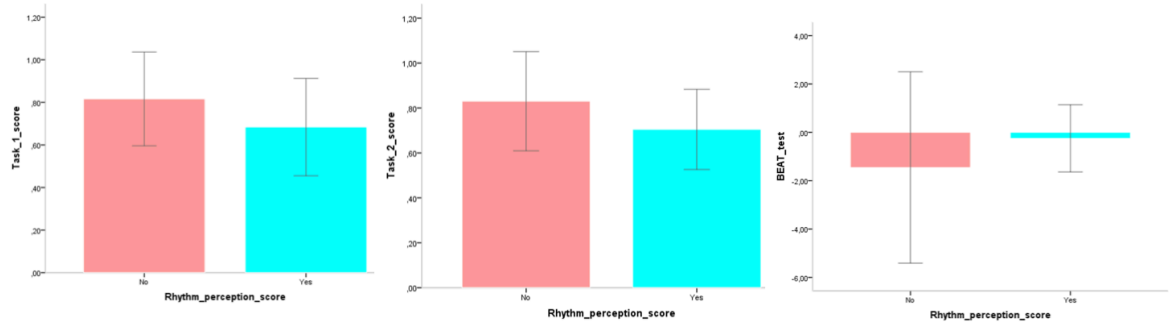

Figure 6. Left: task 1. Middle: task 2. Right: beat test.

Out of 22 participants, five of them answered *No* to having a good sense of rhythm and 17 of them answered *Yes*.

The mean for task 1 was 0.71 ± 0.12. The correct answers in task 1 for those participants who did not perceive themselves as having a good sense of rhythm were 11.4 ± 1.5, and 9.6 ± 1.6 for those who perceived themselves as having a good sense of rhythm. Hence, those who did not consider themselves as having a good sense of rhythm did perform better in task 1 and the difference was significant (U=16.5, z=-2.07, p=0.039).

The mean for task 2 was 0.73 ± 0.11. The correct answers in task 2 for those participants who did not perceive themselves as having a good sense of rhythm were 11.6 ± 1.5, and 9.9 ± 1.2 for those who perceived themselves as having a good sense of rhythm. Hence, those who did not consider themselves as having a good sense of rhythm performed, again, better in task 2 and the difference was significant (U=15.5, z=-2.16, p=0.03).

However, regarding the beat test (0,77 ± 0,42), those participants who considered themselves as having a better sense of rhythm scored higher than the rest (-0.25 ± 0.69 as opposed to -1.45 ± 1.97), although no significant differences were found statistically speaking (U=23, z=-1.53, p=0.13).

6.4.2 Effect of singing ability on stress production and perception tasks results

Figure 7 shows the comparation of each task carried out: task 1-naming test, task 2-reading test and beat test according to the singing ability results.

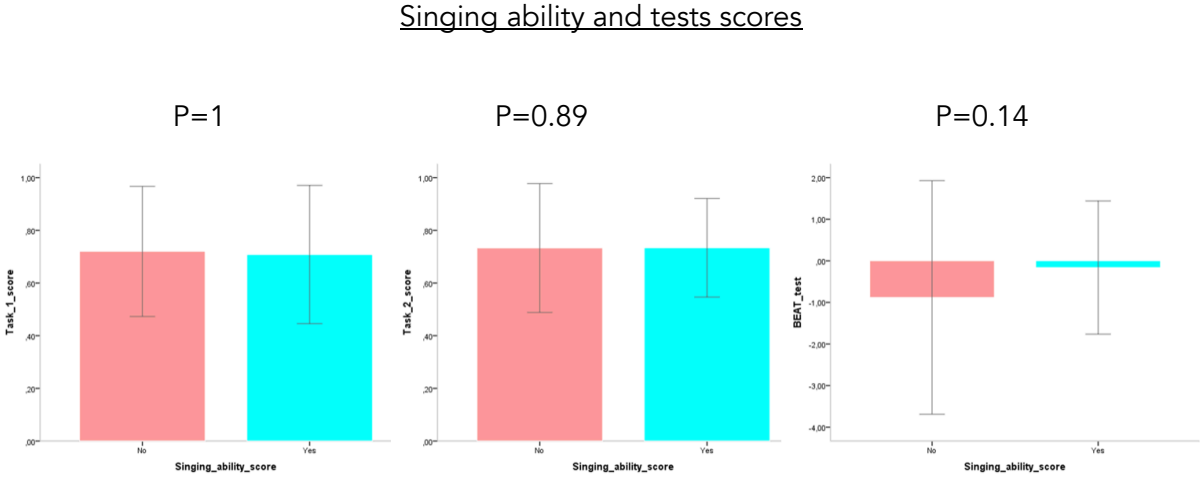

Figure 7. Left: task 1. Middle: task 2. Right: beat test.

Out of 22 participants, 11 of them answered *No* to having a good singing ability and 11 of them answered *Yes*.

The mean for task 1 was 0.71 ± 0.12. The correct answers in task 1 for those participants who did not consider themselves as having a good singing ability were 10 ± 1.7, and 9.9 ± 1.8 for those who perceived themselves as having a good singing ability. In the light of the results, no differences were found (U=60.5, z=-0, p=1).

The mean for task 2 was 0.73 ± 0.11. The correct answers in task 2 for those participants who did not consider themselves as having a good singing ability were 10.3 ± 1.7, and 10.3 ± 1.3 for those who perceived themselves as having a good singing ability. In the light of the results, no differences were found here either (U=58.5, z=-0.13, p=0.89).

However, regarding the beat test, those participants who considered themselves as having a good singing ability scored higher than the rest (-0.16 ± 0.8 as opposed to -0.88 ± 1.4), although these differences did not reach statistical significance (U=38, z=-1.48, p=0.14).

6.4.3 Effect of instrumental training versus stress production and perception tasks results

Figure 8 below shows the comparison of each task carried out: task 1-naming test, task 2-reading test and beat test according to the instrumental training results.

Figure 8. Left: task 1. Middle: task 2. Right: beat test.

Out of 22 participants, 17 of them answered *No* to having previous instrumental training and five of them answered *Yes*.

The correct answers in task 1 for those participants who had not received instrumental training were 9.9 ± 1.9, and 10.2 ± 0.84 for those who had. In the light of the results, no differences were found (U=39, z=-0.28, p=0.78).

Similarly, the correct answers in task 2 for those participants who had not received instrumental training were 10.2 ± 1.6, and 10.4 ± 1.1 for those who had. No significant differences were found either (U=38.5, z=-0.32, p=0.75).

However, regarding the beat test, those participants who had not received instrumental training scored higher than the rest (-0.20 ± 0.84 as opposed to -0.62 ± 1.26), although there were no significant differences statistically speaking (U=34, z=-0.67, p=0.51).

6.5 Words produced with wrong stress

Nine participants of the total 22 produced a wrong stress in the same words while performing tasks 1 and 2. The other 13 participants combined different results of correct words and only two of them produced the same number of mistakes in both tasks with combined words for each task.

Find below table 4 with the percentages of all words produced with the wrong stress, in order of frequency.

Wrong stress words

WORD	Task 1-naming (%)	Task 2-reading (%)
police	68.2	63.6
menu	54.5	50
sofa	50	40.9
email	45.4	36.4
village	45.4	45.4
hotel	40.9	31.8
Japan	31.8	22.7
mobile	27.3	27.3
between	18.2	27.3
Chinese	18.2	27.3

Table 4. Word, percentage of wrong stress productions in tasks 1 and 2 respectively.

As observed above, the words that were pronounced with a wrong stress were: *police*, *menu*, *sofa*, *email*, *village*, *hotel*, *Japan*, *mobile*, *between* and *Chinese* in order of prevalence. Except for the words *between* and *Chinese*, that were stressed wrongly more frequently in task 2-reading task, and *village* and *mobile* that were evenly wrongly stressed, the other six words were wrongly stressed slightly more frequently in task 1-naming.

7. DISCUSSION

7.1 Objectives and results

The primary objective of this study was to investigate to what extent words stress placement had a perceptual basis. This objective was split in different objectives explained below with their results.

As for the first objective, the relationship between a good beat test performance and a better stress production task, although no significant differences were found, the study shows that the production performance for tasks 1 and 2 was slightly better for those participants who got a higher score in the stress perception test (beat test).

The second objective aimed at what would happen when assessing possible differences between task 1 and task 2 performance at an individual level. No significant differences were found after comparing the results with a Wilkoxon test. However, the table presenting the exact number of right answers and results shows a slightly better performance in task 2 in seven of the 22 participants. This proves that in this study, written words did not have a negative impact in the placement of the correct stress.

The last objective aimed at comparing the performance scores of the three tasks carried out according to the open questions the students were asked in relation to their musical aptitude. It is worth mentioning that the shyness of the participants may have had an impact in the reliability of this data. Those participants who considered themselves as not having a good sense of rhythm scored higher in both production tasks with a significant difference. However, as expected, the participants with an auto-perception of good sense of rhythm scored higher in the beat test task. This information reveals that the CA-BAT test seems reliable in terms of predicting beat ability.

The results of stress production performance regarding their ability to sing and musical training showed no significant differences. However, once again, the beat

test results were higher for those participants with singing ability and musical training, although no significant differences were to be found.

7.2 Research question and result

The results abovementioned reject the initial hypothesis that predicted better results in stress production for a better beat perception performance. Although there is no clear link between the aptitude to perceive a musical beat and the aptitude to produce the stressed syllable correctly in previously learnt words in English, the results of the tasks showed a slight better performance in the reading task than in the naming task, but this was not significant.

7.3 Results in previous literature

The results of our findings do not exactly replicate the findings of previous literature by Christiner & Reiterer (2013 and 2015) when it comes to a relationship between rhythm perception and production and the ability to sing as an imitation tool to identify and reproduce the stress in words of an L2. This must be due to the small size of the sample and the subjectiveness of how the singing ability has been assessed. However, the study has partially shown a slight tendency for a better production performance, although not significant, in those participants who scored higher in the beat perception task.

When focusing on individual cases, the participants behaved differently, which gives this study a rich combination of participants in terms of characteristics and behaviour. In the case of the one participant who played the drums in a weekly basis (an instrument that must be on-beat when played), she did not score positively in the CA-BAT test as I t would be expected with such a musical training history, neither did she score higher than the average in the stress production tasks. She was left-handed, together with another participant who was also left-handed and did score higher than the average in the CA-BAT test but not higher in the stress production tasks. This was a very small sample to analyse the impact of being left-handed in the performance of

this task, but what Zapala showed in his studies (2020), an advantage in stress production for the left-handed population, cannot be proved in the present study.

The only participant who had French as his L1, although showing great speaking skills in class, pronounced all the words with stress in the before last syllable. He was clearly affected with stress deafness as explained by Gussenhoven (2002). As for the mistakes in stress in one of the participants with Spanish as his L1 (stressing the words in the last syllable), they seemed to be following the influence of the L1 phonological traits when acquiring an L2 as suggested by Altmann (2006). Some of the words that were wrongly stressed could be due to Spanish as their L1 influence (*sofa, mobile*). When learners encounter a cognate word, they automatically transfer the stress pattern of the L1. However, in this study, it has also been observed that some students have actually behaved differently, changing the pattern (*Japan, hotel*) and stressing the words in the syllable that is not stressed in their L1, so no trend can be recognised in those cases.

Although not significant, there was a slight better performance in the reading task than in the naming task, something that is not the trend in most studies, as written words tend to distract the correct stress production of the participants. Although the result was not significant, there must be some interference on the elicitation task when reading words, as nine of the total of 22 participants (almost 50% of them) did pronounce the stress differently for each task. However, the statistics results do not show these nuances. This could be due to the small number of participants of this study.

7.4 Implications for teaching

When musical training, L2 learning, and singing are used together in class, both teachers and students benefit from it. Moreover, increasing evidence suggests that musical expertise influences brain organisation and brain functions. Results at behavioural and neurophysiological levels have revealed that musical expertise

positively influences several aspects of speech processing such as auditory perception and speech production.

Music specialists seem to present a more developed auditory memory. This may explain why they find it easier to remember how to produce new sounds correctly. In addition to this, the activation of different emotional and physical areas helps the improvement of memory, which is a crucial element in the L2 language acquisition.

Percussion instruments, or any other object that may work as such (a bottle, some chopsticks…) can be presented as tools to be used in the classroom to stress rhythm and syllables when teaching. In fact, vocal motor training, as of singers, may speed up foreign language acquisition processes.

Although many studies confirm the benefits of the use of music in second language acquisition, a more specific approach as musical beat could help future students with language stress learning, as stress and intonation in the foreign language together with accent are challenging skills that are difficult to obtain in a non-immersion program and remain an obstacle towards proficiency in the target language.

From a pedagogical point of view, findings of such sort would be key to understand this matter in second language acquisition and to mitigate fossilized mistakes in stress which become an obstacle in both communication and in language mastering when moving to advanced levels of the foreign language.

7.5 Limitations and directions for further research

The first limitation is undoubtedly the size of the sample. The studies mentioned in previous literature have doubled if not tripled the size of the present one.

Worth mentioning is also the fact that the words that were elicited in the production tasks were words from a language they were taught and known to the participants, so it was not an unfamiliar language, as was the trend in some studies that used those in their research studies. In those cases, it could be argued that they consisted more of an imitation task, rather than an elicitation one. However, some of the words

chosen (from A1 level) present issues at a stress level even for intermediate and advanced students of English (*police, hotel*…) in their EFL lessons.

As for the beat perception test that was used, it was very precise at showing the ability to perceive the musical beat, as it was very challenging in terms of identifying whether the melodies were out of beat or not. However, for someone who had no musical training, it required a lot of concentration. The COVID conditions (use of masks) and the weather conditions (heat) did not help with concentration either, although all participants finished the task successfully and quiet conditions (no noise and privacy without interruptions) were guaranteed.

It is worth mentioning also that although some students were prompted in the middle of the task to keep a slow pace when reading, the fact that it was being recorded might have given the effect of a dictation, hence affected their performance and results as they often seemed to rush their productions.

Not to be forgotten is the fact that individual variability plays an important role too. Some factors that may affect the performance in their tasks are the auditory memory and attention as some previous studies refer to. They are difficult to control and assess but affect the reliability of some results.

8. CONCLUSION

Although the initial hypothesis has been rejected, the results have shown that the stress production performance was slightly better in those participants with a higher score in the beat test, but not significantly. Unfortunately, the small size of the study might have left some questions unanswered if not also uncompleted.

Future lines of study should include further investigation on this matter with a higher number of participants which should also focus on intermediate to advanced EFL students. These students still present difficulties with stress in English, what in the world of teaching is categorised as a fossilized mistake. The aim should be to identify

whether the fossilized wrong stressed words could be due to a poor musical ability in terms of musical stress recognition and singing ability.

As there is not a repetitive pattern in the words mispronounced in the production tasks, it is worth presuming that a future study in the influence of Spanish as a L1 on EFL should be carried out. More tests to assess the stress perception influence on the stress production in EFL should be carried out too, since there is a connection between stress perception and production, according to the literature that has been reviewed for this study. It would also be very positive to conduct parallel studies with different L1 languages to appreciate to what extent the language typology in terms of rhythm affects the perception and production of stress in EFL learning.

To conclude, many are the aspects that surround the stress acquisition in EFL and what definitely enriches its findings is the combination of the world of sciences that can study the impact of the very diverse patterns and particularities that play a role in it.

9. REFERENCES

Altmann, H. (2006). The perception and production of second language stress : a cross-linguistic experimental study. PhD Thesis, Univ. of Delaware, Newark.

Asaridou, S. S., & McQueen, J. M. (2013). Speech and music shape the listening brain: Evidence for shared domain-general mechanisms. *Frontiers in Psychology*, *4* (JUN).

Beckman, M. E. &. J. (1994). Articulatory evidence for differentiating stress categories in Phonological Structure and Phonetic Form. In Keating P. A. (Ed.), *Papers in Laboratory Phonology III: Phonological Structure and Phonetic Form* (pp. 7–33). Cambridge University Press.

Best, C. T., & Tyler, M. D. (2007). Nonnative and second-language speech perception. 13–34. *Language Learning & Language Teaching*. John Benjamins Publishing Company

Bouchon, C., & Peperkamp, S. (2011). The Relation Between Perception and Production in L2 Phonological Processing. *Proc. Interspeech*. 12. 161-164.

Caudrelier, T., Perrier, P., Jean-Luc-Schwartz, & Rochet-Capellan, A. (2018). Picture Naming or Word Reading: Does the Modality Affect Speech Motor Adaptation and Its Transfer? *Interspeech*, 2018-September, 956–960.

Chobert, J., & Besson, M. (2013). Musical expertise and second language learning. *Brain Sciences*, *3* (2), 923–940.

Christiner, M., & Reiterer, S. (2016). A closer look at the interfaces between musicality, singing and individual differences in phonetic language aptitude: Music, song and speech. Cognitive Individual Differences in Second Language Processing and Acquisition. 131–156.

Christiner, M., & Reiterer, S. M. (2013). Song and speech: examining the link between singing talent and speech imitation ability. *Frontiers in Psychology*, *4*.

Christiner, M., & Reiterer, S. M. (2015). A Mozart is not a Pavarotti: Singers outperform instrumentalists on foreign accent imitation. *Frontiers in Human Neuroscience*, *9*.

Christiner, M., Rüdegger, S., & Reiterer, S. M. (2018). Sing Chinese and tap Tagalog? Predicting individual differences in musical and phonetic aptitude using language families differing by sound-typology. *International Journal of Multilingualism*, *15* (4), 455–471.

Cutler, A. (2005). Lexical stress. In Pisoni D.B. and Remez R. E. (Ed.), *The Handbook of Speech Perception* (pp. 264–289). Blackwell.

Cutler, A., & Pearson, M. (2018). On The Analysis of Prosodic Turn-Taking Cues. *Intonation in Discourse*, 139–156.

Flege, J. E. (1995). Second language speech learning: Theory, findings and problems. . In W. Strange (Ed.), *Speech perception and linguistic experience: Issues in cross-language research* (pp. 233–277). York Press.

Flege, J. E., & Bohn, O. S. (1989). An instrumental study of vowel reduction and stress placement in spanish-accented english. *Studies in Second Language Acquisition*, *11*(1), 35–62.

Flege, J. E., & Bohn, O.-S. (2021). The Revised Speech Learning Model (SLM-r). *Second Language Speech Learning*, 3–83.

Fry, D. B. (1958). Experiments in the perception of stress. *Language and Speech*, *1* (2), 126–152.

Goedemans, R., & van der Hulst, H. (2009). StressTyp: A database for word accentual patterns in the world's languages. *The Use of Databases in Cross-Linguistic Studies*, 235–282.

Goldstein, L., & Fowler, C. A. (2011). Articulatory phonology: A phonology for public language use. *Phonetics and Phonology in Language Comprehension and Production: Differences and Similarities*, 159–208.

Good, A. J., Russo, F. A., & Sullivan, J. (2015). The efficacy of singing in foreign-language learning. *Psychology of Music*, *43* (5), 627–640.

Gussenhoven, C., Warner, N., Peperkamp, S., & Dupoux, E. (2002). A typological study of stress "deafness." *Laboratory Phonology*, *7*, 203–240.

Gutiérrez Díez, F. (2005). Intonation focus in the interlanguage of a group of Spanish learners of English. *Revista Alicantina de Estudios Ingleses*, *18*, 129.

Hualde, J. I., Simonet, M., & Torreira, F. (2008). Postlexical contraction of nonhigh vowels in Spanish. *Lingua*, *118* (12), 1906–1925.

Kaiser, D. (2013). Practical approaches and strategies for teaching stress-timed English rhythm. *The Conference Proceedings of MIDTESOL: Cultivating Best Practices in ESL*, 71–90.

Oechslin, M. S., Meyer, M., & Jäncke, L. (2010). Absolute pitch-functional evidence of speech-relevant auditory acuity. *Cerebral Cortex*, *20* (2), 447–455.

Pamies Bertrán, A. (1999). Prosodic Typology: On the Dichotomy between Stress-Timed and Syllable-Timed Languages. *Language Design*, *2*, 103–130.

Pastuszek-Lipińska, B. (2008). The influence of music education and training on SLA. *2nd ITRW on Experimental Linguistics, ExLing 2008*, 185–188.

Patel, A. D. (2003). Rhythm in Language and Music: Parallels and Differences. *Annals of the New York Academy of Sciences*, *999*, 140–143.

Patel, A. D., & Daniele, J. R. (2003). An empirical comparison of rhythm in language and music. *Cognition*, *87* (1), B35–B45.

Peperkamp, S., & Bouchon, C. (2011). The Relation Between Perception and Production in L2 Phonological Processing. *Proc. Interspeech.* 12. 161-164.

Trofimovich, P., & Baker, W. (2006). Learning second language suprasegmentals: Effect of L2 Experience on Prosody and Fluency Characteristics of L2 Speech. *Studies in Second Language Acquisition*, *28* (1), 1–30.

Vangehuchten, L., Verhoeven, V., & Thys, P. (2015). Pronunciation proficiency and musical aptitude in Spanish as a foreign language: results of an experimental research project. *Revista de Lingüística y Lenguas Aplicadas*, *10-*, 90–100.

Wallace, W. T. (1994). Memory for Music: Effect of Melody on Recall of Text. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20* (6), 1471–1485.

Yoshida, K., Nose, T., & Ito, A. (2014). Analysis of english pronunciation of singing voices sung by Japanese speakers. *Proceedings - 2014 10th International Conference on Intelligent Information Hiding and Multimedia Signal Processing, IIH-MSP 2014*, 554–557.

Yoshihara, M., Nakayama, M., Verdonschot, R. G., & Hino, Y. (2020). The Influence of Orthography on Speech Production: Evidence From Masked Priming in Word-Naming and Picture-Naming Tasks. *Journal of Experimental Psychology: Learning, Memory, and Cognition.* Vol. 46, No. 8, 1570 –1589

Zapala, D., Zabielska-Mendyk, E., Augustynowicz, P., Cudo, A., Jaśkiewicz, M., Szewczyk, M., Kopiś, N., & Francuz, P. (2020). The effects of handedness on sensorimotor rhythm desynchronization and motor-imagery BCI control. *Scientific Reports*, *10* (1), 2087.

APPENDIX I

Form completed by all participants with questions about their own autoperception on rhythm (question 14) , singing ability (question 15) and instrumental training (question 17).

HISTORIAL DEL PARTICIPANTE-Estudio sobre el ritmo y las lenguas

No de participante: _____

1. Fecha de nacimiento: _____

2. ¿Con qué mano escribe? Izquierda Derecha Ambas

3. Sexo: Hombre Mujer

4. Nivel de estudios:

5. ¿Actualmente experimenta problemas auditivos o de visión? Sí No

6. Usted o su familia inmediata (padres, hermanos), ¿han tenido/ tienen problemas especiales con el desarrollo del lenguaje (por ejemplo: retraso al empezar a hablar, dificultades serias en aprender nuevas palabras, o recordar nombres de algunos objectos)?

7. ¿Ud. o su familia inmediata (padres, hermanos) han tenido/tienen algún problema especial para hablar (por ejemplo, tartamudear, cecear, etc.)?

8. ¿Ud. o su familia inmediata (padres, hermanos) han tenido/tienen problemas especiales para aprender a leer (por ejemplo, confundir ciertos sonidos or palabras, dislexia)?

9. ¿Qué edad tenía cuando tuvo su primer contacto con el castellano? (Por ejemplo, desde el nacimiento, a los 2 años, a los 5 años)?

10. ¿Se hablaban otras lenguas además del castellano en su hogar cuando Ud. era niñ@? En caso afirmativo, especificar cuáles y la comprensión y producción oral y auditiva (1-5).

11. Por favor díganos qué otras lenguas Ud. ha aprendido fuera del ámbito familiar (por ejemplo, en el colegio, estancia larga en otro país, familiares en el extranjero) qué edad tenía cuando empezó a aprender cada una, y el nivel de cada destreza.

12. Enumere todos los lugares donde ha vivido, edad y tiempo.

13. ¿Dónde crecieron su padre y su madre?

14. ¿Considera que tiene buen sentido del ritmo (puede bailar y seguir el ritmo)?

1 2 3 4 5

15. ¿Considera que canta bien (con ritmo y sin desafinar)?

1 2 3 4 5

16. En educación primaria, ¿ha aprendido a tocar algún instrumento o a cantar?

17. ¿Ha realizado estudios en el conservatorio o similar? Especificar tiempo y especialidad (canto o instrumento).

18. ¿Toca algún instrumento? Especificar tiempo y tipo.

APPENDIX II

Task 1-naming task image

Source: Self production. Images from Google images.

Task 2- Speech material Corpus used for the elicitation tasks

hotel
Japan
thirty
Chinese
village
email
mobile
sofa
question
menu
pencil
between
police
doctor

Source: *Empower A1. Student's Book.* Cambridge. ISBN 13: 9783125404021