2013

The Relationship between Musical Ability and the Perception and Production of L2 Prosodic Features

Jun Akiyoshi
Minnesota State University - Mankato

The Relationship between Musical Ability and the Perception and Production of L2 Prosodic Features

by

Jun Akiyoshi

A Thesis Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

in

Teaching English as a Second Language (TESL)

Minnesota State University, Mankato

Mankato, Minnesota

December 2013

The Relationship between Musical Ability and the Perception and Production of L2 Prosodic Features

Jun Akiyoshi

This thesis has been examined and approved by the following members of thesis committee.

Dr. Karen Lybeck, Advisor

Dr. Glen Poupore, Second Reader

Acknowledgment

I would like to acknowledge a large number of individuals involved in this capstone project. I thank all the participants who agreed with and decided to participate in this research. Without their help, this project would not have been completed in the first place. Likewise, my sincere gratitude goes to all the faculty members in the TESL program at Minnesota State University, Mankato.

First and foremost, I would like to express my deepest gratitude to my academic advisor, Dr. Karen Lybeck for her invaluable support to my thesis. I am pretty sure that it would have been impossible to complete this capstone project on time without her considerable academic and mental support. From the bottom of my heart, I truly feel that she is not only my academic advisor, but also my academic mother. I cannot fully express my gratitude to her no matter how much I try. In addition, I would also like to thank Dr. Glen Poupore for his spending a great amount of time on reading my paper as a second reader. Furthermore, I would like to show my gratitude to Dr. Nancy Drescher and Dr. Stephen Stoynoff as well for their providing me with a lot of knowledge and experiences pertaining to ESL pedagogies and theories.

Last but not least importantly, my special gratitude also goes to my family for their financial and mental support and Dr. Yuichi Todaka in Japan for his mental support throughout my life in the United States. Without their support, I would not be able to acquire this MA degree in the United States

Abstract

The Relationship between Musical Ability and the Perception and Production of L2 Prosodic Features

Jun Akiyoshi

M.A. English: TESL

Minnesota State University, Mankato

Mankato, Minnesota

2013

Studies in L2 acquisition have indicated that musically trained individuals are apt to demonstrate better L2 pronunciation skills. As for music, it was recently clarified that some amusiacs demonstrate selective impairment in L1 prosody discrimination. The purpose of this study was to investigate a relationship between amusical L2 learners and their perception and production of L2 prosody. To investigate this, 24 native-Japanese learners of English either in EFL (n=22) or ESL context (n=2) were examined in terms of their musical ability and L2 intonation perception and production. The musical test indicated that there was one amusiac and 10 low-level musical sufferers in the EFL group. Based on a contrastive analysis between amusical and non-amusical participants, as well as between participant groups with and without musical difficulty, it was found that any level of musical difficulty was correlated with lower auditory processing ability in L2 intonation for these English-language learners. However, the contrastive analysis pertaining to the productive skill indicated that musical difficulty was not associated with their production of accurate L2 intonation patterns. According to these findings, the present study concluded that musical difficulty is only related to these learners' L2

intonation processing. Conversely, the present research found that the ESL learners' learning context appeared to be less associated with their aural performance than with their intonation production. In addition, it was found that the level of previous musical training was related to both better L2 intonation perception and production.

Table of Contents

Tables

Figures

Chapter I: Introduction

In our economically global society, English as a lingua franca or an international language is motivating large numbers of people around the world to learn English for various communicative purposes. Even though the importance of English pronunciation is frequently deemphasized in the prevailing fashion of world Englishes and communicative language teaching (Lightbown & Spada, 2006, p.104), prosodic accuracy nevertheless plays a vital role for non-native speakers (NNSs) of English to achieve successful communication with native speakers (NSs). Indeed, enhancing prosodic fluency, such as rhythm, speech connection and intonation, is of great importance to properly convey NNSs' intentions to native-speaking listeners.

Wells (2006), for instance, states that while NNSs' mispronunciations at the segmental level (vowels or consonants) are acceptable for NSs, NSs are likely to show intolerance toward NNSs' erroneous intonation patterns (p.2). Moreover, according to Celce-Murcia, Brinton, and Goodwin (2010), NNSs' inaccurate prosodic patterns risk frustrating NSs because improper intonation is frequently perceived as offhand or impolite by NSs (p.163). In addition to the NSs' low acceptability toward NNSs' inadequate prosody, intonation errors might also convey unintended meanings. For example, the upward or downward intonation movement at the end of "I beg your pardon?" can represent different speech acts. It represents the difference between a formal request when ended with rising intonation and a formal apology with falling intonation (Togo & Misono, 2009, pp.112-113). Hence, inaccurate intonation movement might result in NNS-NS miscommunication. Because prosodic cues can indicate paralinguistic information, such as speakers' emotional states or attitudes (Ladefoged, 2006, p.24), NNSs' insufficient linguistic melody might create inaccurate impressions of them for NSs. As seen above, prosodic accuracy plays a vital role in fluent and successful communication between native and NNSs.

Because of the importance of prosody in English, a number of studies have been conducted to enhance NNSs' English intonation skills. For instance, Nagamine (2011) investigated the efficacy of a year-long English pronunciation training by focusing on segmental and suprasegmental pronunciation. He employed a hyper-pronunciation training method, in which 30 prospective EFL teachers at one university in Japan firstly exaggerated the pronunciation of pitch height and duration to broaden their pitch range. In order to investigate the efficacy of the training, subjects' speech samples at local and global levels (voice onset time of word-initial voiceless stops and pitch range) were collected before and after the longitudinal training. According to an acoustic analysis of the collected data, Nagamine found his trainees significantly improved their target English pronunciation features.

An earlier study by Taniguchi and Abberton (1999) investigated the impact of tone-marks and other visual feedback in improving Japanese speakers' English intonation. In their study, 12 Japanese EFL college students attending short-term intensive phonetic training were divided into two groups, one of which received regular visual feedback on intonation contours while the other group did not obtain this kind of feedback. Before and after the training sessions, the participants were asked to record themselves reading aloud four texts with and without the intonation markings. While all subjects showed improvement on their intonation when reading the texts with tone marks, the subjects who received visual feedback demonstrated prosodic accuracy when reading the texts without the tone-marks as well. Taniguchi and Abberton concluded that visual feedback on intonation during regular classroom tasks would provide substantial improvement to their prosodic accuracy in natural settings.

It is oftentimes argued that obtaining native-like pronunciation is an unrealistic goal for FL/SL learners. Therefore, we as teachers do not expect our language learners to acquire perfect pronunciation as long as their pronunciation is intelligible and comprehensible. According to Celce-Murcia et al. (2010, p.33), the crucial key to achieving intelligible and comprehensible pronunciation in English lies in attainment of better prosodic fluency, which is both achievable (Nagamine, 2011; Taniguchi & Abberton, 1999) and of great importance for communicative purposes (Celce-Murcia et al., 2010; Togo & Misono, 2009; Wells, 2006).

Current Research on English Prosody

Though English tonal movement from one note to another is not as fine-grained as music, its prosodic features are frequently compared to music, and seemingly share some similarities. For example, in teaching English pronunciation, songs or rap music are found to be effective when enhancing learners' English prosody (Fischler, 2009; Luu & Pham, 2010). Tapping fingers accompanied by a stable rhythm, moreover, is oftentimes introduced to raise learners' prosodic awareness (Celce-Murcia et al., 2010, p.199; Ladefoged, 2006, p. 23). In addition to these pedagogical perspectives on music and English pronunciation, recent research on second-language (SL) acquisition has addressed a close association between SL learners' musical aptitude and their sensitivity to the second or foreign-language (FL) phonology[1].

---

[1] Second-language (SL) indicates learning a non-native language in the environment where that language is spoken (e.g., learning English in the United Kingdom); on the other hand, foreign-language (FL) represents

Pastuszek-Lipińska (2004; 2007; 2008a; 2008b), for instance, has conducted a series of research studies on the relationship between FL speakers' musical ability and their perception and production of FL sounds. According to her study, Polish speaking musicians and non-musicians could successfully imitate word-level pronunciation of English, with no significant differences detected in an acoustic analysis; however, an aural assessment by native-English speakers demonstrated that the musicians outperformed the non-musicians in terms of fluency; thereby substantiating a link between musical skill and FL speech perception and production (2004). In addition to the above findings, subsequent analyses (2007; 2008b) using Pastuszek-Lipińska's own auditory impressions have revealed that musicians could better imitate not only English utterances but also other FLs (e.g., French, Italian, Dutch, Japanese, Spanish). Interestingly, the musicians' phonological superiority was mostly seen in the mimicry of segmental sounds, rather than intonation or other prosodic features (2007; 2008b). She also collected native speakers' auditory assessments of the same data, in which native-speaking raters of various FLs evaluated musicians as much more fluent than non-musicians (Pastuszek-Lipińska, 2008a).

Milovanov and her co-investigators (2004; 2010) have also conducted several studies on the interconnection of musicality and SL acquisition. For instance, Milovanov, Tervaniemi, and Gustafsson (2004) examined 71 Finnish secondary school students learning English as a FL, and found musically trained pupils could pronounce English phonemes that do not exist in their native language better than their non-musically trained peers. Similar research using older subjects was also conducted by Milovanovet, Pietilä,

---

learning a non-native language in the environment where one's native language is spoken, e.g., French speakers learning English in France (Gass and Selinker, 2008, p.7).

Tervaniemi, and Esquef (2010). They investigated three young adult native Finnish-speaker groups (non-musicians, choir members, and English philology students) in the light of their production and perception of specific English phonemes. According to their study, while no participants showed significant differences on a phoneme aural discrimination test, the musician and English philology groups outperformed the non-musician group in the phoneme oral production test. Based on this result, the authors concluded that musical ability correlates with better English pronunciation skills.

Additional research (e.g., Milovanov et al., 2004; Milovanov, Huotilainen, Valimaki, Esquef, & Tervaniemi, 2008; Milovanov et al., 2010; Pastuszek-Lipińska, 2004, 2007, 2008a, and 2008b; Todaka & Hidaka, 2009; Wong, Skoe, Russo, Dees, & Kraus, 2007) has revealed a strong relationship between musical ability and FL pronunciation skills, as well as the musicians' superiority in FL speech perception and production. Moreover, researchers' increasing interests in this field have provided additional insights into the relationship. For example, Todaka and Hidaka (2009) found that players of stringed instruments such as cello or viola outperformed other types of musicians (e.g., a cappella singers, chorus singers, piano players, etc.) on English intonation discrimination. Much less research, however, has been conducted on musically-impaired learners and their sensitivity to FL/SL phonology; namely, the relationship between tone-deafness and FL/SL pronunciation learnability.

Tone-deafness is, in general, associated with poor musical ability and is frequently identified in one's singing or humming of tunes. However, this amusicality, which is more formally termed congenital amusia (Ayotte, Peretz, & Hyde, 2002; Peretz et al., 2002), is a much more problematic and complex phenomenon than commonly thought. According to Ayotte et al. (2002), congenital amusia is a learning disability for music, which specifically affects pitch discrimination in music melodies. Its impairment is highly selective. Though it is a mostly music-specific deficiency, it extends to the inability to detect speech intonation if not other linguistic cues. Though the impairment is seen as low sensitivity to a dissonant melody, the deficit is not seen in perceiving emotion superimposed on a melody. Recognition and memorization of non-music auditory events are intact while those of music melodies are not. In addition to Ayotte et al.'s research, many studies have been conducted to investigate further insights pertaining to the characteristics of congenital amusia, and better appreciation of this disorder is being obtained (e.g., Foxton, Dean, Gee, Peretz, & Grifiths, 2004; Hyde & Peretz, 2004; Peretz & Hyde, 2003; Patel, Foxton, & Griffiths, 2005).

An intriguing finding within the research is that congenital amusia has been considered to have little or no influence on speech intonation perception (e.g., Ayotte et al., 2002; Hyde & Peretz, 2004; Patel et al., 2005; Peretz et al., 2002; Peretz & Hyde, 2003). Although more recent research studies (Nan, Sun, & Peretz, 2010; Patel, Wong, Foxton, Lochy, & Peretz, 2008) have found that amusia may extend to the inability to discriminate pitch in the first-language (L1), only limited influences were detected in those studies. Indeed, even in a tonal language such as Mandarin Chinese, it was found that although some amusical subjects showed impairment in pitch detection at the lexical level, their production of lexical tones was found to be intact (Nan et al., 2010). Nonetheless, the intactness of speech pitch discrimination of amusical individuals is only confirmed in their L1, and little research clarifies whether the FL/SL learners with congenital amusia show intactness or impairment in FL/SL speech perception and production. Hence, this study attempts to shed light on the association between amusical FL/SL learners and their aural and oral sensitivity to their target language prosody, as well as considering the influence of learning context (FL or SL) as a variable. In order to examine these issues, the musical sensitivity and the aural discrimination and oral performance of the English prosody of two groups of native speaking Japanese in both FL and SL contexts were investigated.

Chapter II of this thesis describes in detail the nature of congenital amusia, and considers its influence on L1 speech perception, as well as describing what is known about the association between musical aptitude and SL acquisition. Chapter II concludes with the research questions addressed in the current study. Chapter III provides detailed information about the participants of this study and the research methods including the data collection procedures, instruments, and data analyses. Chapter IV presents the data and discusses the findings obtained in the present research. Chapter V gives our conclusions and the limitations of the study.

Chapter II: Literature Review

This chapter addresses the nature of congenital amusia as well as its influence within the linguistic domain of the first-language (L1), as documented in previous research. In addition, it describes previous findings on the association between EFL/ESL learners' musicality and their perceptive and productive skills of FL/SL pronunciation. This chapter also aims to consider the possible relationship between tone-deafness and tone-deaf individuals' ability to discriminate FL/SL prosody.

The Nature of Tone-Deafness (Congenital Amusia)

Several brain, cognitive, or psychological science studies (Foxton, Dean, Gee, Peretz, & Griffiths, 2004; Hyde & Peretz, 2004; Peretz & Hyde, 2003) have recognized that tone-deafness is an inborn and life-long learning disability specified in the musical domain. Since music and language share some similarities at a prosodic level, it is important to understand the nature of tone-deafness in order to obtain further insights into whether there is a direct relationship between musical ability and L2 pronunciation.

Tone-deafness is normally known as a musical difficulty or problem, which is frequently identified in one's musical performance being out of tune (e.g., singing, humming, or dancing). Though the condition of tone-deafness is apparent and easily recognizable, its existence has long been considered an anecdotal myth because of the lack of empirical evidence and a systematic evaluation method. Ayotte, Peretz, and Hyde (2002) and Peretz et al. (2002) hence attempted to exemplify the probable existence of tone-deafness and to clarify its characteristics. Peretz, Champod, and Hyde (2003) developed a systematic evaluation instrument, the Montreal Battery of Evaluation of Amusia, which has facilitated further investigation of the nature of tone-deafness. The symptoms of tone-deafness, which is more technically termed congenital amusia, are currently being classified for a better understanding of this learning disability. The present literature review primarily describes the general symptoms of congenital amusia and its influence on the linguistic domain.

In a study of 11 amusical individuals, Ayotte, Peretz, and Hyde (2002) were able to determine several symptoms of amusia. The participants' amusicality was determined by a musical examination, which had originally been used with brain-damaged patients and a predecessor of the Montreal Battery of Evaluation of Amusia. The amusical subjects participated in three experiments in order to investigate their pitch discrimination skill, their musical productive skill, and the influence of amusia on other domains. On the pitch discrimination tasks, it was found that amusical subjects (1) cannot discriminate pitch changes in melodies; (2) demonstrate low sensitivity to dissonant melody while less impaired in identifying tempo in melodies; and (3) are not impaired in processing speech intonation although they exhibit deficiency in perceiving speech intonation without other linguistic cues. In another experiment, the subjects' memory and recognition skill toward musical and non-musical sounds were tested. It was determined that amusical subjects experience difficulty in identifying melodies while they demonstrate less difficulty in recognizing lyrics, human voices, and other environmental sounds. On a musical production test, the subjects were asked to sing songs and tap out the beat while they listened to music. A blind evaluation by musicians and non-musicians of the amusical subjects' singing and tapping showed that the amusical individuals performed significantly lower than non-amusical participants in terms of pitch variation and rhythm. Taking the above results together, the authors concluded that congenital amusia is a genuine learning disability, whose impairment is primarily identified in one's inability to recognize musical pitch. Moreover, since the amusical subjects demonstrated difficulty in discriminating speech intonation without the aid of other linguistic signals (e.g., difficulty was seen in identifying a position of prominent pitch and sequence-final pitch direction in non-speech analogues), the authors also argued that congenital amusia is a music-relevant disorder rather than music-specific inability.

A quite similar result was obtained by Peretz' et al.'s (2002) single case study of a French-speaking woman, a self-declared congenital amusiac, in which her pitch perception ability was tested. According to their investigation, it was found that she shared similar symptoms with those found in the study of Ayotte et al. (2002), in that she showed difficulty in pitch discrimination although recognition of non-music sounds and speech intonation in her native language was mostly intact. Subsequently, Peretz and Hyde (2003) attempted to clarify more detailed characterizations of congenital amusia by reviewing previous reports on cognitive and neuropsychological studies from the late 1800s to the early 2000s. Based on their review of previous research, they reported that congenital amusia appears to be a life-long deficiency within music-relevant domains, whose basic impairment lies in the discrimination of fine-grained pitch variations. It was also concluded that since speech intonation has much coarser pitch variation (especially in non-tonal languages) than music, congenital amusia would be unlikely to inhibit speech prosody recognition in the L1.

Recent Amusia Research

Since this review of the literature, however, two additional studies have been published, which show a relationship between amusia and prosodic discrimination similar to Ayotte, et al. (2002). Foxton, Dean, Gee, Peretz, and Grifiths (2004) conducted a contrastive study between non-amusical subjects and amusical subjects. They tested the groups' abilities to detect pitch difference in separated and continuous notes, ability to identify simple and complex pitch patterns, and ability to recognize the organization of pitch (pitch recognition to perceptible triplet rhythm whose middle pitch alters from small to large). They reported that amusical individuals exhibited inabilities in detecting pitch differences and identifying pitch patterns such as pitch-direction or pitch-contour. On the other hand, the amusia group demonstrated approximately the same level of performance with the non-amusical group in perceiving pitch organization. Based on these results, Foxton et al. concluded that the auditory deficits in congenital amusia exist both in detecting pitch changes in isolated or successive notes as well as in identifying changes of pitch patterns such as final-intonation trajectory.

Similarly, Hyde and Peretz (2004) examined 10 amusical and 10 non-amusical adults' auditory sensitivity toward pitch changes and temporal changes inserted in monotonic (constant) and isochronous (regular interval) tone sequences. They found that their amusical adults exhibited low sensitivity to small pitch variations (e.g., smaller than two semitones); however, they did not exhibit that same deficiency with regard to the detection of temporal differences. In addition to this study, Hyde and Peretz also conducted practice sessions with both subject groups and found that despite these sessions, the amusical subjects continued to demonstrate lower performances in the detection of pitch change, while they performed as well as the non-amusical subjects in the discrimination of time differences. The authors thus concluded that congenital amusia is a pitch-specific disorder that does not interfere with discrimination of tempo.

While Peretz et al. (2002), Peretz and Hyde (2003), and Peretz and Hyde (2004) all indicate that amusia does not compromise a person's ability to perceive pitch change in the intonation of their L1, these studies did not provide a detailed analysis of the amusiacs' perceptions of linguistic intonation. However, when such analysis was conducted in Ayotte, Peretz, and Hyde (2002), the amusical participants experienced difficulty determining L1 pitch variation either when other linguistic cues were absent or as compared to non-amusical participants (especially when singing songs).

Based on Peretz and Hyde's (2003) suggestion that a reasonable explanation for the intact speech perception of individuals diagnosed with congenital amusia in the studies they reviewed lay in the coarser pitch variation in linguistic intonation, Patel, Foxton, and Griffiths (2005) hypothesized that amusic individuals would be able to detect pitch variation in non-linguistic tone sequences if the sequences carried exactly the same intonation pattern (pitch and tempo) as those used in speech. In order to examine their hypothesis, seven amusical subjects were presented with lexically identical sentence-pairs that differed only in the position of the prominent syllable, and thus the peak of the rising-falling intonation contour (e.g., "I like BLUE ties on gentleman." vs. "I like blue TIES on gentleman."), which had been originally developed by Patel, Peretz, Tramo, and Labreque (1998). The subjects were also provided two types of non-linguistic analogs created based on the sentence-pairs used for speech perception; one of the analogs was created by discrete-pitch and the other was created by gliding-pitch. The discrete-pitch analogs were created by replacing each syllable in the original sentences with adjusted pitch height, and the gliding-pitch analogs were composed by precisely following the gliding pitch contour of original sentences. Throughout the experiment, the amusical subjects were asked to decide whether the pair was the same or different in terms of intonation pattern. Contrary to the authors' expectation, the results indicated that while speech perception was spared, the amusical subjects demonstrated deficiency in accurately detecting the non-linguistic analogs' pitch pattern even though it followed that of the linguistic sentences exactly (approximately 64% accuracy both in discrete-pitch and gliding-pitch analogs). They concluded that the normal pitch perception found in Peretz and Hyde's (2003) literature review of amusia studies cannot be explained only by the coarser pitch variation in language.

The findings of earlier research in which amusia appeared not to affect the perception of aural discrimination of L1 prosody (Peretz & Hyde, 2003) were called into question by the results of this subsequent study (Patel, Foxton, & Griffiths, 2005). Patel, Wong, Foxton, Lochy, and Peretz (2008) and Nan, Sun, and Peretz (2010) have since identified a selective influence of amusia in the speech domain. Adopting the same method as Patel, Foxton, and Griffiths (2005), Patel, et al. (2008) further investigated the relationship between congenital amusia and the perception of linguistic melody. In their study, the auditory detection of speech and speech-like melodies of 10 British and 11 French-Canadian amusical subjects were examined in relation to their L1. The subjects were asked to discriminate the speech intonation of their respective L1 differing in (1) position of prominence in the sentence and (2) sentence-final pitch direction (downward in statements or upward in questions) by determining if the heard sentences were identical or different. As in the 2005 study, they also discriminated between the non-linguistic tone sequences created as analogs of speech intonation but with the addition of the task of identifying final pitch direction. While they had similar results to the previous study in prominence discrimination (difficulty of prominence discrimination was found in non-linguistic analogs, not in linguistic speech), they found that both language groups' discrimination of pitch direction in speech was actually less accurate than in the non-linguistic tone sequences. The British amusical individuals accurately identified 89.7% of the speech contours and 93.8% of the tone sequences. Similarly, the French-Canadian group scored 86.4% and 96.4% respectively. While these results were unexpected, the difference between the two scores is not considered to be statistically significant. However, they did find significant individual variation, which may have skewed the group statistic (merely 30% of the amusical subjects in each group demonstrated severe impairment in identifying pitch direction). Based on these results, Patel et al. argued that amusical individuals are generally able to detect pitch movement in an utterance (i.e., position of prominence) but some amusiacs exhibit difficulty in perceiving the direction of that movement.

Nan, Sun, and Peretz (2010) also investigated the impact of congenital amusia on the perception of intonation. However, they focused on the perceptions of tonal-language speakers in which small pitch variation can differentiate between the meanings of words. Since Mandarin Chinese speakers have early exposure to slight pitch changes in their language, the authors speculated that these speakers would naturally develop their auditory recognition of fine-grained pitch variations, compensating for their tone-deafness. Hence, Nan et al. investigated 22 non-amusical and 22 amusical Mandarin speakers' musical ability as well as their perception and production of lexical tone. The participants took the Peretz et al. (2003) test of musical ability to identify their amusicality. In addition, they (1) discriminated tone between monosyllabic word-pairs which are lexically identical or different (e.g., “ti2-ti2” or “yu2-yu3” as lexically identical pairs, and “guo3-san3” or “shan1-wu4” as lexically different pairs[2]), (2) identified tone categories (e.g., level, mid-rising, dipping, and high-falling) in monosyllabic and bi-syllabic words. Stimuli in all tasks consisted of meaningful words and nonsense pseudo-words. The two groups performed equally well in discriminating lexical tone between the same word-pairs, while the amusical group demonstrated lower performance on tone discrimination between different lexical-pairs. Furthermore, the amusia group scored lower than the non-amusical group on tone identification generally. However, Nan et al. found that not all of their amusiacs were impaired in tone discrimination and identification. Indeed, half of the amusical participants demonstrated intact lexical tone perception in all tasks; merely six amusiacs (27% of all amusical subjects) showed significant impairment in lexical tone discrimination and identification even though no difference was detected between them on the musical test among all amusical participants. Hence, Nan et al. labeled these specific participants as having lexical tone agnosia (i.e., difficulty in lexical tone-discrimination), and additionally conducted a lexical-tone production test. Their pronunciation samples of lexical tones were mixed with that of non-amusical participants, and all the samples were judged by 6 native Mandarin Chinese speakers. The result indicated no significant performance difference between the two groups. Taking all the results together, Nan et al. concluded that the deficit of congenital amusia may affect the perception of lexical notes of some amusia sufferers (lexical tone agnosiacs) while leaving their productive performance unimpaired.

According to the findings of the reviewed studies, the musical inability of congenital amusia is primarily ascribed to the deficit of pitch processing in music, which

[2] Nan et al. (2010) labeled 1 as level, 2 as mid-rising, 3 as dipping, and 4 as high-falling.

may extend to the deficiency of linguistic pitch or tone identification or discrimination. However, impairment in discriminating speech prosody was confirmed in only about 30% of the amusical groups in both Patel et al. (2008) and Nan et al. (2010). Moreover, the difficulty in identification of pitch direction or tone category might indicate that the deficit in linguistic pitch perception is a selective disability. Albeit further studies are essential to clarify the influence of amusia on the linguistic domain, it is partially understood that music is associated with language sounds, especially with the prosody of one's native language. If such is the case, a naturally arising concern must be a relationship between music and foreign-/second-language. Indeed, recent research studies in second-language acquisition are showing a similar concern, and clearer insights on a connection between musical ability and the acquisition of FL/SL pronunciation are becoming apparent.

Musicality and Foreign-/Second-Language Pronunciation

Considerable L2 research has been conducted to identify the crucial factors in acquiring English pronunciation. According to Celce-Murcia, Brinton, and Goodwin (2010), for instance, a range of factors, such as learners' age; exposure to the target-language; quality and quantity of prior SL learning experience; learners' aptitude, attitude, and motivation; and the nature of the learners' L1, are considered to be associated with the learners' pronunciation acquisition. Musical aptitude, among various agents, has recently gained greater attention in the field of L2 pronunciation acquisition, such as the work mentioned in Chapter I conducted by Pastuszek-Lipińska (2004; 2007; 2008a; 2008b) and Milovanov and her co-researchers (2004; 2008; 2010) on the relationship between FL learners' musicality and their aural/oral performance on the FL pronunciation.

Based on the previous research in the field of neurology on the impact of musicality toward brain plasticity, Pastuszek-Lipińska (2004) speculated that musical training might facilitate flexibility in the human brain and provide a higher sensitivity to FL discrimination. In order to investigate the impact of music on FL performance, she collected speech samples from 106 native-Polish speakers with and without musical backgrounds. The subjects were divided into four groups based upon their musical status (e.g., active professional musicians, active amateur musicians, non-musicians with some previous musical experience, and non-musicians). Their music ability was also evaluated by a simple test of music designed by Pastuszek-Lipińska. On the test, active professional musicians were ranked highest on every test item (melody, rhythm, harmony, and memory) while non-musicians scored lowest. In investigating the subjects' FL sensitivity, Pastuszek-Lipińska utilized 82 synthesized sentences of several FLs (American English, British English, Belgian Dutch, French, Italian, European Spanish, South American Spanish, and Japanese). These FLs were chosen based on phonological classification (stress-timed, syllable-timed, and morae-timed languages). The participants of the study were asked to imitate the heard foreign sentences as precisely as possible. The recorded oral imitation samples were examined using a range of analysis methods in her studies from 2004 to 2008.

In her 2004 study, Pastuszek-Lipińska restricted her analysis to the pronunciation of one American English utterance, "May I help you?" produced by active professional musicians and non-musicians. The target sentence was acoustically analyzed for pitch contour accuracy, as well as native-English speakers' auditory ratings. According to the acoustic analysis of the fundamental frequency value of each word, the musician and non-musician groups exhibited no significant differences in pitch. In contrast, the native speakers' (NS) perceptual evaluation indicated that the active professional musicians outperformed the non-musicians in terms of fluency. Moreover, it was also found that there was a close correlation between musical test scores and NSs' rating scores. Accordingly, Pastuszek-Lipińska maintained that her research results signify a positive relationship between musical ability and FL sound perception and production. However, as mentioned in her study, since English is a commonly learned FL, a genuine association between musical ability and FL imitation performance was not fully corroborated. Indeed, subjects with more language experience tended to be scored higher on the NSs' auditory assessment. Further analysis was thus required at this point in order to examine the influence of musical experience on sensitivity to FL sounds.

Pastuszek-Lipińska (2007; 2008b) therefore analyzed to what extent musicians and non-musicians could accurately produce various FL pronunciation based on the length of their musical education. According to her analysis, musicians could correctly imitate FL utterances at a rate of 56.53% while non-musicians' accurate imitation was only 39.91%. Consequently, it was ascertained that musicians could outperform non-musicians in terms of correct recognition and production of diverse FL sounds. Her further examination, moreover, clarified that although both groups exhibited mispronunciation, musicians were likely to demonstrate superiority at the segmental level, while both subject groups imitated FL intonation at the similar level. Based on the above results, Pastuszek-Lipińska (2007; 2008b) concluded that musicians are apt to experience fewer difficulties in producing FL utterances. However, while Pastuszek-Lipińska's conclusion is seemingly evidential, her analysis depended heavily on her auditory impression rather than empirical analyses.

In her 2008a study, Pastuszek-Lipińska conducted an auditory assessment of the participants' recordings by NS judges from each of the imitated languages. In the auditory assessment, the judges were asked to score the subjects' oral imitations from barely understandable to almost native-like. During the assessment, the judges were able to listen to the same speech as many times as they wanted before scoring. According to the NSs' aural evaluation, a significant score discrepancy was identified between musicians and non-musicians. The raters scored musicians much higher than the members of the non-musician group, indicating that musicians could more fluently and accurately imitate FL pronunciation than non-musicians, which evidentially supports a positive relationship between musicality and FL-sound imitation. Throughout the series of Pastuszek-Lipińska's research studies, it appears that musical ability is related to the recognition and reproduction skills of FL speech utterances.

Other research, such as that by Milovanov and her collaborators (2004; 2008; 2010), has also investigated an association between music and phonemes. Milovanov, Tervaniemi, and Gustafsson (2004) investigated 71 Finnish EFL secondary school students' phonemic awareness of specific English phonemes of which their L1 does not have direct equivalents. The pupils in an ordinary class and in a music class were asked to read aloud a dialogue that included two problematic phonemes without native-models. The students also took a phonemic aural discrimination test consisting of triplets based on minimal pairs that contrast two problematic phonemes (e.g., ship-sheep-ship). Milovanov et al. found that the pupils in the music class better pronounced and discriminated target phonemes with fewer mistakes.

In a similar study on the interconnection between school-aged children's musical aptitude and their linguistic skills, Milovanov, Huotilainen, Välimäki, Esquef, and Tervaniemi (2008) examined 40 Finnish pupils ranging from 10 to 12 years old. They measured the pupils' musical aptitude using the digitally re-mastered version of Seashore Measures of Musical Talents (Seashore, Lewis, & Sateviet, 1960; 2003), a widely used music test to identify one's musical ability in terms of a sense of pitch, timbre, rhythm, tonality, duration, and loudness; production of English phonemes (/ʒ/, /ɜː/, /ð/, /θ/, /tʃ/, and /dʒ/); auditory discrimination of triplets based on minimal pairs of /ʒ/-/s/, /ɜː/-/ö/, /ð/-/d/, /θ/-/f/, /tʃ/-/ʃ/, and /dʒ/-/tʃ/ (e.g., jeep-jeep-cheap for /dʒ/-/tʃ/ discrimination); and auditory discrimination of musical sounds. The participants took the listening discrimination test of the English phonemes and musical chords both before and after an 8-week English pronunciation training, which aimed to equalize the participants' exposure to and knowledge of English pronunciation. At the end of the eight weeks, the participants recorded their pronunciation of the English phonemes embedded within 30 English words by following a NS's pronunciation model. Based upon this production test, the participants were divided into advanced and less-advanced pronunciation groups. The pronunciation samples were then assessed by two native speakers of English and one native Finnish speaker with high English proficiency. It was found that the participants who were assigned to the advanced pronunciation skill had exhibited much higher scores on the Seashore test, especially in pitch, timbre, rhythm, and tonality. Moreover, this group also succeeded in reducing their number of mistakes in aural discrimination between the pre- and post-tests, indicating that better productive and perceptive skills in EFL pronunciation are correlated to both higher proficiency and higher musical ability.

Milovanov, Pietilä, Tervaniemi, and Esquef (2010) subsequently conducted a similar study with adult participants. In their study, 46 native-Finnish speakers (16 non-musical university students, 15 choir members with a high educational background, and 15 English philology students) were examined in the same way with Milovanov, Huotilainen, Välimäki, Esquef, and Tervaniemi (2008). While all of the participants had had an equal amount of English education at school, only the English philology students had had active training in English by attending English classes at a domestic university or studying in an English-speaking country. As for the musical training, both the non-musical university students and the English-philology students had little or inconstant music training compared to the choir members. While the choir group performed highest on the Seashore test, the difference between the choir group and the English philology group was not significant. The non-musical group scored significantly lower than the other two groups on the musical test. While all three groups demonstrated a negligible difference in the auditory phonemic discrimination of English, the choir and English philology groups considerably outperformed the non-musical group on the pronunciation production test. Because both the choir group and the English philology group scored well on the Seashore test, Milovanov et al. (2010) maintained that there is a strong link between musical ability and FL pronunciation skill, at least with regard to the production of phonemes.

Though the studies of Pastuszek-Lipińska (2004; 2007; 2008a; 2008b) and Milovanov et al. (2004; 2008; 2010) have indicated a relationship between musical ability and FL pronunciation skills, their research has primarily focused on the segmental level (vowels and consonants). Several other studies (Todaka & Hidaka, 2009; Wong, Skoe, Russo, Dees, & Kraus, 2007), however, have exemplified that musical aptitude can also be positively correlated with prosodic sensitivity. For instance, Wong, Skoe, Russo, Dees, and Kraus (2007) investigated 10 amateur musicians with at least six years of constant musical training and 10 non-musicians with less than three years' musical training. All participants had not previously been exposed to tonal-languages. The participants listened to three lexically identical but tonally different Mandarin words, while the auditory brainstem responses (brain's response to sound stimuli) of the two groups were compared. The participants' brainstem responses were measured with regard to their frequency-following response and their brainstem pitch tracking. The brainstem reactions indicated that the musicians' brain had tracked the heard pitch contours of Mandarin words more faithfully and robustly than the non-musicians. Brainstem pitch tracking also indicated a positive association between brainstem pitch tracking and length of and initial exposure to music.

In addition to the above brainstem analysis, Wong et al. conducted a lexical tone identification and discrimination task with the same participants. The tone identification consisted of a matching task between a heard Mandarin word and a visual pitch trajectory. The tone discrimination included auditory same-different discrimination on heard Mandarin word pairs. In these auditory tasks, the musicians outperformed the non-musicians as well. Based on these results, Wong et al. suggested that longitudinal musical training could provide better encoding between linguistic pitch and the brainstem, which possibly facilitates musicians' better perception toward speech prosody.

Further insight into the ability to discern linguistic prosody in relation to musical experience is found in Todaka and Hidaka (2009). Their research aimed to identify which types of musical experience could more positively influence FL intonation skills. They hypothesized that musicians who are consistently required to fine-tune pitch (e.g., stringed-instrument players) would have better auditory ability than other types of musicians such as pianists. A total of 45 native-Japanese speakers (33 college students, 11 senior high school students, and one adult) with various musical backgrounds participated in their study. The participants took an auditory discrimination test of English intonation consisting of (1) identification of prominence in 76 sentences and (2) identification of intonation patterns in 10 words and 19 sentences (rising, falling, rising-falling, and falling-rising intonation). According to the listening test, Todaka and Hidaka found that musicians of a stringed instrument (cello) scored especially high followed by musicians of another type of stringed instrument (viola) and cappella singers (cello/84; viola/71.5; a cappella/69.7; Percussion/63.5; Guitar/62.5; Piano/61.7; Non-musician/56.2; and chorus/55.7). Based on this result, they purported to have substantiated their hypothesis: string-instrument players have better auditory sensitivity to FL intonation than other musicians or non-musicians. However, they reported that most of the chorus members who exhibited lower intonation discrimination were high school students without sufficient English proficiency, as well as that some non-musicians with basic knowledge of English phonetics demonstrated higher scores on the listening test. The authors concluded that, in addition to musical training, sufficient English proficiency and phonological training is important in recognizing subtle differences in English intonation. This research suggests that type of musical experience and FL-proficiency level are also issues that should be taken into consideration when investigating a relationship between musical aptitude and FL pronunciation.

Based on these studies, it appears that musical aptitude or musical experience may be positively related to FL speakers' perceptive and productive ability both at the segmental and suprasegmental levels. However, while those studies have put significant attention on high musical ability/experience in relation to FL pronunciation, much less research has addressed the FL/SL pronunciation skills of musically impaired individuals, those with congenital amusia.

Purpose of the Present Study

Previous findings clarified that congenital amusia is mostly music-relevant, which primarily impairs ones' pitch processing in music. It was also detected that congenital amusia may selectively influence ones' perception of linguistic prosody in their L1. While some research has been conducted on the relationship between amusia and L2 phonology, most of that work has focused on phonemic awareness in the FL setting. Since few studies have shed light on an association between tone-deafness and sensitivity to L2 prosody in both the FL and SL contexts, the current study aims to examine whether FL and SL speakers with musical difficulty also have difficulty in auditory recognition and oral production of target-language prosody. This research focuses specifically on English being studied in Japan and the United States.

Research questions addressed in the current study.

As established in Chapter I, the prosodic domain of English is greatly important when learning English for communicative purposes. However, as identified in the studies of congenital amusia, this learning disability influences pitch processing in music and may selectively influence pitch processing in the native language. Besides, since recent EFL/ESL pronunciation studies indicate an association between musical ability/experience and better pronunciation performance, it can be speculated that there may exist a negative relationship as well. In other words, musically impaired individuals may also be impaired in learning FL/SL phonological features. It is hence worth investigating whether this musical abnormality also equally impacts the EFL/ESL speakers' prosodic performance. The research questions addressed in the current study are enumerated below.

a) Do FL/SL learners with congenital amusia have more difficulty in aurally discriminating the target-language prosody accurately than do learners without this learning disability?
b) Do FL/SL learners with congenital amusia have more difficulty in orally producing the target-language prosody accurately than do learners without this learning disability?
c) Does the learning context, SL or FL, have any impact on the ability of the amusia English learners to discriminate or produce the target-language prosody accurately?

In order to answer the above questions, a study of native Japanese-speaking English-language learners was conducted at a Southeastern Kyusyu college in Japan and at a Midwestern state university in the United States. The methodology of this study will be detailed in Chapter III.

Chapter III: Methodology

The current chapter aims to illustrate the detailed information pertaining to the participants of this study and to provide an in-depth description of the research methods including data collection procedures, instruments, and data analysis.

Data Collection in Japan and the United States

In the present research, the recruitment of the participants and the data collection procedure was conducted in Japan and the United States in 2012. Data collection in Japan was conducted between June and July of 2012. The participants in the United States were recruited and investigated between August and December of 2012. As for the research administration in Japan, this research obtained permission from the college Dean before initiating data collection. The participants were selected on the basis of the number of their responses to a screening questionnaire (at least three checks in the musical domain of the screening questionnaire). The informed consent was provided to all the respondents at the screening stage, and their signature to agree to voluntarily participate in the data collection of this study was obtained before gathering data.

Screening Questionnaire for Potential Congenital Amusia

Since it is generally considered that tone-deafness exists at a rate of only 4-5% within the total population (e.g., Peretz & Hyde, 2003), it was firstly required to identify potential amusical subjects before initiating this research. Although potential amusical individuals are usually recruited via media announcement such as newspapers, radio, or university local newspapers as self-declared congenital amusia (e.g., Ayotte, Peretz, & Hyde, 2002; Foxton, Dean, Gee, Peretz, & Griffiths, 2004; Patel, Foxton, & Griffiths, 2005; Nan, Sun, & Peretz, 2010), this study employed a screening questionnaire in order to maximize consideration to potential amusical subjects. The screening questionnaire included 15 likely symptoms or characteristics of congenital amusia, avoiding directly questioning participants about their potential tone-deafness. This questionnaire was designed based on the features of amusiacs described in previous studies; six items (questions 1-6) pertained to non-musical questions and nine items (questions 7-15) related to likely musical difficulty experienced by congenital amusia (see Appendix A). The screening questionnaire was conducted at a college in Southeastern Kyushu province in Japan and at a Midwestern state university in the United States. At this screening stage, the respondents who checked at least three items pertaining to musical difficulty were recruited as potential amusical participants. Consequently, among 301 respondents in Japan and 25 respondents in the United States, a total of 27 (22 females and 5 males) and two participants (one female and one male) respectively were asked to participate in the present study as potential amusiacs.

Participants of the Study

Because five participants in Japan could not complete all the data collection procedures (e.g., stopped participating in the present study during the data collection), 22 Japanese students (18 females and four males) became the actual participants as a group of Japanese students in Japan. Their age ranges from 18- to 21-years old (mean = 19.1 years of age; SD = 1.13). They are all English as a foreign language (EFL) college students in Japan with 8.1 years of English education on average (SD = 2.22). Six of them had attended English medium school in Japan (from 1 to 9 years), and five had experienced short-term (from four days to three months) intensive study abroad programs in English. Their English proficiency level, according to their TOEIC (Test of English for

International Communication) score or their grade on STEP (Society for Testing English Proficiency), is diverse from low to upper-intermediate. Ten participants had previous or active music experience; nonetheless, most of the participants (19 out of 22) self-reported having musical difficulties.

As for the data collection in the United States, the two participants are an English as a second language (ESL) undergraduate (female) and graduate student (male). Their ages were 34 and 26 years respectively. They had already spent at least 4-5 years in the United States at the time of the data collection. Though both of them had previous musical experience, one of them reported musical difficulty. Their English proficiency is considered quite high according to their TOEFL (Test of English as a Foreign Language) scores or based on the fact that they had already spent sufficient time in the English speaking country. Table 1 further details the demographic information of the participants of this study. Participants 1-22 are the Japanese EFL college students, and Participants 23 and 24 are the Japanese ESL undergraduate and graduate students.

Table 1

Demographic Information of the Participants

Note. Since more than half of the EFL participants in Japan were freshmen, they had not yet taken the TOEIC at the time of the data collection. Therefore, in the sake of clarifying the participants' English proficiency, those participants' unofficial score on the TOEIC listening section (maximum 495 points) was obtained for this research. This unofficial TOEIC listening test was conducted on all freshman students during a required course at the onset of the semester. The unofficial TOEIC listening score is labeled "TOEIC (L)," while "TOEIC" indicates an official score obtained through ETS (English Testing Service).

Participant	Age	Sex	English Education	English Medium School	Study Abroad	English Proficiency	Music Experience	Musical Difficulty
1	19	F	9 years	3 years		TOEIC (L) 220/STEP pre2		x
2	18	F	8 years			TOEIC (L) 145		x
3	18	M	6 years			TOEIC (L) 190/STEP pre2		x
4	19	F	10 years	1 year				
5	18	F	8 years			TOEIC (L) 240		x
6	20	M	8 years			TOEIC 650/STEP 2		x
7	18	F	6 years			TOEIC (L) 180/STEP 2	Piano (13)/Horn (3)	x
8	18	F	6 years			TOEIC (L) 225		x
9	20	M	9 years		3 weeks	TOEIC 755/STEP 2		x
10	19	F	7 years		4 days	TOEIC (L) 155	Sax (3)	x
11	20	F	8 years			TOEIC 610	Piano (2-3)	x
12	18	F	6 years			TOEIC (L) 160		x
13	21	F	6 years		2 months	STEP pre2	Trumpet (3)	
14	18	F	6 years			TOEIC (L) 245/STEP pre2	Oboe (3)/Viola (3)	
15	19	F	7 years			TOEIC (L) 165/STEP pre2	Piano (10)	x
16	20	F	14 years	8 years		STEP 2	Piano (7)	x
17	21	F	9 years	2 years	1 week	TOEIC 555	Piano (6)/Clarinet (2.5) A Cappella (active)	x
18	20	F	12 years	6 years		STEP 2		x
19	19	F	7 years			TOEIC (L) 185/STEP pre2		x
20	18	F	12 years	9 years		TOEIC (L) 230	Euphonium (2) Violin (3)	x
21	18	M	7 years			TOEIC (L) 170	Base-Guitar (3 months)	x
22	18	F	7 years			TOEIC (L) 300/STEP pre2		
23	34	F	18 years	2 years and 8 months	4 years	TOEFL iBT 61	Piano (3)	
24	26	M	13 years		5 years	TOEFL PBT 585	Trumpet (1)	x

Data Collection Instruments

Data collection following the screening stage consisted of three steps: the Montreal Battery of Evaluation of Amusia (MBEA), on which all participants' musical ability was assessed; an intonation perception test, on which the participants identified and discriminated English prosody; and an intonation production test, on which the participants recorded themselves reading aloud two diagnostic reading passages.

Montreal Battery of Evaluation of Amusia.

In the present study, the participants, who demonstrated similar characteristics of congenital amuisa at the screening stage, were considered potential amusical subjects, and therefore, it was necessary to identify whether they were actually tone-deaf or not. In order to examine participant musical inability, this study adopted and conducted a systematic musical test for congenital amusia, the Montreal Battery of Evaluation of Amusia (hereafter, MBEA) created by Peretz, Champod, and Hyde (2003)[3]. This musical test is considered the best evaluation instrument of musically impaired individuals (Peretz et al., 2003), and has been widely employed in a number of studies investigating amusia (e.g., Foxton, Dean, Gee, Peretz, & Griffiths, 2004; Hyde & Peretz, 2004; Nan, Sun, & Peretz, 2010; Patel, Foxton, & Griffiths, 2005; Patel, Wong, Foxton, Lochy, & Peretz, 2008). This test contains 184 question items associated with three musical domains: melody, tempo, and musical memory. The melodic domain involves three subtests: scale, contour, and interval, which are all related to pitch variation in music and contain 31 questions each. The temporal domain consists of two subtests: rhythm (31 questions) and metrics (30 questions), which are associated with variations in duration in music. The musical memory test, which is associated with one's recall of previously exposed music

[3] Permission to adopt the MBEA for the present research was obtained from Isabelle Peretz via email.

during the MBEA, contains 30 questions. Figure 1 shows a graphic illustration on the organization of the MBEA.

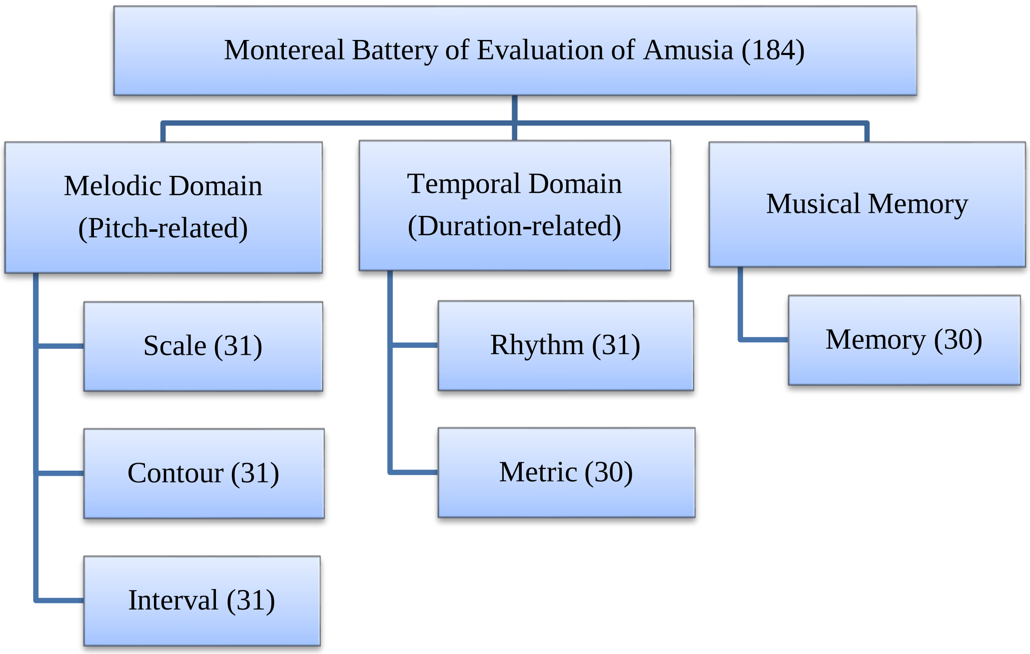


Figure 1. Organization of the Montreal Battery of Evaluation of Amusia

Most of the questions on the MBEA are answered by deciding if what they hear can be considered the *same* or *different*. For instance, on the scale test, the test-takers listen to two melodies, which are either identical or differ in terms of melodic scale. The test-takers are then asked to determine whether the successive melodies are identical or different. In a similar vein, the contour test, the interval test, and the rhythm test respectively provides two successive melodies and asks the test-takers to identify whether the two sound sequences are the same or different in the light of pitch direction, pitch height, and duration. The metric test differs in that it asks the test-takers to distinguish a type of melody. On this test, the test-takers are basically provided two types of melodies:

a waltz, whose rhythmic pattern is composed by three beats (one strong beat followed by two weak beats), and a march, whose rhythmic pattern is based on a unit of two beats (alternately appearing one strong beat and one weak beat). After listening to the melody, the test-takers are required to determine which melodic pattern they have heard, waltz or march. On the musical memory test, the test-takers listen to the melodies to which they have been exposed during the previous subtests, as well as melodies that they have not heard during the test. In each question, the test-takers need to determine whether they have heard the same melody during the test or not.

The whole test procedure takes approximately 90 minutes to complete. The participants of the study were provided sufficient instruction and practice sessions before each subtest, and a 5-minute break in the middle of the test. The participants' test scores on the MBEA are calculated as a percentile score (= (the number of correct responses ÷ the number of total question items) × 100). Since Peretz et al. have set the score range of 75-79% as a fundamental cut-off line for congenital amusia, this study regards the participants whose score was within or below this score range as authentic amusical participants.

Intonation perception test.

In order to investigate the participants' auditory sensitivity toward pitch variations in English, the present study designed a special intonation comprehension test adapting the listening tests from Cook (2000) and Celce-Murcia, Brinton, and Goodwin (2010) (see Appendix B). This test determines the test-takers' aural discrimination and identification skills of linguistic prosody. It consists of 100 questions divided into three parts. The first part contains 18 nonsense word sequences (e.g., duh duh duh) differing in the positions of prominence (e.g., **duh** duh **duh**, duh **duh** duh). In this part, the test-takers listen to the sound sequences and choose the most adequate stress pattern from provided choices. The second part consists of 60 meaningful words and sentences (e.g., a dog, Bob's hot dog, it's my hot dog) whose stress patterns differ from simple to complex (e.g., la-**la**, **la**-la-**la**, la-la-**la**-la). In this section, the test-takers listen to the pronounced meaningful word sequence and sentence; then, they select the most appropriate stress pattern among the provided stress patterns. The last part is 22 identification items of visual intonation contour. The test-takers read and listen to a dialogue between native English speakers. One utterance in the dialogue is provided with several different intonation contours. Based on the pronunciation they listen to, the test-takers select the intonation contour they think they heard. Since the test is comprised of 100 questions, the calculated score is also the percentage of correctly identified items.

Intonation production test.

In addition to the participants' auditory intonation processing skill in English, the present research also investigated whether the participants could adequately produce English intonation patterns. In order to investigate the participants' prosodic accuracy, they were asked to record themselves reading aloud two diagnostic reading passages developed by Prator and Robinett (1985) and Celce-Murcia, Brinton, and Goodwin (2010) (see Appendix C). Although these passages were not designed strictly to diagnose one's English intonation, utterances embedded in the passage are useful to analyze whether learners can successfully produce a variety of English utterances with the appropriate intonation based on the context provided by the text. In this oral production task, the participants listened to the native speaker's pronunciation model three times while reading the provided passages; then, they individually practiced reading aloud the passages before recording their pronunciation.

Since Patel, Wong, Foxton, Lochy, and Peretz's (2008) reported that some amusiacs showed difficulty in discriminating sentence-final pitch direction (e.g., downward or upward direction) in their native language, it can be speculated that amusical FL/SL speakers might have difficulty in producing sentence-final pitch with accurate pitch direction. Therefore, in this study, the participants' oral accuracy is evaluated based on the number of accurate pitch directions in their utterances. Among 31 sentences in the two diagnostic passages, eight sentences ending with rising-falling, rising, or falling intonation patterns are selected as target sentences for analysis (Table 2). In order to determine whether the participants could produce correct intonation patterns in the target sentences, their speech samples are acoustically processed using Praat (a software for acoustic analysis) in the sake of obtaining visualized intonation contours.

Table 2

Target Sentences in the Present Research

Passage 1: Prator and Robinett (1985)
Sentence 2: Where should he live? (rising-falling)
Sentence 3: Would it be better if he looked for a private room off campus or if he stayed in a dormitory? (rising-falling)
Sentence 4: Should he spend all of his time just studying? (rising)
Sentence 5: Shouldn't he try to take advantage of the many social and cultural activities which are offered? (rising)
Passage 2: Celce-Murcia et al. (2010)

Sentence 1: Is English your native language? (rising)

Sentence 3: Why is it difficult to speak a foreign language without an accent? (rising-falling)

Sentence 11: Does this mean that accents can't be changed? (rising)

Sentence 16: Will you make progress, or will you give up? (rising-falling)

When the visualized intonation contour indicates the accurate pitch ending pattern, the participant's utterance is evaluated correct; conversely, if the utterance demonstrates inadequate sentence-final pitch direction, it is evaluated incorrect and the reason of inaccuracy is provided. For instance, if a target sentence is produced with flat pitch direction, it is evaluated incorrect being labeled *flat*. If a participant demonstrates falling intonation in a sentence of final rising intonation (i.e., sentence 4 and 5 in passage 1, and sentence 1 and 11 in passage 2), it is evaluated incorrect being labeled *falling*. Similarly, when one produces an utterance with rising intonation in a sentence ending with rising-falling intonation (i.e., sentence 2 and 3 in passage 1, and sentence 3 and 16 in passage 2), it is evaluated incorrect being labeled *rising*. Figure 2 provides sample intonation contours evaluated as correct (first spectrogram) and incorrect pitch ending (second spectrogram) produced by non-native English speaker and the intonation contour of native English speaker (third spectrogram). Though the first contour has slight rising at the beginning of 'live', since it has sufficient falling, it is evaluated correct. However, since the second contour does not have sufficient falling, it is evaluated as incorrect and labeled *flat*. Based on the evaluation of visualized intonation contours, the participants' ability to produce an adequate intonation pattern is evaluated by the number of correct pitch direction, being calculated as a percentile score (= (the number of accurate pitch direction ÷ 8) × 100).

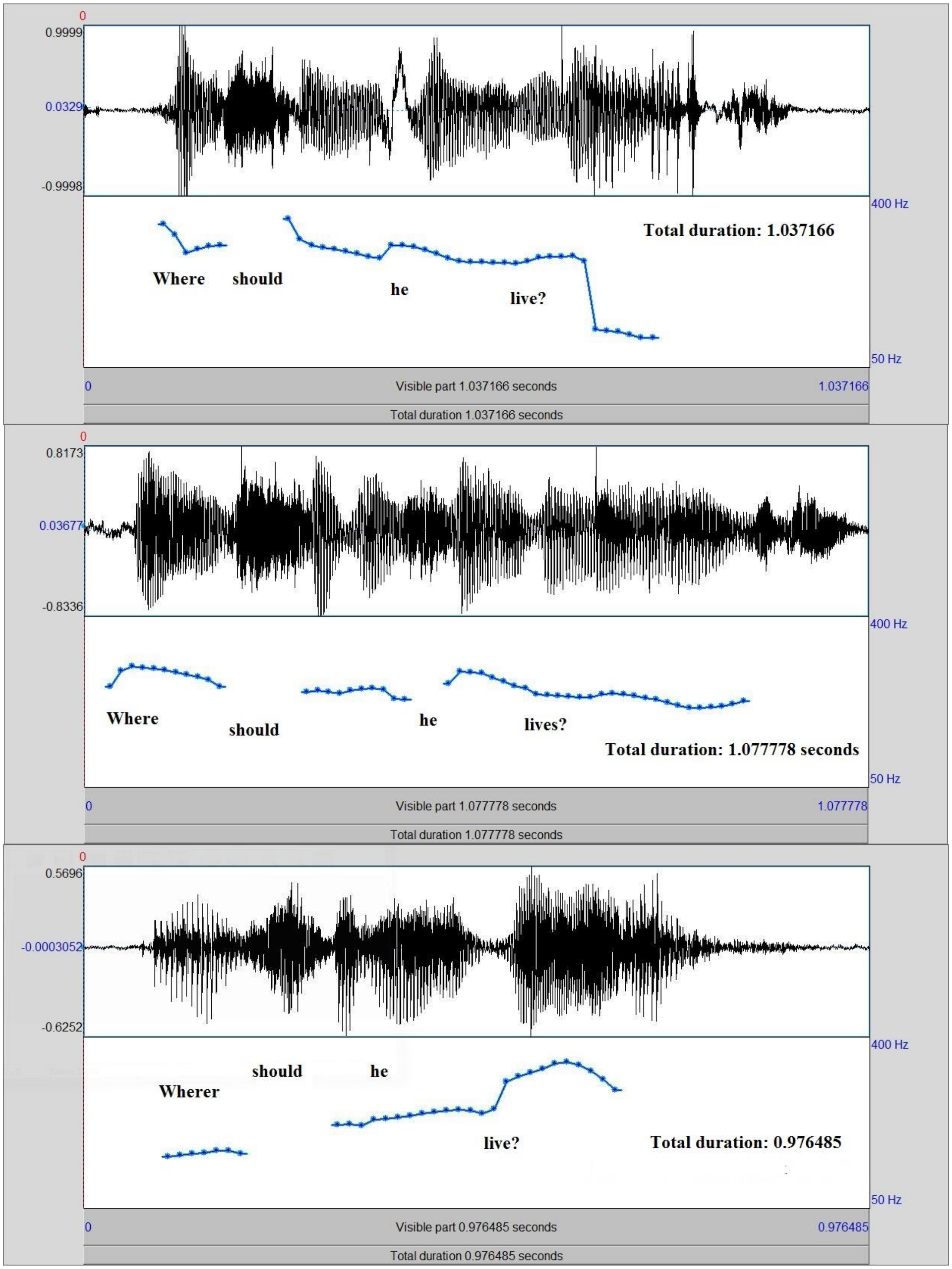


Figure 2. Acoustic Spectrogram of "Where should he live?"

Data Analysis Procedures

The primary purpose of this research is threefold: understanding the influence of musical inability on EFL/ESL speakers' auditory processing of English intonation, understanding the influence of musical disability on EFL/ESL speakers' oral prosodic accuracy, and understanding the influence of learning context on the participants' aural/oral performance.

In order to identify the amusical participants, the present study firstly calculates the participants' MBEA score, and those with the score criteria of tone-deafness set by Peretz et al. (2003) are analyzed in the present study by comparing their auditory and oral performance with the musically intact participants that showed no musical problem on the MBEA. Furthermore, in addition to calculating the participants'MBEA scores, the participants' score on each subtest (i.e., scale, contour, interval, rhythm, metric, and memory) is also compared with data of non-amusical individuals provided by the MBEA to clarify in which musical aspects the participants are impaired (the data of musically normal individuals is available in the MBEA package). Participants who scored 1 SD below the mean score of non-amusical individuals are marked with one asterisk. Those who scored 2 SDs below are marked with two asterisks (the mean score and SD value of non-amusical individuals are scale: mean=26.1 and SD = 2.63; contour: mean = 26.2 and SD = 2.64; interval: mean = 25.9 and SD = 2.80; rhythm: mean = 26.8 and SD =2.60; metric: mean = 25.7 and SD = 4.12; and memory: mean = 27.1 and SD = 2.43).

In order to examine an association between musical difficulty and listening ability of English prosody, the participants' performances on the MBEA and intonation perception test were contrasted. Similarly, the participants' MBEA score and the percentage of accurate pitch direction sentences were compared to investigate the relationship between musical inability and oral prosodic performance. Finally, the environmental factor is analyzed by contrasting the aural and oral performance of the EFL participants with those of ESL participants.

Chapter IV: Results

This chapter provides the results of the analyses of the collected data. The participants' musical ability is firstly described based on their performance on the Montreal Battery of Evaluation of Amusia (MBEA). Then an association between the participants' musical ability and their aural sensitivity to English prosody is analyzed by comparing their MBEA score with their intonation perception test score, as well as investigating whether there is a difference in learning context. This chapter subsequently provides the results of the acoustic analysis on the participants' oral performance in English, attempting to identify whether there is a relationship between their musical ability and oral performance. In addition, the impact of the learning context on FL/SL speaker's oral performance is analyzed. Finally, Chapter IV provides additional analyses on what role both the learners' English-listening proficiency and the extent of their musical training play in the aural/oral findings.

Participants' Musical Ability

In the present study, the participants were recruited according to their responses to the screening questionnaire, which was designed based on the previous findings on the characteristics of congenital amusia. The 24 respondents who checked at least three questionnaire items related to symptoms generally seen in congenital amusia were asked to participate in this research. According to the results of the screening questionnaire shown in the musical category (questions 7-15) in the Figure 3, nearly half of the participants were found to demonstrate several features of congenital amusia. For instance, approximately 50% of the participants reported difficulty in recognizing pitch variations in music, in recognizing or humming familiar tunes, and in identifying when to start singing a song that has a long introduction. Moreover, more than half of the participants reported that they have little sensitivity to dissonant melodies. They also reported that, while they have no difficulty in recognizing linguistic intonation in a song, they become unable to recognize its melody once the lyrics are eliminated. Finally, most of the participants characterized themselves as poor singers. Based on the results of the screening questionnaire, it could be anticipated that at least half of the participants had self-reported musical difficulty.

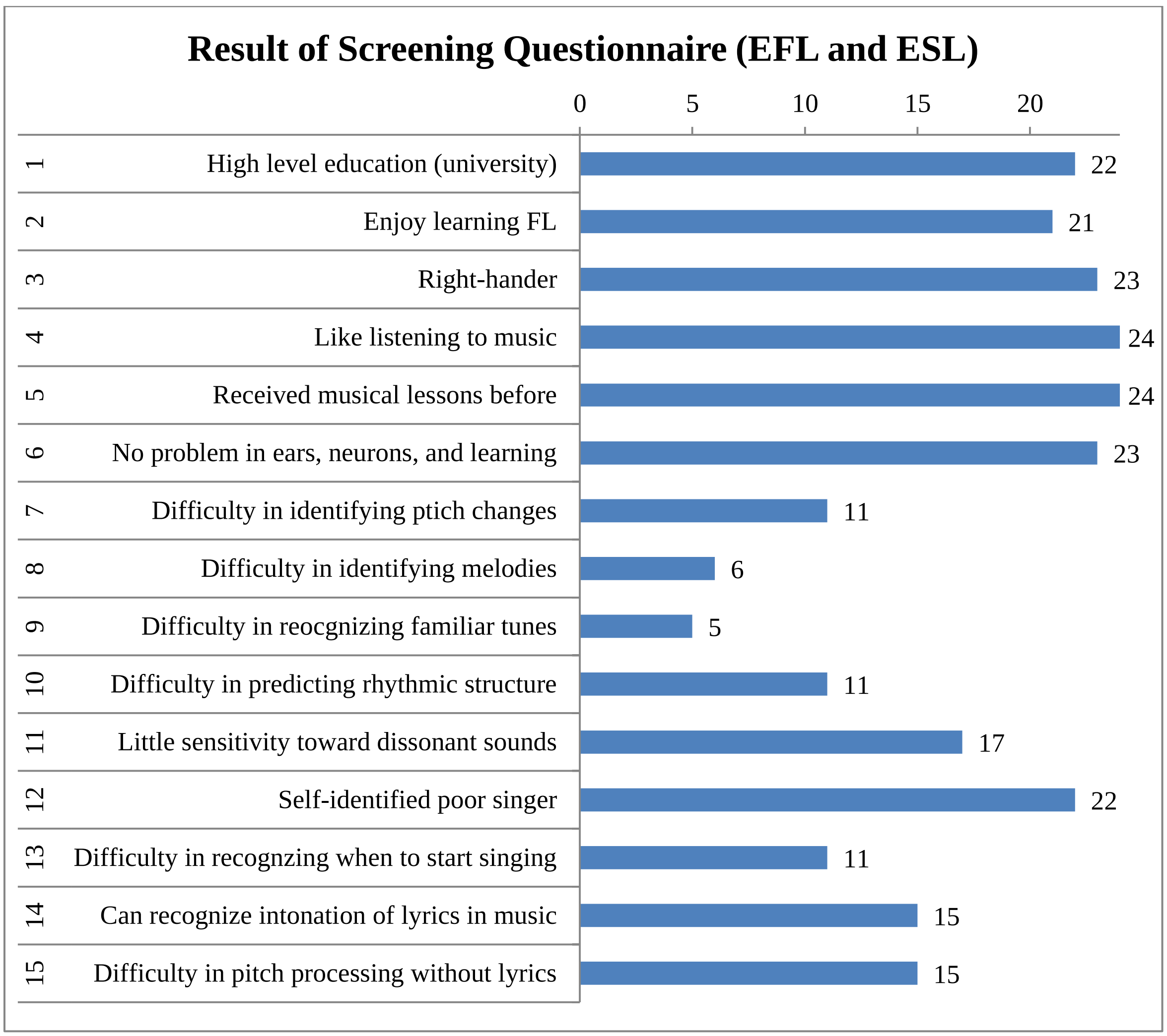
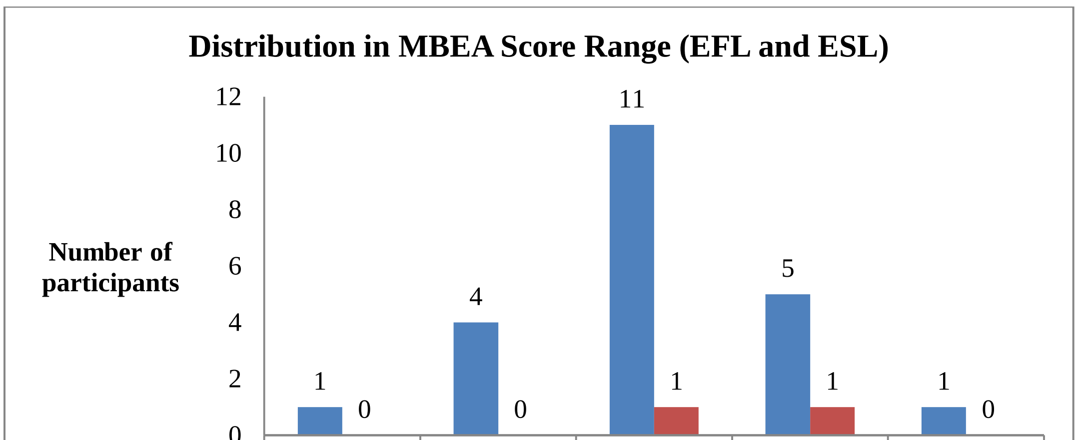


Figure 3. Result of Screening Questionnaire (EFL (n=22) and ESL (n=2))

Note. Full questions in the screening questionnaire are available in Appendix A.

Although it was determined from the screening questionnaire that nearly 50% of the participants seemingly experienced musical difficulty, their results on the MBEA generally did not indicate congenital amusia. In fact, as can be seen in Appendix D, only Participant 1 met the criteria of 75-79 set by Peretz et al. (2003) with a score of 78. The other participants who scored higher than that criterion were distributed into groups of score ranges 80-84, 85-89, 90-94 and 95-99 set by Peretz et al. Figure 5 indicates the participants' distribution into each score range group. For the sake of ease of description, the MBEA score range is labeled group number (Groups 1-5).



	75-79 (n=1) Group 1	80-84 (n=4) Group 2	85-89 (n=12) Group 3	90-94 (n=6) Grpup 4	95-99 (n=1) Group 5
EFL Participants	1	4	11	5	1
ESL Participants	0	0	1	1	0

Figure 4. Participants Distribution by the MBEA Score (EFL and ESL)

In addition to calculating the total MBEA score, the participants' score on each subtest (as shown in Appendix D) is also compared with data the MBEA provides from non-amusical individuals (the bottom row of Table 3) to clarify in which musical aspects the participants are impaired. Table 3 compares the mean and standard deviation results between the participants for this study and the non-amusical group.

Table 3

Mean and SD Comparison between Present Participants and Non-Amusical Individuals

	Scale (31)	**Contour (31)**	**Interval (31)**	**Rhythm (31)**	**Metric (30)**	**Memory (30)**
EFL (n=22)	26.5 (SD=1.90)	26.2 (SD=1.97)	25.8 (SD=2.50)	27.0 (SD=3.12)	27.9 (SD=2.35)	28.1 (SD=1.81)
ESL (n=2)	25.5 (SD=0.71)	25.5 (SD=0.71)	28.5 (SD=0.71)	28.0 (SD=0)	27.0 (SD=2.80)	30.0 (SD=0)
Non-Amusiacs (n=285)	26.4 (SD=2.63)	26.2 (SD=2.64)	25.9 (SD=2.80)	26.8 (SD=2.60)	25.7 (SD=4.12)	27.1 (SD=2.43)

As indicated above, since most of the present participants' MBEA scores did not indicate amusicality (except for Participant 1), there is seemingly no significant difference between the present participants (including EFL and ESL) and non-amusical individuals in terms of mean and SD values on the MBEA. However, some participants, apart from the criterion of congenital amusia (75-79) nonetheless presented musical difficulty in at least one or two MBEA subtests. Those participants scored at least 1 SD below the mean score of non-amusical individuals on at least one MBEA subtest. Table 4 enumerates the MBEA scores of the present participants who exhibited musical difficulty on a subtest. The participants who scored 1 SD below the mean score of non-amusical individuals are marked with one asterisk. Those who scored 2 SD below are marked with two asterisks. The participants are ordered from lowest to highest on their overall MBEA score. Participants who did not reach the SD criteria were not included in the table.

Table 4

Participants with 1 or 2 Asterisk(s) (n=11)

Participant	**SQ Music**	**Score on Montreal Battery of Evaluation of Amusia**						
		Scale	**Contour**	**Interval**	**Rhythm**	**Metric**	**Memory**	**Total (%)**
1	6	21**	26	26	21**	26	24*	78
2	4	24	25	22*	23*	28	26	80
3	4	26	24	24	24*	23	29	82
4	5	27	24	20**	25	28	28	83
5	5	24	26	26	21**	30	28	84
6	7	28	28	24	24*	23	29	85
8	4	25	30	22*	31	24	30	88
10	4	28	24	23*	29	28	29	88
11	7	26	28	27	24*	29	30	89
14	4	28	22*	27	27	30	29	89
16	6	27	27	27	30	30	23*	89
Mean	**5.1**	**25.8**	**25.8**	**24.4**	**25.4**	**27.2**	**27.7**	**85.0**
SD	**1.2**	**2.18**	**2.32**	**2.42**	**3.44**	**2.75**	**2.37**	**3.92**
Participants w/difficulty		**1**	**1**	**4**	**6**	**0**	**2**	

Note. SQ Music indicates the number of items the participant checked on the musical difficulty domain in the screening questionnaire (maximum 9).

As indicated in Table 4, the tested amusia participant (Participant 1) scored at least 1 SD below the mean score of the non-amusical individuals in three subtests (scale, rhythm, and memory). Her significant musical deficiency was recognized in her inability to process musical scale and rhythm. She scored approximately 2 SD below on those subtests (i.e., nearly 2 SD below on scale and 2 SD below on rhythm). Moreover, since her low score is identified in scale, rhythm, and memory, it can be assumed that her musical inability extends to all three domains: melodic domain, temporal domain, and musical memory domain. Interestingly, while it is considered that ones' musical inability is mostly related to the pitch-related area (e.g., scale, contour, and interval), her musical difficulty could be seen in the duration-related area (e.g., rhythm and metric) as well. Moreover, more than half of the participants in Table 4 also demonstrated musical difficulty (1-2 SD below score) on the duration-related subtest (rhythm (n=6)) than pitch-related subtest (interval (n=4)).

In the present study, only one authentic tone-deaf participant was obtained. The previous studies have indicated (Kalmus & Fry, 1980 cited in Ayotte, Peretz, & Hyde, 2002; Foxton, Dean, Gee, Peretz, & Griffiths, 2004; Hyde & Peretz, 2004; Nan, Sun, & Peretz, 2010; and Peretz & Hyde, 2003) that congenital amusia exists at a rate of approximately 4% of a total population, and the percentage of the present amusical participant among the collected population (n=24) is 4.2%. It seems that the percentage of authentic amusiac in the present study corresponds to that in the previous study. However, since the collected participants were already culled from a much larger group (n=301 in Japan and n=25 in the United States), it might be that the percentage is actually 0.3% which is significantly less than the percentage of congenital amusia thought to be found in the total population. This significantly low percentage may be due to the screening questionnaire in which we did not directly question the respondents' amusicality. Nonetheless, this study was able to obtain access to one amusical individual.

The following analyses contrast the aural and oral performances of the amusiac with those of the other participants. In addition, since 11 participants were found to have at least one category of musical difficulty (Table 4), their prosodic performances are also contrasted with those participants whose MBEA scores indicted that their musical ability was fully intact (n=11). In order to exclude the factor of learning context, the contrastive analyses between amusiac (n=1) and non-amusiacs (n=21) and between the musical difficulty group (n=11) and the musically intact group (n=11) are conducted only within the group of EFL participants.

In order to clarify whether learning context (EFL or ESL) can affect amusical language learners' aural perception skill, in addition to contrasting the participants' test scores on the MBEA with those of their intonation perception test scores, EFL participants are also compared with ESL participants. As indicated above, since authentic tone-deafness was found only among the EFL participants, an association between musical inability and pitch processing ability in English is primarily analyzed within the EFL group. Nonetheless, it is still worth conducting a contrastive analysis between the EFL participants and the ESL participants to understand the differences in their auditory discrimination and production skills.

Auditory L2 Prosody Processing

The EFL/ESL participants' test results on the intonation perception test is summarized in Table 5, which provides the mean score and SD value of the EFL participants and the ESL participants. The participants' detailed individual results on the intonation perception test are depicted in Appendix E. In Table 5, we can see that both the EFL and ESL groups did not demonstrate a significant difference regarding their L2 intonation perception on average.

Table 5

Mean Scores and SD Values on the Intonation Perception Test

	Part 1 (18) (Nonsense Words)	**Part 2 (60) (Words/Sentences)**	**Part 3 (22) (Visual Contours)**	**Total (100)**
EFL Participants (n=22)	15.5 (SD=3.5)	45.9 (SD=9.0)	17.2 (SD=3.0)	78.6 (SD=12.6)
ESL Participants (n=2)	14.5 (SD=4.9)	49.0 (SD=9.9)	16.5 (SD=2.1)	80.0 (SD=17.0)

However**,** Figure 5 shows that there is a score discrepancy between the amusical participant and the non-amusical participants. While the amusical participant in Group 1 obtained only 56 points on the intonation perception test (IPT), the non-amusical group scored at least nearly 20 points above that score on average. It was also found, but for a small difference in Group 3, that the higher the MBEA score, the better the learner's intonation perception. Based on these findings, it could be tentatively concluded that congenital amusia is related to one's auditory discrimination of linguistic prosody in the FL, and, conversely, higher MBEA scores were related to better perception of FL prosody. However, contrary to this trend, one of the participants (Participant 10), who scored relatively high on the MBEA (88), scored significantly lower than the others, including the amusia participant, on the intonation perception test (51). In order to account for this, let us compare the participants that showed musical difficulty in at least one of the MBEA subtests (including Participant 10) with those who had no difficulties.

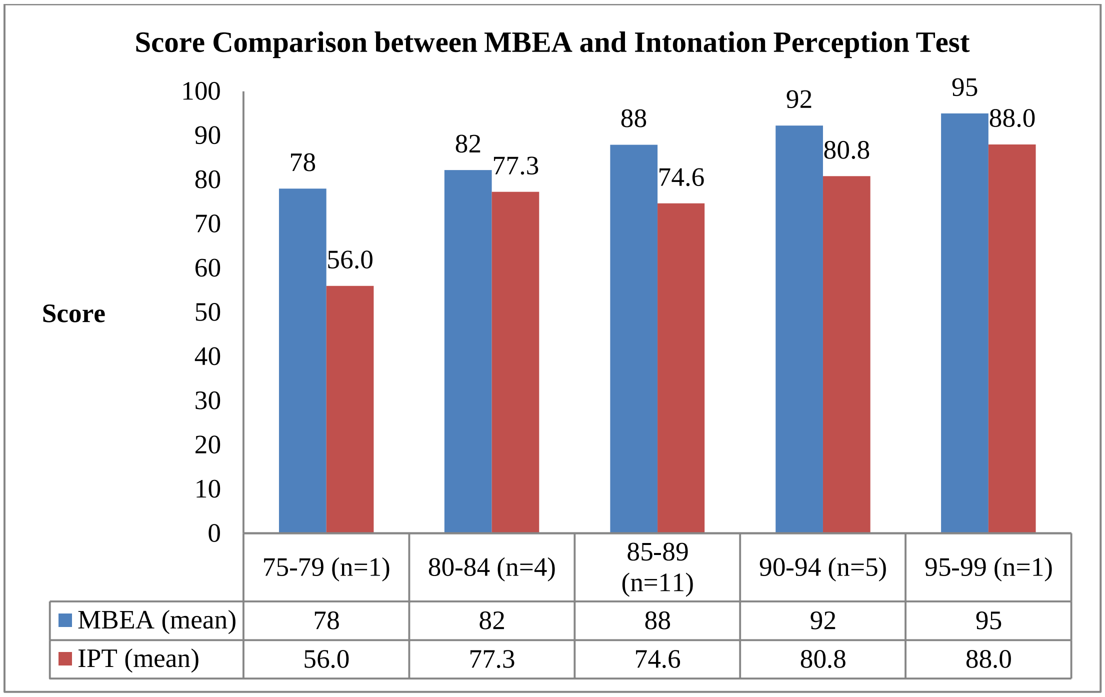


Figure 5. The MBEA and IPT Score Contrast among MBEA Groups (EFL)

The contrastive analysis between the two participant groups given in Table 6 shows that the group who demonstrated musical difficulty scored 7.8 points lower on intonation perception than did the group who presented no problems on any musical subtests. This implies that not only a high-level of musical difficulty (e.g., 2 SD below score on at least two subtests), but also a relatively low-level of musical difficulty in processing musical pitch, tempo, or memory (e.g., at least 1 SD below score on either the melodic, temporal, or memory domain) can correlate with one’s low auditory discrimination ability of FL intonation. Taking all the findings obtained in figure 5 and table 6 together, it can be considered quite reasonable that there may be an association between musical inability or musical difficulty and low aural sensitivity to FL prosody.

Table 6

Score Comparison between Musical Difficulty Group and Musically Intact Group (EFL)

	MBEA (mean)	IPT (mean)
Musical Difficulty Group (Participant 1, 2, 3, 4, 5, 6, 8, 10, 11,14, and 16)	85.0 (SD=3.9)	72.4 (SD=11.9)
Musically Intact Group (Participant 7, 9, 12, 13, 15, 17, 18, 19, 20, 21, and 22)	90.7 (SD=2.6)	80.2 (SD=12.5)

Auditory SL prosody discrimination of ESL participants.

A part of the current research objectives involves inquiring whether ESL participants with congenital amusia demonstrate better intonation perception skill than amusical EFL participants. However, since no authentic tone-deaf participant was obtained in a group of ESL students (the participants scored 88 and 91 on the MBEA without any musical difficulty on subtests), the current study can no longer answer that particular research question. Nonetheless, it is still worth investigating whether the participants' learning context (EFL context or ESL context) may influence their FL/SL pitch processing ability. In order to investigate the influence of learning context on ESL participants' auditory pitch processing skill, their performance on the intonation perception test is contrasted with those of EFL participants in Figure 6.

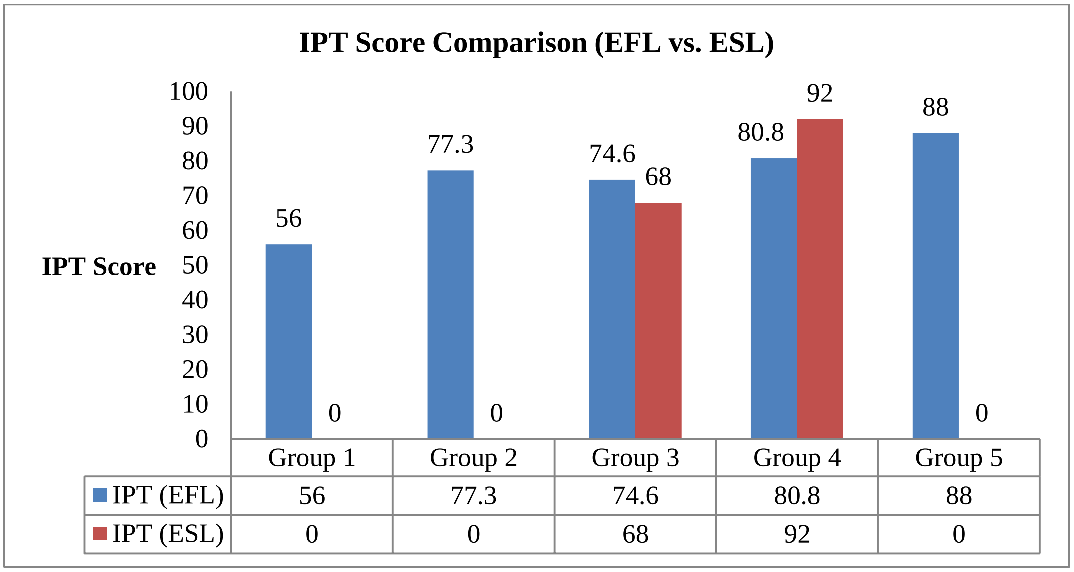


Figure 6. The IPT Score Contrast between EFL and ESL groups

Since ESL learners are exposed to authentic English daily, it was generally expected that they would demonstrate a higher listening ability. On the one hand, Participant 24 in Group 4 obtained a significantly higher score (+ 11.2 points) on the intonation perception test than did the EFL participants. On the other hand, however, Participant 23 in Group 3 presented a relatively low auditory performance in processing English prosody compared to the mean score of the EFL participants in the same MBEA score range (− 6.6 points). Accordingly, there appears to be no relationship between the variables for these two ESL learners.

Oral L2 Prosody Performance (Pitch Direction Patterns)

In addition to the participants’ intonation perception, since Patel, Wong, Foxton, Lochy, and Peretz (2008) reported that some amusiacs had showed difficulty in discriminating utterance-final pitch direction even in their native-language, the present study also attempted to investigate to what extent they could produce accurate English intonation patterns, especially focusing on the pitch directions at the end of utterances. The participants' detailed individual results on this test are available in Appendix F. The present oral production section follows the same analysis procedure of the perception study. We firstly analyze the influence of musical difficulty on FL prosody production. Then, the ESL participants' oral accuracy in SL prosody is analyzed and contrasted with that of EFL participants.

Influence of musical difficulty on FL prosody production.

This study has already shown that there is a discrepancy between the amusical participant (Group 1) and the rest of the participants (Groups 2-5) regarding their intonation perception. Therefore, Figure 7 similarly contrasts the participants' scores on the MBEA with their oral performance on pitch direction. The participants' prosodic accuracy is calculated as a percentile score based on the number of accurate intonation patterns produced.

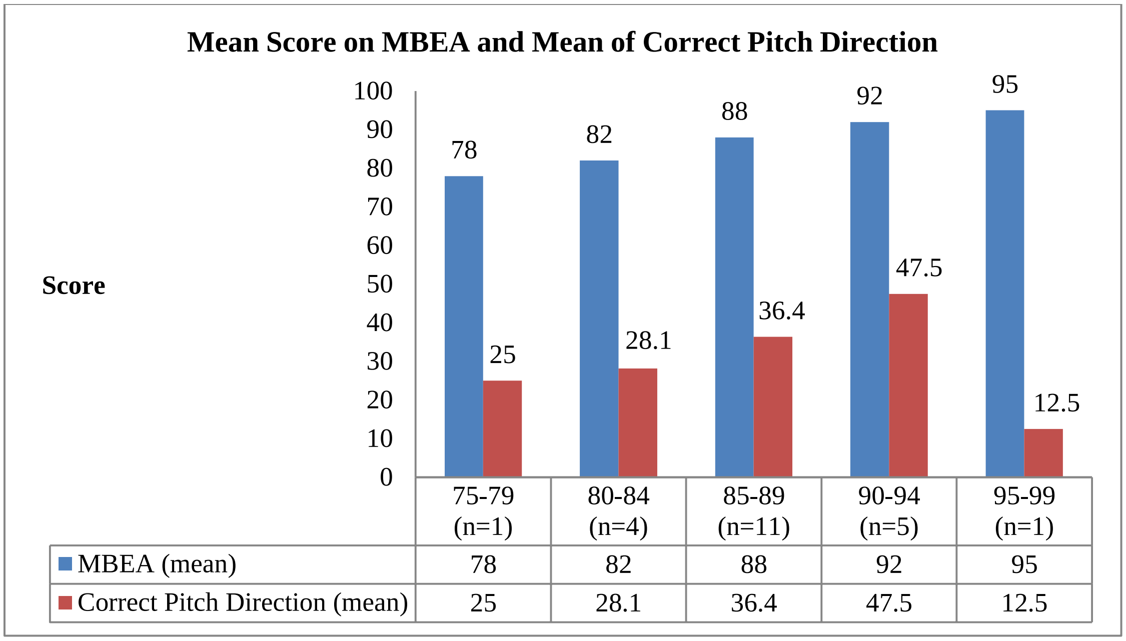


Figure 7. The Number of Accurate Intonation Pattern in each MBEA Group (EFL)

With one exception, the results here show that a higher MBEA score correlates with more frequently correct final pitch direction. The exception is the Group 5 participant, who scored highest on the MBEA, but showed lower intonation production accuracy (12.5%) than all of the other participants, including the amusical participant (25%). Moreover, although Groups 3 and 4 demonstrated much higher intonation production performance as a group (36.4% and 47.5%, respectively), there was a large discrepancy between the individual participants. In fact, three participants in Group 3 (Participants 7, 8, and 12) showed oral performance on a par with the Group 5 participant and lower than that of the amusical participant (0%, 12.5%, and 12.5%, respectively). Additionally, Participant 13 (Group 3) and Participant 18 (Group 4) performed at the same accuracy level as the amusiac at 25%. Since the individual results varied widely, we might tentatively conclude that congenital amusia is not necessarily related to one's intonation production.

Since the analysis of intonation perception indicated that even a low-level musical difficulty negatively influenced the participants' intonation perception, it may be helpful to look at that group configuration with regard to intonation production as well. Table 7 shows the results of that contrastive analysis.

Table 7

Score Comparison between Musical Difficulty Group and Musically Intact Group

	MBEA (mean)	**Correct Pitch Direction (%)**
Musical Difficulty Group (Participant 1, 2, 3, 4, 5, 6, 8, 10, 11, 14, and 16)	85 (SD=3.9)	35.2 (SD=17.5)
Musically Intact Group (Participant 7, 9, 12, 13, 15, 17, 18, 19, 20, 21, and 22)	90.7 (SD=2.6)	36.4 (SD=22.0)

As seen above, the two groups produced English intonation at a nearly equal accuracy level (35.2% in musical difficulty group and 36.4% in musically intact group). In addition to the tentative conclusion above, this result does not provide evidence for a relationship between musical difficulty and FL intonation production.

Oral SL prosody production of ESL participants.

Figure 8 shows the ESL participants' MBEA scores in contrast with their intonation performance in English. In terms of the number of accurate pitch contours, both of the ESL participants outperformed the average score of the EFL participants in the same MBEA score range group. The accuracy level of Participant 23 was 50% while that of the corresponding EFL group (Group 3) was 36.4% on average (+ 13.6%), and the accuracy level of Participant 24 was 62.5%, 15% above the corresponding EFL group's 47.5% (Group 4).

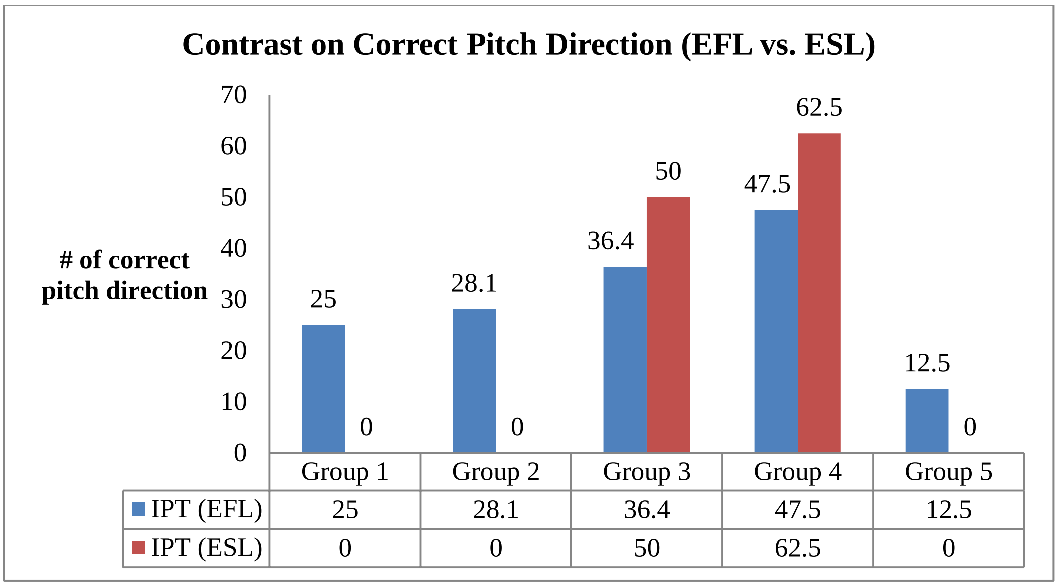


Figure 8. Accurate Pitch Directions (%) between EFL and ESL Groups

Interestingly, while Participant 23 in Group 3 demonstrated lower auditory performance on the intonation perception test than the EFL group in the same MBEA score range, she could produce English pitch direction more accurately. While there are only two ESL participants in this study, ESL speakers' increased experience with NSs of English may give them an advantage in the production of English intonation over EFL learners. Indeed, as is shown in Figures 9 and 10, Participant 23 produced a much closer intonation contour to the native-speaker's than the FL learners. This difference between ESL and EFL can be seen in the contrast between the spectrograms of Participant 23 and

Participant 11 (Figure 11). Both participants produced 50% of the utterances with accurate pitch direction; however, it is apparent from the spectrograms that Participant 23 produced the target utterance with a more native-like intonation contour. Here we have seen that both ESL participants were better at accurately producing sentence-final pitch direction, and that Participant 23 demonstrated a much closer pitch contour to the native speaker of English, than the FL learners.

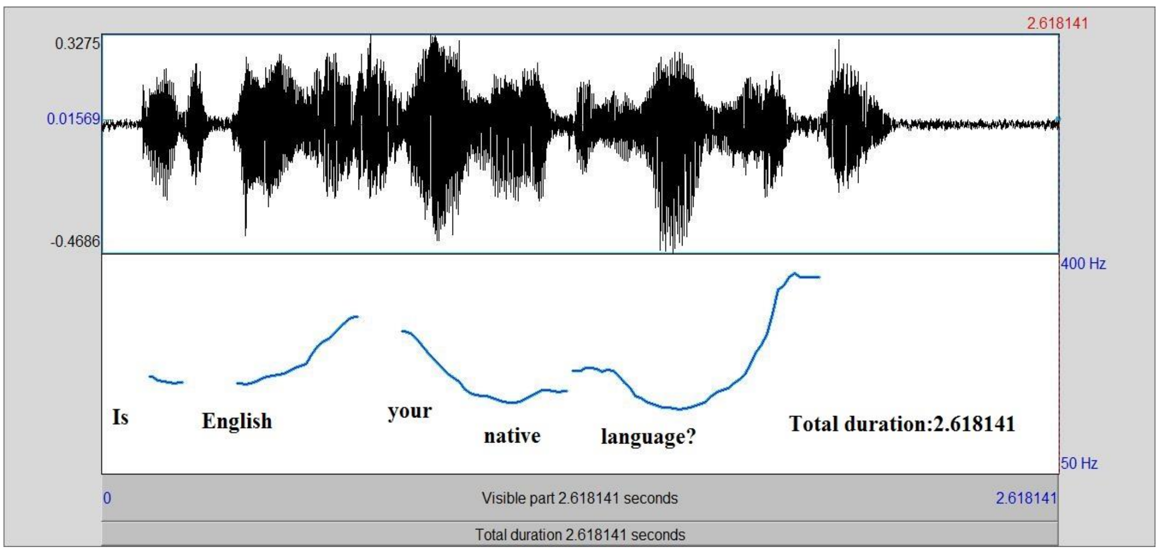


Figure 9. Pitch contour of "Is English your native language?" produced by Participant 23.

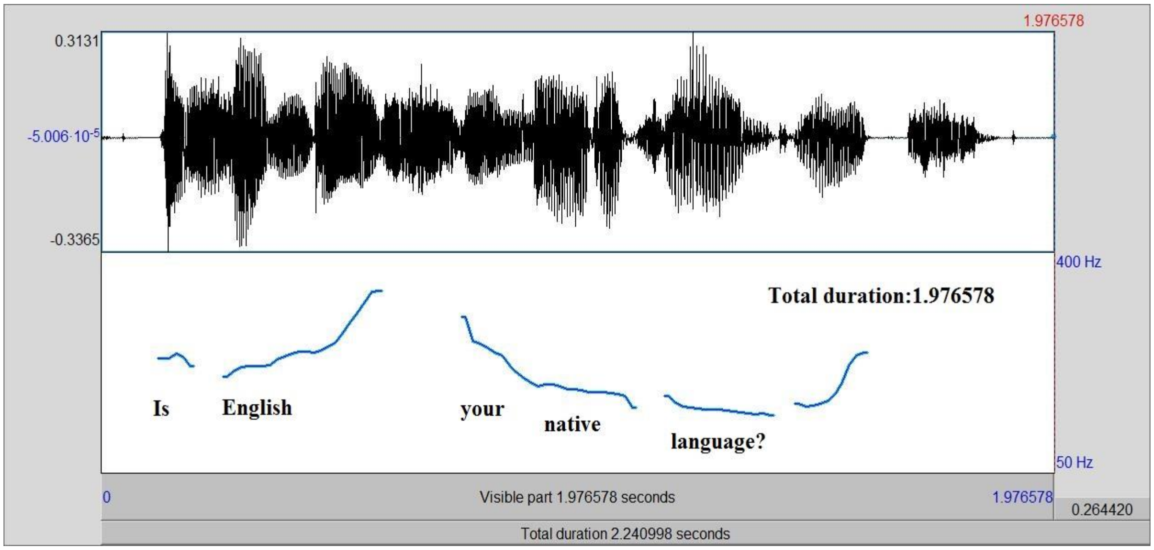


Figure 10. Pitch contour of "Is English your native language?" produced by native speaker of English.

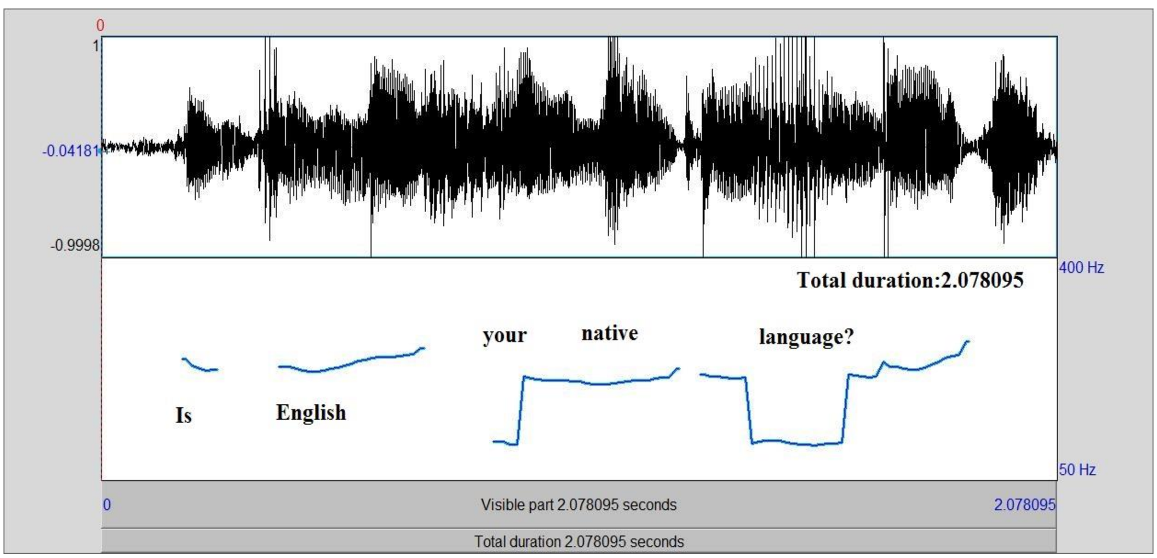


Figure 11. Pitch contour of "Is English your native language?" produced by Participant 11.

Based on the all findings obtained in the analyses of L2 intonation production, it appeared that musical difficulty does not necessarily have relationship to the lower intonation production performance (Figure 5 and Table 8). In addition, contrary to the finding obtained in the analysis on the L2 intonation perception, it was found that both ESL learners outperformed the EFL learners regarding the L2 intonation production. It was hence concluded that learners' context might play a role in enhancing learners' oral prosodic accuracy.

Up to this section, this study has focused on the relationship between musical difficulty and learners' aural and oral prosodic performances, as well as clarifying whether the learning context provides an influence on those performances. From the subsequent section, the present study investigates the learners' intonation perception and production skills by focusing on their English-listening proficiency level and their level of musical training.

Is there a Relationship between the Perception and Production of L2 Pitch and a Learner's Level of English Proficiency or their Level of Musical Training?

As for the association between musical ability and L2 auditory intonation discrimination, Todaka and Hidaka (2009) found that musicians generally outperformed the non-musicians in discriminating subtle differences in English prosodic patterns. However, some of their participants, most of whom were members of chorus group but had much lower English proficiency level (since they were high-school students), demonstrated lower aural performance than non-musicians. According to that finding, it can be speculated that not only musical ability but sufficient L2 proficiency may play an important role in discriminating L2 prosody. Hence, though apart from our original concern, this study conducted additional analyses focusing on the present participants with academically equal status to investigate the association between their L2 proficiency level and musical training and their aural and oral L2 intonation performance.

Because not all participants had taken the same proficiency test, 14 of the EFL participants who had equal academic status (Freshmen) and had taken the TOEIC listening test were selected from the group of 22 and analyzed. As indicated in Chapter III, the scores from the TOEIC listening test taken in one of their required courses at the beginning of the data-collecting semester was used as the primary index of their English proficiency level, ranging from 145 to 300, on a scale reaching 495 points. As for their musical backgrounds, nearly half of these participants had some musical training, from 3 months to 13 years, while the other half had no musical training. Table 8 shows this data in order of the students' TOEIC listening test scores.

Table 8

14 EFL Freshman College Students

Participant	English proficiency	Music Experience	MBEA	IPT	Pitch Direction
2	TOEIC (L) 145		80	78	25.5%
10	TOEIC (L) 155	Sax (3)	88	51	37.5%
12	TOEIC (L) 160		89	92	12.5%
15	TOEIC (L) 165	Piano (10)	89	100	62.5%
21	TOEIC (L) 170	Base-Guitar (3 months)	94	71	50%
7	TOEIC (L) 180	Piano (13)/Horn (3)	87	67	0%
19	TOEIC (L) 185		91	75	62.5%
3	TOEIC (L) 190		82	84	12.5%
1	TOEIC (L) 220		78	56	25%
8	TOEIC (L) 225		88	62	12.5%

20	TOEIC (L) 230	Euphonium (2)/Violin (3)	94	92	50%
5	TOEIC (L) 240		84	67	37.5%
14	TOEIC (L) 245	Oboe (3)/Viola (3)	89	88	50%
22	TOEIC (L) 300		95	88	12.5%

In order to investigate the relationship between English proficiency level and ones' intonation perception and production skill, the 14 participants are allocated into two groups based on their score on the TOEIC listening test (Table 9). Eight participants with equal to or lower than 190 on the TOEIC listening test are categorized in the group $LT \geq 190$, and six participants with scores equaling 220 or higher are allocated to the group $220 \leq LT$. According to Table 9, it was found that the participants' listening proficiency is not related to their aural or oral FL prosodic performance. Rather, the lower listening-test score group demonstrated slightly better performance on both the intonation perception test and intonation production.

Table 9

Relationship between Prosodic Performances and Listening Proficiency

Listening Proficiency Group	**TOEIC (L) Mean (SD)**	**MBEA Mean (SD)**	**IPT Mean (SD)**	**Correct Pitch Direction Mean (SD)**
LT ≥ 190 (n=8)	168.8 (SD=15.5)	87.5 (SD=4.6)	77.3 (SD=15.2)	32.9 (SD=24)
220 ≤ LT (n=6)	243.3 (SD=29.3)	88.0 (SD=6.4)	75.5 (SD=15.6)	31.3 (SD=13.2)

Note. LT indicates the TOEIC listening test score.

Likewise, in Table 10, the same participants are divided into a non-musician group and a musician group to investigate whether the length of their musical training could be related to their FL auditory pitch-processing skill and oral intonation-production skill. The non-musician group consists of 10 learners with little or no musical-training background (shorter than 3 years' of musical training). The musician group consists of four learners with 5 or more years of musical training.

Table 10

Relationship between Prosodic Performances and Musical Training

	Non-Musicians: No training (n=8) & Less than 3 years' training (n=2)	**Musicians: More than 5 years' training (n=4)**
TOEIC (L) mean	199 (SD=47.7)	205 (SD=38.5)
MBEA mean	86.9 (SD=5.8)	89.8 (SD=3.0)
IPT mean	72.4 (SD=13.6)	86.8 (SD=14.1)
Correct Pitch Direction mean	27.5 (SD=18.4)	40.6 (SD=27.7)

Table 10 indicates that the musician group outperformed the non-/little trained-musician group in all four tests: proficiency, musical aptitude, auditory pitch processing, and accuracy level of intonation production, which may indicate a relationship between musical training and both perception and production of English pitch/intonation contours. The non-/little trained-musician group obtained 72.4 on the intonation perception test while the musician group scored 86.8 on the same test (+ 14.4). Similarly, the non-/little-trained musician group could demonstrate 27.5% accuracy level on the intonation production while the musician group showed 40.6% accuracy level (+ 13.1%).

Based on the results in Tables 9 and 10, it can be concluded that while English listening proficiency scores may not necessarily be related to the participants receptive and productive performances of L2 intonation, musical training was associated with their prosodic performances. However, as indicated in the case of Participant 7, who had had considerable musical training (Piano for 10 years and Horn for 3 years) but produced no accurate pitch direction, individual differences within the groups should be accounted for. While the data do not lend themselves to determining why this participant scored poorly on the production task, when we take this outlying performance out of the equation (Table 11), the musician group demonstrates significantly increased productive performances (54.2) with a much narrower standard deviation range (7.2), indicating that musical training can be possibly associated with oral prosodic performance in the FL, though individual factors also play an important role.

Table 11

Relationship between Production Performance and Musical Training (Except for Participant 7)

	Non-Musicians: **No training (n=8) &** **Less than 3 years' training** **(n=2)**	**Musicians:** **More than 5 years' training** **(n=3)** **(except for Participant 7)**
TOEIC (L) mean	199 (SD=47.7)	213.3 (SD=42.5)

MBEA mean	86.9 (SD=5.8)	90.7 (SD=2.9)
Correct Pitch Direction mean (%)	27.5 (SD=18.4)	54.2 (SD=7.2)

Summary of Findings in the Present Research

According to the analysis results above, the present research has revealed that while the participants' musical difficulty, as represented by low scores on at least one MBEA subtest, appeared to be related to their lower L2 prosody perception, their musical difficulty was seemingly less related to their production of L2 prosodic patterns. Moreover, the participants' who had had significant musical training earlier in their lives, tended to perform better than those who had little or no musical training in both L2 perception and production of pitch contours. Nonetheless, significant individual variation from the mean production score was found in the production test. In terms of learning context, it was found that whether the participants were learning EFL or ESL was not necessarily associated with their auditory performance, while its association with the ESL learners' oral prosodic accuracy was possibly identified. Finally, the participants' English listening proficiency level, as measured on the TOEIC listening test, appeared to have no relationship to their L2 intonation performances.

Chapter V: Discussion

Recent L2 studies have addressed the association between musical ability and L2 pronunciation, and it is currently apparent that musically trained individuals are apt to demonstrate better L2 pronunciation performance (Milovanov, Tervaniemi, & Gustafsson, 2004; Milovanov, Huotilainen, Valimaki, Esquef, & Tervaniemi, 2008; Milovanov, Pietilä, Tervaniemi, & Esquef, 2010; Pastuszek-Lipińska, 2004, 2007, 2008a, and 2008b; Todaka & Hidaka, 2009; Wong, Skoe, Russo, Dees, & Kraus, 2007). However, while these studies clarified the relationship between musicality and better L2 pronunciation skills, few studies have been conducted to clarify the association between amusicality and L2 pronunciation skills.

According to the studies pertaining to amusia, it has been revealed that amusia is mostly related to ones' inability to auditorily process musical pitch variations (Ayotte, Peretz, & Hyde, 2002; Patel, Foxton, & Griffiths, 2005; Peretz et al., 2002; Peretz & Hyde, 2003), which may selectively impair ones' L1 linguistic pitch discrimination (Nan, Sun, & Peretz, 2010; Patel, Wong, Foxton, Lochy, & Peretz, 2008). Based on the studies on amusiacs, one question arises, "Are amusical L2 learners impaired in their L2 linguistic prosody discrimination?" In addition, since Nan et al. (2010) found that even amusiacs with an inability to discriminate their L1 lexical tones were still intact in their production of L1 lexical tones, it is considered the amusia has less association with linguistic prosody production. However, since their research only focuses on amusical L1 speakers, the association between amusia and L2 prosody production has not been investigated yet. The present study, hence, addressed the relationship between amusia and the perception and production skill of L2 prosody. Moreover, it is considered that FL/SL learners' learning context may play a role in their aural and oral prosodic performance, so the contrastive analysis between learners in FL and SL context was also researched. The answers to the research questions addressed in this study are answered below.

Do FL/SL Learners with Congenital Amusia have More Difficulty in Aurally Discriminating the Target-Language Prosody Accurately than do Learners without this Learning Disability?

The single amusical participant in this study demonstrated a significantly lower score on the intonation perception test (56) than the mean scores of the non-amuscial participants who widely ranged in their level of musical ability as measured by the MBEA (80-95). In addition, the contrastive analysis between the group of participants who demonstrated difficulty in at least one MBEA subtest and the group of participants who showed no problems on any subtests of the MBEA, showed that, as a group, the participants with demonstrated musical difficulty scored lower than those without any musical problems (mean score difference of 7.8). Accordingly, for the participants in this study, it was concluded that their musical difficulty at any level was related to their low L2 intonation perception performance.

This result can be partly corroborated by the finding of Patel, Wong, Foxton, Lochy, and Peretz (2008), which found that some amusical individuals demonstrated an L1 pitch discrimination problem. However, while the Patel et al.'s participants mainly demonstrated their L1 pitch-processing inability in the discrimination of sentence-final pitch direction, the present intonation perception test was not specific only to the pitch direction discrimination. Rather, it also included prominence position identification tasks (78 question items out of 100), which may indicate that a wider view of pitch discrimination is needed in further studies of amusia and language perception. Additionally, since L2 learners are exposed to the TL in fewer contexts and in different ways that L1 learners, it seems likely that the L2 learner group would exhibit more difficulty.

Do FL/SL Learners with Congenital Amusia have More Difficulty in Orally Producing the Target-Language Prosody Accurately than do Learners without this Learning Disability?

According to the contrastive analysis between the amusical participant and the non-amusical participants, it was found that the amusical participant scored lower on pitch production than did the non-amusical participants as a group. However, while there did appear to be a trend in the data for higher MBEA scores being related to higher pitch production scores, it was determined that the two variables were not necessarily related to one another due to the fact that seven of the 21 individuals in the non-amusical group scored the same or even lower than did the amusical participant. Moreover, the contrastive analysis between the group of participants who showed some musical difficulty on the MBEA and those who did not showed no significant differences in terms of L2 intonation production (only 1.2%). While, Nan et al. (2010) found that amusiacs, who demonstrated an inability to discriminate their L1 lexical tones, showed intact oral performance in the production of L1 lexical tones, the current study shows that both amusical and non-amusical participants exhibited difficulty producing L2 prosody. This may be due to the fact that these learners do not yet have a high enough proficiency level for any of them to be able to control their oral production, even if they are able to perceive the pitch differences.

Does the Learning Context, SL or FL, have any Impact on the Ability of the Amusia English Learners to Discriminate or Produce the Target-Language Prosody Accurately?

Since the present study did not identify any amusiacs in the ESL context, this study could not answer this research question directly. However, when the ESL participants' prosodic performances (aural and oral) were contrasted with those of the EFL participants in the corresponding MBEA score-range group (Groups 3 and 4), it was found that while the ESL participants demonstrated higher oral prosodic performance, they did not necessarily score higher in the perception of L2 intonation. Namely, Participant 23 obtained a lower intonation perception test score than the mean score of the EFL participants in Group 3. Taking these results together, this research concluded that the SL learning context, which gives more exposure to NSs, may be more directly related to the ESL learners' L2 prosodic production than to their L2 intonation listening discrimination.

Is Level of English-Listening Proficiency and Musical Training Related to L2 Learners' Intonation Perception and Production?

While not an original research question, issues pertaining to the learners' level of English-listening proficiency and of their previous musical training became apparent in the study. The preliminary findings in this study, as well as Todaka and Hidaka (2009), who found that chorus singers at high school with lower English proficiency also demonstrated lower L2 intonation discrimination, reinforced the need to consider these variables in relation to the learners' perception and production skills.

In the proficiency analysis, the linguistic variables were contrasted with the learners as grouped by their TOEIC listening-test scores. According to the contrastive analysis, it was found that the learners' English-listening proficiency, as measured by the TOEIC, had little relation to their L2 intonation skills both in perception and production. Indeed, though not significant, the lower listening-proficiency group scored slightly higher than the higher listening-proficiency group on both tests (by 1.8 on intonation perception and 1.6 on intonation production). This result indicates that their listening-test results showed no association with their L2 prosodic performances, which, interestingly, opposes the findings in Todaka and Hidaka. However, since their study did not provide detailed information on their high-school participants' L2 proficiency level (e.g., scores on the TOEIC or grades on the STEP) and since the linguistic variables of the present participants' TOEIC listening-proficiency are also considered not necessarily broad enough to identify the exact threshold line for the relationship between L2 proficiency level and L2 intonation performance, it is arguably required to investigate a variety number of L2 learners with a much wider range of L2 comprehension levels for the sake of further clarifying the association between the L2 proficiency and the aural and oral prosodic performance in L2.

In addition, the participants were also divided into two groups based on their previous musical training with one group that had little or no musical training and one whose members had five or more years of musical training. When contrasting the participants musical training level and their L2 intonation performance, it was found that the participants with a long history of musical training outperformed the group with little or no musical training not only on the MBEA, but also on both L2 intonation perception

(+ 14.1) and production (+ 27.7). However, a significant individual difference was found in that one of the participants in the musically trained group was not able to produce accurate L2 intonation at all. Once that participant was eliminated from the musician group as an outlier, they produced L2 intonation accurately 54.2% of the time, with a much narrower standard deviation range (7.2). Based on this result, the present research concluded that although individual differences occur, musical training is generally associated with better L2 intonation control.

This higher sensitivity to prosody exhibited by those with musical training is related to the findings of Wong, Skoe, Dees, and Kraus (2007), which found that the amateur musicians in their study with six or more years of musical training had higher auditory sensitivity toward L2 pitch changes than did the participants with less than three years of training. In addition, the present finding can also be partly corroborated by the findings of Milovanov Pietilä, Tervaniemi, and Esquef (2010), in which choir members produced L2 phonemes at equal level with English philology students, as well as significantly outperforming non-musicians. In their study, interestingly, English philology students demonstrated as good musical auditory performance as choir members on the musical test. According to their findings, it can be speculated that as the musical training provides the better L2 phonological performance, the higher L2 proficiency may be related to better musical ability. Furthermore, the close correlation between musical training and L2 pronunciation skills clarified in the Milovanov et al.'s study and our research can inspire us to employ musical training into our L2 pedagogy for the sake of raising L2 prosodic awareness, and vice versa (L2 training to enhance musical awareness). Future studies investigating the efficacy of musical training to L2 prosody and the efficacy of L2 training to musical prosody may be expected.

Limitations of the Present Research

The present study consists of considerable limitations. First and foremost, the number of authentic amusiacs is strictly limited in the present study. One amusical participant is not sufficient to statistically support the present research findings. Furthermore, the limitation is also recognized in the present amusical participant's MBEA score. Her MBEA score lay within the cut-off criteria for congenital amusia, and it may be anticipated that a different result might be obtained if there were a higher number of severely impaired amusiacs in this study.

Moreover, since the musical sufferers were found only in the group of EFL participants, this study could not fully answer the question, "Is learning context related to amusical FL/SL learners' intonation aural and oral performance?" Since a musically intact ESL participant demonstrated low intonation perception while performing better oral control in L2 intonation, it is apparently quite interesting to investigate the actual relationship between learning context and amusiacs' prosodic perception and production. A future contrastive study with a larger number of amusical FL and SL learners would prove of value.

In addition to the absence of ESL amusiacs, what should be noted is that the findings pertaining to the ESL learners' intonation skills depended on significantly limited number of participants (n=2). Investigating only two ESL participants' prosodic skills and contrasting them with groups of EFL participants may not be sufficient to evidentially generalize the present findings. Albeit genuine contrastive analysis between

EFL and ESL learners is apart from the primary interest of this study (congenital amusia and L2 prosody), further study with sufficient EFL/ESL learners may also be expected in order to clarify the factor of learning context.

Additionally, the proficiency level of the students may have played a role in the auditory sensitivity and oral control in L2 prosody. Since the present amusical participant and the participants who demonstrated musical difficulty on the MBEA might not be sufficiently proficient in L2, different results might have been obtained if we could obtain various participants differing in their L2 proficiency level. As can be speculated from a study of Milovanov, Pietilä, Tervaniemi, and Esquef (2010), if highly proficient L2 learners can also be proficient in music as well, it may be hypothesized that more highly proficient L2 learners would be able to better discriminate L2 prosody as well as better manipulating L2 prosodic patterns despite their amusicality. Arguably, amusical L2 learners with much broader linguistic proficiency should be required to examine an association between amusicality and L2 proficiency level.

As a last limitation, some problems regarding the data collection method cannot be ignored and should be modified for further studies. Firstly, the MBEA and the intonation perception tests took quite long to complete (184 questions and 100 questions, respectively), which might exhaust the participants and influence the validity of their answers. In future research, shorter tests and a sufficient amount of resting time should be inserted during the tests in order to decrease participants' fatigue. Moreover, another modification for the future research is identified in the quality of the perception and production test in L2 intonation. Since the present study found that impairment of amusia extends to an inability in identifying the prominence pattern in an L2 and a slight difficulty in accurately producing final pitch contour, diagnostic methods specifying those issues should be employed in future research.

Implications for Future Research

As indicated in the present chapter, the sample quality of amusical L2 learners is significantly limited in terms of number and variation (e.g., variation in L2 proficiency level or variation in learning contexts). Likewise, the need of modified data collection method was clarified as well. Hence, future research, which investigates the relationship between L2 intonation skills and amusicality with a greater number of amusical EFL/ESL learners with a higher level of L2 proficiency and utilizing more specific diagnostic methods, is indicated.

References

Ayotte, J., Peretz, I., and Hyde, K. (2002). Congenital amusia: a group study of adults afflicted with a music-specific disorder. *Brain, 125,* 238-251

Celce-Murcia, M., Brinton, D., Goodwin, J. (2010). *Teaching pronunciation: a reference for teachers of English to speakers of other languages* (2nd ed.). Cambridge.

Cook, A. (2000). American accent training (2nd ed.). [Hauppauge, NY]: Barron's.

Fischler, J. (2009). The rap on stress: teaching stress patterns to English language learners through rap music. *MinneWITESOL Journal, 26,* 35-59.

Foxton, J. M., Dean, J. L., Gee, R., Peretz, I., and Grifiths, T. D. (2004). Characterization of deficits in pitch perception underlying ‘tone deafness’ *Brain, 127,* 801-810.

Gass, S.M., and Selinker, L. (2008). *Second language acquisition: an introduction* (3rd ed.). Routledge.

Hyde, K. L. and Peretz, I. (2004). Brains that are out of tune but in time. *Psychological Science, 15*(5), 356-360.

Kalmus, H., and Fry, D.B. (1980). On tune deafness (dysmelodia): frequency, development, genetics and musical background. *Ann Hum Genet, 43,* 369-382.

Ladefoged, P. (2006). *A course in phonetics* (5th ed.). Thomson Wadsworth.

Lightbown, P., and Spada, N. (2006). *How languages are learned* (3rd ed.). Oxford: Oxford University Press.

Luu, T.T., and Pham, T.V.A. (2010). Teaching English rhythm by using songs. *Studies in Literature and Language, 1*(2), 13-29.

Milovanov, R., Tervaniemi, M., and Gustafsson, M. (2004). The impact of musical aptitude in foreign language acquisition. In: Lipscomb, S.D., Ashley, R., Gjerdingen, R.O., Webster, P. (Eds.), Proceedings of the 8th International Conference on Music Perception and Cognition (ICMP8). Casual productions, Adelaide, Australia, 717-718.

Milovanov, R., Huotilainen, M., Valimaki, V., Esquef, P. A. A., & Tervaniemi, M. (2008). Musical aptitude and second language pronunciation skills in school-aged children: Neural and behavioral evidence. *Brain Research, 1194*(15), 81-89.

Milovanov, R., Pietilä, P., Tervaniemi, M., and Esquef, P. A.A. (2010). Foreign language pronunciation skills and musical aptitude: a study of Finnish adults with higher education. *Learning and Individual Differences, 20,* 56-60.

Nagamine, T. (2011). Effects of hyper-pronunciation training method on Japanese university students' pronunciation. *Asian EFL Journal Professional Teaching Articles, 53,* 35-50

Nan, Y., Sun, Y. and Peretz, I. (2010). Congenital amusia in speakers of a tone language: association with lexical tone agnosia. *Brain, 133*(9), 2635-2642

Pastuszek-Lipińska, B. (2004). An overview of a research project and preliminary results of two experiments on perception and production of foreign language sounds by musicians and nonmusicians. *TMH-QPSR, 46*(1), 61-74.

Pastuszek-Lipińska, B. (2007). Musicians outperform nonmusicians in a study with shadowing speech. *Proceedings of ICPhS XVI, Saarbrücken, 6*(10), 821-824.

Pastuszek-Lipińska, B. (2008a). Influence of music education on second language acquisition. *Acoustics 08 Paris.*

Pastuszek-Lipińska, B. (2008b). Musicians outperform nonmusicians in speech imitation. *Lecture Notes in Computer Science, 4969*, 56–73.

Patel, A. D., Foxton, J. M., and Griffiths, T. D. (2005). Musically tone-deaf individuals have difficulty discriminating intonation contours extracted from speech. *Brain and Cognition 59,* 310-313

Patel A. D., Peretz, I., Tramo, M., and Labreque, R. (1998). Processing prosodic and musical patterns: a neuropsychological investigation. *Brain and Language, 61,* 123-144.

Patel, A. D., Wong, M., Foxton, J., Lochy, A., and Peretz, I. (2008). Speech intonation deficits in musical tone deafness (congenital amusia).*Music Percep, 25,* 357–368.

Peretz, I., Ayotte, J., Zatorre, R.J., Mehler, J., Ahad, P., Penhune, V.B., and Jutras, B. (2002). Congenital amusia: a disorder of fine-grained pitch discrimination. *Neuron, 33*, 185-191.

Peretz, I., and Hyde, L, K. (2003). What is specific to music processing? Insights from congenital amusia. *TRENDS in Cognitive Sciences*, *7*(8), 362-367

Peretz, I., Champod, A.S., and Hyde, K. (2003). Varieties of musical disorders: the montreal battery of evaluation of congenital amusia. *Annals of the New York Academy of Science, 999,* 58-75.

Prator, C.H., and Robinett, B.J. (1985). *Manual of American English pronunciation for adult foreign students.* New York: Holt, Rinehart, & Winston.

Seashore, C.E., Lewis, D., and Saetveit, J.G. (1960). *Seashore measures of musical talents manua*l (2nd ed.). New York: Psychological Corporation.

Seashore, C.E., Lewis, D., and Saetveit, J.G. (2003). *Seashore measures of musical talents CD, digitally remastered version by Esquef, P.* Finland: Helsinki University of Technology.

Taniguchi, M., & Abberton, E. (1999). Effect of interactive visual feedback on the improvement of English intonation of Japanese EFL learners. *Speech, Hearing and Language: work in progress, 11*, 76-89

Todaka, Y. and Hidaka, N. (2009). Musical experience and English intonation acquisition. *English Phonetics, 13*, 201-210.

Togo, K., and Misono, K. (Eds.). (2009). *Hikkei eigo hatsuon shidou manual* [Companion manual for teaching English pronunciation]. Tokyo: The Hokuseido Press.

Wells, J.C. (2006). *English intonation: an introduction*. Cambridge University Press.

Wong, P. C., Skoe, E., Russo, N. M., Dees. T., and Kraus, N. (2007). Musical experience shapes human brainstem encoding of linguistic pitch patterns. *Nature Neuroscience, 10,* 420–422.

Appendices

Appendix A: Screening Questionnaire for Potential Congenital Amusia

1) I have a high level of education (university level).
2) I enjoy learning a foreign language.
3) I am right-handed.
4) I like listening to music.
5) I had music lessons during childhood or during my school days (e.g., elementary school, junior-high school, or high school).
6) I have normal audiograms, neurological history, and education.
7) I have difficulty in identifying the pitch difference on music.
8) I have difficulty in identifying melodies even when the melodies are very popular ones (e.g., popular Japanese pop-music or Jiburi music).
9) I have difficulty in recognizing or humming familiar tunes.
10) I cannot predict the rhythmic structure in music.
11) I have little sensitivity to the presence of obvious dissonant chords in classical music.
12) I do not think I am good singer.
13) If the introduction melody is long in songs, I sometimes do not know when to start singing.
14) I have no difficulty in recognizing Japanese language intonation and song lyrics in music.
15) Though I have no difficulty in recognizing song lyrics, it becomes much more difficult to recognize the pitch changes of the music once the lyrics are eliminated.

Appendix B: Intonation Perception Test

Task 1: Non-linguistic Intonation Matching (CD 1~18)

You will listen to non-linguistic sounds. When you listen to those sounds, choose the best matching sound pattern from a-d in the box below. You will listen to the same intonation only once.

1. duh duh duh ( )
2. duh duh duh ( )
3. duh duh duh ( )
4. duh duh duh ( )
5. duh duh duh ( )

Your Choice
a. **duh** duh **duh** b. duh duh **duh** c. duh **duh** duh d. **duh** duh duh

6. la la la ( )
7. la la la ( )
8. la la la ( )
9. la la la ( )

Your Choice
a. **la** la **la** b. la la **la** c. la **la** la d. **la** la la

10. mee mee mee ( )
11. mee mee mee ( )
12. mee mee mee ( )
13. mee mee mee ( )

Your Choice
a. **mee** mee **mee** b. mee mee **mee** c. mee **mee** mee d. **mee** mee mee

14. ho ho ho ( )
15. ho ho ho ( )
16. ho ho ho ( )

17. ho ho ho ( )
18. ho ho ho ( )

Your Choice
a. **ho** ho **ho** b. ho ho **ho** c. ho **ho** ho d. **ho** ho ho

Task 2: Sentence Stress Identification (CD 19~81)

(1) You will listen to sentences with two different intonation patterns (la-**la** and **la**-la). Listen to the sentences and identify which intonation pattern is utilized. At first, you will listen to the model intonation (la-**la** and **la**-la). (CD 19~29)

1. a dog ( )
2. hot dog ( )
3. icy ( )
4. destroy ( )
5. a pen ( )
6. Get one! ( )
7. Pea soup ( )
8. Do it! ( )
9. Pretend ( )
10. Sunset ( )

Your Choice
a. la-**la** b. **la**-la

(2) You will listen to sentences with four different intonation patterns (**la**-la-**la**, la-la-**la**, la-**la**-la, and **la**-la-la). Listen to the sentences and identify which intonation pattern is utilized. At first, you will listen to the model intonation (**la**-la-**la**, la-la-**la**, la-**la**-la, and **la**-la-la). (CD 30~55)

1. Bob’s hot dog ( )
2. a hot dog ( )
3. I don’t know. ( )
4. Bob won’t know. ( )
5. Analyze ( )
6. Tomorrow ( )
7. Bill went home. ( )
8. I don’t know. ( )
9. Hot dog stand ( )
10. We don’t care. ( )
11. Potato ( )

12.	Cell structure	( )
13.	Sam's the boss	( )
14.	Jim killed it.	( )
15.	I don't know.	( )
16.	Stocks can fall.	( )
17.	He's the boss.	( )
18.	Dinnertime	( )
19.	I went home.	( )
20.	a hot dog	( )
21.	It's in March.	( )
22.	Cats don't care.	( )
23.	Digital	( )
24.	The engine	( )
25.	School is fun.	( )

Your Choice
a. **la**-la-**la** b. la-la-**la** c. la-**la**-la d. **la**-la-la

(3) You will listen to sentences with six different intonation patterns (**la**-la-la-**la**, la-la-la-**la**, **la**-la-**la**-la, la-la-**la**-la, la-**la**-la-la and **la**-la-la-la). Listen to the sentences and identify which intonation pattern is utilized. At first, you will listen to the model intonation patterns (**la**-la-la-**la**, la-la-la-**la**, **la**-la-**la**-la, la-la-**la**-la, la-**la**-la-la and **la**-la-la-la). (CD 56~81)

1.	A hot dog stand	( )
2.	It's my hot dog.	( )
3.	He doesn't know.	( )
4.	Ai brought some ice.	( )
5.	We like science.	( )
6.	Office supplies	( )
7.	Spot's a hot dog.	( )
8.	Ann eats pancakes.	( )
9.	Permanently	( )
10.	Jim killed a man.	( )
11.	Bears are fuzzy.	( )
12.	He bought a book.	( )
13.	a platypus	( )
14.	imitation	( )
15.	Jim killed a snake.	( )
16.	Joe doesn't know.	( )
17.	He killed a snake.	( )
18.	Bob likes hot dogs.	( )
19.	Analytic	( )
20.	We came back in.	( )
21.	Demonstrated	( )
22.	Nate bought a book.	( )
23.	Analysis	( )

24. Educator ( )
25. Cats eat fish bones. ( )

Your Choice
a. **la**-la-la-**la** b. la-la-la-**la** c. **la**-la-**la**-la d. la-la-**la**-la e. la-**la**-la-la f. **la**-la-la-la

Task 3: Intonation Matching of English sentences (CD 82~95)

(1) Listen to the CD. For each of the three contexts below, see if you can find the best match among the choices provided. (CD 82~84)

<u>Context 1</u>
Alice: Bob, Joe, and John kept doing nice things for me because it was Mother's Day. Bob washed the car, and Joe ironed the shirts. Guess what else happened.
Betty: ____?
Alice: Yes.

(a) John COOKED DINner?

(b) **JOHN** COOKED **DIN**ner?

<u>Context 2</u>
Alice: The guys kept doing nice things for me because it was Mother's Day. Bob washed the car, and Joe ironed the shirts, and John cooked dinner.
Betty: ____?
Alice: Yes, it was quite a surprise to me too. He's never boiled an egg before.

(a) **JOHN** COOKED **DIN**ner?

(b) Did JOHN COOK DINner?

<u>Context 3</u>
Alice: I was really tired when I got home last night, and I just couldn't cook.
Betty: ____?
Alice: Yes, he did.

(a) **JOHN** COOKED DINner?

(b) Did JOHN COOK DINner?

(c) ~~Did~~ JOHN COOK DINner?

(2) Listen to the CD. For each of the two contexts below, see if you can find the best match among the three choices provided**.** (CD 85~86)

<u>Context 1</u>
Alice: I brought chips, and Ann brought a meat dish.
Betty: ____?
Alice: She brought fried chicken.

(a) WHAT did ANN BRING?

(b) WHAT did ANN BRING?

(c) ANN BROUGHT **WHAT**?

<u>Context 2</u>
Alice: I was amazed, because Ann, who is a strict vegetarian and a gourmet cook, brought a big bucket of fried chicken to the party.
Betty: ____?

(a) WHAT did ANN BRING?

(b) WHAT did ANN BRING?

(c) ANN BROUGHT **WHAT**?

(3) Listen to the CD. For each of the two contexts below, see if you can find the best match between the two choices provided. (CD 87~88)

<u>Context 1</u>
Larry: The score was Brazil 4, Italy 2 in the final minutes of the game when I had to turn off the TV and go to work.
Jan: Nothing much else happened.
Larry: ____?
Jan: Yeah.

(a) BraZIL WON DIDn't they?

(b) BraZIL WON DIDn't they?

<u>Context 2</u>
Larry: The score was Italy 3, Brazil 2, with 15 minutes left in the game, when I had to turn off the TV and go to work.
Jan: Too bad. It was an exciting game.
Larry: ____?
Jan: Yes, they did.

(a) BraZIL WON DIDn't they?

(b) BraZIL WON DIDn't they?

(4) Listen to the CD. For each of the two contexts below, see if you can find the best match between the two choices provided. (CD 89~90)

Context 1
Larry: We have some time before the game.
____?

Jan: That's a good idea. Food and drinks are too expensive in the stadium.

(a) Do you want to GET SOMEthing to **EAT** or **DRINK**?

(b) Do you want to GET SOMEthing to **EAT** or **DRINK**?

Context 2
Larry: I don't have much cash on me.
____?

Jan: How about you get the drinks? I can get some popcorn.

(a) Do you want to GET SOMEthing to **EAT** or **DRINK**?

(b) Do you want to GET SOMEthing to **EAT** or **DRINK**?

(5) There are three sentences having three different intonation patterns. Listen to the CD and choose the best match intonation pattern from 1-3. (CD 91)

1-a. What do you think? (   )
1-b. What do you think? (   )
1-c. What do you think? (   )

1. WHAT do you THINK?
2. WHAT do YOU THINK?
3. WHAT do you THINK?

2-a. He didn't take the car. (   )
2-b. He didn't take the car. (   )
2-c. He didn't take the car. (   )

1. He **DID**n't TAKE the CAR.
2. HE DIDn't TAKE the CAR.
3. He DIDn't TAKE the CAR.

3-a. She thinks the film is good. (   )

3-b. She thinks the film is good. (   )
3-c. She thinks the film is good. (   )

1. She THINKS the FILM is GOOD.
2. SHE THINKS the FILM is GOOD.
3. She THINKS the FILM is **GOOD**?

(6) There are four conversations. The speaker B utilizes four different intonation patterns. Listen to the CD and choose the best match intonation. (CD 92~95)

<u>Context 1</u>
A: I'd like some pancakes.
B: We don't serve pancakes. (   )

<u>Context 2</u>
A: Three eggs and a short stack of pancakes.
B: We don't serve pancakes. (   )

<u>Context 3</u>
A: What do you mean? Everybody serves pancakes.
B: We don't serve pancakes. (   )

<u>Context 4</u>
For the last time… bring me some pancakes and eggs.
B: We don't serve pancakes. (   )

Your choice

1. We **DON'T** SERVE **PAN**cakes.
2. We DON'T SERVE PANcakes.
3. We DON'T SERVE PANcakes.
4. WE DON'T SERVE PANcakes.

Appendix C: Diagnostic Reading Passages

Passage 1 (Prator & Robinett, 1985)

When a student from another country comes to study in the United States, he has to find the answers to many questions, and he has many problems to think about. Where should he live? Would it be better if he looked for a private room off campus or if he stayed in a dormitory? Should he spend all of his time just studying? Shouldn't he try to take advantage of the many social and cultural activities which are offered? At first it is not easy for him to be casual in dress, informal in manner, and confident in speech. Little by little he learns what kind of clothing is usually worn here to be casually dressed for classes. He also learns to choose the language and customs which are appropriate for informal situations. Finally he begins to feel sure of himself. But let me tell you, my friend, this long-awaited feeling doesn't develop suddenly--does it? All of this takes practice.

Passage 2 (Celce-Murcia, Brinton, & Goodwin, 2010)

Is English your native language? If not, your foreign accent may show people that you come from another country. Why is it difficult to speak a foreign language without an accent? There are a couple of answers to this question. First, age is an important factor in learning to pronounce. We know that young children can learn a second language with perfect pronunciation. We also know that older learners usually have an accent, though some older individuals also have learned to speak without an accent. Another factor that influences your pronunciation is your first language. English speakers can, for example, recognize people from France by their French accents. They can also identify Spanish or Arabic speakers over the telephone, just by listening carefully to them. Does this mean that accents can't be changed? Not at all! But you can't change your pronunciation without a lot of hard work. In the end, improving appears to be a combination of three things: concentrated hard work, a good ear, and strong ambition to sound like a native speaker. You also need accurate information about English sounds, effective strategies for practice, lots of exposure to spoken English, and patience. Will you make progress, or will you give up? Only time will tell, I'm afraid. But it's your decision. You can improve! Good luck, and don't forget to work hard.

Appendix D: Result of the Montreal Battery of Evaluation of Amusia

Participant	SQ	Score on Montreal Battery of Evaluation of Amusia						
	Music	Scale (31)	Contour (31)	Interval (31)	Rhythm (31)	Metric (30)	Memory (30)	Total (%)
1	6	21**	26	26	21**	26	24*	78
2	4	24	25	22*	23*	28	26	80
3	4	26	24	24	24*	23	29	82
4	5	27	24	20**	25	28	28	83
5	5	24	26	26	21**	30	28	84
6	7	28	28	24	24*	23	29	85
7	6	25	25	26	27	28	29	87
8	4	25	30	22*	31	24	30	88
9	5	25	25	29	28	26	28	88
10	4	28	24	23*	29	28	29	88
11	7	26	28	27	24*	29	30	89
12	3	27	25	28	27	29	27	89
13	4	27	26	25	28	29	28	89
14	4	28	22*	27	27	30	29	89
15	4	27	25	24	29	30	28	89
16	6	27	27	27	30	30	23*	89
17	4	27	27	28	28	30	28	91
18	4	29	29	28	28	25	29	91
19	5	28	27	28	26	30	28	91
20	4	26	29	29	31	29	29	94
21	5	29	26	28	31	29	30	94
22	5	28	28	27	31	30	30	95
Mean	**4.8**	**26.5**	**26.2**	**25.8**	**27.0**	**27.9**	**28.1**	**88.3**
SD	**1.1**	**1.90**	**1.97**	**2.50**	**3.12**	**2.35**	**1.81**	**4.4**
23	3	25	26	28	28	25	30	88
24	5	26	25	29	28	29	30	91
Mean	**4.0**	**25.5**	**25.5**	**28.5**	**28.0**	**27.0**	**30.0**	**89.5**
SD	**1.4**	**0.71**	**0.71**	**0.71**	**0**	**2.80**	**0**	**2.2**

Appendix E: Result of the Intonation Perception Test

Participant	Score on Intonation Perception Test			
	Nonsense word	Word and Sentence	Intonation Contour	Total
1	11	30	15	56
2	18	49	11	78
3	18	52	14	84
4	17	45	18	80
5	7	46	14	67
6	13	49	13	75
7	15	35	17	67
8	12	32	18	62
9	11	40	18	69
10	6	30	15	51
11	17	42	15	74
12	17	53	22	92
13	15	29	18	62
14	15	51	22	88
15	18	60	22	100
16	16	49	16	81
17	17	53	19	89
18	18	42	17	77
19	15	41	19	75
20	18	54	20	92
21	15	42	14	71
22	18	54	16	88
Mean	**15.5**	**45.9**	**17.2**	**78.6**
SD	**3.5**	**9.0**	**3.0**	**12.6**
23	11	45	15	68
24	18	56	18	92
Mean	**14.5**	**49.0**	**16.5**	**80.0**
SD	**4.9**	**9.9**	**2.1**	**17.0**

Appendix F: Result of Acoustic Analysis (Pitch Direction)

Note. *RF* indicates rising-falling intonation pattern. *R* indicates rising intonation pattern.

Participant	Sentence-Final Pitch Direction								Total
	Passage 1				Passage 2				
	Sentence 2 (RF)	Sentence 3 (RF)	Sentence 4 (R)	Sentence 5 (R)	Sentence 1 (R)	Sentence 3 (RF)	Sentence 11 (R)	Sentence 16 (RF)	
1	flat	correct	flat	falling	correct	flat	flat	flat	2 (25%)
2	rising	flat	correct	flat	flat	flat	flat	flat	1 (12.5%)
3	flat	correct	flat	flat	flat	flat	flat	rising	1 (12.5%)
4	rising	correct	correct	flat	correct	rising	correct	rising	4 (50%)
5	flat	flat	correct	flat	correct	correct	falling	flat	3 (37.5%)
6	flat	correct	correct	flat	correct	flat	correct	correct	5 (62.5%)
7	flat	flat	flat	flat	flat	flat	flat	flat	0 (0%)
8	flat	flat	flat	flat	Flat	flat	flat	correct	1 (12.5%)
9	rising	rising	correct	correct	correct	correct	falling	rising	4 (50%)
10	rising	rising	correct	flat	falling	correct	correct	rising	3 (37.5%)
11	correct	rising	correct	flat	correct	flat	correct	falling	4 (50%)
12	rising	flat	falling	flat	flat	correct	flat	rising	1 (12.5%)
13	rising	correct	flat	flat	correct	flat	falling	flat	2 (25%)
14	rising	rising	correct	correct	correct	flat	correct	rising	4 (50%)
15	rising	correct	correct	correct	correct	flat	correct	rising	5 (62.5%)
16	correct	flat	correct	flat	flat	rising	correct	rising	3 (37.5%)
17	rising	flat	correct	flat	correct	flat	correct	correct	4 (50%)
18	correct	flat	flat	flat	correct	flat	flat	flat	2 (25%)
19	rising/flat	flat	correct	falling	correct	correct	correct	correct	5 (62.5%)
20	rising	correct	falling	correct	correct	flat	correct	rising	4 (50%)
21	rising	rising	correct	correct	correct	rising	correct	rising	4 (50%)
22	correct	flat	flat	flat	flat	flat	flat	flat	1 (12.5%)
23	correct	rising	correct	rising	correct	rising	correct	rising	4 (50%)
24	flat	flat	correct	correct	correct	flat	correct	correct	5 (62.5%)