The Influence of L1 Turkish Regional Dialects on L2 English Speech Production

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Declaration

I declare that this thesis is my own work, and it has not been submitted in substantially the same form for the award of a higher degree elsewhere.

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Abstract

It is widely known that the development of L2 speech perception and production is influenced by the L1 phonological system (Zampini, 2008). Current models of L2 speech learning propose a number of mechanisms that explain such phenomena, such as the existence of a shared L1-L2 phonological space (e.g., Speech Learning Model [SLM]; Flege, 1995), early perceptual attunement to L1 phonology (Perceptual Assimilation Model L2 [PAM-L2]; Bohn & Best, 2007), and the idea that the L1 represents the initial state for L2 learning (Second Language Linguistic Perception [L2LP]; Escudero, 2005). Despite strong theoretical understandings of how L1 phonology influences L2 production, our knowledge of how *between-speaker variation in the L1* influences the L2 remains less well established. For example, research confirms the influence of L1 regional dialects on L2 speech perception (Chládková & Podlipský 2011; Escudero & Williams 2012), but research focusing on the influence of L1 regional dialects on L2 speech production has revealed only partial effects (Marinescu, 2012; Simon et al. 2015). There is a clear need, then, for further investigation into the precise dynamics of how structured L1 variation influences the outcomes of L2 speech production.

This thesis investigates the influence of regional dialect on L2 English speech production focusing specifically on L1 Turkish speakers from two different regional dialect backgrounds. First, I carried out acoustic phonetic analysis investigating the nature of regional variation between İstanbul Turkish and Trabzon Turkish speakers (N=28) in terms of the production of vowels, and the voiced affricate. Second, I examined the role of regional dialect in L2 English speech production by comparing the same dialect groups of Turkish together with Standard Southern British English (SSBE) speakers. Fourteen speakers for each dialect group (N=42) aged 18-35 were recruited for speech production experiments in Trabzon, İstanbul, and Lancaster.

The acoustic phonetic analysis of regional variation in Turkish shows that the production of low vowels and fronting mechanisms differ between the two target regions. However, high vowels, acoustic correlates of lip rounding, and durational features show similarities between the two regional dialects. In terms of voiced affricate

production in Turkish, there are no significant L1 dialect differences, but there remain overall effects of word position and vowel context. I interpret these findings according to the socio-phonetic/linguistic contexts of the target regions.

The findings on L1 dialect variation are then used to investigate differences in L2 speech production. There is no regional dialect influence on L2 speech production of the voiced affricate, which is expected given the lack of differences between dialects in L1 Turkish. Yet, the results find that acoustic realization of /dʒ/ is different between L1 Turkish and SSBE speakers. There is evidence of L1 dialect effects on L2 production of English vowels, such that the tense -lax contrast /ɪ/ -/i:/ in L2 English is smaller in magnitude for speakers of Trabzon than speakers of İstanbul, with both groups showing smaller distinctions than SSBE speakers. The /ɜː/ vowel shows L1 dialect effects on L2 English despite the lack of regional dialect differences in the L1. The regional dialect differences found for /ʌ/ and /æ/ vowels in the L1 are not found in L2 English, yet the allophones of /ʌ/ in L1 – [ɑ:] and [ɒ] – are influenced by the regional dialect in L2 English production.

In summary, the results demonstrate the variable effects of L1 regional dialects on L2 speech production. The influence of L1 regional dialect was observed in L2 English production of vowels, in line with the predictions of L2LP; however, there were no significant differences in the production of voiced affricates. Overall, these analyses suggest that L1 regional dialect can shape L2 speech production patterns, but that this occurs to different degrees for different phonemes. In summary, this thesis advances our understanding of cross dialectal and cross linguistic influences in L2 speech production, while also providing important documentation of regional phonetic variation in Turkish.

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List of Abbreviations and Acronyms

L1	First Language
L2	Second Language
CAH	Contrastive Analysis Hypothesis
OT	Optimality Theory
SLM	Speech Learning Model
SLM-r	Speech Learning Model-Revised
PAM	Perceptual Assimilation Model
PAM-L2	Perceptual Assimilation Model-L2
L2LP	Second Language Linguistic Perception
AoL	Age of Learning/Arrival
AO	Age of Onset
UNP	Universal Perception Model
LoR	Length of Residence
BC	Bohemian Czech
MC	Moravian Czech
MSD	Minimal Sonority Distance
CoG	Centre of Gravity
SD	Standard Deviation
CD	Closure Duration
FD	Frication Duration
SSBE	Standard Southern British English
TUİK	Turkish Statistical Institute
TRT	Turkish Radio and Television
HPI	House Price Index
LPC	Linear Predictive Coding
ST	Standard Turkish
LRT	Likelihood Ratio Test
VOT	Voice Onset Time

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1 Introduction

This thesis describes an acoustic phonetic investigation of regional dialect variation in Turkish and its influence on second language (L2) English speech production. Previous research has widely documented the influence of first language (L1) phonology on L2 speech production (Best & Strange, 1992, Colantoni et al., 2015). One factor that is often overlooked, however, is variation between L1 speakers and how this might influence those speakers' L2 speech. The assumption that speakers share a homogeneous L1 is particularly problematic, given established knowledge on dialect variation across a wide range of languages (Chládková & Podlipský 2011; Escudero & Williams 2012). To this end, different L1 regional dialects may display varying degrees of difference from the phonological and phonetic system of a target L1. It stands to reason, then, that L1 regional dialect differences may be evidenced in the production of L2 speech. Previous research confirms the influence of L1 regional dialects on L2 speech perception (Chládková & Podlipský 2011; Escudero & Williams 2012), but research on the influence of L1 regional dialects on L2 speech production has revealed only partial effects (Marinescu, 2012; Simon et al. 2015). This thesis investigates the claim that speakers with different L1 dialects may show different patterns of speech variation in the same L2.

Specifically, this thesis builds on previous research by (1) further testing claims around L1 dialect effects on L2 speech; (2) expanding the range of languages examined in such scenarios, particularly focusing on a non-Indo-European language that displays a greater range of differences from English; (3) focusing on a context where L2 English is largely restricted to the classroom context. In doing so, I focus on Turkish, an Altaic language, whereby L2 English production among such Turkish speakers is highly confined to classroom contexts. In addition to this, Turkey Turkish and its regional dialects have not been widely researched in terms of their phonetic and sociolinguistic aspects. Although there exists regional dialect variation research in Turkish, most studies focus on vocabulary and morpho-syntax (e.g., Caferoğlu, 1946, Menz, 2002). As a result, this thesis also advances our knowledge of the socio-phonetics and regional dialects of Turkish, with the aim of exploring the role of regional dialects on L2 speech production as an under-researched topic and contributing to existing knowledge on sociolinguistic and phonetic variation in Turkish.

I carried out four studies: two of them examined the regional dialect variation of the voiced affricate consonant and monophthongal vowels between Standard (İstanbul) and Trabzon Turkish speakers aged 18-35. The other two studies focused on the L2 English speech production of the same Turkish speakers from these regions and examined the voiced affricate and selected vowels in L2 English. These were also compared with the production of the same features by Standard Southern British English speakers.

The aim of this thesis is to extend our understanding of L2 speech production by exploring how, and to what extent, regional dialect speakers vary in L2 speech production, as well as reporting the current regional dialect variation in Turkish. The focus is intentionally given to the role of regional dialects, instead of comparing phonologically similar L1s. This is because I consider the phonological similarity between any two L1s would again lead us to surmise a shared homogenous phonology between speakers and leave any potential variation within L1 unattended. In addition, comparing phonologically similar L1s is different than comparing regional dialects as the former may entail differences in other aspects of L2 speech learning. For example, Simon et al. (2015) conceptualizes regional and standard dialect as L1 and L2 and suggests that second/foreign language speech learning (L3) can occur under the influence of L2 (standard dialect) due to learning conditions or language ideologies and policies toward an L2. Comparing phonologically similar L1s would not enable us to test the potential role of language standardization or bidialectalism on second language speech production. Previous studies examining the regional dialect influence on L2 focused on target vowel contrasts, whereas this thesis also analyses vowels while simultaneously incorporating consonant analyses. Furthermore, focusing on regional dialect variation of young Turkish speakers offers some insights into the current linguistic changes in Turkey Turkish. Finally, I aim to extend our understanding of L2 speech production by focusing on a context where English is taught as a Foreign Language, and where L2 English use is mostly limited to classroom contexts. This focus enables me to contribute to the scope of L2 speech perception and production studies in L2 tutored/instructed learning settings (Dmitrieva et al., 2020, Solon, 2016).

These issues are framed in this thesis by formulating the main research questions below:

RQ1a: Is there regional phonetic variation in the production of the voiced affricate between İstanbul Turkish and Trabzon Turkish speakers?

RQ1b: Do İstanbul Turkish and Trabzon Turkish speakers differ in their production in L2 English voiced affricate?

RQ2a: Is there a phonetic regional variation in the production of vowels between İstanbul Turkish and Trabzon Turkish speakers?

RQ2b: Do İstanbul Turkish and Trabzon Turkish speakers differ in their production of the L2 English vowels?

1.1 Thesis Structure

This chapter introduced the main focus of this thesis and its contribution to the field of socio-phonetics and L2 speech research.

Chapter 2 provides an in-depth review of the existing research relevant to this study. It begins with definitions of the influential models of L2 speech perception and production, before narrowing the focus to research that has investigated the role of regional dialect influence on L2 speech. I then review the phonology and phonetics of Turkish, underpinning the focus of this study. Finally, I provide a brief linguistic description of the target regional dialects explored in this study.

In Chapter 3, I describe the research communities as the primary regional focus of the thesis. I begin with the introduction of regional dialects, and present information about their socio-linguistic, economic, and geographic profile. This is followed by Chapter 4, the methodology, which frames the research design, explains the protocols used for experimental design such as selection of word lists and texts, data collection, participant recruitment, and the data analysis. I also discuss ethical considerations that guided the design of the study.

Chapter 5 presents the acoustic phonetic analysis of variation in the voiced affricate /ʤ/ between speakers of İstanbul Turkish and Trabzon Turkish. It begins with an overview of the target sound and its hypothesised variation in the two regional dialects. Then I provide the methodology for the acoustic and statistical analysis. This is followed by a presentation of the quantitative results, supplemented with qualitative analyses to illustrate key points. The chapter ends with a discussion of the findings.

Chapter 6 follows the same structure as Chapter 5, but with a focus on L2 English production of the voiced affricate /ʤ/ among speakers from the same regional dialect groups. This chapter also compares the L2 English production with SSBE speakers.

Chapter 7 and 8 describe the acoustic phonetic analysis of vowels in Turkish between İstanbul and Trabzon Turkish speakers, and L2 English production of vowels compared to SSBE speakers respectively. Both chapters begin with a phonetic description of vowels in Turkish and English respectively. Then descriptions of the methodological approaches for the acoustic and statistical analysis are provided. Both chapters continue with the presentation of the results and interpretation of these findings according to theoretical models of L2 speech learning.

Lastly, Chapter 9 summarizes the main findings of the thesis, followed by a discussion of the research questions in the light of findings in this thesis. In addition, it explains the contribution of this thesis to L2 speech studies and to the sociolinguistics of Turkish. Lastly, I detail the limitations of the research and recommendations for future studies.

2 Theoretical Background

Second Language (L2) speech learning has been an interest of many disciplines such as linguistics, education, and psychology. In linguistics, L2 learning can simply be defined as learning a language that is different than one's native language. L2 speech learning entails difficulties and differences from that of L1, which became the primary interest of several frameworks/hypotheses to explain L2 speech learning. For example, the Contrastive Analysis Hypothesis (CAH) argues that a systemic phonological comparison of L1 and L2, mainly focusing on phonemes, can reveal what sounds will be difficult to learn in L2 (Lado, 1957). Although CAH received great attention in research, findings demonstrated that the lack of a phoneme in L1 may not necessarily impede L2 learning (Davidson, 2011). Another attempt to account for difficulties in L2 speech learning was proposed by Eckert (1977) in Markedness Theory. According to Markedness Theory, the difficulty in learning language universals in L2 is related to their relative markedness between the native and target language (Eckert, 1977). That is the more marked and different a language unit between the target language and native language, the more difficult it will be to acquire. For example, Carlisle (1998) examined the acquisition of biliteral and triliteral onsets of English by native Spanish speakers. Triliteral onsets are assumed to be more marked than biliteral onsets and thus can be more difficult to acquire in L2 English. Although the findings of this study did not provide counterevidence to the hypothesis, the fact that L2 learners were able to produce biliteral and triliteral onsets similarly demonstrated that the degree of (perceived) markedness may be hypothetical. Another theory developed to account for L2 speech learning is the Optimality Theory (OT) (Prince & Smolensky, 2004). OT blends the markedness and L1 influence and confines it to the initial L2 learning state for L2 phonology attainment. OT proposes that the phonological constraints arising from L1 will be the highest at initial L2 learning from which the interlanguage (L2 development) will re-adjust the constraints through L2 development. OT also forms the basis for the Second Language Speech Perception (L2LP) model and will be thoroughly discussed in Section 2.1.

Another inevitable influence of L1 on L2 speech learning is the foreign accent. Accent can be defined as a set of segmental and suprasegmental units that carry both social and linguistic information to the hearer (Moyer, 2013). Given that L2 learning begins after the formation of the L1 phonological system, the acquisition of new sounds in L2 is tied to the L1 phonological filter, which leads to the formation of a foreign accent. Studies in SLA and related disciplines conceptualized L1 monolinguals as the target-like version of L2 users. Hence, reaching a native-like pronunciation used to be a primary aim of L2 pronunciation (Saito, 2021). More recently, the focus on foreign accents has shifted from native-like pronunciation to the intelligibility-comprehensibility-accentedness dimension (See Munro & Derwig, 2020 for a recent discussion). Munro et al. (2006) propose that the strength of a foreign accent may not always lead to poor intelligibility. Instead, intelligibility and comprehensibility can be perceived differently and do not have a linear relation with a foreign accent (Munro,2008). Since the relationship between foreign accent, intelligibility, and comprehensibility is beyond the scope of this thesis, L2 speech learning will be discussed in terms of speech production and perception in phonetics in the following sections.

L2 speech has been investigated in a wide range of sub-disciplines in linguistics: second language acquisition (Kormos, 2014), language teaching and learning (Cook, 2016), and pragmatics (Taguchi, 2019) among others. In phonetics and phonology, L2 speech research centres on understanding the mechanisms that underpin speech perception and production. L2 research in speech perception and production targets two main areas: the segmental level (consonants and vowels), and the suprasegmental level (stress, tone, intonation) (See Wayland, 2021). L2 speech perception can be broadly defined as the ability to perceive phonetically relevant acoustic properties of L2 speech (Strange & Shafer, 2008). L2 perception may include different cognitive processes such as the ability to discriminate non-native sounds compared to existing L1 sounds or identify new sounds and mapping them onto the phonological space. Recent studies have shown that L2 speech perception is challenging for lower proficiency learners with multiple cognitive and social factors contributing to the level of challenge (Strange & Shafer, 2008). That is, psychoacoustic salience of the acoustic cues or patterns of selective perception in L2 speech at cognitive level, social and psychological variables such as age, type of input, and motivation can influence the perceptual attainment of non-native L2 perception at the initial learning stage.

L2 speech production research, on the other hand, focuses on the production of non-native sounds, stress, tone, and intonation in terms of acoustics and articulation. Phonetic studies of L2 speech have investigated a range of variables that may impact on speech production. Early studies of L2 speech production mostly drew attention to phonetic dimensions at a segmental level such as examining voice onset time of stops (Williams, 1977) or production of French vowels by English speakers (Flege, 1987) (for a review, see Flege and Bohn, 2021). These studies subsequently led to several different speech models that have been proposed to account for the mechanisms underlying L2 speech perception and production. In this chapter, I will introduce three L2 speech models that have underpinned a considerable proportion of research in L2 speech perception and production. These models are, the Speech Learning Model (SLM), the Perceptual Assimilation Model (PAM), and Second Language Linguistic Perception (L2LP). While the primary focus is on the speech production of Turkish speakers throughout the thesis, this chapter also provides a broad overview of L2 speech perception and how it relates to L2 speech production. This will be followed with an overview of the phonetics and phonology of Turkish, and how it varies in the two regional dialects of Turkish. Finally, I will address previous work that includes Turkish as an L1 or L2 variable in relation to second language speech research. The chapter concludes with a set of research questions that will guide the study.

2.1 L2 Speech Models

2.1.1 SLM and SLM-r

The Speech Learning Model (SLM) focuses on the perception and production of L2 speech at the allophonic level. Flege (1995) puts forward four postulates and six hypotheses to discuss how L2 speech production differs from L1, depending on the L1 and L2 phonetic features. The hypotheses of the SLM are mainly grounded in perception focusing on the ability to discern L2 sounds. The first argument states that the mechanisms behind learning an L1 sound system remain intact over the lifespan, and hence, can be applied to L2 learning (Flege,1995). The second postulate posits that phonetic categories are the memory representation of language-specific aspects of sounds. That is, categorization of an L2 sound based on its phonetic proximity to an L1 sound is determined by the perceived allophone-level position-sensitivity (Flege, 1995). Since allophonic variation can vary considerably across languages, the differences in the acoustic and articulatory qualities of an allophone may lead to different phonetic categorizations in L2. The third postulate states that "phonetic categories established in the childhood for L1 sounds evolve over the lifespan to reflect the properties of all L1 and L2 phones identified as a realization of each category" (Flege, 1995, p.239). By claiming this, Flege opens a space for plasticity of production through language development. Therefore, according to the SLM, L2 speakers might produce an L2 sound with different realizations over time due to the factors such as age of learning (AOL), quality of input, length of residence (LOR), and use of L1/L2 (Flege & Wayland 2019). The final postulate concerns the existence of a common phonological space which bilinguals maintain to differentiate sound contrasts in L1 and L2 phonetic categories. That is, this shared phonological space enables bilinguals to (re)map sound contrasts between native and non-native phonetic categories. The six hypotheses (Flege,1995) also focus on the L2 phonetic category formation of learners. According to Flege (1995), the greater perceived phonetic dissimilarity of a sound in L2 will lead to category formation in perception thereby constraining the production. To sum up, based on these postulates and the hypotheses, Flege (1995) argues that L2 speech production and the ability to discern an L2 sound will vary according to a) the phonetic and allophonic features of a sound such as position sensitivity, b) bilinguals' sound category representation (proximity of L1 and L2 sounds), and c) other variables such as AOL or LOR. It should be noted that SLM focuses on advanced learners as the target group, so these claims are intended to account for L2 advanced speakers.

The key argument of SLM is that learning L2 sounds will be differentially difficult according to their proximity to L1 sounds (Flege,1995). SLM investigates learning difficulty of L2 sounds on a (dis)similarity continuum under three conditions: identical sounds, new sounds, and similar sounds (Flege, 1995). According to SLM, identical sounds are the easiest to learn because direct transfer from the L1 will lead to high accuracy of the target sound in L2 speech production. For example, an L2 learner might not have any difficulty in producing and perceiving stop consonants if the learner's L1 already has categorical representations of these sounds that are produced in the same way in the L2. On the other hand, new sounds are more difficult to learn. While they may differ sufficiently from an L1 sound to prevent equivalence classification, that is relating non-native L2 sounds to L1 sounds phonetically at initial stages of learning, they require L2 learners to create a new category representation (Flege, 1995). The last case, similar sounds, creates the most difficult learning condition for L2 speech. This is because two sounds are categorically too close to one another for the L2 learner to sufficiently discriminate the phonetic differences. Consequently, the L1 has a significant influence on these similar sounds, as existing L1 routines tend to be used in production and perception. As an example, consider a Turkish speaker trying to learn French as an L2. Turkish has an open-mid central unrounded vowel /ɛ/ whereas there is an oral - nasal contrast of /ɛ/ - /ɛ̃/ in French. In this case, according to SLM, it is highly possible that L1 speakers of Turkish would be unable to categorize the two sounds differently due to the lack of nasal vowels in their L1, hence they will assimilate the production of the two sounds into one category. However, this assumption might be reinterpreted considering another hypothesis Flege (1995) argued: that the probability of discerning a non-native L2 sound contrast will be higher as age of learning (AOL) decreases. Thus, the impact of sound similarity may differ for two groups of L2 speakers depending on age.

The hypotheses of SLM have been tested over the years through empirical L2 speech production and perception research (see Flege et al., 1999, Aoyama et al. 2004). Although these studies found supporting evidence of SLM in terms of perceived phonetic dissimilarity in L1 and L2, other aspects such as age of learning have a varying degree of influence on production and perception. This has led to a recently revised version of SLM, namely-SLM-r (Flege and Bohn, 2021). I will here briefly mention the new aspects of SLM-r. First, SLM-r updates its focus on the age hypothesis that early learning is more advantageous than late learning due to plasticity in the brain. SLM-r removes this distinction between early and late learners of L2 because cumulative research has shown that the adult brain also preserves plasticity for L2 sound processing (Flege & Bohn, 2021). Secondly, SLM developed a model to represent advanced L2 learners, but SLM-r abandons this approach for two reasons. SLM-r suggests that being bilingual itself can prevent mastery of L2 sounds as in the way a monolingual does in L1. This stems from the fact that exposure to different input between monolinguals and bilinguals can cause subtle phonetic differences in production. In addition, SLM-r proposes that examining the early stages of L2 learning is a prerequisite to understand ongoing category formation in L2 speech development. Having introduced these changes, SLM-r also amends some of its previous hypotheses on L2 speech production. SLM-r points out a co-evolving relationship between L2 speech perception and production instead of previously assumed unidirectional influence of perception on production. Accordingly, L2 speech production and perception is thought to develop in different ways with a varying degree of influence on each other. This removes the constraining influence of perception on production. Instead, it suggests that perceptual and productional development of L2 sound categories can follow different paths in relation to cognitive, social, and psychological variables. It indicates that L2 production and perception can be dynamic, and other social factors, such as identity development in the L2, can explain these variations within an individual (Nance, et al. 2016). That is, it is possible for an L2 speaker to reach a native-like perception, or acoustic production; however, this may not be preferred by the speaker themself depending on their attitude towards the L2 (Nance, et al., 2016). What may be regarded as non-native production in the L2 may represent an identity marker or personal stance, rather than a passive L1 influence (Sung, 2016).

The second revision in SLM-r is the ‘L1 category precision’ hypothesis. According to this, the phonetic differences between an L1 sound and its nearest L2 sound can be discerned better if the L1 categories are more precise during initial exposure to L2 (Flege & Bohn, 2021). That is, categorization of L1 sounds with higher precision will enable speaker-hearers to discern L2 sounds at initial exposure to L2. For example, the ability to discern /ɛ/ and /æ/ vowels in L2 English may be difficult for L1 Turkish speakers since [æ] is an allophone of /ɛ/ in Turkish. SLM-r maintains its argument that not all L2 sounds differing from the nearest L1 sound will lead to a categorical distinction since a sound in the L2 might be perceived as phonetically similar to the L1 sound. Therefore, L1 speakers of Turkish may not categorize /ɛ/ and /æ/ differently at initial L2 learning because the phonetic proximity of these vowels in the L1 are not precisely different. Hence, SLM-r claims that a learner’s ability to build a new phonetic category may vary according to the degree of phonetic dissimilarity between the L2 and L1 sound, the precision of the closest L1 category, and L2 input quality and quantity (Flege & Bohn, 2021).

In conclusion, SLM-r provides a detailed L2 speech model both for speech perception and production, taking recent studies into consideration. While it preserves some core arguments, it enlarges its modelling from advanced learners to all learners, including a bidirectional influence of speech production and perception, and L1-L2 and L2-L1 interaction as a consequence of the shared phonological space. In addition, it conceptualizes L2 sound category formation based on its precision in L1 and L2, as well as input quality, quantity, and distribution. Finally, SLM-r points out the importance of endogenous factors and inter-subject variability in L2 speech and calls for more research to improve understanding of L2 speech production and perception process. In the next section, I will discuss PAM-L2, which differs from SLM-r in centring around the perception of non-native sounds at the phonological level.

2.1.2 PAM-L2

Another widely examined speech model is the Perceptual Assimilation Model (PAM), which aims to provide an understanding of non-native speech perception by naïve listeners (Best, 1995). Best (1995) conceptualizes naïve listeners as functional monolinguals who do not have an active second language learning experience. PAM essentially argues that the perception of non-native sounds is achieved through the native language, and its similarities and discrepancies from the target sounds. PAM (1995) proposes a framework of non-native speech perception in which L2 speakers perceive phonological contrasts of an L2 according to signals obtained through articulatory gestures. That is, PAM suggest that L2 learners' attainment of non-native phonological contrasts are achieved through perceptual learning of (non)-assimilation in phonological categories. While SLM-r focuses on the category formation of L2 sounds individually, PAM is based on the perception of non-native contrasts.

In an extension to PAM, PAM-L2 (Best & Tyler, 2007) links non-native sound contrast perception to L2 learners who are actively engaged in the second language learning process. They define "experienced" learners as those who have a minimum of six to twelve months immersion. PAM-L2 (2007) posits that whether listeners discriminate non-native sound contrasts depends upon the phonological and phonetic (dis)similarities between their L1 and the target L2. The distinctiveness between an L2 sound and its perceptual assimilation as a phonetically similar sound in L1 creates varying degree of contrast (Tyler et al., 2014). Therefore, PAM-L2 offers different assimilation scenarios based on the phonological categorization and discrimination of the target sounds. The first scenario is known as Two-Category Assimilation. That is, each non-native sound contrast is assimilated to a separate category by L2 listeners thereby leading to good discrimination (Best,1995). For example, the interdental fricatives /θ/ and / ð/ in English will be discriminated as /t/ and /d/ respectively by L1 Turkish listeners who do not have a phonological representation of interdental fricatives in their native language. So, while their phonetic realisation of the fricatives will not necessarily be L1-like, L1 Turkish listeners would be predicted to have high perceptual discrimination due to the relative mapping between L1 and L2.

The second scenario is known as Category-Goodness Assimilation, where listeners categorise the sound as a poor or good assimilation of the sound in the native language. In this case, L2 listeners assimilate two sound contrasts into one category, but the degree of assimilation for each sound varies, such that one might be very similar whereas the other sound might be a poor representation of that category (Best & Tyler, 2007).This can be illustrated by comparing Turkish /ʌ/ with English /ɑ/ and /ɒ/ vowels. It might be assumed that Turkish listeners of L2 English will assimilate these two vowels into the same category because in Turkish these two sounds do not create a contrast, unlike in English. Therefore, Turkish learners may perceive these sounds similarly, but the assimilation goodness might vary for each non-native vowel because one vowel may be a better match to a nearby L1 vowel than the other (Best, McRoberts, & Goodell, 2001).

The third scenario is Single-Category Assimilation. In this scenario, listeners will assimilate two contrastive sounds in the L2 as a single phone in their L1. An example of this may be (un)aspirated fricatives in Chinese. Mandarin Chinese has a 3-way contrast between /ts/, /ts^h/, and /s/. In Turkish /ts/ and /ts^h/ do not exist as a phonemic contrast, thus Turkish speakers of L2 Mandarin Chinese might assimilate these two sounds into one single category /s/. PAM-L2 also propose scenarios for Uncategorized-Categorized (UC) and Uncategorized-Uncategorized (UU) assimilations. According to PAM-L2, the definition of *categorization* is that listeners perceive a sound as native phonological category at a defined threshold (e.g., above 50%), while *uncategorized* sounds refer to situations when a sound does not correspond to native (L1) category. Faris, Best, and Tyler (2016) advance the uncategorized assimilation in three different ways: focalized responses in which assimilation to a single L1 sound occurs below 50% categorization threshold, clustered responses where uncategorized non-native can be perceived to be a small set of L1 sounds, and dispersed responses, such as selecting many L1 sounds, which may suggest random responses. In a study investigating the perception of Australian English vowels by Egyptian Arabic listeners, Faris et al. (2016) found that some phonologically meaningful phones in the L1 can aid listeners in detecting focalized and clustered uncategorized non-native phones whereas dispersed responses were only found to show sensitivity to the phonetic level of detail. Drawing attention to the relationship between perceived phonological overlap and discrimination accuracy in L2 speech sound perception, Faris, Best, and Tyler (2018) investigated Uncategorized–Categorized assimilations via a perceived degree of phonological overlap method. According to this, perceived phonological categorization for non-native contrasts can be identified in three ways: non-overlapping, partially overlapping, and completely overlapping (Faris et al., 2018). This study found that non-overlapping contrasts in perception lead to higher discrimination accuracy. The final category of perceptual assimilation according to PAM is Non-Assimilable (NA) where both contrasting phones in L2 are not perceived as speech. In other words, perceptual categorization arises from the non-linguistic auditory difference rather than a phonological contrast or category goodness fit. Tyler (2021) recently pointed out that the methodological requirements need to be improved to account for factors facilitating the discrimination of non-native phones, specifically the source of information listeners would rely on for their discrimination.

It is worth mentioning a recent paper in relation to PAM-L2 that introduces a Universal Perception Model (UNP, Georgiou 2021) for L2 speech in relation to the degrees of overlap proposed by Faris et al. (2016). UNP enlarges the scope of 'degrees of overlap' from uncategorized to all phones. According to UNP, L2 phones can fall into three categories; non-overlapping in which each L2 phone is identified as different from all L1 phones, partially overlapping where there is an above chance probability that an L2 phone has a shared L1 phone, and completely overlapping which is the complete identification of L2 phones within corresponding L1 categories. Georgiou (2021) proposes that discrimination of L2 phones will be higher in non-overlapping conditions and will be lower if completely overlapping.

Similar to other models, PAM-L2 emphasizes the difference between naïve listeners and proficient L2 listeners. As we shall see later in this section, this distinction is also mentioned in L2LP but with a more transitional emphasis from initial stage to full acquisition. The difference between naïve listeners (or functional monolinguals) and L2 learners is based on a few factors. First, the language learning environment which, for learners of English, can be characterised English as a Second Language (ESL) vs English as a Foreign Language (EFL). Best and Tyler (2007) argue that L2 speech perception might develop differently if learners are exposed to L2 speech in natural conditions where learners receive input from native speakers of the L2 (ESL). Perceptual development may be constrained by the factors such as the use of L2 only in a classroom environment with non-native teachers of the L2 (EFL) (Tyler, 2019). Considering the context of this study, it is highly possible that the Turkish learners' foreign language learning experience is restricted to teachers of English who are also native speakers of Turkish, and possibly using phonological or phonetic features of their L1 in their L2. When learners who apply an L1 phonological filter for L2 learning receive L2 input that is already influenced by their shared L1, the development of non-native language contrasts in L2 may be much slower, thereby increasing the role of individual differences (Bohn & Best, 2012). However, I would argue that the differences in an EFL vs ESL learning environment essentially arise from the requisite for learning another language, which overall influences the social and cognitive aspects of L2 speech perception and production.

As PAM-L2 primarily focuses on L2 speech perception in L2 immersion settings, the potential influence of L2 perception on production is not conceptualized in as much detail as other models of L2 speech learning. PAM-L2 conceptualizes perception through the articulatory gestures of speech production by the interlocutor. However, it remains unclear that whether, and to what extent, this perceptual influence will be transferred to L2 production. Previous research has found that L2 speakers' production may not in line with their L2 perception abilities, even though their L2 perception ability is in line with PAM-L2's predictions (Rallo Fabra & Romero, 2012, Ghaffarvand & Werner, 2017). This suggests that perception and production patterns of L2 speakers can develop in different ways. For example, L2 English learners of L1 Turkish speakers can reach the ultimate attainment of /θ/ and / ð/ contrast in perception, while they may not be able to produce the contrast in their speech. This reinforces the argument of SLM-r that perception and production can have a co-evolving relationship (Flege & Bohn, 2021).

2.1.3 L2LP

The Second Language Linguistic Perception model (Escudero, 2005) provides a computational L2 learning mechanism at a phonological level for L2 speech perception. L2LP aims to model the developmental process of L2 speech perception from naïve, non-native to advanced, and native-like performance (Leussen & Escudero, 2015). A principal distinction is made in L2LP between two levels of abstract representations that take place during perceptual mapping. The first level is the perception grammar, which can be defined as mapping the acoustic signal to phonological representations, and the second is the recognition grammar, which includes mapping phonological categories onto lexical representations (Colantoni, Steele & Escudero, 2015). L2LP proposes that an individual's L2 perception grammar is equal to his/her L1 phonological representations at the initial learning process. Yet, individuals' perceptual development will be different after the initial learning process depending on the trajectory of perceptual learning. That means, phonetic discrimination of learners' will be formed through perception grammar, which then interacts with phonological categories (recognition grammar). According to this, learners with different L1 backgrounds will show different L2 development, because the acoustic input learners receive will be phonologically and perceptually different from their respective L1s. In addition, two individuals with different dialects of the same L1 might also differ in L2 speech learning since the perception grammar they implement may vary in the phonetic make-up of their sound systems.

L2LP presents three different scenarios for L2 speech perception in terms of the nature of the cross-language contrasts involved in speech learning. The first one, **new scenario**, is the situation when an L2 contrast between two sounds is perceptually assimilated into one category in the learner's L1. Escudero (2005) describes this as the initial stage of L2 learners, with the phonological mapping of new sounds based on the L1 phonological map. This is also referred to Single-Category Assimilation in PAM-L2. In this situation, learners are expected to either create a new L2 category or split an existing L1 category into two in order to adjust their phonological representation of the L2. For example, Spanish listeners may experience difficulty in acquiring the /ɪ/-/i/ contrast in L2 English since Spanish does not have a phonological /ɪ/ vowel (Escudero & Boersma, 2004). The new scenario proposes that if a contrast does not exist in the L1 inventory, non-native contrasts are often perceived as a single category in the L2 and poor discrimination of the contrast occurs (Elvin, Williams, Shaw, Best, Escudero, 2021).

If the target L2 sound contrast is perceptually categorised into two different phonetic categories, it is referred to as **similar scenario**. This is equal to PAM-L2 two category assimilation (Van Leussen & Escudero, 2015). In this scenario, learners are assumed to use their existing L1 categories and adjust them to match the L2 contrast. This scenario is considered less difficult for L2 learners as it will not require learners to create a new category in their phonological representation. Instead, learners can adjust the category boundaries of the contrast in their L1 to match the L2 contrast. The last scenario, known as the **subset scenario**, occurs if a single non-native sound is perceived as more than one L1 category which will require L2 learners to reduce perceptual categories through development. For example, Dutch has /y/ - /ʏ/ contrast which does not exist in Australian English. Alispahic et al. (2017) found that the non-native Dutch vowels /ʏ/ and /y/ were perceptually categorized into three different vowels by Australian English speakers. The perception of /ʏ/ was categorized as /ɛ/, /ʊ/, and /ʉː/, while /y/ was categorized as /ʉː/, /ʊ/, and /ɪ/ among Australian English speakers.

According to the L2LP the difficulty level of each scenario can be ordered as; a) new scenario – most difficult, b) subset scenario – medium difficulty, and c) similar scenario – less difficult. It should be recalled that L2LP claims are built upon the phonological contrast whereas, as addressed in the previous section, SLM-r is more concerned with native-like phonetic or allophonic features. What also differentiates L2LP from other speech perception theories is that L2 learners might not rely on the same cue weighting as native speakers. L2 learners might be able to perceive a non-native sound contrast due to durational differences, whereas native speakers might do the same by relying on spectral differences of the contrast (Strange, 2011, Marinescu, 2012, Debeane, 2013). Although L2LP does not conceptualize L2 speech production, its claims can be tested for L2 speech production. The core argument of L2LP, which is the developmental learning of non-native sounds through input, can suggest that L2 learners can adjust the acoustic signals in their production in line with L2 development. For example, L2 learners may shift the cue weighting from temporal to spectral features in speech production of non-native sound contrast while it may be different than L1 speakers. L2LP scenarios can be applied to L2 speech production for non-native contrasts, however, the intricate relationship between L2 speech perception and production remains unaddressed.

To sum up, L2LP claims a different perceptual development process for every individual. It bases its assumptions on a computational model which conceptualize L2 perception at a phonological level. In order to delineate the approaches of each model toward second language speech, a comparison of these three influential models is provided below (See Table 2.1).

Table 2.1 ***Comparison of SLM-r, PAM-L2, and L2LP (adapted from Chang, 2019)***

L2 Models	Main Argument for L2 Speech Mechanism	Learning Scenarios	Basic Unit	Learning Conditions	Phonological Space
SLM-R	A phonetic level (position sensitive allophones) framework looking at variation in L2 speech perception and production	- New sounds (less difficult), - Similar sounds (most difficult), - Identical sounds (medium difficulty)	Position-specific allophone	Naturalistic L2 setting	Shared L1-L2
PAM-L2	An articulatory framework combining higher order phonological level and lower order gestural level for non-native speech perception	- Two-category assimilation, - Single category, - Category Goodness, - (un)categorized–(un)categorized, - Non-assimilable	Articulatory gestures	L2 immersion	Shared L1-L2
L2LP	A Developmental model of L2 speech perception from initial to end state of learning	* Scenarios updated at each learning state - Similar scenario (less difficult), - New scenario (most difficult), - Subset scenario (medium difficulty)		Not specified	L1 L2 phonological maps are separate

These models outline the essential elements of L2 speech production/perception based on cognitive and physiological mechanisms. Nevertheless, the role of social factors influencing the L2 speech production or perception have also received a considerable amount of research (Edwards, 2008), and will be discussed in the next section.

2.1.4 Social and Psychological Variables in L2 Speech

Over recent decades, a wide range of empirical studies have conceptualized L1 phonology, individual differences, and age of onset as some of the core aspects affecting L2 speech production and perception (Inceoglu, 2019, Pickering, 2013). While theoretical frameworks of L2 speech perception and production are built on linguistic elements (i.e., L1 phonology), they cannot fully elucidate the variation in L2 speech patterns which are influenced by several social and psychological factors (Mayr & Morris, 2021). Several social and psychological variables such as age of learning (AoL), length of residence (LoR), motivation, and investment have received considerable attention in L2 speech learning research. For example, studies about the role of AoL in second language (phonological) acquisition show that children might have advantages in L2 speech production compared to late learners. Since children's L1 phonology is still under development, it provides learners with the flexibility to realize non-native target sounds. In contrast, the sound system of adults is more established when L2 learning begins. Thus, children's L2 perception and production can develop earlier than L2 adult speakers (Aoyama et al., 2008, Baker et al., 2008). Despite its crucial role in L2 speech production, the disadvantages of AoL for adults may be compensated through other elements, such as individual differences, L1-L2 phonological distance, or learning experience (Baker & Trofimovich, 2006, Lee & Cho, 2020).

Age of Learning (also referred to as Age of Arrival) and Length of Residence (LoR) have also been examined as social variables in L2 speech production (Aoyama et al, 2008, Aoyama & Flege, 2011). Although several studies found positive evidence of LoR influence on the L2 acquisition of learners in immersion settings (Flege et al., 1997, Højen, 2019), its impact on L2 speech is not always consistent (Piske et al., 2001). Recently, Flege and Bohn, 2021) suggested that LoR might not be a strong indicator of

L2 speech production as the quality and quantity of input can vary significantly among learners who share a similar LoR (Flege & Bohn, 2021). Similarly, Al-Kendi and Khattab (2021) found that LoR did not play any role in the perception and production of Arabic consonants among foreign domestic helpers who work in Oman. Al-Kendi and Khattab (2021) discuss that the motivation to interact with their interlocutors instead of reaching a native-like pronunciation may reduce the impact of LoR on L2 speech.

Several other social and psychological variables, such as motivation, type of input, identity, and individual differences have been examined in L2 speech learning (Aliaga-García, 2007, Rindal, 2010, Saito et al., 2018). For example, two speakers who share similar AoL and L1 may differ considerably in their production if one of them lives in the target L2 country whereas the other can only receive input in classroom settings (Jia et al., 2006). The role of motivation, on the other hand, has been rarely examined in terms of L2 speech perception and production and thus awaits further research (Trofimovich et al., 2015). Overall, these studies demonstrate the importance of social and psychological factors influencing L2 speech and hence reveal the need for methodology integrating linguistic, social, and psychological variables in L2 speech research (Al-Kendi & Ghattab, 2021).

This thesis focuses on the influence of L1 Turkish regional dialects on L2 English speech production. As the participants received L2 education in an EFL context, the focus was not on social variables such as AO, LoR, or type of input. Instead, regional dialect was the social variable in this study. In the next section, I will discuss the role of regional dialects on L2 speech perception and production.

2.2 Regional Dialect effects on L2 speech

When L2 learning starts, the phonological (or phonetic) mapping of L1 is often assumed to represent the starting point for L2 speech learning. This application of an L1 phonological map for L2 production is called the L1 phonological filter (Polivanov, 1931, as cited in Escudero 2005). This means that a speaker's ability to learn L1 sounds might be more flexible since there is no phonological filter. However, it can be less flexible when they encounter an (un)familiar or (dis)similar sound in the L2 due to the influence of the L1 phonological system. This influence of L1 in L2 learning can create specific patterns in speech production and perception thereby providing an advantage to listeners for interpreting speech produced by a speaker from the same background (Cooper & Bradlow, 2018). This shared L1 advantage can increase the perceived intelligibility of speakers, called the interlanguage speech intelligibility benefit (Bent & Bradlow, 2003).

The influence of L1 phonological filter can be more complex given that speakers of a shared L1 could potentially develop different phonological filters due to regional dialect variation. Both L2LP and SLM-r extend the role of the L1 phonological filter and claim that exposure to a particular language environment leads to development of language-specific sound perception, or category precision, because L2 learning assumes the L1 phonology as its initial state (Escudero, 2005, Flege & Bohn, 2021). This difference can exist in shaping L1 categories, which in turn can influence L2 initial speech performance. However, Chládková and Podlipský (2011) problematize a simplistic version of this claim, arguing that the assumption of a homogenous L1 phonetic/phonological map for a group of L1 speakers might obscure the actual outcomes of L2 speech production. That is, speakers of a given L1 may develop different phonological maps due to differences in their regional dialects and this might lead to different outcomes when learning L2 sounds. Thus, the role of regional dialects on second language production and perception is likely to be more important than was first assumed, considering that variation among dialects of a language may arise from phonetic/phonological differences. The ways in which L1 regional dialect affects L2 speech production is a recently emerging issue, and this thesis aims to further contribute to this area.

Since a full discussion of the definition of dialect would exceed the scope of this study, I will give a brief overview. Dialects can be broadly defined as the social, economic, or geographical subdivisions of a language community (Trudgill, 2004). Dialectal variation may occur in many aspects of the language including vocabulary, grammar, or accent. What is referred as native/L1 dialect throughout this thesis is the regional dialect (topolect, regiolect) that can be defined as a form of language spoken within the natural borders of a geographical area. More specifically, I aim to examine regional *accent* as it represents the phonetic and phonological variation in Turkish L1.

Dialect variation has been studied with respect to social categories such as ethnicity or social class (Meyerhoff, 2011), gender (Cheshire, 2002), and age (Labov, Ash, & Boberg, 2006). However, there have been significantly fewer studies on the possible role of L1 dialect background on L2 speech production and perception, which will be explored in the next section.

2.2.1 Regional Dialect Effects on L2 Speech Perception

Before discussing the research on regional dialect effects and L2 speech production as the focus of this thesis, I briefly touch on the role of regional dialects in L2 speech perception. Previous studies show that L1 dialect background is correlated with differences in L2 speech perception (Chládková and Podlipský 2011; Williams and Escudero, 2014). For example, Escudero, Simon, and Mitterer (2012) examined the perception of English /ɛ/ - /æ/ contrast by North-Holland and West Flanders (Flemish) Dutch speakers. The researchers used a categorization task of /ɛ/ and /æ/ vowels in Dutch and English to examine acoustic similarity in Dutch dialects and its perceptual assimilation in English. The participants' dialects both lack an /ɛ/ - /æ/ contrast in Dutch but differ in the phonetic realization of /ɛ/ in Dutch, which may potentially influence their perception of the L2 /ɛ/ - /æ/ contrast. Findings showed that the two Dutch listener groups differed in perception of L2 English /ɛ/ - /æ/. In addition, North-Holland listeners' classification of /ɛ/ was more accurate than /æ/ whereas Flemish listeners showed the same level of accuracy in their classification for both vowels. This shows that regional dialect patterns of these sounds in L1 influence the non-native vowel perception in L2.

In another foundational study of the effect of regional dialect on L2 speech perception, Chládková and Podlipský (2011) investigated Bohemian Czech (BC) and Moravian Czech (MC) listeners' perception of Dutch vowels with a focus on durational over spectral contrast. They found that listeners from both dialect groups showed similar mapping of Dutch vowels in two-forced-choice identification task. However, BC and MC listeners differed in perceiving Dutch vowel contrasts /i-I/ and /y-Y/. The authors discussed that both dialect speakers are predicted to follow different learning paths for the Dutch vowel pair, which is in alignment with the proposal of L2LP about native dialects. Escudero and Williams (2012) compared Peruvian Spanish (PS) and Iberian

Spanish (IS) speakers' perception of L2 Dutch vowels /a-ɑ/, /i-ɪ/, /y-ʏ/, /i-y/, and /ɪ-ʏ/. They found that the vowel contrast and native dialect affected discrimination accuracy; dialect speakers performed differently for different vowel contrasts, with IS learners demonstrating higher accuracy scores. However, in the second task, there was not a significant influence of dialect on sound classification except for a significant vowel-dialect interaction. In addition to regional dialect influence on L2 speech studies, there is also research examining acquisition of different L2 dialects with the aim to move beyond the assumption that all learners acquire a standard dialect in their L2. For example, Escudero and Boersma (2004) examined the /i: - ɪ/ contrast acquisition of Spanish speakers learning L2 Scottish English and Southern British English and found that L2 learners can differ in the perception of contrasts depending on the target dialect they learn.

To sum up, the influence of regional dialects on L2 speech perception appear to be influential in L2 speech depending on the vowel contrast conditions. This is in line with the argument of SLM-r and L2LP2 that fine-grained phonetic differences may lead to variation in L2 speech. In line with the theory, these subtle phonetic differences arising from the regional dialects are observed in L2 speech perception.

2.2.2 Regional Dialect Effects on L2 Production Research

Regional dialect and L2 speech production studies are scarce in the field. Among these few studies, Marinescu (2012) examined the perception and production of L2 English /æ, ʌ, ɒ/ vowels between in Cuban and Peninsular Spanish. Although there was not a significant influence of regional dialect in L2 speech perception, Marinescu (2012) found that Cuban Spanish speakers produced L2 vowels /æ, ʌ, ɒ/ longer than Peninsular Spanish speakers. Simon et al (2015) also found partial evidence on the role of regional dialects in perception and production of native and second languages. Their study compared East Flemish and Brabantine speakers of Belgian Dutch in perceiving and producing Standard Dutch and Standard British English vowels. In terms of perception, Dutch vowels were perceived differently by the two dialect groups, with the more accurate performance by East Flemish listeners. For cross-language perception, the two dialect groups showed similar categorization patterns except for English /ʊ/ and /ʌ/. In terms of production, the two dialect groups showed variation in Dutch vowels contrasts

/i - ɪ/ and /y - ʏ/. However, the dialectal variation in producing Dutch vowels by East Flemish and Brabantine speakers was only a minor difference in English vowels.

In conclusion, these studies so far provide inconsistent results on the role of regional dialect in L2 speech performance, specifically on production. This might arise from methodological differences such as the use of different type of tasks for eliciting speech samples, the scope of the target sounds investigated (vowels only), and variation in experimental settings. This highlights the necessity of more research in this area, such as replication or extension studies in order to reach conclusive results. Another reason for inconsistent findings in previous research could be the scope of the L1 target languages. Most of the existing research concerning native dialect and L2 speech has focused on Indo-European Languages such as Dutch and English, which share similarities in their phonological inventories. There have been fewer comparisons between more typologically distinct languages. This thesis aims to expand this scope by investigating Turkish, an Altaic language, and its dialects, which are influenced by typologically different languages such as Armenian, Greek, Arabic, and Russian. I examine the effects of this L1 Turkish dialect variation on L2 speech production in English, in a foreign language learning setting. In the next section, I will briefly overview the phonology and phonetics of contemporary Turkey Turkish and existing work in socio-phonetics of Turkish in order to set the scene for the L1 analysed in this thesis.

2.3 Turkish

2.3.1 Phonology and Phonetics of Standard Turkey Turkish

Turkish is a member of the Altaic language family which is agglutinative and has vowel harmony as a distinctive feature. It has 21 consonant sounds (See Table 2.2), one of which is named as a ‘soft-g’ (whether it functions as vowel lengthening or a consonant is an ongoing discussion among phoneticians, see Unal-Logacev et al. 2014, Unal-Logacev et al. 2019). Despite the closeness in number of consonant sounds (24 in English), Turkish phonology can lead to some pronunciation difficulties among L2 English speakers of Turkish. Here I will summarize the main phonological and phonetic features of Turkish consonants and vowels respectively in relation to potential L2

English pronunciation difficulties. Phonetic characteristics of the target sounds of this study, namely the voiced affricate /ʤ/ and the Turkish vowel inventory, will be introduced in detail in chapters 5 and 7 respectively.

Table 2.2 The Consonant Inventory of Standard Turkish

Manner	Voicing	Bilabial	Labio-Dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Glottal
Plosive and affricate	Voiced	b		d		dʒ		g	
	Voiceless	p		t		tʃ		k	
Nasal	Voiced	m		n					
Fricative	Voiced		ʋ	z		ʒ			
	Voiceless		f	s		ʃ			h
Tap	Voiced				ɾ				
Approximant	Voiced						j		
Lateral approximant	Voiced					l			

One of the common difficulties that Turkish speakers can experience when speaking English stems from the difference in syllable structure between the two languages. Turkish does not allow for initial consonant clusters, and final consonant clusters mostly consist of –(V)CC forms (Kornfilt, 1997). It is nowadays possible to find CCVC word types in Turkish in written form; many are borrowed words such as *spor*-sport, *trafik*- traffic, *klas*-class, and *klüp*-club. One way of adapting a borrowed CC initial cluster in Turkish is to insert a vowel to the onset of the word to change cluster types such as spirit-*ispirto*, station-*istasyon*. Some studies suggest that words not adapted in re-syllabification are broken up by vowel (according to vowel harmony) epenthesis (Van der Hulst & Van de Weijer, 1991, Kornfilt, 2003, Kabak, 2007). However, Bellik (2018) argues that vowel insertion occurs as an intrusion for onset-repairs and epenthesis for coda-repairs, hence it is an example of vowel intrusion. Vowel intrusion occurs post-phonologically at the level of articulation. Bellik (2018) suggests that intrusive vowels differ gesturally and are unable to resist coarticulation effects of a preceding consonant and a following vowel. Whether it is epenthesis or intrusion, it is clear that for L1 Turkish speakers the production of initial consonant clusters is challenging and may lead to variation in their L2 speech production. Regarding the final consonant clusters, Turkish allows for CVC and CVCC word types. CVCCC forms are very rare and can only be observed in loan words such as *horst* (geographical term). In addition, in terms of the Minimal Sonority Distance (MSD) parameter (Selkrik,1982), Turkish CVCC combinations are limited and can only occur in 3 types (Kornfilt, 1997). These 3 types are as follows.

- sonorant + obstruent: *basınç* (pressure), *şark* (orient)
- voiceless fricative + oral plosive: *zift* (tar), *meşk* (practice)
- /k/ + /s/: *boks* (boxing- borrowed from English), *raks* (dance – borrowed from Arabic)

Second, Turkish has a phonotactic constraint for word final voiced stops /b d g/ and for the voiced affricate /dʒ/, whereby these sounds become voiceless in word-final position. Borrowed words with a voiced final sound were adapted with a voiceless equivalent. For example, several words such as *kitab* (book), *meded* (hope) borrowed from Arabic becomes *kitap* and *mede*t in Turkish. When a vowel initial suffix follows these consonants, they are replaced by its voiced equivalents; for example, *kitap-ı* becomes *kitabı*. Although this rule applies to many borrowed words, there are some exceptions where word-final devoicing does not occur such as *miting* (meeting), *lig* (league), *rab* (God).

Another potential pronunciation difficulty might arise from the voiced labiodental fricative /v/ and word-initial liquid sounds in L2. The voiced labio-dental fricative /v/ becomes the glide [w] if it is in intervocalic position (Kornfilt, 2003, Selen 1979). This leads to an intriguing point as Turkish phonologically lacks the glide sound /w/, and it is not clear whether speakers in L2 speech perception and production replace it with its closest orthographic equivalent /v/ or its liquid contrasts. Bohn and Best (2012) examined the non-native perception of approximants by Danish and German speakers and found that phonetic similarities outweighed phonological correspondence in perception. The claim is that speakers of languages such as Turkish or Norwegian with lip-rounding vowel contrasts in L1 would discriminate English glides /w - j/ at high levels as they lack a /w - j/ contrast. Liquids phonologically are not allowed in word-initial positions in Turkish as a general feature of Altaic Languages (Yavaş & Topbaş, 2004). Borrowed words with this feature are produced with a preceding vowel such as lemon – *ilimon* in old Turkish. Yet this feature has been abandoned mostly, and word-initial liquids are found both in the written and spoken forms of Turkey Turkish. Standard Turkish has a tap alveolar /ɾ/ and lateral approximant /l/ in alveolar and retroflex conditions depending on word position (Yavaş & Topbaş, 2004).

In conclusion, some of the phonological features of Turkish discussed above might cause difficulty in L2 English consonant production. First, consonant-initial clusters may cause vowel intrusion (or epenthesis for some researchers) and this might impact L2 English pronunciation of L1 Turkish speakers. Besides, word-final clusters are allowed in limited numbers, thus L1 Turkish speakers' L2 English production may be different than native speakers when they encounter a CCVCC word with obstruent-sonorant order, such as the word *Britain*. Third, Turkish word-final stops are always voiceless, with the exception of some borrowed words, whereas both voiced and voiceless stops are used in English. For example, words pairs like (bag - back) or (bed - bad - bat) might be produced in the same way by L1 Turkish speakers. Finally, Turkish speakers' L2 English productions of the labio-dental fricative /v/, glide /w/, and liquids might vary depending on coarticulation or word position.

Standard Turkish is considered to have 8 vowels, with no diphthongs (Zimmer & Orgun, 1999, Kornfilt, 2013). Standard Turkish vowels are classified according to front/back, low/high, and rounded/unrounded contrasts and have a symmetrical phonological system as presented in Table 2.3(Ozcelik & Sprouse, 2017).

Table 2.3 ***Classification of Turkish Vowels***

	[-] back		**[+] back**	
	[-] round	**[+] round**	**[-] round**	**[+] round**
[+high]	ɪ	y	ɯ	u
[-high]	ɛ	œ	ʌ	o

The English tense/lax classification does not correspond to a phonemic difference in Turkish (Varol, 2012). This can cause production difficulties in L2 English by Turkish speakers, as well as in the perception of non-native vowel contrasts such as /u:/ - /ʊ/ (Swan & Smith, 2001). Turkish has a smaller vowel inventory than English, which might also lead to L2 production difficulties. For example, each language has an /ɛ/ vowel, but the Turkish [æ] is an allophone of /ɛ/ instead of a phonemic contrast. Similarly, Turkish has the /ʌ/ vowel whereas the English contrast /ɑ:/ - /ɒ/ - /ʌ/ does not exist in Turkish phonology. According to SLM-r, if the precision of these sounds involved in the contrast is not strong at the initial learning stage, it is possible that Turkish speakers may not create a contrast among these vowels, as similar sounds cause difficulty in L2 speech. A final note is the diphthong difference between Turkish and English, as Turkish does not have diphthongs or triphthongs. While /j/ can function as a consonant both in English and Turkish, the differences in syllable structure of both languages lead to a difference in its distribution (Yavuz & Balcı, 2011). For example, the word "fire" can be a monosyllabic word whereas in Turkish if there is a following vowel, /j/ would move to the following syllable (e.g., *say* count, *sa-yı* - number).

While it is not directly linked to the aim of this research, it is worth addressing how Turkish vowel harmony might influence the production patterns of speakers in L2. Turkish vowel harmony can be defined as the well-formedness of vowels in suffixes in accordance with the root/stem in terms of back-ness and rounding (Yavaş, 2010, Kabak & Weber, 2013). That is, if the last syllable of a root has a back vowel, suffixes can only be back vowels. Similarly, round vowels cannot exist within the suffixes if the root ends with an unrounded vowel. Demircan (1997) argues that there is no harmony, hence disharmony, in the root of the original Turkish words such as *anne, hangi, hani*. Thus, vowel harmony can be considered as a prosodic unity of the suffix with the previous syllable rather than word level unity. However, some scholars argue that harmony in Turkish roots is no longer active in terms of disharmonic roots (Polgardi, 1999, Clements and Sezer, 1982). A comparative example of the main rules in Turkish Vowel harmony are shown below.

- *barış* /bʌrɯʃ/: + *barış-a/ı,* - *barış-e/i** last syllable is a back vowel (or central) so front vowels violating the harmony.
- *keder* /kɛdɛr/: + *keder'i/e – keder'o/u** last syllable is unrounded so suffix must be unrounded, too.

The above outline of Turkish vowel harmony is typically based on Standard Modern Turkish features and ignores potential dialectal differences. In terms of dialect variation and its relation to this thesis, Trabzon Turkish shows archaic Old Anatolian Turkish features in suffixes, such as *gel-usun*, *gid-esun*, *bak-miş* (Brendemoen, 2002). I would argue that phonological flexibility/variation might be realized differently in L2 speech production. In terms of vowel harmony in Trabzon Turkish, Demir (2021) analysed a corpus of Trabzon Turkish comprised of texts collected and presented by Brendemoen (2002). Demir (2021) argues that Trabzon Turkish shows partial harmony for two reasons. First, due to fixed non-alternating vowel suffixes, backness does not apply in all conditions, yet the following suffix can be alternated accordingly. This may arise from the limited vowel inventory of contact languages in the region or an incomplete stage of vowel harmony. Second, the adjacent velar or labial consonants, irrespective of vowel harmony, enables preceding vowel for rounding. The discussion of Turkish vowel harmony and its potential effect on L2 speech has also been investigated in different aspects as such L2 acquisition (Özçelik et al., 2017), experimental linguistics (Arık, 2015), and word recognition (Kabak, Maniwa, Kazanina, 2010). These studies (Arık, 2015, Kabak et al., 2010) have found evidence that vowel harmony can influence Turkish speakers' word/suffix recognition of nonsense words, which can be transferred to their L2. Özçelik et al., (2017) found that the orthography of Turkish can assist phonological development (i.e., vowel harmony) among L2 Turkish learners, although this dependence decreases in higher proficiency.

Lastly, another phonological difference between Turkish and English lies in prosody. Several scholars claim Turkish is a stress-accent language (Sezer, 1983 as cited in Levi (2005), Inkelas, 1999), while Underhill (1986) considers Turkish to have a pitch-accent. The primary stress mostly falls on the last syllable in Turkish, and its phonetic correlates are loudness and pitch (Kornfilt, 1997) while the number of syllables does not have an impact on this. However, several exceptions such as certain places and personal names, and borrowed words can carry stress on the first syllable. Several affixes in Turkish (i.e., negation, question) lead to non-final stress by assigning the stress to the right of the affixes. (Kabak & Vogel, 2001). Özçelik (2012) propose that the final stress in Turkish should be considered as a boundary tone due to the difference in phonetic cues in relation to regular and exceptional stress. In terms of sentence intonation, the peak occurs at preverbal position, which is the second to the end of a sentence in regular sentence structure. English is a lexical-stress language (Cutler, 2015). In English, stress is mainly on the first syllable if it consists of bi-syllabic words, although it is hard to generalize stress patterns according to syllable count. Research on the role of L1 Turkish prosody on L2 English finds that Turkish speakers lack the prosodic patterns used for articles (a, an, the) in English and may employ different strategies such as deletion (Goad & White, 2009, Snape & Kupisch, 2010).

To sum up, it can be argued that Turkish speakers might have pronunciation difficulties with open-mid and open vowels of English. The tense/lax contrast might be another difficult aspect of English phonology for Turkish speakers to perceive or produce. It is also likely that Turkish speakers might transfer lip rounding contrasts to vowels, even though it does not lead to a phonemic distinction in English. In terms of consonants, word-final devoicing and syllable structure variation may cause difficulties for L2 English learners of Turkish. However, many existing studies and hypotheses concerning Turkish L1 transfer effects on L2 English production are based on Modern

Standard Turkish. There is little known about the extent to which variation in regional dialects of Turkish might lead to variable effects on L2 English speech production. The next section introduces the target dialects used in this study. This will be followed by an overview of research examining Turkish as L1 or L2 variable in speech research.

2.3.2 The Sociolinguistics of Turkish

The sociolinguistics of Turkish largely focused on lexical, morphological, and grammatical variation, while little has done on phonetic variation. Interestingly, the greatest proportion of research is available on the sociolinguistic context of Turkish in relation to teaching English (e.g., Bayyurt, 2013, Doğançay-Aktuna, 1998, Selvi, 2011), whereas ethnographic or variationist sociolinguistic research in Turkish is scarcely available. An earlier attempt at mapping the regional dialects in Turkey was done by Caferoğlu in the 1940s (See Caferoğlu, 1944, 1946, 1948). Although they provide a rich source of vocabulary and morphological variation of the dialects, the phonological variety was obscured as the data was presented using Standard Turkish orthography. More recently, Karahan (1996) presents a dialect map of Turkish dividing the regional dialects into three main groups that are I East Region dialects, II North East Region Dialects, and III West Region dialects, each including sub-regional varieties (See Figure 2.1).

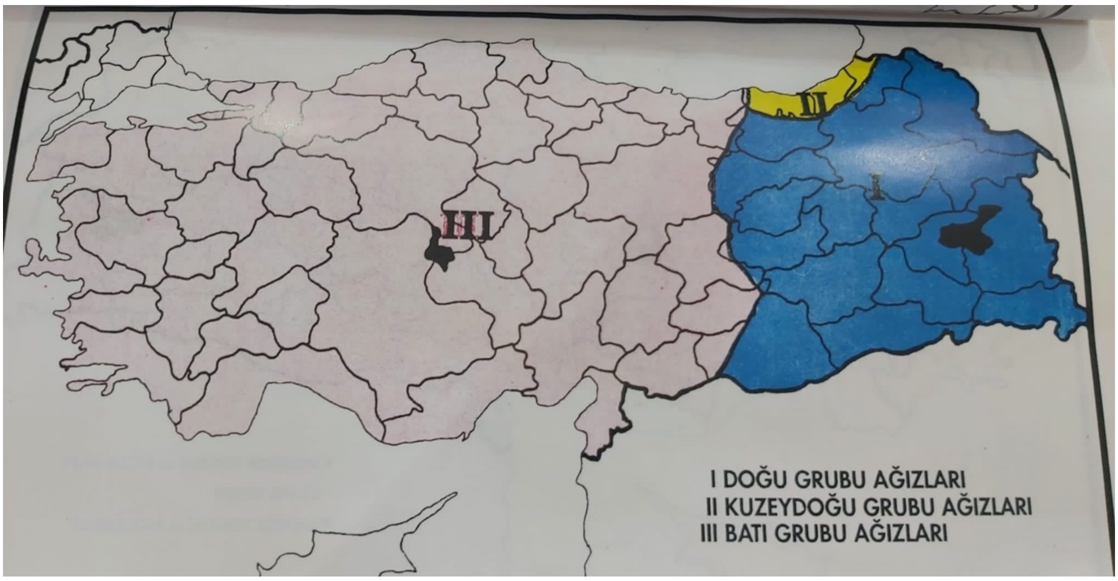

Figure 2.1 Dialect Classification of Turkish (Karahan, 1996)

As can be seen in Figure 2.1 above, this broad classification of regional dialects can be potentially linked to ethnic languages spoken in the region and their influence on Turkish such as Kurdish in the East, and Laz and Pontic Greek in the Northeast. Phonetic variation of regional dialects in Turkish is still not widely examined. Hence, the following outline on the socio-phonetics of Turkish and its regional dialects are based on phonological documentation provided in a small number of Master's theses (i.e., Aydoğdu, 2011, Öründü, 2001). Here, I will narrow down the focus on the description of selected regional dialects and address the very few socio-phonetic studies of Turkish. Lastly, I will discuss the role of Turkish as a variable in phonetic studies.

2.3.3 Review of Standard (İstanbul) Turkish Dialect

The Istanbul dialect of Turkish obtained its prestigious and dominant dialect position through the political and historical importance of Istanbul as a capital. Being the capital city of the Ottoman Empire since 1453, Istanbul was, and still is, the centre of attention for education, business, literature, and art. Although the Turkish Republic moved the capital to Ankara in 1923 to reduce the imperial influence on the new republican regime, İstanbul retained its position as the cultural capital of the country (Aksarı, 2013). One of the greatest aims of the Turkish Republic was to create a national identity during the 1920 and 1930s by focusing on language and education reforms (Çolak, 2004). Alphabet reform and establishing a Turkish Language Association (TDK) to 'purify' the language from the influence of Arabic and Persian are some examples of this policy (Çolak, 2004). Widespread education and language reform together were among the key elements for achieving national Turkish identity. These reforms essentially aimed to reduce Arabic and Farsi lexical influences on science, engineering, and literature, and replace those words with new Turkish rooted words. For example, the word plane was initially *tayyare*, an Arabic word, which was replaced with *uçak*, deriving from verb origin fly: *uç*. To promote language unity, some campaigns like 'Citizen, Speak Turkish' were also launched to encourage/force ethnic minorities to speak Turkish (Salihpaşaoğlu, 2007). The 1982 Constitution of Turkish also banned using languages (such as Kurdish) in press and public if they were not a first language of a country that Turkey recognizes (Gunter,2012). This was removed in the early 2000s to comply with EU minority language policies

Another feature of the early Turkish Republic was the positioning of Standard Turkish on the basis of İstanbul Turkish. Hence, Standard Turkish gained its importance as the most prestigious dialect, symbolizing the high, civilized life which state and intellectual elites represent (Çolak, 2004). In addition, Turkish Radio and Television (TRT) broadcasting, being the only TV channel in Turkey until 1990, imposed a highly strict language policy in line with the state's policy, as even today retired presenters share "how to speak Turkish properly" videos on social media. During the early republic era, the elite society of İstanbul and very prominent authors and poets discarded the use of Ottoman Turkish and produced their novels in İstanbul Turkish. Among these, the poem of Ziya Gökalp (1918-1976), widely considered as the key intellectual to establish Turkish national identity, clearly stated "İstanbul Turkish, the purest, the most elegant for us" (researcher's translation). In terms of pronunciation, Aksarı (2013) stated that Alphabet Reform was carried out corresponding to pronunciation criteria of İstanbul Turkish. He gave the example that the close and open /ɛ/ variation of Anatolian Turkish and /n/ variation was not included in the phoneme-to grapheme reform because these features do not belong to Istanbul Turkish. Following the time of the early republic, İstanbul Turkish kept its prestigious position as Standard Turkish until the late 1960s. After that, İstanbul became the centre of domestic migration waves in the country that potentially led to changes in the dialect while Standard Turkish (rules) remained the same in state policies.

Several phonetic changes in İstanbul Turkish have been reported as a result of rapid urbanization and internal migration. Tekin (1995) pointed out that increasing urbanization and internal migration of people from various Anatolian villages to İstanbul led to an increasing prevalence of local pronunciations within Standard Turkish. According to Tekin (1995) it became common to use close /ɛ/ for the [ä] sound, and open [æ] . Speakers who had migrated from Anatolian villages would typically use /ʤ/ instead of /ʒ/ in words borrowed from French such as jeep-*jip*, gilet-*jilet*, which is similar to pronunciation of these words in English. Another variation Tekin (1995) mentions is the use [x] instead of [q] as an allophone of /k/ among Eastern migrants.

From 1995 to today, Istanbul has been exposed to larger waves of migration, as well as the influence of mass media, widespread technology use, an increase in the number of literate people, and emerging new social classes (Kaya, 2008). This has inevitably influenced the dialect. Bayyurt (2009) claims that the Turkish spoken in İstanbul today is better described as a blend of varieties and dialects of Turkish. Yet, phonetic documentation is not available to describe which varieties these are, or which features of İstanbul Turkish are salient.

I would like to note here that my field trips and discussion with participants gave me the impression that, as of 2021, young people in particular do not think they use a high-status register of İstanbul Turkish. They perceived this dialect as the equivalent of how TRT broadcasters sound, which they found artificial in daily spoken language. The use of Standard/İstanbul Turkish has arguably modernized itself among young speakers. However, some scholars such as Bayyurt (2009) argues that Standard Turkish can be passed to younger generations if it is refined and promoted according to how it is used in the media rather than the natural change in the community. Yağlı (2018) argued that language variation among different social classes all contributes to reshaping varieties of Turkish. It is certain that more research is a prerequisite to understand the factors behind this change and its direction. However, it is also another prerequisite for some researchers to accept the fact that ongoing change is a part of current İstanbul Turkish rather than looking for ways to promote a privileged pronunciation.

2.3.4 Review of Trabzon Dialect

The other regional dialect selected for examination in this study is Trabzon Turkish. There are several reasons for selecting the Trabzon dialect for cross-regional comparison. First, the saliency of this dialect (eastern Black Sea Region) is high among speakers of other regions (Demirci, 2002). Second, the city provides a geographically distant but linguistically preserved dialect area for comparison unlike other eastern cities where Kurdish can be the dominant language. Last, reaching participants was feasible compared to other regions due to researcher's familiarity with the region.

The use of Turkish in Trabzon dates to around the mid-15th century (Brendemoen, 2002). Until the Ottoman Empire took control of the region in 1461, the Pontic Greek empire ruled, and Pontic Greek was the dominant language. Although the population of Turkish speakers reached a considerable level gradually, the prestigious position of Pontic Greek was preserved due to 'intense localism' in the region

(Brendemoen, 2002). Prior to language reform and alphabet change in the early years of the Turkish Republic, population exchange between the Greek and Turkish governments in 1923 resulted in disconnection of the Pontic Greek influence in the region. Other than Pontic Greek, Laz, Armenian, and some Caucasian languages are considered to influence Trabzon Turkish. According to the last census that included language information (1965), the number of speakers of different languages as a native language in Trabzon are: 4535 (Pontik Greek), 1 (Georgian), 11 (Armenian), 72 (Kurdish), and 12 (Arabic) (TUIK, Turkish Statistics Board). At that time, urbanization of Trabzon was 18% while in 2012 it was estimated as 56%. Currently, the status of Pontic Greek is shifting, and the Laz language is threatened in the region according to data from Ethnologue (Eberhard et al., 2022) Despite the lack of recent census information on the use of language in Trabzon, it can be assumed that increased urbanization and domestic migration may have led to monolingual practices in public.

A detailed historical and phonological analysis of Trabzon dialect is provided by Brendemoen (2002). According to Brendemoen (2002), some of the main characteristics of Trabzon Turkish are: the preservation of archaic features of Old Turkish such as long vowels, use of unaspirated voiceless stops, palatalization of velar stops, and dental realization of affricates. However, there is a lack of information on the current status of Trabzon Turkish. For example, it is not known whether there is ongoing sound change, or how young and old people differ in their language use. One can expect that lengthening of compulsory education from 5 to 8 years (in 1997) and then 12 years (in 2006) might enable state language policies to dominate local varieties. Other factors such as internal migration from villages to city centres and widespread use of technology for communication may also have led to some changes in the local dialect. It is also not known how attitudes to local dialects shape the society. There are some studies in relation to Kurdish language use in Turkey (see Coşkun, Derince &Uçarlar, 2011, Öpengin, 2012), but cross-regional accent and identity issues are not investigated at all. Along with the language policies of the state, internal migration from villages to city centres, and from Anatolia to İstanbul have contributed to change of these dialects.

In conclusion, it can be said that İstanbul Turkish was the standard and prestige variety of Turkish. However, the distinction between İstanbul Turkish and Standard Turkish needs further perceptual phonetic research because, while İstanbul Turkish have undergone many changes over the decades, Standard Turkish appears to be less impacted by these changes. Therefore, I defined both İstanbul Turkish and Trabzon Turkish as regional dialects whose speakers were born and raised in the city. I also acknowledge that İstanbul speakers might potentially have first or second-generation immigrant parents who might speak with a regional dialect. In the next section, I will summarize studies which include Turkish as either an L1 or L2 variable.

2.3.5 Turkish as L1 or L2 Variable in Speech Production

There are several studies that investigate the phonetics of Turkish either as an L1 or L2 variable (Denwood, 2006, Aktürk-Drake, 2010). Among these, Levi (2005) provides a detailed phonetic investigation of word level accent and found that F0 peaks followed by intensity are the key cues for pitch-accented Turkish, and that these cues play a role when Turkish learners acquire a stress language such as English. Evis and Kılıç (2020) compared the English lexical stress patterns of loanwords produced by two Turkish speaker groups. They found that Turkish speakers' stress placement was significantly different from native speakers of English. In addition, a treatment group who received lexical stress training performed better in the post-test for isolated utterances. Ng, Chen and Sadaka (2009) looked at vowel features in Turkish-accented American English. Unlike the traditional IPA classification, this study used acoustic closeness/distantness of vowels in American English for Turkish speakers. Measuring F1 and F2 values of close /ʌ u ʊ o/ and distant /i ɪ e ɛ æ ɔ ɑ/ vowels, they found that Turkish speakers produced those vowels significantly differently from native speakers of English, especially in terms of F1 formant frequency. In addition, Ng et al., (2009) found that the vocal tract space of Turkish speakers is narrower compared to American English speakers in the production of English vowels. Sabev (2019) carried out an acoustic study on stressed vowel reduction between bilingual and monolingual Bulgarian and Turkish speakers. This study included İstanbul Turkish speakers as monolinguals and bilinguals aged 18-27. The study revealed that duration was found to be significantly different between stressed and unstressed vowels with minor exceptions both for monolingual and bilingual İstanbul Turkish speakers. Open vowels of Turkish were observed to undergo spectral and durational reduction in unstressed syllables.

Although stop consonants have been widely studied in L2 speech research (Zampini, 2008), there are few previous studies that examine these target consonants across word-initial (for VOT time), word-medial, or word-final (for (de)voicing) position in L1 Turkish in relation to L2 speech. Öğüt, Kılıç, Engin, and Midilli (2006) investigated the VOT of stops in Turkish across eight vowel conditions. Their study on speakers from the Aegean region showed that the voiceless plosives have positive VOT values similar to other languages, yet /k/ has the longest VOT values among all. Comparing these results with the findings of other studies reporting VOT values of English, Öğüt et al. (2006) suggest that there are crosslinguistic differences in VOT values of some stops such as /g/ between Turkish and English (Öğüt et al., 2006). They also show that neither the following vowel nor the gender of the speaker has a significant effect on VOT values in Turkish. However, a recent study by Ünal-Logacev, Fuchs and Lancia (2018) examining the VOT values of voiced - voiceless alveolar stops in Turkish found that /ʌ/ as neighbouring vowel led to a longer duration and a higher intraoral pressure peak, and argued that the surrounding context might be an important factor in the phonetic realization of voiced stops in Turkish. Yet, it is not known whether L1 Turkish speakers alter this difference in L2 speech, and whether (de)voicing of these stops at word-final positions causes variation in L2 speech.

Another segmental focus that been investigated for L2 pronunciation of Turkish speakers is liquids. Demirezen (2013) investigated the pronunciation of retroflex /ɹ/ in American English produced by L1 Turkish PhD students based on auditory analysis. This study argues that most of the participants do not produce retroflex /ɹ/ in L2 English, and instead use an alveolar tap, which is a phonetically similar phoneme of Turkish. Nichols' (2016) acoustic investigation of /ɾ/ produced by Turkish speakers found two main variations: devoiced and fricated /ɾ/ occurs word-finally, and non-fricated /ɾ/ occurs at word-initial or medial positions. Aktürk-Drake (2010) discusses phonological and sociolinguistic factors of /l/ in Turkish with a focus on loanwords from Swedish and Arabic. This study shows that those phonetic details of the native language play a role in perceiving and adapting borrowed words. These studies suggest that Turkish speakers' phonetic realization of the liquids in L2 can be different from the native-like production due to categorical differences as well as positional constraints. Overall, this research suggests that the vowel inventory, stops, and liquids may be the phonetic features for which L1 Turkish speakers show variation in L2 speech production, depending on the other conditions such as L2 phonotactics.

In conclusion, Turkish provides an interesting case for the investigation of crosslinguistic speech production. Despite the existing sociolinguistic documentation, it is not clearly known whether regional dialect differences are phonetically salient or whether there is uniformity toward a standard language speech style in Turkey. Lastly, I aimed to document phonetic studies that served to narrow down the phonetic variables examined in this thesis.

2.4 Summary

This chapter began with the description of influential L2 speech models. Specifically, I reviewed the theoretical background of SLM-r, PAM-L2, and L2LP and recent related studies. It was followed by an overview of the phonology and phonetics of Turkish demonstrating the challenges of L2 English for L1 speakers of Turkish as the L1 of interest in the thesis. Then, regional dialect variation, specifically focusing on İstanbul and Trabzon, are described as well as sociolinguistic and socio-phonetic studies in Turkish.

All in all, it became clear that the coverage area of L2 speech models will be enriched by examining typologically different languages other than Indo-European languages. Turkish, a member of the Altaic language family, can contribute to this with its highly symmetrical vowel phonology, and phonological constraints in consonants. Viewed through the focus of SLM-r and L2LP on subtle phonetic differences, I reviewed whether dialect variation in Turkish would lead to difference in L2 English speech production. Hence, two regional varieties of Turkish were presented with a focus on their salient features in speech. The information presented in this chapter contributed to the formulation of research questions of the thesis, which are presented in the next section.

2.5 Research Questions

The overarching aim of this thesis is to investigate whether subtle differences within L1 phonetic systems, which can be observed through the regional dialects of a language, can lead to variation in L2 speech production. More specifically, I focused on whether Turkish dialect speakers of İstanbul and Trabzon would differ in L2 English speech production. Within the frame of SLM-r (Flege &Bohn, 2021), this research includes early and experienced learners (low and high in L2 proficiency) of age 18-35. Since phonetic variation between regional dialects is not documented for the target age group, two pre-conditional questions aiming to investigate regional variation in Turkey Turkish were also formulated. Consequently, the specific research questions are formulated and addressed below.

RQ1a: Is there phonetic regional variation in the production of the voiced affricate between İstanbul Turkish and Trabzon Turkish speakers?

RQ1b: Do İstanbul Turkish and Trabzon Turkish speakers differ in their production of L2 English voiced affricate?

RQ2a: Is there phonetic regional variation in the production of vowels between İstanbul Turkish and Trabzon Turkish speakers?

RQ2b: Do İstanbul Turkish and Trabzon Turkish speakers differ in their production of L2 English vowels?

The next chapter addresses the methodological issues in designing the stimuli, participant recruitment, data analysis, and description of target regional dialects.

3 Research Communities

This chapter presents a detailed linguistic description of the selected regional varieties of Turkish that form the focus of this study; İstanbul and Trabzon. I will describe the socio-economic and geographical conditions of the two regions in turn, to highlight their potential relationship with language variation in Turkish.

3.1 İstanbul

İstanbul Turkish is considered the prestige variety of the Turkish Republic. Having been a capital city for centuries until 1923, İstanbul kept its powerful position as the centre of education, bureaucracy, trade, and culture. This consequently led to the emergence of İstanbul Turkish, which was the basis of Standard Turkish in the early years of the Turkish Republic (Yalçıner, 2002). Here, I will describe the current profile of İstanbul in terms of linguistic, geographic, and socio-economic parameters.

3.1.1 Linguistic Profile

Although the city is considered the cultural capital, phonetic and sociolinguistic research on İstanbul Turkish is limited. Since current information about the status of İstanbul Turkish is not well documented, I aim to include a historical background so that the changes in the dialect and its recent situation can be fully perceived in terms of its linguistic profile. Early documentation of İstanbul Turkish dates to the beginning of the 20th century, with a specific focus on alphabet reform. Alphabet reform, which involved the replacement of Arabic letters with Latin script in all settings including official establishments, private companies, and personal usage, was launched in 1928. In addition, Arabic letter documents were set to be valid until June,1929 and requested to be renewed by Latin alphabet. The aim of the alphabet reform within the newly established Turkish Republic was twofold; first, it aimed to increase public literacy, which was 10.58% in 1927 according to the national census of the Turkish Statistical Institute (TÜİK,1927). Second, a change from Arabic script to the Latin alphabet aimed to clearly mark the transition of the Turkish Republic away from its imperial background toward the western world (Lewis, 1999).

The Ottoman Turkish was a mix of Arabic, Persian, Turkish with some Greek, Italian, and Armenian words written in an Arabic script (Aytürk, 2004). Thus, in line with the nationalism movement of the Turkish Republic, the language and alphabet reform, which aims to reduce the impact of Arabic and Persian on language used in the Ottoman Empire, aid westernization of society. As cultural and educational reforms are the main focus of the early Turkish Republic, the Turkish Language Council was founded on 23rd of May 1928, and a group of 9 members were appointed by the cabinet to examine methods and the applicability of Latin alphabet for Turkish (Aytürk, 2008). The Turkish Language Council consisted of 9 members, 3 of them were established literary authors who also served as Member of Parliaments (Falih Rıfkı Atay, Yakup Kadri Karaosmanoğlu, Ruşen Eşref Ünaydın), 3 were linguists (Ragıp Hulusi Özdem, Ahmet Cevat Emre, Fazıl Ahmet Aykaç), and the other 3 were civil servants (Mehmet Emin Erişirgil, İhsan Sungu, İbrahim Grandi), who were tasked with pursuing the interests of the public (Aytürk, 2008). The adoption of the Latin alphabet, which is more in line with the phonetics and phonology of Turkish, brought the question of which Turkish variety to set as a standard. Develi (2015) states that the Turkish Language Council chose İstanbul Turkish as the variety that would represent modern Standard Turkish. It was decided that each letter in the newly adopted Latin alphabet would represent a phoneme in İstanbul Turkish, although some scholars argue that it is not fully representative of İstanbul dialect due to unfamiliar structures in the new script (Develi, 2015). Despite some opposition, İstanbul Turkish was mostly accepted as the prestige dialect of Turkish among the intellectuals and authors. It came as no surprise that the modification of the Latin alphabet for Turkish was based on the phonology and phonetic features of İstanbul Turkish, while regional idiosyncrasies are not represented.

Over the years, a number of studies have described the phonological and phonetic features of İstanbul Turkish. Yalcıner (2002) examined the essential phonetic features of İstanbul Turkish between 1930–1950 based on radio recordings of İstanbul speakers. According to Yalcıner (2002), these can be summarized as follows.

- Soft g "ğ" in suffixes generally drops and causes diphthongization or palatized /j/ in some contexts. Soft g dropping can also lead to vowel shortening in suffixes. *yapmağa - yapmaya*
- If followed by /l/, syllable final /r/ and /n/ assimilate as /l/. *diyorlar - diyollar*
- Syllable final /tʃ/ often assimilates to fricative /ʃ/. *açlık - aşlık*
- /t/ assimilates to /d/ if preceding consonants are /s f k t p/.
- /h/ dropping occurs unless it is stressed, while /t/ is dropped after syllable final /s/. *merhaba - meraba*

In addition, Yalcıner (2002) suggested that vowel harmony and labial harmony were not common features of İstanbul Turkish at that time. Winnick (1972) provides a detailed acoustic description of sounds in İstanbul Turkish based on local speakers from İstanbul in the late 1960s. This study proposed that mid lowering of /ɛ/ occurred when followed by liquids in monosyllabic words. In addition, Winnick (1972) also claimed that /ɛ/ became slightly closer if preceded by /k/. Yalcıner (2002) suggested that "closed e" was observed in a small amount of spoken data. More recently, Aksan (1995, as cited in Yalçıner 2002) argued that the occurrence of an open e [æ] among İstanbul Turkish speakers is the result of domestic migration from eastern Turkey. This warrants further research on the acoustics of /ɛ/ in the İstanbul region and its potential change over time.

In terms of consonants, Winnick (1972) provided a detailed phonetic analysis, which is in congruence with the previous phoneme to grapheme match of Turkish with the Latin alphabet, such that each phoneme has one grapheme and allophonic variation is not represented in the writing. Although there have been attempts at an acoustic analysis of consonants in Turkish (e.g., Selen, 1979), none of them specifically aimed to examine changes in İstanbul Turkish. Several phonetic studies of Standard Turkish can be found for stop consonants (Öğüt et al., 2006), fricatives (Ertan & Kopkallı-Yavuz, 2012), laterals (Börtlü, 2020), and soft g 'ğ' (Ünal-Logacev et al., 2019). These studies offer an acoustic, and rarely articulatory, documentation of the target sounds for Standard Turkish speakers.

It is important to note that the terms İstanbul Turkish and Standard Turkish have been used interchangeably in many studies of Turkish Linguistics. However, this simple conflation may misrepresent some important distinctions between the variety of Turkish unique to Istanbul, and the standard variety of Turkish that forms the basis for education at the national level. The substitutive usage of Standard Turkish for İstanbul Turkish might stem from the fact that language policy and related reforms during the 1920s and 1930s in the new Turkish Republic were made according to İstanbul Turkish and its prestigious status. This might have been valid at the time of language reform; however, I argue that current Standard Turkish is and should be considerably different from İstanbul Turkish for several reasons. First, Standard Turkish has become the medium of education at the national level and exposed to few minor changes in spelling, while İstanbul Turkish has been exposed to changes over decades due to its dynamic population (Yalçıner, 2002). Second, İstanbul Turkish itself includes many sub-dialects for socio-economic, religious, and regional groups, especially following the migration waves beginning from 1950s. Although the alphabet reform was claimed to be based on İstanbul Turkish of the 1920s, the fact that it includes features that cannot be observed in İstanbul Turkish (Develi, 2015) put a slight distinction between the two. Thus, it can be claimed that the standard language is the language of state that is used widely in formal environments such as public and private schools, government agencies, and local administrations. This shows us that "the received pronunciation of Turkish" is the one related to education rather than wealth, social class, region, or ethnicity.

It is worth mentioning that formal primary and secondary education of Turkey is controlled and conveyed by the Ministry of National Education. The word "national" here emphasizes a law that the Turkish Republic introduced in the early 1920s for the unification of education. This law aimed to ensure that the language of schooling practices, curricula, textbooks, and teacher education would be uniform nationwide. Thus, the use of Standard Turkish in educational and formal setting would either reduce the use of regional dialects or confine it to informal settings. I argue that Standard Turkish can be presented by any Turkish speakers who received compulsory education at state schools, and whose speech is unaffected by any salient regional pronunciation features. The scope of Standard Turkish speaker is beyond the İstanbul region as the origin of speaker. Several studies where researchers describe speakers from Ankara, the capital of Turkey, İstanbul, or Eskişehir as 'Standard Turkish' speakers support the notion that Standard Turkish may extend beyond the specific variety spoken in İstanbul (e.g., Kopkallı-Yavuz, 2010, Börtlü, 2020).

In addition, over the last century, İstanbul Turkish has been exposed to drastic changes arising from domestic and international migration waves, industrial development, and the emergence/disappearance of social classes in the city. In terms of sociolinguistics, many aspects of these changes on the influence of İstanbul Turkish have not been well-documented. Data from the Turkish Statistical Institute (TUİK) demonstrates the multilingual status of İstanbul from 1935 to until 1965 in Table 3.1 (Turkish Statistical Institute, 2021). Unfortunately, TUİK ceased collecting linguistic data on the population from 1965. In addition to data from TUİK, the last census information of the Ottoman Empire (Karpat, 1985) has been included here to reflect historical change in the linguistic profile of the city. This data does not include specific language information. Therefore, speakers of nations/religions were included to reflect a rough picture of languages. This is because there are rare cases where ethnicity, religion, and language preferences would not overlap. For example, the Kurdish population is mostly Muslim, but there are also Kurdish Christians and Kurdish Jews, many of whom speak a different native language than Kurdish. Similarly, Muslims include many speakers of languages other than Turkish. These figures can help us understand the change from a multilingual to a more monolingual society as a result of transition from empire to nation. Since İstanbul was always the home of many ethnic minorities from the Balkans to the Middle East and Caucasians, I will only include the languages with the most speakers following Turkish.

Table 3.1 ***First Language Speakers by Nation in İstanbul from 1914 to 1965 (Turkish Statistical Institute, 2021)***

Census Year	Languages/Religion	Population	Percentage
1914	Muslims	560,434	
	Greek	205,375	
	Armenian	82,880	
	Yiddish	52,126	

	Bulgarians	3339	
1935	Turkish	692,460	78.4%
	Greek	79,920	9.1%
	Armenian	39,821	4.5%
	Yiddish	26,435	3%
	Albanian	6722	0.8%
	Bulgarian	4321	0.5%
1965	Turkish	2,185,741	95.3%
	Greek	35,097	1.6%
	Armenian	29,479	1.3%
	Yiddish/Jewish	8608	0.4%
	Albanian	4341	0.2%
	Bosnian	3072	0.1%

Following 1965, it is known that mass immigration from the Balkan countries (late 1980s) and domestic migration, mostly from eastern Turkey, reshaped the social and linguistic structure of İstanbul (Tekin, 1995). This migration and rapid urbanization of İstanbul led to many social changes which can also be observed in İstanbul Turkish. For example, Deniz (2006) found that h-deletion is associated with lower (Kağıthane) and middle (Yeni Bosna) class İstanbul speakers, while upper class İstanbul society (Bebek, Sarıyer) retains the pronunciation of /h/. Gender also influences the pronunciation; such that female speakers refrain from using the vernacular form more than men. In addition to social moves, from 1993 TRT (Turkish Radio and Television), with its notoriously strict standard language policy, such as banning singers or songs which they consider inappropriate for their music and language policy (Yurdatapan, 2004), lost its unique position as the only broadcasting channel of Turkey. In line with changes toward a liberal economic policy in the late 1980s following the military coup in 1980, social movements and developments took a new direction in Turkey that can also be reflected in language use in the media (Adaklı, 2009). For example, TRT eased its language policy, which did not allow broadcasting in ethnic or minority languages, to be compatible with the law of harmonization code of the European Union. Private TV channels started broadcasting in the early 1990s with no standard language policy restrictions on the use of Turkish. The introduction of new media such as private TV channels, the internet and computers has potentially influenced the language use of youths.

A final note is that language variation in İstanbul Turkish can be due to religious beliefs. Being an old capital of an Islamic Empire, some districts of İstanbul are today highly conservative. Combined with the moderate Islam policy of the government since 2002, the language preferences of the religiously conservative neighbourhood are reflected in the linguistic landscape of the districts. That is, there is tendency for using Arabic–Persian words for brand names and public area naming in conservative districts, whereas European origin words are a dominant choice for non-conservative cities. For example, a quick search of the word “cafes” in Google Maps can reveal Arabic and Persian names such as *Keyif*, *Latilokum*, *Erva*, *Sitare*, and *Nefes* in Üsküdar, whereas the names used in Beşiktaş include The Best, Café Bias, Café De Cuba, Happy Moon’s Café, Stuttgart, Pati Café, Mugshots, and Café Swiss. These two districts are very close by transportation (10 minutes by ferry) although they do differ in terms of socio-economic factors. The lack of research on the socio-phonetics of İstanbul does not allow me to discuss whether this religion-based division can also be observed in the pronunciation of İstanbul speakers.

Finally, Turkey is home to 3.7 million officially recorded refugees and asylum seekers, along with other refugees from mostly Syria, Iraq, and Afghanistan (as of 2021 according to the United Nations Refugee Organization). İstanbul hosts 531,568 refugees, the largest refugee population in Turkey. However, due to a lack of information on their first language and second language background, it is difficult to draw a clear-cut framework for the current linguistic profile of İstanbul.

In conclusion, one can conclude that İstanbul Turkish of the early Turkish Republic has been exposed to some changes over time. Current demographic data, however, provides an incomplete profile of the language use in İstanbul. Therefore, sociolinguistic, and socio-phonetic examination is a core necessity in order to understand strata of the city. Along with this linguistic profiling and despite the lack of data over the last two decades, I aim to describe the geographical and social profile of İstanbul in the next section.

3.1.2 Geographical and Socio-economic Profile

Geographic profile: İstanbul is in the north-west of Turkey. It the biggest city of Turkey in terms of population with 15,462,452 residents while it is 64th of 81 in terms of size. The city is grouped in the Marmara Region and is divided by the Bosporus, creating an Asian side and a European side. Hosting 18.49% of the total population of Turkey, İstanbul is the leading city of Turkey for commerce, business, education, art, and sports. The city has served as a capital to three empires (Roman empire, Byzantine Empire, Ottoman Empire) over a thousand-year period (AC 330 to 1922). Historically, İstanbul was referred to the peninsula which is today within the border of the Fatih district. It is still considered as one of the central locations of the city. It includes Topkapı Palace, Hagia Sophia, Grand Bazaar, Blue Mosque, Basilica Cistern, and many other historical buildings within the city walls. (See Fig 3.1, taken from the website https://istanbulharitasi360.com/istanbul-ilce-haritasi).

Figure 3.1 Map of İstanbul showing the district borders

In the 1950s, due to economic reasons, İstanbul became the main destination for domestic migration in Turkey. The reason for migration became political after 1980 (Özbay & Yücel, 2001). Migration waves and economic growth of the city resulted in transformation of many rural districts to urban areas in İstanbul. This led to the emergence of new districts for different reasons. For example, domestic migration of low skilled workers centred around Zeytinburnu, Gaziosmanpaşa and Kağıthane, while Kurdish populations located at Bağcılar, Esenyurt, and Sultangazi. A few districts of İstanbul such as Adalar (Prince Islands), Şile, and Çatalca were relatively less impacted by migration and urbanization due to their distance from the mainland of İstanbul. Currently there are 49 districts of İstanbul. Table 3.2 shows the 10 most and 10 least populated districts of İstanbul (Turkish Statistical Institute,2021).

Table 3.2 ***10 Most and 10 least populated districts of İstanbul, with land surface area (Turkish Statistical Institute,2021)***

District	Population (2021)	Size (km^2)	District	Population (2021)	Size (km^2)
1.Esenyurt	957,398	43,12	40. Şişli	266,793	34,98

2.Küçükcekmece	789,633	37,51	41.Büyükçekmece	257,362	157,68
3. Bağcılar	737,206	22,40	42. Beykoz	246,110	310,36
4.Pendik	726,481	180,20	43.Beyoğlu	226,396	8,96
5.Ümraniye	713,803	45,30	44.Bakırköy	226,229	29,65
6. Bahçelievler	592,371	16,57	45. Silivri	200,215	869,51
7. Sultangazi	537,488	36,24	46. Beşiktaş	176,513	18,04
8.Üsküdar	520,771	35,34	47.Çatalca	74,975	1.040,42
9. Maltepe	515,021	53,06	48. Şile	37,904	781,73
10.Gaziosmanpaşa	487,778	11,67	49. Adalar	16,033	11,05

The locations I visited to collect speech production data are Kadıköy, Beyoğlu, Şişli, in public libraries or state and private universities. Kadıköy and Beyoğlu are the central locations of social events for the young population as these districts include many public and private universities. Şişli, a neighbouring district of Beyoğlu, is also a central location for the young adult population working in İstanbul. These locations enable me to reach public and private university students who meet the participant criteria for age and L2 proficiency. Plus, these locations are central transfer points of public transportation between the European and Asian sides, thereby making it a convenient location for worker participants. I would like to note that there are several cases where participants live in another district (i.e., Çekmeköy, Maltepe) but commute to those districts daily either for education or work.

Socio-Economic Profile: The emergence of social classes in İstanbul, and in Turkey generally, occurred in a slightly different way than in European countries due to the late arrival of the industrial revolution. Turkey was mainly an agricultural country in the early years of the Republic. The first 50 years of the Turkish Republic aimed to adapt western capitalism by accelerating its industrialization process (Gevgilili, 1972). By 1961, 52% of the national income was generated through industrialization and 31% was generated through agriculture. Throughout this process, İstanbul was the main centre of industrialization, which resulted in significant immigration to the city. In the early years of the Turkish Republic, İstanbul constituted 5% of the Turkish population while it is currently at 18.71% (Turkish Statistical Institute, 2022). According to data from TUİK, 84% of the residents in İstanbul in 2012 were born outside of İstanbul. However, İstanbul has recently lost its position as the top migration-receiving city as its population decreased by nearly 60,000 in the last two years (2020-2021). Figures also show that, as of 2021, the percentage of residents in İstanbul who were born outside of İstanbul decreased to 47.2%. In 2020, the number of residents who were registered in another city (top five) and lived in İstanbul were as follows: Sivas 768,338, Kastamonu 562,160, Ordu 526,669, Giresun 495,871, Tokat 488,461. Trabzon ranked as the 9th city with 414.453 residents registered in Trabzon and living in İstanbul, Overall, this leads us to speculate that there can be a potential bidirectional influence between the regional dialects and İstanbul Turkish in İstanbul, yet the degree or the prestigious position of İstanbul Turkish is not fully explored.

The socio-economic profile of the cities/districts can be measured through several parameters such as education, transportation, and the House Price Index (HPI). Among these, I focused on HPI to reflect the affordability of buying a house in İstanbul. I compared the public transportation facilities and average travelling time to the Fatih district as it is the centre of the city. Lastly, information about the average green area per person in those districts is included for a fair comparison. HPI data are taken from Endeksa, which is a real-estate investment website founded in 2020 (https://www.endeksa.com/tr/, n.d.). Public Transport information was gathered via the İstanbul Municipality Metro website (https://www.metro.istanbul/YolcuHizmetleri/AgHaritalari, n.d.). The last parameter is based on a column published in the newspaper *Haberturk* (Boğazlıyan, 2019). The top and bottom districts of İstanbul in terms of HPI, transportation and green areas are presented in Table 3.3.

Table 3.3 ***House Price Index and related parameters of the districts of İstanbul***

Districts	**House Price Index (₺)**	**Average travel time to central**	**Public Transport**	**Green area per person (m^2)**
1. Sarıyer	₺15.629/m2	54 minutes	Metro, bus,	10
2. Beşiktaş	₺14.475/m2	39 minutes	Metro, tram,bus, ship,	10
3.Bakırköy	₺11.868/m2	28 minutes	Metro, metrobus, tram, ship	10
4. Kadıköy (Asian)	₺11.314/m2	36 minutes	Metro, bus, ship, metrobus	2.8
5. Beykoz (Asian)	₺11.138/m2	53 minutes	Bus, ship (rare)	740
6. Adalar (Prince Islands)	₺10.752/m2	95 minutes	Ship only	2.7
45. Esenler	₺3696	34 minutes	Bus, metro,	1
46.Sultanbeyli	₺3392	59 minutes	Bus,	11
47.Sancaktepe	₺3263	63 minutes	Bus, metro (in progress)	67
48.Arnavutköy	₺3219	47 minutes	Bus	34
49. Esenyurt	₺3792	58 minutes	Bus, metrobus	5

£ /₺: 13.20 (as of 22.10.2021) - £ /₺ : 20.91 (as of 15.06.2022)

This information shows that the average distance to the city centre taken together with the public transportation options may not be a good indicator of the socio-economic profile for the case of İstanbul. For example, Sarıyer, where celebrities, football players, and upper-class businesspeople prefer to live, and Esenyurt, where immigrants and refugees mostly live, have a similar distance to the centre. However, the average green area per person and the variety of public transport are more developed for higher HPI districts. As of 2021, education level data shows that 59% of the population in İstanbul received secondary education, 22% high school, and 19% had an undergraduate degree (Turkish Statistical Institute, 2021).

Lastly, religion can be a sign of social stratification of the İstanbul districts as discussed above. To explore the effect of religion as a social factor, I have compared the number of mosques in each district. The origin of this idea arises from a published critique called *Ezansız Semtler* (towns without Islamic Prayings) written by a famous Turkish novelist and poet Yahya Kemal Beyatlı. This critique discusses that Turkish children were deprived of a national and religious atmosphere due to a lack of local mosques (first published in 1922) in places where mostly European people were gathered such as Kadıköy, Şişli, and Sarıyer, while the Muslim population was dominant in Fatih and Üsküdar. In relation to this, I have compared the districts of Istanbul in terms of the number of mosques they have. As of 2022, data from the Governance of İstanbul (İstanbul Valiliği) showed that the districts with the most mosques are Fatih (350), Üsküdar (196), Ümraniye (147), Pendik (146), Beykoz (137), and Arnavutköy (130). On the other hand, districts with the least number of mosques are Prince Island's (9), Bakırköy (37), Beşiktaş (42), Çekmeköy (46), Güngören (47), and Beylikdüzü (48). Looking at this data at first glance, it can be interpreted that the Asian side of the city has a greater number of mosques then the European side, where it is only the old town Fatih which continues to keep its highly religious position, that can be an invisible sign of eastern/western division of the city.

To sum up, it can be said that the social stratification of İstanbul has very complex layers such as upper, middle, and lower classes which then can be subdivided into religious, conservative, and liberal, in addition to youth-oriented districts. How these stratifications are reflected in the languages of İstanbul in terms of phonetics, sociolinguistics, and socio-phonetics is beyond the scope of this work and awaits further research. However, it is beneficial to be aware of these stratifications that can be useful to control participant recruitment and explain within-group variation if found in the analysis.

Without the existence of factual data for each district, it is difficult to make fair and objective judgements as opposed to personal impressions of the characteristics of each location. The participants of this study were specifically selected from the age group of 18-35. In doing so, I aimed to reach a wider socio-economic profile of participants. As will be detailed later in Section 4.2.2 (Dialect Speakers of İstanbul), participants from İstanbul are undergraduate students or recent graduates, whose socio-economic conditions in İstanbul vary widely (i.e., private vs public university students). In the next section, I will turn the focus to Trabzon city, describing it along the same dimensions, which allows for a detailed comparison between the regional groups of this study.

3.2 Trabzon

There are several reasons why Trabzon Turkish was selected for comparison with İstanbul Turkish to explore both regional variation and its influence on L2 English. First, both cities historically served as capital cities (Trabzon was the capital of Empire of Trebizond between 1204 -1461), thus each city's local dialect might highly be associated with prestige. Secondly, the Turkification of both cities began at around the same time in the 1450s. While İstanbul was a connection point between Asia and Europe, Trabzon was the centre of the Persian-Black Sea junction, a religious melting pot for Christianity and Islam, and provided connections to Caucasia (Turgay, 1993). However, Trabzon has been one of the top cities for emigration since the early years of Turkish Republic due to its limited economic growth capacity, thereby providing a less dynamic social environment for language variation and change. What follows is a concise description of the linguistic, geographic, and socio-economic profile of Trabzon.

3.2.1 Linguistic Profile

Due to scarcity of linguistic data about Trabzon, I aim to draw a linguistic framework based on historical turning points of the city. Trabzon was the capital of the

Empire of Trebizond, a Pontic successor of Byzantine in the east, for nearly two centuries until it was conquered by Fatih the Conqueror in 1461. Starting from its conquest by the Ottoman Empire in 1461, the city received settlements from Turkish tribes. Brendemoen (2002) discusses that despite Turks being the new rulers of the city, Pontic Greek kept its prestigious language status over centuries due to "intense localism". Although the old Byzantine Empire was replaced by the Ottomans, upper-class Christian families kept their political power in local government and received concessions from İstanbul over centuries. These concessions and power in local governing might have contributed to the preserved status of Pontic Greek. At the beginning of the 20th century, demographic information based on a religious census in 1906 showed that the number of Muslim people was 507,503, the number of Greek people was 82,128, and the number of Armenians was 26,583. Between 1915-1917, Trabzon was under the invasion of Russia in the First World War. The invasion and drawback of Russia had two demographic consequences for the city. First, many Turkish people migrated to the western part of Anatolia to escape from the Russian invasion and did not come back following the Russian withdrawal. Secondly, a great deal of Pontic Greek people left the city with Russian troops (Xanthopoulou-Kyriakou, 1991). The reason why Pontic Greek people of the region migrated to Russia can be twofold: first, the arising independence war of Turks can threaten their existence in the region; second Orthodox religion of Russian and Pontic Greek may create a religion-based solidarity. A final drastic change in the linguistic profile of the city was the termination of Greek-Turkish dialect contact in the region. The prestigious status of Pontic Greek in the region came to a sudden end with the treaty of Lausanne in 1923, which included a population exchange between Greece and Turkey. This forced migration between the Greek population in Anatolia and the Turkish population in Greece happened over the next few years (Greek people in İstanbul were exempted from this forced migration).

The population exchange was based on religion rather than ethnicity, and therefore, some Muslim Greek speakers were able to stay in the region, and some Christian Greek people either preferred to convert to Islam to stay in the lands or practiced crypto-Christianity (Hasluck, 1921). This kind of crypto-religion practice was previously reported in several regions of the Ottoman Empire. Many reasons related to financial (taxation by religion), or security (compulsory army duty by religion) considerations underpinned the need for crypto-religion practices. The deportation of Pontic Greek speakers inevitably resulted in lesser use of Pontic-Greek in the region, which eventually led to its loss as a prestigious language. Table 3.4 below presents the demographic and linguistic change of Trabzon from 1914 to 1965. Data of 1914 was based on the administrative borders of Trabzon; hence it is very different from the current administrative borders of the city. In order to minimize the effect of over-population, I utilised a conservative approach to reach population numbers based on the book *Ottoman Population*:*1830 – 1914* (Karpat, 1984).

Table 3.4 ***Demographic and Linguistics Information of Trabzon from 1914 to 1965***

Census Year	Turkish	Pontic Greek	Armenian	Other
1914	235,853	37,730	4,149	-
1935	358,184	2,265	24	42 (Russian)
1965	590,799	4,535	11	316 (English)

From 1965 to this day, there is a lack of data on first, second, and foreign language use in Trabzon, which prevents me from making precise assumptions about the linguistic profile of the city. Yet, it can be argued that a monolingual tendency continued to increase since there was no attempt to reverse it, neither regionally nor at national level. Pontic-Greek is now considered one of the region's endangered languages and spoken only in certain villages in the city (Sitaridou, 2013, Özkan, 2013). In addition, urbanization and the standard language policy of the state might have weakened the use of regional languages and dialects, limiting them to an inner circle between family and friends. However, it is not known to what extent the long-lasting prestigious status of Pontic Greek had left salient features in Trabzon Turkish.

Brendemoen (2002) provided very detailed phonological mapping of Trabzon dialects collected in 1978-1979. This study did not include the linguistic profile of young age groups below 40; rather, Brendemoen takes a historical approach and focuses on non-mobile, rural, and older groups of people who would have been considerably less influenced by Standard Turkish. This study revealed that dialects of Trabzon can be grouped as a) the Beşikdüzü -Şalpazarı region, b) the Of – Çaykara region, c) the Sürmene – Yomra region, d) the Maçka region, and e) the Akçaabat – Vakfıkebir region. Brendemoen (2002) summarizes the salient features of Trabzon Turkish that are mostly across all regions as follows:

- Vowels are similar to Standard Turkish (ST), yet allophonic variation is different due to fronting and backing mechanisms
- /ʌ/ is more fronted than ST / äkɾaba – ʌkɾaba/, /ɯ/ does not occur at anlaut position
- Dental realization of affricates /tʃ/ - /ts/, / dʒ/ - /ʒ/ (confined to Sürmene Yomra region) / ʒɛnɑzɛ - dʒɛnɑ:zɛ/
- Occurrence of unaspirated voiceless stops /te:il - de:il/
- Palatalization of velar stops /k/ /g/ before back vowels
- Tendency for short articulation of consonants in terms of duration

In the next section, I will explain how the geographical and socio-economic profile of Trabzon contributes to its current linguistic profile.

3.2.2 Geographical and Socio-economic Profile

Geographical profile: Trabzon is in the North-West of Turkey with a coastline along the Black Sea. It is the 27th largest city in terms of population and the 68th of 81 cities in terms of size. The city consists of high mountains starting from the coastline and is divided into districts by the rivers between the mountains. The city consists of 18 districts, of which Akçaabat has the highest population (127,331) and Dernekpazarı (3948) has the lowest population. Due to its geography and climate, the city is not convenient for large scale agriculture, and is susceptible to heavy rain and landslides. Some of these landslides (1929, 1967) resulted in forced domestic migration that villagers from Of – Sürmene region were resettled in other cities of Turkey such as Van and Erzincan. The landslide in the Akçaabat region in 1950 led to emergence of a natural lake (Sera Lake), which is one of the tourist resorts in the city. The climate is typically rainy (9 to 14 rainy days per month) and high in humidity (68–77%). The average temperature is between 4–9 ^{o}C during winter and 17-26 ^{o}C during summer.

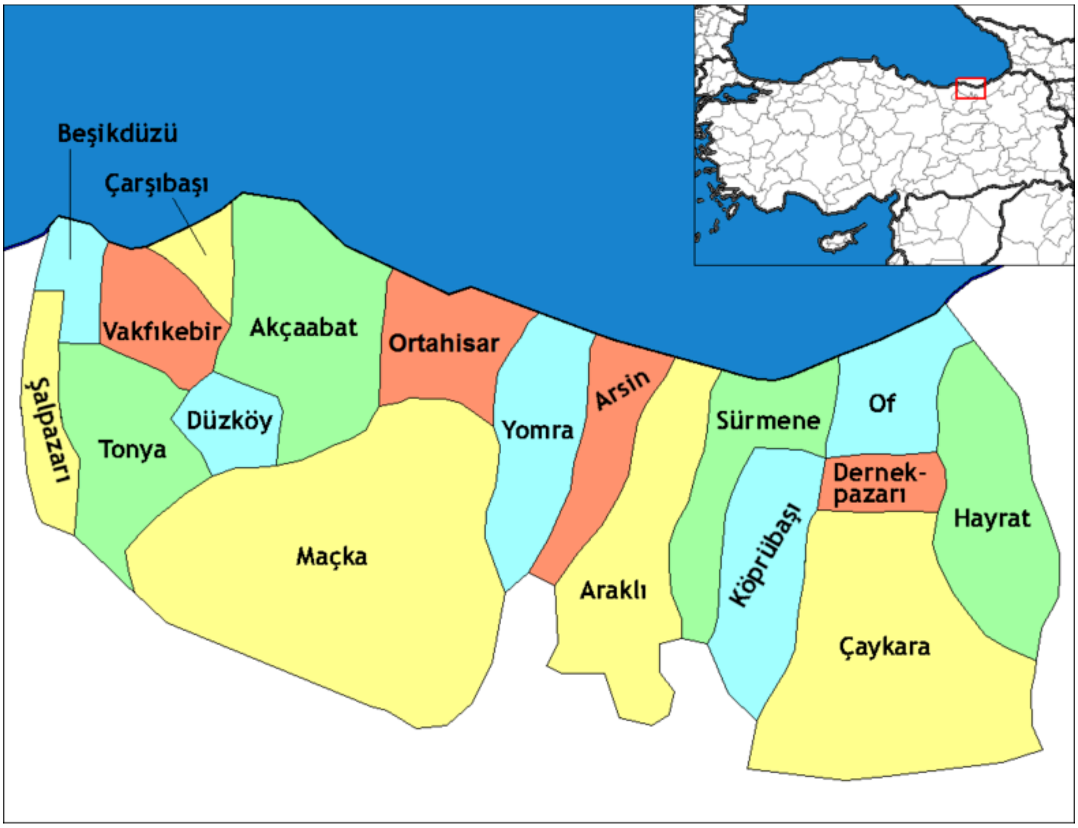

Figure 3.2 Map of Trabzon showing the district borders

Due to the lack of flat terrain in the city, much of the infrastructure has been constructed along the large-scale sea embankment, including a coastline motorway and the football stadium. Tunnels have also been built to provide access through mountainous terrain. Many of the old districts are famous for a local product. For example, Akçaabat is known for fishing and tobacco farming, Vakfıkebir is famous for its special bread, Tonya imports butter and dairy products, Sürmene has traditional knife production. The city is also home to many historical buildings and natural attractions. Among these, Sümela Monastery and Hagia Sophia are important buildings for Orthodox Greeks and now serve as a museum and a mosque respectively. Many of the churches left from Greek and Armenian communities have either been converted to mosques or destroyed during urbanization. The scenic countryside of Trabzon on the high mountains has led to recent economic growth in tourism. A considerable number of foreign tourists from Middle Eastern countries visit Trabzon, with seasonal direct international flights from Bahrain, Dubai, Kuwait and Amman. In addition, a large number of people from Germany (typically as the second and third generations of

Turkish Labour immigration) visit the city during the summer period, and there are high numbers of seasonal direct flights from Germany and the Netherlands.

Socio economic profile: During the Ottoman Empire's reign, the main income sources of the population were fishing, tobacco agriculture, nomadic transhumance, and import of goods through the port. When it was a medieval city, the centre was protected by city walls in the east and west and had a port in the north for transportation and commercial purposes. These walls, albeit mostly broken down, still build up the centre of the city to this day. Like İstanbul connecting Asia to Europe, the port in Trabzon was a strategic one connecting the silk road from Persia to the Black Sea countries. Commerce was mainly conveyed by non-Muslim residents of Trabzon during 18th and 19th centuries. This might be another explanation as to how Pontic Greek maintained its prestige status despite its demographic disadvantages over time (Turgay, 1993). Along with the decrease in non-Muslim ethnicities, the income resources of the city have changed. Although Trabzon port is still the largest and biggest port in the North-East of Turkey, the city lost its strategic status through changes in industrialization and the change in transportation connection. For example, the city was the main transfer point for travelling to İstanbul from Eastern cities until Ankara became the new capital and received transportation development. Since Trabzon was mainly an emigration city, the urbanization rate increased slowly compared to İstanbul. Data from TUIK shows that an 18% urbanization rate in 1965 increased to 49% in 2000 and 56% in 2012. Due to an amendment in the law related to the administrative structure in Turkey, the city was given a metropolis status, thereby reflecting the urbanization rate as 100% in 2013. In practice, it can be assumed that urbanization rate of the city might be around 60-65% as of 2021.

The domestic migration from the eastern parts of Turkey to western cities has influenced the socio-economic profile of many cities. Limited agriculture areas and lack of business opportunities cause residents of Trabzon to migrate nationally and internationally. Losing its multi-ethnic structure after the foundation of the Turkish Republic, and not receiving any domestic migration except for state servants for obligatory service, Trabzon was categorized as a moderate-sized city. Despite this, the city has always managed to receive developmental support from the state. One of several reasons behind this could be the maintenance of the "intense localism" network inside and outside of the region. Another reason could be the export of education and gaining political power, which in turn resulted in developmental support to the city. For example, Karadeniz Technical University, established in 1955 in Trabzon, was the fourth university of Turkey following İstanbul and Ankara despite being the 9th city in terms of population. Political figures from the city always take key roles in administrative positions in governments. Today, as of March 2022, the Minister of Interior, the Minister of Transportation and Infrastructure, the Minister of Trade, and the Minister of Industry and Technology are all from Trabzon. It is highly likely to find a minister who is from Trabzon nearly in every cabinet of the Turkish Republic. Trabzon is considered a conservative-nationalist city (Koç & Alptekin,2016) and it is one of the rare cities where the People's Democratic Party (HDP), a party to represent Kurdish movement, do not have a representative agency due to public reaction in the region. Another characteristic of the city is its high attachment with sports, especially football. Trabzonspor, the football club of the city, joined the first league in 1974 and subsequently became champion in the following years. Being the first champion football club outside İstanbul, this huge success was completely owned by its residents, and, saying "I am from Trabzon" and "I am a Trabzonspor fan" almost meant the same thing for them (Alptekin, 2013). Alptekin (2013) discusses that over-attachment with the football club is also another sign of intense localism and local identity/nationalism of the city.

In terms of economics today, the main income resources in Trabzon are tea agriculture in the east, hazelnut harvesting in the west, and forestry, fishing, and tourism. Data released in 2018 by the Trabzon Chamber of Commerce and Industry shows that income resources of the city economics come from trade (18.2%), agriculture (17.7%), transportation and communication (16.9%), industry (6.7%), building trade (6.7%), and others (26.5%).

To summarize, Trabzon is an old historical city with a limited workforce, mostly in agriculture and trade. Yet, its intense localism enabled it to be the biggest city of the North-East part of Turkey. Today, the city has two state and one public universities, many specialized hospitals, a sport club of each district, and an international port and airport. Although the dialect of the city may change from the East to the West, I did not include micro-categorization of participants given a widespread lack of previous research on the dialect in any sense.

So far, I have described the sociolinguistic status of the two regional dialects of Turkish. As the main research questions examines their speech production in L2 English, I included English speakers as a control group in L2 speech production experiments. Participant selection and brief description of SSBE speakers will be provided later in Section 4.2 (Participants).

The sociolinguistic summary above unfortunately does not provide enough information on the potentially salient phonetic features of each dialect. This creates a need for examining regional dialect variation in Turkish in terms of acoustic phonetics and greater documentation of how this varies by different groups. Thus, I aimed to design instruments to be inclusive of sounds both in Turkish and English. In the light of previous studies about Turkish and marked phonetic features of Trabzon Turkish, I narrowed down the selection of sounds to vowels, the voiced affricate, stops, and liquids.

3.3 Summary

This chapter provided an overview of the target dialect regions in this study. It was framed chronologically and focused on linguistic, geographic, and socio-economic profiles. It aimed to demonstrate how geography and socioeconomics of a region can interact with the linguistic variation in the selected regions. In the next chapter I will address the study design, considerations for preparing speech production materials, and its implementation.

4 Methodology

This chapter describes an overview of the research design of the thesis. The chapter continues with the description of the participants, materials for speech production experiments, data collection, and data analysis for each study. This will be followed by an explanation of ethical procedures applied during and after the data collection process

4.1 Research Design

A two-stage, quantitative research design was employed to address the research questions. The two stages were implemented (a) to explore regional variation in Turkish with a view to selecting features for further investigation, and (b) to examine the potential role of regional dialect features among speakers of İstanbul and Trabzon Turkish on L2 English production.

In Phase 1, two pre-cursor speech production experiments focusing on voiced affricate and vowel inventory differences in Turkish was carried out to examine regional dialect variation between Trabzon and İstanbul Turkish (Chapter 5 and 7). Rationales for the choice of features will be discussed in Section 4.3.1 and 4.3.2 below. Then, in Phase 2, two speech production experiments in English were conducted to investigate the influence of variation in the production of these features in the two Turkish regional dialects on pronunciation of L2 English. In Study 2, the L2 English production of the Turkish L1 speakers was also compared with Standard Southern British English (SSBE) speakers to explore cross-language acoustic differences (Chapter 6 and 8).

The whole data collection period began in June 2019 (pilot study) and lasted until mid-March 2020 when the Covid-19 pandemic occurred[1]. Initially, I had aimed to conduct an exploratory pilot study examining the acoustic phonetics of several Turkish consonants and vowels between the two regional dialects that might cause differences in L2 speech. This pilot study was intended to inform the design of the main studies examining the influence of regional dialect on L2 speech production and perception. However, I had to modify this initial design and removed the L2 speech perception focus due to the time constraints of the thesis and the unavailability of participants to take part in data collection during the Covid-19 outbreak. Thus, the initial data collection for the pilot – which focused on speech production – was expanded to capitalise on the data that had been conducted at the point the pandemic began. I switched the focus of my study to speech production only as a pragmatic solution to the impossibility of collecting perception data at that point in time.

The first round of data collection was completed in Trabzon in June 2019. SSBE speakers were recruited between July and November in 2019 in Lancaster, and speakers from İstanbul were recorded between January and February in 2020. Table 4.1 below summarizes the research design of the thesis. The detailed methods of the studies in Turkish and English are described in the remaining sections of this chapter.

[1] Covid-19 is an infectious disease caused by SARS-CoV-2 virus. It was first reported in Wuhan on 31st of December 2019. The first case in the UK was reported on 29th of January 2020. World Health Organization announced it a global pandemic on 11th of March 2020, which caused a nation-wide lockdown for 3 months.

Table 4.1 ***Research Design of the Phd Project***

Research Design		
	Phase 1	**Phase 2**
Research focus	Regional Dialect Variation in Turkish	Regional dialect influence on L2 English Speech production
Number of Participants	28 (14 Istanbul, 14 Trabzon)	42 (14 İstanbul, 14 Trabzon, 14 SSBE)
Methods	Elicited speech production in Turkish of the voiced affricate and the vowel inventory	Elicited speech Production in English of the voiced affricate and the vowel inventory
Materials	- Word list (voiced affricate) reading text (vowel inventory) in Turkish, - Linguistic background questionnaire	- Word list (voiced affricate) and reading text (vowel inventory) in English, - Linguistic background questionnaire
Data analysis	Acoustic analysis of the speech samples	
RQs	RQ1a, RQ2a	RQ1b, RQ2b

4.2 Participants

In total, 85 participants were recorded for the experiments in three regional locations. Fourteen participants were recruited from each of the dialect groups (Istanbul Turkish, Trabzon Turkish and SSBE) based on data obtained via the Language Background Questionnaire (See Section 4.3.3). In total, 28 Turkish participants took part in Phase 1, and 42 participants took part in Phase 2. The initial aim was to recruit 20 participants for each regional dialect group for a reliable statistical sample. However, I was only able to obtain 14 speakers for the SSBE group due to the Covid-19 outbreak. In addition, I was not able to reach 20 eligible participants for regional dialect speakers, especially in Trabzon region. Therefore, I reduced the number of speakers to 14 across all three groups for consistency. While 14 is lower than I initially planned, it is an acceptable sample size in phonetic studies which is generally low in sample size and power size (Coretta, 2020). Thus, I acknowledge the fact that the number of participants is not large enough for a strong statistical claim in terms of power size.

At the first stage, the aim was to identify age and location criteria to obtain participants. Any participant who is aged between 18-35, lives in the target region, and has A1-2 or above English proficiency was accepted for participation in the experiment. The reason to include A1-2 level English proficiency is to assure that participants can take part in the experiment in English. Since the focus is on speech production, and the fact that proficiency may not be a direct indicator of pronunciation, A1-2 according to the Common European Framework of References for Languages (CEFR) is set for participant selection. CEFR defines A1-2 level speakers as basic users who can understand sentences and communicate in simple tasks as required in the experiment. The age limit was set to between 18-35 for two reasons. First, this thesis is interested in the current usage of regional dialects which can be best grasped in young people's speech. Secondly, English language requirement for the experiment is more applicable to younger speakers as they received a longer compulsory education including English at an early age. In addition to these requirements, any volunteer who reported speech or vision difficulties was excluded from the experiment. Following this, a set of criteria was prepared to aid participant selection. Since domestic migration and mobility is high among younger generations in Turkey due to obligatory military service, university education, or family background, data from the language background questionnaire was used. First, I prioritize candidates who lived in the target region between birth and the age of 12/13. By doing this, I aimed to assure that participants had been exposed to phonological and phonetic features of the regional target dialect from a young age. Secondary criteria were participants' self-identification of dialect usage. Participants who identify themselves as the speaker of the target dialect (according to question in 2.1 in the language background questionnaire) were selected. Based on such criteria, the participant selection for Turkish speakers from the two regional dialects was completed. The same procedure was employed for the selection of SSBE participants. However, in order to meet the minimum level of participants, all participants who identified themselves as a SSBE speaker were included in this group. L2 proficiency levelling was determined based on the questionnaire responses. Since the English language tests and education level varied greatly among the Turkish participants, detailed CEFR based L2 proficiency categorization may not reflect a reliable picture of the data. Therefore, I utilised a three-level broad categorization to determine L2 proficiency based on the L2 exam scores reported in the linguistic background questionnaire. Participants with a low proficiency were categorized as A level, participants with higher grades were categorized as B level, finally participants who have international or nationwide level certificate were categorized as C (if the scores are above a certain level, otherwise they were put into level B).

Since the nature of study is a cross regional accent comparison of L1 Turkish speakers in L2 English speech, I aimed to reach participants in the target cities in Turkey: Istanbul and Trabzon, and in the UK. Participants in Turkey were contacted via flyers (See Appendix A), social media announcements (e.g., Twitter, Facebook), and a snowball sampling technique in which I asked participants to reach out their friends who met the eligibility criteria in the region. In addition to this, I invited several people to take part in the experiment when I heard them speaking with a very strong regional dialect (according to my perception) on public transport or in public areas in Trabzon. I felt that including these speakers would benefit my study as they would potentially be less likely to switch between Standard Turkish and their regional dialect, unlike other participants who were mostly undergraduate highly educated students in Trabzon.

Recruiting suitable participants was, in fact, a substantial challenge in the project. In addition to dealing with participants who would naturally switch between Standard Turkish and their regional dialect, I experienced other difficulties. For example, because the experiments included English production, many speakers in Trabzon assumed that I would want participants who have a good level of English and helped me to find other speakers who had advanced English proficiency but who were not actually from Trabzon. For example, I was directed to a tourist guide and his questionnaire results revealed that he was born in Berlin, raised as a multilingual Laz-Turkish-German speaker, and later received formal foreign language education in English. Since I was not able to easily confirm the language background of participants until I collected their data, field trips typically included recordings of many speakers who were ultimately not eligible for the study according to the experiment criteria. The reason why I could not decline recording these speakers is that rejecting any volunteer recommended by other speakers could be perceived as impolite and cause me to reach fewer speakers. Thus, I aimed to create a participant pool from which eligible cases could be selected for acoustic phonetic analysis. Another difficulty I experienced was the participants' self-definition of dialect usage. For example, several participants in Trabzon region were perfectly eligible according to the criteria. However, they reported themselves as Standard Turkish speaker who does not speak with a regional accent. To decide upon whether to include these speakers in the analysis, speech samples of participants from Trabzon were rated for regional accentedness by 4 people (2 non-linguist İstanbul speakers, 2 linguists) including me. In summary, I selected participants for acoustic analysis according to a) language questionnaire data (i.e., age and location) b) their identification of regional dialect use, c) and the accent rating results.

Detailed background information about the selected participants for each target dialect from the data pool will be presented in the following sections.

4.2.1 Dialect Speakers of Trabzon

Thirty-four participants were recorded in Trabzon. Recordings took place in the city centre and some districts, namely, Yomra, Akçaabat, Tonya, and Beşikdüzü. As mentioned above, I used a Language Background Questionnaire to select eligible participants for acoustic phonetic analysis. Details of the 14 participants selected from

Trabzon based on the Language Background Questionnaire are presented below in Table 4.2

Table 4.2 ***Questionnaire Information of the Selected Participants from Trabzon***

Participant	Age	Region 0 -12	Gender	Life in another city	Duration living in another city	Regional dialect usage and naming	L2 proficiency
P001	18	Trabzon	Male	NA	NA	Bidialectal, Trabzon	A2
P007	30	Akçaabat	Male	NA	NA	Yes, Akçaabat	A2
P008	28	Trabzon	Male	İzmir	2 years (M)	Yes, Black Sea	A1
P010	24	Akçaabat	Male	Ankara	7 years (E)	Yes, Trabzon	A2
P011	26	Maçka	Male	İstanbul,Tunceli	5 months,8 months (M)	Yes, trabzon	A1
P013	28	Sürmene	Male	Ankara	4 years (E)	Bidialectal - Trabzon	A1
P017	18	Beşikdüzü	Male	NA	NA	İstanbul Turkish	A1
P019	18	Beşikdüzü	Male	Zonguldak	4 months(T)	Bidialectal - Trabzon	A1
P020	20	Araklı	Male	NA	NA	No- Trabzon	B1-2
P029	25	Tonya	Male	Russia	1 year (B)	Tonya	A1
P030	26	Tonya	Male	Erzurum	6 years (E)	Tonya	B1
P032	26	Tonya	Male	NA	NA	No - Standard	A1

P033	20	Tonya	Male	NA	NA	Black Sea	A1
P034	18	Arsin	Male	NA	NA	Trabzon	A2

*B: Business, E: Education, M: Military Duty, T: Travel

The mean age for speakers was 23, and all participants were male for this regional dialect group. Unfortunately, among 34 participants, there were only 7 female speakers, all of whom were either born in İstanbul or had experience of growing up in different cities. Therefore, I decided not to include any female speakers as it would create an unbalanced group according to the selection criteria for the experiment. All participants were considered to have acquired Turkish as their first language, while P029 reported that he is a bilingual speaker of Turkish and Pontic Greek/ Romeyka. In addition, only three participants identified themselves as not speaking with a local dialect, another three claimed to switch between local and standard Turkish, and eight claimed that they always speak with the local accent of the region. Two speakers who identified themselves as non-regional speakers were rated from 1 (Standard/Istanbul Turkish) to 5 (regional dialect speaker) by four Turkish speakers (2 linguist, 2 non-linguist). If the overall rating is above 3, I concluded that the speech of those speaker can be considered as a regional speaker of Trabzon. Therefore, I included their data for the acoustic phonetic analysis.

Another interesting point is the L2 proficiency level of Trabzon speakers. Many of the participants reported that they did not receive a foundational year at university nor an English placement test upon acceptance to the university. That is, the language of their university education is in Turkish, and thus, their L2 learning process may either slow down or stop. Although foreign language learning conditions are ideally considered to be similar across the country, it became clear that the socio-economic differences between these cities also influences their L2 learning, as well as other aspects of education. For example, if you study medicine in Karadeniz Technical University in Trabzon, the language of education is 30% English, whereas it is 100% English at Marmara University in İstanbul for the same degree. This type of difference arising from the socio-economic gap between the East and the West part of Turkey in the quality of foreign language education can also be observable in compulsory education. As I followed a broad categorization of L2 proficiency due to a great deal of variety in L2 tests participants received, I have concluded that those who received a foundational year of English education are intermediate level (B) speakers. I categorized participants who did not receive English education at the university and provided L2 English proficiency scores according to high school exams as A level.

Although L2 proficiency level is not an independent variable of the studies in this thesis, it is helpful to be aware of these differences rooted in the socioeconomics of the two research communities when interpreting the results about their L2 speech production patterns.

4.2.2 Dialect Speakers of İstanbul

Thirty-seven participants were recorded in İstanbul at different locations. Among these, 24 were eligible to meet the criteria for being born and raised in İstanbul. Fourteen speakers (6F, 8M) were selected based on the minimum duration spent abroad or in another city. Table 4.3 shows the profile of speakers based on the information from the Language Background Questionnaire.

Table 4.3 ***Questionnaire Information of the Selected Participants from İstanbul***

Participant	Age	Region 0 -12	Gender	Life in another city	Duration of another city	Regional dialect usage and naming	L2 proficiency
P056	27	Çekmeköy	Male	NA	NA	No - Standard	B1
P058	29	Kadıköy	Female	Malta	6 months (E)	No - Standard	C (TOEFL)
P059	24	Çekmeköy	Male	USA	3 months (E)	No - Standard	C
P060	31	Beyoğlu	Male	USA	3 months (E)	No - Standard	C
P064	20	Ataşehir	Male	NA	NA	No - Standard	B2 (TOEFL)
P065	23	Kadıköy	Male	NA	NA	No - Standard	B1
P066	21	Kadıköy	Female	NA	NA	No - Standard	B1
P067	20	Kadıköy	Male	NA	NA	No - Standard	B1
P068	21	Beylikdüzü	Male	NA	NA	No – Standard	B1
P070	20	Pendik	Male	NA	NA	No - Standard	B
P071	20	Ataşehir	Female	NA	NA	No - Standard	A1
P075	24	Üsküdar	Female	NA	NA	No - Standard	A1

P076	25	Beşiktaş	Female	Portugal	3 months (E)	No - Standard	B1
P082	26	Beşiktaş	Female	Canada	6 months,(E)	No - Standard	C

*B: Business, E: Education, M: Military Duty, T: Travel

The mean age for İstanbul speakers was 24 (23.6). Unlike speakers from Trabzon, participants in this group had more overseas experience rather than purely mobility within Turkey. Participants reported that the purpose of overseas travel was mostly to attend English Language Schools and Erasmus exchange programs. This could be another reflection of the socio-economic developmental differences of the two cities, which generally improves from East to West in Turkey.

The participants in this group reported that they did not speak with a regional dialect and that their Turkish was standard in response to question 2.a. in the questionnaire. In terms of L2 proficiency, participants reported that they received a foundational year upon entrance to university or a language placement test. Several participants reported that they received education in private universities that uses international proficiency exams such as TOEFL or IELTS or national foreign language proficiency tests as an alternative to placement tests. State universities located in İstanbul, and Ankara have a higher ranking in the quality of education, making a potential difference in the standard of L2 English education received in these cities and others in Turkey. In addition, the difference in the socio-economic development of the two cities might make travelling abroad for İstanbul residents more affordable compared to Trabzon, thereby impacting the overall L2 language learning conditions. Lastly, the multi-national status of İstanbul as well as being the centre of international business can induce the motivation of L2 learning for the residents of İstanbul. It is for these reasons, the L2 proficiency level of İstanbul speakers were found to be considerably higher than Trabzon speakers. As I follow a broader categorization of L2 proficiency, participants who reported an international exam or have attended language schools abroad are categorized as C level (advanced) speakers. Participants who received a foundational year, or national level L2 exam are categorized as B level (intermediate) if their scores are above an optimal threshold. Other participants were categorized as A (beginner) level.

4.2.3 SSBE speakers as control group

The English Language Education curriculum of the Ministry of National Education does not state any criteria for teaching any target English accents or non-native varieties both for primary and secondary level education (The National Curriculum for English, Ministry of National Education, 2018). The curriculum for English in high school involves pronunciation outcomes for each grade. For example, 9th grade students are expected to differentiate sounds contrasts such as /i:/ - /ɪ/ or /t/ - /θ/ at the end of the educational year. However, the curriculum guidebook does not provide any specific description for a target accent/pronunciation practice. In this study, I included Standard Southern British English as a control group in comparison with Turkish Speakers' L2 English production. This selection was based on the market dominance of English coursebook publications in Turkey that are more representative of British English. I assumed that potential learners would orient more towards the SSBE pronunciation as the content of learning materials heavily consists of British pronunciation and culture. Although there is a recent trend of providing a variety of English in EFL coursebooks, Received Pronunciation or American English is still the dominant model in coursebooks (Vettorel & Lopriore, 2013). It is also the case that the launch of these books and their dominance in the market might show its effects on adolescents and children rather than young adults and adults who are the primary focus of this thesis. Hence, I consider the SSBE variety best suited for crosslinguistic comparison with Turkish speakers of different dialects. Fourteen SSBE speakers were recruited for the experiment and all of them were included for the acoustic phonetic analysis. Participants were reached via flyers and e-mail calls to departments at Lancaster University. Participants were students at Lancaster University at the time of the recording except for P036. Questionnaire information of the participants is presented in Table 4.4. The Language Background Questionnaire was shortened and used only for Section 1 for the SSBE speakers. Similarly, the Turkish word lists and read-aloud text were removed from the experiment. The experiment took around five to six minutes to complete for each participant. The mean age of SSBE speakers was 21, and the gender was balanced (8M, 6F).

Table 4.4 ***Questionnaire Information of SSBE Participants***

Participant	Age	Region 0 -12	Gender	Life another city	Duration of another city	L2

P035	26	Petersfield, Hampshire	Male	Lancaster	8 years	French
P036	28	London (Suburbs)	Male	Lancaster	7 years	German
P037	18	Hertfordshire	Female	Lancaster	2 months	-
P038	20	London	Male	Lancaster	3 years	-
P039	20	Surrey	Female	Lancaster	2 years	Spanish
P040	18	Leatherhead	Male	Lancaster	2 months	German
P041	18	Buckinghamshire	Female	Lancaster	3 months	-
P042	25	Hertfordshire	Female	Lancaster	2 years	-
P043	22	Cheltenham	Female	Lancaster	3 years	French
P044	18	Gloucestershire	Female	Lancaster	2 months	-
P045	20	Exmouth, Devon	Male	Lancaster	2 years	-
P046	19	Reading	Male	Lancaster	1 year	French
P047	25	London	Male	Lancaster	2.5 years	German
P048	21	Brighton, Hastings	Male	Lancaster	years	-

To summarise, 42 participants were selected for the acoustic phonetic analysis from the three regional dialect groups. Gender was balanced for İstanbul speakers and SSBE speakers while it was male only for Trabzon speakers. The next step of the research is to prepare and process the data for acoustic analysis and for doing statistical analysis to answer the research questions.

4.3 Materials

Speech production studies for acoustic measures typically draw on a range of data sampling techniques such as word lists, interviews, and structured elicitation tasks. These techniques have advantages and disadvantages for phonetic investigation (See Boyd et al., 2015 for a comparative analysis of different methods). For example, word lists can provide highly controlled speech, but they may not actually represent the real-life speech conditions. On the other hand, spontaneous speech samples such as open interview recording can represent spontaneous and non-self-conscious speech to a greater extent. However, this sort of sampling can make it difficult to control the co-articulatory environments, overlapping of phonemes, or reaching sufficient repetitions of the samples. In addition, uncontrolled speech comes with its own risks such as a researchers' lack of control over culturally sensitive topics due to his/her potential unfamiliarity with these aspects. Although several studies showed that elicited speech (i.e., read aloud texts) and spontaneous speech can differ in prosody and other acoustic parameters (Batliner, 1995, Hazan & Baker, 2010), some studies argue that controlled speech can also provide similar results to spontaneous data (DiCanio et al., 2015). I selected controlled speech techniques for data collection as I aimed to control co-articulation and word position of the target sounds, which may not be elicited to a sufficient degree through interview methods. Due to the scarcity of socio-phonetic studies in Turkish, controlled speech recordings provide the researcher to eliminate the variables that do not directly contribute to the aim of the research. Controlled speech recordings are also practical in terms of time management. Volunteers' participation can increase if a fixed experiment duration is offered in the information sheet whereas the length of open interviews can vary for each participant, and it may not be convenient for some. Two common controlled speech collection techniques for phonetic investigations 'word lists' and 'read aloud' tasks are used for speech recording of voiced affricate and vowels respectively. I used the wordlist for the examination of voiced affricates as they differ in phonological constraints between the two languages (i.e., word-final position). Since the focus is on one consonant in different word positions, wordlists are more practical to use than a text in Turkish and English which includes position sensitive forms of the voiced affricate with multiple occurrences. For the examination of vowels, (9 in Turkish and 11 in English), read-aloud texts were shown to be a better fit because a) there was not a phonological constraint between the two languages in one-syllable words and b) producing each vowel with repetitions again would take more time than obtaining the whole dataset embedded in a read-aloud text. Thus, I created the wordlists for consonants and selected text for vowels. Unless picture naming tasks are used, this type of stimuli requires participants to have a basic level of literacy skill. For L2 speech production research, the role of orthography on read aloud tasks should also be taken into consideration as speakers can produce non-existent phonological contrasts in L2 based on the orthographic representation in L1 (Basetti, 2017). Bearing those obstacles in mind, I created speech material in Turkish and English for the pilot study.

4.3.1 Material for Turkish Speech Production

For cross-dialectal speech production data in Turkish, the initial aim was to create a data pool by including various sounds. First, the dental realization of the palato-alveolar affricates is widespread articulation of Trabzon Turkish among Anatolian dialects (Brendemoen, 2006). Focusing on these sounds also enabled me to examine the influence of phonotactic conditioning of the voiced affricate in L2 English. I then included words targeting voiced stops in the same conditions, and liquids /ɾ/ and /l/ for exploratory purposes. Lastly, words targeting the vowel inventory of Turkish in word-medial position were included in the list. Although there is not a phonetic comparison of vowels between İstanbul and Trabzon Turkish, the phonological comparison (Brendemoen,2002) suggests differences in the fronting and backing mechanisms between dialects. Since this was an exploratory word list focusing on multiple consonants and sounds, I did not include words as fillers for this experiment to keep the experiment at an optimal length. Instead, each target sound functioned as the filler of other stimuli set.

The Turkish spoken data were collected in two ways: word lists and a read aloud task. Creating a word list in Turkish for phonetic investigation has its own difficulties. First, due to only limited research done so far in Turkish phonetics, there is not a widespread wordlist or minimal-pairs list. Secondly, many one-syllable root words receive suffixes if used within a sentence due to agglutinative nature of the Turkish language. This complicates writing authentic sentences with one-syllable target words. In addition, Turkish vowel harmony and labial harmony constrict the sound options, which creates challenges for investigating cross-linguistic influences. With these difficulties in mind, I selected words with the target sound presented in an imperative sentence form “Lütfen XXX deyiniz (Please Say X again)” instead of using authentic sentences with the target word. This enabled me to use root words while keeping the sentence meaningful.

Following the decision of the target sounds and the controlling sentence, target words were created accordingly. For consonants, coarticulation was controlled by selecting the vowels /ʌ/ and /ɪ/ as neighbour sounds. This was to control the impact of the preceding/following vowel on the acoustics properties of the consonant (Soli,1981). Mono-syllabic words were chosen for word-initial and word-final words, and bi-syllabic words chosen for word medial contexts. Cognate words from English such as “link, data, şov (show)” were avoided where possible to prevent a potential influence of L2 on L1 pronunciation. However, words are included if there is mere orthographic resemblance with no shared meaning (e.g., *dam*: “roof” in Turkish). Word-final voiced stops and affricates are neutralized with rare exceptions and, therefore, were not included in the experiment. Target words selected for speech production in Turkish are presented in Table 4.5 and 4.6.

Table 4.5 ***Turkish Wordlist for voiced stops, affricates, and liquids***

				Vowel context /ʌ/					
Sound	**Word-initial**	**Meaning**	**IPA**	**Word-medial**	**Meaning**	**IPA**	**Word-final**	**Meaning**	**IPA**
/l/	laf	(saying)	[ɫʌf[	ala	(mixed)	/ʌlʌ/	fal	(presage)	[faɫ]
/ɾ/	raf	(shelf)	/ɾʌf/	ara	(to call)	/ʌɾʌ/	far	(headlight)	/faɾ/
/b/	bak	(look)	/bʌk/	kaba	(rude)	/kʌbʌ/	NA		
/dʒ/	cam	(glass)	/dʒʌm/	baca	(chimney)	/bʌdʒʌ/	NA		
/d/	dam	(roof)	/dʌm/	adam	(man)	/ʌdʌm/	NA		
/g/	gam	(grief)	/ gʌm/	pagan	(polytheist)	/pʌ gʌn/	NA		
				Vowel context /ɪ/					
Sound	**Word-initial**	**Meaning**	**IPA**	**Word-medial**	**Meaning**	**IPA**	**Word-final**	**Meaning**	**IPA**
/l/	lif	(fiber)	/lɪf/	ilif	(washcloth)	/ɪlɪf/	fil	(elephant)	/fɪl/

/ɾ/	rica	(request)	/ɾɪdʒʌ/	Iri	(grand)	/ɪɾɪ/	pir	(master)	/pɪɾ̥/
/b/	bin	(thousand)	/bɪn/	kabin	(cabin)	/kʌbɪn/	NA		
/dʒ/	cilt	(skin)	/dʒɪlt/	sicil	(registry)	/sɪdʒɪl/	NA		
/d/	din	(religion)	/dɪn/	idil	(pastoral poem)	/ɪdɪl/	NA		
/g/	giz	(mystery)	/gɪz/	engin	(profound)	/ɛŋgɪn/	NA		

For the investigation of vowels, a word list with a /kVl/ context was created. Since it is impractical to control co-articulation for meaningful words within the same consonantal context, one pseudoword in line with Turkish phonology was included for the vowel list.

Table 4.6 ***Turkish Wordlist for vowels***

Vowel	word	meaning	IPA	vowel	word	meaning	IPA
/a/	Kal	(to stay)	[kʌɫ]	/o/	Kol	(arm)	[koɫ]
/ɛ/	Kel	(bold)	[k̟ɛl]	/œ/	Köl	Pseudoword	[k̟œl]
/ɯ/	Kıl	(hair)	[kɯɫ]	/u/	Kul	(slave)	[kuɫ]
/ɪ/	Kil	(clay)	[k̟ɪl]	/y/	kül	(ash)	[k̟yl]

In addition to the word list, a read-aloud text was selected to use for speech production. Although the material in Turkish includes a word list of vowels, I did not create a wordlist of vowels for English production to balance the number of words in each experiment. As the word list for English experiment includes word-final stops and voiced affricates, including English vowels word list may have extended the overall experiment duration to a degree that participants may become overly fatigued. Thus, the read aloud texts are used for the acoustic analysis of vowels in Turkish and English. In a phonetic transcription of Turkish, Zimmer and Orgun (1992) used the Turkish equivalent of “The North Wind and the Sun”. Deterding (2006) made a comparative analysis of this text with “The Boy Who cried Wolf” in terms of its suitability for phonetic analysis in English. Following Deterding’s (2006) conclusion that ‘The Boy Who cried Wolf’ includes more samples of sounds for phonetic analysis, this text has been widely used for phonetic analysis in English. However, there is neither an investigation of the ‘the North Wind and The Sun’ in Turkish in terms of its fitness for the phonetic purpose nor a comparison for a better text. I argue that the Turkish version of “The North Wind and The Sun” does not cover many phonological and phonetic features of current Standard Turkish, thereby not allowing for a generic investigation. Similarly, many folk stories such as The Boy who Cried Wolf will not provide the most suitable content for phonetics in Turkish. This is because the fact that the combination of fixed suffixes for past (perfect) tense, aspect, personal ending, and plurality in folk story style, along with the vowel and labial harmony in Turkish constrain the variety of sounds occurring together for these types of texts. In addition, folk stories do not include borrowed words, which violates many rules of Turkish phonology. For example, word-final devoicing is a feature of Turkish. However, in the case of recent borrowed words such as “blog” and “block”, it is not known whether Turkish speakers are able to perceive or produce this contrast in Turkish.

Considering these critiques of existing options, for this study, I selected an introductory paragraph from the novel “Crust Man/Kabuk Adam” written by Aslı Erdoğan. Although this selection does not solve all the problems of the suitability of a Turkish text for phonetic analysis, I propose that it provides a wider variety of sounds for phonetic investigation. A short comparison of The North Wind with Crust Man in Turkish elucidates the suitability of each text. Orthographic and IPA transcription of both texts are presented in the appendices section (See Appendix B). Here, I will provide a comparison of these texts in terms of occurrence of consonants and vowels, lexical diversity and density, and syllable types (Table 4.7).

Table 4.7 ***Comparative Analysis of The North Wind and Crust Man in Turkish***

	The North Wind	Crust Man
Words in total	65	177
Repetitive words	Yolcu (4), palto (4), daha (4), poyraz (3), kuvvetli (3), güneş (3), ol-root (3)	Bir (11), kadar (3), öykü (3), anla(t) (5)
Repetition percentage	%36.93	%12.98
Missing sounds	/ʒ/	/ʒ/
Restricted occurrence	/t/, /l/, /r/, /dʒ/, /œ/, /y, / ʃ/, /z/, /f/ Missing word-initially	/ɯ/, /l/, /y/, /p/ missing at word-initial
Soft ğ sample	3 (/..uğu/)	Eğer, iği, uğu, more option of vowels
3 Sample for each vowel	No /œ/, /y/ at word-initial	No /ɯ/, /y/ at word-initial
Tense	Simple past, past continous,	Simple past, simple present, future tense, future
Syllable types	CV (%53) CVC (%39) VC (%6) V (%1) CVCC (%.0.5)	CV (%50) CVC (%39) VC (%5) V (%5) CVCC (%0.40), CCV (%.0.20) * (tro)

The Crust Man, which is used in this research, provides moderately more options for sounds to be compared at different word positions than The North Wind, as presented in Table 4.7. With that being said, the need for a customized text in Turkish for phonetic description and investigation is evident. This word list and text builds up the first phase of the experiment for cross dialectal examination of Turkish. In the next section, I will describe the procedure of selecting stimuli for L2 English speech.

4.3.2 Material for English Speech Production

Following the same co-articulation criteria in 4.3.1, a wordlist of target sounds was selected in English. In addition, word-final voiced stops and affricates were also included in English wordlist. This allows me to examine whether the two regional dialect speakers of Turkish show uniformity for a new phonological feature in L2 English. As the consonant environment of the vowel word list /kVl/ in Turkish were not applicable to all vowels in English, a wordlist of vowels in English was not included. Instead, the reading text was used to facilitate a wider range of unplanned analyses, one of which ended up being vowels. This also helped to keep the overall wordlist at optimal length for participants as the consonant wordlist in English included more samples in total (with the addition of word-final consonants). For the acoustic analysis of vowels in Turkish and English, "The Crust Man" and "The Boy Who Cried Wolf" (Deterding, 2006) texts were selected in Chapter 6 and 7 respectively. Table 4.8 below presents words used for the speech production experiment.

Table 4.8 ***English wordlist for voiced stops, affricates, and liquids***

	Vowel context /a/					
Sound	**Word-initial**	**IPA**	**Word-medial**	**IPA**	**Word-final**	**IPA**
/l/	laugh	/lɑːf/	Bally	/bæli/	foul	/faʊl/
/r/	rap	/ræp/	Carry	/kæri/	par	/pɑː/
/b/	back	/bæk/	Cabbage	/kæbɪʤ/	badge	/bæʤ/
/ʤ/	jam	/ʤæm/	Ajar	/əˈʤɑː/	cab	/kæb/
/d/	dam	/dæm/	Madam	/mædəm/	mad	/mæd/
/g/	garb	/ɡɑːb/	Baggage	/bægɪʤ/	bag	/bæg/

	Vowel context /ɪ/					
Sound	**Word initial**	**IPA**	**Word-medial**	**IPA**	**Word-final**	**IPA**
/l/	leaf	/li:f/	Belly	/bɛli /	feel	/fiːl/
/r/	rib	/ɾɪb/	Berry	/bɛri /	peer	/pɪə/
/b/	bin	/bɪn/	Cabin	/kæbɪn/	nib	/nɪb/
/dʒ/	gin	/dʒɪn/	Pidgin	/pɪdʒɪn/	bridge	/brɪʤ/
/d/	dean	/di:n/	Midi	/mɪdi:/	need	/niːd/
/g/	gift	/gɪft/	Vegan	/viːgən/	fig	/fɪɡ/

The English Text "The Boy Who Cried Wolf" and its IPA translation are provided in Appendix C. These texts and wordlists in Turkish and English built up the data pool for speech production samples. Among the samples, I selected the voiced affricate to be analysed for regional dialect variation and L2 English production due to its potential saliency in Trabzon region (which is not the case for liquids or velars). Similarly, vowels are selected for analysis as the cross-regional phonological comparison studies offer a potential variation, specifically in front-back contrast (Brendemoen, 2002). Along with the wordlists and read aloud texts, what follows is an explanation of the Language Background Questionnaire which I employed to gain knowledge about participants' regional dialect and second language usage.

4.3.3 Language Background Questionnaire

The language background questionnaire used in this research is an adaptation of the Language Experience Questionnaire (Harding, 2012). The original questionnaire can be accessed online in the IRIS Database (Marsden, Mackey, & Plonsky, 2016). While adapting the questionnaire, there were two foci: regional dialect experience and second language experience. The questionnaire consists of 4 sections (See Appendix D). The first section aims to collect information about the participants, such as age, gender, L2 education/proficiency level, and experience living abroad. For example, regarding L2 proficiency, participants were asked whether they have taken an international or national level foreign language exam. In the case that they have received no language assessment certificate at national level, details were asked about university level exams. Many undergraduate courses in Turkey require a certain level L2 proficiency depending on the subject. Thus, students receive a foreign language placement test prior to their studies at universities. They receive either a foundational course in English for a year or begin their subject straightaway according to the placement test results. If participants are high school graduates, their high school grades are taken into consideration. According to the English Language curriculum of the Ministry of National Education, students are supposed to begin with A1 level at 9th grade and reach B2+ level at their final year (12th grade) based on CEFR descriptions. However, teaching conditions are not equal nationwide due to insufficient resources, which can increase the gap in teaching and learning between rural and urban schools (Çiftçi & Cin, 2018). Hence, there is the potential that students cannot reach the desired level of L2 proficiency in practical terms. For these reasons, I assumed that participants with a high school graduate background may be at A1-A2 level if their most recent exam score was not above 85 out of 100.

The second part focuses on the participants' experience with their regional dialect exposure and usage. The questions focus on whether participants identify their language use with the regional dialect they live in, whether they categorize their speech to a specific dialect, how familiar they are with the regional accents, and their usage of the regional accent. The third section of the questionnaire seeks information on second language and regional dialect usage in the participants' daily lives. Since L2 usage and regional accents will be at different levels/strengths for individuals, the questionnaire aimed to gain insights into how participants describe their dialect usage. The questionnaire ends with an open comment section on the language experience of participants in case they would like to report a specific thing on their regional dialect or L2 usage.

So far, I have defined the target regional dialects and the stimulus of speech production experiment. In the next section, I will discuss the data collection procedure.

4.4 Data Collection

4.4.1 Recording Environment

A desirable recording environment for speech production experiments would be a recording studio/lab as the elimination of noise is a key problem (Ladefoged, 2003). Since finding a studio-like recording environment on field trips can be difficult, I aimed to record participants in quiet rooms with comfortable furnishings (e.g., desk, chairs, carpets) to prevent echoing, while receiving optimal day light (Bowern, 2008). Priority was given to university lecturer offices or university research labs, which provide a better recording environment as well as being a convenient location for participants. If participants were not able to travel due to working conditions or timing, the researcher took the responsibility to provide a recording room convenient for them. Places such as a hotel room, a photography studio, a law office, an advertising agency, and a public library group study spaces were used for recordings. In all conditions, water and sweets were provided to maintain the comfort level of participants. Despite the measures taken to prevent noise, some of the recordings were disrupted by *ezan* (prayer callings), or temporary sounds such as an ambulance on the way. In these circumstances, recordings were paused until the background sound level reached an optimal level for recording and the participant felt comfortable once again.

4.4.2 Speech Production Experiment

All participant recordings followed the same protocol. First an information sheet and ethics form were given to the participants to inform them about the aim and nature of experiment. Both documents were presented in English. If requested, I provided a Turkish translation of these documents to the participants who reported that their L2 proficiency level is beginner to lower intermediate. Upon completing the ethics form and questionnaire, participants were also told in Turkish about the nature of the experiment and informed that they can stop and rest at any time of the recording. As speaking in foreign language with a researcher around may trigger anxiety, I found it necessary to inform participants that I had no intention to evaluate their speaking or pronunciation skills in this experiment.

The experiment was audio recorded using a Zoom H1 voice recorder with a built-in microphone with a sampling rate of 44100 Hz and 16-bit quantization as .wav files. The experiment was designed in PowerPoint presentation with Calibri font (44 size for the wordlists, and 28 for read aloud texts) and single spaced. The experiment was completed in four phases. In the first phase, the Turkish wordlist were presented twice in the carrier sentence "*Lütfen XXX deyiniz*". Prior to recording, trials were completed to ensure that participants understood the instructions. Slide transitions were controlled by the researcher to prevent missing data due to potential double-clicks, slips of the tongue, or fast speech. The order of the wordlist in the presentation is randomized and presented to all participants in the same randomized order. On average, this phase took around four to five minutes to complete. The second phase began with instructions about the read-aloud text in Turkish. Participants were asked to begin when they felt comfortable to continue. Estimated time for the completion of this phase varied from two to three minutes. In order to prevent possible influence of the L2, the instructions for Phase 1 and Phase 2 were given in Turkish. By doing this, I aimed to ensure that participants are in L1 mode that their L1 phonetic systems are activated (Grosjean, 1998), which then help preserve potential regional dialect differences.

Phase 3 began with English instructions and a trial for participants to familiarize themselves reading aloud in English. The same structural design in Phase 1 is used for the English word list in carrier sentence '*Say XXX again*'. On average, it took 5-6 minutes for participants to complete the Phase 3. Phase 4 began with instructions for the read-aloud text. The Boy Who Cried Wolf passage was presented on two slides to the participants. In the rare case when low proficiency participants stated not knowing the pronunciation of a target word, a written sample was provided according to Turkish orthography. For example, if the participant did not say "pidgin", "picin" was written down on blank paper. However, if participants pronounced the words differently due to their phonological coding of sounds, further repetition was not requested. This was mostly observed as an orthographic influence in words such as "feast" pronounced as [feast] or "third" pronounced as [tiɾd] due to phoneme-to-grapheme matching influence of Turkish. Since this shows the tendency of Turkish learners' L2 speech production patterns, I included those samples in data analysis instead of excluding them as mispronunciation. I would like to note that the written form of pronunciation was provided if participants stop reading and request the pronunciation for a word. In the case of a serious mispronunciation of the target sound in the carrier sentence, I noted down these words and asked participants to re-read going back to related slides following the end of the wordlist presentation. The average duration for the completion of phases 3 and 4 was around ten minutes.

The experimental setting described above is used for Turkish participants from Trabzon and İstanbul Dialects. For the audio recordings of SSBE speakers, Phase 1 and 2 were removed from the experimental design as SSBE speakers were recruited for English production only. SSBE speakers took part in the Phase 3 and 4 of the experiments. The average completion time for SSBE speakers was around 6 -7 minutes.

Any single data collection session inevitably reflects only a narrow aspect of a speaker's linguistic repertoire and it must be remembered that this is the case here too. For example, recalling the language reform, uniformity, and nationalism policies of the early Turkish Republic (See Chapter 2.3.3), I observed that some Trabzon dialect speakers shifted from vernacular dialect to Standard Turkish upon starting the experiment. In broad terms, style-shifting is the social awareness of the speakers of a linguistic variable (Eckert & Rickford, 2002). Although the attitudes might vary for regional dialect perception, it is clear that the language and dialect uniformity policy of Turkey may have an impact on regional dialect speakers' style-shifting in various social contexts. Due to the fact that the experiment included planned and written speech in a formal context, some Trabzon dialect speakers adjusted their speech (at their capacity) to Standard Turkish. Since it reflects the subconscious pronunciation preferences in Turkish, I did not intervene with the participants to change their pronunciation throughout the recordings. However, I acknowledge that the style-shifting did have an impact on the overall speech production of the Trabzon dialect speakers.

In conclusion, the whole experiment took around 15 minutes for each participant. During the recording, no other people were present in the room except for the researcher and the participant. This was done to reduce anxiety of speakers as well as preventing other participants from familiarizing themselves (excessively) with the experiment. In total, 78 participants were recorded in three different cities. From this pool of 78, 42 were selected based on eligibility criteria for the acoustic analysis of regional dialect variation and L2 English production. In the next section, an overview of the methodological approach for data analysis will be discussed while detailed information about the acoustic analysis of each target sound will be provided in the related chapters.

4.5 Data Analysis

Prior to the acoustic analysis, data were processed through several steps. First, each recorded file was divided into tokens using ELAN (Version 5.8, 2019). Each token was tagged for participant code, target sound, word, dialect, and language (See Figure 4.1).

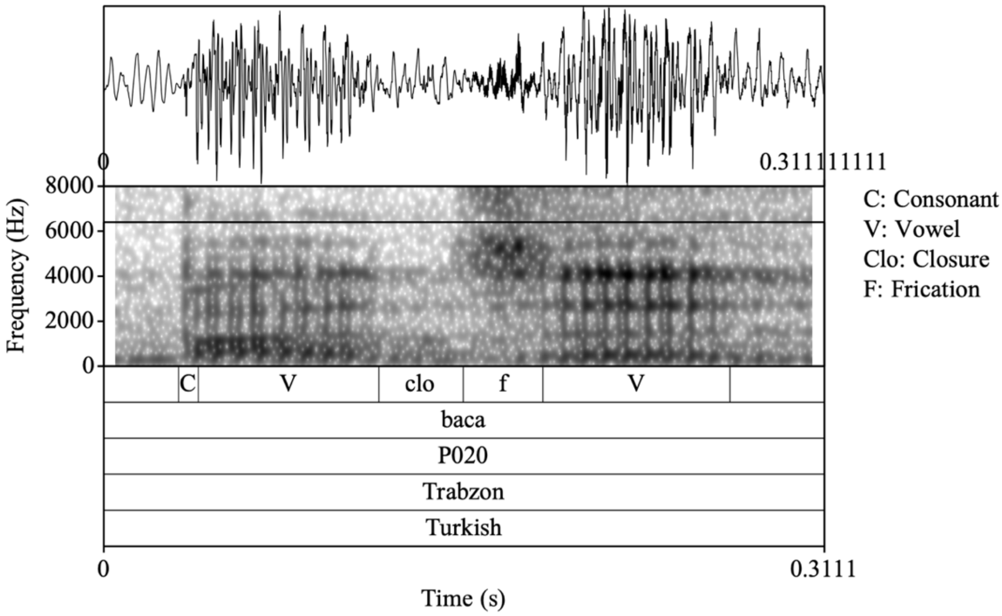

Figure 4.1 A Sample of sound segmentation in Praat

In the case of repetitions where participants produced sentences twice due to a slip of tongue or misreading, I included the second sample as it better fits to the aim of using controlled speech. Following this, tokens were manually segmented in Praat version 6.1 (Boersma & Weenik, 2019) so that acoustic correlates of the target sound could be measured. The acoustic correlates and corresponding segmentation criteria differ in measuring vowels and affricates. Therefore, I will discuss sound segmentation and acoustic measures in detail in the relevant chapters. Numeric values of acoustic correlates for each token were obtained via custom scripts. The remainder of this section focuses on the statistical procedure applied for the analysis of acoustic data. All statistical analyses were done in R (Version, 4.1.2., 2021) using several packages for statistics. For the data visualization and quantitative analysis of the data, I used tidyverse (Wickham et al., 2019), jtools (Long, 2020), wesanderson (Ram et al., 2018), interactions (Long, 2019), and rcolorbrewer (Neuwirth, 2022) packages.

4.5.1 Statistical Analysis

Linear Mixed-Effects Models (LMEM) with a restricted maximum likelihood ratio were fitted to the data for the statistical analysis of acoustic measures in R (Version, 4.1.2., 2021) by using the lme4 package (Bates et al., 2015). Due to the different variables used for each research question in the thesis, details about each model will be explained in each related results chapter. In this section, I intend to discuss the theoretical background of applying LMEMs for statistical analysis. One of the main advantages of using Mixed-Effects Modelling in statistics is flexibility in accounting for the variability within and across participants and items, while appropriately handling missing data (Brown, 2021).

The structure of Mixed-Effects Models contains fixed effects and random effects to determine the degree of association with the outcome/dependant variable. Fixed effects are the variables that are hypothesised to have a relationship with the outcome variable. Random effects are non-independent clusters, which might vary for each grouping factor such as item or participant (Winter, 2019). A generic model of MEMs can be shown as follows:

Outcome variable = fixed effects + random effects (random intercept, random slopes).

Since the degree of variance for each grouping (i.e., item) will differ, the model can be improved by including varying intercepts and varying slopes. The varying intercept allows for the inclusion of the deviation of each participant from the population intercept. Similarly, the degree of variation in a main effect could also be different for each speaker (varying slope). In my study, a varying slope could be the effect of word position on voiced affricate production, with the potential effect of word position varying between participants. Including random intercepts and random slopes are favoured to capture the underlying structure of the data, as it provides more conservative estimates than non-mixed models and reduces the Type I error rate. The outcome variable is the variable which is the primary measure that we wish to understand in terms of the predictor variables. Considering the structure of this study, the acoustic correlates of a target sound such as formant frequencies (i.e., F1, F2, F3) are the outcome variables, while the speaker's regional dialect is a fixed effect. Since the value of acoustic correlates will be different between participants and for each word, speaker and word were included as random intercepts. In addition, the influence of word position (if it exists) will vary across speakers and words. Therefore, I included by-speaker random slopes for the effect of word position in the model. According to this, a sample mixed-effects model application of this study was fit as follows:

```
Sample_Model <- lmer(F1  ~ dialect + position  + (1
|speaker) + (1 |word) + (1 + position | speaker), data
= data)
```

Although the introduction and application of Mixed Effect Models in the field has received great interest, a recent discussion emerged on whether to fit maximal models, or more parsimonious models that reflect only the predictor variables of theoretical interest (Barr et al., 2013). Winter (2019) argued that including every variable to keep it maximal in the model might lead to estimation difficulties and convergence issues. Thus, any predictors which either caused convergence issues or was found not to improve the model were removed from the initial model. Lastly, none of the models included gender as a random or fixed effects due to its unequal distribution among the groups. The physiological influence of gender was reduced using statistical normalization procedures. For example, normalization of vowels can reduce gender-based physiological differences while preserving the dialect-based differences, which is typically achieved by considering relative differences between contrasts in each speaker's vowel space.

Following the fitting of mixed-effect models, a series of Likelihood Ratio Tests (LRT) were used to compare the goodness of fit of the statistical model. LRT tests compare whether the inclusion of a dependant variable improves the model over the simple/nested models. LRT test results are interpreted as the significant difference of the models, and all *p*-values reported in this thesis are the outcome of Likelihood Ratio Tests obtained via model comparisons.

4.6 Ethical Approval

This project was approved by FASS-LUMS ethical committee at Lancaster University. A risk assessment document was also required by the committee to ensure the safety of the researcher as well as the experiment conditions during the field trips. Informed consent was obtained from all participants. Since the experiment focuses on controlled speech samples, recordings did not begin until participants confirm that they are comfortable with being recorded. A copy of the signed consent form and participant information sheet were given to participants (See Appendix E). In the case that participants would like to withdraw from the experiment for any reason within two weeks following the experiment, their data would be removed from the pool. Fortunately, I was not contacted by any of the participants regarding this issue.

4.7 Summary

This chapter addressed the research design of the thesis. Then, I outlined a series of methodological justifications, such as participant selection for the acoustic analysis and the material selection for the speech production experiments in both languages. Following this, a detailed description of the data collection procedure was addressed. Lastly, I discussed the approaches to examine phonetic data, statistical analyses, and the ethical suitability of the research. This chapter along with the preceding theoretical background and research communities chapters have framed the focus of this research. In the following chapters, I will first examine the acoustic correlates of the voiced affricate /dʒ/ in L1 and L2 speech production respectively. This will be followed by an examination of the production of vowels in L1 Turkish and L2 English between the regional dialect groups compared to SSBE speakers.

5 Regional Variation of Voiced Affricate /dʒ/ in Turkish

5.1 Introduction

This chapter aims to examine regional dialect variation in voiced affricate /dʒ/ produced by Trabzon and İstanbul dialect speakers. The voiced affricate /dʒ/ is categorized as a palato-alveolar consonant in İstanbul Turkish, whereas dental realizations such as the allophone [dz] occur in some parts of Trabzon (Brendemoen, 2002). This study aims to provide acoustic documentation of the voiced affricate in Turkish cross-regionally among the younger speakers of Turkish. In this chapter, RQ1a: "Is there regional dialect variation between İstanbul and Trabzon Turkish speakers in the production of the voiced affricate /dʒ/?" will be answered.

The chapter begins with a phonological and phonetic description of affricates, and later details their properties in Turkish in the two regional dialects. The chapter continues with the methodological consideration of measuring the acoustic correlates of affricates, which are then used to explore regional dialect variation in Turkish. This will be followed by presenting the statistical results. The chapter ends with a discussion of results and its implications for language variation in Turkish.

5.2 Phonetics and phonology of affricates

The phonological definition of affricates is an ongoing debate in the field, although their acoustic and articulatory correlates are relatively straightforward (Berns, 2013). Phonologically, three definitions of affricates are proposed to classify this consonant. The Stop Approach classifies affricates as stops with a strident release (Kehrein, 2002). The Affricate Approach proposed by Chomsky and Halle (1968) categorizes affricates as a separate class from fricatives and stops with a delayed release. According to this, stridency and release are different articulatory cues to affricates, which would enable the classification of strident and nonstrident affricates occurring in some languages. Finally, The Complex Segment Approach defines affricates as a separate sound that can show similar patterns to stops or fricatives while also functioning as a natural class on its own (Van deWeijer, 2014). The phonological status of affricates and the validity of these approaches is an ongoing discussion (See Berns, 2013 for a review), but not one that this thesis aims to solve.

Phonetically, affricates are considered to be a homorganic combination of a 'stop + fricative' with a different timing characteristic than a stop + fricative (heterorganic) segment (Tabani, 2013). Acoustically, affricates differ from stop + fricative segments by the amplitude rise time (Johnson, 2011). Affricates have shorter rise time whereas frication noise increases more slowly in fricatives. Several acoustic parameters provide cues about their place, manner, and the voicing characteristics. For example, temporal characteristics of an affricate can be a cue to the voicing contrast, with voiced affricates having shorter closure duration and affricate duration than their voiceless counterparts (Cho, 2017). Spectral characteristics can signal the place of articulation as well as the shape of the tongue (Kochetov & Lobanova, 2007). Centre of Gravity (CoG, or 'spectral mean'), Standard Deviation (SD), Skewness, and Kurtosis are some of the main spectral characteristics of affricates to determine the place of articulation. In addition, some aspects of the surrounding vowel such as F2 transition and the duration of the preceding vowel are also used as an acoustic cue in studies examining affricates. For example, a high F2 in the vowel offset transition to an affricate is considered to be the consequence of a fronted tongue body, thereby signalling palatalization (Cho, 2017).

Most languages have a voicing contrast at the post-alveolar place of articulation (Maddieson & Disner, 1984), while in some languages such as Mandarin-Chinese, it can also contrast in three places of articulation (Kochetov & Arseanult, 2019). In Modern Standard Turkish, there are two palato-alveolar affricates /dʒ/ and /tʃ/ contrasting in voicing (Selen, 1979).

5.2.1 Affricates in İstanbul Turkish

Turkish affricates are phonologically categorized as palato-alveolar (Kornfilt, 2013). Although Selen (1979) provides an acoustic analysis of the Turkish consonants, affricates are the only sound not addressed in this study. To the best of my knowledge, there are no phonetic studies examining the acoustic characteristics of affricates in Turkish. Yet, many researchers agree on the fact that affricates in Turkish are palato-alveolar and contrast in voicing in line with the phonological restrictions of Turkish (Demircan, 1997). Rona-Winnick (1972) describes the voiced palato-alveolar affricate /dʒ/ similarly, with a more palatalized articulation if the neighbouring vowel is front. Ergenç and Uzun (2020) present spectrograms and waveforms of the affricates, but do not provide information on more precise spectral or temporal parameters such as CoG, SD, closure duration, and frication duration. Since aspiration is not a phonemic contrast in Turkish, the classification of the affricates does not typically discuss aspiration.

In Turkish phonology, voiced affricates, and stops are subject to word-final devoicing (with rare exceptions). Loanwords with a voiced final stop or affricate expose to word-final devoicing such as *kitab* (book, Arabic) becomes *kitap*, or Covid - *Kovit* as a recent borrowing in the language. Although the word-initial voiced affricate is not a feature of Old Turkish, current Standard Turkish includes many words with word-initial voiced affricates. In addition, Selen (1979) and Demircan (1997) argue that if an affricate is a final sound of a syllable word-medially, it will assimilate to the following consonant such as *açlık* /ʌtʃlɯk/ → *aşlık* /ʌʃlɯk/, or *necdet* /nedʒdet/ → *nezdet* /neʒdet/. The few studies in relation to the socio-phonetics of Turkish do not describe any social or regional variation in affricates, while Brendemoen (2002) describes the phonological variation of this sound in Trabzon region.

5.2.2 Affricates in Trabzon Turkish

Affricates are one of the most salient features of Eastern Black Sea dialects in Turkish. As discussed by Brendemoen (2002), affricates have different allophones in the regional dialect. /tʃ/ has the [ts] allophone, and /dʒ/ has the dental [d̪z] and [ʒ] allophones. Brendemoen (2002) mentions that the dental allophonic usage of affricates is observed in certain sub-regions of Trabzon. The Eastern side of the city between Yomra and Sürmene districts and the east-end district around Of are the main locations where dental allophonic use of the voiced affricate can be frequently heard. Brendemoen (2006) proposes that these dental allophonic variations of affricates are the result of code-copying from other spoken languages in the region, specifically Caucasian languages and Armenian, which are both affricate-rich languages. With regard to word-final position, Brendemoen (2002) notes that word-final devoicing of stops and affricates is similar between Standard Turkish and Trabzon Turkish. Similar to the case of İstanbul Turkish, I am not aware of any acoustic phonetic analyses of affricates in Trabzon Turkish. Therefore, the current use of these allophones and their salience among younger speakers in particular is not documented. Accordingly, this chapter aims to analyse variation in the voiced affricate in word-initial and word-medial positions in Turkish across two regional dialects. What follows is a brief description of the methodology for data collection and analysis.

5.3 Method

5.3.1 Data and Participants

Fourteen participants from the two dialect groups aged 18 - 35 were selected for the speech production experiments. A word list of voiced affricate /dʒ/ in word-initial and word-medial position across high and low vowel contexts was created for the experiment. Due to the rarity of word-final /dʒ/, I did not include this context in the analysis. Participants were required to read "*Lütfen xxx deyiniz* – Please say xxx" in Turkish. Each word was repeated twice in a randomized order with 40 fillers focusing on stops or liquids. The word list used for the voiced affricate data collection and analysis is presented below (Table 5.1). As I restricted the intervocalic words in word-medial position, selected words in the list below may not be a comprehensive representation of phonological categories and phonetic realisation. For example, Brendemoen (2002) notes that the occurrence of dental variants is more common when followed by a sibilant, which is not controlled in the word list below.

Table 5.1 ***Word List for Voiced Affricate Acoustic Analysis***

Vowel	/ʌ/	/ɪ/

Position	Initial	Medial	Initial	Medial
Word	cam	baca	cilt	Sicil
IPA	/dʒʌm/	/bʌdʒʌ/	/dʒɪlt/	/sɪdʒɪl/

Detailed information about participant background is addressed in Chapter 4. Since Chapter 4 covers the details of word list and experimental design, I will here address the specific measurement of the voiced affricate, while all other experimental details are the same as in Chapter 4.

5.3.2 Acoustic Coding and Analysis

Audio files were segmented into tokens for each target word in ELAN (Version 5.8, 2019). General coding in ELAN included participant code (e.g., P058), target consonant, word, and language. Praat scripts were then employed for processing data as individual sound files and individual sound files were then labelled using Praat to mark the beginning and ending of the relevant interval for each acoustic target measure. As there are not any previous studies on the acoustics of affricates in Turkish, I aimed to include both temporal and spectral features to explore potential regional variation. Acoustic correlates that relate to place of articulation, such as F2 transition or spectral analysis of burst spectrum, are not covered here, as I do not have specific predictions on how these are likely to differ between dialects. Table 5.2 below presents the acoustic measures and their coding criteria on the spectrogram and waveform based on the existing literature on affricates.

Table 5.2 ***Acoustic Correlates of Voiced Affricate, and the Criteria for Segmentation and Measure***

Label	Acoustic Annotation	Measures
Frication	Interval from the onset of frication to offset.	- Centre of Gravity (COG), SD, Skewness, and Kurtosis (Hz) - Duration of frication (ms) - Rising time (amp_peak – amp_onset) (dB)
Burst (if any)	"a sudden rise in sound energy relative to the preceding stop closure" (Chodroff & Wilson, 2014)	- Occurrence of burst (counted as yes/no)
Closure duration (word-medial)	A period of silence from the offset of the preceding vowel to the release of burst/frication	- Duration of closure
Preceding /following vowel duration	The interval from the beginning of periodic waves to burst/closure/frication	- Duration of vowel (Preceding vowel in word-medial position and, following vowel in word-initial position)
Total Consonant Duration	The total length of closure, burst, and frication	- Duration of the target consonant

As affricates are a combination of a stop + frication segment, it is important to investigate each aspect in order to more fully understand variation in production. In the case of regional variation in the voiced affricate in Turkish, previous studies suggest that speakers of Trabzon Turkish may produce /dʒ/ as [dz] or [z] while İstanbul speakers are not reported to produce these distinct allophones. First of all, the presence of a stop burst is coded in order to examine whether a plosive-like sound is produced, rather than simply just a fricative. The burst is defined as a sudden rise in acoustic intensity, which can be observed as a transient or spike in the waveform. In this study, I did not analyse the spectral aspects of the burst spectrum. Instead, the occurrence of 'burst' was coded as yes/no based on the previously mentioned characteristics. If multiple bursts were observed in the spectrogram, the last one before frication was labelled as burst, to ensure consistency across the data. The ratio of 'burst'+ 'fricative' tokens were then compared between groups in order to describe allophonic variation in voiced affricates.

Regarding the frication part of the affricate, both spectral and temporal measures were obtained for acoustic analysis. Among these, Centre of Gravity is one of the key spectral measures both for fricatives and the frication part of the affricates. CoG measures the mean frequency of the frication spectrum weighted by intensity (Kochetov & Arsenault, 2019). Higher values of CoG broadly correlate with a more anterior articulation of the consonant. Standard deviation (SD), or variance/dispersion, indicates the deviation from the CoG, with larger values corresponding to a broader bandwidth (Jones & McDougall, 2009). Kurtosis shows the flatness of the frication spectrum with negative values corresponding to a flatter distribution. Skewness indicates the difference in the shape of the spectrum from the CoG. Positive skewness is correlated with more energy at lower frequencies and negative skewness implies more energy at higher frequencies (Kochetov & Arsenault, 2019). Lastly, the amplitude rise slope of the frication portion is measured, which is calculated as the rate of increase in the root-mean square (RMS) amplitude of the acoustic waveform (Mitani et al., 2006). Amplitude rise slope is considered to be a cue for the manner of articulation and is calculated as the time from the beginning of the frication to the maximum amplitude (Mitani et al., 2006). In addition to these measures, the closure duration (at word-medial position), frication duration, total consonant duration (e.g., closure + burst + frication) and preceding vowel duration were also measured in this study.

An example segmentation of word-medial /dʒ/ affricate is presented in Figure 5.1 below. Numeric results of the acoustic correlates are obtained through a custom Praat script. The script sets the frication spectrum range between 2000 and 11000, excluding the low frequency energy. All files were down sampled to 22,050 Hz, and the spectral moments were computed at the frication onset, midpoint, and offset locations using a Hamming window length of 10 ms. Midpoint spectral moments are selected for statistical analysis as they are considered to provide the most stable portion of the frication with the least influence of vowels. In total, 28 Turkish speakers from the two dialect regions produced the voiced affricate /dʒ/ twice in word-initial and word-medial positions in two vowel contexts, which resulted in 224 tokens. One token was removed from the data prior to analysis because devoicing of the preceding vowel made clear segmentation impossible. The closure phase was segmented only in word-medial positions, thereby resulting in 112 potential tokens in total for the closure duration analysis. However, some tokens did not include a closure transition, reducing the available closure duration token to 84 for statistical analysis.

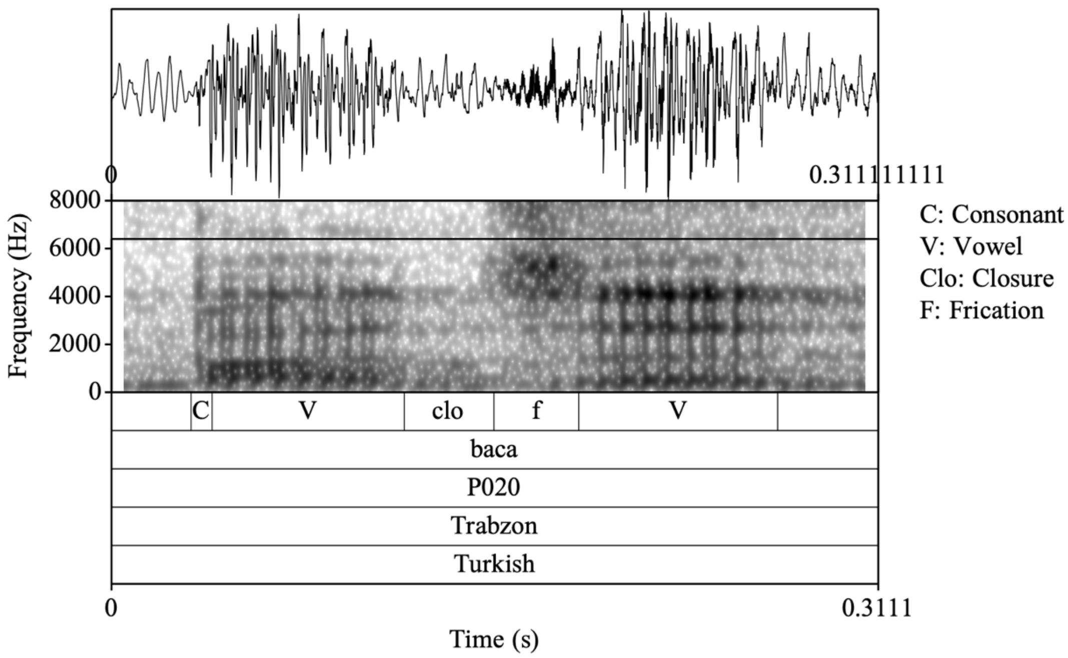

Figure 5.1 A Sample segmentation of the voiced affricate /dʒ/ consonant in Praat

5.3.3 Statistical analysis

Statistical analysis was carried out in R (Version, 4.1.2., 2021). As the primary aim of this chapter is to advance an acoustic description of the voiced affricate production in Istanbul and Trabzon Turkish, I initially report descriptive statistics, followed by fitting inferential models to assess the significance of key predictor variables. It is important to state that all of these measurements are un-normalized. Although normalization is a common procedure to minimize the influence of biological and physiological differences on the vowel and consonant production, I have selected not to apply normalization for several reasons. First, this study does not compare multiple consonants/affricates within a group, instead it focuses on the production of one voiced affricate in two regional dialects. A normalization procedure typically uses the relative distribution of multiple consonants/vowels, which would potentially eliminate the differences arising from dialects while normalizing gender specific variation. Second, studies using 'normalization' of affricates or fricatives vary in methods such as the normalization of temporal aspects only, normalization of amplitude (Nirgianakai, 2014), or proportional duration (Iskarous et al.,2011). Stuart-Smith et al. (2019), in their large-scale dialect and gender comparison of sibilant fricative /s/, state that using non-normalized values of CoG also allows us to account for the potential influence of dialect and gender. All things considered, I chose to not normalize both temporal and spectral acoustic parameters used in descriptive and inferential statistics in order to preserve potential regional dialect differences in the data, and because there was no obvious reference point against which normalization could be conducted. Descriptive statistics for each dialect were obtained using psych package (Revelle & Revelle, 2015) in R (Version 4.1.2., 2021).

In order to investigate the regional dialect effects on acoustic correlates of the voiced affricate, a series of mixed-effect models were implemented in R (Version, 4.1.2.,2021) using the lme4 (Bates, Maechler, Bolker, & Walker, 2014) and lmertest packages (Kuznetsoca, Brockhoff, & Christensen, 2017). A separate model was fitted to each acoustic parameter (nine in total) excluding the affricate burst, which was a categorical variable and is only reported descriptively. Models were designed to test each acoustic parameter of the voiced affricate according to variation across dialect, word-position, and vowel context. Fixed effects were dialect (İstanbul or Trabzon), position (initial or medial) and vowel context (/ʌ/ or /ɪ/). Random effects were ‘word’ and ‘speaker’. Since the production of the voiced affricate may vary for each speaker in each position, a by-speaker random slope for the effect of position is also included in the model. It is worth mentioning that interactions (i.e., dialect * position) are not fitted into the models as the primary focus of this study is to examine regional dialect effects and interactions place a much greater demand on statistical power, making them difficult to reliably estimate without a very large data set. Instead, potential interactional effects are explored qualitatively by examining the data. A sample of the fitted mixed model is demonstrated below:

```
Model.1.a <- lmer( CoG ~ dialect + position + vowel (1 + speaker |position) + (1|word), data = turkish_affricate, REML = FALSE)
```

Due to small sample size of the dataset, this modelling caused convergence issues for several acoustic correlates. These convergence issues either resulted from the by-speaker random slope for the effect of position, or the ‘word’ random intercept. Centre of Gravity and affricate duration converged with the maximal model. Models for dispersion, skewness, kurtosis, and frication duration included the random slope while the ‘word’ random intercept was removed from the random effects. Rise Slope model did not include either the random slope or the ‘word’ random intercept due to the convergence issues.

The fixed effect ‘position’ was not included in the model fitted for ‘Closure Duration’ as closure duration was measured in word-medial position only. Consequently, the by-speaker random slope for the effect of position was also removed, leaving only ‘speaker’ and ‘word’ as random intercepts in the model. A summary of the results of all mixed-effect models in the study is presented in Appendix F.

Significance testing of the fixed effects in the mixed-effects models was evaluated using a Likelihood Ratio Test (LRT). LRT measures the goodness-of-fit of a model with some fixed effect compared to nested model without that fixed effect. If the model with the relevant fixed effect is significantly different from the nested model, then we conclude that the relevant effect is statistically significant. As there are three fixed effects in the model, each full model is compared with 3 different nested models, each one missing one of the relevant variables. The results of the analysis will be presented in the next section along with the qualitative investigation of other acoustic correlates.

5.4 Results

5.4.1 Overview

This section presents the result of statistical analysis on the acoustic correlates of the voiced affricate in Turkish produced by Trabzon and İstanbul speakers. The subsections present the results in the order of spectral correlates and temporal correlates. I will summarize the main findings in the last section.

5.4.2 Descriptive and Inferential Results

Table 5.3 presents the mean values of each acoustic measure of the voiced affricate in word-initial and word-medial position between the two regional dialects.

Table 5.3 Mean Values of Acoustic Correlates of the Voiced Affricate

Dialect	Acoustic Correlates	Word-initial		Word-medial	
		Mean	SD	Mean	SD
İstanbul	CoG (Hz)	4531	624	4664	691
Trabzon		4470	548	4809	607
İstanbul	Dispersion (Hz)	1103	347	1259	357
Trabzon		1083	310	1250	364
İstanbul	Skewness (Hz)	1.64	0.84	1.65	0.88
Trabzon		1.81	0.84	1.54	0.75
İstanbul	Kurtosis (Hz)	6.61	7.42	5.37	4.81

Trabzon		7.07	7.53	4.94	4.43
İstanbul	Rise Slope (dB)	3.23	2.36	2.35	1.45
Trabzon		2.83	2.83	1.72	1.33
İstanbul	Frication Duration (ms)	40	10	40	10
Trabzon		40	40	40	10
İstanbul	Closure Duration (ms)	-	-	30	10
Trabzon		-	-	30	10
İstanbul	Vowel Duration (ms)	100	30	80	20
Trabzon		110	20	80	20
İstanbul	Consonant Duration (ms)	40	10	60	20
Trabzon		50	20	60	20

The descriptive results in Table 5.3 suggest that the mean temporal correlates of /dʒ/ are not substantially different between Trabzon and İstanbul speakers. Regarding the spectral acoustic parameters, the rise slope of İstanbul speakers is higher in word-initial and word-medial positions than Trabzon speakers. Rise slope is one of the acoustic parameters that discriminates voicing and manner of articulation (affricates vs fricative). For example, the rise slope is typically steep for affricates whereas it tends to be flatter (or shorter) for fricatives. This suggests that the voiced affricate may slightly vary in terms of manner of articulation. Higher Centre of Gravity values correlate with the anteriority of the constriction (Stevens, 2000, Gordon et al., 2002). While Istanbul speakers have higher CoG values in word-initial position, Trabzon speakers have higher values when it is in word-medial position, suggesting that the effect of position varies between dialects to some extent. The differences in dispersion, skewness, and kurtosis are nearly identical between dialects.

In summary, the two dialects show relatively few mean differences in the production of the voiced affricate /dʒ/. However, the above analysis does not consider the effect of word-position or vowel context, which will be explored in greater detail below.

5.4.3 Spectral Analysis of the Voiced Affricate Variation

Centre of Gravity (CoG) is a proxy for the place of articulation, with higher values suggesting a more anterior articulation. LRT model comparisons revealed that there was no significant effect of dialect (X^2 (1) = 0.0774, p = .780) and vowel (X^2 (1) =1.1608, p = .281) on CoG, but there was a significant effect of position on COG (X^2 (1) = 4.9074, p = .026) (See Figure 5.2). CoG is higher in word-medial position in both dialects, especially if the preceding/following vowel is /ʌ/.

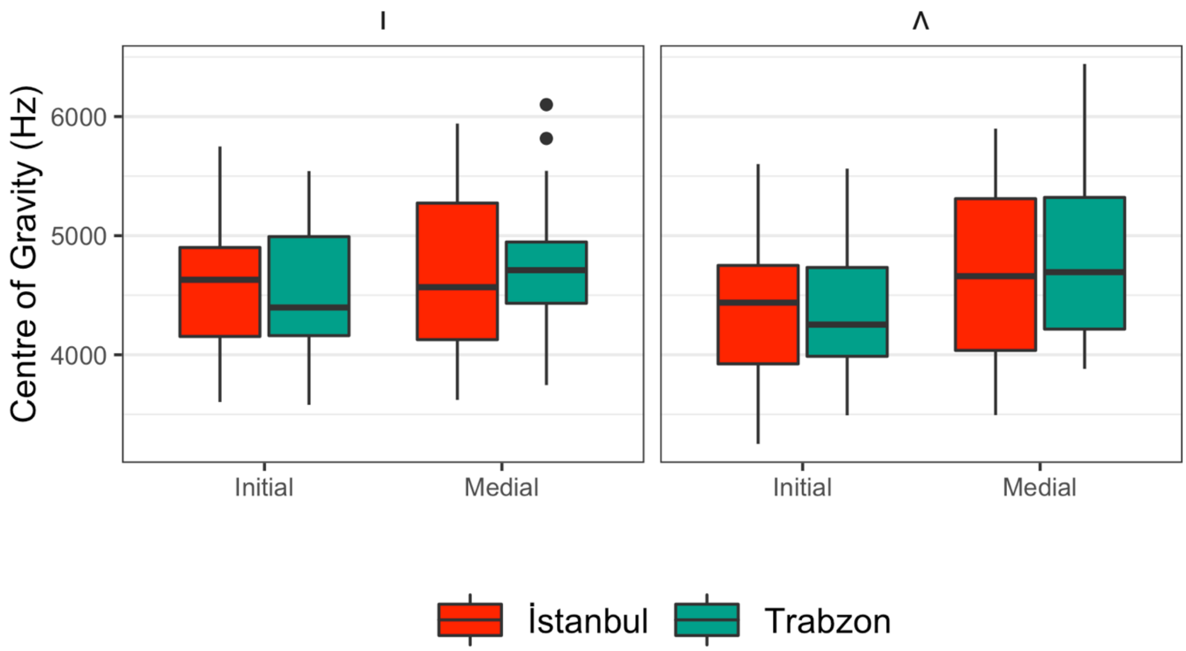

Figure 5.2 Box plot of Centre of Gravity of voiced affricate /dʒ/ between İstanbul and Trabzon Turkish

While there is no significant regional dialect influence on the production of voiced affricate /dʒ/, Figure 5.3 below reveals how dialect interacts with vowel context and position. It suggests that the production of Trabzon speakers is influenced by position more than İstanbul speakers, specifically word-medial position in the /ʌ/ vowel context. This may stem from variation in the low vowel between regional dialects (see Chapter 7), thereby suggesting that dialect variation in vowels may interact with the production of neighbouring consonants.

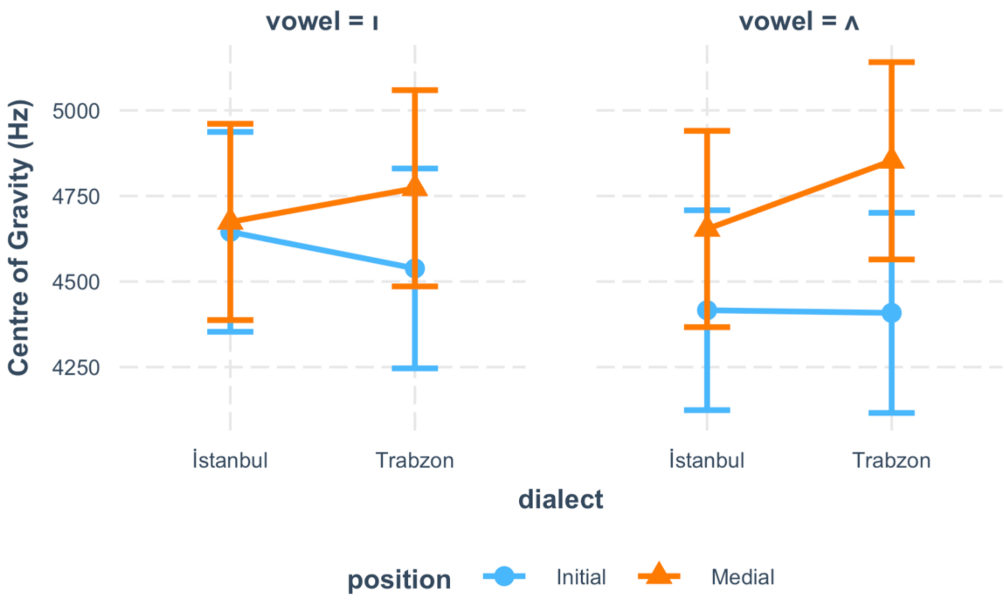

Figure 5.3 Interaction Plot of Centre of Gravity

Standard deviation, similar to CoG, describes the deviation of energy around the CoG (Kochetov, 2020). LRT model comparisons showed that there were no significant effects of dialect (X^2 (1) = 0.0054, p =.941) and vowel (X^2 (1) = 3.6703, p = .055) on dispersion, but there was a significant effect of position (X^2 (1) =10.746, p = .001), with medial tokens showing higher values than initial tokens (See Figure 5.4).

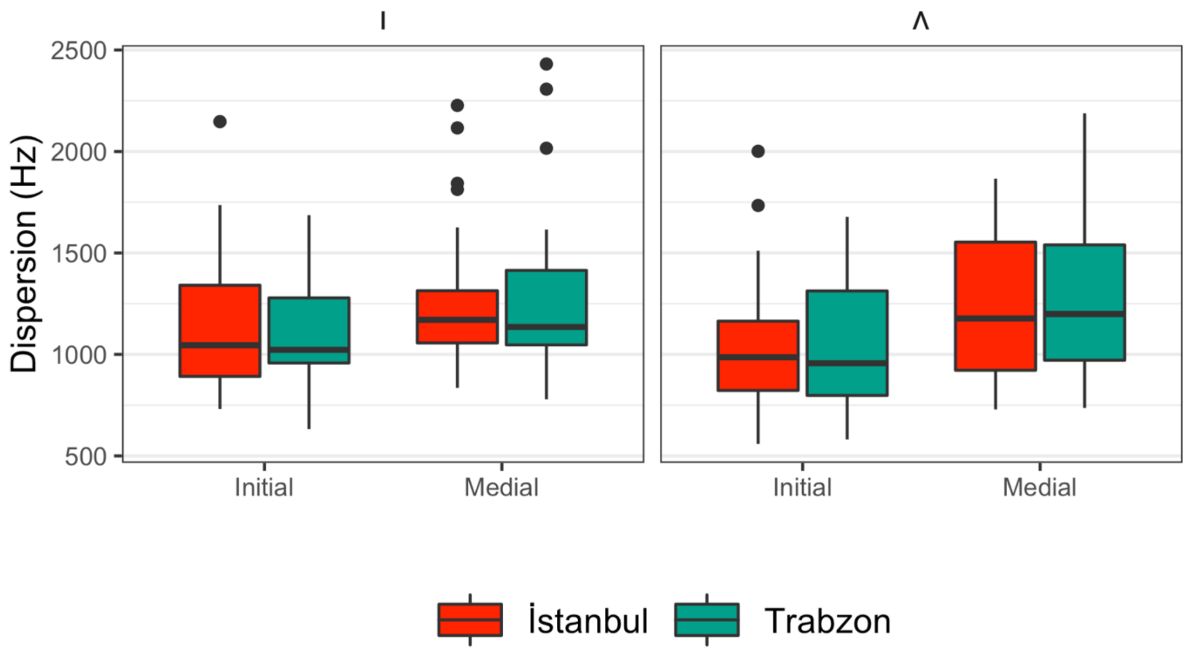

Figure 5.4 Box Plot Dispersion (Standard Deviation) of voiced affricate /dʒ/ between İstanbul and Trabzon Turkish

Skewness describes difference in the shape of spectrum below and above the CoG. There were no significant effects of dialect (X^2 (1) = 0.0085, p =.926), position (X^2 (1) =1.2888, p = .256), or vowel (X^2 (1) = 0.124, = < .724) on skewness. Similarly, no significant effect of dialect (X^2 (1) = 0.1517, p = .696), position (X^2 (1) < 2.8426, p = .091) or vowel (X^2 (1) = 0.4536, p = .500) were found for kurtosis.

Rise slope is an acoustic correlate of manner of articulation with a steep slope corresponding to more affricate-like production. The results showed that there was no significant effect of dialect (X^2 (1) =1.7075, p = .191), but there was a significant effect of position (X^2 (1) = 14.767, p = .001) and vowel (X^2 (1) = 4.7038, p = .030) (See Figure 5.5).

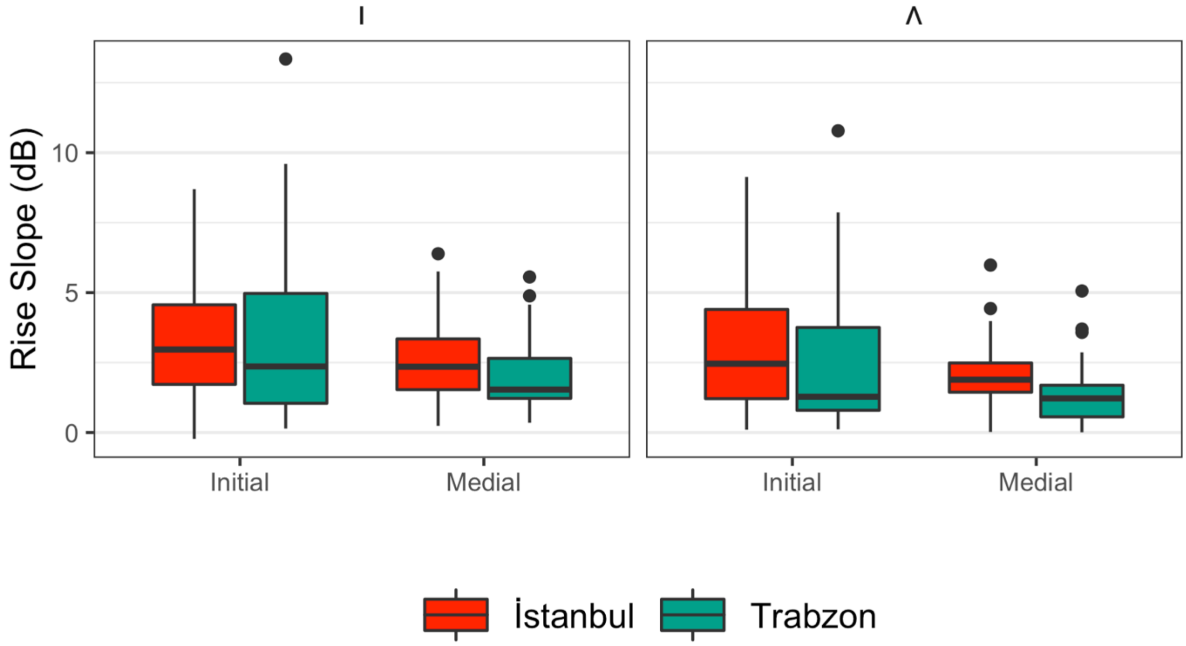

Figure 5.5 Box plot showing Rise Slope of Voiced Affricate /dʒ/ between İstanbul and Trabzon Turkish Speakers

According to Figure 5.5 above, it can be concluded that, although not significant, Trabzon speakers have lower rise slope in general. In addition, in the word-medial context, the vowel /ʌ/ shows wider variation between the regional dialect speakers, while they are near identical in the word-initial vowel /ɪ/ condition. An interaction plot (See Figure 5.6) demonstrates how the dialect*position*vowel interaction influences the production of the voiced affricate, which is relatively minimal in nature.

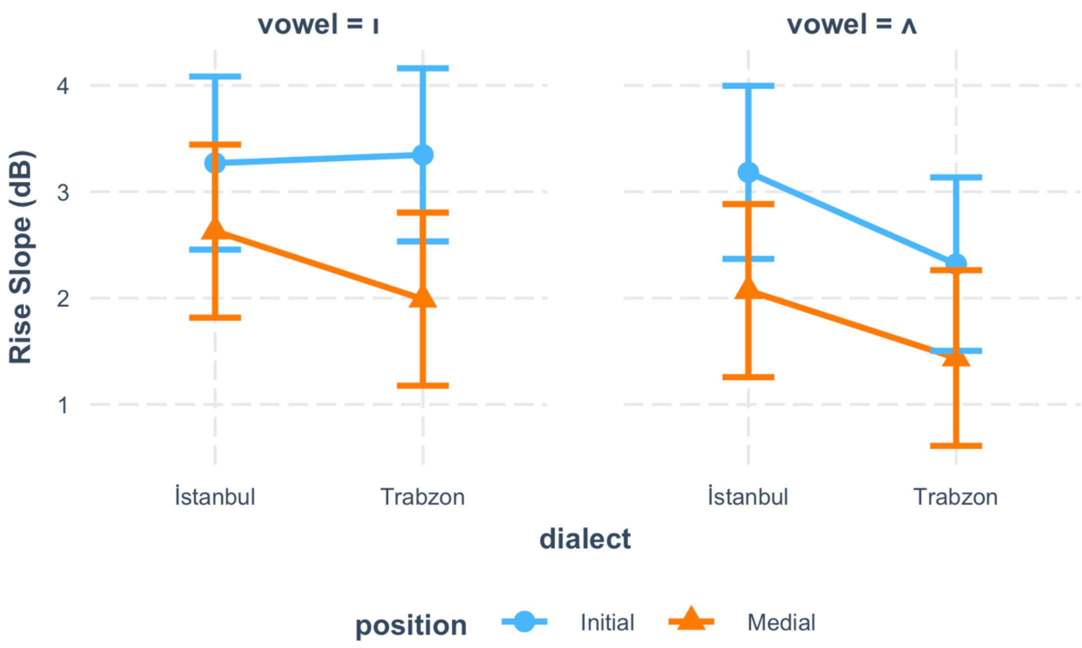

Figure 5.6 Interaction Plot of Rise Slope by Dialect, Position, and Vowel

5.4.4 Temporal Analysis of the Voiced Affricate Variation

Frication duration is a cue of aspiration and voicing. LRT model comparisons revealed a significant effect of vowel (X^2 (1) = 30.336, p = .001) and position (X^2 (1) = 3.8501, p = .049) on frication duration, but no significant effect of dialect (X^2 (1) = 1.5432, p = .214). Frication duration is longer when the vowel is /ɪ/ in both dialect groups. Similar to the previously mentioned acoustic correlates, the word-medial /ʌ/ vowel context showed a slightly larger difference between the regional dialect speakers (See Figure 5.7).

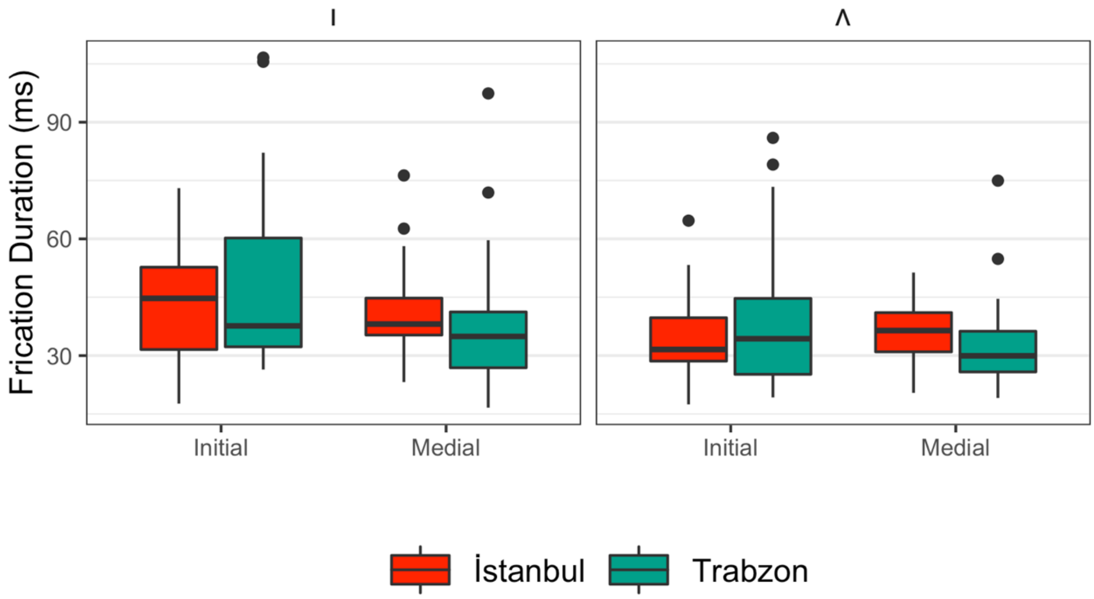

Figure 5.7 Box plots of Frication Duration of voiced affricate /dʒ/ between İstanbul and Trabzon Turkish

Vowel duration is measured for the following vowel if the affricate is in word-initial position, and for the preceding vowel in word-medial position. Previous studies argue that speakers produce a longer preceding vowel duration for voiceless stops than voiced stops, hence a similar pattern can be expected for affricates as affricates show a stop-like release (Raphael, 1981, Choo, 2017). In the Turkish data, speakers of both regions showed a similar pattern if the following vowel was /ʌ/ (See Figure 5.8). LRT results showed that there was not a significant effect for dialect (X^2 (1) = 0.5758, p = .448) or position (X^2 (1) = 0.8739, p = .349). However, the following vowel length was significantly longer with the low vowel /ʌ/. This does pattern with previous studies claiming that high vowels are shorter than low vowels (Westbury & Keating, 1980, Cho, 2017). However, speakers slightly varied in preceding vowel length when the vowel was /ɪ/ following the word-initial voiced affricate. At word-medial position, the same pattern and effects were observed for the duration of preceding vowel length. There was a significant difference of preceding vowel length duration in terms of the vowel (with /ɪ/ being shorter in all conditions).

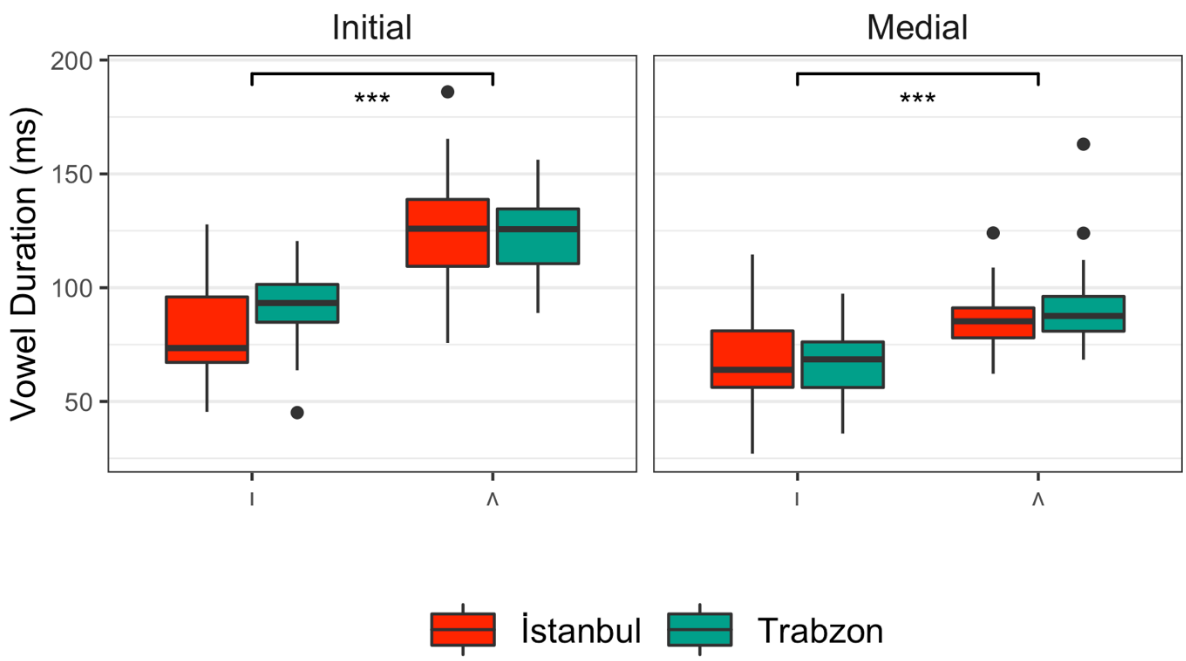

Figure 5.8 Box plots of Vowel Duration of Voiced Affricate /dʒ/ between İstanbul and Trabzon Turkish

Closure duration was analysed only for word-medial position. There was no significant effect of dialect (X^2 (1) = 0.1673, p = .682) on closure duration, whereas there was a significant effect of vowel (X^2 (1) = 5.9232, p = .014) on closure duration. In both vowel contexts, Trabzon speakers produced a slightly shorter closure duration, and /ɪ/ vowel resulted in longer closure duration (See Figure 5.9).

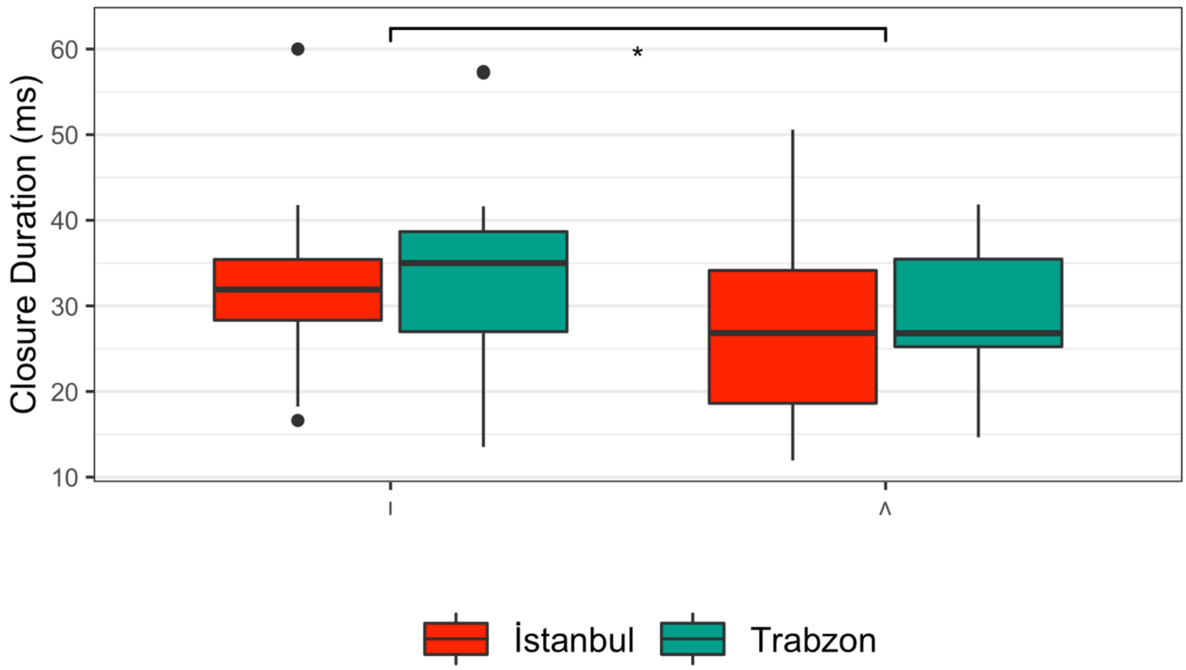

Figure 5.9 Box plot showing Closure Duration of Voiced Affricate /dʒ/ between İstanbul and Trabzon Turkish

Lastly, overall consonant duration was analysed for the influence of dialect, position, and the vowel. LRT results found that there was not a significant effect of dialect (X^2 (1) = 1.9008, p = .168). However, the results show that there was a significant effect of position (X^2 (1) = 10.356, p = .001) and vowel (X^2 (1) = 4.0214, p = .044) (See Figure 5.10). Since the word-initial voiced affricate does not have a closure phase, the longer duration in word-medial position is expected, which may explain the significant difference regarding the word position. The interaction plot in Figure 5.11 below reveals that vowel /ɪ/ does not influence the duration of the voiced affricate /dʒ/ among Trabzon speakers in word positions, while vowel /ʌ/ interacts with word position. Recall that closure duration and frication duration is shorter (closure not available in some word-medial context) in Trabzon speakers, this interaction suggests that the voiced affricates of Trabzon speakers are shorter and more fricative-like (lower rise slope) when the preceding/following vowel is /ɪ/.

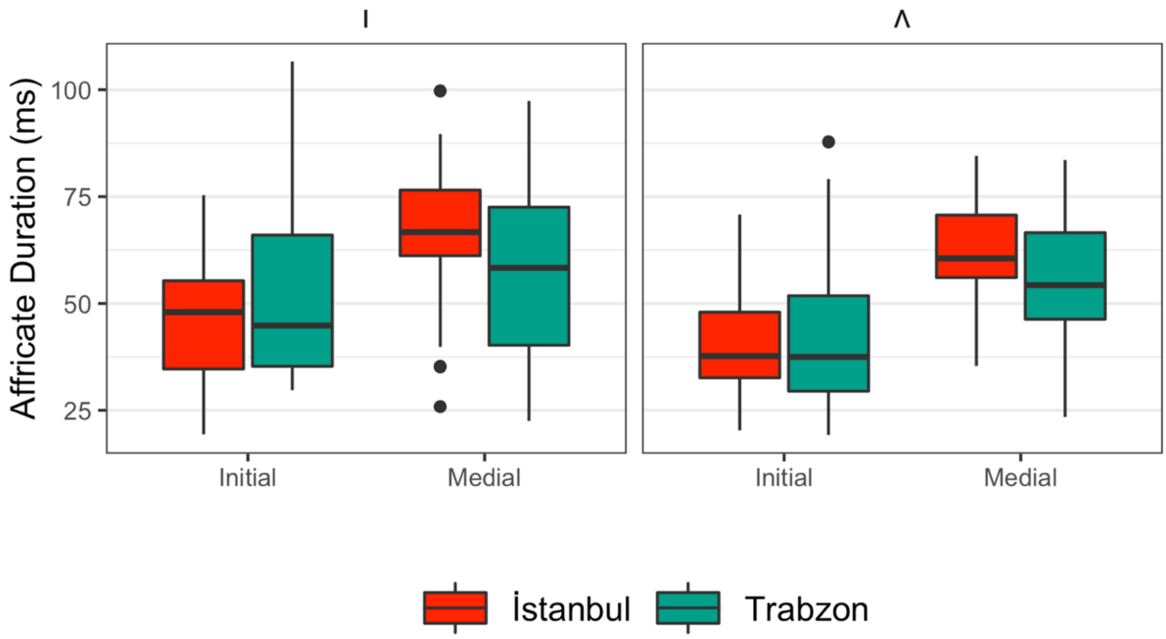

Figure 5.10 Box Plots of Affricate Duration of Voiced Affricate /dʒ/ between İstanbul and Trabzon Turkish

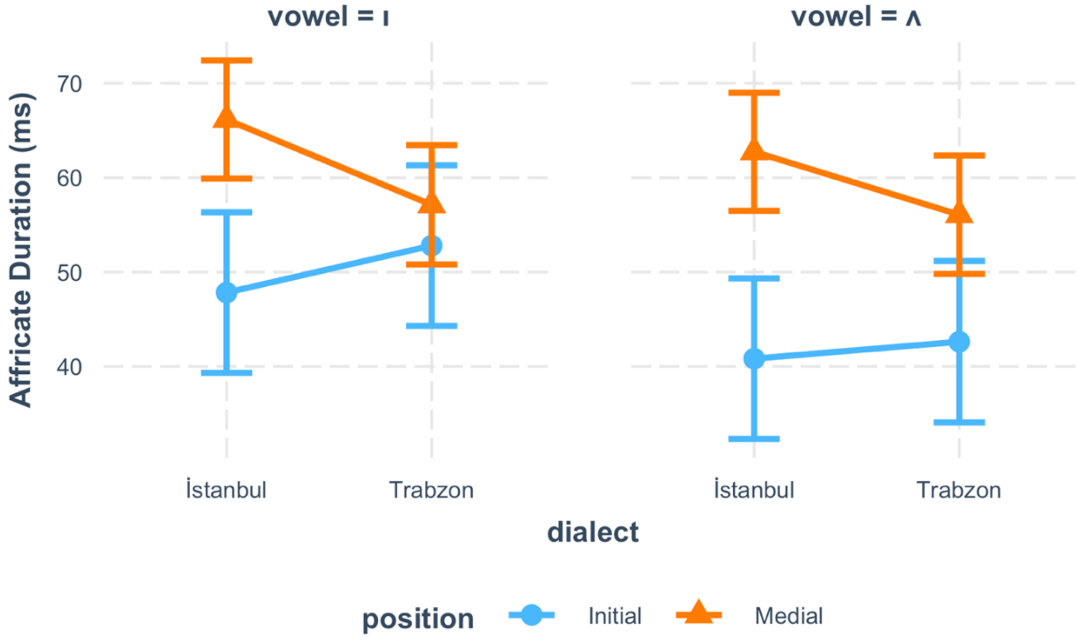

Figure 5.11 Interaction Plot of Affricate Duration by dialect, position, and vowel

In summary, these results showed that there were no significant effects of regional dialect on any of the acoustic correlates. On the other hand, there were significant position effects on CoG, dispersion, and rise slope. There was a significant effect of vowel on the duration of closure and total duration of the voiced affricate.

The last phonetic correlate is a categorical coding for the presence or absence of a burst transient, which was investigated quantitively in the data. As Brendemoen (2002) has argued that [dz] is an allophone of /dʒ/ in Trabzon Turkish, I examined the proportion of burst transients that were present. The results showed that speakers of both regions produced a burst mostly at word initial position whereas there is a noticeable decrease of burst transients at word-medial position (See Figure 5.12). In addition, Trabzon speakers had fewer ‘burst + fricative’ occurrences than İstanbul speakers in both positions.

There can be several reasons for this positional difference. First, it may result from the positional effect, as closure duration is included as a part of the consonant in intervocalic word-medial positions. The absence of burst transients may signal the lenition of stops and affricates (Lavoie, 2001). In addition, it is proposed that lack of burst transients can distinguish an affricate from a semi-fricative consonant (Marotta, 2001, as cited in Stevens & Hajek, 2005). Thus, intervocalic word-medial position may lead to weaker production of the voiced affricate among Turkish speakers. Second, consonants are typically shorter in word-medial position (Pycha, 2007) and this may result in speakers producing affricates with no or a quasi-burst release. A final reason could be that Turkish speakers more strongly weight the fricative part of the affricate, and a prominent burst transient is not obligatory in order to produce an unambiguously voiced affricate.

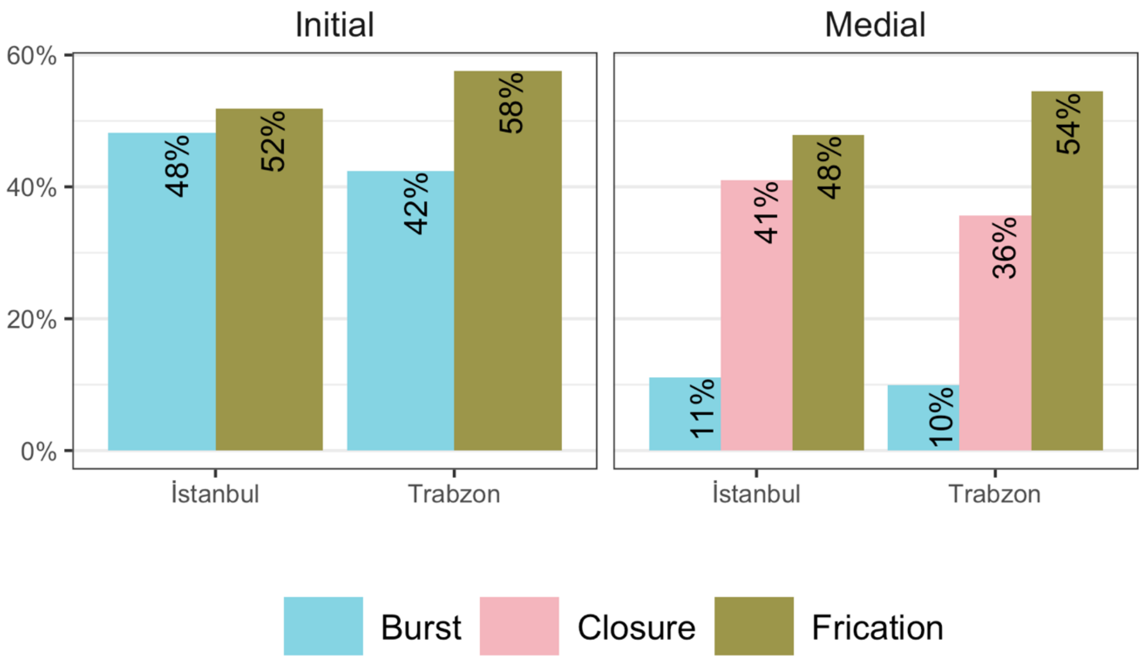

Figure 5.12 Bar Plot showing the occurrence of Burst, Closure, and Frication between İstanbul and Trabzon speakers

5.4.5 Summary of the Results

In summary, this section has analysed acoustic variation in the voiced affricate /dʒ/ between Trabzon and İstanbul dialects in relation to word position and vowel context. The results found that there were no significant regional dialect differences in the acoustic correlates of /dʒ/. However, word position and vowel context significantly impacted the majority of acoustic correlates. Qualitative inspection of the data showed that word position and vowel context may also interact, with some combinations suggesting small dimensions of variation between the two dialects, but these are not formally tested in this analysis. The following section now discusses the implications of these findings.

5.5 Discussion

This chapter examined regional dialect variation of the voiced affricate /dʒ/ in Turkish between the regional dialects of Trabzon and İstanbul. In this section, I will discuss the findings in terms of the socio-linguistic variables in the context of Turkey, and Turkish.

5.5.1 Comparison of the Trabzon and İstanbul Dialects

Brendemoen (2002) proposes that Trabzon speakers produce allophones of the voiced palato-alveolar affricate /dʒ/ as a voiced dental affricate or a voiced palato-alveolar sibilant, while such variants are not documented in Istanbul (Standard) Turkish. This study showed that younger speakers in Trabzon region did not significantly differ from younger speakers from İstanbul in terms of durational or spectral acoustic correlates of the voiced affricate.

Although positional and vocalic effects are well established in these data, regional variation was not significant in any of the acoustic correlates, contrary to Brendemoen's study based on the data collected in 1978 -1979 (2002). This suggests that, over roughly 40 years of time, the reported allophones of /dʒ/ might have faded away in the young speakers of the Trabzon region. Whether these phenomena vary by age in the region is a fruitful avenue for future investigation. Several sociolinguistic reasons behind this similarity can be proposed. First, this similarity may result from the fact that younger generations receive longer formal compulsory education in Standard Turkish, which was initially 5 years until 1997, 8 years during 1998-2012, and 12 years since 2012 (Cin, Karlıdağ-Dennis & Temiz, 2020). Turkish language and education policy targets Standard Turkish, which discourages dialect speakers from using their regional dialect especially in formal places such as schools and public workplaces, as language policy has been considered an important part of building Turkish National Identity since the earliest times of the Turkish Republic (Aydıngün & Aydıngün, 2004). Second, factors such as the spread of mass media and domestic migration from villages to city centres, especially after 1980s, might have led speakers to use Standard Turkish for prestige and social acceptance. Moving from agricultural and pastoral life to city life, many jobs require formal interaction either with companies or public organizations, where Standard Turkish is the general norm. Furthermore, the evidence of a dialect shift may be magnified by the fact that Brendemoen (2002) collected data from old speakers in villages in around 1978-1979, while the current data focuses on younger generations in 2019-2020. The differences might not have been as stark had similar age groups been compared across the 40-year period. Finally, I should state that the dental allophonic usage of the voiced affricate is mostly observed in the eastern part of the city. As my data includes speakers from all around Trabzon, speakers of Eastern Trabzon participants do not make up the 50% of the data (5 from the Eastern, 7 West, and 2 central locations). Thus, it is possible that this sub-dialect feature may not have been fully reflected in the data of the present study. Before concluding, it is worth mentioning that the data presented here consists of careful reading of written stimuli, which might lead participants to orient more towards standard norms. Previous studies have shown that speakers' production of speech segments can vary between spontaneous and careful speech (Warner & Tucker, 2011, Ernestus et al., 2015). Due to the formality in the design (careful speech) and nature of the experiment (formal recordings), it is potential that participants may subconsciously shift their speech style toward standard dialect usage. Further research comparing the casual and careful speech of regional dialect speakers can reveal more about the role of standard language ideology in regional dialect use. In conclusion, based on the data reported here, the acoustic correlates of the voiced alveo-palatal affricate /dʒ/ are not notably different between speakers of Trabzon and Istanbul Turkish.

5.5.2 The Role of Position and Vowel

The statistical analysis showed that the acoustic correlates of /dʒ/ are influenced by word position and vowel context. While position significantly influences the spectral parts of the affricate (i.e., Centre of Gravity, dispersion, rise slope), vowel context significantly influenced the temporal measures, such as frication duration, closure duration, and affricate duration. For the word-initial voiced affricate, speakers of both regions produced a burst with a slightly longer frication duration, whereas the frequency of burst transients and the frication duration decreased at word-medial position. That means that the production of the voiced affricate can be described as "burst + frication" at word-initial position and "closure + [unreleased stop] + frication" at word-medial position for Turkish speakers. This might lead us to conclude that Turkish speakers use different acoustic cues for the voiced affricate at word-initial and word-medial positions.

The statistical analysis revealed that vowel context significantly influences closure duration (CD). Variation in CD is considered to be linked with (de)voicing in stops and affricates (Recasens & Espinosa, 2007, Al-Tamimi & Khattab, 2018). Trabzon speakers have a slightly shorter CD in both vowel contexts, and /ɪ/ significantly leads to longer CD in both dialects.

The mixed-effects models did not reveal a significant influence of dialect and position on the duration of the preceding/following vowel. However, the duration of the vowel following the voiced affricate tends to be longer if it is /ʌ/. Similarly, the duration of /ʌ/ in word-medial voiced affricate is longer than /ɪ/ in both regional dialects. As expected, this study confirms that preceding/following vowel length is shorter when the vowel is high, with the exception that Trabzon speakers produced slightly longer vowel length in word-initial high-front condition compared to İstanbul speakers.

Rise slope is the only acoustic correlate which was found to be significantly different in both word position and vowel context. Although not significant, İstanbul speakers had slightly higher rise slope than Trabzon speakers in different positions and vowel contexts. This difference becomes more noticeable when the voiced affricate is in word-medial position. Given that the minor differences are observed in other acoustic correlates, such as less occurrence of burst tokens, shorter CD (if exists), the lower rise slope suggests that Trabzon speakers may articulate the voiced affricate more as a fricative consonant in word-medial position. It must be stated, however, that such interactions were not formally tested in this study and, therefore, should be taken as hypotheses for future research to investigate more fully.

In conclusion, while a significant regional dialect difference was not found for the production of the voiced affricate, the results suggest that there could be more nuanced dimensions of regional variation with specific combinations of word position and vowel context, but these interactions could not be tested properly using the data in this paper. The results confirm that significant effects of word position are found for spectral correlates of the voiced affricate whereas the vowel context influenced the durational correlates. Finally, both groups of speakers exhibited a similar pattern on burst tokens in terms of position, yet with a moderate difference between the regional speakers.

5.6 Chapter Summary

This study targeted two initial aims. First, it aimed to document the acoustic properties of the voiced affricate /dʒ/ in Turkish which, to the best of my knowledge, has not been documented in the phonetics literature. Second, it aimed to explore whether the acoustic properties of the voiced affricate /dʒ/ produced by speakers of Trabzon and Istanbul dialects show regional variation as discussed by Brendemoen (2002). I found that regional dialect variation is not found for any of the acoustic correlates, while word position and vowel context lead to acoustic variation in the voiced affricate across many acoustic measures. Potential reasons behind this similarity between dialects in the younger generations were discussed according to the sociolinguistic context and standard language policies of Turkey.

The following chapter will analyse the L2 English voiced affricate production of Turkish speakers in comparison to SSBE speakers. As there is not any regional dialect difference in their L1, I predict that Turkish speakers of both regions will produce this consonant similarly in L2 in word-initial and word-medial positions. This forms a useful test of the hypothesis of L1 dialect influence on L2 speech production, as any potential differences in L2 English cannot be straightforwardly explained with references to differences in the L1. However, no hypothesis is made with regard to word-final position due to the phonological restrictions of word-final voiced affricate in Turkish. As Turkish has the word-final devoicing of stops and affricates, regional dialect variation of in this position was not explored. English has a robust voiced-voiceless phonemic contrast in word-final position, so the next chapter will also explore whether this leads to variation in L2 production.

6 Voiced Affricate /dʒ/ Variation in L2 Speech Production

6.1 Introduction

The aim of this chapter is to explore whether regional dialect speakers of Turkish, specifically Trabzon and İstanbul speakers, vary in the production of the voiced affricate /dʒ/ in L2 English. Similar to Turkish, English also has two alveo-palatal affricates /dʒ/ and /tʃ/, which contrast in voicing, though English does not have word-final affricate devoicing phonological constraint. This chapter seeks answer to RQ1b "Do regional dialect speakers of İstanbul and Trabzon differ in the production of L2 English voiced affricate /dʒ/ in word-initial, medial, and final position?"

The chapter begins with the brief phonological and phonetic description of affricates in English, which is followed by hypotheses for the Turkish speakers' L2 English affricate production. It will then present the methods for data collection and measuring the acoustic correlates of affricates, which will be followed by presenting the statistical analysis and the results. The chapter ends with a discussion section interpreting the findings in terms of L2 speech models.

6.1.1 Affricates in English

English has two affricates /dʒ/ and /tʃ/. Despite the IPA transcription of two symbols, these affricates act as mono-segmental units (Berns, 2013). Affricates are considered a separate class from stops and fricatives due to their phonotactic conditions in English (Van de Weijer, 2014). For example, in English, a word-initial syllable is not formed with a stop + fricative sequence, while affricates can act as word-initial onsets, demonstrating that affricates act as a single segment (Jensen, 1993). In word-final position, affricates can be formed with nasals and rhotics, though they are not formed with the fricative /s/. Van de Weijer (2014) posits that the constraint on the word-final /s/ formation also shows that affricates in English are a distinct class.

The only difference in the phonotactics of affricates between English and Turkish is word-final devoicing. While English allows for word-final voiced affricate and the possibility of phonetic devoicing, Turkish word-final affricate is always phonetically voiceless. Although Kopkallı-Yavuz (1993) provides an acoustic analysis of word-final devoicing in Turkish, this study only covers stops, which are also devoiced in final position. Moreover, few studies examined how Turkish speakers deal with word-final devoicing in their L2. Hişmanoğlu and Hişmanoğlu (2011) draw attention to the articulation problem of Turkish speakers in L2 English word-final voicing. Similarly, Ülkersoy (2009) discussed that the word-final position causes Turkish speakers to have difficulty in pronouncing word-final voiced stops in English. Similar to İstanbul Turkish, Brendemoen (2002) states that the voiced-voiceless stop distinction in word-final position is neutralized in Trabzon Turkish.

As regional dialect variation is reported to be minimal in the production of voiced affricate in word-initial and word-medial positions in Turkish, and the fact that word-final devoicing is similar across both regions, I predict that L2 English production of voiced affricates will be similar between the regional dialect speakers of Trabzon and İstanbul. In addition, the voicing contrast in word-final position between Turkish and English speakers will be explored, as this is expected to form a strong point of difference between L1 and L2 English in this context.

6.2 Method

This section explains the methodological approach for the acoustic and statistical analysis of voiced affricate production in English. Since Chapter 4 (Methodology) states the general approach, I will here provide background information in relation to this specific experiment.

6.2.1 Data and Participants

Fourteen participants from each Turkish regional dialect group and 14 SSBE speakers aged 18 - 35 were recruited for the acoustic analysis from the participant pool. A word list containing the voiced affricate in word-initial, medial, and final position was created, with the same adjacent vowels /ɪ/ and /ʌ/ used to maintain consistency across the two languages. Since the phoneme-to-grapheme match is not transparent in English, the /æ/ vowel which was represented by the grapheme ‘a’ in the selected words was used for low vowel condition. A common influence of the orthography is the substitution of a sound according to its spelling in L2 (Basetti et al., 2020). Thus, I aimed to limit the potential variation in the production of these words with neighbouring vowel /ʌ/. That is, L2 Turkish participants would either pronounce it /æ/, or /ʌ/ as a result of L1 phoneme-grapheme matching influence. The same experimental setting detailed in the previous chapter (Chapter 5) was used and only differed in language mode (i.e., English). Table 6.1 shows the word list used for the experiment.

Table 6.1 ***Word List for L2 English Voiced Affricate Production***

Vowel	**/ʌ/**			**/ɪ/**		
Position	**Initial**	**Medial**	**Final**	**Initial**	**Medial**	**Final**
Word	jam	ajar	badge	gin	pidgin	bridge
IPA	/dʒæm/	/əˈdʒɑːr/	/bæʤ/	/dʒɪn/	/ˈpɪdʒɪn/	/brɪʤ/

6.2.2 Acoustic coding and analysis

The same criteria for segmentation, acoustic coding, and analysis used in Chapter 5.3.2 is applied. In addition, as this dataset includes word-final tokens, preceding vowel duration and closure duration of the word-final consonant segments are also measured (See Figure 6.1).

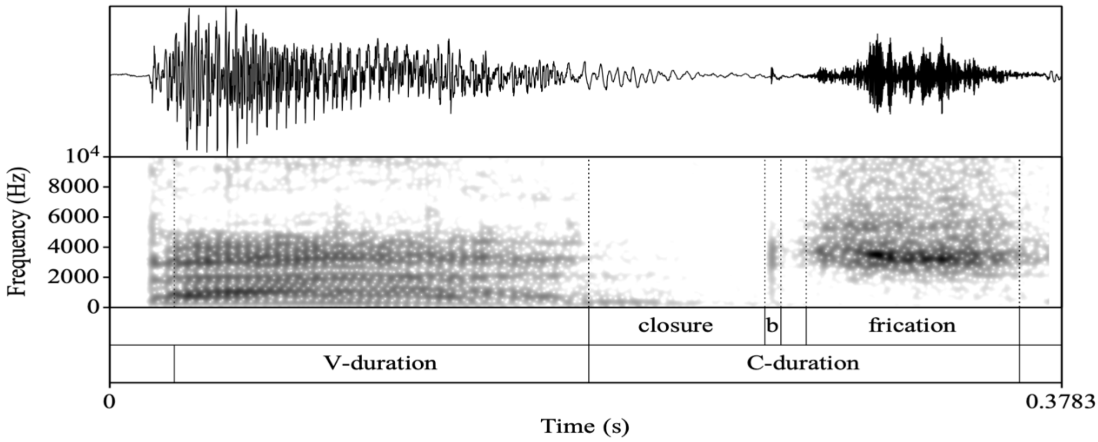

Figure 6.1 Sample annotation of the voiced affricate in English ("badge")

In total, 504 speech tokens were obtained (14x3x6x2) for acoustic coding and analysis. However, one token was removed from the data as a result of mispronunciation. Although I included other mispronunciation tokens, this had to be removed as the mispronunciation of 'badge' as 'budget' changed the position of the consonant, which then influenced the acoustic correlates. One token was mistakenly labelled as Turkish by me, and not included in the analysis as the dataset was filtered by language. In total, 502 tokens were used for the spectral and temporal analysis of the data. Closure duration was coded and measured in word-medial and word-final position, which was expected to yield 336 tokens. However, as closure duration was not observed and therefore not measured for several participants, 316 tokens were used for the statistical analysis. Normalization of the acoustic correlates was not used to preserve potential dialect differences in the variation of the voiced affricate consonant (see Chapter 5.3.3 for the discussion).

6.2.3 Statistical analysis

Statistical analyses were performed in R (Version 4.1.2.,2021) using the lme4 (Bates et al., 2015) and lmertest (Kuznetsoca, Brockhoff, & Christensen, 2017) packages. Descriptive statistics showing the group differences between dialects and word position were obtained via the psych package (Rewelle, 2022). For each acoustic correlate, a separate model was fitted, and the analysis of the burst transient was explored descriptively. Dialect (Istanbul vs Trabzon vs SSBE), position (initial vs medial vs final), and vowel context (/ɪ/ and /ʌ/) were set as fixed effects. In order to account for variation of the production in each position by the same speakers, a by-speaker random slope for the effect of position was included in the model, while 'word' was set as a random intercept. However, due to the small sample size, this structure resulted in convergence issues in the model. Therefore, the random slope was removed from the model, and only 'speaker' and 'word' included as random intercept. However, 'word' as a random intercept was removed from the models for dispersion, skewness, kurtosis, and rise slope as the model continued to have convergence issues, and 'word' was found to cause overfitting error according to the model summary. The interaction of position*vowel*dialect was not statistically examined in the models; however, the role of interaction was further analysed visually by using the interaction package (Long, 2021) in R (Version, 4.1.2.,2021). Results of the mixed-effects models are presented in Appendix G. The results of the mixed-effects models further were assessed for the goodness of fit of the models by using Likelihood Ratio Tests. That is, the improved model was compared with a nested model which lacks one of the fixed effects. The next section will present the results of the statistical analysis.

6.3 Results

6.3.1 Overview

This section shows the descriptive and statistical results of the acoustic analysis of /dʒ/ in relation to regional dialect, position, and vowel context.

6.3.2 Descriptive Results

Prior to statistical analysis, I calculated the mean values of all acoustic correlates across each word position between the regional dialect groups. Table 6.2 demonstrates the differences between dialect groups in the production of the voiced affricate /dʒ/.

Table 6.2 ***Descriptive results of voiced affricate in L2 English***

Dialect	Acoustic Correlates	Word initial	Word-medial	Word-final

		Mean	SD	Mean	SD	Mean	SD
Trabzon	**COG**	4257	655	4366	417	4285	511
İstanbul	(Hz)	4390	558	4447	666	4405	703
SSBE		3868	515	3888	561	3785	523
Trabzon	**Dispersion**	971	220	1026	328	1012	269
İstanbul	(Hz)	1055	260	1191	292	1105	293
SSBE		1041	369	1040	394	1026	405
Trabzon	**Skewness**	1.90	0.93	1.99	0.84	1.96	0.78
İstanbul	(Hz)	1.50	0.93	1.64	0.89	1.65	0.94
SSBE		2.24	1.23	2.59	1.15	2.63	1.25
Trabzon	**Kurtosis**	8.74	7.29	8.95	7.30	8.55	6.48
İstanbul	(Hz)	5.52	6.39	5.44	7.16	5.91	6.02
SSBE		11	8.44	13.62	11.81	14.04	14.04
Trabzon	**Rise Slope**	3.79	2.69	2.52	2.15	3.34	2.34
İstanbul	(dB)	3.39	2.04	2.46	1.72	3.47	3.20
SSBE		4.88	2.93	3.82	2.68	4.85	3.25
Trabzon	**Frication Duration**	50	10	50	20	90	30
İstanbul	(ms)	50	20	40	20	70	40
SSBE		50	10	50	10	70	20
Trabzon	**Closure Duration**			40	20	50	30
İstanbul	(ms)	Na	Na	40	20	50	30
SSBE				40	10	50	20
Trabzon	**Vowel Duration**	120	30	90	20	140	30
İstanbul	(ms)	120	40	90	30	150	40

SSBE		120	40	80	20	130	40
Trabzon	**Consonant Duration**	50	10	80	40	150	60
İstanbul	(ms)	50	20	80	30	120	70
SSBE		50	10	90	20	120	40

The results in Table 6.2 confirm that temporal correlates of the voiced affricate /dʒ/ are similar across regional dialect groups while there are slight differences in word position. In terms of the spectral measures, the results revealed an L1 influence that SSBE speakers have a lower CoG, skewness, and kurtosis, and a higher rise slope than the Turkish speakers of both dialects. Lastly, dispersion/SD was found to show variation between dialects depending on the word position. Dispersion was the lowest for Trabzon speakers in word-initial position, while İstanbul and SSBE speakers showed similarity. However, word-medial and word-final position resulted in similarity between Trabzon, while SSBE speakers had considerably higher dispersion in these positions.

6.3.3 Statistical Analysis Results

A Likelihood-Ratio Test was run to test the statistical models' goodness-of-fit. Each acoustic correlate was compared with nested models, each one missing one of the fixed effect variables. Models for spectral and temporal correlates will be presented respectively. Lastly, I will provide the descriptive analysis of the stop burst in voiced affricates.

With regard to CoG, results showed that there was a significant effect of dialect (X^2 (2) = 11.316, p = .003) on CoG, while the effect of position (X^2 (2) = 0.907, p = .635) and vowel (X^2 (1) = 0.392, p = .531) on CoG were not significant. Figure 6.2 below shows that the significant dialect difference arises from the L1 difference between Turkish and SSBE speakers in the production of voiced affricate /dʒ/. While L1 significantly influenced the CoG, the role of position and the vowel and how they interact with dialect groups in terms of CoG is explored in Figure 6.3. The interaction plot suggests that vowel /ɪ/ did not influence the word-final voiced affricate production of regional dialect speakers of L1 Turkish, while vowel /ʌ/ led to an interaction between dialect speakers in word-final voiced affricate production. On the other hand, /ʌ/ leads to a lower degree of interaction in word-initial and word-medial positions between Trabzon and Istanbul speakers. Yet, /ɪ/ vowel showed a consistent influence on word position and dialect that İstanbul speakers have the highest CoG rates and SSBE speakers have the lowest degrees.

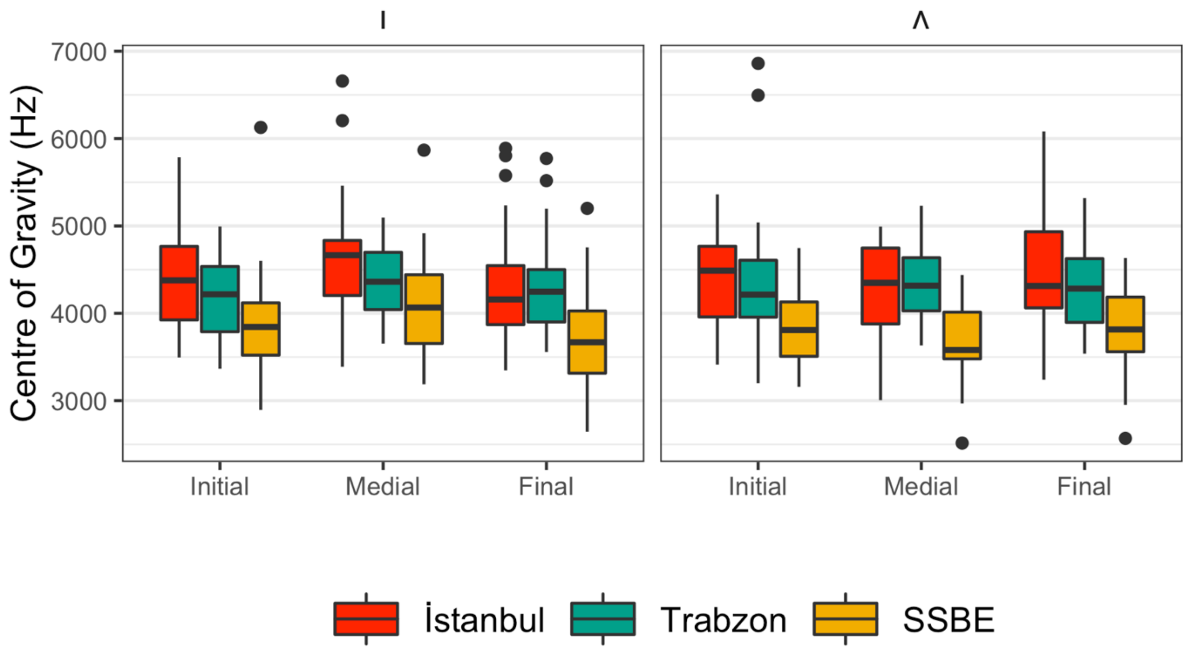

Figure 6.2 Boxplot showing the median CoG in each dialect

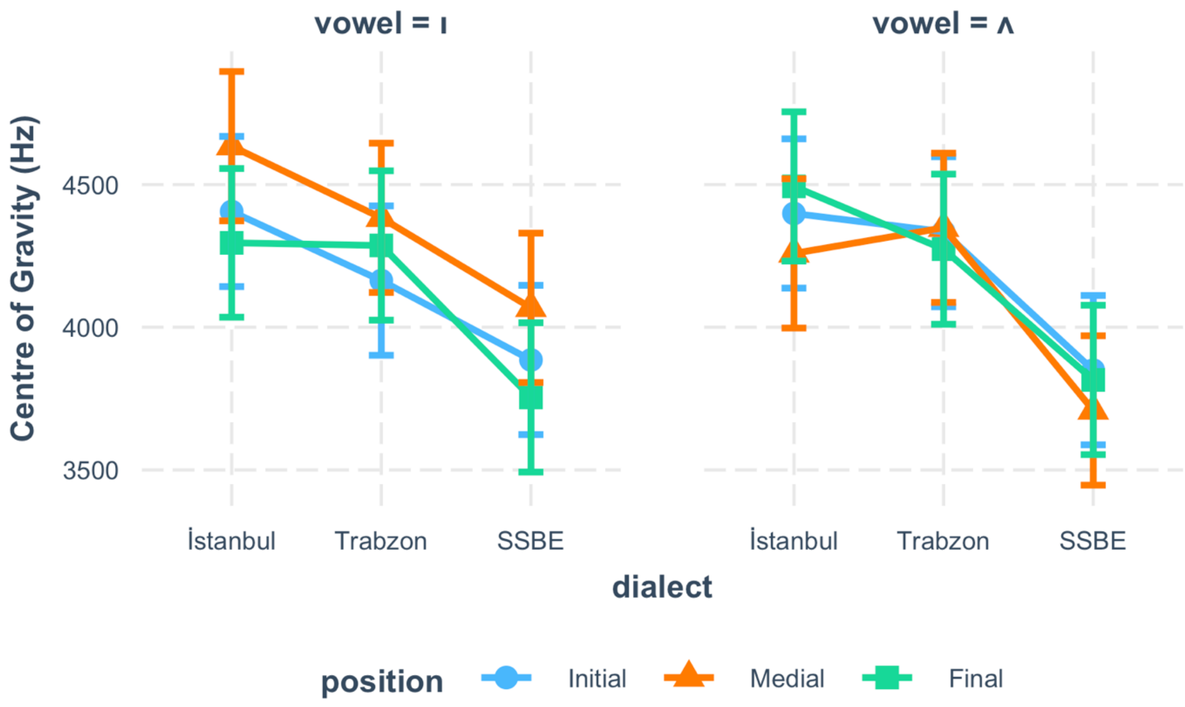

Figure 6.3 Interaction plot of CoG in L2 English

Standard deviation (Dispersion) shows the degree of deviation from the spectral mean of CoG. LRT model comparison showed that there was no significant effect of dialect (X^2 (2) =1.6089, p = .447) and vowel (X^2 (1) = 1.0259, p = .311) on SD, however, there was a significant effect of position (X^2 (2) =7.0585, p = .029) on SD.

In relation to skewness, there was a significant effect of dialect (X^2 (2) = 9.9211, p = .007) and position (X^2 (2) = 7.5575, p = .022) on skewness, but there was no significant effect of vowel (X^2 (1) = 2.2977, p =.129). Similar to CoG, the influence of dialect was more notable between SSBE and L1 Turkish speakers. Figure 6.4 demonstrates that skewness was significantly higher among SSBE speakers. Although it was not significant, there was a tendency for İstanbul speakers to have lower skewness in each word position in comparison to Trabzon speakers. A closer look at the interaction plot (See Figure 6.5) reveals that, unlike SSBE speakers, position was less influential on skewness for Turkish speakers, specifically in the Trabzon region. Similar to the lack of interaction observed in CoG, there was no interaction of word-final position between Trabzon and İstanbul speakers when the vowel was /ɪ/, while the vowel /ʌ/ results in variation between all dialects and word position.

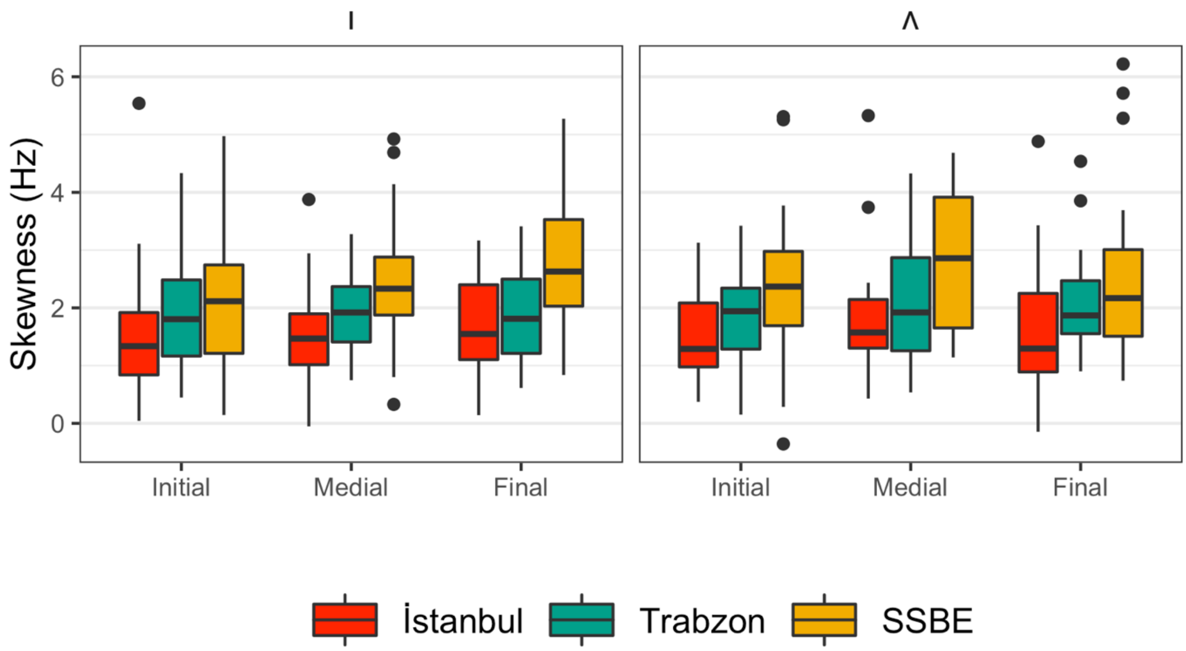

Figure 6.4 Boxplot showing Skewness of voiced affricate across regional dialects

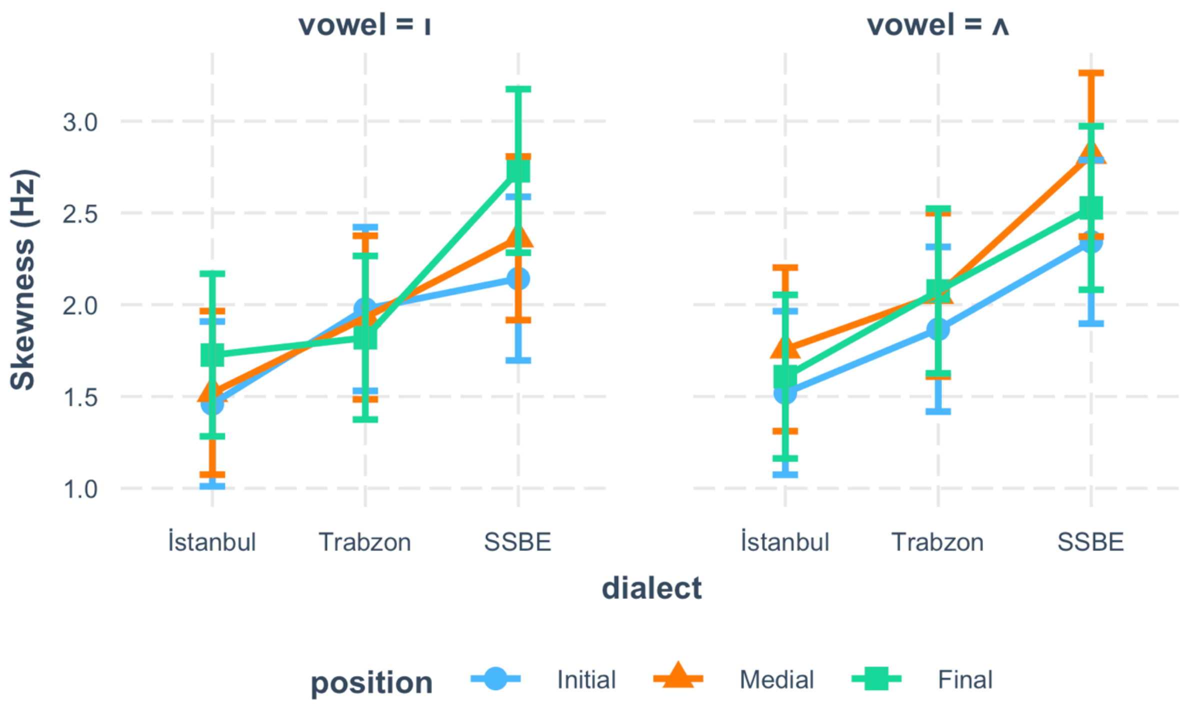

Figure 6.5 Interaction plot of Skewness

Kurtosis was found to be significantly influenced by dialect (X^2 (2) = 5.9401, p = .006). There was no significant effect of position (X^2 (2) = 2.4129, p = .299) and vowel (X^2 (1) = 2.1044, p = .146) on kurtosis. As in previous spectral measures, a closer look at the data shows that the significant influence of dialect arose from the L1 differences, in which SSBE speakers had higher kurtosis in all word positions and vowel contexts, and İstanbul speakers had the lowest kurtosis in all word positions and vowel contexts (See Figure 6.6).

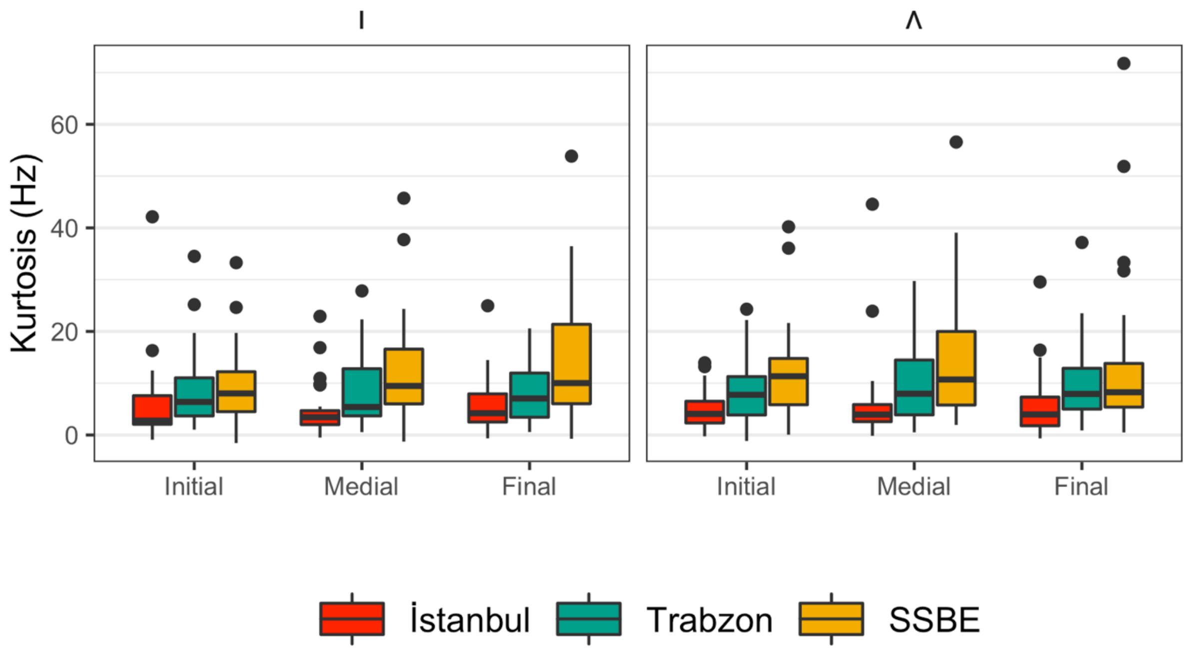

Figure 6.6 Boxplot showing Kurtosis of voiced affricate across regional dialects

Rise slope, with higher scores corresponding to more affricate like production, was found to be significantly affected by dialect (X^2 (2) = 6.9442, p = .031) and position (X^2 (2) = 23.981, p = .001), while there was no significant effect of vowel (X^2 (1) = 3.382, p = .065). Unlike other spectral measures, there was more variation between groups in each word position and vowel contexts. While SSBE speakers had a higher rise slope in all positions when the vowel was /ʌ/, vowel /ɪ/ resulted in greater similarity between the dialect groups in each word position. Looking at the interactional plot (See

Figure 6.8), it can be claimed that the production of voiced affricate /dʒ/ is greatly conditioned to /ʌ/ vowel in word-medial position, which resulted in differences across the three dialect groups. This difference diminishes between Trabzon and SSBE speakers when the vowel is /ɪ/ in word-medial position, while İstanbul speakers have a lower rise slope than the two other dialect groups. Lastly, similar to previous spectral correlates, the word-final voiced affricate was not different between Trabzon and İstanbul speakers when the preceding vowel is /ɪ/.

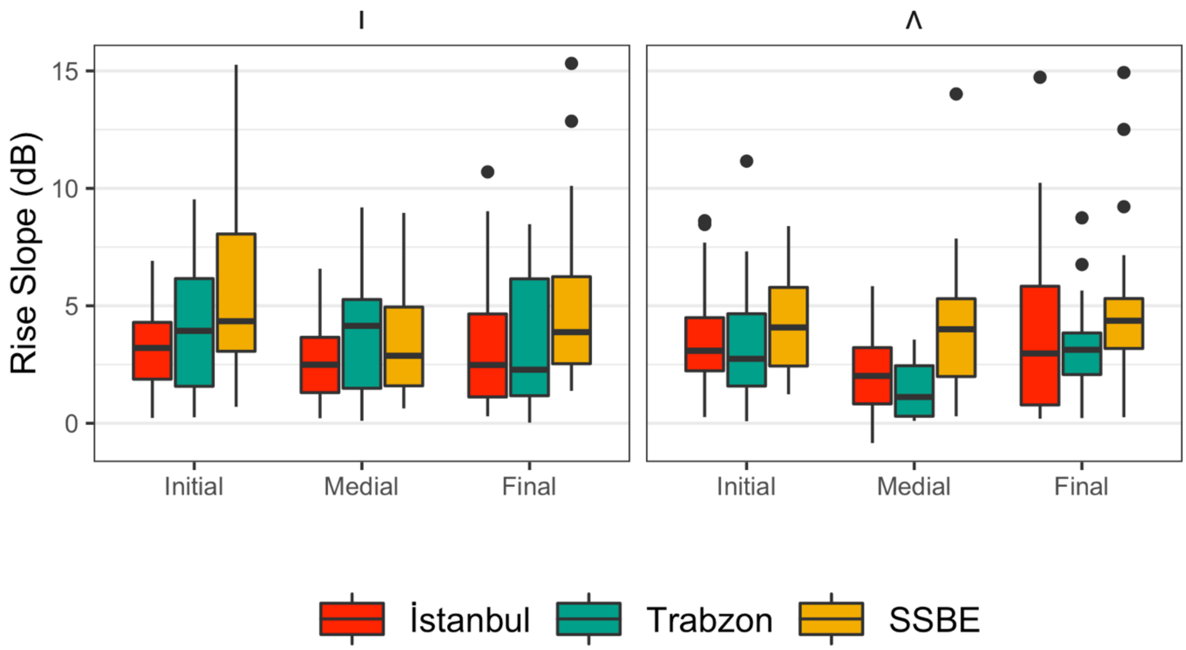

Figure 6.7 Boxplot showing Rise Slope of voiced affricate in each dialect

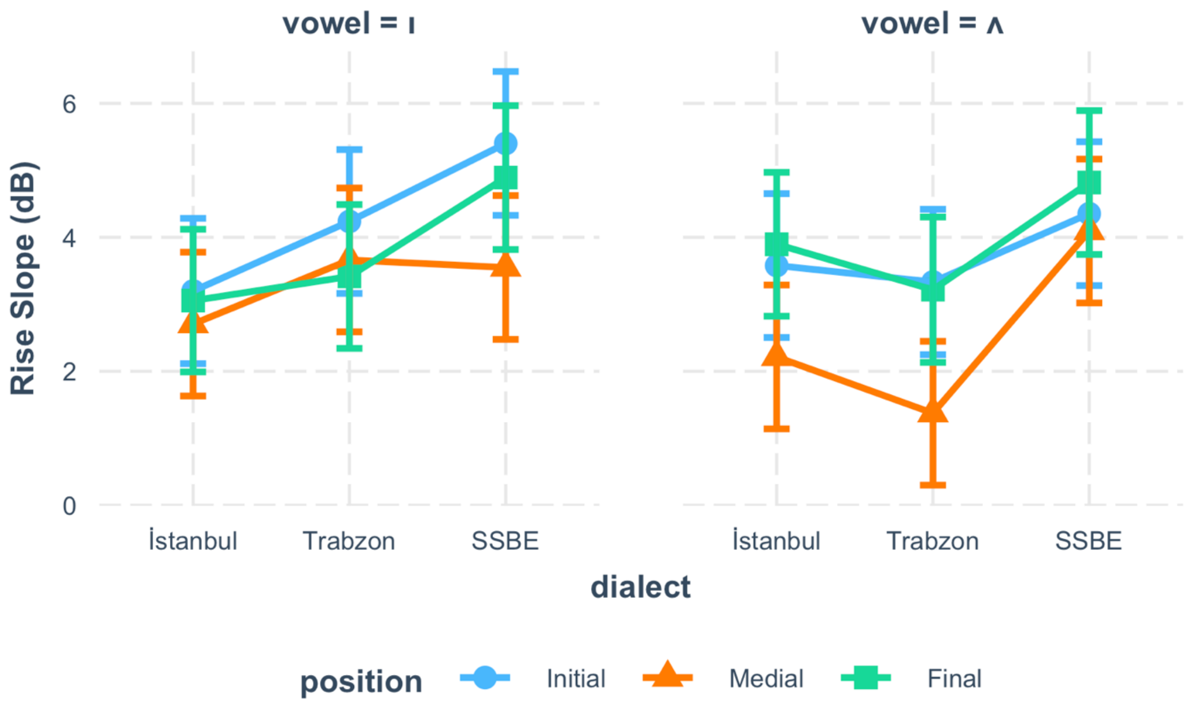

Figure 6.8 Interaction plot of Rise slope

With regard to temporal acoustic correlates, LRT model comparisons found that there was no significant effect of dialect (X^2 (2) = 1.98, p =.371) and vowel (X^2 (1) = 0.5772, p =.447) on frication duration, while there was a significant effect of position (X^2 (2) = 10.688, p =.0.096). Figure 6.9 below reveals the influence of position and dialect to a limited extent. Frication duration of word-initial voiced affricate was similar across all groups in both vowel contexts. Similar patterns were observed for word-medial voiced affricate, with SSBE speakers showing slightly longer frication duration. On the other hand, word-final voiced affricate frication duration led to variation among regional dialect groups depending on the vowel context. First, the results show that frication duration is the longest in word-final position for all dialect groups if the preceding vowel is /ʌ/, while /ɪ/ vowel showed a minimal influence on position among the dialect groups. In addition, the interaction plot (See Figure 6.10) suggests that Trabzon speakers are more sensitive to positional influence on the frication duration, while İstanbul and SSBE speakers show similar duration patterns across positions.

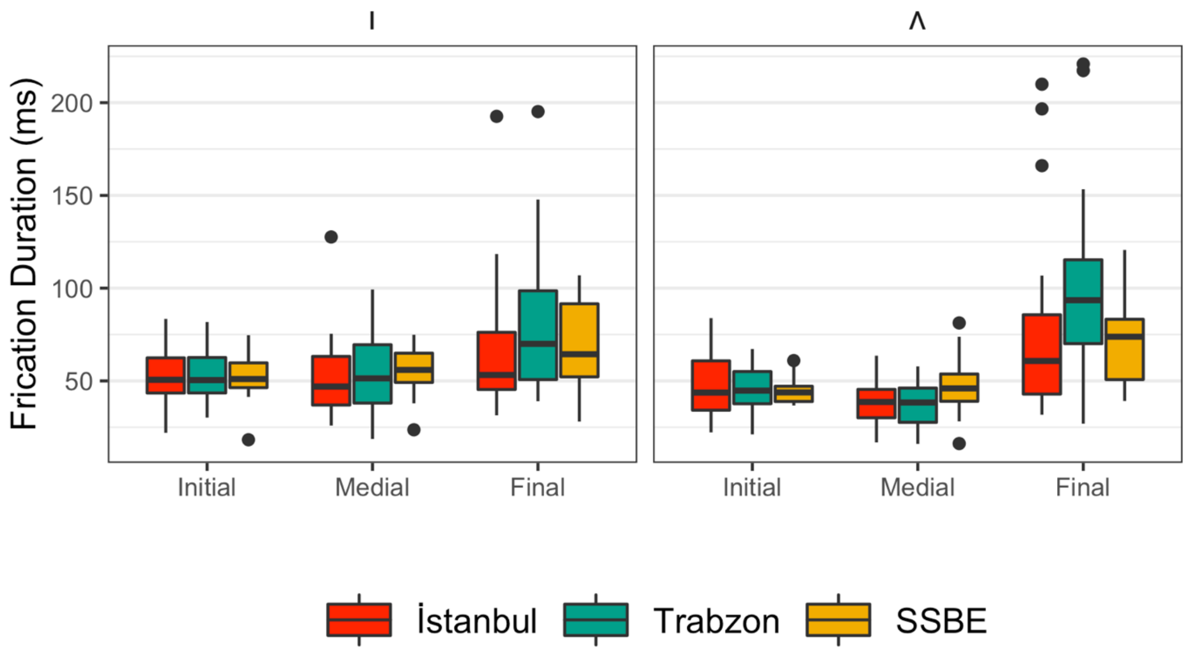

Figure 6.9 Boxplot showing Frication Duration (ms) in each dialect

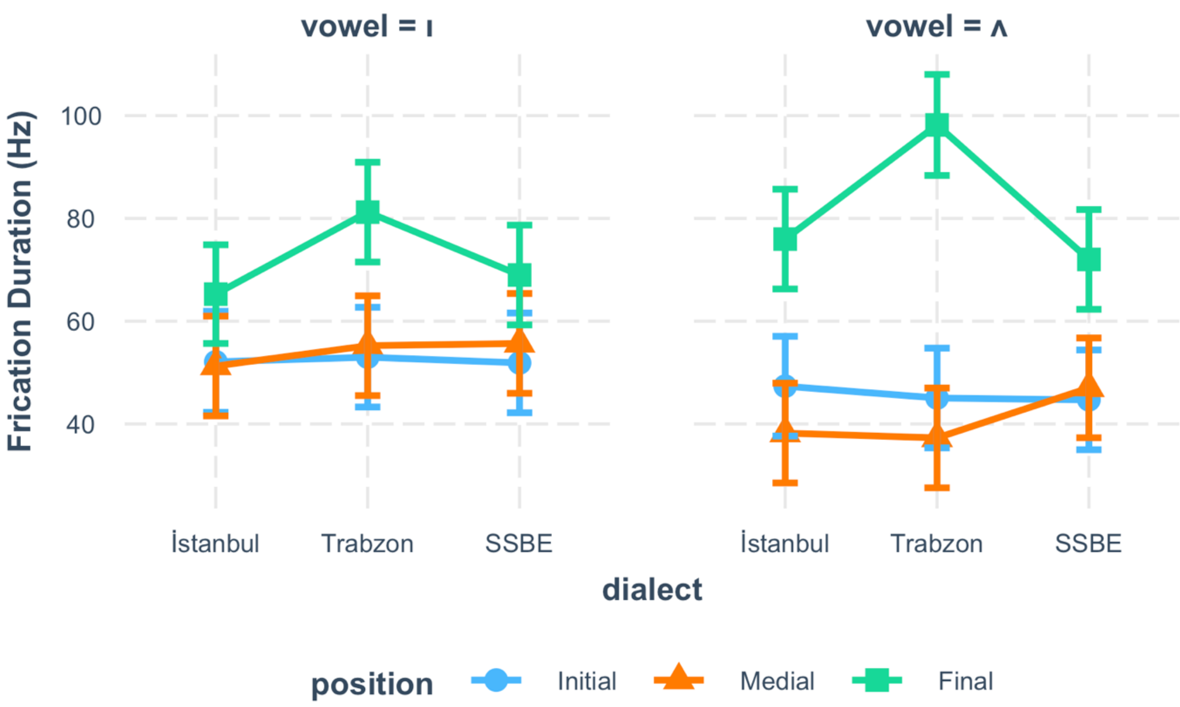

Figure 6.10 Interaction plot of Frication Duration

Closure duration was examined in word-medial and word-final position. The results showed that there was no significant effect of dialect (X^2 (2) =1.0354, p =.595) and vowel (X^2 (1) =0.8067, p =.369) on closure duration, but there was a significant effect of position (X^2 (1) = 6.3431, p =.011) on closure duration, which was longer at word-final position across all dialect groups in both vowel contexts (See Figure 6.11). Although not significant, Trabzon speakers tend to have a longer closure duration than İstanbul and SSBE speakers if the vowel is /ɪ/, whereas the closure duration is the shortest in Trabzon speakers if the vowel is /ʌ/.

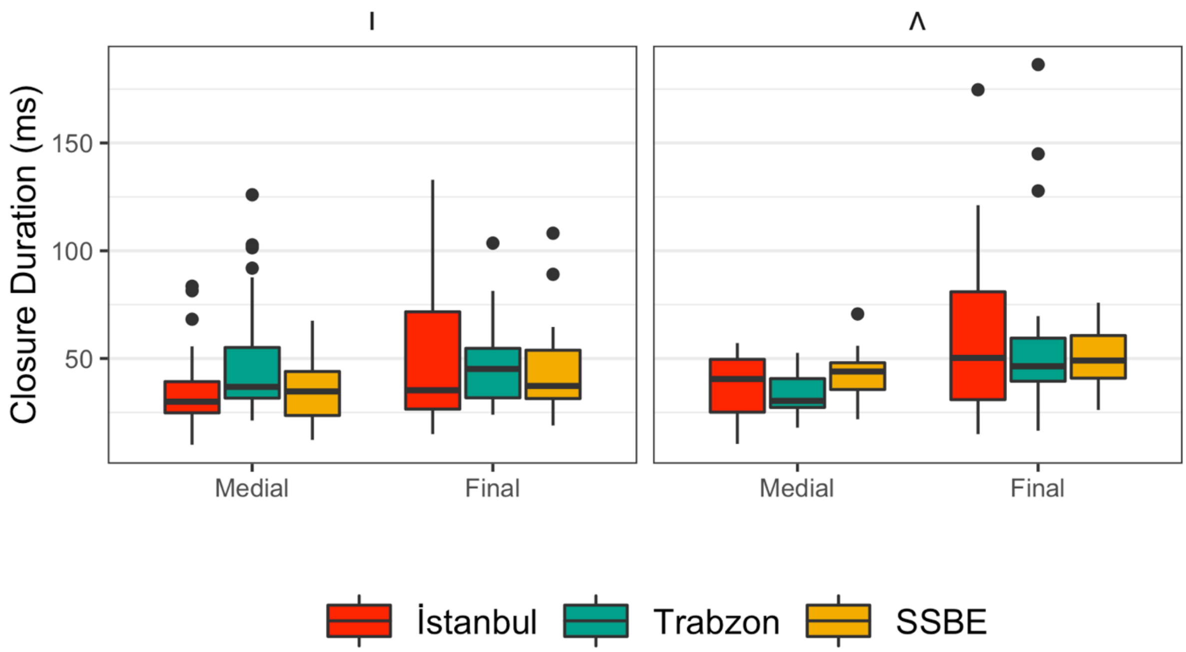

Figure 6.11 Boxplot showing Closure Duration (ms) in each dialect

Vowel duration was measured for following vowel in word-initial position and preceding vowel for word-medial and word-final position. LRT model comparisons showed that there was not a significant effect of dialect (X^2 (2) = 2.7684, p=.250) on the preceding or following vowel duration, while there was a significant effect of position (X^2 (2) = 17.822, p =.001) and the vowel (X^2 (1) = 10.579, p =.001) on the duration of the vowel. In line with the previous studies, /ɪ/ was shorter than /ʌ/. In all dialect groups, word-medial position resulted in the shortest production of preceding vowel, and SSBE speakers considerably have the shortest preceding vowel duration than İstanbul and

Trabzon dialect speakers in /ɪ/. The same pattern was also observed for word-final position of /ɪ/. However, Figure 6.12 demonstrates that these dialectal differences in word-medial and final positions decrease when the preceding vowel is /ʌ/.

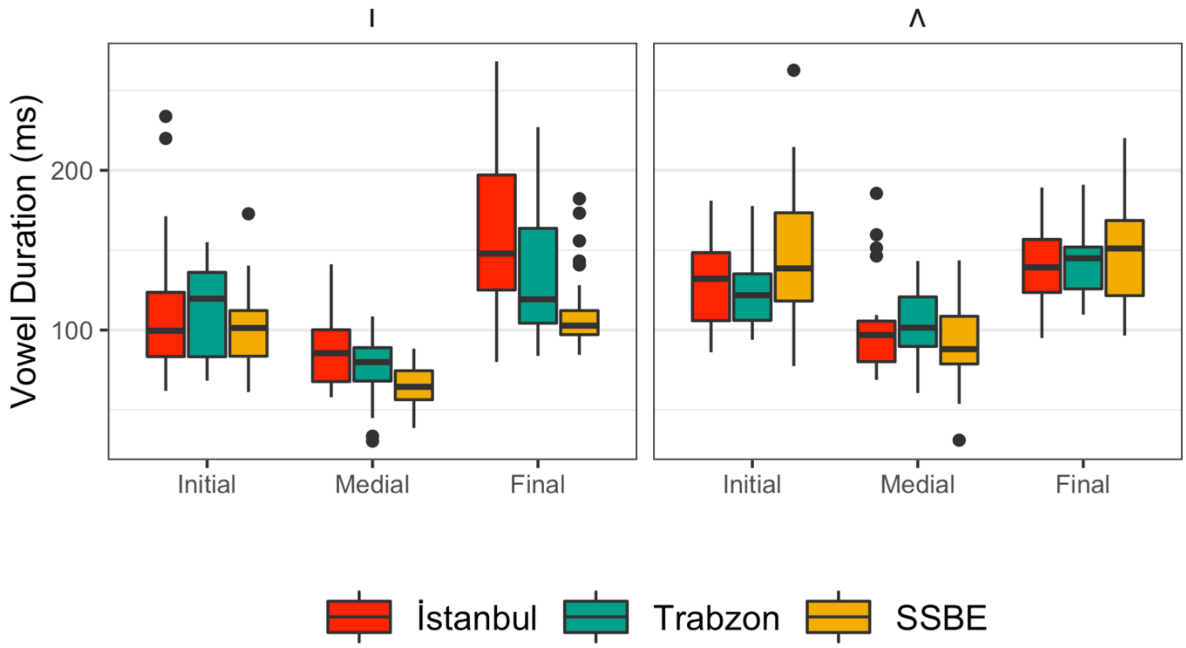

Figure 6.12 Boxplot showing Vowel Duration (ms) in each dialect

Like other temporal acoustic correlates, the results revealed that there was no significant effect of dialect (X^2 (2) = 1.544, p =.461) and vowel (X^2 (1) = 0.0453, p =.831) on total duration of the voiced affricate /dʒ/. However, a significant effect of position (X^2 (2) = 8.3524, p =.015) was found for total affricate duration. As expected, word-initial voiced affricate was the shortest in all vowel and dialect contexts, which can be easily explained by the lack of closure duration (See Figure 6.13). The difference in the duration of affricate between word-medial and word-final becomes notable when the preceding vowel is /ʌ/. Speakers from the Trabzon region, again, are found to be more influenced by /ʌ/ in word-final position.

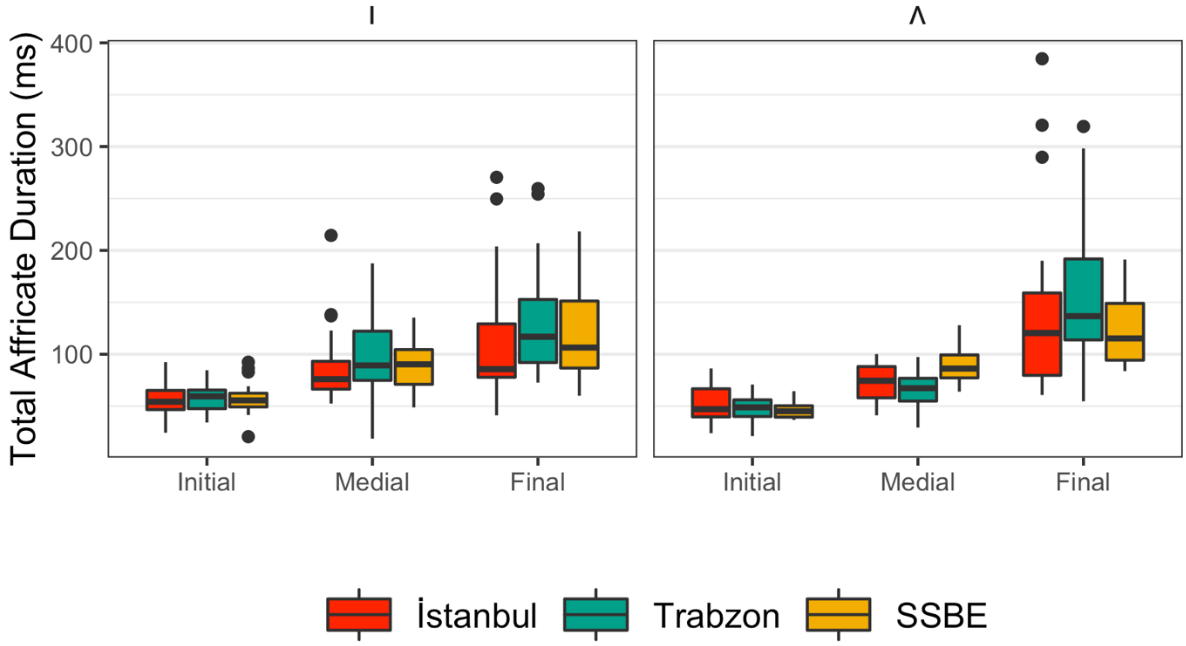

Figure 6.13 Boxplot showing duration of the voiced affricate in each dialect

In summary these results demonstrate that 'dialect' (SSBE vs İstanbul vs Trabzon) is significantly different in CoG, skewness, kurtosis, and rise slope. A closer look at the data reveals that this dialect influence arises from the L1 differences between SSBE and L1 Turkish speakers, as further inspection of the data showed that Trabzon and İstanbul speakers show similarity in spectral measures. This suggest that the acoustic realization of /dʒ/ is considerably different between SSBE speakers and L1 Turkish speakers, but that different L1 Turkish dialects do not differ substantially in the production of this sound in L2 English.

Regarding the role of position, the results showed that frication duration and vowel duration are significantly different, while there is a limited influence of word-medial position on rise slope as explored in the interaction plot. Lastly, as expected, vowel context (high vs low) was found to be significantly different in preceding/following vowel duration, but it did not influence the production of voiced affricate in other spectral and temporal aspects.

Finally, I examined the occurrence of burst tokens among the regional dialect groups in each word position. Recalling that Trabzon speakers produced slightly fewer burst tokens in word-initial and word-medial tokens than speakers of İstanbul in L1, I examined whether this trend is similar when the language is English including word-final position. The results showed that this pattern is also observable in the L2 English production of Turkish dialect speakers. While dialect speakers of all regions produced 'burst + fricative' tokens in word-initial position similarly, there was a notable decrease of burst tokens in word-medial position, with Trabzon speakers having the fewest tokens. In word-final position, again SSBE speakers were shown to produce more 'burst' tokens, and Turkish speakers of both dialects produced more burst tokens in word-final position compared to word-medial position.

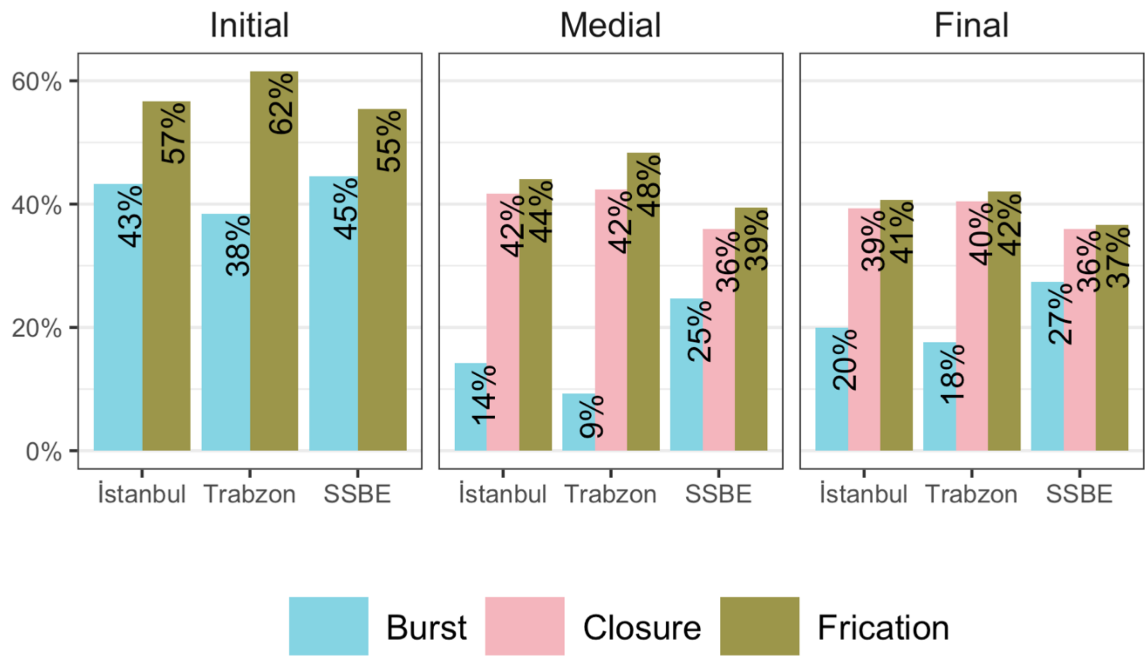

Figure 6.14 Bar Plot showing the occurrence of Burst, Closure, and Frication segments in voiced affricate consonant

The ratio of burst to frication tokens was very similar in word-initial position between SSBE and İstanbul speakers, but L1 Turkish speakers produced fewer burst tokens in other word positions, especially word-medially. Given that the spectral features of the frication varied between L1 groups, I looked further at the spectral aspects of the burst spectrum between the dialect groups to examine potential L1 differences in the spectral quality of the burst spectrum. Figure 6.15 below shows that the CoG value, indeed, has the largest difference between L1 Turkish and SSBE speakers in word-initial position.

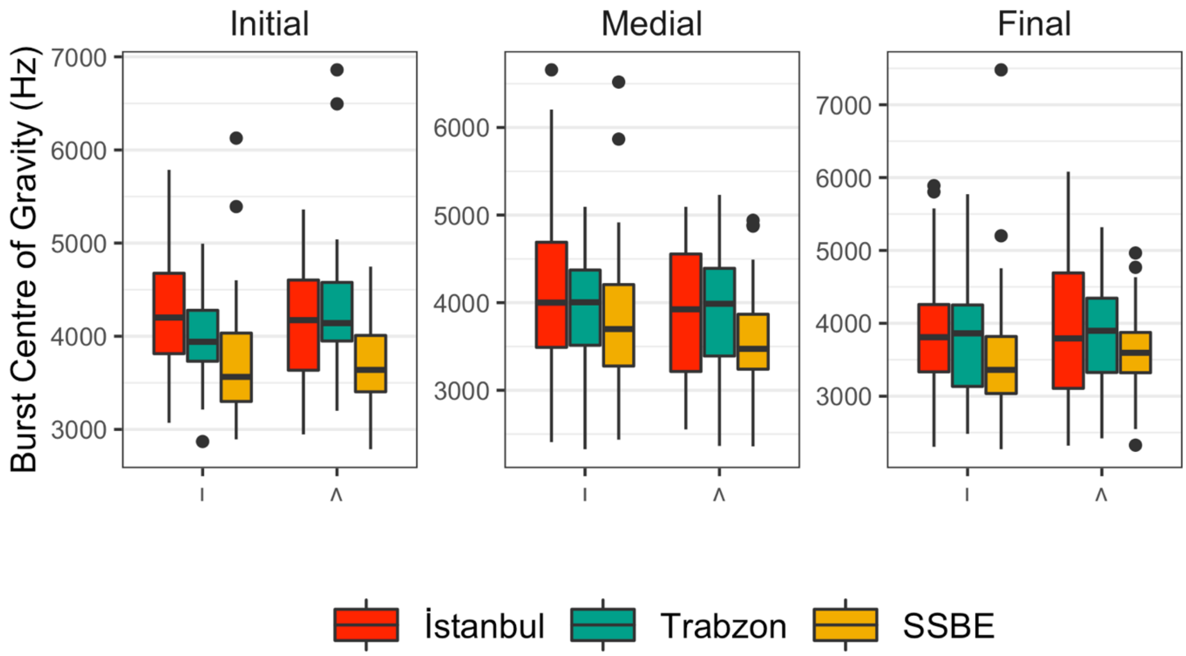

Figure 6.15 Boxplot showing the Mean Centre of Gravity of Burst Transient in each dialect

According to Figure 6.15 above, the vowel context and word position do not influence the CoG of the burst spectrum. This L1 difference in the burst transient becomes clearer when I examined the maximum amplitude of the burst in all dialect groups (See Figure 6.16). As can be seen from the Figure 6.16, SSBE speakers had a lower amplitude rate than L1 Turkish speakers in all word positions. This suggest that the phonetic realization of the voiced affricate differs between L1 Turkish and SSBE speakers both in burst transient and frication spectrum.

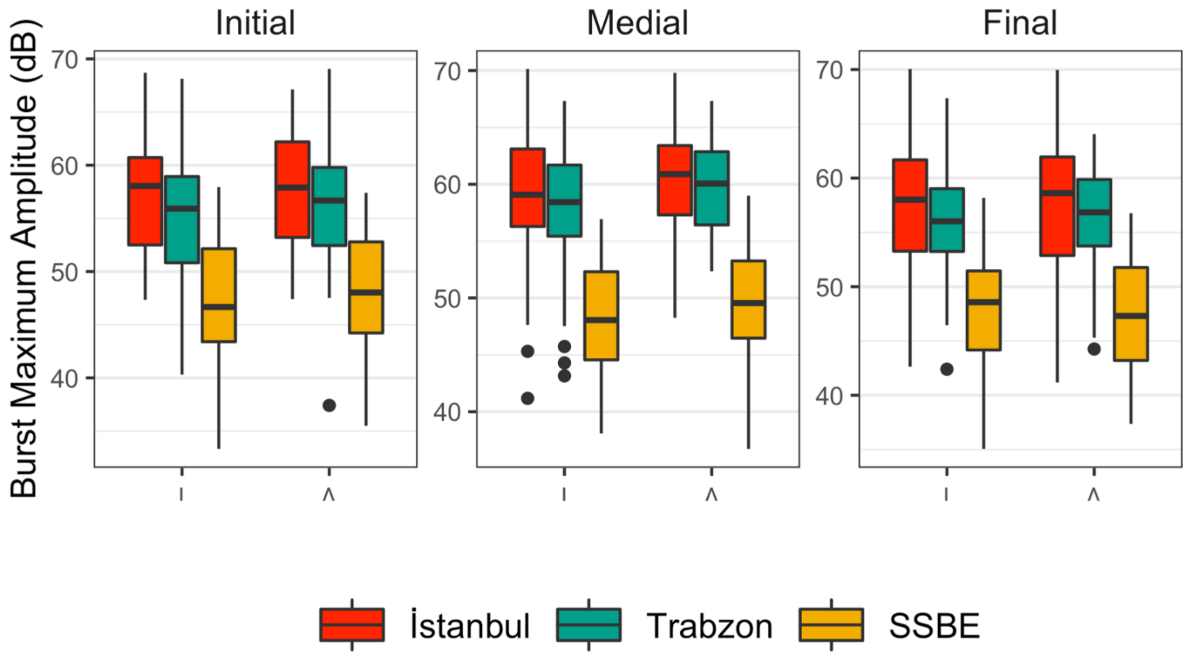

Figure 6.16 Boxplot showing the mean Maximum Amplitude of the Burst Transient in each dialect

6.3.4 Summary of the Results

In this section, I presented the statistical results examining the effect of dialect, word position, and vowel context on voiced affricate production in L2 English compared to SSBE speakers. The results showed that while L1 language significantly affects the production of the voiced affricate in spectral measures, regional dialect speakers of Turkish were found to be similar. This similarity appeared to be particularly strong in word-final position if the preceding vowel is /ɪ/. However, some regional dialect differences were observed between İstanbul and Trabzon speakers when the preceding vowel is /ʌ/, specifically in word-medial position, although this finding was not formally tested using the statistical model. In addition, the results showed that temporal measures such as frication duration and closure duration are influenced by word position. Lastly, analysis of burst tokens showed that SSBE and L1 Turkish speakers slightly varied in their production, which becomes more explicit in word-medial position. In the next section, I will interpret these finding in terms of L2 speech production models and sociolinguistic variation.

6.4 Discussion

In this chapter, the aim was to examine regional dialect influence of L1 Turkish speakers from İstanbul and Trabzon regions on L2 English voiced affricate production. The findings will be interpreted in terms of L2 speech models as well as native language and other conditional variables, which shows a variable impact on voiced affricate production. The discussion will first focus on the regional dialect influence on L2 production, and then will compare L1 and L2 speakers of English in voiced affricate production.

6.4.1 Regional Dialect Influence on L2 English Voiced Affricate /dʒ/ Production

Although considered as one of the salient features of Trabzon Turkish, there were not any regional dialect differences in the acoustics of the voiced affricate between Trabzon and İstanbul dialect speakers in Turkish. The result of this second study is congruent in that there was no significant dialect variation between Trabzon and İstanbul speakers in L2 English either. In fact, the similarity between the speakers of the two regional dialects increased when their production of the voiced affricate was compared in word-final position, which is constrained in L1 Turkish phonology. This suggest that L2 speakers of a shared L1 can show a greater (acoustic) phonetic uniformity/similarity on features for which there are shared L1 phonological constraints.

Although the regional dialect itself did not lead to L2 speech variation in voiced affricate production, visual inspection of the data revealed that word position and vowel condition can induce dialect variation to a certain extent. The interaction plots demonstrated that İstanbul and Trabzon speakers may differ in word-medial position with a /ʌ/ neighbouring vowel. Although the interactional influence of the vowel can be explained by the regional variation in this vowel (See Chapter 7), the reason why word-medial position interacts with the dialect awaits explanation. One explanation may arise from the difference in stress between the two dialect groups. Brendemoen (2002) argues that stress mainly falls into initial syllables in Trabzon Turkish and it is on the last syllable in Standard Turkish. Taken together with the variation in /ʌ/ and /æ/ vowels, this may explain the more nuanced variation in the voiced affricate production in L2.

Several patterns such as lower CoG, higher skewness and kurtosis, and less occurrence of burst tokens were observed to be slightly different, although statistically not significant, between İstanbul and Trabzon Turkish speakers' L2 English. The participants recruited in the Trabzon region varied more in terms of educational background and mobility. In addition, participants such as from Beşikdüzü and Tonya (6 in total) districts were not considered to have dental variation of alveo-palatal affrication in Trabzon (Brendemoen, 2002). Although I have experienced hearing dentalized production of the alveo-palatal voiced affricate from some participants during the data collection, the reasons stated above likely overshadowed the statistical results. Hence, the similarities between Trabzon and İstanbul speakers should be tested further, taking into account the role of socio-economic and sub-regional differences.

6.4.2 Comparison of L1s in Voiced Affricate /dʒ/ Production

It is widely accepted that the phonetic realization of phonemes might vary in different languages (Chodroff & Wilson, 2017). The results here reveal that the spectral acoustic correlates of the voiced affricate, except for dispersion, significantly varied between SSBE and Turkish speakers. In general, SSBE speakers have a lower CoG, and higher skewness, kurtosis, and rise slope. While the spectral correlates differ significantly between Turkish and SSBE speakers, temporal aspects such as frication duration and closure duration are nearly similar in all word positions. Recall that L2 learners can overly rely on temporal cues for L2 sounds (Cebrian,2006, Escudero, 2000), it can be argued that this overreliance resulted in higher similarity of temporal acoustic correlates between L1 Turkish and SSBE speakers than spectral correlates.

Another interesting L1 difference emerged in the production of burst tokens. Although the production pattern 'burst + fricative' was similar between the SSBE and L1 Turkish dialect groups, spectral analysis revealed that SSBE speakers produce a lower CoG in word-initial position, and maximum amplitude than İstanbul and Trabzon speakers. Although some of the Trabzon speakers did not produce a burst in word-medial and word-final position, those who did produce a burst transient showed similarity in spectral correlates with İstanbul speakers as demonstrated by the results. Given that most of the participants from Trabzon were mostly either university students or graduates, it is potential that these speakers produce the burst + fricative portion similar to İstanbul speakers as a consequence of exposure to Standard Turkish in educational settings.

Overall, these results provide evidence that the phonetic realization of the voiced affricate /dʒ/ is different between SSBE and L1 Turkish speakers from the İstanbul and Trabzon regions. This difference is clearer in spectral aspects whereas temporal aspects of the voiced affricate are similar in all dialect/L1 groups. However, the results also revealed that word position and the preceding vowel might interact with dialect backgrounds as in the case of /ʌ/ vowel for Trabzon speakers, or /ɪ/ vowel for vowel duration. That said, there was no clear effect of L1 dialect on L2, which offers one line of evidence for the claim that the specific phonetic patterns produced in the L1 do have some degree of transfer to the L2.

6.5 Chapter Summary

In conclusion, this study sought an answer to the research question “Do regional dialect speakers of Trabzon and İstanbul Turkish differ in L2 English voiced affricate production?”. The results revealed that while there is not a significant dialect difference between Trabzon and İstanbul speakers in L2 English voiced affricate production, there are differences predicted by word position and vowel context between the Turkish L1 dialect speakers for several acoustic correlates. This regional dialect difference was in favour of Trabzon speakers in terms of their similarity with SSBE speakers in skewness, and kurtosis, while İstanbul and SSBE speakers were more aligned in durational acoustic correlates. Another conclusion drawn from this study is that L1 Turkish speakers and SSBE speakers, in line with the previous studies, differed in the acoustic phonetic realization of the voiced affricate consonant. Although both languages have the same affricate group, phonological constraint on word-final voiced affricate creates a challenge for Turkish speakers in L2 English. I found that Trabzon and İstanbul speakers were similar in their production of word-final voiced affricate if the preceding vowel is /ɪ/, while preceding /ʌ/ vowel resulted in some regional dialect differences in word-final position. These results provide answers to the main research question of this chapter to a certain extent. However, given the limitations in the design of this study, future research is necessary to enlighten the role of regional dialects and L1 phonological constraints on L2 speech.

7 Regional Dialect Variation of Vowels in Turkish

7.1 Introduction

The aim of this chapter is to explore regional dialect variation in Turkish vowels specifically focusing on young speakers of Istanbul and Trabzon. This study will contribute to socio-phonetic documentation of Turkish as well as setting up a baseline for the L2 speech production experiments of next chapter. In line with the literature, I focused on eight Turkish vowels represented in Standard Turkish, as well as the additional [æ] allophone, which is a result of sonorant conditioned /ɛ/ lowering, an ongoing change in Turkish (Gopal & Nichols, 2017). Diphthongs are not included in this study since they are not a phonemic contrast in Turkish. In this chapter, I aim to answer RQ1a: "Is there regional variation between İstanbul Turkish and Trabzon Turkish speakers in the production of Standard Turkish Vowels?"

This chapter begins with outlining the acoustic characteristics of vowels in Turkey Turkish and how they vary in two target regions in Turkey, namely Istanbul Turkish as the representation of Standard Turkish and Trabzon Turkish. I will address how phonetic and phonological features such as backness, lowering, and rounding are represented in each dialect. This will be followed by an acoustic analysis of vowels in Turkish. The chapter ends with a discussion about the findings on regional dialect variation.

7.1.1 Acoustic Correlates of Vowels in Standard Turkish

Standard Turkish is considered to have eight vowels, with no diphthongs (Zimmer & Orgun, 1999, Kornfilt, 2013). Standard Turkish vowels are classified according to front/back, low/high, and rounded/unrounded and have a symmetrical phonological system as presented in Table 7.1 (Ozcelik & Sprouse, 2017). Tense/lax classification does not correspond to a phonemic difference in Turkish (Varol, 2012).

Table 7.1 ***Phonological Categorization of Turkish vowels***

	[-] back		[+] back	
	[-round]	**[+] round**	**[-] round**	**[+] round**
[+high]	ɪ	y	ɯ	u
[-high]	ɛ	œ	ʌ	ɔ

The number of vowels in Turkish (including allophones) ranges between 8 to 21 in different auditory or perceptual studies (for a review, see Davutoğlu, 2010). Yet acoustic phonetic documentation of allophones in Turkish does not appear to exist. Many claims about allophonic variation analysis in Turkish are based on impressionistic accounts. Early documentation of Standard Turkish vowel phonemes in terms of acoustic parameters dates to the 1970s. Selen (1979) attempted to establish the vowel space of Turkish, classifying /ɯ/ as central and /ʌ ɛ ɔ œ/ as low vowels. Demircan (1997) argues that, phonologically, /ɯ/ is a high-front unrounded vowel and /ʌ/ is a mid-central non-round vowel. Kornfilt (1997) put vowels into high /ɪ y ɯ u/ and non-high categories /ʌ ɛ o œ/ thereby leaving the mid-open, open discussions available. Kılıç (2003) contributed to the discussion by investigating the acoustic properties of Standard Turkish vowels in isolation produced by five male speakers. Another aim of this study was to match IPA symbols for Turkish vowels based on formant frequency results. The results of this study, orthographic symbols of vowels and their representation in IPA can be summarized as below.

- a is a non-round, open, back vowel /ɑ/,
- e is a non-round open-mid, front vowel /ɛ/
- ı is a non-round close, back vowel /ɯ/,
- i is a non-round close, front vowel /ɪ/

- o is a round, open-mid, back vowel /ɔ/,
- ö is a round, close, front vowel /œ/
- u is a round, close, back vowel /u/,
- ü is a round, close, front vowel /y/.

Kılıç and Öğüt (2004) further investigated the acoustic and articulatory correlates of high unrounded /ɯ/ due to disagreement among researchers about its frontness/backness. Five male speakers from the south or southeast region of Turkey produced the targets vowels in isolation. Results concluded that the /ɯ/ is a back vowel due to its contrast with /ɪ/, yet due to its unstable nature and being the shortest vowel of Standard Turkish, a more comprehensive study of /ɯ/ and its contextual variants are needed (Kılıç & Öğüt, 2004). More recently, Kopkallı-Yavuz (2010) stated that the above differences in the classification of vowels partially results from the variation in methodology, such as mixed gender or male-only gender, and analysing vowels in isolation or in different contexts. In order to establish a more robust baseline, Kopkallı-Yavuz (2010) analysed formant variations of eight Turkish vowels produced by seven speakers (5 male, 2 female) in seven contexts within a carrier sentence. This study provides the most up-to-date detailed acoustic description of eight Turkish vowels within different phonetic contexts while it does not include by-gender comparison. It should also be borne in mind that the lack of information about participants such as dialect use or bilingualism, and the fact that data was collected in Eskişehir, which is located Western to Mid-Anatolia and home to Balkan migrants, raises questions about the extent to which it represents Standard Turkish. The results indicated that monosyllabic words resulted in higher F1 values than disyllabic words, and F2 values were lower for monosyllabic words. Syllable structure (open, closed) did not have an impact on formant values (Kopkallı-Yavuz, 2010). The average not-normalized formant values of eight vowels in Standard Turkish from this study are presented in Table 7.2.

Kopkallı-Yavuz (2010) classify /ɪ y ɛ œ/ as front vowels and /u ɯ o ʌ/ as back vowels. She argues that, based on the F1-F2 results, there are no low vowels in Standard Turkish; instead, the contrast is realized as high vowels /ɪ y u ɯ/, /ʌ/ as being open-mid vowel, and /ɛ œ ɔ/ as close-mid vowels.

Table 7.2 ***Formant Values of Standard Turkish vowels (retrieved from Kopkallı-Yavuz, 2010)***

Vowel	F1 (Hz)	F2 (Hz)	F3 (Hz)
/ɪ/	276	2025	2829
/y/	307	1719	2493
/ɯ/	338	1455	2678
/u/	318	1031	2571
/ɛ/	455	1923	2805
/œ/	445	1505	2526
/ɔ/	479	1050	2684
/ʌ/	667	1334	2710

Davutoğlu (2010) investigated the acoustic correlates of Turkish vowels produced by speakers who are professional actors/actresses and specifically trained in elocution or voice training (according to guideline of Turkish Radio and Television Association). Davutoğlu (2010) argues that these participants best reflect an idealised representation of the Standard/İstanbul Turkish features. Eight speakers between the ages of 30-65 produced vowels in different contexts in a professional music studio. The classification of Turkish vowels mostly overlaps with Kılıç (2003), except for /œ/ being positioned as close-mid and /u/ as central. The most recent phonetic documentation of Standard Turkish vowels was introduced in Ergenç & Uzun, (2020), which provides a detailed documentation of each vowel. However, there is no information about the participants whose productions are claimed to be representative of Standard Turkish. Ergenc and Uzun (2020) categorize /ɯ/ as close central, /ʌ/ and /ɔ/ as open back, and /u/ as close-back. Table 7.3 below presents the classification differences of these four recent studies of acoustic correlates of Standard Turkish vowels.

Table 7.3 ***A Comparison of Standard Turkish Vowel Classification in Recent Studies***

Vowel	IPA	Kılıç (2003)	Kopkallı-Yavuz (2010)	Davutoğlu (2010)	Ergenc & Uzun (2020)
a	**/ʌ/**	Open, back	Open-mid, central	Open, back	Open, back
e	**/ɛ/**	Open-mid, front	Close-mid, front	Close-mid, front	Open, front
ı	**/ɯ/**	Close, back	Close, front-central	Close, backcentral	Close, central
i	**/ɪ/**	Close, front	Close, front	Close, front	Close, front
o	**/ɔ/**	Open-mid, back	Close-mid, front	Close-mid, back	open, back
ö	**/œ/**	Close, front	Close-mid, central-back	Close-mid, front	open, front
u	**/u/**	Close, back	Close, back	Close, central	Close, back
ü	**/y/**	Close, front	Close, central-back	Close, front	Close, front

In terms of vowel duration in Standard Turkish, vowels in initial syllables have lower mean duration, and low vowels have longer duration compared to high vowels (Arısoy et al., 2004, Şayli, 2002). Lip rounding is not included in the table as its phonological and phonetic classification is largely agreed among researchers, with /o œ u y/ as rounded and /ʌ ɛ ɯ/, and /ɪ/ unrounded. Radisic (2014) examined Turkish vowels with a focus on contrast in rounding among 6 Turkish speakers who lived in Canada during the time of the experiment. F2 is found to be higher among unrounded vowels whereas F1 and F3 were less constant for the rounding contrast. Radisic (2014) emphasized that acoustic and articulatory correlates of vowels do not necessarily show one-to-one relationship for this target group. For example, while this study found articulatory evidence that /ɯ/ is a back vowel, its acoustic properties (i.e., F2) were similar to previous studies defining it as a central vowel.

As can be seen from the table above, the front–back dimension is the main cause of disagreement among researchers regarding the acoustic characteristics of Standard Turkish vowels. To put such results into context and move towards agreement, it is of great importance for future studies to provide clear background information of participants/representatives and methodology.

Vowel Lengthening in Standard Turkish:

Another important feature of Turkish phonology is compensatory vowel lengthening. First, the so-called soft g, orthographically represented as ‘ğ’, makes the previous vowel longer if it is the final consonant of a syllable (see 1a). Compensatory lengthening is also observed in loan words from Arabic and Persian, but interestingly not applied to all words recently borrowed from English (1b). The durational contrast of vowels in those loanwords do not always cause a phonemic difference and its orthographic representation is not systematic (1c). That is, this lengthening is sometimes marked in the orthography while sometimes it does not show any representation in the writing system. Another instance of compensatory lengthening is related to /-h, -v, -j/ deletion (1d) in word positions (Sezer, 1986). Both Sezer (1986) and Kornfilt (1986) discussed the phonological explanations of compensatory lengthening in Turkish in relation to consonant deletion.

- 1a. *dağlık* - /ˈdʌ:lɯk/ (mountainous) *yağmur* /ˈjʌ:mur/ (rain)
- 1b. Arabic - *hususi* /huˈsu:si:/ (personal), *hariç* /ˈhɑːrɪʧ/ (external),
- English - *miting* /ˈmɪtɪng/ (meeting), *pik* /pɪk/ (peak),
- 1c. *irâde* /ɪrɑːˈdɛ / (willpower), *memur* /mɛːˈmur/ (civil servant)
- 1d. *gavur* /v/ deletion /ˈgɑːur/ (non-believer of İslam), *kahvɛ* /ˈkɑːvɛ / (coffee)

Vowel lengthening in Turkish origin words is only realized through soft g and it can be argued that Turkish speakers often extend this phonological feature to loanwords. Yet, to the best of my knowledge, there are no previous studies investigating vowel lengthening in relation to Turkish speakers producing L2 languages which have lengthening as the phonemic contrast (e.g., English). In addition to this, such lengthening does not appear to have been investigated acoustically in Modern Standard Turkish.

This section summarized the main features of Standard Turkish. In the next section, I will point out the phonetic and phonological features of Trabzon Turkish.

7.1.2 Vowel Production in Trabzon Turkish

To the best of my knowledge, there are no previous phonetic studies documenting acoustic characteristics of vowels in Trabzon Turkish. Therefore, I will rely on the phonological descriptions of Brendemoen (2002) who published a thorough phonological analysis of the dialect in the region based on recordings he collected during 1978-79.

Brendemoen (2002) claims that fronting and backing mechanisms of the vowels in Trabzon Turkish are the most notable dialect differences from Standard Turkish especially with the [ä] and [ẹ̜] as marginal phonemes. The rest of the vowel inventory of Trabzon Turkish is very similar to Standard Turkish. Table 7.4 below summarizes the description of Trabzon Turkish vowels according to Brendemoen (2002). The diacritic /ᵒ/ refers to voicelessness, and the diacritic /ᶜ/ refers to half-rounding according to Brendemoen's description (2002).

Table 7.4 ***Phonological Description of Trabzon Turkish vowels (Brendemoen, 2002)***

Vowel	IPA	Allophones	Description
a	/ɑ/	[ä], [aᵒ]	Low to lower-low, central, unrounded
e	/ɛ/	[ä], [ẹ̜], [ɛᵒ]	Mid/lower-mid, front, unrounded
ı	/ɯ/	[ɨ], [ʊᶜ]	High, back, unrounded
i	/i/	[ɨ], [yᶜ], [e]	High, front, unrounded
o	/ɔ/	[o], [uᵒ]	Low, back, rounded

ö	/œ/	[oᵒ], [ɛᵒ],	Low, front, rounded
u	/u/	[ʊᶜ], [o], [u]	High, back, rounded
ü	/y/	[u], [yᶜ],	High, front, rounded

Other dialectal investigations of the region focused on lexicology (Caferoğlu, 1946, Demir, 2006), morphology (Çoşar, 2010), and literature and folkloric themes (Demir, 2006). In a regional phonetic comparison, Çiyiltepe, Bekar, and Ergenç (2009) investigated the formant values of vowels from four regions including the Black Sea region. However, of the 70 participants in this study, it is not known how many of them were from the Black Sea region or from Trabzon. More importantly, it is not known which part of the Black Sea participants were recruited from, given the range of dialects change drastically along the coastline. A recent dialect analysis that focused on the speech of women in a particular district in Trabzon revealed similar findings as discussed by Brendemoen (2002) for phonology (Mısır, 2020).

Vowel Lengthening in Trabzon Turkish:

The realization of vowel lengthening in Trabzon Turkish is almost the same as in Standard Turkish. The only important issue noted by Brendemoen (2002) is that the first syllable has a lengthened vowel as stress is on the first syllable in Trabzon Turkish whereas stress mostly falls on the last syllable of the word in Standard Turkish (Kornfilt, 2013).

Despite the sociolinguistic studies and rich linguistic environment of the Trabzon region, the studies I reviewed above reflect the language of old, rural people based on data collected around the late 1970s. There is a lack of phonetic research on the current use of dialects, and it is highly likely that sound change has occurred alongside changes in social, economic, and cultural factors, and to what extent these are in line with Standard Turkish. This chapter of the PhD thesis aims to address this gap by investigating phonetic features of Trabzon Turkish produced by young people. This then provides a foundation for examining the effects of L1 regional dialect on L2 speech production in Chapter 8.

7.2 Method

7.2.1 Data and Participants

Fourteen speakers of İstanbul and fourteen speakers of Trabzon Turkish were selected for the acoustic analysis. Detailed information about participants and their dialect background were addressed in Chapter 4 (Methodology). This section only addresses the specific details that are relevant to the analysis of vowels, with more general methodological details covered in Chapter 4.

7.2.2 Stimuli

It is known that the acoustic quality of vowels is influenced by many factors such as the preceding consonant, word type, and stress (Recasens, 2018). For this study, I used a read aloud Turkish text to examine the production of vowels. Although an environmentally controlled sentence may help to control factors such as certain phonemic contrasts or similar consonant conditions, participants may produce a more spontaneous performance with a read aloud text (Ladefoged, 2003). The reading text included most of the vowels in different positions. However, low rounded vowels in word-final position clash with the phonotactic rules of Turkish. This phonological rule is violated in borrowed words such as *balo* (ball), *tiyatro* (theatre), *banliyö* (suburb). As the text used for the experiment did not include loanwords violating this rule, word position was not included in the dataset. In addition, many monosyllabic verbs and nouns are formed with suffixes according to vowel harmony which limits the variability of vowels in polysyllabic words. For consistency, all vowels were selected from bi or polysyllabic words, which had the target sound in word-medial position. Previous studies of Turkish phonetics did not report a potential influence of open vs closed syllable type on the acoustic properties of vowels, hence I did not consider this aspect when selecting sample words for the vowel analysis. When possible, words with the target vowel used twice in the text were selected for providing the same phonetic context. Five of the target vowels were available in the same word and consonant environment. This was to prevent potential place and manner of articulation influences of consonants on the following vowel. For vowels /ɯ/, /u/, and /y/ different words with similar consonant environments (as far as possible) were selected from the text. Table 7.5 below demonstrates the selected words and vowel position for the acoustic analysis.

Table 7.5 ***Target Words for Analysing Vowels in Turkish***

Word (Meaning)	IPA	Vowel (highlighted)
Kadar (x2) (until)	kʌdʌɾ	/ʌ/ kʌˈdʌɾ
Gerçekten (really)	gærtʃɛk̡tɛn	[æ] gærtʃɛk̡ˈtɛn
Gerçekliği (reality)	gæɾtʃɛk̡lɪːɪ	[æ] gæɾtʃɛk̡lɪːɪ
Tek (only), dek (till)	tɛk, dɛk	/ɛ/ tɛk, dɛk
Yaşadıklarım (,	jʌʃʌdɯkɫʌɾɯm,	/ɯ/ jʌʃʌdɯkɫʌˈɾɯm,
Çıldırtıcı (maddening)	tʃɯɫdɯɾtɯdʒɯ	/ɯ/ tʃɯɫdɯɾtɯˈdʒɯ
Gibi (as) (x2)	gɪbɪ	/ɪ/ gɪbɪ
Çok (a lot),	tʃɔktan	/ɔ/ tʃɔkˈtan
Çoktan (already)		
Dökme(ye) (x2) (pouring)	dœk̡me	/œ/ dœk̡ˈme
Kabuk (crust), tutkuyu (passion)	kʌbuk, tutku̡ju̡	/u/ kʌˈbuk, tutku̡ˈju̡
Öyküsünü (story (of)), Bütün (the whole),	œjk̡ysyny, bytyn	/y/ œjk̡ysyˈny, byˈtyn

7.2.3 Acoustic Coding

Upon recording, sound files were segmented into tokens for each target vowel in ELAN (Version 5.8, 2019). General coding on ELAN included participant code (e.g., P058), target vowel, word, and language. Praat scripts were used to chop data into individual sound files for each token. Individual sound files were then labelled using Praat textgrids in order to mark the beginning and ending of duration for each vowel.

In total, 504 tokens (14x2x9x2) were obtained for acoustic coding. For consistency of labelling, the onset and offset of the vowels were determined based on periodicity on the waveform and the onset/offset of formants on the wideband spectrogram (See Figure 7.1).

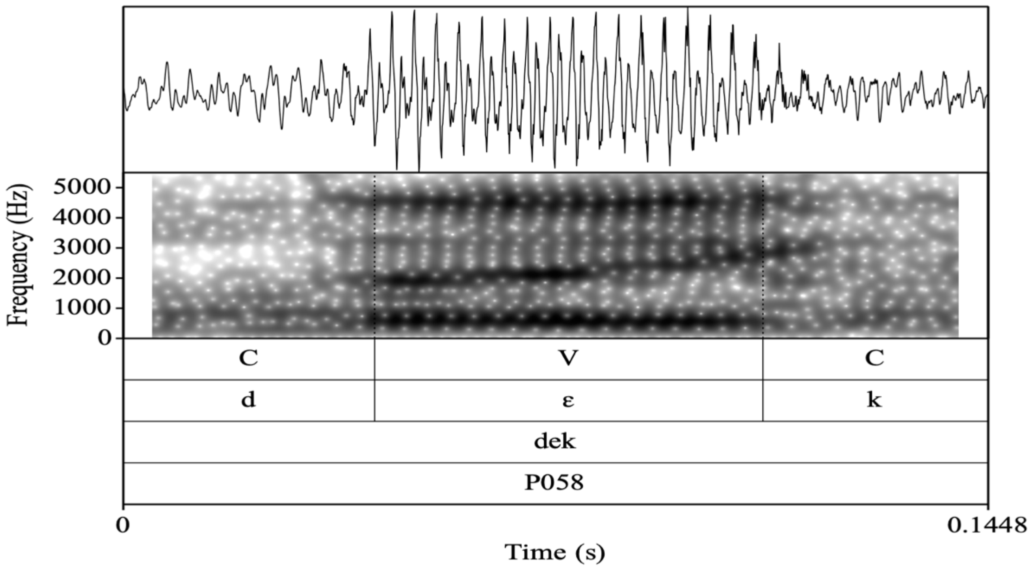

Figure 7.1 Sample acoustic labelling on Praat showing onset and offset boundaries of the vowel (V)

In the case of surrounding liquids and nasals, it is difficult to make a clear-cut decision on segmentation, so a conservative approach was used to limit the effects of these consonants. That is, the onset and offset of the phoneme was cut short based on the auditory inspection. While the neighbouring nasal and liquids did not lead to much confusion in segmentation of low vowels (e.g. [æ]), attention was given to high vowels due to their shorter duration in nature. For example, in the word /tutkṳjṳ/, the duration of the vowel was short, and more importantly, it was followed by an approximant + high back rounded vowel, leading some Turkish speakers to weight in lip rounding with a very short acoustic realization of the vowel. The offset was segmented at a point where the auditory and visual inspection overlap and did not include the following approximant/liquid consonant. In addition, eight tokens were not coded because the acoustic inspection on the spectrogram was not clear enough to draw onset/offset lines (which was mostly observed for the /y/ vowel, see vowel devoicing in Turkish, Jannedy, 1995).

7.2.4 Acoustic Analysis

Formants can be described as the resonant frequencies of the vocal tract that result from the shape of vocal tract airway, often modulated by the position of tongue and lips (Johnson, 1997, p.84). Different vowels have different resonant frequencies due to different articulatory configurations. The lowest resonant frequency or formant is F1, and subsequent formants are labelled as F2, F3, F4, and F5 (Harrison, 2013). Among those, F1 is roughly correlated with phonological vowel height, and F2 roughly correlates with backness, although they are more specifically related to the size of front and back cavities in the formation of a vocal tract constriction. For languages that include lip rounding as a contrast, such as Turkish, F2 and F3 can also be helpful to understand this dimension of vowel variation. Rounded vowels lead to lower F2 and F3 formants, as a consequence of an extended supra-laryngeal tract due to lip protrusion (Mayr, 2010). Vowel duration can carry phonemic information in some languages or dialects. Although vowel duration is not a phonemic contrast in Standard Turkish, I have included it in the analysis, both for exploring potential dialect differences, as discussed by Brendemoen (2002), and for examining the potential influence of adjacent consonants.

Prior to acoustic analysis, all sound files were downsampled to 11.025 kHz. I followed a proportional distance approach to obtain F1, F2, and F3 formant values of vowels at three points 25%, 50%, and 75% (Di Paolo, Yeager-Dror, & Wassink, 2011). F1, F2, and F3 measures were obtained automatically via Praat scripts based on the LPC (Linear Predictive Coding) Burg method, with a 25ms window length. Praat's maximum formant parameter was set to 5000 Hz for male speakers and 5500 Hz for female speakers to optimise measurement accuracy. Vowel duration was calculated as the duration between the onset and offset of the vowel.

Automatic formant estimation in Praat may sometimes lead to miscalculations. One way of dealing with this, which I follow, is to check distribution of vowels visually in an F1~F2 plot and detect any outliers. That is, if their acoustic values were not within the average range of F1~F2 values which were miscalculated due to highly anomalous position (e.g., an unambiguously back vowel being represented as an acoustically front vowel). Unless it is a result of mispronunciation in L2, they were considered as outliers. Five tokens were removed from the data based on the visual inspection. Among these, one token was beyond the optimal F1~F2 formant ranges (above 4000 Hz). Another four tokens were removed due to their extreme low and front display as high back vowels (i.e., /u/ vowel being lower and fronted than /ʌ/ vowel). In total, five tokens were removed from the data, and 491 tokens were used for further analysis.

In socio-phonetic studies, the use of raw Hertz (Hz) values for speakers-comparison can be problematic due to fact that each speaker has a differently sized and shaped of the vocal tract, which affects vowel quality to different degrees. It can be difficult, therefore, to establish whether differences are a consequence of differences in vocal tract shape and size or represent socio-linguistically meaningful differences. Normalization of formant frequencies for vowels is a common standard in socio-phonetics that has been developed to address this problem (Di Paolo et al., 2011). Normalization aims to reduce the effects of anatomical differences across speakers while also modelling human speech perception of variation (Adank, Smits & Hout, 2004). Various normalization techniques have been developed for several purposes and conditions, such as speaker-intrinsic/extrinsic, formant-intrinsic/extrinsic, and vowel-extrinsic/intrinsic. Intrinsic here refers to use of a single sample of the target (vowel/formant/speaker) for the calculation whereas extrinsic refers to use of multiple tokens of the target, such as relative distances between vowels (Fabricus, Watt & Johnson, 2009). Similarly, speaker-intrinsic would refer to use of single speaker per vowel while speakers-extrinsic include multiple speakers per vowel. One of the primary aims in regional phonetic studies is to reduce physiological differences while preserving the sociolinguistic and phonemic information obtained by the formants. Although normalization reduces the potential physiological effects, it risks obscuring the potential between-accent differences (Ferragne & Pellegrino, 2010), meaning that care must be taken to avoid using a method that over-normalizes. Adank et al (2004) compared vowel-extrinsic and vowel-intrinsic normalization methods and found that Lobanov to be the best, while Nearey1 and Gertsman were among the most other two successful normalization techniques for preserving phonemic differences while reducing the anatomical variation (Adank et al., 2004). Similarly, Flynn and Foulkes (2011) concluded that Lobanov was highly effective (i.e., ranked 3/11) for equalizing the vowel space and 6/11 for vowel space alignment. Lobanov normalization is a speaker-intrinsic, vowel-extrinsic, formant-intrinsic method. Since the aim of this study is to compare regional linguistic variation while reducing the physiological effects, formants were normalized using the Lobanov z-score technique for the inferential statistical analysis of regional variation. However, I also present the raw Hz values for descriptive purposes, which might be compared with other studies in the future. This is especially useful given that such values are more easily interpretable across different studies.

Lobanov z-score normalisation of vowel formants and vowel duration for each speaker were applied using the 'scale' function in R following the removal of outliers in the data. Since the aim of this baseline study is to examine regional variation in Turkish, normalization was calculated for Turkish and English vowels on separate files, so that vowel phonemes are expressed relative to each speaker's vowel space for each language separately. Three single points (25%, 50%, 75%) measurements for each formant were calculated for analysis, but only 50% midpoint formants values were used for statistical modelling because this point provides a good approximation for a steady-state where co-articulatory effects on the vowel are minimal. Since previous research on Turkish phonetics does not provide information about dynamic features of the vowels, I focused on single point measure for are reliable comparison with previous studies.

7.2.5 Statistical Analysis

Statistical analysis was conducted in R (Version, 4.1.2., 2021). First, descriptive values were obtained to document the acoustic characteristics of vowels. We compared these results in two ways, firstly the distribution of vowels within each dialect. Second, a more formal statistical comparison of how these dialect speakers differ from each other is presented, which is grounded in linear mixed-effects model regression analyses. As discussed in the methodology chapter, mixed-effects modelling enables us to account for variation between speakers and words, while examining the dialect influence on the acoustic measures of Turkish vowels. The lme4 (Bates et al., 2015) package was used for fitting mixed models in R (Version, 4.1.2., 2021). In addition, several packages were run simultaneously to obtain statistical information such as confidence intervals using multcomp (Hothorn, Bretz, & Westfall, 2008), p-values from lmerTest (Kuznetsoca, Brockhoff, & Christensen, 2017), and power size from simr package (Green, McLead, & Alday, 2016) in the model. Models were designed to test each vowel separately. Formant values were set as outcome variables, and dialect was set as fixed effect. Speaker and word were set as random intercepts. Separate models were fitted to each vowel to avoid interaction terms, which are known to require significantly more data than a main effect in order to be robustly estimated (Harrell, 2015). As the hierarchical structure is less complex when data is filtered for lexical set, while 'word' and 'speaker' random intercepts cover the potential variability within the data, the use of a random slope was not necessary for these models. The 'word' random intercept was removed from the model if there is only a single word observation between dialect groups, as in the case of /ʌ/ and /ɪ/. If the target words have the same roots but differ due to suffixation process (i.e., *dökme, dökmeye*), they were categorized as two different words due to potential variation in the stress and intonation change of these words.

For each data set, four separate models were fit for the spectral (F1, F2, F3) and the durational variables with the same structure of fixed and random effect variables. A sample mixed-effect model is as follows.

```
      lmer (F1_50norm ~ dialect + (1|speaker) + (1|word),
data = DRESS_vowels, REML = FALSE)
```

Summaries of the mixed effects models results for spectral and durational values are presented in Appendix H. Mixed-effect models revealed that that /ʌ/ and /æ/ are the two vowels which show significant difference between each dialect in terms of duration, while the other vowels were produced at similar duration by regional speakers of Turkish. The results demonstrate that /æ/ significantly differs both for F1 and F3, and /ʌ/ and /ɔ/ significantly differ in F1. Only moderately significant differences were found for F2 of the /ɛ/ and /ʌ/ vowels.

In order to assess the goodness-of-fit of these models, a likelihood ratio test (LRT) was implemented for each model in R (Version,4.1.2., 2021). LRT was calculated by comparison of models with/out 'dialect' as fixed variable. A sample code for calculating LRT for /ɛ/ vowel is shown below as proposed in Winter (2019) .

```
Model.1.a <- lmer(F1_50norm ~ dialect + (1|speaker) + (1|word),  data = DRESS_vowels, REML = FALSE)

Model.1.b <- lmer(F1_50norm ~ 1 + (1|speaker) + (1|word), data = DRESS_vowels, REML = FALSE)

anova(Model.1.a, Model.1.b, test = `Chisq`)
```

As in the previous analysis chapters, significance testing of the fixed effects in the mixed-effects models was evaluated using LRT. If the improved model with the fixed effect (dialect) is significantly different from the nested model, then I concluded that the dialect effect is statistically significant.

This section summarized the statistical protocol applied to examine regional dialect influence on Turkish variations. The next section will present the results.

7.3 Results

7.3.1 Overview

This section will present the descriptive and statistical analysis of vowels produced by Trabzon and İstanbul speakers of Turkish. The subsections present the results in the order of spectral measures, duration, and lip rounding. The last section summarizes the main findings.

7.3.2 Vowel Formants

A comparative description of mid-point formant values of the two regional dialect was presented in Table 7.6.

Table 7.6 ***Formant Values (non-normalized) of the Vowels in the Regional Dialects in Turkish***

F1_50 (Hz)	F2_50 (Hz)

	Trabzon		İstanbul		Trabzon		İstanbul	
Vowel (IPA)	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
/ʌ/	546	69	594	84	1351	110	1481	228
/ɛ/	422	58	520	102	1864	161	2090	179
[æ]	491	67	705	123	1704	218	1702	274
/ɯ/	388	54	460	81	1519	221	1636	243
/ɪ/	318	53	363	54	1961	157	2184	336
/ɔ/	462	66	494	107	1068	86	1054	178
/œ/	395	81	474	89	1536	189	1629	179
/u/	377	55	432	107	1262	408	1322	469
/y/	339	63	354	61	1702	235	1701	398

F3_50 (Hz)

	Trabzon		İstanbul	
Vowel (IPA)	**Mean**	**SD**	**Mean**	**SD**
/ʌ/	2511	205	2573	294
/ɛ/	2567	175	2853	341
[æ]	2462	202	2392	316
/ɯ/	2494	160	2713	337
/ɪ/	2529	263	2775	311
/ɔ/	2301	165	2506	238
/œ/	2289	172	2536	283
/u/	2303	211	2474	401
/y/	2476	239	2559	295

According to the results in Table 7.6, both dialect groups showed similarities in the acoustic realization of /y/ across all acoustic measures. The results showed that

Trabzon speakers differ from İstanbul speakers considerably in terms of F1, except for /ʌ ɔ y/. In addition, Trabzon speakers have lower F1 values than İstanbul speakers. This pattern is also observed for F2 where Trabzon speakers have lower formant values than İstanbul speakers except for /æ/, /ɔ/, and /y/. Lastly, for F3 formant values, results revealed that Trabzon speakers have lower F3 than İstanbul speakers. As these results are based on the raw Hz values, Figure 7.2 below demonstrates normalized F1~F2 distributions of vowels in each dialect.

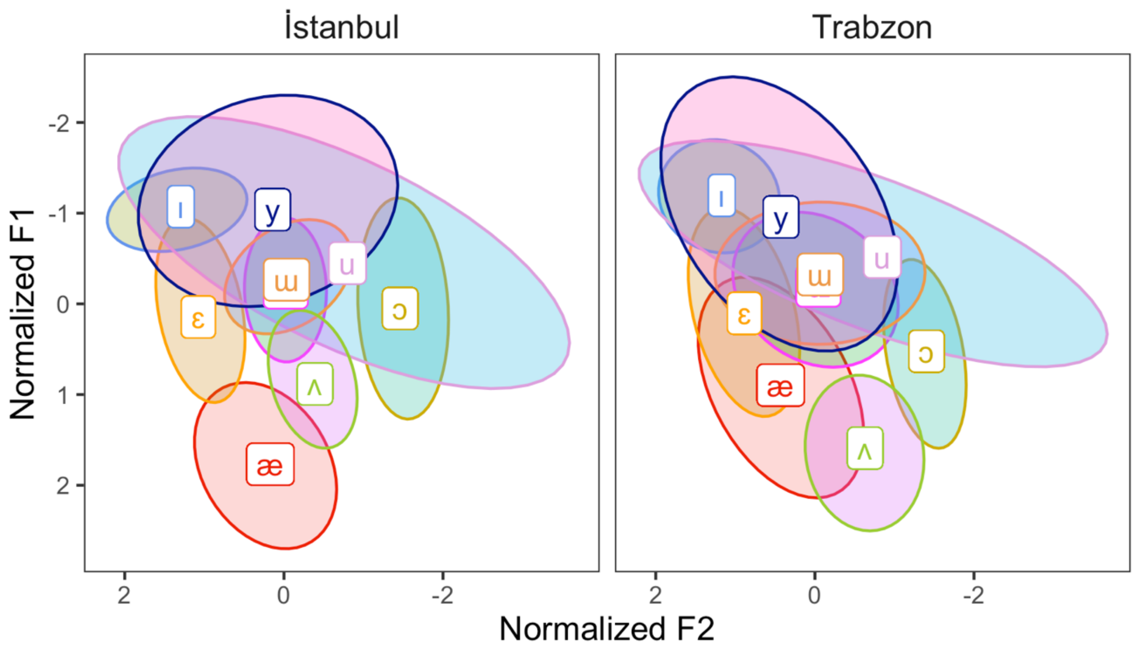

Figure 7.2 F1~F2 of Turkish Vowels in İstanbul and Trabzon Dialects

Figure 7.2 shows that dialect speakers mainly differ in realization of /ʌ/, /æ/, and /ɔ/. While /ʌ/ and /ɔ/ are lower in Trabzon Turkish, /æ/ is higher in F1. The /æ/ vowel is also more fronted in Trabzon Turkish. High vowels are slightly more fronted in İstanbul Turkish. The pair /œ/ and /ɯ/ were observed to be overlapping in terms of F2. However, these vowels mainly differed for lip rounding in Turkish, therefore F1-F2 similarity may not be considered as the main discriminator. As presented in Table 7.2 above, /œ/ is lower in F3 in comparison with /ɯ/, which confirms the rounding contrast between the two vowels.

In addition, Figure 7.3 below demonstrates the vowel space area difference in the two regions. As gender is not evenly distributed across groups, a male-only (8 per group) comparison of vowel size shape was calculated to further investigate how vowels are positioned and in the two regional dialect groups. Figure 7.3 shows that dialect groups mainly differ in low vowels where speakers of Trabzon have lower vowels than speakers of Istanbul except for [æ]. For this allophone, lowering is a notable feature of Istanbul speakers. Lastly, Figure 7.3 shows that vowels are more fronted among. male İstanbul speakers.

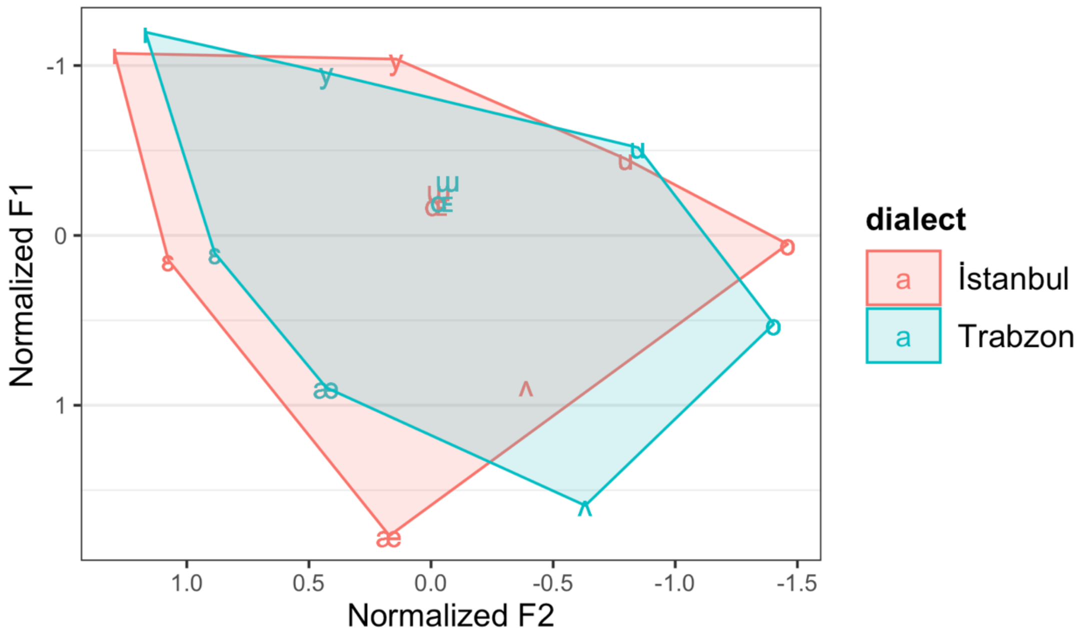

Figure 7.3 Vowel Space Area of Regional Dialect Speakers (Male-only)

Likelihood Ratio Test model comparisons revealed that that regional dialect influence was significant in /ɔ/, [æ], and /ʌ/ for F1, and /ʌ/, [æ], /ɛ/ in F2. For rounded vowels, a significant difference between regional dialect speakers was found for /ɔ/ and /œ/ vowels in F3. Finally, significant effect of regional dialect was found for duration of /æ/ and /u/, showing a moderate difference between the regional dialects. There was no significant effect of regional dialect on any of the acoustic correlates for /œ y ɯ ɪ/.

Table 7.7 demonstrates the output of LRT model comparisons for spectral and durational differences of the two regional varieties.

Table 7.7 ***LRT Model Comparisons for Dialects on the Acoustics of Turkish Vowels***

Vowel	comparison	X^2	*df*	*p*
/ɔ/	F1	7.639	1	**.005**
	F2	0.555	1	.456
	F3	2.784	1	.095
	duration	4.670	1	.030
/œ/	F1	0.021	1	.882
	F2	0.045	1	.830
	F3	5.970	1	.014
	duration	0.549	1	.045
/u/	F1	0.073	1	.786
	F2	0.882	1	.347
	F3	0.095	1	.757
	duration	7.18	1	**.007**
/y/	F1	0.347	1	.555
	F2	2.108	1	.146
	F3	0.636	1	.425
	duration	2.194	1	.138
/ʌ/	F1	23.59	1	**.001**
	F2	5.649	1	.017
	F3	3.77	1	.052
	duration	5.371	1	.020
[æ]	F1	22.49	1	**.001**

	F2	3.648	1	.056
	F3	9.81	1	**.001**
	duration	7.401	1	**.006**
/ɛ/	F1	0.022	1	.881
	F2	6.428	1	.011
	F3	2.972	1	.084
	duration	2.693	1	.100
/ɯ/	F1	0.423	1	.515
	F2	0.088	1	.765
	F3	0.270	1	.603
	duration	0.478	1	.489
/ɪ/	F1	1.904	1	.167
	F2	1.206	1	.272
	F3	1.147	1	.284
	duration	0.033	1	.854

7.3.3 Lip Rounding

Lip rounding results in lower F3 and F2 values. The boxplot below (Figure 7.4) shows that F3 of rounded vowels were clearly lower than unrounded vowels among speakers of Trabzon region except for /y/. The same tendency can be claimed for İstanbul speakers as well, however, the contrast was not as strong as Trabzon speakers. In addition, it was observed that Trabzon speakers had lower F3 values for rounded vowels than İstanbul speakers. /œ/ and /ɯ/, which were observed to overlap in F1~F2 comparison, differed significantly in lip rounding (F3) with Trabzon speakers having a larger contrast.

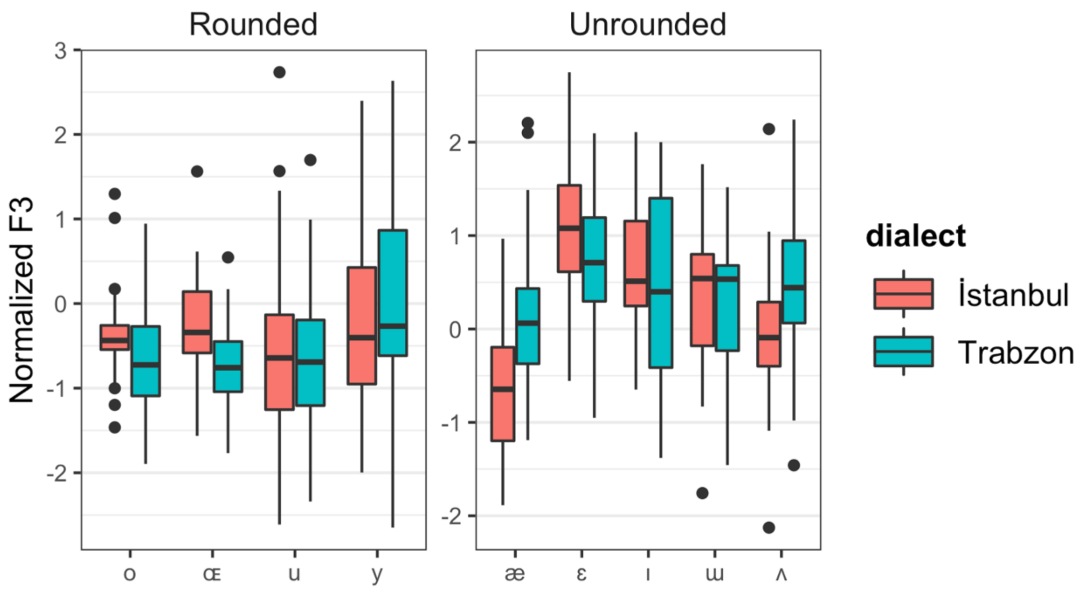

Figure 7.4 Boxplot showing F3 values of vowels in İstanbul and Trabzon Turkish

7.3.4 Duration

Lastly, durational values were examined for the regional dialect influence. The results showed differences between vowels, but only very small differences were observed between the dialects (See Fig 7.5). For example, duration of /ɛ/, /ɔ/, and /u/ were slightly longer for Trabzon speakers. Interestingly, [æ] was significantly longer than other vowels in terms of duration in both dialects. /y/ was the shortest vowel in both dialects. This contrasts with Kılıç (2004) claiming that /ɯ/ is the shortest of vowels in Turkish.

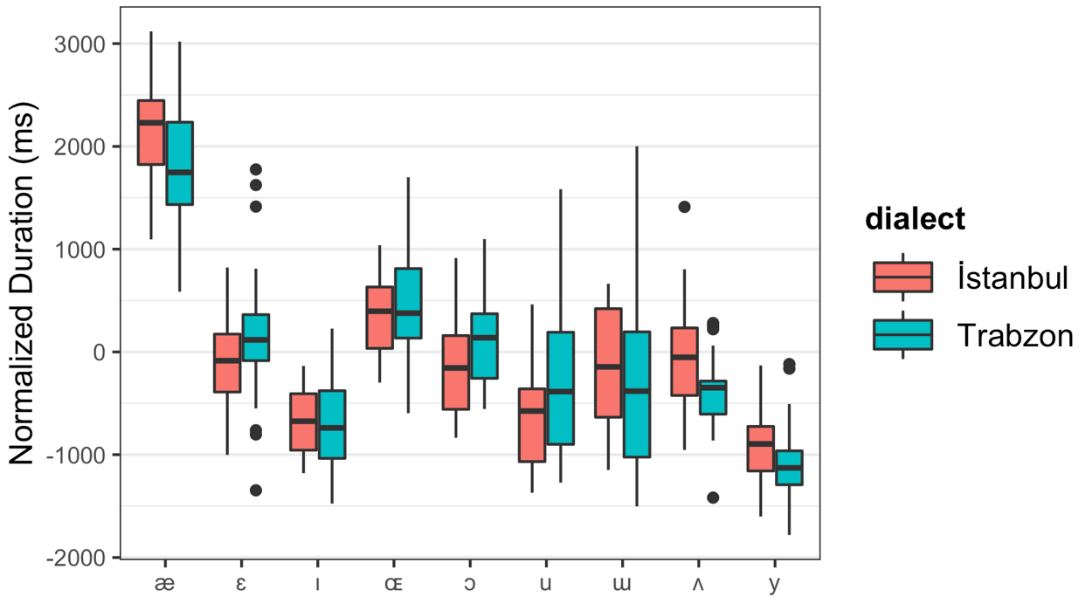

Figure 7.5 Duration of Vowels in İstanbul and Trabzon Turkish

7.4 Discussion

7.4.1 Acoustic Correlates of Vowels in Trabzon Turkish

In relation to younger speakers of Trabzon Turkish, the above results show that the acoustic features of vowels are congruent with the phonological analysis of Brendemoen (2002) except for /ɯ/ and /œ/ for open-close contrasts. It can be suggested that despite differences in age (old vs young) and time (1978-1979 vs 2019), the acoustic features of most of the vowels in the Trabzon region have not undergone drastic changes. The reason why /ɯ/ and /œ/ were not congruent with the analysis of Brendemoen (2002) has several possible explanations. First, it may be argued that the production of these sounds changed over time and younger speakers now distinguish these sounds based on lip rounding rather than a front-back contrast. On the other hand, it is possible that the influence of language standardization toward Istanbul Turkish might have influenced this pair more than other vowels, given that these vowels do not exist in the vowel inventory of contact languages such as Pontic Greek and Armenian in the region. That is, speakers of the Trabzon region maintain the influence of the contact languages on shared vowels between languages, such as /ʌ/ and /ɛ/, but for vowels not shared between historic contact varieties and Trabzon Turkish (e.g., /ɯ/ and /œ/) it may be possible that these vowels are more susceptible to influence from Standard Turkish.

The results also confirmed that lip rounding is consistently evident, based on differences in F3 among vowels. The mean F3 of /y/ is higher than other rounded vowels, which shows a great similarity with /ɛ/, yet this pair is clearly differentiated in F1 values. Finally, a significant durational difference is only found for /æ/ and /u/. As Brendemoen (2002) proposes that Trabzon speakers produce vowels longer if they are on a stressed syllable, I examined whether this trend is noticeable among young speakers as well. Primary stress usually falls on the last syllable in Turkish. Six of the eleven words including the target vowels are in the first syllable in this experiment, hence a non-initial stress word. Thus, it is conceivable that longer durations of Trabzon speakers might be due to the influence of word-stress difference between the two dialects. A comparison of the effect of initial versus non-initial stress on duration is presented below. According to Figure 7.6, Trabzon speakers produce slightly longer vowels than İstanbul speakers at initial-stress vowels except for /y/, which is lower in both cases.

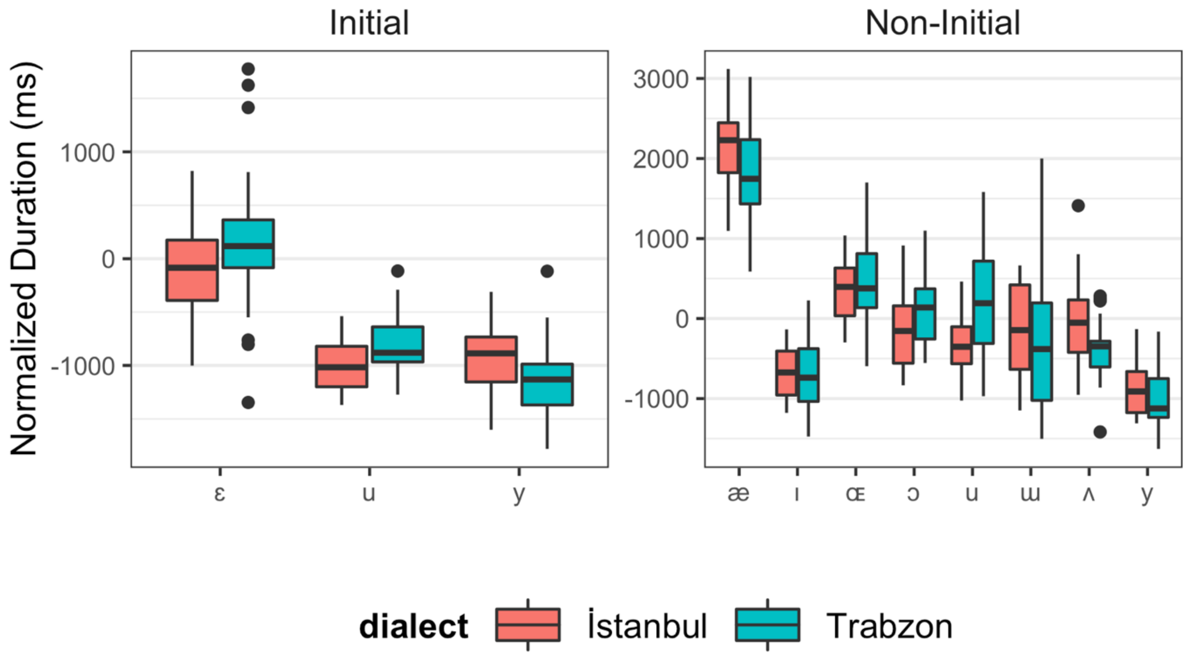

Figure 7.6 Duration Comparison of Vowels in Trabzon and İstanbul Dialects in terms of Primary Stress

According to the results, it appears that /ʌ/ is the lowest of all vowels in Trabzon Turkish, and /ɪ/ is the most fronted and highest vowel. /y/ is the shortest vowel and it is also the least rounded (based on F3).

7.4.2 Acoustic Correlates of Vowels in İstanbul Turkish

The result of this study demonstrates how younger speakers of İstanbul Turkish produce eight Standard Turkish vowels and the allophone [æ]. The results generally support Kopkallı-Yavuz (2010) that the vowel /ʌ/ is central and mid-open. In addition, it also confirms that /ɯ/ is central, in contrast with Kılıç (2003) and Kılıç and Öğüt (2004) suggesting /ɯ/ as back vowel. This vowel being produced as close-mid instead echoes the findings of Zimmer and Orgun (1999). In terms of the variable results in previous literature and this study, such differences may represent the production of /ɯ/ having slightly lowered and centralized among young generations. Alternatively, it is worth noting the limited number of participants and different experiment conditions in previous studies, and it could be the case that slight sampling between studies yielded these results. Therefore, I propose that /ɯ/ is produced as a close-mid vowel among young İstanbul speakers in the early 2020s, but it is unclear to what extent this is a genuine sound change or has long been a regular realisation that has not been adequately captured in previous research. Based on the descriptive results of this study, Table 7.8 shows a comparison of how different studies have classified vowels in İstanbul Turkish, alongside a classification of the results presented here.

Table 7.8 ***Comparison of phonetic description of Istanbul Turkish Vowels***

Vowel	Kılıç (2003)	Kopkallı-Yavuz (2010)	Davutoğlu (2010)	Ergenc & Uzun (2020)	Aksu (2022)
/ʌ/	Open, back	Open-mid, central	Open, back	Open, back	Open-mid, central
/ɛ/	Open-mid, front	Close-mid, front	Close-mid, front	Open, front	Close-mid, front
/ɯ/	Close, back	Close, front-central	Close, back-central	Close, central	Close-mid, central
/ɪ/	Close, front	Close, front	Close, front	Close, front	Close, front
/ɔ/	Open-mid, back	Close-mid, front	Close-mid, back	open, back	close-mid, back
/œ/	Close, front	Close-mid, central-back	Close-mid, front	open, front	close-mid, central
/u/	Close, front	Close, central-back	Close, front	Close, front	Close, front
/y/	Close, front	Close, central-back	Close, front	Close, front	Close, front
/æ/	NA	NA	NA	Open, front	Open-front

My results showed that [æ] is the lowest of the vowels in Standard Turkish. This was also discussed by Ergenc and Uzun (2020), who claimed that /ɛ/ can be produced with the allophone [æ] in Standard Turkish when it precedes from liquid or nasal sounds such as /l m n r/. However, there is still a need for more comprehensive accounts of coarticulatory effects in Turkish vowels, which will help to better document the extent of contextual variation.

Regarding lip rounding, it is observed that F3 was lowest for /u/, while the difference between rounded and unrounded vowels of İstanbul Turkish were less contrastive than in Trabzon Turkish. Although the tense-lax distinction is not a phonemic contrast in Turkish, the results revealed that /y/ is the shortest vowel, and [æ] is the longest vowel in the realization of İstanbul Turkish speakers.

7.4.3 Comparison of the Two Regional Dialects

The main aim of this study was to explore regional variation in the production of vowels between Trabzon and İstanbul speakers. The results showed no significant regional differences in /y/, /ɯ/ and /ɪ/, at least for the acoustic measures reported here. However, the low vowels /ʌ/, [æ], and /ɔ/ were found to differ in F1 between the two dialects. These vowels are also observed to be significantly different between speakers from Trabzon and İstanbul in terms of duration. While /ʌ/ and /æ/ were shorter in Trabzon Turkish, /ɔ/ was shorter in İstanbul Turkish. Regional dialect differences in F1 were not found for the rest of the vowels in Turkish. In terms of F2, only /ɛ/ and /ʌ/ values differed significantly between dialects, with these vowels being higher and less fronted among Trabzon speakers.

Although F1-F2 values are very similar for many vowels, the rounded vowels /ɔ/ and /œ/ showed a significant effect of dialect in F3. When we compare both dialects, we see that lip rounding, based on F3, is more distinctive for speakers of Trabzon, with larger differences between vowel pairs, while the contrast is smaller for İstanbul speakers in relation to the /ɔ/ and /œ/ rounded vowels. This suggests that the two dialects might utilize lip rounding differently in the production of vowel contrast, but articulatory data is needed to test this argument more comprehensively, as it is also possible to modify F3 using a range of lingual constrictions. In terms of /y/, only very small dialect differences are observed both for F1, F2, and F3, which can lead us to claim that this sound is produced very similarly by both dialects.

A significant dialect difference is observed for the contrast between /ʌ/ and [æ]. İstanbul speakers produce [æ] as the only open vowel and /ʌ/ as open-mid. However, Trabzon speakers produce /ʌ/ as an open vowel, lower than speakers of İstanbul, and [æ] as a more open-mid vowel. As discussed by both Brendemoen (2002) and Demir (2020), this difference might arise from the influence of contact languages. That is, the small vowel inventory of Pontic Greek vowels and its allophonic variation might influence the Turkish speakers in the Trabzon region because of "intense localism" (Brendemoen, 2002). A recent publication for the phonetic description of Pontic Greek speakers living in North-West Greece after the population exchange showed that /ʌ/ is indeed closer to a front low vowel /a/, unlike modern Greek, while /ɛ/ is close-mid and front (Armostis, Voniati, Drosos, & Tafiadis, 2020). This study also notes that /æ/ is not recognized by the speakers of this dialect in contrast to reports of Oeconomides (1908). Although a direct comparison of these studies would be impractical, due to differences in the nature of data in each case, it may assist our understanding of sound change in this region and point toward potential explanations for the patterns reported in this study.

Regarding variation in the [æ] vowel, the influence of the following consonant was found to influence each dialect to a different degree. Sonorant-conditioned /ɛ/ lowering is found to be greater among İstanbul speakers, whereas the degree of lowering is very low for Trabzon speakers. Armostis et al. (2020) reported Pontic Greek speakers produce this vowel as a low front /a/. Gopal and Nichols (2017) examined sonorant-conditioned mid-vowel lowering in Turkish and suggest that the strength of lowering is more advanced among speakers from Ankara and İstanbul (the two biggest and capital cities of the country) than other regions. Taken together, it can be concluded that İstanbul speakers apply mid-vowel lowering conditioned by /ɾ/, whereas the degree of lowering is considerably smaller for Trabzon speakers as a result of their long-term exposure to the Pontic Greek dialect. Further dialect studies would highlight whether this allophone replacement pertains to Standard Turkish, or whether it is only lacking for speakers of Trabzon Turkish who show different allophones both for /ʌ/ and /ɛ/ vowels.

In conclusion, the regional variation reported here shows different levels of similarity and divergence for each vowel. Close back and high vowels showed greater similarity between the dialects, while the significant difference observed in, /ʌ/, /ɔ/, and [æ] highlight areas of notable dialect differences. Closed rounded vowels have shortest duration values in both dialects confirming the previous research on vowel duration in Turkish (Arısoy et al., 2004). Lip rounding is found to discriminate some vowel pairs for Trabzon speakers while İstanbul speakers showed only a small variation for the rounding contrast. It would be worthwhile to examine articulatory data with a focus on lip rounding in order to better contribute to our understanding of the role of lip rounding in Turkish vowels. In concluding this section, Table 7.9 below compares the findings of this study with the previous research on vowels in Turkish.

Table 7.9 ***Summary of the Findings in Comparison with Previous Key Studies***

		İstanbul/Standard Turkish		**Trabzon Turkish**	
Vowel	**IPA**	**Kopkallı-Yavuz (2010)**	**Aksu (2022)**	**Aksu (2022)**	**Brendemoen (2002)**
a	/ʌ/	Open-mid, central	Open-mid, central	Open, central	Open, central
e	/ɛ/	Close-mid, front	Close-mid, front	close-mid, front	Open-mid, front
e	[æ]	-	Open, front	Open-mid, front	-
ı	/ɯ/	Close, front-central	Close-mid, central	Close-mid, central	Close, back
i	/ɪ/	Close, front	Close, front	Close, front	Close, front
o	/ɔ/	Close-mid, front	Close-mid, back	Open, back	Open, back
ö	/œ/	Close-mid, central-back	Close-mid, central	Mid, central	Open, front

u	/u/	Close, back	Close, back-central	Close, back	Close, back
ü	/y/	Close, central-back	Close, front	Close, front	Close, front

7.5 Chapter Summary

The aim of this study was to explore regional dialect variation among young speakers of Trabzon and İstanbul Turkish. This provides an important and up-to-date description of the Turkish vowel inventory across two dialects, but it will also inform the L2 speech production experiment reported in the next chapter, which examines whether these dialect differences influence the speakers' L2 production. In summary, the results in this chapter show that regional variation exists in the production of /ʌ/, /ɔ/ and the [æ] allophone while lip rounding varies for open rounded vowels. These findings contribute to the phonetic documentation of the Trabzon dialect, which shows potential influence from historical contact languages, despite the prestige loss and language disconnection that occurred in the area nearly a century ago.

In the next chapter, I will examine whether these dialectal acoustic differences and similarities show clear patterning with the L2 English vowel production patterns of regional dialect speakers.

8 Regional Dialect Effects on L2 English Vowel Production

8.1 Introduction

This chapter aims to investigate the influence of L1 regional dialect on L2 English vowel production among L1 Trabzon and İstanbul Turkish speakers. Previous chapter provided a detailed analysis of vowels in Turkish. In this chapter, I will only address the vowel inventory of English in relation to L1 Turkish, with the aim of pointing out cross linguistic differences. Since English itself includes many varieties across continents, I will focus on Standard Southern British English (SSBE), as being one of the most common input type/learning materials of EFL learners in Turkey. This chapter seeks to answer RQ2b: Do İstanbul Turkish and Trabzon Turkish speakers differ in their production of L2 English vowels?

The outline of this chapter is as follows. First, I will address the phonetics and phonology of SSBE vowels, and how the phonology of Turkish can influence the production of Turkish speakers' L2 English. Second, I will explain my methodological approach and provide descriptive and inferential statistics results. Lastly, I will interpret the results and discuss how Turkish L1 regional dialects influence production of vowels in L2 English.

8.1.1 Vowel system of Standard Southern British English

The vowel inventory of Standard Southern British English (SSBE) has been widely investigated in terms of both acoustics and articulation (Henton, 1983, Deterding, 1997). Since this study focuses on the recent use of English among young people as a control group, the focus will be on recent phonetic and phonological analysis of English such as Lindsey (2019), Williams and Escudero (2014), and Bjelakovic (2016). The SSBE vowel inventory consists of 11 monophthongs and 5 diphthongs with an additional schwa /ə/ sound in unstressed syllables (McMahon, 2002).

8.1.2 Acoustic Correlates of Vowels in English

This review excludes the diphthongs and schwa as they were not examined in the previous chapter. Vowels in English are phonologically considered to vary according to three features, highness, backness, and the tense-lax distinction. In addition, vowel-inherent spectral change is found to affect vowel identification in English for some vowels (Jin & Liu, 2013). What is mostly agreed among recent investigation of SSBE is that some vowels are showing change-in-progress, such as /u:/ and /ʊ/ fronting, /ɑ/ and /ɔ:/ becoming more retracted, and /æ/ shifting to /a/ (Bjelakovic, 2016, Lindsey, 2019, Williams & Escudero, 2014). Table 8.1 below presents IPA transcriptions and phonetic categorizations of SSBE vowels according to the aforementioned studies.

Table 8.1 ***Phonetic Classification of SSBE English vowels***

Lexical Set	IPA	Lax -Tense	Front - Back	High - Low
kit	ɪ	lax	Front	High
Foot	ʊ	lax	Back (fronted)	High
dress	ɛ	lax	Front	Mid
Strut	ʌ	lax	Mid (back)	Low
Lot	ɒ	lax	Mid	Low
Trap	æ	lax	front	Mid-low
Fleece	i:	tense	front	High
Goose	u:	tense	Back (fronted)	High
Nurse	ɜ:	tense	mid	High
Thought	ɔ:	tense	back	Mid

Bath	ɑ:	tense	back	low

When compared with Turkish vowels, several features of SSBE vowels may present potential phonetic difficulty for L1 Turkish speakers. First, long-short vowels do exist in Turkish, but they do not lead to a phonemic contrast. It is possible that Turkish speakers may have difficulty in perceiving, hence producing, phonemes in tense-lax contrasts, such as sheep versus ship. Second, several allophones in Standard Turkish are phonemes in English, which creates the 'similar sound' scenarios in L2 models such as SLM-r and L2LP. The similar sound scenario is conceptualized as the most difficult L2 learning scenario in SLM-r which focuses on learning native-like phonetics. L2LP, focusing on learning the phonemic contrasts, consider the similar sound scenario as the least difficult one for L2 learners. Standard Turkish has one central-low /ʌ/ and a low back rounded /ɔ/ vowel. In the case of English, the low back vowel contrast between /ɑ:/ - /ɒ/, and /ɒ / - /ɔ:/ pairs may create perceptual or production difficulties for L1 Turkish speakers. According to the L2LP model (Escudero, 2005), it can be assumed that Turkish learners might map all of these vowels to /ʌ/ (or maybe the back rounded /ɔ/ vowel), and then gradually establish distinct categories for these English vowels over the course of learning. Since the phonological space is separated in L1 and L2, learners can easily update the phonetic positioning of the new phonemes in L2. However, the SLM-r model (Flege & Bohn, 2021) proposes the phonetic proximity of vowels in the L1 will determine whether Turkish speakers would be able to produce these L2 vowels as categorically different. That is, L2 English learners of Turkish may produce these vowels overlapping with /ʌ/ or /ɔ/ due to their allophonic proximity in the L1 inventory. Thus, the shared phonological space and phonetic similarity of these vowel may hinder creating a new category through L2 language development.

Another example of 'similar scenario' for Turkish speakers is the /æ/ - /ɛ/ contrast in English since [æ] is an allophone of /ɛ/ vowel in Turkish. SLM (1995) argues that the ability of a learner to produce L2 sounds can depend on position-sensitive allophonic variation. In the case of Turkish, this allophone exhibits context sensitive conditioning when following approximants, whereas in English it can occur before other consonants as well as approximants (e.g., trap, chat). The previous chapter on Turkish vowels showed that Trabzon and İstanbul speakers differed significantly in the effect of sonorant-conditioned mid-vowel lowering. Thus, this allophonic level regional dialect variation might lead speakers to produce the new phoneme /æ/ in different ways. For example, the greater phonetic proximity between /æ/ and /ɛ/ among İstanbul speakers in L1 might enable them to establish a new categorization of /æ/ and /ɛ/ in L2 English with less difficulty in comparison with Trabzon speakers.

To sum up, in light of the previous findings in Chapter 7 and phonological differences between Turkish and English, I predict that dialect differences in L2 English will be most prominent in /æ/, /ʌ/, and /ɔ:/ vowels. These predictions, framed according to the similar sound scenario in SLM-r, can be summarised as follows:

a. İstanbul speakers may produce /æ/ in L2 English similar to SSBE speakers as İstanbul speakers showed greater phonetic proximity of /æ/ in their L1 compared to Trabzon speakers.
b. L2 English production of /ʌ/ may differ among Trabzon and İstanbul dialect speakers due to variation of /ʌ/ in L1 Turkish dialects, and the phonetic proximity of /ɑ:/ and / ɒ/ and can lead SSBE and L1 Turkish speakers to differ in production.
c. /ɔ:/ can be produced lower and shorter by Trabzon speakers because /ɔ/, the similar sound in their L1, was produced lower in L1 Trabzon Turkish.
d. Since tense-lax contrast is not phonemic in L1 Turkish, I predict that L2 speakers may produce tense vowels shorter compared to SSBE speakers as this will create a similar sound scenario of the SLM-r (e.g., /ɪ/ - /i:/). However, no regional dialect influence is expected as duration was not significantly different in any of the vowels in their L1.

8.2 Method

8.2.1 Participants

Fourteen speakers from each region, İstanbul and Trabzon, were selected for the acoustic analysis from the data pool. In addition, 14 SSBE speakers recruited in order to compare L2 English speech production data with L1 English speakers. Multistage sampling of the participants and their regional dialect and second language profile are addressed in detail in the Chapter 4 (Methodology).

8.2.2 Stimuli

Productions of English vowels were obtained via the reading text "The Boy Who Cried Wolf" (Deterding, 2006). The recording procedure was the same as detailed in Chapter 6 for Turkish. Participants first read a series of word list in a sentence. Following this, they were asked to read aloud 'The Boy Who Cried Wolf' text (Deterding, 2006). Vowel samples were taken from the read-aloud text. Two words for each vowel were selected from the text for the acoustic analysis. The only vowel with one sample token is /ɑ:/ "dark" due to limitations on word-medial position of the vowels in the text. Stop consonants were chosen as a co-articulatory environment where possible. If not, vowels occurring before approximants had to be included. Selected words for speech analysis were shown in the table below.

Table 8.2 ***Target Words for the Acoustic Analysis of Vowels in English***

Vowel	Word-medial	IPA	Lexical Set (Wells, 1982)
/ʌ/	Duck, come	/dʌk/, /kʌm/	strut
/ɛ/	Next, get	/nɛkst/, /gɛt/	dress
/ɪ/	Chicken, did	/ˈʧɪkɪn/, /dɪd/	kit
/i:/	Sheep, feast	/ʃiːp/, /fiːst/	fleece
/ɔ:/	Short, thought	/ʃɔːt/, /θɔːt/	thought
/ɜ:/	Heard, third	/hɜːd/, /θɜːd/	nurse
/ʊ/	Foot, good	/fʊt/, /gʊd/	foot
/u:/	fool, soon	/ˈfuːl/, /suːn/	goose

/æ/	Plan, began	/plæn/, /bɪˈgæn/	trap
/ɒ/	Hot, not	/hɒt/, /nɒt/	lot
/ɑː/	Dark (1)	/dɑːk/	bath

8.2.3 Acoustic Coding

The same coding criteria for vowels in Chapter 7 was used.

8.2.4 Acoustic Analysis

The same coding criteria as in the previous chapter was used. In total 882 tokens were obtained for analysis. Six tokens were not included in the analysis as the corresponding acoustic cues were not unambiguously visible on the spectrogram. This was mostly observed for the /ɪ/ and /uː/ vowel among Turkish speakers and might represent potential high vowel devoicing. Similar to the Turkish analysis, visual inspection of F1~F2 was conducted to detect outliers in the data. A formant frequency distribution check resulted in some outliers in the L2 speakers' production of some target vowels, including mispronunciations such as [tɪɾd] for the word [θɜːd]. These outliers, however, were kept in the dataset for analysis to preserve any effects of L2 proficiency or regional dialect on L2 speech production. One token (/æ/ vowel) of an L2 speaker was removed from the analysis as the visual F1~F2 inspection and auditory inspection of the sound did not overlap. In total, 875 tokens were measured for acoustic analysis.

8.2.5 Statistical Analysis

The same statistical analysis procedure was employed as discussed in Chapter 7. Since the primary aim of this study is to explore influence of regional dialect on L2 speech, other factors such as L2 proficiency and gender were not included for statistical analysis. This was to preserve statistical validity as L2 proficiency level is not even across groups, and the sample is too small to estimate the effect of proficiency with any degree of reliability. In addition, the L2 assessment results come from a wide variety of different language exams, and, therefore, may not be completely comparable across speakers. Thus, secondary variables such as L2 proficiency, or consonant context will be excluded from the statistical analysis.

A series of mixed-effects model were fitted to test the effect of dialect on vowel production. Models were fitted separately to each lexical set to simplify the model. Formant values were set as outcome variables separately for each model. In order to test regional dialect effects, 'Dialect' (Trabzon vs İstanbul vs SSBE) was set as a fixed effect. Since all the target words were monosyllabic except for 'began' and 'chicken', and vowels were measured in word-medial position, syllable type and word position were not included as a random effect in the model. Speaker and word were included as random intercepts, and no random slope was included. If there is a between-subjects variable, with one observation per subject, the random effects term become redundant. Therefore, random intercepts for word were removed from the model if there was only one word per participant, such as for the /ɑː/ vowel. Example code for one model is shown below:

```
    Model.1.a <- lmer( F1_50norm ~ dialect + (1|speaker)
+ (1|word),  data = DRESS_vowels, REML = FALSE)
```

A summary of the models' statistical results is presented in Appendix I.

8.3 Results

8.3.1 Overview

This section presents the results of statistical analysis of regional dialect influence on the acoustic values of English vowels looking at formant values and duration. The last section summarizes the main findings of the study.

8.3.2 Descriptive Results

The L2 production of Turkish learners from the two different dialects were compared with SSBE speakers. Table 8.3 below provides the raw F1, F2, and F3 midpoint values of each vowel.

Table 8.3 ***Mean Formant Value (non-normalized) Comparison of English Vowels***

	F1 (Hz)			F2 (Hz)		
Vowel	**Trabzon**	**İstanbul**	**SSBE**	**Trabzon**	**İstanbul**	**SSBE**
/ɪ/	331	400	451	1995	2111	2073
/i:/	359	370	375	1954	2291	2340
/ʊ/	367	430	473	980	1135	1676
/u:/	433	477	409	1013	1041	1427
/ɛ/	457	553	615	1785	2003	1886
/æ/	567	637	757	1551	1640	1605
/ɑː/	627	737	702	1358	1346	1226
/ɒ/	628	790	660	1129	1299	1099
/ʌ/	657	765	716	1221	1367	1439
/ɜː/	521	583	646	1347	1358	1616
/ɔː/	498	586	475	967	1053	1008

	F3 (Hz)		
	Trabzon	**İstanbul**	**SSBE**
/ɪ/	2639	2744	2735
/i:/	2679	2887	2848
/ʊ/	2432	2587	2588
/u:/	2456	2570	2608

/ɛ/	2463	2685	2643
/æ/	2421	2523	2482
/ɑː/	2533	2434	2622
/ɒ/	2639	2703	2817
/ʌ/	2368	2502	2574
/ɜː/	2262	2185	2640
/ɔː/	2389	2534	2626

The results show that L1 speakers of Trabzon have lower F1 values than İstanbul speakers in L2 English, which may arise from the gender imbalance between the datasets. Trabzon speakers also have lower F1 than SSBE speakers. However, /uː/ and /ɔː/ have the lowest F1 in SSBE compared with İstanbul and Trabzon L2 English. Thus, except for these high-back, rounded long vowels /uː/ and /ɔː/, it can be summarized that Trabzon speakers have the lowest F1, and SSBE speakers have the highest F1. F2 and F3 values are also the lowest for Trabzon speakers and highest for SSBE speakers with some exceptions. Overall, the raw Hz values from the data suggest that Trabzon speakers clearly differ from SSBE and İstanbul speakers with lower values in F1, F2, and F3, yet long vowels such as /ɑː/, /ɜː/, and /uː/ can vary differently across dialects. Figures 8.1, 8.2, and 8.3 below show F1-F2 distribution of each vowel for each dialect for visual comparison, the vowel represents the mean value, and the circle shows the distribution of this vowel within the dialect.

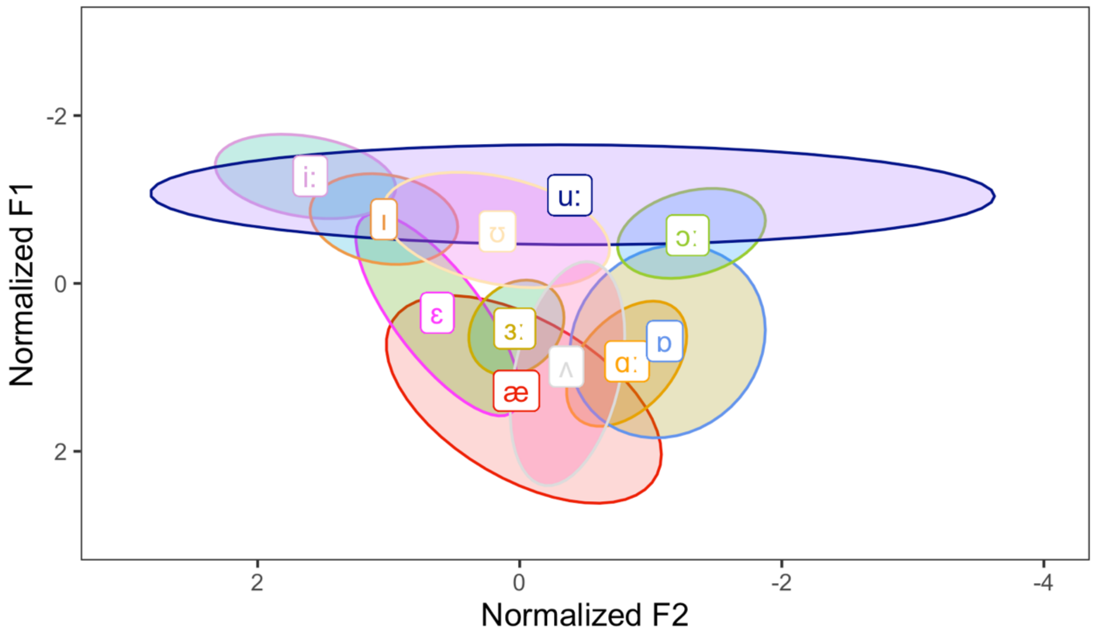

Figure 8.1 F1~F2 Plot of Vowels produced by SSBE Speakers

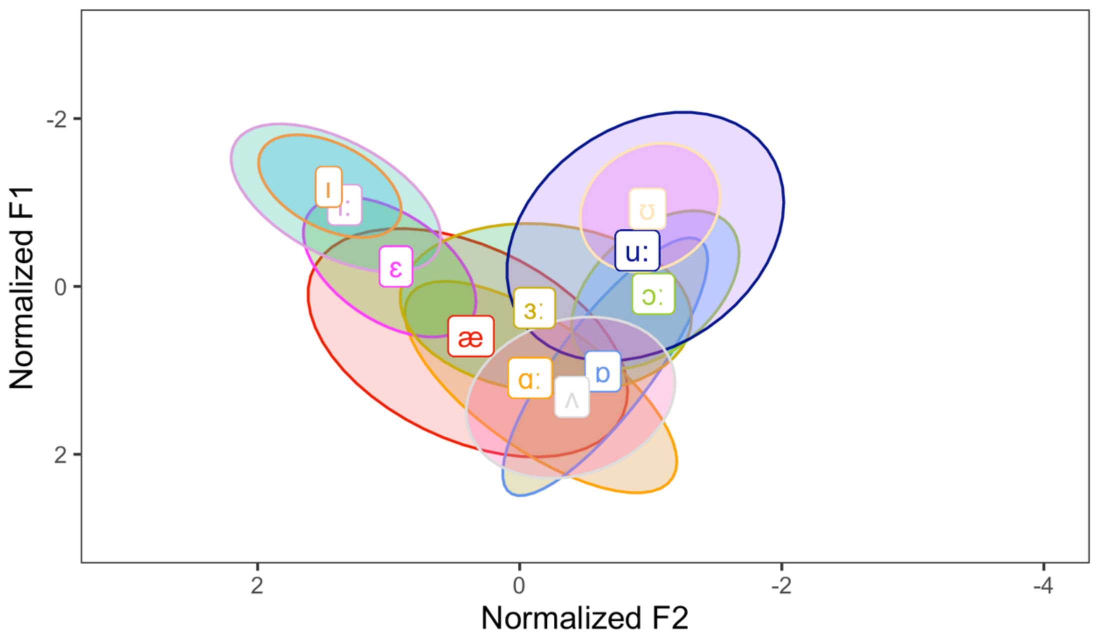

Figure 8.2 F1~F2 Plot of L2 English Vowels Produced by Trabzon Speakers

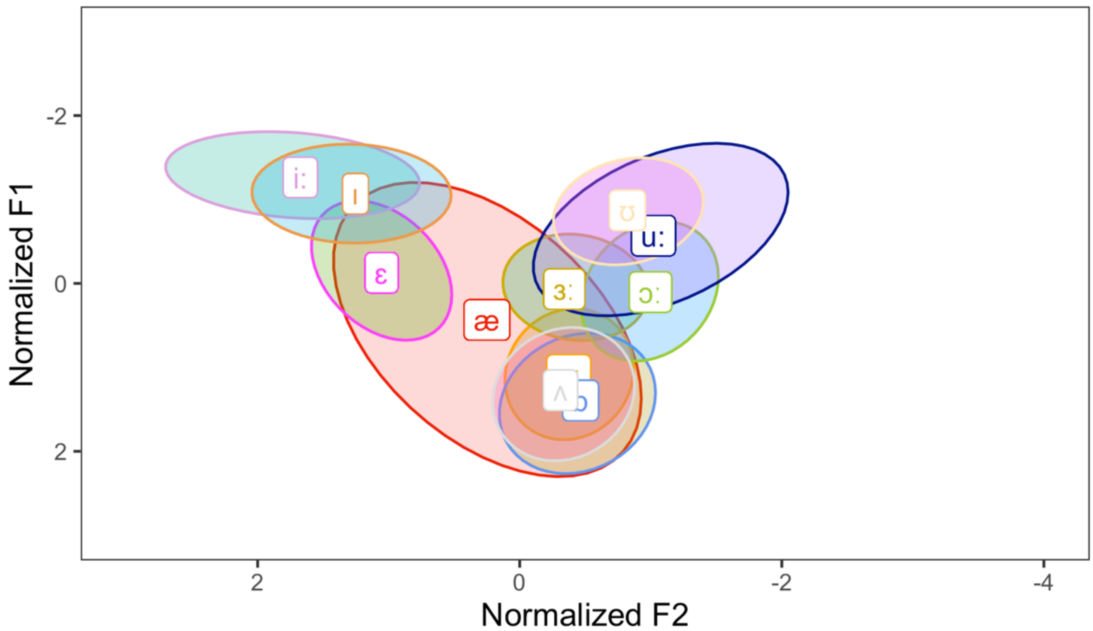

Figure 8.3 F1~F2 Plot of L2 English Vowels Produced by İstanbul Speakers

Since these plots emphasise the relative positioning of the vowels, a further look at the vowel space area is included to examine whether regional dialect speakers differ in overall vowel size area shape. Vowel size shape was only calculated for men because the distribution of gender was not equal across groups. Seven men (out of 8 in total) were randomly selected from the İstanbul and SSBE group, and seven men from Trabzon group were selected based on the accentedness rating results (See Chapter 4.2) to calculate vowel size area. Figure 8.4 below shows the variation in vowel size shape of male speakers of Trabzon, İstanbul, and SSBE regions in English.

Male-only vowel size shape of L2 English speakers reveals some interesting details. First, while /ʌ/ was the lowest vowel of Trabzon speakers and [æ] was the lowest vowel of İstanbul speakers in L1, Figure 8.4 shows that male İstanbul speakers show /ʌ/ and /ɒ/ being the lowest in L2. /ɛ/ is closer and more fronted in both regions than SSBE speakers, while /æ/ is more lowered among Trabzon speakers in L2 English. Although /u/ was higher and more fronted than /ɔ/ vowels in Turkish in both regions, Figure 8.4 shows that fronting is not applied in L2 English of regional dialect speakers. İstanbul speakers nearly merge the low vowels /ɑː/ - /ʌ/, and /ɒ/, while Trabzon speakers produce a front back contrast for /ɑː/ - /ɒ/ with a lower /ʌ/. This might stem from the allophonic variation of /ʌ/ in Turkish and warrants further examination. Lastly, Figure 8.4 shows that /ɜː/ is mid-open central for SSBE speakers while Turkish speakers of both regions produced it higher. Yet, regional differences among Turkish speakers were found for fronting mechanisms.

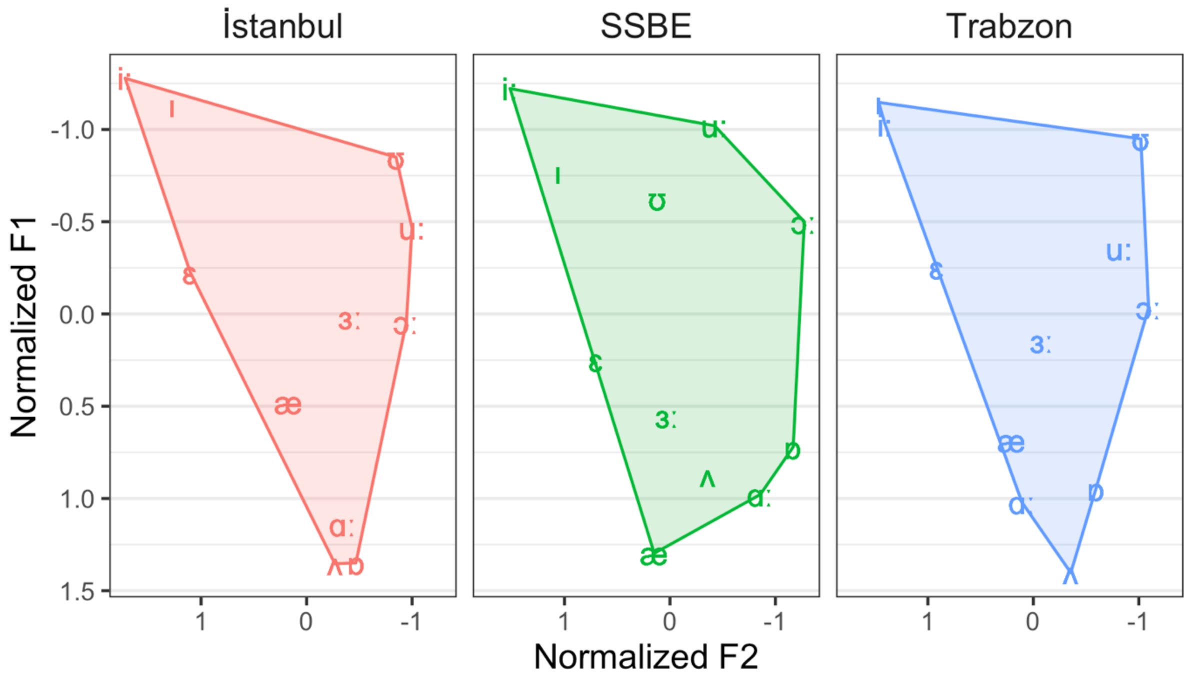

Figure 8.4 Vowel Size Area of the Three Dialect Groups (Male-Only)

8.3.3 Statistical Results

Following the mixed-effects model analysis, a Likelihood-Ratio Test was run to test the statistical models' goodness-of-fit. As the data was divided into lexical sets for each vowel, I will present the findings on whether regional dialect influenced the acoustic correlates of each vowel. Each acoustic correlate was compared with a nested model, each one missing the fixed effect (dialect) variable.

***Regional dialect influence* on /ɛ/:**

LRT model comparisons showed that there was a significant effect of dialect on F1 (X^2 (2) = 25.37, p < .0001) and on F2 (X^2 (2) = 19.65, p = .0001), while there was no significant effect of dialect on F3 (X^2 (2) = 5.127, p = .077), and on duration (X^2 (2) = 5.674, p = .058) of /**ɛ**/. Figure 8.5 demonstrates that the significant difference was observed between L1 Turkish and SSBE speakers. SSBE speakers produced the lowest and least fronted /ɛ/. The production of /ɛ/ in L2 English is similar between the dialect speakers of Trabzon and İstanbul regions, as observed in their L1.

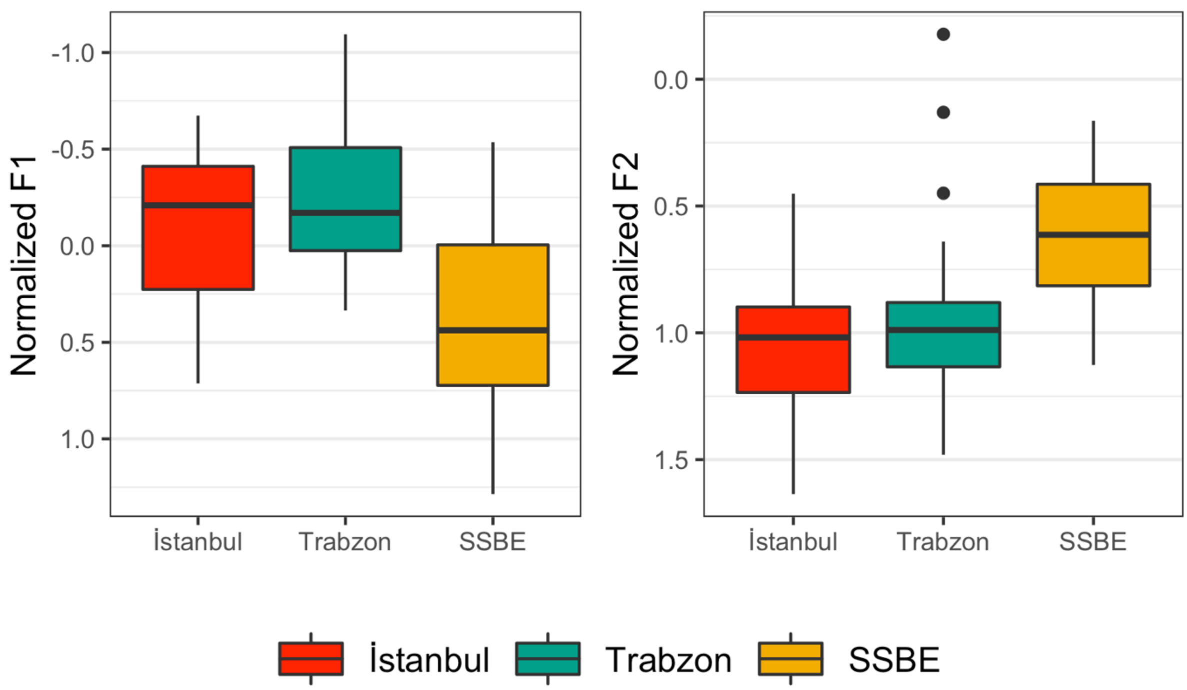

Figure 8.5 Boxplot showing F1 and F2 values of /ɛ/ across three groups

Regional dialect influence on /æ/:

There was a significant effect of dialect on F1 (X^2 (2) = 20.77, p = .0001), but there was no significant effect of dialect on F2 (X^2 (2) = 5.108, p = .077), F3 (X^2 (2) = 2.551, p = .279) and on the duration (X^2 (2) = 9.383, p = .009). The visual inspection of the data reveals that the significant influence of the dialect is rooted in the cross-linguistic difference. Figure 8.6 shows an L1 influence on F1 that SSBE speakers produce the lowest /æ/. In terms of F2, there is not a significant L1 influence, İstanbul and SSBE speakers produce this vowel nearly the same, yet there is a slight difference between SSBE and Trabzon dialect speakers that /æ/ is produced more fronted by

Trabzon speakers. Despite the significant regional dialect difference in Turkish, the results demonstrated that L2 production of /æ/ was similar between Trabzon and İstanbul speakers.

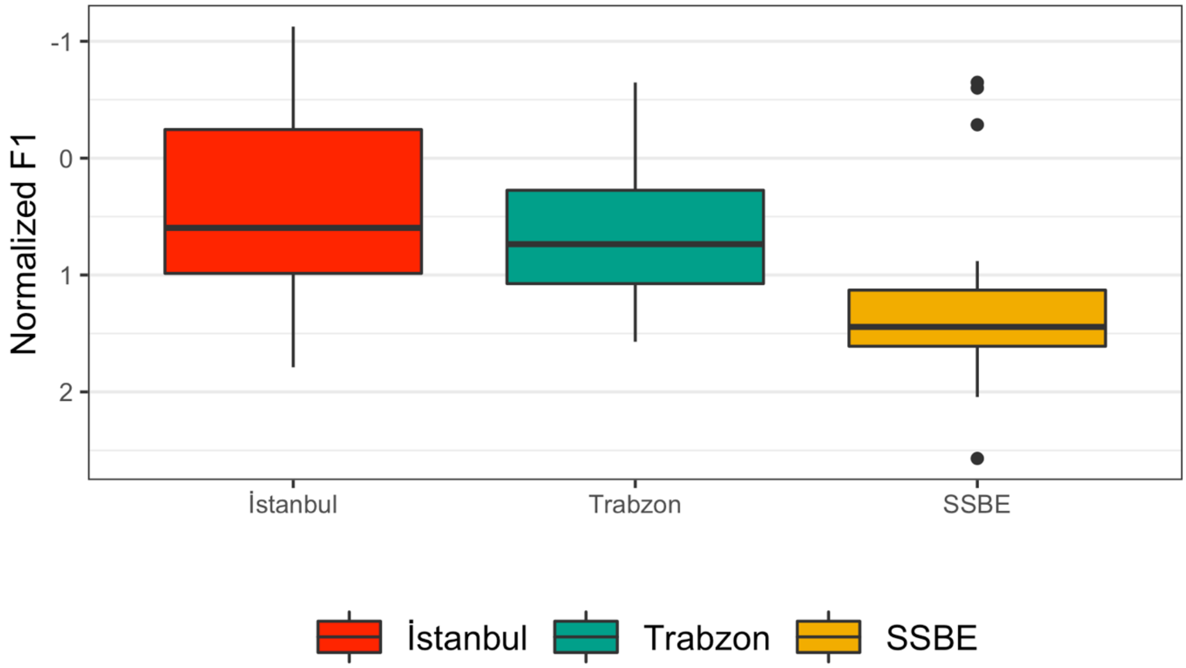

Figure 8.6 Boxplot showing F1 values of /æ/ across three groups

Regional dialect influence on /ʌ/:

The results showed that, unlike the regional dialect variation found in L1, there was not a significant effect of dialect on F1 (X^2 (2) =5.539, p = .062), F2 (X^2 (2) =1.461 p = .481), F3 (X^2 (2) =0.716, p = .698), and the duration (X^2 (4) = 4.496, p = .105). In addition, there was not any cross linguistic difference in production /ʌ/ as L1 Turkish and SSBE speakers produced this vowel very similarly.

Regional dialect influence on /a:/:

/ɑ:/ is one of the new phonemes in L2 English for L1 Turkish speakers. LRT model comparison showed that there was a significant regional dialect influence on F2 (X^2 (2) =-3.887, p = .0001), and duration (X^2 (2) =-7.472, p = .0001). However, there was no significant effect of dialect on F1 (X^2 (2) =-0.246, p = .537) and F3 (X^2 (2) =-

1.772, p =.309). SSBE speakers produced the longest and the least fronted /ɑ:/ compared to L1 Turkish speakers of İstanbul and Trabzon regions (See Figure 8.7).

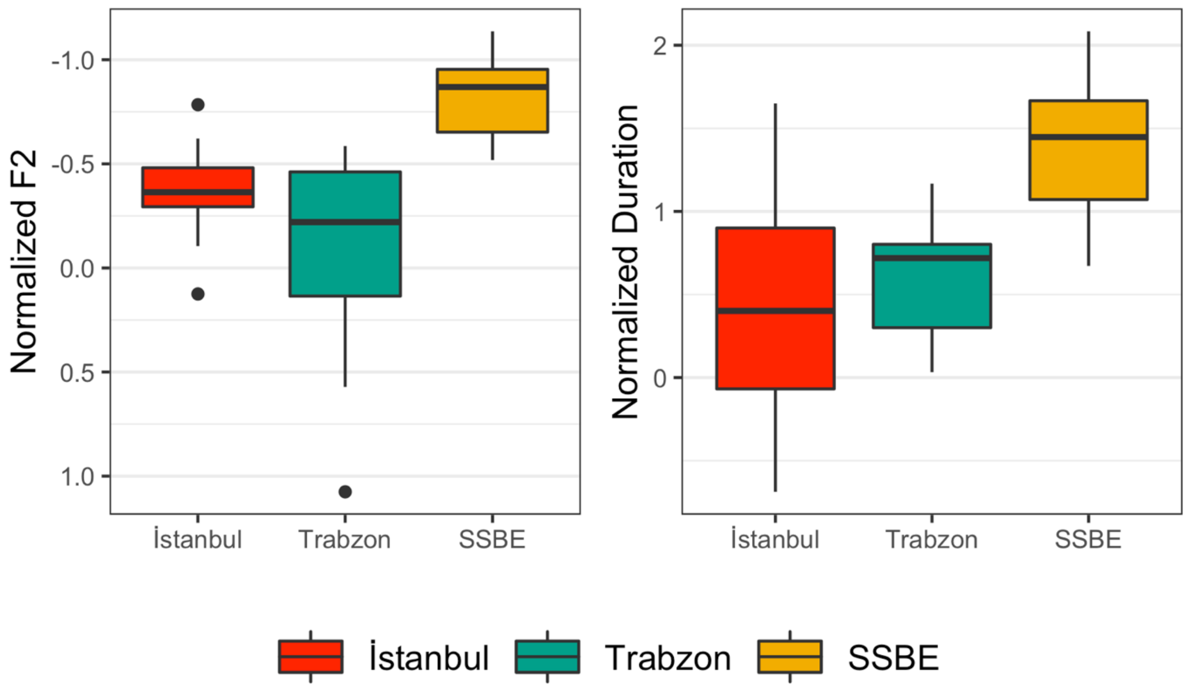

Figure 8.7 Boxplot showing F1 and duration values of /ɑ:/ across three groups

***Regional dialect influence on* /ɒ/:**

/ɒ/ is another new phoneme for L1 Turkish speakers in L2 English and resulted in regional dialect variation. LRT model comparison showed that there was a significant effect of dialect on F1 (X^2 (2) =-18.80, p = .0001) and F2 (X^2 (2) =-38.26, p = .0001), while there was no significant effect of dialect on F3 (X^2 (2) =1.582, p = .453), and duration (X^2 (2) = 0.690, p = .708). Figure 8.8 demonstrates that Trabzon and İstanbul speakers produced /ɒ/ differently in terms of F1, while Trabzon and SSBE speakers showed similarity. In terms of F2, SSBE speakers significantly differed from L1 Turkish speakers of both dialects by producing it as a back vowel.

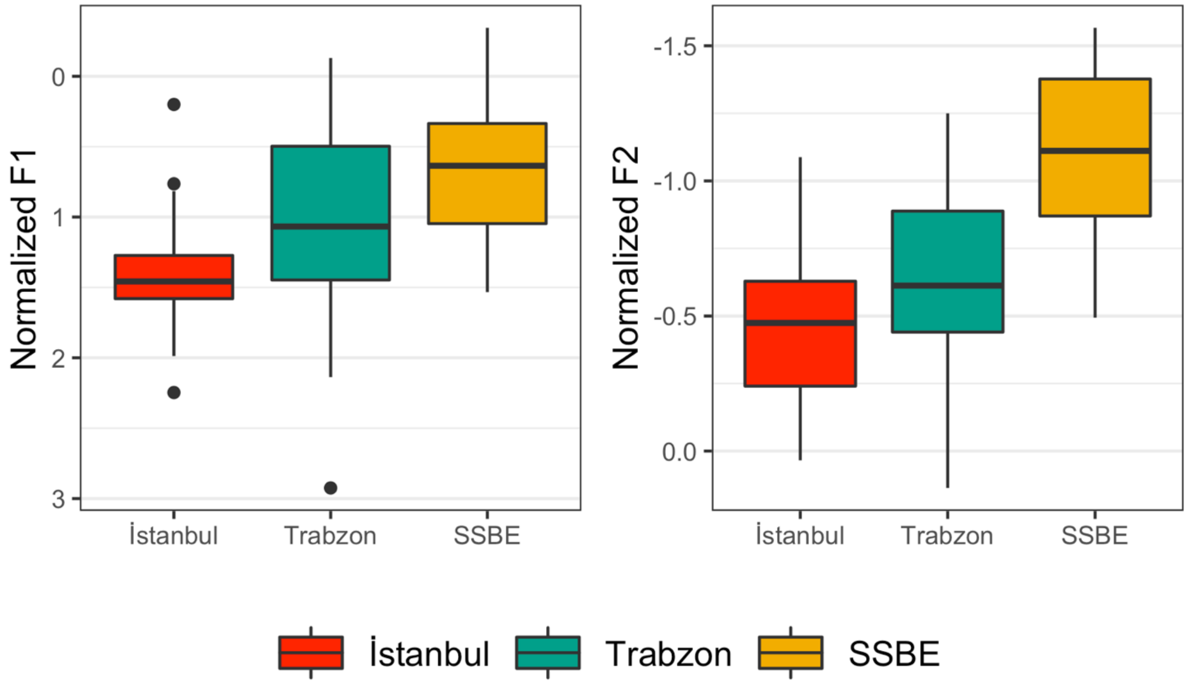

Figure 8.8 Boxplot showing F1 and F2 values of /ɒ/ across three groups

***Regional dialect influence on* /iː/:**

LRT model comparison revealed that there was a significant dialect influence on F1 (X^2 (2) =-13.35, p = .0001) and F2 (X^2 (2) =-10.92, p = .004), while there was no significant effect of dialect on F3 (X^2 (2) =0.378, p = .827) and duration (X^2 (2) = 3.81, p = .148). Although tense-lax is not a phonemic contrast in L1 Turkish, hence not explored in L1 data, the results demonstrated that İstanbul speakers produced /iː/ similar to SSBE speakers, while Trabzon speakers differed from İstanbul and SSBE speakers by producing it lower and less fronted (See Figure 8.9).

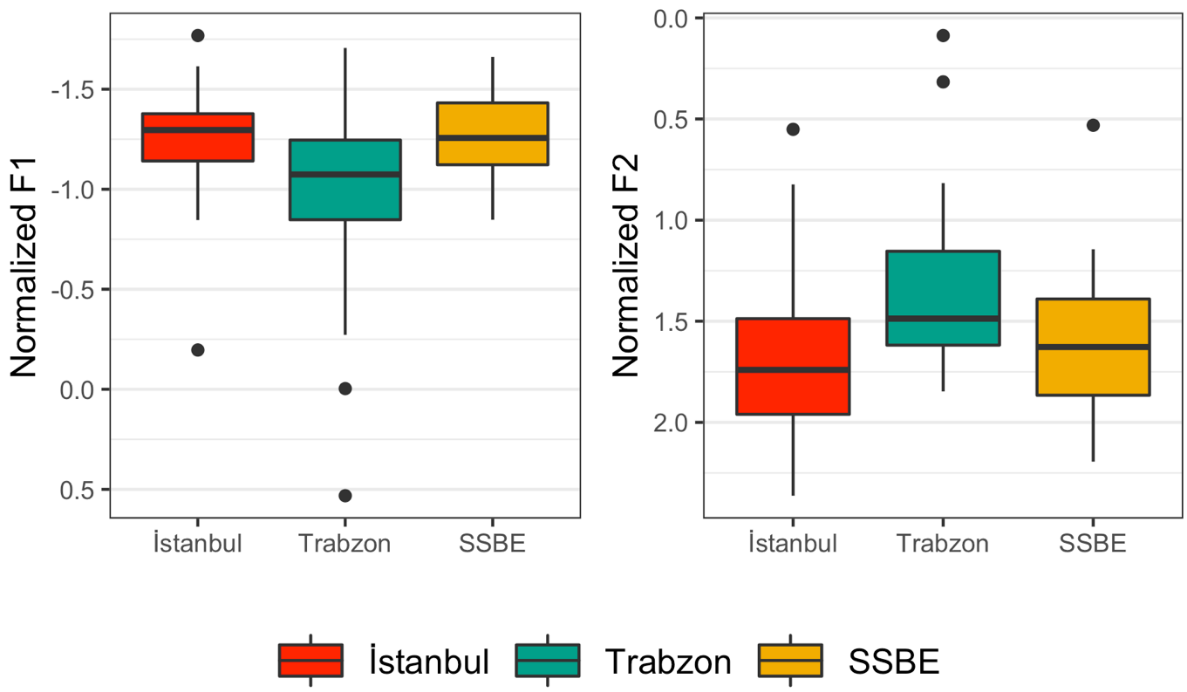

Figure 8.9 Boxplot showing F1 and F2 values of /i:/ across three groups

Regional dialect influence on /ɪ/:

LRT model comparison showed that there was a significant dialect influence on F1 (X^2 (2) =25.78, p = .0001), F2 (X^2 (2) = 20.51, p = .0001), and duration (X^2 (2) =28.9, p = .0001), and there was no significant effect of dialect on F3 (X^2 (2) = -1.006, p = .604). Similar to their L1 patterns, Trabzon and İstanbul speakers did not vary producing /ɪ/ in L2 English in terms of F1 and F2, while SSBE speakers produced it lowered and less fronted than L1 Turkish speakers (See Figure 8.10). With regard to duration, SSBE speakers produced the shortest /ɪ/, while Trabzon and İstanbul speakers produced it at similar length.

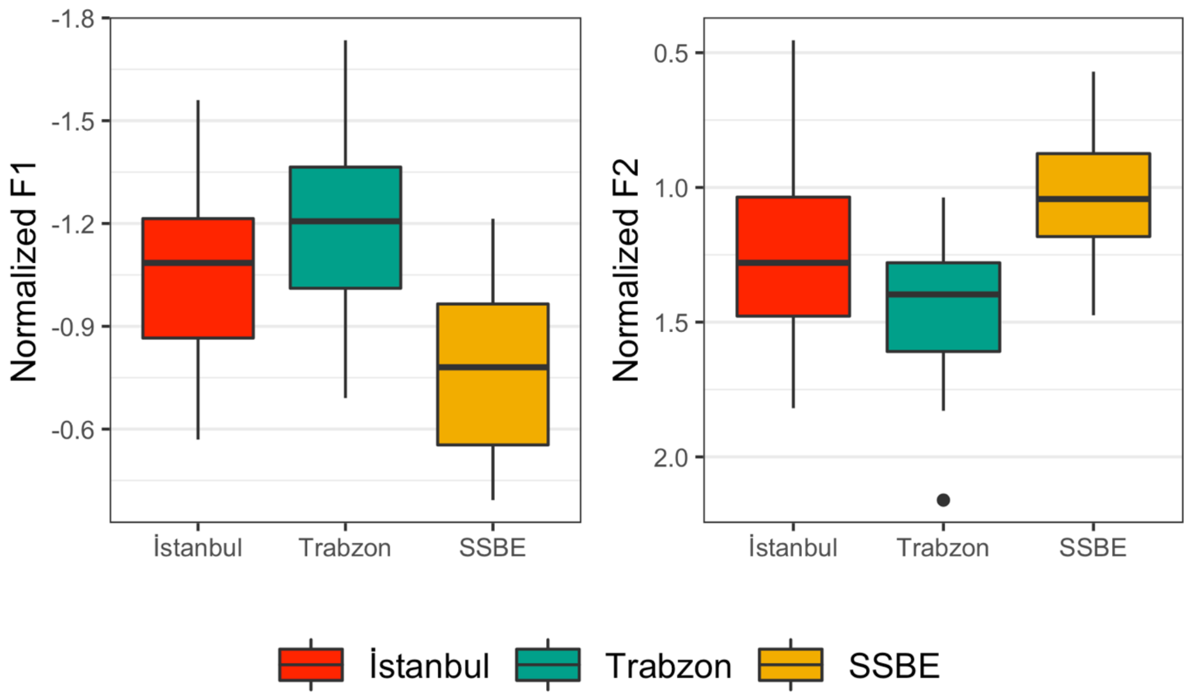

Figure 8.10 Boxplot showing F1 and F2 values of /ɪ/ across three groups

Regional dialect influence on /u:/:

LRT model comparison found that there was a significant effect of dialect on F1 (X^2 (2) =17.89, p = .0001), F2 (X^2 (2) =17.21, p = .0001), but there was no significant effect of dialect on F3 (X^2 (2) =1.244, p = .536) and duration (X^2 (2) =3.271, p = .194). Similar to previous vowels, the difference in the production of /u:/ was clearer between L1 Turkish and SSBE speakers (See Figure 8.12).

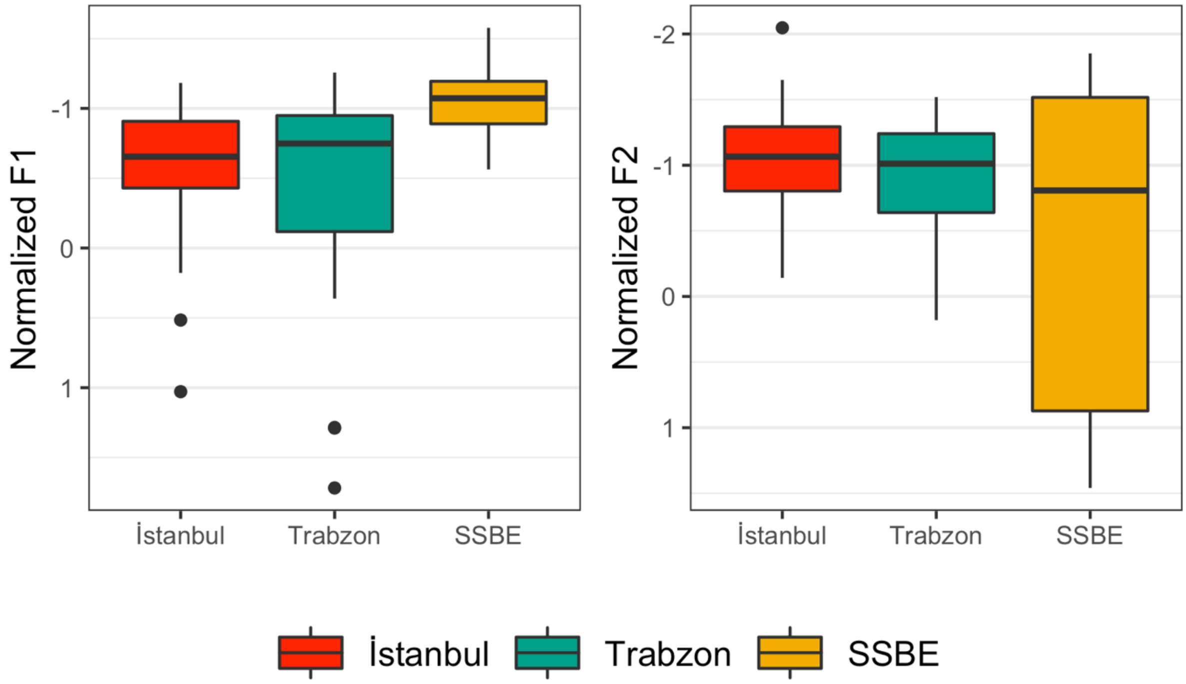

Figure 8.11 Boxplot showing normalized F1 and F2 of /u:/ across three groups

Regional dialect influence on /ʊ/:

LRT model comparison revealed that there was a significant effect of dialect on F2 (X^2 (2) =87.3, p = .0001), and duration (X^2 (2) =30.64, p = .0001). In addition, a moderate effect of dialect was found for F1 (X^2 (2) =13.82, p = .0009), while there was no significant effect of dialect on F3 (X^2 (2) =2.828, p = .243). A visual inspection of the data presents that SSBE speakers produced /ʊ/ more fronted and shorter than L1 Turkish speakers of both dialects. While L1 Turkish speakers produced /ʊ/ at similar duration, Trabzon speakers produced it noticeably less fronted than İstanbul speakers (See Figure 8.12).

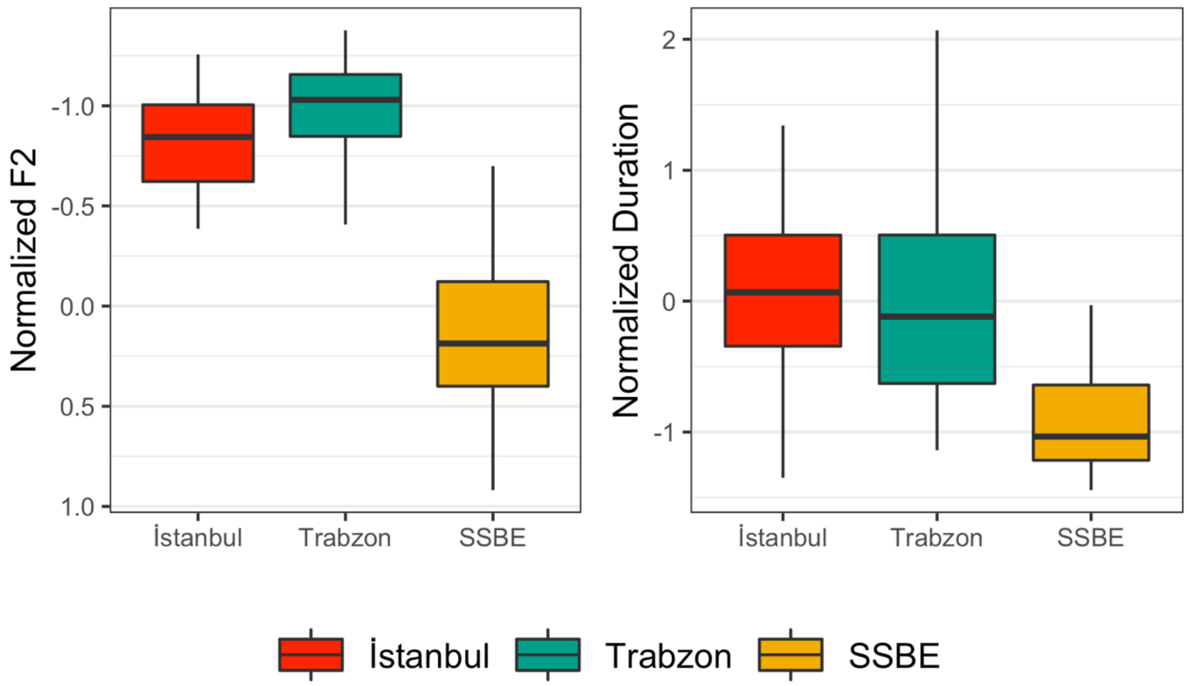

Figure 8.12 Boxplot showing normalized F1 and duration of /ʊ/ across three groups

***Regional dialect influence* on /ɔː/:**

LRT model comparison results showed that there was a significant effect of dialect on F1 (X^2 (2) =35.04, p = .0001), and on F2 (X^2 (2) =15.13, p = .0005). Although lip rounding was a phonological contrast for Turkish speakers, LRT results showed that there was no significant effect of dialect on F3 (X^2 (2) =1.083, p =.581). Lastly, LRT model comparison revealed that dialect did not significantly affect duration (X^2 (2) =3.930, p =.140) of /ɔː/ in L2 English. Figure 8.13 demonstrated that the production of /ɔː/ is higher and less fronted among SSBE speakers, while L1 Turkish speakers of both regional dialects produced it very similarly.

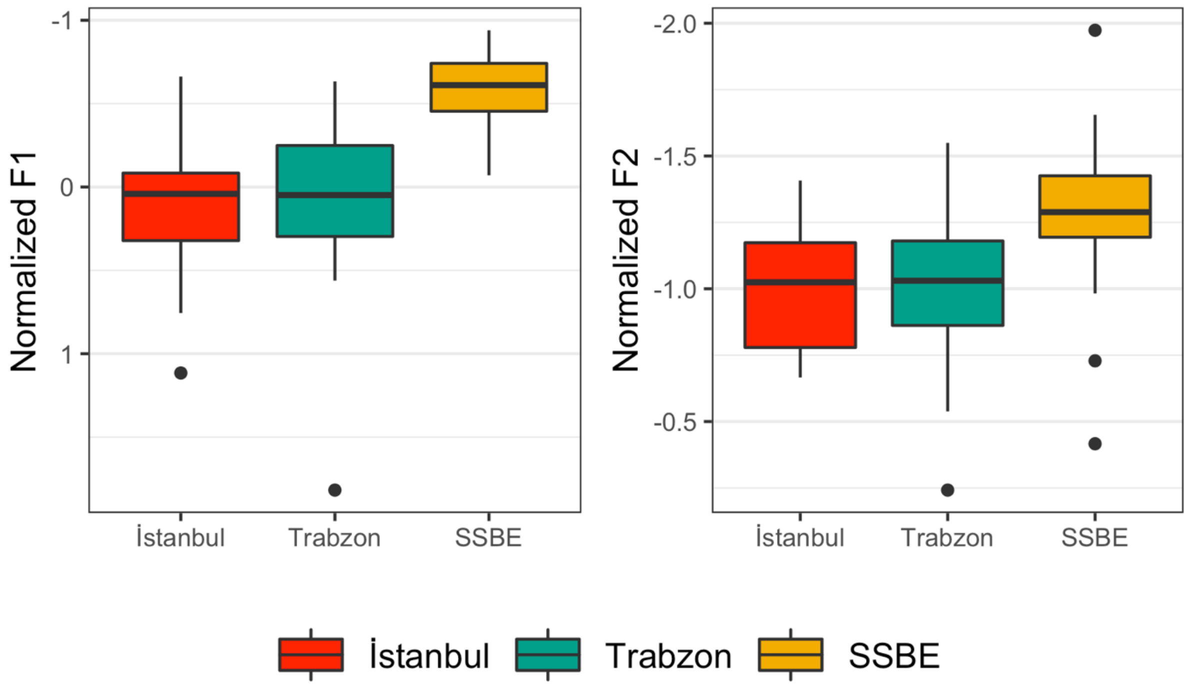

Figure 8.13 Boxplot showing normalized F1 and F2 values of /ɔː/ across three groups

Regional dialect influence on /ɜː/:

LRT model comparison revealed that there was a significant effect of dialect on F1 (X^2 (2) =17.23, p =.0001), F2 (X^2 (2) =10.96, p = .004), F3 (X^2 (2) =25.3, p = .0001), and duration (X^2 (2) =31.03, p = .0001). While the influence of dialect mostly arises from the L1 differences, visual inspection of the results showed that /ɜː/ vowel lead to different acoustic realizations across the three regional groups (See Figure 8.14 and 8.15).

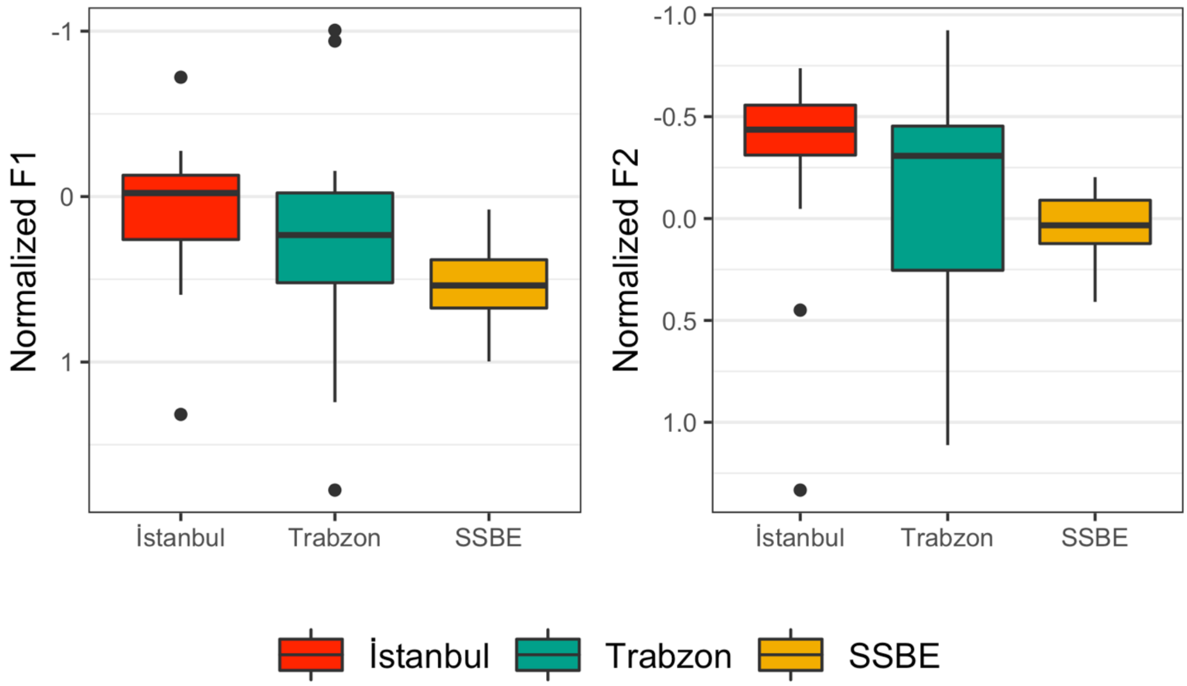

Figure 8.14 Boxplot showing normalized F1 and F2 of /ɜː/ across three groups

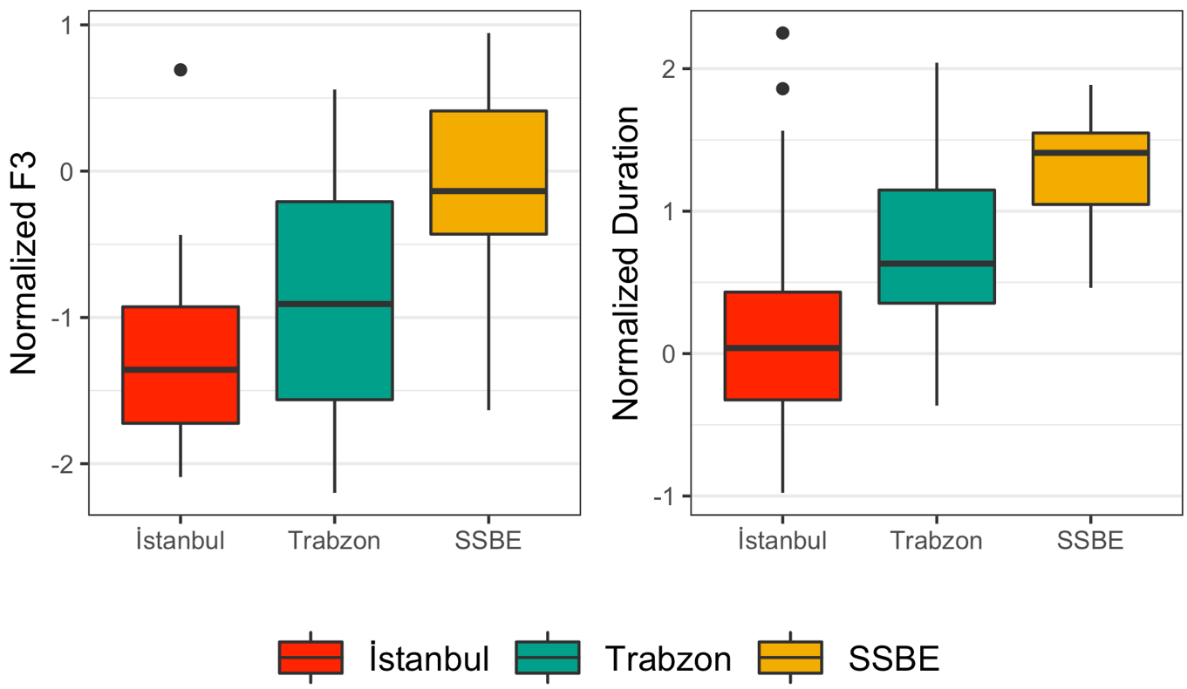

Figure 8.15 Boxplot showing normalized F3 and duration of /ɜː/ across three groups

8.3.4 Summary of The Results

Table 8.4 below summarizes the main findings in this study. The results revealed that regional dialect influence is found for most of the vowels in F1 and F2. The results also showed that F3, the acoustic correlate of lip rounding, is not different between regional dialect of Turkish and English speakers.

Table 8.4 Summary of findings showing regional dialect differences in L2 vowels

Vowel	F1	F2	F3	Duration
ɛ	√	√	X	X
æ	√	X	X	X
ʌ	X	X	X	X
ɑː	X	√	X	X
ɒ	√	√	X	X
i:	√	√	X	X
ɪ	√	√	X	√
u:	√	√	X	X
ʊ	X*	√	X	√
ɔː	√	√	X	X
ɜː	√	√	√	√

√: Statistically different X: Statistically not different *Moderately different

In conclusion, the results showed that regional dialect effect on L2 English was found in /i:/ and /ɑː/ vowels for F1. In addition, there is a significant difference between Turkish and SSBE speakers in /æ ɔː u:/, and /ɪ/ in F1. Regarding F2, regional dialect influence on L2 was found for /ɑː i: ɪ ɜː/, and /ʊ/. This suggests that regional dialect speakers mainly differ in fronting and backing mechanisms, both for existing and new contrastive sounds in the L2. Although it is not a main acoustic discriminator in English, I found that regional dialect speakers significantly differ in F3 of /ɜː/, while the other rounded vowels were produced with similar F3 values in all dialects. Lastly, duration was found to be influenced by regional dialect in /ɑː ɪ ʊ/ vowels.

This section aimed to summarize main findings of this study. The implication of these results will be discussed in relation to L2 speech models in the following section.

8.4 Discussion

This study investigated the regional dialect influence on L2 English speech production, with a focus on 11 English vowels. This section will discuss the findings in terms of L2 speech learning models and the influence of regional dialects on L2 speech, and the role of Turkish as an L1. I will interpret the results in terms of groups of vowels, as they represent a 'similar sound scenario' of SLM-r, that is the new sound in L2 is very similar to one in L1 that a learner may not create new phonetic category for the new sound (Flege, 1995). I will use the following categorization in the discussion for comparison of vowels in line with the predictions made earlier in Section 8.1.2.

a. İstanbul speakers may produce /æ/ in L2 English similar to SSBE speakers as İstanbul speakers showed greater phonetic proximity of /æ/ in their L1 compared to Trabzon speakers, → /æ/ - /ɛ/ similar sound scenario
b. L2 English production of /ʌ/ may differ among Trabzon and İstanbul dialect speakers due to variation of /ʌ/ in L1 Turkish dialects, and the phonetic proximity of /ɑ:/ and / ɒ/ and can lead SSBE and L1 Turkish speakers to differ in production →/ʌ/ is compared with /ɑ:/ - /ɒ/ similar sound scenario
c. /ɔ:/ can be produced lower and shorter by Trabzon speakers because /ɔ/, the similar sound in their L1, was produced lower in L1 Trabzon Turkish. → /ɔ:/ and /ɜ:/ in relation to similar L1 sounds /ɔ/ and /œ/ respectively.
d. Since tense-lax contrast is not phonemic in L1 Turkish, I predict that L2 speakers may produce tense vowels shorter compared to SSBE speakers as this will create a similar sound scenario of the SLM-r (e.g., /ɪ/ - /i:/). However, no regional dialect influence is expected as duration was not significantly different in any of the vowels in their L1. → tense-lax contrast /i:/ - /ɪ/, /u:/ - /ʊ/ according to SLM-r similar sound scenario,

8.4.1 Regional Dialect Influence on L2 English Vowel Production

Prediction a:

In terms of /ɛ/ - /æ/ similar sound scenario, the results found no regional dialect influence on the production of /ɛ/ vowel in L2 English between Trabzon and İstanbul speakers, with this vowel also showing no differences in Turkish between L1 Turkish speakers. However, the results showed a significant difference between speakers of L1 Turkish and SSBE speakers in terms of F1 and F2. SSBE speakers produce a lower and less fronted /ɛ/ than L1 Turkish speakers. [æ] is an allophone of /ɛ/ in Turkish but a phoneme in English. Despite the significant regional dialect difference in Turkish, the results demonstrated that L2 production of /æ/ was similar between Trabzon and İstanbul speakers. Both dialect speakers produced it lower than /ɛ/ and higher than /ʌ/ in L2, which implies that İstanbul speakers restore the acoustic phonetic positioning in L2 (while it stays similar for Trabzon speakers). This result confirms that Turkish speakers can produce /æ/ as a phonemic contrast in L2 English and supports the argument of SLM-r that the formation of a new phonetic category is enabled by its perceived dissimilarity from the closest L1 sound (Flege & Bohn, 2021). However, it is worth noting that the height and frontness of /æ/ in L2 English of Turkish speakers is significantly different from SSBE speakers. SSBE speakers' production of /æ/ was lower and less fronted than Turkish speakers. /æ/ is the lowest sound in SSBE whereas it is positioned between /ʌ/ and /ɛ/ among Turkish speakers of both dialects. L2 speakers produce this sound in a way sufficient to create a phonemic contrast in their L2 speech, but not following the similar acoustic/spectral patterns of SSBE speakers. This finding contributes to the scope of the L2LP argument that L2 speakers may initially differ in cue-weighting, which is then gradually adapted over time toward an optimal L2 perception and production strategy (Yazawa et al., 2017). Lastly, the results found that Trabzon speakers, although not significant, produced shorter /æ/ than both İstanbul and SSBE speakers while the duration is not a phonetic discriminator for this sound.

Prediction b:

Another vowel that showed significant dialect variation in Turkish was /ʌ/. Trabzon speakers produced /ʌ/ lower and less fronted than Istanbul Speakers in Turkish.

However, statistical analysis revealed that neither a regional dialect nor L1 affected the production of /ʌ/ in L2 English. SSBE speakers have a slightly higher /ʌ/ than Turkish speakers and F2 and duration values are similar across dialect groups. Similar to /ɔː/, the regional dialect difference in /ʌ/ in L1 Turkish was diminished in L2 English. Since the neighbouring consonants were similar across both languages, a potential reason why the existing regional dialect difference did not lead to L2 variation for a specific sound may be related to a difference in the L1 - L2 phoneme inventory size. That is, when L1 Turkish learners encounter /ɑː/ and /ɒ/ as new phonemes in L2 English, they may easily update the phonemic category of /ʌ/ in L2, as it fits the 'identical sound' scenario of SLM-r, whereas the new phonemes /ɑː/ and /ɒ/, 'similar sound' scenario, may cause regional dialect speakers to vary.

/ɑː/ - /ɒ/ do not form a phonemic contrast in Turkish. The SLM-r proposes that L2 learners can easily produce a non-native sound as a separate category if it is distant enough from its nearest category in the L1 (equivalence classification). That is, if /ɑː/ and /ɒ/ in English are distant enough from /ʌ/, L2 speakers can more easily produce those sounds contrasting in spectral or durational features. It is found that Turkish dialects differ in the production of /ɒ/ in terms of F1, while /ɑː/ varies in F2. In addition, both /ɑː/ and /ɒ/ differed between SSBE and L1 Turkish speakers in terms of F2 and duration in /ɑː/ only (See Figure 8.16). This shows that L2 learners of regional dialects use different acoustic correlates for each novel L2 sound. /ɒ/ is open-mid and back in Trabzon, while it is realized as open central by İstanbul speakers. Results showed that Istanbul speakers tend to merge these vowels around /ʌ/ which supports the 'category precision' hypothesis of SLM-r that since these vowels are categorically not distant enough, L2 speakers of İstanbul were not able to produce it categorically different than /ʌ/. This means forming new phonetic categories for these new L2 sounds was hindered by the phonetic closeness of these sounds to their equivalent in L1 (i.e., /ʌ/) for İstanbul speakers. However, speakers of Trabzon were able to produce a moderate back-front contrast between these vowels. Regional dialect speakers of Turkish show similarity for /ʌ/ in L2 English despite the variation in L1. However, they differ in mapping /ɑː/ and /ɒ/, which are allophones of the /ʌ/ vowel in Turkish. Taken together, this may imply that the acoustic realization of allophonic variation in the regional dialects of L1 can be equally as important as a phonemic variation for L2 phonetic development, such as learning non-native contrasts. Since allophonic variation in /ʌ/ is not well-documented in Turkish for these regional dialects, potential causes behind this regional dialect influence on the production of /ɑː/ and /ɒ/ in L2 remain unclear.

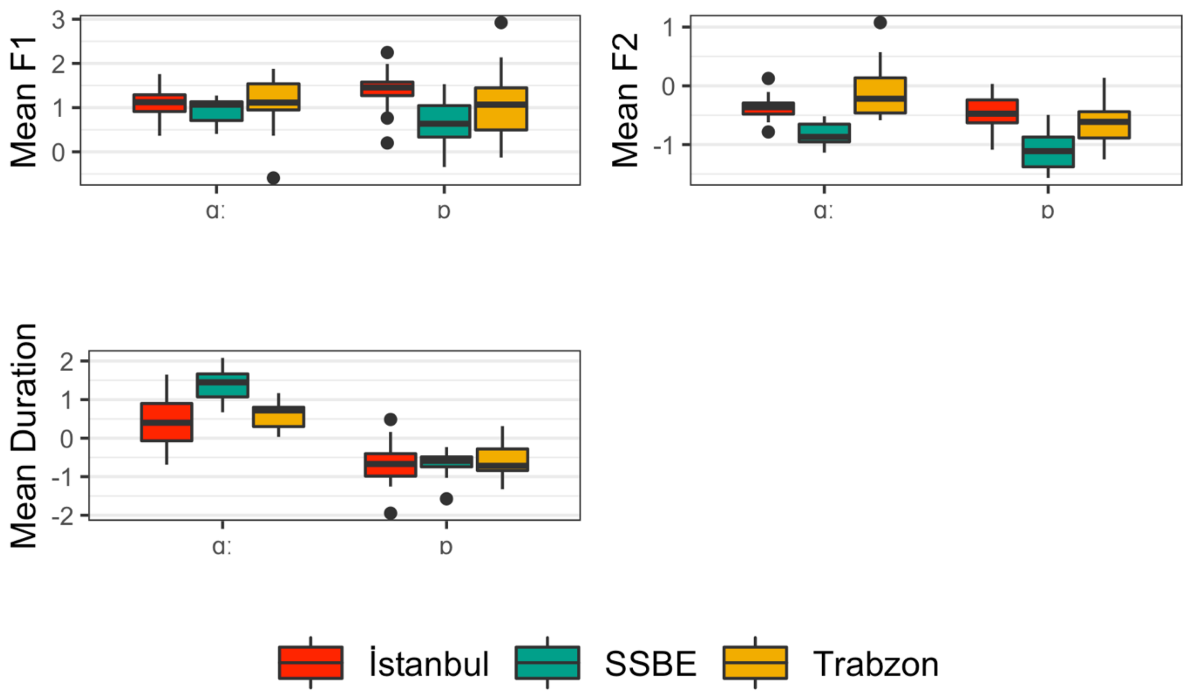

Figure 8.16 Boxplot showing the /ɑː/ and /ɒ/ contrast of dialect speakers in spectral and temporal values

Prediction c:

Regarding /ɔː/ and /ɜː/ vowels, regional dialect variation in the L1 showed that /œ/, similar to /ɜː/ in L2 English, did not vary between Trabzon and İstanbul speakers, while /ɔ/ was significantly lowered in Trabzon Turkish. The results from L2 English production showed that the existing L1 dialect variation in /ɔ/ was not reproduced in the same fashion in English. Figure 8.17 below shows that regional dialect speakers of Turkish produced /ɔː/ similarly both in spectral and temporal features. A closer look at the regional dialect variation in /ɔː/ in L2 reveals that Turkish speakers produce it significantly lower and less fronted compared with SSBE speakers, while they are similar in F3 and duration, which shows that Turkish learners are able to produce durational properties like SSBE speakers. This is congruent with the previous studies that L2 learners' acquisition of durational patterns, secondary phonetic cues to native speakers, may precede the acquisition of spectral features (Escudero et al., 2009).

On the other hand, a significant dialect influence was found for the production of /ɜː/ in L2 English between Trabzon and İstanbul speakers in F2, F3, and duration. Unlike the /iː/ - /ɪ/ contrast, where one of the dialect speakers showed similarity with SSBE speakers, the results revealed that SSBE speakers differ significantly from L1 Turkish speakers in F2, and duration. This is an interesting case because /ɔ/ was significantly different in F1 and duration between dialect speakers in Turkish while /œ/ was produced similarly. The existing regional dialect variation in L1 does not seem to influence /ɔː/ in L2 English. However, /ɜː/ shows regional dialect variation in L2 English for F2 and duration values (See Figure 8.17). This may stem from the phonetic re-mapping of similar sounds in the phonetic space through input as discussed by L2LP. That is, the two regional dialect groups differ in the way they recalibrate /ɜː/ vowel in relation to /œ/ in L1 Turkish. Regarding the durational difference, I can speculate that the neighbouring following consonant might explain L1 and regional dialect differences to some degree. SSBE speakers produced /ɜː/ longer than Trabzon speakers, whose production is longer than İstanbul speakers. In English, /ɜː/ is often represented alongside an orthographic <r> which might lead SSBE speakers to produce a longer vowel due to non-rhoticity, whereas İstanbul Turkish speakers produce a voiced alveolar flap /ɾ / and a shorter /ɜː/. Thus, the durational difference between Turkish and SSBE speakers can be explicable, to some extent, by the role of derhoticisation in English. However, what causes regional dialect speakers of Trabzon and İstanbul to vary in the duration of /ɜː/ is unclear. Yet, this finding is important to show that regional dialect influence in L2 may not necessarily follow the existing phonetic contrast within the L1 exactly; instead, it might emerge from the overall variation in the phonological space of dialect speakers.

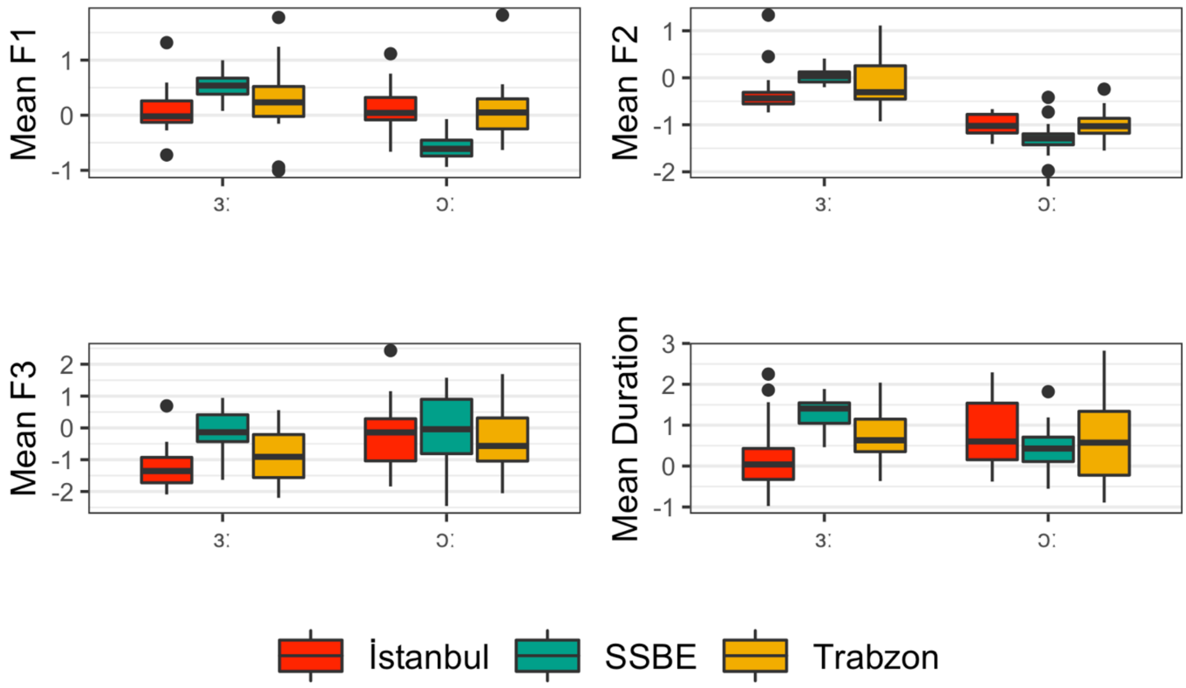

Figure 8.17 Boxplot showing the /ɔː/ and /ɜː/ of dialect speakers in spectral and temporal values

Prediction d:

/iː/ - /ɪ/ high front vowel pair resulted in some interesting findings in terms of regional dialect variation. /iː/ do not cause a phonemic difference in Turkish, and there is no regional dialect variation in /ɪ/ between Trabzon and İstanbul speakers. In L2 English, however, the results showed that /iː/ was significantly different between speakers of Trabzon and İstanbul in terms of F1 and F2. SSBE and İstanbul speakers produce /iː/ and /ɪ/ contrast similarly both for spectral and temporal features. However, Trabzon speakers were able to produce the /iː/ - /ɪ/ contrast only in duration. A regional dialect influence was found for F1 and F2 values of /ɪ/. Overall, speakers of both regions were able to create this new phonemic contrast in duration while they differ regionally in terms of spectral features. What causes L2 speakers of the same L1 to rely on different acoustic cue weighting for a new phonemic contrast, despite the lack of variation in L1 production, might be rooted in perceptual development and requires further exploration. One explanation for this inter-dialectal variation in L2 despite the identical patterns in L1 might lie in the L1 allophonic variation of Turkish dialects. From a historical perspective, the long-term phonological influence of Arabic and Persian on vowel lengthening through borrowed words is stronger in İstanbul dialect as it was the capital for centuries (Recall that the Ottoman Language was a mix of Turkish, Arabic, Persian, etc). On the other hand, shorter pronunciation of long vowels in borrowed words were noted in Trabzon dialect (Brendemoen, 1998). This may provide İstanbul speakers with an advantage of developing spectral features in L2 as they are already attuned to durational cues in their L1. Another alternative explanation might be related to variation in the received L2 input or overall L2 proficiency. Remember that several İstanbul speakers had study abroad experience or attended private universities with higher English language level requirements, it is potential that the quality of input they received is different from Trabzon speakers. This might enable İstanbul speakers to develop spectral differences between the vowels. Lastly, the overall L2 proficiency level of İstanbul speakers is higher than that of Trabzon speakers. According to L2LP, learners adjust the phonemic boundaries of L2 non-native sounds throughout development (Escudero, 2005). As Trabzon speakers have an overall lower proficiency in English, their phonological mapping of /i:/ and /ɪ/ contrast may be in progress as they only adjusted the temporal boundaries. It is, however, important to note that further evidence is necessary to strengthen any of these claims.

Speakers of both Turkish dialects did not produce the phonemic contrast between /u:/ and /ʊ/. First, the main distinction in duration was not observed for L2 Turkish speakers. Second, these vowels were realized as close-back by Turkish speakers and close-central by SSBE speakers, although there was a moderate difference between the Turkish dialect speakers in terms of /ʊ/-fronting. A possible reason why Turkish speakers from the two dialects produce a phonemic difference between /i:/ and /ɪ/ but not /u:/ and /ʊ/ may be due to allophonic variation of these sounds in the L1 or related to the orthographic influence of the L1. As discussed in Chapter 2 (Literature Review), L2 learners rely on orthographic cues more if their L1 has a transparent (one grapheme to one phoneme) orthographic system such as Turkish (Erdener & Burnham,2005, Rafat, 2016). When we compare the target words used in the experiment, it is shown below that orthographic cues are the same for /u:/ - /ʊ/ but different for /i:/ - /ɪ/. This might cause Turkish speakers to produce lexical contrasts such as foot-fool and took-tool similarly.

- KIT: chicken / ˈʧɪkɪn/, did /dɪd/ - Fleece: sheep /ʃiːp/, feast /fiːst/
- FOOT: foot /fʊt/, good /gʊd/ - Goose: fool /fuːl/, /suːn/ soon

To sum up, while there were not any regional dialect differences in the production of /ɪ/ and /u/ in Turkish, the results showed that regional dialect speakers can differ in the phonetic realization of these vowels in L2 English as a result of a new phonemic contrast (e.g., /ɪ/ - /i:/).

Overall, these results showed that regional dialect influence on L2 English speech production was found to different degrees for each vowel. Although there are regional dialect differences in the L2 English speech of Turkish speakers, I found that these are not always in line with the regional dialect variation in L1. For example, /ʌ ɔː/ and [æ] were found to significantly vary between regional dialects in Turkish. However, it was also found that the existing regional difference diminished for these vowels in L2 English. On the other hand, allophonic variation in L1 such as long vowels /i: ɑː/, /ʊ/, or new phonemes such as /ɒ/ were found to vary significantly among regional dialects in L2 English. The production of new L2 phonemes were tested according to the SLM-r's similar sound scenario. The results demonstrated that the similar sound scenario can yield in different degree of variation for each non-native target sound across regional dialects. Therefore, regional dialect influences on L2 speech may be more related to variation in phonetic categories and overall acoustic-phonetic space rather than the concrete phonemic contrasts between regional dialects. This could gain more importance when allophones in the L1 become a phonemic contrast in the target L2, as in the case of L2 English speakers of L1 Turkish. Since this study only examined the realisation of phonemic categories in Turkish across the two sets of dialect speakers, allophonic variation in Turkish was not explored except for [æ]. In addition, I discussed that orthography and L2 proficiency can hinder or aid the development of L2 non-native sounds such as tense-lax contrast in L2 English. Thus, more research with greater control over L2 proficiency and orthographic influence can highlight the underlying process in L2 speech production.

In conclusion, the results of this study can be summarized as follows. First, the regional dialect is less influential on the duration of L2 vowels. Regional dialect influence on the duration of L2 English vowels was found for /æ/ and /ɜː/, which do not have a phonemic contrast in duration in English. For spectral variation, F2 was the key acoustic cue in L2 English of regional dialect variation for /ɑː iː ɪ ɜː/, and /ʊ/ vowels, while F1 was a discriminator only for /iː/. It can be proposed that the fronting-backing mechanisms are the main difference between Standard Turkish and Trabzon Turkish in L1 (Brendemoen,2002) which then play a crucial role in L2 English speech production variation. Finally, the results show that the existing regional dialect variation may not necessarily lead to L2 variation in all cases; instead, L2 speakers may remap these vowels in the L2 if contrasted with new phonemes.

8.4.2 The Influence of L1 Turkish on L2 English Production

One of the interesting outcomes of this study is that the duration of vowels among L2 English learners were significantly different from the duration patterns of SSBE speakers. Turkish vowels are short in general, and vowel lengthening does not lead to phonemic contrast. Figure 8.18 below shows that the duration of high back vowels /ɔː ʊ uː/ are longer for L1 Turkish speakers than SSBE speakers. However, they produce shorter vowel then SSBE speakers for high front /ɪ/, mid-central /ɜː/, and low back /ɑː/. Although duration is not involved in phonemic contrast in Turkish, the underlying phonological process, such as soft g lengthening or borrowed words, may enable Turkish learners to utilize this phonetic feature in their L2. In addition, it can be argued that L1 Turkish learners of English might initially use orthographic cues in the early stages of learning, but as they develop in language proficiency, they may reduce their dependence on orthography.

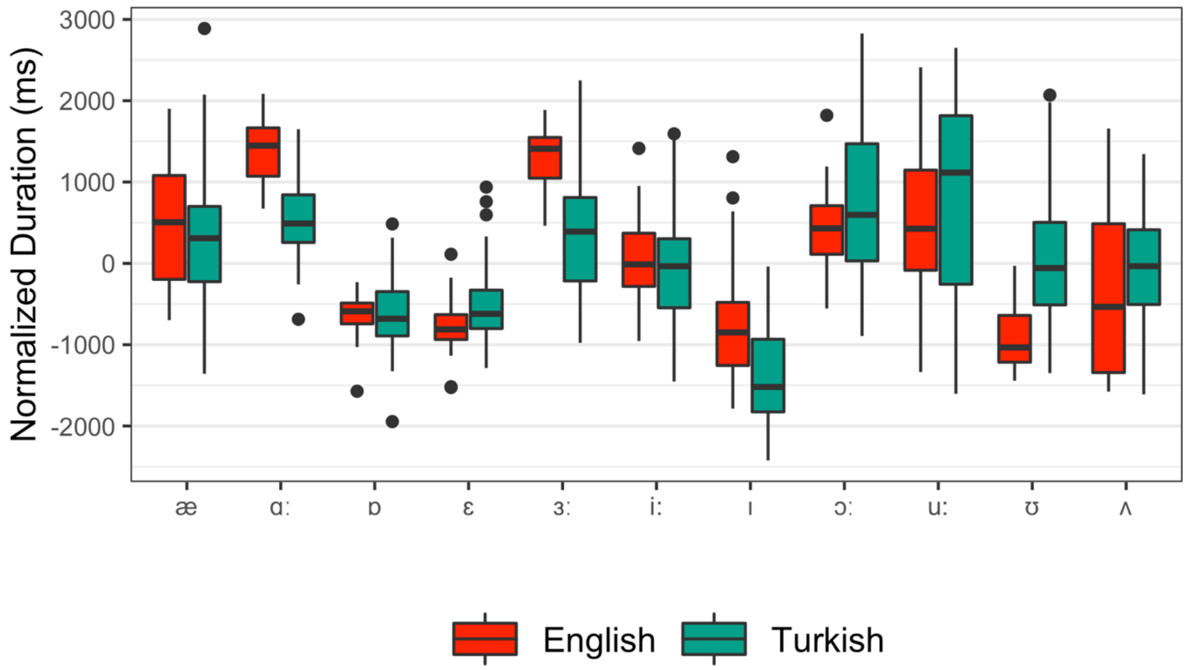

Figure 8.18 Boxplot showing durational difference of English vowels between L1 Turkish and SSBE speakers

Another L1 influence was observed when learners produced a contrast that existed as an allophone in their L1 inventory. Since this study focused on word-medial vowels only, the results here are not fully conclusive for position-sensitive production as categorization of a sound and its related acoustic cues can vary in each position (Dmitrieva, 2019). However, it can be suggested that the existence of similar allophones in the L1 can assist L2 learners' phonetic categorization, as they already have experience with a similar acoustic-articulatory phonetic space for such representations.

Finally, this study showed that L2 speakers with a smaller L1 phoneme inventory (i.e., /ʌ/ in Turkish vs /ʌ ɑː ɒ/ in English) and with a difference in phonological classification (such as lip rounding in Turkish versus tense-lax contrast in English), are able to learn phonemic contrasts in an L2. However, the acoustic patterns used for these new phonemic contrasts might be different from the native speakers of target L2. This supports the L2LP arguments that L2 learners can achieve non-native contrast, while they might differ in the use of phonetic cues to achieve these contrasts (Escudero, 2005).

8.5 Chapter Summary

The aim of this chapter was to examine whether the existing phonetic variation between the regional dialect speakers of Trabzon and İstanbul Turkish can be reflected in their L2 English speech production compared to SSBE speakers. The results revealed that the regional dialect influence on L2 speech production was mainly observed in F2, while the influence of F1 and duration was observed to a limited extent. The existence of new phonemic differences in the L2 also lead to differences in the production of these contrasts between regional dialect speakers. The results support the SLM-r claim that L2 learners (Istanbul speakers) may have difficulty in establishing new phonemic categories when the new sounds in the L2 are not sufficiently distant enough from their L1 equivalents as in /ʌ/ - /ɑː ɒ/ contrasts in L2. The reason why Trabzon speakers were better at establishing this contrast in their L2 might lie in the allophonic variation of /ʌ/ in their L1. Last but not least, the results demonstrated that the existing regional dialect differences can also diminish in L2 when the phonemic inventory of the target L2 is larger in the number of relevant phonemic contrasts, such as between /æ/ - /ʌ/ vowels.

In conclusion, the findings of this study are congruent with the hypothesis of L2LP (Escudero, 2005) that fine grained differences among regional dialects can affect L2 speech production of the shared L1 speakers. In addition, allophonic variation among regional dialects can be an influence on L2 speech production when acquiring new phonemic contrasts in the L2. Further studies investigating regional dialect influence on the perception of such contrasts could be beneficial for further understanding the variation in L2 production and its relationship with perception.

9 Conclusion

This chapter presents a summary of the main findings of the thesis. While each analysis chapter has an interim discussion, this chapter interprets the findings from a wider perspective by evaluating their contribution to theoretical models of L2 speech production and the role of regional dialect variation. I will then discuss the implications of these results in terms of future research and also address the limitations of the research design of the thesis. The chapter ends with some final remarks.

9.1 Summary of Main Findings

This thesis aimed to explore the role of regional dialect influence in L2 speech production by specifically looking at regional dialect speakers of İstanbul and Trabzon Turkish. Due to a lack of phonetic studies describing regional dialect variation, two experiments were carried out in Turkish to explore potential regional dialect variation. Study 1 in Chapter 5 sought answer to RQ1a 'Is there phonetic regional variation in the production of the voiced affricate between İstanbul Turkish and Trabzon Turkish speakers?'. The results revealed that the production of the voiced affricate /dʒ/ was similar between the Trabzon and İstanbul Turkish speakers. However, some of the acoustic correlates such as CoG, dispersion and rise slope were found to differ by word position. Although not significant, a visual inspection of the data showed that word position and preceding vowel appeared to have differential effects for speakers of the different dialects. These results demonstrate that the allophonic dental realization of the voiced affricate /dʒ/ in Trabzon region was not strongly observed among the younger speakers who took part in the study. This might be the result of social attitudes towards regional accents in the country. Although accent attitude studies are limited to Kurdish accented speakers or L2 (English accents) studies in Turkey (i.e., Polat, 2007, Akçay, 2020), it is not a stretch to claim that the long lasting national (standard) language policy of the state lead many regional speakers to shift toward standard language, specifically for social acceptance in formal environments.

RQ1b “Do İstanbul Turkish and Trabzon Turkish speakers differ in their production of L2 English voiced affricate?” examined the role of regional dialect on L2 speech production by focusing on a consonant sound. In line with the findings of study in Chapter 5, Chapter 6 also found that L2 English speech production of the voiced affricate /dʒ/ was similar between Trabzon and İstanbul dialect speakers. This shows consistency between groups in terms of L1-L2 speech production. However, this study revealed that phonetic realization of /dʒ/ was different between SSBE and L1 Turkish speakers, showing that L1 Turkish speakers do not produce native-like productions of this sound. In addition, the results showed that the word position and vowel context of /dʒ/ in L2 English varies slightly between regional dialect speakers of Turkish. For example, the /ɪ/ vowel influences CoG differently at word-medial position. While speakers of both regional dialects were observed to be very similar at word-final /dʒ/ production in L2 English in terms of spectral acoustic correlates, the visual inspection of the dialect*position*vowel interaction demonstrated that frication duration at word-final position was longer for Trabzon speakers, specifically if the preceding vowel is /ʌ/. Although SSBE and L1 Turkish speakers of the two dialects differed in their production of the voiced affricate, the results demonstrated that this difference was larger in spectral acoustic correlates, and minimal in temporal acoustic correlates. This is congruent with previous L2 studies which have found that L2 learners rely on/develop durational cues earlier than spectral aspects of a given contrast or target sound (Burgos et al., 2014, Cebrian, 2007, Escudero et al., 2009)

RQ2a: ‘Is there phonetic regional variation in the production of vowels between İstanbul Turkish and Trabzon Turkish speakers?’ focused on regional dialect variation of vowels in Turkish. Chapter 7 presented findings showing that Istanbul and Trabzon speakers differed significantly in their production of the /ʌ ɔ/ vowels and the [æ] allophone in F1 and F2, while their productions were broadly similar across other vowels. The results also founded that lip rounding /ɔ œ/ is a larger contrast in Trabzon speakers, suggesting that there might be a potential ongoing change of these contrasts in İstanbul Turkish.

The last research question, RQ2b ‘Do İstanbul Turkish and Trabzon Turkish speakers differ in their production of L2 English vowels?’ aimed to elucidate the role of L1 regional dialect variation in L2 English vowel production. In Chapter 8, the results found that regional dialect differences in the L1 appear to influence L2 English vowel production, with İstanbul and Trabzon speakers differing mostly in F2. In addition, although /uː ʊ ɔː/ vowels were produced in similar ways in L2 English, these vowels nonetheless differ from the productions of SSBE speakers of English. In terms of vowel duration, the results showed that Turkish speakers are able to produce phonemic contrasts if orthography is a positive contributor as in the /ɪ/ - /iː/ contrast. The findings of this study are particularly interesting in that regional dialect difference in L1 vowels do not only lead to difference for a specific phoneme contrast in L2. Instead, it may result in different remapping of the L2 sound inventory. For example, while the allophone [æ] was significantly different between regional dialect speakers in the L1, İstanbul speakers remapped the production of this phoneme in L2 by producing it higher and slightly more fronted, yet it is still produced differently from SSBE speakers. Similarly, the results found that production of /ʌ/ was significantly different between İstanbul and Trabzon speakers in L1 Turkish. However, there was greater similarity in their production of /ʌ/ in L2 English, while the new contrast vowels such as /ɒ/ - /ɑː/ resulted in regional dialect differences in L2 English production. The results of this chapter also found that the tense-lax contrast in L2 English, which is not a phonemic contrast in Turkish, also shows regional dialect differences in the /iː/ - /ɪ/ L2 vowel contrast.

9.2 Implications

9.2.1 Regional Dialect Variation in Turkey

RQ1a and RQ2a both focused on the regional dialect variation in Turkey by analysing the acoustic correlates of the voiced affricate and the vowels in Chapter 5 and 7 respectively. These studies revealed some interesting insights into language variation and change in Turkey. The results showed that the speech of highly educated young generations, at least between İstanbul and Trabzon, are becoming more alike due to several factors such as education and social class (Kerswill, 2003). Language standardization is a conscious use of a correct form of language (Milroy, 2001). While the trend in Europe is shifted toward the recognition and inclusivity of minority languages and dialects (see, The European Charter for Regional or Minority Languages,1992), Turkey's one nation-one language ideology still holds its power and influence the language and dialect attitudes of the regional speakers (Schluter, 2021). Although it is only impressionistic, the (sub)conscious change in the speech of Trabzon dialect speakers in experimental settings suggests that style-shifting occurs as a consequence of standard language ideology. This shift is clearly observable even in a region where regional dialect use is still considered a strong part of local identity and socio-politics. Given that accent discrimination creates pressures towards standard language forms, there is a potential for the phonetic features of the regional dialects to be restrained into informal contexts (i.e., family and friends) due to widespread education and the disadvantage of regional accents in the socio-economic realm. There are several reasons to slow this trend. First, preserving regional varieties may help us understand language change in many aspects, as they can include archaic forms of a language and act as a living history of linguistic development. Second, accents are considered to be a part of identity for many speakers (Eustace, 2012), and extrinsic factors favouring style shifting towards a standard dialect due to socio-economic reasons may affect identity and attachment, leading to gradual regional accent reduction for many speakers. Finally, given the influence of media on language change and attitudes (Kristiansen, 2014) and how they represent regional varieties, large-scale public awareness can be practiced for a positive change for the use of regional varieties.

The dental variation of the voiced affricate was not found to be significantly different between Trabzon and İstanbul speakers. It can be interpreted that this marked feature of the Trabzon region is confined to sub-dialect of Trabzon in the eastern part of the city. In addition to role dialect levelling, language (dis)contact might be another reason why there was not a significant difference in the acoustic realization of the voiced affricate between regional dialects. Brendemoen (2006) stated that the use of dental affricates in the region was a result of language contact with Armenian and Caucasian languages, which both have dental and alveolar phonemic affricates. Following the foundation of Turkish Republic in 1923, it is known that a considerable population change occurred in the region. In addition to population exchange of the Pontic Greek people, the Armenian population in the region, which was nearly five thousand people in 1914 and only 24 people in 1935 (See Table 3.4), decreased significantly. During the same time, the establishment of the Soviet Union and strict border controls reduce the potential language contact of the Caucasian languages with

Turkish in the Eastern Black Sea Region. Thus, the dental allophonic variation of the voiced consonant may have been confined to the sub-regions of Trabzon, and its occurrence may have gradually decline in the younger generations.

With regard to vowel variation between Standard Turkish and Trabzon Turkish, results mostly confirmed that the variation mostly occurs in fronting and backing mechanisms (Brendemoen, 2002). While the variation was greater in low vowels [æ], /ʌ ɔ/, I found that the production of high vowels such as /ɯ y œ/ were nearly identical between the two regional dialects. These vowels /ɯ y œ/ lack in the vowel inventory of contact languages in the Trabzon Region such as Pontic Greek, Armenian, Laz Languages as they consist of relatively small vowel inventory (/ʌ ɛ ɪ u ɔ/). While the shared vowels in the inventory of contact languages might have caused Trabzon speakers to accommodate these vowels, which then resulted in variation in the production, the three vowels /ɯ y œ/ produced similarly due to lack of influence from the contact languages. It is worth noting that there may be the role of religion explaining the variation and similarities between these vowels, too. That is, the islamization of the Trabzon region, such as Greek and Armenian speakers converting to Islam in the region, may have influenced their language preferences such as switching to Turkish as the language of Islam in the region. Consequently, this may have caused the production of Turkish heavily influence by their mother tongue.

Another interesting finding of this study in terms of regional dialect variation was found for İstanbul Turkish. The results showed that, /ɯ/ vowel is phonetically produced close-mid, and central by young İstanbul speakers although its phonological classification in Turkish is described as a back vowel. Rona-Winnick (1972) describe /ɯ/ a close back vowel in her analysis of İstanbul Turkish. However, Zimmer and Orgun (1992) defined /ɯ/ close central vowel. Hence, the production of /ɯ/ might have been fronted over the decades, showing a potential sound change for this vowel. As the previously mentioned studies rely on a very small sample size (e.g., 1 speaker in Zimmer & Orgun (1992), there is a certain need for a wider dataset and sample size to examine apparent time change of this vowel. Similarly, the results found that the sonorant conditioned mid lowering of /ɛ/, realized as [æ], is significantly greater among İstanbul Turkish speakers. Gopal and Nichols (2017) found that the degree of mid-lowering is greater among speakers from İstanbul and Ankara, which can be interpreted that Standard Turkish speakers are more inclined to produce sonorant conditioned [æ]. Whether this inclination is rooted in education based Standard Turkish usage or a West to the East sound change in Turkey is another research direction for the future socio-phonetic studies in Turkish. Lastly, the noticeable degree in the variation of lip rounding, acoustically signalled by lowered F3, between the regional dialects necessitate further research on the relationship between acoustic and articulatory data. That is whether regional dialect speakers rely on different cue weighting (articulatory vs acoustic) in the realization of rounded vowels in Turkish. Although it was not examined properly in this thesis, the frequent occurrences of high vowel devoicing in the data analysis and the difference in the F3 require further phonetic analysis in this aspect.

This study only scratches the surface of sociolinguistic variation in Turkey. With its 16 million population, including nearly 3 million refugees speaking varieties of L1 Arabic, İstanbul itself needs an in depth-socio-phonetic and sociolinguistic study, taking into account various aspects such as religion, education, and socio-economic class. It is highly likely that İstanbul, which makes up 20% of the population of Turkey, is at the vanguard of linguistic change in Turkey. Thus, there is a need to track how language and sound change occurs in this city. Similarly, an in-depth analysis of regional dialect usage/shift in the Trabzon region, as well as examining its sub-dialects, can offer insights into the socio-politic and socio-economic motivations of regional dialect use in Turkey.

9.2.2 Regional Dialect Influence on L2 Speech Production

RQ1b and RQ2b aimed to reveal if and how regional dialects influence the L2 English speech production of voiced affricate and vowels produced by İstanbul and Trabzon dialects speakers respectively. There was no significant difference in the production of the voiced affricate /dʒ/ in L1, and the results confirmed that regional dialect speakers produced this sound similarly in L2. However, qualitative analysis of this consonant also showed that the interaction of word position and preceding vowel context can cause dialect speakers to slightly vary in the production of the voiced affricate, but this effect may be too small to show any transfer to L2 English speech production.

The findings of L2 English vowels speech production experiment shows that regional dialect speakers of a shared L1, in this case Turkish, can explain differences in L2 English speech production of new phonemes, depending on their phonetic approximant to L1 sounds. Moreover, these results showed that regional dialect speakers can also vary in the phonetic remapping of sounds, which were allophones in the L1 and are phonemes in the L2, such as /i:/. Remembering that there was not significant regional dialect variation in the production of /ɪ/ in Turkish, it is interesting that the regional dialect speakers differed in the acoustic realization of /ɪ/ - /i:/ contrast in L2 English. Both dialect speakers produced the durational contrast of this pair, while it was only İstanbul speakers producing a spectral difference similar to SSBE speakers. This suggests that L2 speakers' speech production has intricate patterns in which both sound-specific and overall phonetic mapping plays a role. Namely, the difference in the allophonic variation of /ɪ/ vowel in Turkish dialects, which was not examined in this thesis, might have led regional dialect speakers to produce this new phoneme differently. Another reason might be ingrained in the perceptual differences between the two regional dialects. Although there is not any research on the perceptual variation of these dialects in Turkish, the existing phonological differences such as stress and vowel lengthening might influence dialect speakers' perception and production of L2 contrasts.

The results in the production of L2 vowels also showed that L2 learners can follow different patterns for phonetic category formation of L2 sounds than native speakers. For example, the acoustic realization of /æ/ was significantly different than /ɛ/ and /ʌ/ both for İstanbul and Trabzon speakers, showing that L2 speakers are able to produce new phonetic category for this phoneme. However, the acoustic correlates of /æ/ were significantly different between L1 Turkish and SSBE speakers. This result supports the argument of SLM-r that L2 speakers will be different than monolingual speakers in forming new phonetic categories due to differences in the input they receive to form these categories (Flege & Bohn, 2021).

An overall finding, observed both in the production of the voiced affricate and the L2 English vowels, was the attainment of durational correlates prior to spectral correlates among L2 speakers. While there were spectral differences in the production of voiced affricate between L1 Turkish and SSBE speakers, they produced this consonant similarly in terms of temporal correlates. Similarly, L1 Turkish speakers produced several L2 English vowels /ɔː uː iː/ at similar duration to SSBE speakers, while the spectral correlates of these vowels differed significantly between SSBE and L1 Turkish regional dialect speakers. These results confirm the theoretical claims of L2LP that L2 learners may develop and rely on durational cues while native speakers' primary cues would be on spectral features (Escudero et al., 2009). However, it is important to remember that this cue weighting did not apply to all vowels in this dataset. For example, the duration of /ɑː/ and /ɜː/ was significantly different between SSBE and L1 Turkish speakers. While L1 Turkish speakers produced the durational correlates of other vowels similar to SSBE speakers, they produced these vowels shorter than SSBE speakers. Given the target words used in the data set both included rhotic (namely, dark, heard, third) as a following consonant, it is potential that co-articulation (i.e., following consonant) may lead to the difference between L1 Turkish and English speakers. Thus, I can argue that, even though L2 speakers may rely on temporal correlates as a primary cue, other parameters such as co-articulation or the input form (written vs spoken) can cause variation in cue-weighting among L2 speakers. Overall, while these results confirm L2LP on the difference of acoustic cue-weighting between native and L2 speakers, it raises the issue that L2 learners' cue-weighting can be susceptible to co-articulation or the input form interaction of co-articulation.

Taken as a whole, the results suggest that phonetic variation in L1 regional dialects may influence L2 speech production. This supports and expands previous research on L2 speech production and establishes such links between languages that show a lower degree of typological relatedness. The findings also raise issues concerning the variables that L2 learners are sensitive to in L2 speech development. One possible explanation for some findings in this study is that L2 learners develop their speech production with reference to standard varieties of their L1 rather than with reference to their regional dialect. For example, Simon et al (2015) have argued that in a multilingual context, the regional dialect can be considered the L1, standard dialect is the L2, and foreign language is the L3. Simon et al. (2015) suggest that this might cause speakers to produce L3 phonemes under the influence of the L2 (rather than the L1). In Turkey, given that the foreign language practice is limited to classroom contexts, which naturally forces the use of Standard Turkish, this theory might help to explain the findings concerning the voiced affricate, but it clearly does not apply to vowels. Advancing this argument, I consider applying the bilingual language-mode continuum (Grosjean, 2012) to bidialectalism (Smith & Durham, 2012). That is, regional dialect speakers activate their standard Turkish in classroom settings and hence it interacts with their L2 learning. Their use of local dialects, which is mostly confined to family and friends, do not provide any motive to produce L2 speech thereby reducing the potential influence of regional dialect. What remains a mystery is the varying strength of this bidialectal switch. Despite the EFL context, language standardization, and style-shifting due to experimental conditions, the results revealed that regional dialects do affect the L2 English production of several non-native sounds. Overall, this study showed that studying regional dialect influences on L2 speech can offer a unique perspective that is not similar to comparing phonologically similar L1s such as Swedish and Norwegian. Regional dialect influence on L2 speech provides us with the fine-grained phonetic variation that can explain the mechanism of L2 speech learning in more details.

9.2.3 Future Directions

The results of the studies in this thesis reveal several issues that can contribute to further research in bilingualism, (standard) language ideology, and second/foreign language learning and teaching. First, the results demonstrated that L2 speech production is a dynamic process susceptible to physiological, cognitive, and social variables. The fact that L2 English production of vowels has varied considerably among regional dialect speakers, with/out the existing regional variation in L1, indicates the requirement of further studies examining regional dialect both as a social and phonological variable. SLM-r accounts for the cognitive and physiological relationship by pointing out the co-evolving interaction of speech perception and production, while conceptualizing the social variables (i.e., age, motivation, type of input) as a mediator in between. Further research can scrutinize the intertwined influence of these aspects on L2 speech perception and production in different social/learning contexts. How social and cognitive variables influence one another which then leads to the remapping of non-native sounds in L2 speech perception and production awaits further research.

While the primary aim of this thesis was to investigate regional dialect influence on L2 English speech production, I now address some aspects that would be practical for future research into language learning and teaching. This study showed that the nature of L2 language speech production is sensitive to many variables including the role of regional dialects. Thus, L2 language teachers, and candidate teachers, can be trained on these aspects. This would enable them to gain awareness on pronunciation differences of regional speakers. For example, it is a duty for early state teachers in Turkey to work in Eastern parts of Turkey, where many of their students speak Kurdish-accented Turkish, hence also Kurdish-accented English. Similarly, regional varieties and their phonetic features differ from East-to-West and North-to-South in Turkey. An introductory training course on how local varieties might influence speakers'/students' production of English can help teachers plan the phonetic aspects on which to focus for pronunciation teaching. Another issue is curriculum development in L2 teaching, where there is often a mismatch in orthographic transparency between the L1 and target L2 language. The chance that the role of orthography is less influential on high proficiency L2 speakers might suggest that the amount of written input should be optimised for language teaching at different proficiency levels. This might prevent naive L2 learners from setting L2 phonetic categories under the shadow of L1 orthography at initial learning stages. In addition, the questionnaire results of this study highlighted that, in terms of L2 learning conditions, proficiency is increasing from the East to the West of the country, signalling that the principle of equal opportunity in foreign language education has not been achieved. Language teachers and the education policy authorities should consider potential challenges of foreign language teaching for different regions of the country.

It is also worth mentioning that standard language ideology can also influence foreign language learning. As revealed in this study, L2 learners receive foreign language education in school settings, which is a core venue for conveying standard language policies of a country across the regions. Similar to bilingual's mode activation (Grosjean, 2012), an inevitable result of the standard language ideology is the shift between regional dialect and standard dialect among local speakers. For this reason, it is important to consider that the way regional dialects are perceived or treated in language policy in a given community can reduce its impact on L2 speech, specifically in EFL contexts. Thus, further research can elucidate the role of standard language ideology on foreign language learning as well as the role of regional dialects.

9.2.4 Limitations

The results, and interpretations of this study should be considered carefully due to the limitations in the thesis. Some of these limitations were based on my experience during the field trips for data collection. First and foremost, the small sample size in terms of the participants and the dataset (tokens for each variable for each condition) limits the statistical power of the results. While these results can be representative for L1 Turkish to some degree, and L2 English of L1 Turkish speakers, I acknowledge that future studies may refine and extend the findings obtained in this thesis.

Second, as already discussed in the previous chapters, the use of written stimuli for speech production probably resulted in the activation of L1 orthographic influence as well as standard dialect usage. Having witnessed that several participants speaking with a local dialect of Trabzon but switching to the standard Turkish during the production experiment shows that written stimuli influence Turkish participants' dialect mode. In addition, the use of written stimuli can have a crucial role in L2 experimental settings, specifically when there is higher phoneme to grapheme mismatch between L1 and L2 as in the case of this thesis. Thus, further research eliciting spoken data on these dialect groups might offer different findings.

Controlling the co-articulatory contexts across the two language modes was also another limitation in examining the vowel inventories between languages. For example, it is certain that mid-sonorant conditioning is different between İstanbul and Trabzon speakers in L1. However, I was not able to test whether this would create a regional dialect advantage for İstanbul speakers in L2 English when /æ/ is produced in words without a following sonorant consonant such as trap, chat, bad.

There is also a need for a more elaborated participant recruitment to control sub-dialect variation in dialect regions, as well as controlling the gender balance. While I focused on young speakers in both dialects, there was no control on the participant selection for socio-economic variables such as class and religion. Given the strata of İstanbul, more detail on the profile of the participants strengthen the validity of results, at least for the described group. Similarly, sub-dialect classification of participants is important for Trabzon dialect speakers, as saliency of phonetic features vary in each sub-region. For example, the dental allophonic variation of the voiced affricate is a feature of eastern part of Trabzon dialects, whereas only a few of the participants in this study represented this sub-region. Thus, it is of great importance to classify sub-dialects depending on the acoustic target of the intended research.

Future research designs taking these aspects into consideration would enhance the validity of the results.

9.3 Final Remarks

In this thesis, I examined the role of regional dialects in L2 English speech production, specifically focusing on L1 Turkish dialects from Trabzon and İstanbul regions. My findings showed that L2 speech production can vary between speakers of different L1 dialect backgrounds if the phonetic differences between dialects are also salient or significant in the L1. These results support the argument of L2LP (Escudero, 2005) that subtle differences in L1 regional dialects can lead to variation in L2 speech and, therefore, suggest the plausibility of the L1 as an initial learning stage for L2 speech production. However, this thesis also supports some of the claims in the SLM-r (Flege & Bohn, 2021) model, such that position-specific allophones can be crucial in phonetic mapping of L2 sounds. The intricate interaction between regional dialects, word position, and coarticulation provides insights on the dynamic process of L2 speech production and highlights the complexity of cross-linguistic phonetic interactions. An important contribution of this study is that it expanded the scope of L2 speech models validating several assumptions on a typologically different and less studied language where L2 speech is confined classroom settings. These findings raise several new questions for our understanding of L2 speech production and for the study of regional dialect variation in Turkey. I hope that these findings will serve as beneficial suggestions to extend our understanding of L2 speech production, as well as contributing to socio-phonetic studies of Turkish.

10 References

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11 Appendices

11.1 Appendix A

Flyers for Participant Recruitment

18 yaş üstü ve Trabzonlu musunuz?

Türkçe ve diyalektlerinin yabancı dil (İngilizce) kullanımı üzerine etkilerini araştırmak için yapmakta olduğumuz deneyimize katılımcılar arıyoruz. Deneyimizde bir dizi cümle ve 2 kısa metini Türkçe ve İngilizce olarak okumanız istenecek ve çalışma sırasında sesiniz kaydedilecektir. Çalışmamıza özellikle Doğu Karadeniz- Trabzon bölgesinde yaşayan **Karadeniz aksanlı** veya standart Türkçe aksanlı ve İngilizce eğitimi almış katılımcılar gerekmektedir. Deney KTÜ Kanuni yerleşkesinde gerçekleşecek olup yaklaşık 30 dakika sürmesi planlanmaktadır. Bu çalışma Lancaster Üniversitesi tarafından yürütülmekte olup kişisel bilgileriniz ve ses kayıtlarınız etik ilkeler çerçevesinde saklı tutulacaktır. Katılımcı olarak gösterdiğiniz katkıdan ötürü ikramlık verilecektir.

Detaylı bilgi ve katılım için iletişim;

Bahar AKSU

E-mail: b.aksu@lancaster.ac.uk

Teşekkürler!

Are you a SSBE (Standard Southern British English) speaker and aged 18 or over?

We are looking for participants to take part in a study which uses voice recording to investigate how native speakers of SSBE produce speech sounds in English. You will be asked to read some English sentences and a short text aloud while your speech is recorded. We are particularly interested in speakers from Southern England. Recordings will take place at Lancaster University and should take no longer than 15 minutes. The project is run by researchers from Lancaster University. As a thank you for taking part, we are offering you chocolate and refreshments.

For details and to take part, please contact

Bahar AKSU
email: b.aksu@lancaster.ac.uk

Thank you!

11.2 Appendix B

Turkish Texts with IPA transcriptions

Text 1: “The North Wind and The Sun – Rüzgar ile Güneş

“Poyrazla güneş, birbirlerinden daha kuvvetli olduklarını ileri sürerek iddialaşıyorlardı. Derken, kalın bir palto giymis bir yolcu gördüler. Bu yolcuya paltosunu çıkarttırabilenin daha kuvvetli olduğunu kabul etmeye karar verdiler. Poyraz, var gücüyle esmeye basladi. Ancak, yolcu paltosuna gitgide daha sıkı sarınıyordu. Sonunda poyraz uğraşmaktan vazgecti. Bu sefer güneş actı; ortalık ısınınca yolcu paltosunu hemen çıkardı. Böylece poyraz, güneşin kendisinden daha kuvvetli olduğunu kabul etmeye mecbur kaldı.”

IPA:

“/po̟jɾazła g̟ynɛʃ, bɪɾbɪɾlɛɾɪndɛn daha kuβvetlɪ ołdukłaɾɯnɯ ɪlɛɾɪ syɾɛɾek ɪd:ɪałaʃɯjo̟ɾłaɾdɯ. dɛɾk̟ɛn, kałɯn bɪɾ pałto g̟ɪjmɪs bɪɾ jo̟łdʒu g̟œɾdylɛɾ. bu jo̟łdʒu̟ja̟ pałtosunu tʃɯkaɾttɯɾabɪlɛnɪn daha kuβvetlɪ ołdu:unu kabuł ɛtmɛjɛ kaɾaɾ vɛɾdɪlɛɾ. po̟jɾaz, vaɾ g̟ydʒyjlɛ ɛsmɛjɛ basładɯ. andʒak, jo̟łdʒu pałtosuna g̟ɪtg̟ɪdɛ daha sɯkɯ saɾɯnɯjo̟ɾdu. sonunda po̟jɾaz u:ɾaʃmaktan vazg̟edʒtɪ. bu sefɛɾ g̟ynɛʃ adʒtɯ; oɾtałɯk ɯsɯnɯndʒa jo̟łdʒu pałtosunu hɛmɛn tʃɯkaɾdɯ. bœjlɛdʒe po̟jɾaz, g̟ynɛʃɪn k̟ɛndɪsɪndɛn daha kuβvetlɪ ołdu:unu kabuł ɛtmɛjɛ mɛdʒbuɾ kałdɯ/”

Text 2: “The Crust Man- Kabuk Adam

“Bazen insana hiçbir şey hatırlamak kadar acı veremez, özellikle de mutluluğu hatırlamak kadar. Unutamamak. Belleğin kaçınılmaz intikamı. Herhangi bir iz taşınıyorsa eğer, bu bir zamanlar bir yara açıldığındandır.

Yaşadığımız anları dondurup cümlelere dökme çabası, çiçekleri kurutup kitap yaprakları arasında ölümsüzleştirmeye benzer. Hepimizin çoktan öğrendiği gibi, bir öykü, gerçekten yaşanmış da olsa, gerçekliği yansıtmaktan çok uzaktır, onun birkaç resminden, simgesinden oluşmuştur. Az sonra başlayacağım, Karayipler'de geçen o korkunç öyküyü yaşamış kişi benim. Oysa biliyorum ki, son noktayı koyduğumda, elimde bulacağım, gerçeğin tortusundan ibaret olacak. Yaşadıklarım, o her biri elmas değerindeki anlar su damlaları gibi kayıp gitti avcumdan. Gerçekliğin sonsuz okyanusundan tek bir deniz kabuğu kaldı geriye. Ona kulağımı dayayarak sonsuz bir şarkıyı sözcüklere dökmeye çalışacağım. Anlayabildiğim, yorumlayabildiğim kadarını elbette.

Size Kabuk Adam'ın öyküsünü anlatacağım, tropik bir adayı, cinayet ve işkencenin, şiddetin bataklığında filizlenen bir aşkı, içinde yetiştiği toprak kadar acı dolu bir aşkı anlatacağım. Çıldırtıcı gücünü, sonuna dek yaşanmayan arzulardan, en gizli hayallerden alan bir tutkuyu, ölümle yaşamın sınırında kurulan mucizevi bir dostluğu ve bütün yıkımların nedeni olan korkuyu, insanın en temel özelliği olan korkusunu, alçaklığını, umutsuz yalnızlığını...”

IPA “bazɛn ınsana hıtʃ bıɾ ʃɛj hatɯɾłamak kadaɾ adʒɯ vɛɾɛmɛz, œzɛl:ık̟lɛ dɛ mutłułuu hatɯɾłamak kadaɾ. unutamamak. bɛl:ɛ:ın katʃɯnɯłmaz ıntıkamɯ. hɛɾhaŋg̟ı bıɾ ız taʃɯnɯjo̟ɾsa ɛjɛɾ, bu bıɾ zamanłaɾ bıɾ ja̟ɾa atʃɯłdɯ:ɯndandɯɾ.

ja̟ʃadɯɯmɯz anłaɾɯ dondurup dʒymlɛlɛɾe dœk̟me tʃabasɯ, tʃıtʃɛk̟lɛɾı kuɾutup k̟ıtap ja̟pɾakłaɾɯ aɾasɯnda œlymsyzlɛʃtıɾmɛjɛ bɛnzɛɾ. hɛpımızın tʃoktan œ:ɾɛndıjı g̟ıbı, bıɾ œjk̟y, g̟ɛɾtʃɛk̟tɛn ja̟ʃanmɯʃ da ołsa, g̟ɛɾtʃɛk̟lı:ı ja̟nsɯtmaktan tʃok uzaktɯɾ, onun bıɾkatʃ ɾɛsmındɛn, sımg̟ɛsındɛn ołuʃmuʃtuɾ. az sonɾa baʃła̟ja̟dʒa:ɯm, kaɾa̟jiplɛɾ'dɛ g̟ɛtʃɛn o koɾkuntʃ œjk̟yjy ja̟ʃamɯʃ k̟ıʃı bɛnım. o̟jsa bılıjo̟ɾum k̟ı, son nokta̟jɯ ko̟jdu:umda, ɛlımdɛ buładʒaɯm, g̟ɛɾtʃɛ:ın toɾtusundan ıbaɾɛt oładʒak. ja̟ʃadɯkłaɾɯm, o hɛɾ bɪɾɪ ɛlmas dɛjɛɾɪndek̟ɪ anłaɾ su damłałaɾɯ g̟ɪbɪ ka̟jɯp g̟ɪttɪ avdʒumdan. g̟ɛɾtʃɛk̟lɪ:ɪn sonsuz okja̟nusundan tɛk biɾ dɛniz kabu:u kałdɯ g̟ɛɾɪjɛ. ona kuła:ɯmɯ da̟ja̟ja̟ɾak sonsuz bɪɾ ʃaɾkɯjɯ sœzdʒyk̟lɛɾɛ dœk̟mɛje tʃałɯʃadʒa:ɯm. anła̟ja̟bɪldɪjɪm, jo̟ɾumła̟ja̟bɪldɪjɪm kadaɾɯnɯ ɛlbɛttɛ.

sɪzɛ kabuk adamɯn œjk̟ysyny anłatadʒaɯm, tɾopɪk bɪɾ ada̟jɯ, dʒɪna̟jɛt ve ɪʃk̟ɛndʒɛnɪn, ʃɪd:ɛtɪn batakłɯ:ɯnda fɪlɪzlɛnɛn bɪɾ aʃkɯ, ɪtʃɪnde jɛtɪʃtɪ:ɪ topɾak kadaɾ adʒɯ dołu bɪɾ aʃkɯ anłatadʒaɯm.tʃɯłdɯɾtɯdʒɯ g̟ydʒyny, sonuna dɛk ja̟ʃanma̟ja̟n aɾzułaɾdan, ɛn g̟ɪzlɪ ha̟ja̟łlɛɾdɛn ałan bɪɾ tutku̟ju̟, œlymlɛ ja̟ʃamɯn sɯnɯɾɯnda kuɾułan mudʒɪzɛvɪ bɪɾ dostłu:u ve bytyn jɯkɯmłaɾɯn nɛdɛnɪ ołan koɾku̟ju̟, ɪnsanɯn ɛn tɛmɛl œzɛl:i:i ołan koɾkusunu, ałtʃakłɯɯnɯ, umutsuz ja̟łnɯzłɯ:ɯnɯ”

11.3 Appendix C

English Text with IPA transcription

The Boy Who Cried Wolf

There was once a poor shepherd boy who used to watch his flocks in the fields next to a dark forest near the foot of a mountain. One hot afternoon, he thought up a good plan to get some company for himself and also have a little fun. Raising his fist in the air, he ran down to the village shouting ‘Wolf, Wolf.’ As soon as they heard him, the villagers all rushed from their homes, full of concern for his safety, and two of his cousins even stayed with him for a short while. This gave the boy so much pleasure that a few days later he tried exactly the same trick again, and once more he was successful. However, not long after, a wolf that had just escaped from the zoo was looking for a change from its usual diet of chicken and duck. So, overcoming its fear of being shot, it actually did come out from the forest and began to threaten the sheep. Racing down to the village, the boy of course cried out even louder than before. Unfortunately, as all the villagers were convinced that he was trying to fool them a third time, they told him, ‘Go away and don’t bother us again.’ And so the wolf had a feast.”

IPA:

“ðeə wɒz wʌns ə pʊə ˈʃɛpəd bɔɪ huː juːzd tuː wɒʧ hɪz flɒks ɪn ðə fiːldz nɛkst tuː ə dɑːk ˈfɒrɪst nɪə ðə fʊt ɒv ə ˈmaʊntɪn. wʌn hɒt ˈɑːftəˈnuːn, hiː θɔːt ʌp ə gʊd plæn tuː gɛt sʌm ˈkʌmpəni fɔː hɪmˈsɛlf ænd ˈɔːlsəʊ hæv ə ˈlɪtl fʌn. ˈreɪzɪŋ hɪz fɪst ɪn ði eə, hiː ræn daʊn tuː ðə ˈvɪlɪʤ ˈʃaʊtɪŋ wʊlf, wʊlf.’ æz suːn æz ðeɪ hɜːd hɪm, ðə ˈvɪlɪʤəz ɔːl rʌʃt frɒm ðeə həʊmz, fʊl ɒv kənˈsɜːn fɔː hɪz ˈseɪfti, ænd tuː ɒv hɪz ˈkʌznz ˈiːvən steɪd wɪð hɪm fɔːr ə ʃɔːt waɪl. ðɪs geɪv ðə bɔɪ səʊ mʌʧ ˈplɛʒə ðæt ə fjuː deɪz ˈleɪtə hiː traɪd ɪgˈzæktli ðə seɪm trɪk əˈgɛn, ænd wʌns mɔː hiː wɒz səkˈsɛsfʊl. haʊˈɛvə, nɒt lɒŋ ˈɑːftə, ə wʊlf ðæt hæd ʤʌst ɪsˈkeɪpt frɒm ðə zuː wɒz ˈlʊkɪŋ fɔːr ə ʧeɪnʤ frɒm ɪts ˈjuːʒʊəl ˈdaɪət ɒv ˈʧɪkɪn ænd dʌk. səʊ, ˌəʊvəˈkʌmɪŋ ɪts fɪər ɒv ˈbiːɪŋ ʃɒt, ɪt ˈækʧʊəli dɪd kʌm aʊt frɒm ðə ˈfɒrɪst ænd bɪˈgæn tuː ˈθrɛtn ðə ʃiːp. ˈreɪsɪŋ daʊn tuː ðə ˈvɪlɪʤ, ðə bɔɪ ɒv kɔːs kraɪd aʊt ˈiːvən ˈlaʊdə ðæn bɪˈfɔː. ʌnˈfɔːʧnɪtli, æz ɔːl ðə ˈvɪlɪʤəz wɜː kənˈvɪnst ðæt hiː wɒz ˈtraɪɪŋ tuː fuːl ðɛm ə θɜːd taɪm, ðeɪ təʊld hɪm, gəʊ əˈweɪ ænd dəʊnt ˈbɒðər ʌs əˈgɛn.’ ænd səʊ ðə wʊlf hæd ə fiːst.”

11.4 Appendix D

Language Background Questionnaire

1. General Information (Please complete the statements and use a tick (√) where necessary)

1a. Age _________________

1b. Gender

Female ___________ Male __________

1c. Nationality

____

1d. City/ Local region(s) where you lived/grown up in your home country?

____

____

First Language(s)

____

1f. Other languages spoken fluently:

____

1g. Please specify your proficiency level in your second language. This could be a recent exam score at local (University Exam), national (YDS), or international level (IELTS, TOEFL).

Exam Type:

____

Year of the exam: _______________Proficiency level:

1g. How long have you been living in the current city?

____

1h. Have you ever lived for more than 3 months in another city or country?

Yes ____________ No __________________

If "yes", where?

____

For how long?

____

2. Experience with Different Accents in L1 (Turkish)

2a. Do you speak a local dialect? If yes, what dialect you call it?

____

2.b. In general, how familiar are you with Turkish spoken with the following accents? (Please circle one number for each accent)

	Not Familiar				**Very Familiar**
Standard Turkish (İstanbul Türkçesi)	1	2	3	4	5
South-West Turkish (Ege Şivesi)	1	2	3	4	5
North-East Turkish (Doğu Karadeniz Şivesi)	1	2	3	4	5
Central Anatolian Turkish (İç Anadolu Şivesi)	1	2	3	4	5

2b. Which of the statements below do you agree with?

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I always speak Standard Turkish.					
I speak standard Turkish in formal situations (work, university, etc.) and with a local dialect in informal situations (family, friends, etc)					

I have difficulty in understanding speakers with local dialects.					
I understand speakers with a local dialect, but I cannot respond in the same way.					

3. Foreign and Native Language Use

3a. If you speak a local dialect of Turkish, what percentage of your time do you speak a in that dialect? And what percentage of your time do you speak standard Turkish?

____

____

____

3b. How long have you been learning English? (You can add other languages you have known)

____

____

3c. How often do you use English in your daily time?

____

3b. Please list what percentage of the time you are currently and on average exposed to dialects and languages below:

	1)Standard Turkish	2) Local Dialect	3) English
List percentage here			

3c. When choosing a language to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time. (Your percentages should add up to 100%):

	1)Standard Turkish	2) Local Dialect	3) English
List percentage here			

3d. Please write any comments you would like to mention about your language experience:

____

____

____

____

____.

Thanks for your participation!

11.5 Appendix E

Participant Information Sheet and Consent Form

Participant information sheet

L2 Speech Perception and Production in relation to L1 Dialects: The case of Turkish consonant sounds

My name is Bahar AKSU and I am doing a PhD in Linguistics at Lancaster University. I would like to invite you to take part in a research study about how sounds are perceived and produced in Turkish and how Turkish speakers perceive and produce sounds in English. Please take time to read the following information carefully before you decide whether or not you wish to take part.

What is the study about?

This study will investigate possible differences of regional variation among Turkish speakers in perception and production of Turkish and English sounds. Turkish has not been extensively studied including the role of dialects before, so the aim is to document this aspect of the language and better understand how sounds are produced and perceived and whether it can be linked to L2 speech perception and production.

Why have I been invited?

I have approached you because we are interested in collecting data from a range of Turkish speakers from different regions. I would be very grateful if you would agree to take part in this study.

What will I be asked to do if I take part?

If you decided to take part, this would involve the following: I will ask you to read a list of Turkish and English words and sentences. While you are reading, we will record your speech using an ultrasound probe and microphone. I will spend some time adjusting the microphone to make sure it is comfortable. Before recording your speech, I will ask you to complete a language background questionnaire to allow us to understand patterns in the data. Finally, I will ask you to listen sounds and categorize them according to the given chart, and identify the sound you hear as Sounds_X or Sound_Y. The whole process should take less than 30 minutes.

What are the possible benefits from taking part?

Taking part in this study will contribute to the documentation of Turkish and Turkish dialects and allow us to better understand how native and second language speech sounds are perceived and produced among Turkish speakers.

Do I have to take part?

No. It’s completely up to you to decide whether or not you take part. Your participation is voluntary.

What if I change my mind?

If you change your mind, you are free to withdraw at any time during your participation in this study. If you want to withdraw, please let me know, and I will extract any data you contributed to the study and destroy them. However, it is difficult and often impossible to take out data from one specific participant when this has already been anonymised or pooled together with other people’s data. Therefore, you can only withdraw up to 2 weeks after taking part in the study.

What are the possible disadvantages and risks of taking part?

There are no major disadvantages involved in participating. Taking part in this study will involve contributing up to an hour of your time.

Will my data be identifiable?

After the experiment has taken place, the data will only be accessible to myself and my two research supervisors involved in the project. All data will be anonymised and your personal information will be kept confidential.

How will we use the information you have shared with us and what will happen to the results of the research study?

We will use the recordings of your speech in the following ways: The results will be presented at dissertation, academic conferences and journal articles. When presenting the results, we might use audio recordings or images from the data. We might also use sound clips of individual words when presenting at conferences or workshops. Individual speakers will not be identifiable when we are presenting the data and your name and personal information will remain confidential.

How will my data be stored?

Your data will be stored on a password-protected, encrypted laptop, and on Lancaster University’s computer system. It will only be accessible to myself and the other researcher working on the project. In accordance with University guidelines, we will keep the data securely for a minimum of ten years and for a maximum of twenty years to allow further analysis to take place.

What if I have a question or concern?

If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact myself:

Bahar AKSU
Department of Linguistics and English Language
Lancaster University LA1 4YL
b.aksu@lancaster.ac.uk
You can also contact the supervisor of this project:

Dr Sam Kirkham **Dr Luke Harding**

Department of Linguistics and English Language **Department of Linguistics and EnglishLanguage**
Lancaster University LA1 4YL **Lancaster University LA1 4YL**
s.kirkham@lancaster.ac.uk l.harding@lancaster.ac.uk

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact my Head of Department:

Professor Uta Papen
Department of Linguistics and English Language
Lancaster University LA1 4YL
u.papen@lancaster.ac.uk
01524 593 245

This study has been reviewed and approved by the Faculty of Arts and Social Sciences and Lancaster Management School's Research Ethics Committee.

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection.

Thank you for considering your participation in this project.

Lancaster University

Consent form

Project Title: L2 Speech Perception and Production in relation to L1 Dialects: The case of Turkish

Name of Researcher: Bahar AKSU, email: b.aksu@lancaster.ac.uk
Name of Research supervisor:
Dr Sam Kirkham, email: s.kirkham@lancaster.ac.uk
Dr Luke Harding, email: l.harding@lancaster.ac.uk

Please tick each box:

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time during my participation in this study and within two weeks after I took part in the study, without giving any reason. If I withdraw within two of taking part in the study my data will be removed.	☐
3. I understand that any information given by me may be used in future reports, academic articles, publications or presentations by the researcher/s, but my personal information will not be included and I will not be identifiable.	☐
4. I understand that my name will not appear in any reports, articles or presentation without my consent.	☐
5. I understand that my speech will be recorded and that data will be protected on encrypted devices and kept secure.	☐
6. I understand that data will be kept according to University guidelines for a maximum of twenty years after the end of the study for research analyses.	☐
7. I agree to take part in the above study.	☐

Name of Participant	Date	Signature
Name of Researcher	Date	Signature

One copy of this form will be given to the participant and the original kept in the files of the researcher at Lancaster University

11.6 Appendix F

Mixed Model Effects results of Voiced Affricate Variation in Turkish (Chapter 4)

Parameter				
CoG	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	4438.11	4159.77 – 4716.44	**<0.001**
	dialect [trabzon]	52.47	-306.46 – 411.41	0.774
	position [medial]	235.21	69.32 – 401.09	**0.006**
	vowel [i]	75.53	-49.71 – 200.77	0.236
Dispersion	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	1127.28	983.25 – 1271.31	**<0.001**
	dialect [Trabzon]	-7.06	-196.11 – 181.99	0.941
	position [Medial]	168.75	76.79 – 260.71	**<0.001**
	vowel [ʌ]	-60.16	-121.72 – 1.41	0.055
Skewness	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	1.71	1.39 – 2.02	**<0.001**
	dialect [Trabzon]	-0.02	-0.41 – 0.37	0.924
	position [Medial]	-0.12	-0.31 – 0.08	0.251
	vowel [ʌ]	0.03	-0.14 – 0.20	0.725
Kurtosis	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	6.75	4.34 – 9.16	**<0.001**
	dialect [Trabzon]	-0.44	-2.68 – 1.79	0.696
	position [Medial]	-1.63	-3.48 – 0.22	0.085
	vowel [ʌ]	0.44	-0.85 – 1.73	0.501
Rise Slope	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	3.57	2.92 – 4.21	**<0.001**
	dialect [Trabzon]	-0.51	-1.28 – 0.25	0.186
	position [Medial]	-1.00	-1.50 – -0.50	**<0.001**
	vowel [ʌ]	-0.56	-1.06 – -0.05	**0.030**
Frication duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.05	0.04 – 0.05	**<0.001**
	dialect [Trabzon]	-0.00	-0.01 – 0.00	0.178
	position [Medial]	-0.00	-0.01 – -0.00	**0.044**
	vowel [ʌ]	-0.01	-0.01 – -0.00	**<0.001**
Vowel duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.06	0.03 – 0.10	**0.001**
	dialect [Trabzon]	0.00	-0.01 – 0.01	0.446
	position [Medial]	0.02	-0.00 – 0.05	0.107
	vowel [ʌ]	0.03	-0.02 – 0.08	0.258
Closure Duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.03	0.03 – 0.04	**<0.001**
	dialect [trabzon]	0.00	-0.00 – 0.01	0.683
	vowel [ʌ]	-0.00	-0.01 – -0.00	**0.015**

Consonant Duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.05	0.04 – 0.06	**<0.001**
	dialect [Trabzon]	-0.01	-0.01 – 0.00	0.132
	position [Medial]	0.01	0.01 – 0.02	**<0.001**
	vowel [ʌ]	-0.01	-0.01 – -0.00	**0.005**

11.7 Appendix G

Mixed Model Effects results of Voiced Affricate Variation in L2 English (Chapter 5)

COG	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	4416.04	4151.81 – 4680.26	**<0.001**
	dialect [SSBE]	-567.12	-893.87 – -240.37	**0.001**
	dialect [Trabzon]	-115.51	-442.32 – 211.30	0.488
	position [Initial]	-7.88	-169.28 – 153.52	0.924
	position [Medial]	67.10	-96.06 – 230.26	0.419
	vowel [ʌ]	-43.57	-177.55 – 90.42	0.523
SD/Dispersion	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	1100.25	967.73 – 1232.76	**<0.001**
	dialect [Trabzon]	-115.10	-296.80 – 66.60	0.214
	dialect [SSBE]	-81.68	-263.34 – 99.99	0.377
	position [Medial]	60.69	15.00 – 106.37	**0.009**
	position [Final]	19.53	-26.17 – 65.24	0.402
	vowel [ʌ]	-19.22	-56.48 – 18.04	0.311
Skewness	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	1.42	1.03 – 1.81	**<0.001**
	dialect [Trabzon]	0.36	-0.17 – 0.88	0.185
	dialect [SSBE]	0.89	0.36 – 1.41	**0.001**
	position [Medial]	0.19	0.03 – 0.35	**0.020**
	position [Final]	0.20	0.04 – 0.36	**0.015**
	vowel [ʌ]	0.10	-0.03 – 0.23	0.130
Kurtosis	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	4.52	1.33 – 7.72	**0.006**

	dialect [Trabzon]	3.15	-1.13 – 7.43	0.148
	dialect [SSBE]	7.27	2.99 – 11.55	**0.001**
	position [Medial]	0.90	-0.55 – 2.36	0.224
	position [Final]	1.07	-0.38 – 2.53	0.148
	vowel [ʌ]	0.88	-0.31 – 2.06	0.147
Rise slope	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	3.70	2.83 – 4.56	**<0.001**
	dialect [Trabzon]	0.10	-1.03 – 1.23	0.862
	dialect [SSBE]	1.41	0.28 – 2.53	**0.014**
	position [Medial]	-1.09	-1.56 – -0.62	**<0.001**
	position [Final]	-0.14	-0.61 – 0.33	0.556
	vowel [ʌ]	-0.36	-0.74 – 0.02	0.066
F_dur	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.07	0.06 – 0.09	**<0.001**
	dialect [SSBE]	0.00	-0.01 – 0.01	0.715
	dialect [Trabzon]	0.01	-0.00 – 0.02	0.170
	position [Initial]	-0.03	-0.04 – -0.02	**<0.001**
	position [Medial]	-0.03	-0.04 – -0.02	**<0.001**
	vowel [ʌ]	-0.00	-0.01 – 0.00	0.436
Vowel duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.14	0.13 – 0.15	**<0.001**
	dialect [SSBE]	-0.01	-0.02 – 0.00	0.093
	dialect [Trabzon]	-0.01	-0.02 – 0.01	0.328
	position [Initial]	-0.02	-0.03 – -0.01	**<0.001**
	position [Medial]	-0.05	-0.06 – -0.04	**<0.001**

	vowel [ʌ]	0.02	0.01 – 0.03	**<0.001**
Closure duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.05	0.04 – 0.06	**<0.001**
	dialect [SSBE]	-0.00	-0.01 – 0.01	0.930
	dialect [Trabzon]	0.00	-0.01 – 0.02	0.402
	position [Medial]	-0.01	-0.02 – -0.01	**<0.001**
	vowel [ʌ]	0.00	-0.00 – 0.01	0.338
Sound Duration	*Predictors*	*Estimates*	*CI*	*p*
	(Intercept)	0.12	0.11 – 0.14	**<0.001**
	dialect [SSBE]	0.00	-0.01 – 0.02	0.787
	dialect [Trabzon]	0.01	-0.01 – 0.02	0.232
	position [Initial]	-0.07	-0.09 – -0.06	**<0.001**
	position [Medial]	-0.04	-0.06 – -0.03	**<0.001**
	vowel [ʌ]	-0.00	-0.01 – 0.01	0.831

11.8 Appendix H

Mixed Model Effects Results of Turkish Vowels (formants only)

		F1			F2			F3		
	Predictors	β	95%CI	*p*	β	95%CI	*p*	β	95%CI	*p*
/æ/	(Intercept)	1.77	1.56- 1.98	**< 0.001**	0.17	-0.10 – 0.44	0.205	-0.67	-1.11 - -0.24	**0.003**
	dialect [trabzon]	-0.87	-1.17 - -0.57	**<0.001**	0.26	-0.00 – 0.52	0.054	0.77	0.32 – 1.23	**0.001**
/ɛ/	(Intercept)	0.13	-0.17 – 0.43	0.395	1.07	0.81 – 1.34	**<0.001**	1.00	0.71 – 1.30	**<0.001**
	dialect [trabzon]	-0.03	-0.37 – 0.32	0.882	-0.18	-0.32 - -0.05	**0.010**	-0.37	-0.78 – 0.04	0.79
/ʌ/	(Intercept)	0.88	0.72 – 1.05	**<0.001**	-0.39	-0.53 - -0.25	**<0.001**	0.05	-0.39 – 0.29	0.778
	dialect [trabzon]	0.71	0.48 – 0.94	**<0.001**	-0.24	-0.43 - -0.05	**0.016**	0.48	0.00 – 0.96	**0.050**
/ɯ/	(Intercept)	-0.27	-0.39 - -0.14	**<0.001**	-0.03	-0.36 – 0.29	0.839	0.37	0.07 – 0.66	**0.016**
	dialect [trabzon]	-0.06	-0.23 – 0.12	0.518	-0.04	-0.27 – 0.20	0.767	-0.11	-0.52 – 0.31	0.604
/ɪ/	(Intercept)	-1.07	-1.20 - -0.95	**<0.001**	1.30	1.13 – 1.46	**<0.001**	0.66	0.33 – 0.98	**<0.001**
	dialect [trabzon]	-0.12	-0.30 – 0.05	0.166	-0.13	-0.36 – 0.10	0.272	-0.25	-0.71 – 0.22	0.287
/ɔ/	(Intercept)	0.06	-0.42 – 0.54	0.797	-1.46	-1.57 - -1.36	**<0.001**	-0.33	-0.62 - -0.05	**0.023**
	dialect [trabzon]	0.47	0.15 – 0.78	**0.005**	0.06	-0.09 – 0.21	0.452	-0.33	-0.72 – 0.06	0.097
/œ/	(Intercept)	-0.18	-0.37 – 0.02	0.070	-0.02	-0.17 – 0.13	0.763	-0.28	-0.54 - -0.02	**0.035**
	dialect [trabzon]	-0.02	-0.30 – 0.26	0.883	-0.02	-0.23 – 0.19	0.831	-0.47	-0.83 - -0.10	**0.013**
/u/	(Intercept)	-0.46	-1.06 – 0.14	0.128	-0.76	-2.29 – 0.77	**0.322**	-0.55	-1.00 - -0.10	**0.018**
	dialect [trabzon]	-0.04	-0.33 – 0.25	0.787	-0.13	-0.40 – 0.14	0.348	-0.09	-0.67 - -0.49	0.759
/y/	(Intercept)	-1.02	-1.47 - -0.56	**<0.001**	0.12	-0.34 – 0.58	0.608	0.12	-0.69 – 0.44	0.662
	dialect [trabzon]	0.09	-0.22 – 0.40	0.558	0.28	-0.10 – 0.67	0.148	0.29	-0.44 – 1.03	0.426

Mixed Model Effects Results of Turkish Vowels (duration only)

	/ɛ/			/ʌ/			/ɪ/		
Predictors	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***
Intercept	-0.10	-0.43 – 0.23	0.537	-0.07	-0.25 – 0.11	0.438	-0.68	-0.84 - -0.51	**<0.001**
dialect [trabzon]	0.28	-0.06 – 0.62	0.100	-0.31	-0.56 - - 0.05	**0.018**	-0.02	-0.26 – 0.22	0.855
	/ɯ/			**/ɔ/**			**/œ/**		
Predictors	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***
Intercept	-0.17	-0.98 – 0.65	0.679	-0.15	-0.32 – 0.03	0.093	0.38	0.19 - 0.58	**<0.001**
dialect [trabzon]	-0.10	-0.38 – 0.18	0.490	0.27	0.02 – 0.52	**0.032**	0.10	-0.17 – 0.37	0.460
	/u/			**/y/**			**/æ/**		
Predictors	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***
Intercept	-0.63	-1.27 – 0.01	**0.055**	-0.90	-1.05 - -0.75	**<0.001**	2.16	1.90 – 2.43	**<0.001**
dialect [trabzon]	0.36	0.10 – 0.63	**0.008**	-0.16	-0.38 – 0.06	0.141	-0.41	-0.71 - -0.12	**0.007**

11.9 Appendix İ

Mixed Model Effects Results of L2 English Vowels (formants only)

		F1			F2			F3		
/ɛ/	**Predictors**	***β***	**95%CI**	***p***	***β***	**95%CI**	***p***	***β***	**95%CI**	***p***
	(ıntercept)	-0.13	-0.40 – 0.15	0.356	1.05	0.91 – 1.19	**<0.001**	0.36	0.10 – 0.61	**0.007**
	dialect [SSBE]	0.48	0.27 – 0.69	**<0.001**	-0.42	-0.60 - -0.25	**<0.001**	-0.42	-0.78 - -0.05	**0.025**
	dialect[trabzon]	-0.11	-0.32 – 0.10	0.303	-0.11	-0.28 – 0.07	0.220	-0.28	-0.65 – 0.08	0.124
/æ/	(ıntercept)	0.43	0.01 – 0.86	**0.047**	0.25	0.02 – 0.49	**0.037**	-0.20	-0.71 – 0.32	0.450
	dialect [SSBE]	0.84	0.50 – 1.19	**<0.001**	-0.23	-0.53 – 0.08	0.140	-0.43	-1.07 – 0.22	0.191
	dialect[trabzon]	0.15	-0.20 – 0.50	0.402	0.12	-0.18 – 0.43	0.419	0.05	-0.59 – 0.70	0.872
/ʌ/	(intercept)	1.27	1.03 – 1.51	**<0.001**	-0.31	-0.47 – -0.15	**<0.001**	-0.22	-0.73 – 0.28	0.386
	dialect [SSBE]	-0.28	-0.57 – 0.01	0.057	-0.04	-0.19 – 0.10	0.550	-0.17	-0.65 – 0.31	0.483
	dialect[trabzon]	0.04	-0.25 – 0.33	0.788	-0.09	-0.24 – 0.06	0.228	-0.19	-0.67 – 0.30	0.450
/ɑː/	(intercept)	1.09	0.85 – 1.33	**<0.001**	-0.37	-0.55 – -0.20	**<0.001**	-0.39	-0.86 – 0.08	0.102
	dialect [SSBE]	-0.16	-0.50 – 0.18	0.344	-0.45	-0.69 – -0.20	**0.001**	0.37	-0.30 – 1.03	0.273
	dialect[trabzon]	0.00	-0.34 – 0.34	0.988	0.29	0.05 – 0.54	**0.021**	0.48	-0.18 – 1.15	0.150
/ɒ/	(intercept)	1.40	1.19 – 1.60	**<0.001**	-0.46	-0.64 – -0.29	**<0.001**	0.33	-0.11 – 0.76	0.140
	dialect [SSBE]	-0.71	-1.00 – -0.42	**<0.001**	-0.65	-0.82 – -0.48	**<0.001**	0.32	-0.20 – 0.85	0.227
	dialect[trabzon]	-0.38	-0.68 – -0.09	**0.011**	-0.17	-0.34 – 0.00	0.052	0.24	-0.29 – 0.76	0.374
/iː/	(intercept)	-1.26	-1.41 – -1.12	**<0.001**	1.67	1.46 – 1.89	**<0.001**	0.92	0.49 – 1.35	**<0.001**
	dialect [SSBE]	-0.02	-0.20 – 0.16	0.850	-0.08	-0.28 – 0.13	0.462	-0.01	-0.55 – 0.53	0.968
	dialect[trabzon]	0.29	0.11 – 0.47	**0.002**	-0.34	-0.55 – -0.13	**0.002**	-0.15	-0.69 – 0.39	0.582
/ɪ/	(intercept)	-1.07	-1.17 – -0.96	**<0.001**	1.25	1.13 – 1.37	**<0.001**	0.44	0.15 – 0.74	**0.004**
	dialect [SSBE]	0.30	0.16 – 0.45	**<0.001**	-0.21	-0.38 – -0.05	**0.011**	-0.13	-0.54 – 0.28	0.533

	dialect[trabzon]	-0.12	-0.27 – 0.03	0.102	0.21	0.04 – 0.37	**0.015**	0.08	-0.34 – 0.49	0.720
/ɔː/	(intercept)	0.10	-0.04 – 0.25	0.166	-1.00	-1.17 – -0.83	**<0.001**	-0.17	-1.10 – 0.76	0.712
	dialect [SSBE]	-0.68	-0.88 – -0.47	**<0.001**	-0.28	-0.43 – -0.14	**<0.001**	0.04	-0.42 – 0.51	0.850
	dialect[trabzon]	-0.01	-0.22 – 0.19	0.887	-0.02	-0.17 – 0.12	0.756	-0.19	-0.65 – 0.28	0.428
/ɜː/	(intercept)	0.07	-0.08 – 0.22	0.374	-0.34	-0.54 – -0.14	**0.001**	-1.27	-1.56 – -0.98	**<0.001**
	dialect [SSBE]	0.47	0.25 – 0.68	**<0.001**	0.38	0.16 – 0.59	**0.001**	1.19	0.78 – 1.60	**<0.001**
	dialect[trabzon]	0.19	-0.02 – 0.40	0.082	0.23	0.01 – 0.44	**0.038**	0.39	-0.02 – 0.80	0.063
/uː/	(intercept)	-0.57	-0.90 – -0.24	**0.001**	-1.02	-1.85 – -0.19	**0.017**	0.08	-0.28 – 0.44	0.672
	dialect [SSBE]	-0.48	-0.76 – -0.21	**0.001**	0.64	0.33 – 0.95	**<0.001**	-0.29	-0.80 – 0.23	0.270
	dialect[trabzon]	0.14	-0.13 – 0.42	0.309	0.12	-0.19 – 0.43	0.432	-0.10	-0.62 – 0.41	0.684
/ʊ/	(intercept)	-0.87	-1.04 – -0.70	**<0.001**	-0.82	-1.03 – -0.62	**<0.001**	-0.04	-0.38 – 0.30	0.818
	dialect [SSBE]	0.25	0.09 – 0.41	**0.003**	0.99	0.85 – 1.14	**<0.001**	-0.30	-0.66 – 0.05	0.096
	dialect[trabzon]	-0.06	-0.22 – 0.10	0.481	-0.15	-0.30 – -0.01	**0.035**	-0.11	-0.46 – 0.25	0.551

Mixed Model Effects Results of L2 English Vowels (duration only)

		/ɛ/			/ʌ/			/ɑː/	
Predictors	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***
Intercept	-0.54	-0.72 – 0.36	**<0.001**	-0.17	-0.80 – 0.46	0.600	0.46	0.18 – 0.73	**0.002**
dialect [SSBE]	-0.25	-0.51 – 0.01	0.056	-0.21	-0.55 – 0.13	0.221	0.96	0.57 – 1.35	**<0.001**
dialect [trabzon]	0.04	-0.21 – 0.30	0.729	0.16	-0.18 – 0.50	0.361	0.15	-0.24 – 0.54	0.441
		/ɔː/			**/ɜː/**			**/uː/**	
Intercept	0.77	0.18 – 1.36	**0.011**	0.20	-0.04 – 0.43	0.096	0.84	-0.14 – 1.82	0.092
dialect [SSBE]	-0.35	-0.69 – -0.00	**0.049**	1.10	0.77 – 1.43	**<0.001**	-0.35	-0.82 – 0.12	0.142
dialect [trabzon]	-0.19	-0.53 – 0.15	0.275	0.52	0.19 – 0.85	**0.003**	0.04	-0.43 – 0.51	0.858
		/æ/			**/ɪ/**			**/iː/**	

Intercept	0.58	0.03 – 1.12	**0.038**	-1.41	-2.18 – -0.65	**<0.001**	0.01	-0.22 – 0.25	0.901
dialect [SSBE]	-0.05	-0.43 – 0.34	0.810	0.65	0.42 – 0.88	**<0.001**	0.01	-0.32 – 0.35	0.932
dialect [trabzon]	-0.56	-0.95 – -0.18	**0.005**	0.06	-0.17 – 0.29	0.610	-0.28	-0.62 – 0.05	0.099

	/ɒ/			**/ʊ/**		
Predictors	**β**	**95%CI**	***p***	**β**	**95%CI**	***p***
Intercept	-0.67	-0.82 – -0.52	**<0.001**	0.02	-0.29 – 0.33	0.901
dialect [SSBE]	0.03	-0.19 – 0.24	0.793	-0.95	-1.30 – -0.61	**<0.001**
dialect [trabzon]	0.09	-0.13 – 0.30	0.416	0.07	-0.27 – 0.42	0.670