GERMAN VOWEL L2-PRODUCTION AND L1-CATEGORIZATION OF L2 STUDENTS AT AN AMERICAN UNIVERSITY

by

ROBERT KLOSINSKI

(Under the Direction of JOSHUA BOUSQUETTE)

ABSTRACT

This thesis examines how L2 German students produce vowels and consequently integrate them in their L1 categories. For this study, interviews were conducted, in which 21 L1 AE students and one L1 Cantonese speaker completed an elicitation task in which they read 35 sentences, which were then analyzed. Results indicate that, contrary to previous studies, similar vowels are pronounced more target-like than new vowels, even for beginner speakers. The OPM by Major (2001) is able to account for the results, through the similar and marked phenomena of OPM. Furthermore, this thesis will serve as a missing link to directly support the OPM, as it includes interviews with speakers of various levels, which previous have yet to do. This allows for a simulated longitudinal study through study of L2 learners in apparent time.

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DEDICATION

I dedicate this thesis to my parents, Angelika and Uwe Klosinski, my sister, Jeanette Klosinski as well as my grandparents, Waldina and Dieter Foth and Gerlinde and Günter Klosinski.

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1. INTRODUCTION

It has widely been accepted that studying a second language (L2) is a process that takes its time and that may not result in the ultimate attainment of the second language. Consequently, learners of an L2 typically struggle to attain native-like pronunciation which then results in accented speech. It is also widely known that second language production and perception are strongly influenced by the speaker's native language (L1). Flege states that "Foreign accents in English are common in the speech of non-native speakers. Listeners hear foreign accents when they detect divergences from English phonetic norms […]" (Flege, 1995, p. 233). Even though Flege is only concerned with the English language, this approach can also be adapted to other languages, if not all other languages.

In this thesis, four language learning models (Ontogeny Model (OM) (Major, 1986); Speech Learning Model (SLM) (Flege, 1995); Perceptual Assimilation Model (PAM) (Best, 1995); Ontogeny Phylogeny Model (OPM) (Major, 2001)) will be considered and applied to a study that analyzed 17 L2 German students with Southern American English L1 dialect at an American university. Through analyzing the formant values (F1 and F2) of L2 German learners, implications regarding acquisition and consequently of production can be drawn. Formant values are the "resonances of the vocal tract" (Ladefoged, 2001, p. 33) and "groups of overtone pitches" (Ladefoged, 2001, p. 38). The results shed light upon vowel acquisition and have pedagogical implications. In addition to the 17 L2 German students, who were enrolled in various German classes at the time of the interviews, five heritage German speakers were analyzed. These speakers were included in the analysis of this project to account for variation across heritage

speakers at the university level. Overall 22 subjects were interviewed in October 2015 and then compared to 11 native speakers of German, who were interviewed in December 2015. Furthermore, through the analysis of the current study, this thesis will provide a missing link to a direct support for the OPM, as it includes different proficiency levels so that stages of the OPM can be determined, which previous studies have failed to do (Major, 2001, p. 92).

This thesis will tackle the following research questions, which correspond. Two of the research questions were posed by Bohn and Flege in 1992 and this thesis will expand them to the purpose of the current study that was conducted in the Fall of 2015. The hypotheses of the thesis are stated following the research questions.

1. "Can adults learn foreign language (L2) sounds [, specifically vowels during the course of the University career]?" (Bohn & Flege, 1992, p. 132)

Hypothesis: More input and consequently longer exposure to the target language leads to more target-like acquisition can be seen in the production results of all vowels.

2. "Is their success or failure to do so explicable in terms of sound correspondences between the native language (L1) and the L2?" (Bohn & Flege, 1992, p. 132).

Hypothesis: While *similar* vowels are expected to be more target-like early on, *new* vowels will be more difficult to acquire with target values. The first language has a bigger influence for the beginner speaker groups than for later speaker groups.

3. Will the results of the different student groups indicate differences in L1 categorization of L2 vowels?

Hypothesis: Categorization differences will be seen, as exposure to the target language increases, which means that beginner speakers will utilize their L1 categories more than intermediate and advanced speakers.

An answer to this question of what is *similar* and *new* can be found in the Second-Language Linguistic Perception (L2LP) model proposed by Escudero (2009, p. 167). While this model was created to account for "describing, explaining and predicting L2 sound perception at the initial, developmental and end states", this thesis argues that at least the definitions of *similar* and *new* sounds work in regards to L2 speech production. Escudero describes the term "similar sounds" as "L2 sounds that are phonemically equivalent but phonetically different from L1 sounds" (Escudero, 2009, p. 167). This is consistent with Flege's definition: "[an] L2 sound that is similar to a sound in L1 is represented with the same IPA symbol as the L1, even though statistical analyses reveal significant - and audible - differences between the two" (Flege, 1997, p. 17).

Additionally, learners will relate two similar L2 sounds to two L1 sounds. New L2 sounds, though, are two L2 sounds that are equated to one L1 sound (Escudero, 2009, p. 167). Flege defines a *new* sound as "[a]n L2 sound that […] differs acoustically and perceptually from the sound(s) in L1 that most closely resemble(s) it" (Flege, 1997, p. 17). Crucially, the L2 sound will "receive an IPA symbol" that is non-existent in the L1. Identical sounds are not considered in this thesis, since these were dropped from the language learning models, since they do not differ acoustically from an L1 sound (Flege, 1997, p. 17).

The thesis is structured as follows: The next section will discuss similar studies that observed different parts of segmental and suprasegmental L2 phonology. The third section will compare the four language learning models to set a framework in which the results of the current study should be seen. Thereafter, having introduced the theoretical framework, this thesis moves on to the experimental section, where first the methodology (§4) of the study that was briefly mentioned above is presented. Fifth, a general overview of the vowel production results

including formant values (F1 and F2) and vowel duration is outlined, while differences and noteworthy findings are also noted. The subsequent section will discuss these findings, and also split the L1 Cantonese speaker from the L1 American English (AE) speakers to account for Cantonese-specific influences on the L2 production. The seventh part of the thesis will be concerned with the pedagogical implications instructors can draw from the results. Finally, the findings of thesis will be summarized in the conclusion of the thesis, which is the eighth section.

2. PREVIOUS RESEARCH

Within the field of second language acquisition, several studies have looked at how an L1 influences L2 segments. In the following section numerous studies will be discussed to reflect on what has been studied and analyzed already. German and English, due to their common history, share a series of characteristics in all areas of their grammar. As mentioned in the previous section, the focus of this thesis lies on phonetics and phonology. The vowel maps of German and English share similarities. Ten vowels can be found in German that have a direct correlate in American English (/a/; /a:/; /e:/; /ɛ/; /ɪ/; /i:/; /o:/; /ɔ/; /u:/; /ʊ/). However, there are also five vowels that English-speaking learners of German have to acquire (/ɛ:/; /ø:/; /œ/; /y/; /y:/), while German-speaking learners of AE have to learn only two new vowels (/æ/; /ɝ/). The following vowel maps will help illustrate the differences.

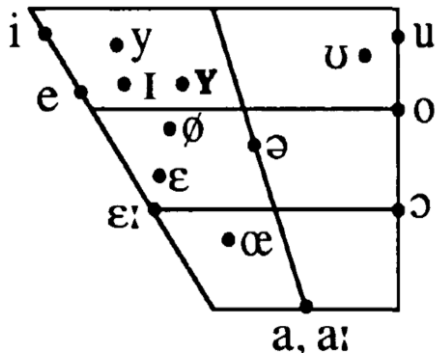


Figure 1: Vowel System of German (Kohler, 1999, p. 87)

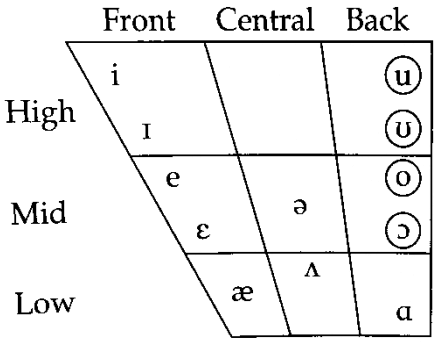


Figure 2: Vowel System of English Monophthongs (Yavas, 2011, p. 12)

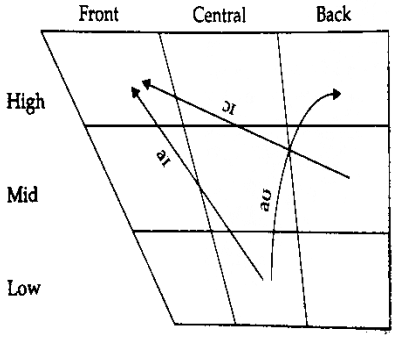


Figure 3: Vowel System of English Diphthongs (Yavas, 2011, p. 86)

Features of L2 phonology that have been studied intensively for German and English are suprasegmental features (e.g. Batliner et al., 2001; Delattre, 1963; Grabe, 1997) and segmental features (e.g. Iverson, Ekanayake, Hamann, Sennema, & Evans, 2008; Smith & Peterson, 2011; Standwell, 1973; W. Strange, Bohn, Trent, & Nishi, 2004). These studies have looked at the influence of the L1 variety not only on L2 vowel production. The following studies will reflect on segmental differences between German and English. More than just vowel production studies, they look at L2 acquisition of the phonetic system.

While many studies have been conducted regarding these parts of speech of German and English, only a few have looked at L2 vowel production of German.

2.1. Bohn & Flege (1992)

In 1992, Ocke-Schwen Bohn and James Flege collaborated for a study that looked at vowels that are *similar* (/i:/; /ɪ/; /ɛ/) and *new* for German learners of English as a second language. They examined whether the effect of second language exposure and experience would influence the production of L2 vowels (Bohn & Flege, 1992).

For this, they analyzed ten L1 German subjects, who were grouped as inexperienced (average time in the UK 0.6 years) and experienced learners (average time in the UK 7.5 years) of English. The students had to produce four English words (beat, bit, bet, bat), for which the vowel quality for the vowels /i:/; /ɪ/; /ɛ/; /æ/ was analyzed. The English words were embedded in the carrier sentence "I will say _____". The spectral analysis showed that L2 experience does not affect the L2 production of the similar vowels /i:/ and /ɪ/. To account for the difficulties for learners they not only looked at the analysis of formant values, which they converted to the bark scale, but also at production differences in terms of vowel length. The results for vowel length confirmed the results of the spectral analysis of the similar vowels /i:/ and /ɪ/, in that vowel duration did not differ significantly between experienced and inexperienced learners. This result leads to their conclusion that similar vowels are learned phonetically at the beginning stages of the L2 acquisition (Bohn & Flege, 1992, p. 152).

However, the vowel /ɛ/, which is also a *similar* vowel in English and German, did not support that result. Instead, the vowel duration indicated that the inexperienced learners pronounced this vowel more target-like than the experienced. The vowel /æ/, which is *new* to L1 German speakers, by contrast, indicated that experienced learners have a more target-like production than inexperienced learners, as shown by spectral analysis. This also means that /æ/ is a vowel that requires a new category formation for native German Speakers to be able to

pronounce it target-like, which requires more L2 exposure to be successfully acquired (Bohn & Flege, 1992, p. 155).

2.2. O'Brien & Smith (2010)

A study that built on Bohn & Flege's was conducted by Mary Grantham O'Brien and Laura Smith (2010). They did not observe L1 German speakers as L2 English learners but vice-versa. Therefore, this study has the same subject groups (AE students studying German as an L2) as the current study of this thesis. What makes O'Brien & Smith's study even more pertinent is that they not only assumed *one* consistent L1, but rather, reflected on three L1 dialects (Inland North; Western Canada; North Central) and how these influence the L2 production of German vowels.

These three dialects differ in their vowel space for AE /u/ and the L2 production of students from these dialects for /y:/ and /u:/ sheds light upon the influence of the L1 dialect. The study analyzed "whether speakers can separate German /y:/ from /u:/ and whether they differ in their pronunciation of this new sound according to L1 dialect" (O'Brien & Smith, 2010, p. 299). The German vowels /u:/ and /y:/ were chosen because they differ most extremely from AE vowels. Additionally, the vowel /u/ was chosen as it is subject to dialectal L1 variation of AE. The results show that L2 German students do not directly transfer their English vowels to German but rather produce the German counterpart /u:/ in a "less German-like manner than if they had simply substituted their own English vowels for the German vowels" (O'Brien & Smith, 2010, p. 316). The North Central has L1 /u:/ formant values that are closer to the native German values for /u:/, than the other two AE dialects (Inland North; Western Canada). However, the analysis of the F2

values revealed that North Central speakers produced /u:/ even more fronted (higher F2 values) than expected.

The results for /y:/ indicated that the subjects of the North Central and Inland North dialects pronounced this vowel significantly more fronted than /u:/. Interestingly, the dialect of Western Canada did not make a differentiation along the F2 scale, but rather along the F3 scale (roughly corresponds to lip rounding). Similarly to two studies by Winifred Strange and colleagues (W. Strange et al., 2004; Winifred Strange, Levy, & Law, 2009), O'Brien and Smith found that /y:/ is sometimes assimilated to the back rounded vowel /u:/.

2.3. Smith & Peterson (2011)

Smith and Peterson (2011) looked at the *Auslautverhärtung* (final obstruent devoicing) of German in the pronunciation of L1 AE speakers. Even though their study focused on consonants and not vowels, this study shows how segmental differences are acquired in an L2. The final devoicing of German stops is a phenomenon that AE native speakers have to master to sound more native-like in German. While English contrasts between voiced and voiceless (final) obstruents. German, on the contrary neutralizes the distinction by devoicing all obstruents in coda position.

Overall the study observed 12 native AE students in the second semester of L2 German instruction. For the production task, the subjects had to speak ten repetitions of 26 different German words that were embedded in the following sentence frame: ''Ich habe schon oft ___ gesagt; jetzt sage ich nur noch___.'' (I have said___ often; now I say___.)" (Smith & Peterson, 2011, p. 131). Since each sentence frame consisted of two gaps, 130 sentences were produced,

while each German token was not repeated in the same sentence. Like the current study of this thesis, Smith and Peterson also utilized distractor items "to minimize the awareness of the stimuli" (Smith & Peterson, 2011, p. 131).

Analyses of vowel lengthening before voiced consonants, of voiceless versus voiced stop consonant closure duration, of glottal pulsing during stop closure and of final stop release burst duration were conducted. Vowel lengthening is a characteristic of English that is apparent while producing voiced consonants (Smith & Peterson, 2011, p. 130). German, however, does not have vowel lengthening preceding voiced consonants in coda position (König & Gast, 2012, p. 15). That means, if L2 students with an L1 AE lengthened the vowel prior to the voiced consonant, L1 influence played its part through L1 transfer. Consequently, these differences are only apparent if an L2 learner fails to devoice consonants in final position, since L1 German speakers would show a consistent vowel duration. Results suggested that the students indeed showed L1 transfer by producing vowels preceding voiced consonants longer than before voiceless consonants. Nevertheless, the extent to which the students lengthened the vowels was less than they would in English for voiced as well as voiceless consonants (Smith & Peterson, 2011, p. 133). Furthermore, students showed a "tendency toward devoicing German underlying word-final voiced stop targets when compared with orthographically similar English word-final voiced stops" (Smith & Peterson, 2011, p. 137).

However, they did not neutralize the final obstruent devoicing as German L1 speakers do. Therefore, though it can be seen, that students acquired at least some aspects of German final devoicing. However, interspeaker variation was also found, since even though students were within one level of language instruction, they performed heterogeneously.

2.4. Gardner (2010)

A study that looked at L2 vowel perception as well as L2 vowel production was conducted by Christine Gardner for her MA thesis (2010). Similarly to O'Brien and Smith (2010), this study also accounted for L1 dialects, as subjects were chosen from two American universities with different vowel realizations in their L1. Gardner analyzed subjects at the University of Mississippi (UMiss), which is located in an area known for its neutralization of certain vowels before nasals, which leads to the similar production of e.g. "him" / "hem" or "pin" / "pen" (Gardner, 2010, p. 23). These neutralizations, however, do not occur at the subjects at the Brigham Young University (BYU).

Unlike the current study of this thesis, subjects were not divided by language proficiency (e.g. beginner, intermediate and advanced) but rather the researcher chose the subjects, who "needed to be able to read German aloud at an intermediate to advanced level" (Gardner, 2010, p. 30). In total she analyzed 22 students (13 from UMiss and 9 from BYU). The study was conducted in two parts on two days, one part being the perception task (forced-choice identification) and one part being the production task (reading task).

Gardner's results showed that the L1 vowel mapping influenced the L2 vowel perception. Furthermore, the two university groups differed in their production of some vowels, i.e., German height and frontness of /ɪn/-/ɛn/, English frontness of /e/-/ɛ/, and German frontness for /u:/-/ʊ/-/o:/, demonstrating that dialect does play a role in how some segments or contrasts are pronounced in the L1 and L2. This indicated that the L2 segments were influenced by L1 dialect for the students who had the merger in their L1 (UMiss). Therefore, this thesis confirmed that L1 dialect plays a role in the L2 production as proposed by O'Brien and Smith (2010).

After having introduced several studies that analyzed different elements of L1 and L2 production and perception, it is necessary to introduce models, that explain the results of those studies. As noted by Schuhmann and Huffman (2015, p. 1), "[a] key question in second language phonology is how multiple languages are represented in the brain of a speaker. It is by now well established that multilinguals can show interaction between the representations of their languages." In the following section, several models will be introduced that try to account for these interactions.

3. FOUR MODELS OF SECOND LANGUAGE ACQUISITION

To account for differences in L2 production, it is crucial to take a look at how the L2 learner acquires sounds.

3.1. The Ontogeny Model (OM)

In 1986, Roy C. Major proposed a model that tried to account for transfer and development of language acquisition (Major, 1986). The model proposed that "errors due to transfer processes decrease, but errors due to developmental processes increase and then decrease" (Major, 1986, p. 455). While this model was revolutionary for its time, because of its consideration of the interaction of transfer and developmental processes and also because it realized that errors not only decrease, it was by no means flawless. In particular, to account for second language acquisition it lacks the crucial second language component. So while this model acknowledged that there was L1 transfer and developmental processes happening, it did not consider any influence of the L2, like similar or marked phenomena, which Major later included in the revised version of this model, OPM. Major also accepts these deficits (Major, 2001, p. 49): "The OM, as originally proposed, deals with NN [non-native] errors but does not make any claims about target-like productions or the relative proportions of transfer substitutions, developmental substitutions, and target-like productions. Furthermore, although markedness and similarity are addressed, they are not explicitly part of the model." Phenomena are features, characteristics and principles that are part of a language, which will be discussed in more detail in §3.3.

3.2. The Speech Learning Model (SLM)

James E. Flege established the Speech Learning Model (SLM), which tries to account for perception and production second language sounds. Furthermore, he addressed the shortcomings of the OM. This model aims "to account for age-related limits on the ability to produce vowels and consonants in a native-like fashion" (Flege, 1995, p. 237). Flege "primarily" limits his model to "bilinguals" who have spoken their L2 for many years". According to Flege, the acquisition of L2 phonemes rests on the degree of perceived similarity between the L1 and L2 phonemes. A learner will have to be able to connect the received input to perceptual targets in order to be able to produce a target-like utterance, or in other words "without accurate perceptual 'targets' to guide the sensorimotor learning of L2 sounds, production of the L2 sounds will be inaccurate" (Flege, 1995, p. 238). A speaker sometimes will not be able to differentiate between an L1 and L2 sound for the following reasons (Flege, 1995, p. 238): "because phonetically distinct sounds in the L2 are 'assimilated' to a single category" and "because the Ll phonology filters out features (or properties) of L2 sounds that are important phonetically but not phonologically. For example, two L2 sounds, that differ in their phonetic properties (e.g. voicing) will be assimilated to a single perceptual L1 target, because the L1 does not make a differentiation of a given phonetic property. Below are seven hypotheses stated by the SLM that are relevant to the current study of this thesis.

Table 1: SLM Hypotheses (from Flege (1995, p. 239))

Hypotheses	
H1	Sounds in the L1 and L2 are related perceptually to one another at a position sensitive allophonic level, rather than at a more abstract phonemic level.
H2	A new phonetic category can be established for an L2 sound that differs phonetically from the closest L1 sound if bilinguals discern at least some of the phonetic differences between the L1 and L2 sounds.
H3	The greater the perceived phonetic dissimilarity between an L2 sound and the closest L1 sound, the more likely it is that phonetic differences between the sounds will be discerned.
H4	The likelihood of phonetic differences between L1 and L2 sounds, and between L2 sounds that are non-contrastive in the Ll, being discerned decreases as AOL [age of learning] increases.
H5	Category formation for an L2 sound may be blocked by the mechanism of equivalence classification. When this happens, a single phonetic category will be used to process perceptually linked L1 and L2 sounds (diaphones). Eventually, the diaphones will resemble one another in production.
H6	The phonetic category established for L2 sounds by a bilingual may differ from a monolingual's if: 1) the bilingual's category is "deflected" away from an L1 category to maintain phonetic contrast between categories in a common L1-L2 phonological space; or 2) the bilingual's representation is based on different features, or feature weights, than a monolingual's.
H7	The production of a sound eventually corresponds to the properties represented in its phonetic category representation.

Unlike Flege's study, the current study does not exclude beginners, as even beginners pronounce vowels to a degree target-like and it is necessary to account for that. Additionally, Flege (1995, p. 239) mentions the difficulties, which L1 Japanese speakers have articulating the two laterals of English (/ɹ/ and /l/) differently. These difficulties are explained by the lack of a second liquid in Japanese, which is therefore support for the first hypothesis (H1). Similarly, the current study looks at the different vowel systems of German and English and their corresponding vowel pronunciation to account for target-like pronunciation of certain vowels and non-target-like pronunciation of others. The six following hypotheses refer to the

categorization of L2 sounds. For example, students of the current study do not have an L1 sound /y/, that is existent in the second language they are learning (German) If the students fail to recognize any phonetic differences between the L1 and L2 sounds, then they will be less likely to create a separate phonetic category (H2). Therefore, L2 /y/ would be perceptually assimilated and produced like an L1 sound (e.g. /ʊ/.)

Additionally, the third hypothesis states that bigger phonetic differences will lead to more likely discern of L1 and L2 sounds. This means that the sound categorization of /y/ will more likely occur than for a sound that has less phonetic differences in the two languages (for English and German e.g. /ɪ/). The likelihood of such a discern increases, if the learner starts learning the language early in life, which corresponds to the Critical Period Hypothesis (CPH), which is "a neurologically-based period, ending around age 12, at the onset of puberty, beyond which complete mastery of a second language is no longer possible" (Singleton & Lengyel, 1995, p. 31). If the learner fails to recognize phonetic differences, the learner will produce the L2 sound (/y/) like an L1 sound (e.g. /ʊ/), as category formation was blocked (H5). Contrary to this, it is also possible that a category of an L2 sound takes a shape that is unlike a category that native L2 speakers would produce (H6). So while native German speakers produce /y/ relatively high and fronted, an L2 German speaker could categorize this vowel even higher and/or more fronted. The last hypothesis (H7) refers to the phonetic representation of a given sound, e.g. the vowel /y:/ in contrast to /y/ shows phonetic property of a long vowel.

Flege's model also states that it is necessary to classify L2 phonemes in comparison to the L1 sounds. For this paper, German vowels will be categorized as *similar* to L1 speech sounds, e.g., German /u:/ and English /u/, and *new* phonemes, which do not have an equivalent in English, e.g., German /y:/. This is consistent with Flege's who dropped the "identical", "similar" and

"new" distinction in favor of the "similar" and "new" distinction (Flege, 1997, p. 17; 2005, p. 98). Identical L2 sounds were dropped from the model since they do not differ acoustically from an L1 sound. An L2 sound is pronounced with nativelike proficiency through a process called "positive transfer" (Flege, 1997, p. 17), which is also known as "free ride" since the learner does "not need to acquire anything new" (Major, 2001, p. 3).

3.3. The Perceptual Assimilation Model (PAM)

In the same year as Flege's SLM, Best proposed a model that poses a crucial difference to Flege's model. Whereas Flege focuses on production with the SLM, Best chooses perception. The Perceptual Assimilation Model (PAM) (Best, 1995) claims that similar L2 sounds would pose less difficulties for perception. Best proposes six different assimilation scenarios in which a non-native sound is assimilated by L2 learners (Best, 1995, p. 194 f.).

First, Best states the Two-Category assimilation (TC), which assumes that the L2 learner is able to differentiate one L2 sound from another, which are then assimilated into their respective L1 categories. TC would for example be in place if the learner hears two L2 sounds that each have an equivalent in the L1. The next process Category-Goodness Difference (CG), states that two L2 sounds are assimilated into one L1 category, whereas one L2 sound is a better candidate than the other. The third assimilation process is the Single-Category Assimilation (SC). SC categorizes two distinct L2 sounds into one L1 category, which leads to poor discrimination by the learner, e.g. L1 Japanese speakers sometimes hear the L2 English sounds /ɹ/ and /l/ as poor examples of their L1 sound /r/. The next type of assimilation process claims, that both L2 sounds are bad examples of an L1 category and they can therefore not be categorized to any L1 sound. Nevertheless, Best claims that the learner's discrimination abilities of two L2 sounds will range

from bad to very good depending on the closeness or distinctness to each other and corresponding L1 categories. The type of assimilation process that categorizes one L2 sound into a native and a second L2 sound into a non-native category is called UC-Type (Uncategorized vs. Categorized assimilation). Here the discrimination probability by the learner is rated very high. The last assimilation model states that "non-native categories fall outside of speech domain [and are] heard as non-speech sounds" (Best, 1995, p. 195). Consequently, L1 categorization does not occur (Nonassimilable (NA)).

These three models set the ground for the next model that came at the turn of the century. The new model realized that something was missing in OM, SLM and PAM. All of these models assumed that the transfer and the development from L1 to L2 is straightforward. They are somewhat idealized models that lack interference from something that acknowledges differences in the interlanguage (IL) (Selinker, 1972, p. 214). An interlanguage is "a combination of L1, L2 and universals" (Major, 2001, p. 27), which is regarded as a "separate linguistic system" (Selinker, 1972, p. 214). In other words, the IL is the language that is formed through the progression from the L1 to the L2. That means that any language that is not L1 or L2 is the IL. Instead, all of these models assume that production errors of learners are caused by transfer from L1 to L2 only, neglecting the existence of universals (U).

"Among the universals of language (in L1 and L2) are UG, learning principles, markedness considerations, rules, processes, constraints and stylistic universals", e.g. "L2 learners may exaggerate the pronunciation of American English /r/ because of hypercorrection" (Major, 2008, p. 76). It is exactly the interlanguage that is missing in all of the previous models, which is also indicated in the lack of universals. Major goes as far as saying that every speaker has an

interlanguage, as long as they are not complete monolinguals. This realization lead Major to revise the OM and create the Ontogeny Phylogeny Model (OPM).

3.4. The Ontogeny Phylogeny Model (OPM)

Unlike the OM, OPM uses the IL as the third entity to account for production as well as perception errors. Besides L1 and L2, OPM utilizes U, "which are not already part of the L1 or L2 system" (Major, 2001, p. 83). These are part of the development that the L2 learner takes to acquire an L2 sound. This e.g. means that an L2 vowel would sound neither like an L1 vowel, nor like the target vowel in the L2, because of hypercorrection. As Major points out "a good model should account for the interaction and interrelationships of [L1, L2 and U] and should provide the reasons for such interrelationships" (Major, 2001, p. 82). Crucially, positive transfer, which is the direct transfer from the L1 to the L2 does not need an IL, since L1 and L2 are identical for a given sound. That does not mean that OPM does not account for this phenomenon, instead it acknowledges it and gives further reasons for what happens when the IL is involved in the language learning process.

An example is the influence of U in the IL that leads to "hypercorrection, meaning the learner makes every effort to make the IL not sound like the L1, and consequently exaggerates or overcompensates the pronunciation, for example, a learner of American English who s and [æææææææ]s you to death" (Major, 2001, p. 119). The OPM uses different scenarios[1] to illustrate the performance differences across speakers and across segmental differences during

[1] I will not reflect on the fourth scenario, which is the Stylistic Corollary of the OPM, as style of formality is not relevant to this study.

the IL stage. The basic pattern is similar across all of these scenarios, as L1 decreases, L2 increases, U increases and finally decreases again.

The Ontogeny Phylogeny Model

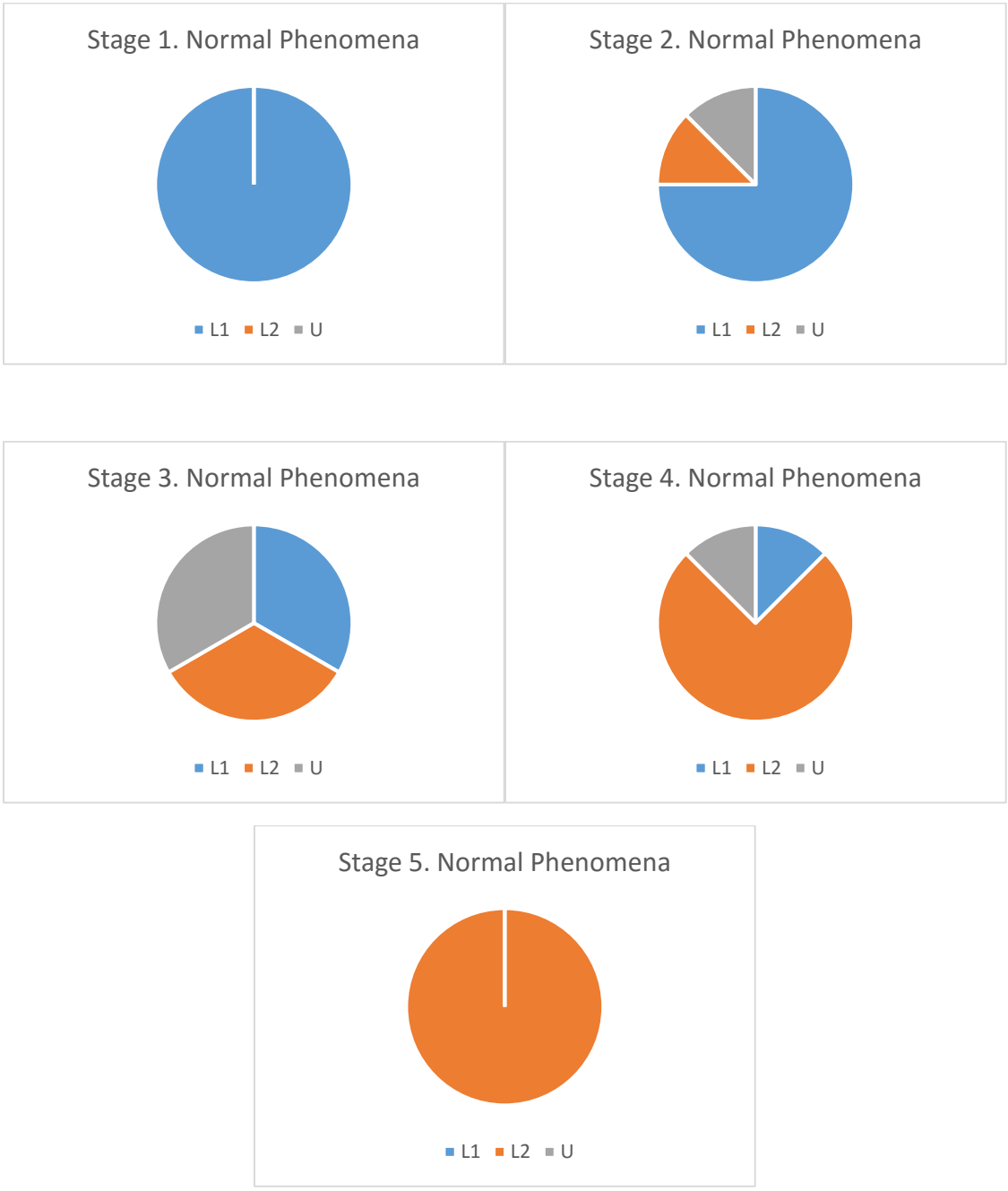
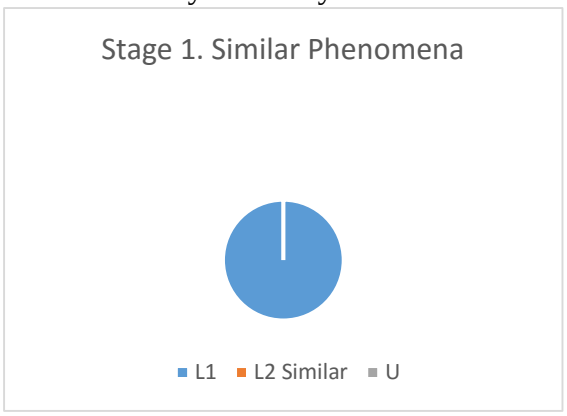


Figure 4: The Normal Phenomena of OPM (adapted from Major (2001, pp. 86-87)

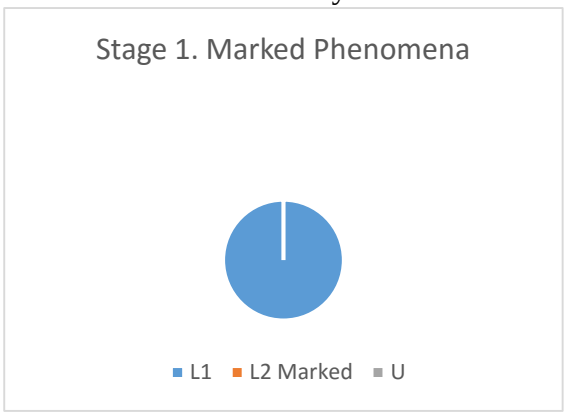
However, a closer look at the scenarios will reveal how they progress in contrast to another. As with Flege's SLM and Best's PAM, OPM also focuses on the *similar* and *new* (marked) segments. Phenomena, as stated above, can be features, characteristics and principles of a language. Similar phenomena are therefore similar characteristics of two languages, whereas new or marked phenomena are characteristics of a language that are missing in the other. Therefore, it becomes clear that new vowels correspond to the marked phenomena and similar vowels to the similar phenomena. The Similarity Corollary of the OPM, which is the similar phenomena, focuses on segments that are to a certain degree similar between L1 and L2. The order of this scenario is: L2 increases slowly, L1 decreases slowly, U increases slowly and then decreases slowly.

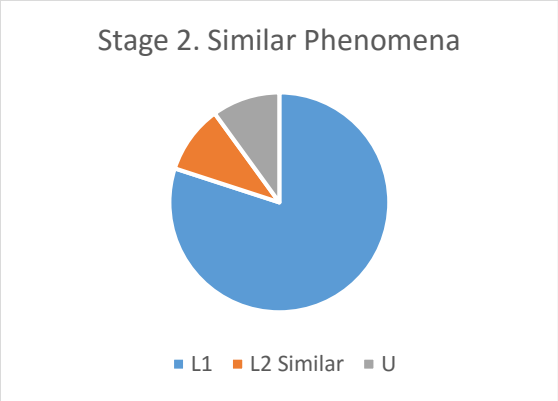
In contrast, the Markedness Corollary of the OPM assumes that the IL development is the following: L2 increases slowly, L1 decreases and then decreases slowly, U increases rapidly and then decreases slowly. The following diagrams will illustrate the progression clearer:

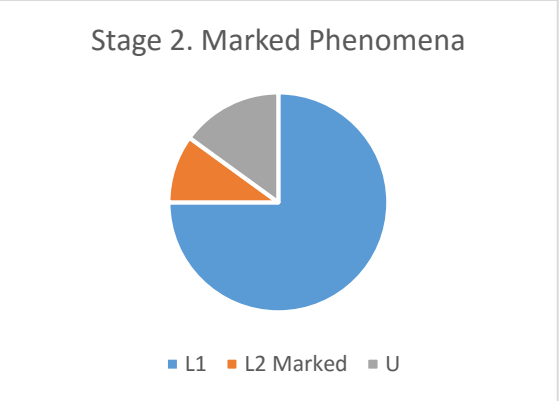
Similarity Corollary of the OPM

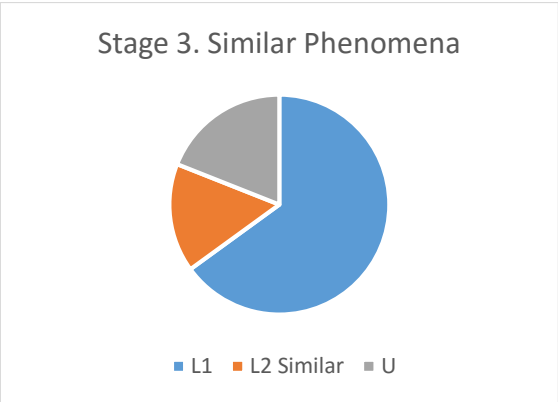


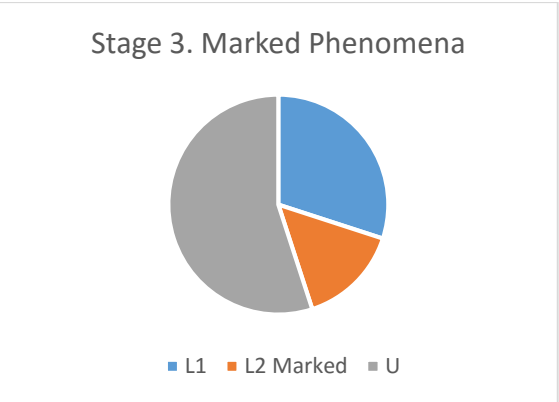
Markedness Corollary of the OPM

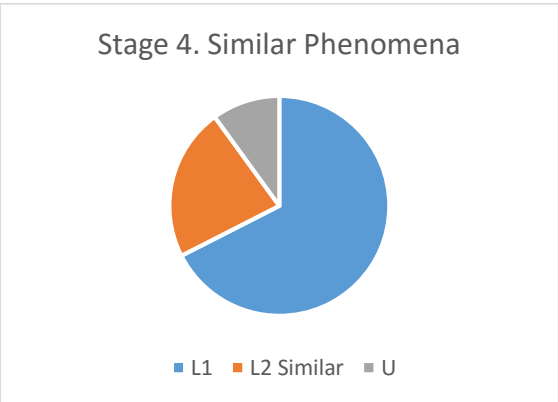


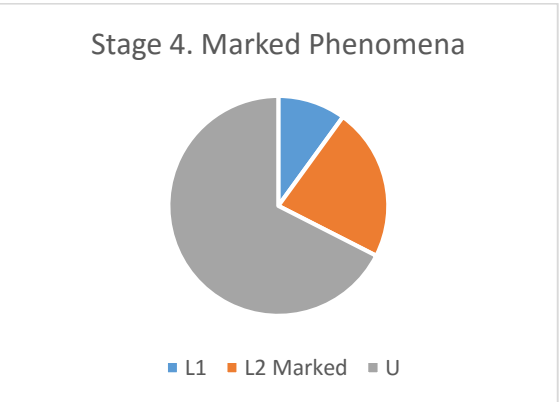

Stage 2. Similar Phenomena
L1
L2 Similar
U

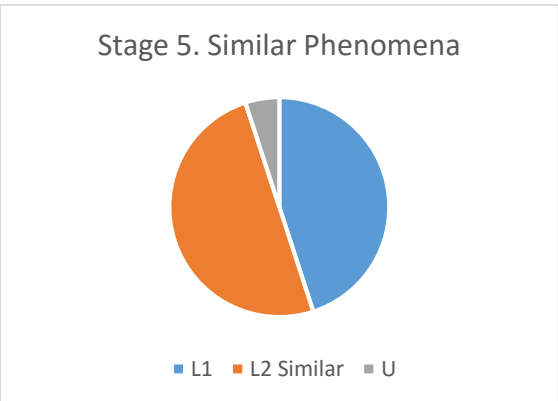

Stage 2. Marked Phenomena
L1
L2 Marked
U

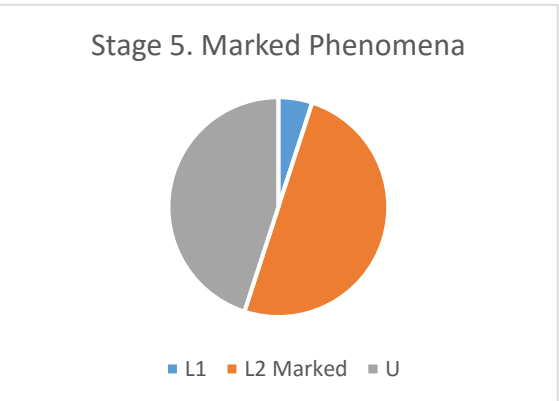

Stage 3. Similar Phenomena
L1
L2 Similar
U


Stage 3. Marked Phenomena
L1
L2 Marked
U


Stage 4. Similar Phenomena
L1
L2 Similar
U


Stage 4. Marked Phenomena
L1
L2 Marked
U


Stage 5. Similar Phenomena
L1
L2 Similar
U


Stage 5. Marked Phenomena
L1
L2 Marked
U

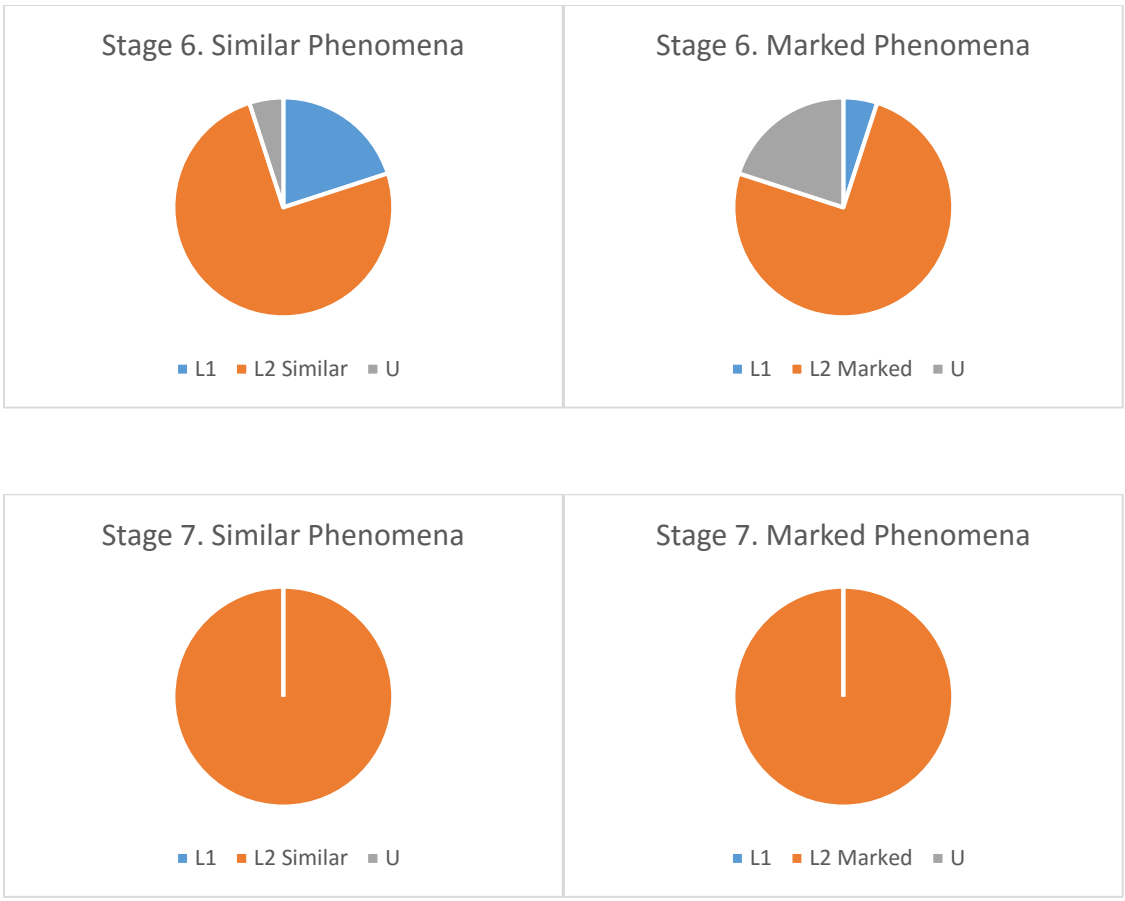


Figure 5 (left): The Similar Phenomena of OPM (adapted from Major (2001, pp. 102-104))

Figure 6 (right): The Marked Phenomena of OPM (adapted from Major (2001, pp. 108-110))

As can be seen from the diagrams, Stage 4 through 7 are quite similar in that they approach the L2 with the same speed. However, they crucially differ from each other in that the roles of L1 and U are mixed from one phenomenon to the other. This means, while for the Similar Phenomena the L1 is slowly decreasing and therefore keeps its influence, it is difficult for the learner to discriminate similar L1 and L2 sounds. For the Marked Phenomena it is the universals, which increase rapidly at the beginning (from stage 2 to 3) and then keep their momentum till the IL gains more L2 Marked and eventually turns the IL into the L2. Taking the U influence in the IL for the Marked Phenomena and L1 transfer for the Similar Phenomena into

account, it becomes clear that similar sounds are more difficult to acquire than different or new sounds, which goes hand in hand with Flege's SLM.

Comparing the Normal Phenomena to the Similar and the Marked Phenomena, it becomes evident that the Normal Phenomena is a highly idealized model that does not account for any variety within the learner nor in segments as it is. Consequently, Major argues for learner monitoring as a source for individual variation. On the one hand, there is the "*hypomonitor*", "who hardly monitors at all" and on the other hand there is "*hypermonitor"*, "who monitors to the extreme" (Major, 2001, p. 117). Monitoring refers to the attention students pay towards particular concepts and characteristics. Projecting these speaker labels of hypomonitor and hypermonitor on the motivation of learners, it becomes obvious that hypermonitor speakers, who are more motivated learners, will anticipate the sounds and consequently acquire the target sound faster (e.g. have less foreign accent) than hypomonitor speakers, who are not as motivated to acquire L2 sounds (e.g. have more salient foreign accent). Major additionally compares a hypomonitor speaker to a normal learner acquiring the Similar Phenomena; and a hypermonitor speaker to the Marked Phenomena, which is acquired by a normal learner. Through this comparison, Major shows that hypomonitors will have a more persistent L1 influence than hypermonitors, who monitor the second language and consequently acquire a second language feature more rapidly. (Major, 2001, p. 117)

Major also states an interesting example that many of us have encountered before when meeting a person who does not speak the same L1: hypomonitors have an accent that can be attributed to a specific L1. That is explained by the L1 is persisting in the acquisition of the L2 sounds. In contrast, the accent of hypermonitors will be less identifiable, since U plays a major role in the IL and the L1 transfer has decreased or vanished. (Major, 2001, p. 117)

Additionally, Major claims, that the OPM differs from previous SLA models in that the "OPM with its corollaries adds very explicit claims" regarding the four interrelationships of "transfer, U, markedness, and similarity." (2001, p. 113)

However, it is precisely this claim of being very explicit that a reviewer criticizes about the OPM. The reviewer acknowledges the positive sides and the theoretical advantages of the model, however he notes that the terms normal, similar and marked are not explicitly stated. Picard questions the certainty of the determination of "normality, similarity and markedness of every segment/syllable so that given any two of them, we may be able to determine in advance what will happen in terms of the increase or decrease of L1 and U" (Picard, 2001).

Taking these models into consideration for the results of the current study relevant to this thesis, conclusions can be drawn in terms of how and when students at an American university acquire target vowels and whether motivation, as derived from the hypomonitor and hypermonitor distinction of the OPM can be a factor. Whether the findings of the current study will provide support for or against the OPM will be discussed in the next chapter. The findings of the current study will serve as a pioneer, since "most studies are not longitudinal, nor do they include different proficiency levels so that stages can be determined" to provide support for the OPM. The subjects of the current study provide exactly that – proficiency levels to argue for or against specific stages of the OPM.

3.5. A final remark regarding the categorization of *similar* and *new* vowels

When considering the various models of L2 perception and production, one has to classify vowels into *new* and *similar* vowels, as noted above. In a study conducted by Strange and

colleagues (W. Strange et al., 2004), it was noted that this categorization may not seem as straightforward as initially thought. In their study they looked at differences of North German (NG) and AE vowels. This study observed L1 AE speakers "with no German-language experience" who listened to NG to judge German vowels according to their cross-language similarities to English vowels (2004, p. 1794). Results shed light upon the categorization difficulties of the vowels across languages, as acoustic similarity (i.e., comparison of the vowel formants) was found to be different than perceived similarity (i.e., listener judgements).

However, I propose that it is a shortcoming of that article that they analyzed L1 AE listeners with no L2 German experience whatsoever. By using listener subjects who have no experience in the L2, it is expected to encounter mapping difficulties for vowels, as they are neither existent in the L1, nor the listeners had received L2 NG input prior to the study. In turn, this study confirms what is proposed by the SLM and PAM, namely that beginner learners (or in this case listeners with no L2 experience) will map the L2 vowels to their (perceptually) nearest L1 category.

4. METHODOLOGY

The following chapter will present the methodology of the study, including speakers, stimuli, recording and acoustic analysis.

4.1.Procedure

4.1.1. Stimuli

At the beginning of the interview, the students were asked to introduce themselves and respond to a series of introductory questions. They were asked to respond to these questions in German. Therefore, the students would have spoken German immediately prior to when they were supposed to read a list of German sentence frames.

Table 2: Introductory questions to get student into German language mode

1. Wie heißt du?	(“What is your name?”)
2. Wie alt bist du?	(“How old are you?”)
3. Wo wurdest du geboren?	(“Where were you born?”)
4. Wie lange lebst du schon in Georgia?	(“How long have you been living in Georgia?”)
5. Wo hast du noch gelebt, neben Georgia?	(“Where else did you live besides Georgia?”)
6. Hast du deutsche Vorfahren (Heritage)?	(“Do you have German heritage?”)
7. Hattest du Deutsch in der High School, oder bevor du zur UGA kamst?	(“Did you have German in High School, or before you came to UGA?”)
8. Welche Deutschkurse belegst du zurzeit?	(“Which German course(s) are taking right now?”)
9. Welche höheren Kurse hast du schon belegt?	(“Which other higher level courses did you take?”)
10. Wurden diese in Deutsch unterrichtet?	(“Were they taught in German?”)
11. Sprichst du noch andere Sprachen, als Deutsch und Englisch?	(“Do you speak any other languages besides German and English?”)

The 22 subjects (and 11 native speakers) were asked to read German tokens from a word list in German, embedded in carrier sentences. These sentences contained all German vowels across the sentences (Word list can be found in the Appendix: Protocol of Study / Stimuli). Overall, there were 35 sentences with 35 tokens. The sentence-frame, containing the token was: "Kannst du _____ nochmal sagen?" ('Can you say _____ again?'). For the 5 heritage speakers, a total of 25 German and 12 English sentences were recorded. The sentence frame for the English sentences was: "Can you say _____ again?" Sentence frames are a common method to elicit vowels (e.g. Lindblom, 1963; Luce & Charles-Luce, 1985; Winifred Strange et al., 2009), since the vowel in question is stressed. Additionally, the token is not isolated, which results in a more natural speech setting than a simple word list reading task. Tokens with nasals preceding or following the vowel were avoided, as surrounding sounds can influence the vowel frequencies (Sendlmeier & Seebode, 2006, p. 1). To minimize this effect, tokens excluding nasals were selected. Tokens with nasals are often omitted in vowel elicitation tasks, as "vowels are allophonically nasalized to some degree in the context of a nasal consonant", which would consequently skew the formant values (Beddor, 1993, p. 173). Many tokens were taken from a word list adapted from Gast & König (c.f. 2012, p. 21) who summarized the German monophthongs[2].

[2] The complete word list and the protocol of study can be found in the Appendix (Protocol of Study / Stimuli).

Table 3: The monophthongs of German (König & Gast, 2012, p. 21)

position		round	tense	vowel	example
front	close	-	+	/iː/	[s]tiehl
		-	-	/ɪ/	still
		+	+	/yː/	fühlen
		+	-	/y/	füllen
	close-mid	-	+	/eː/	fehlen
		+	+	/øː/	Höhle
		+	-	/œ/	Hölle
	open-mid	-	+	/ɛː/	Bären
		-	-	/ɛ/	Bett
central	open	-	+	/aː/	Haar
		-	-	/a/	hart
back	close-mid / open-mid	+	+	/oː/	wohl
		+	-	/ɔ/	Wolle
	close	+	+	/uː/	buhlen
		+	-	/ʊ/	Fluss

In addition to the token relevant for the study, distractor tokens were integrated that were either polysyllabic, contained diphthongs, or were cognates from English. These were not analyzed. The distractor items were the following: *Braunschweig*, *Stau*, *Handy*, *Maus*, *Berlin*, *Auto* and *Volkswagen*. Subtracting these words from the word list, analysis of vowels from 28 tokens was conducted. Furthermore, the subjects were instructed to skip any token of the word list that they did not know or with which they were not familiar.

At the end of the interview, the subjects were asked to respond to a second set of questions. These questions, combined with a self-rating of three statements on a 5-point Likert scale (1 low – 5 high), account for the results of the language production task by correlating them

with the student's language learning history, exposure, motivation and goals. Additionally, implications regarding the pronunciation instruction can be drawn from the students' experience with explicit pronunciation teaching.

The questions at the end of the interview can be seen below.

1. Do you intend to have German as a Major or Minor?
2. Have you been to a German-speaking country?
3. Did you do a study abroad there?
4. Has your teacher explicitly taught the pronunciation of German? If so, what sorts of activities did you do? Was he/she a native speaker? What about here at the University?
5. What do you think has helped you more with your pronunciation? (e.g. study abroad experience, class room exercises, others)
6. Where do you see yourself in the future?
7. Do you prefer reading and writing in the German language or speaking?

Now I'd like to ask you to rate the following statements from 1 (low) through 5 (high).

1. Importance to sound like a native speaker of German
2. Motivation to earn a high degree of proficiency in German
3. Native-likeness of your own proficiency of German

A Likert scale is generally used to represent a subject's attitude towards a statement or topic. This 5-point Likert scale provides mean values for the statements mentioned above for any given group and can therefore shed light upon specific spectral results. By correlating formant values with the Likert ratings, it is possible to account for speaker variation.

Furthermore, questions about the explicit pronunciation instruction by former instructors were asked to gather information about what might account for the subject's pronunciation acquisition most in the past and can therefore be seen as potential solutions to the pedagogical implications for achieving more native-like pronunciation in the target language.

4.1.2. Recording

All student subjects were recorded in the recording studio of Gilbert Hall at the University of Georgia. The recording studio is designed to create a soundproof environment which minimizes interference from outside the studio and reflections from the walls that are constructed with acoustic wall panels. The 22 subjects spoke into a Shure SM-58 microphone, which was connected to a Sound Devices USBPre, which is a preamplifier that reduces interference and noise from the recordings before these reach the computer. The eleven subjects of the control group were interviewed in a room with no interfering noises. The microphone used to interview these speakers was a Samson C01UCW USB Condenser Microphone. All interviews were recorded by Audacity at a sampling rate of 44.1 kHz and saved as WAV-files. Afterwards the list of the tokens containing the relevant vowels were extracted into a second smaller sound file. These files were then annotated and analyzed in Praat (Boersma & Weenink, 2015). Praat is an audio analysis software through which for example the formant values of a vowel can be recorded.

4.1.3. Acoustic Analysis

The annotation of the sound files was conducted through Text Grids in the free acoustic software Praat. After creating one TextGrid file per sound file, a script was used to annotate the two tiers (‘words’ and ‘vowels’), as seen in the figure below (marked with red circle).

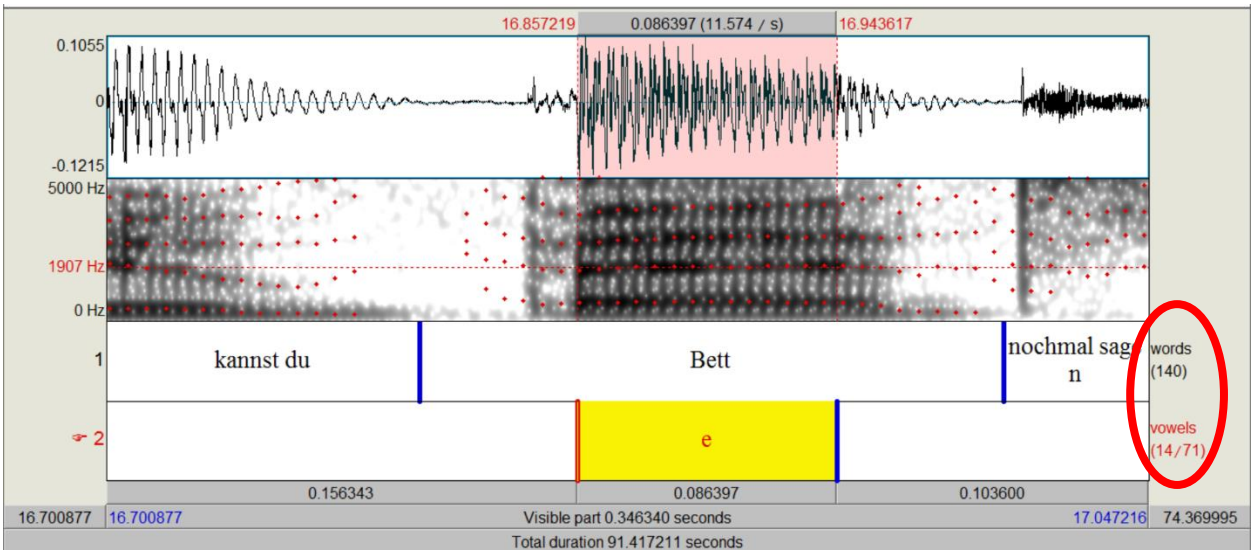


Figure 7: Example of Praat Analysis and annotation window

The sound files were analyzed using a second script, which calculates the vowel duration and formant values (F1, F2, and F3 in Hertz) at the halfway point of vowels. The formant values are necessary since "the locations of the first three formants that most strongly determine [the] perceived sound quality" (Zsiga, 2009, p. 136). The first formant (F1) "is inversely proportional to vowel height" (Zsiga, 2009, p. 136). The second formant (F2) relates "to the front-back position of the tongue and the degree of lip rounding", since the lowering of the second formant is caused by the lip rounding (Ladefoged, 2001, p. 41). Finally, the third formant roughly correlates to lip rounding. Another important feature of the formant values is "the distance between F1 and F2 is inversely proportional to vowel backness" (Zsiga, 2009, p. 136). This means that the formant values F1 and F2 are closer together the more back a vowel is. Conversely, they are more apart, the more front a vowel is located in the vocal tract. Taking measurements at the center point of the vowel minimizes the influence that surrounding consonants, like nasals, can have on the formant values of the vowel. As can be seen from above,

the formant values indicate non-target realization of the vowel for a number of speaker groups. As will be noted in the following discussion (§5), the phonemically similar, but phonetically dissimilar vowels (/e:/; /o:/) have to be monophthongized by the L2 German learners. Consequently, the first half of the vowel was measured for these vowels and not the second.

The results were saved in a text file, which was analyzed using a statistical analysis software (SAS/STAT® software JMP®[3]) to account for significance of vowels and speakers, and to create a vowel plot for each speaker. The results were then compared to target values, which were recorded from 11 native speakers (6 females and 5 males) of German in December of 2015, which will be introduced below.

4.2.Participants

The subjects whose data are reported in this study were recorded in October of 2015. All 22 subjects were students from an American University learning German as a foreign language. 21 of 22 students were native speakers of North American English. One student was a native speaker of Chinese (Cantonese dialect). In addition to the students learning German, 11 native speakers of German were interviewed.

Student subjects ranged in age from 18 to 25 years. The German native speakers ranged from 24 to 31 years of age.

Table 4: A summary of study participants

Speaker	**Speaker Level**	**Gender**	**Age**	**Native Language**	**SA[4] in Germany**
Speaker 1	1001 (Beginner)	M	18	Am. English	
Speaker 2	1001 (Beginner)	M	18	Am. English	
Speaker 3	1001 (Beginner)	M	18	Am. English	
Speaker 4	1001 (Beginner)	M	18	Am. English	

[3] *SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.*
[4] Study Abroad.

Speaker 5	1001 (Beginner)	M	21	Am. English	
Speaker 6	1001 (Beginner)	F	20	Cantonese	
Speaker 7	2001 (Intermediate)	M	19	Am. English	
Speaker 8	2001 (Intermediate)	F	19	Am. English	
Speaker 9	2002 (Intermediate)	M	20	Am. English	
Speaker 10	2002 (Intermediate)	F	19	Am. English	
Speaker 11	2002 (Intermediate)	F	20	Am. English	
Speaker 12	3000 (Advanced)	M	22	Am. English	Yes
Speaker 13	3000 (Advanced)	M	24	Am. English	Yes
Speaker 14	3000 (Advanced)	F	20	Am. English	
Speaker 15	3000 (Advanced)	F	22	Am. English	
Speaker 16	3000 (Advanced)	F	20	Am. English	Yes
Speaker 17	4001 (Advanced)	F	19	Am. English	Yes
Speaker 18	Heritage Speaker	F	20	Am. English	
Speaker 19	Heritage Speaker	F	19	Am. English	
Speaker 20	Heritage Speaker	M	19	Am. English	
Speaker 21	Heritage Speaker	M	25	Am. English	
Speaker 22	Heritage Speaker	M	18	Am. English	
CG Speaker 1	Native Speaker	F	18	German	
CG Speaker 2	Native Speaker	F	29	German	
CG Speaker 3	Native Speaker	F	27	German	
CG Speaker 4	Native Speaker	F	18	German	
CG Speaker 5	Native Speaker	F	25	German	
CG Speaker 6	Native Speaker	F	25	German	
CG Speaker 7	Native Speaker	M	26	German	
CG Speaker 8	Native Speaker	M	28	German	
CG Speaker 9	Native Speaker	M	28	German	
CG Speaker 10	Native Speaker	M	26	German	
CG Speaker 11	Native Speaker	M	29	German	

The subjects were at a variety of different levels of German university instruction: beginners (1st year), intermediate (2nd year) and advanced (3rd year)[5]. This classification was also used in this thesis to group the students in anticipated proficiency levels. Eight students had taken German before in high school. Additionally, eight subjects had various abroad experiences in Germany, ranging from a few days to several months. Five subjects reported spending at least four weeks in Germany, all of whom were in the 5th semester of German instruction or higher.

The control group consisted of eleven native speakers of German. The participants were carefully selected: None of them had been exposed to English or any other language in the

[5] The speaker labels do not correspond to the ACTFL proficiency guidelines, instead they refer to the years of language instruction given in parenthesis.

immediate time prior to the interviews. This was done to minimize interference by any other languages that might affect formant values. Furthermore, they were interviewed in their native environment and judged as speakers of the Standard German (‘*Hochdeutsch*’) by the researcher.

The first group of students were students in the first year of German language instruction. None of these students had more than three months of classroom experience of German. Three 1st year speakers reported having been to Germany: one was on transit through Germany on the Frankfurt Airport; one was in Bavaria three times totaling seven days; and one subject reported having spent three days in Berlin. All but one speaker (Speaker 1) have knowledge of another second language besides German. Speakers 2, 4 and 5 reported having at least some knowledge of Spanish, Speaker 3 was raised bilingually in English and Tamil, which is a Dravidian language predominantly spoken by the Tamil people of India and Sri Lanka. Speaker 6 was an international student from China, speaking Cantonese. She started learning English as a second language when she was seven years old and in second grade.

Students enrolled in the second year German classes reported having a wide range of previous high school experience of German, ranging from no exposure (Speakers 7; 8) to ten years of German instruction (Speaker 11). Speakers 9 and 10 were enrolled 3 and 4 years, respectively. Furthermore, Speaker 9 spent a week travelling through Germany and Speaker 11 participated in a 3-week high school exchange. Only one subject of this group had experience in another second language, as he took two years of Spanish in high school (Speaker 7).

The most advanced group of students is marked by its common travel abroad experience in Germany. All but one of these subjects had study abroad experience (SA) in Germany, participating in intensive language programs, such as a 4-week exchange trip to Freiburg (Speakers 12; 16; 17); a 4-week summer trip sponsored by the *Pädagogischen Austauschdienst*

(PAD - German Student Exchange Program) (Speaker 17); or a foreign exchange student year at a German high school (Speaker 13). Speaker 14 spent eight years at an Air Force base in Germany. Unfortunately, she was not able to take advantage of the surroundings to receive sufficient input in the German language. Instead, she gained the motivation to start teaching German to herself during a senior project at her American high school, as the school itself did not provide German language classes. Speaker 15 spent one week travelling through Germany, not participating in any classroom activities. As mentioned above, Speaker 14 did not receive high school classroom instruction of German, yet started teaching it to herself. Speaker 16 had no German instruction before she started attending university. Speakers 12, 15 and 17 reported having three years of German in high school, while Speaker 13 had one. Two of the six advanced subjects did not report any other knowledge of a second language (Speakers 16; 17). Speakers 12, 13 and 14 had some basic knowledge of French, while Speaker 14 additionally had basic knowledge of Russian. Speaker 15 reported basic Japanese skills.

The group of the heritage speakers consisted of five speakers, three males and two females. The two female subjects were both born in Florida, USA. Two of the three male participants were born in Germany. The third one was born in New Orleans, USA. All of these speakers had acquired German naturalistically in the household, which, by definition, is crucial: "An individual qualifies as a heritage speaker if and only if he or she has some command of the heritage language acquired naturalistically although it is equally expected that such competence will differ from that of native monolinguals of comparable age" (Rothman, 2009, p. 156). Keeping this definition in mind, it becomes obvious that heritage speakers differentiate from the student learners in that they started acquiring the language from early childhood. This difference also aims at the Critical Period Hypothesis (CPH), as defined in §3.2. Consequently, it is

expected that heritage speakers outperform second language learners, who started learning the L2 after the age of 12.

The primary focus of the analysis of the vowels was to shed light upon the L2 acquisition process of *similar* and *new* vowels. By conducting a synchronic experimental study, the pronunciation of vowels across apparent time can be illustrated and irregularities across speaker levels can be seen and accounted for. Therefore, the formant values of the subjects were compared to the values of the control group to see the progression towards target values. In the following section the measurements will be displayed for all speaker groups.

5. DESCRIPTIVE PRESENTATION OF THE DATA

Before the results of the vowel production can be presented, it has to be clarified which vowels are *similar* and which are *new*. Keeping in mind Flege's classification of *similar* and *new* vowels through IPA symbols, it becomes clear which sounds are grouped with which (Flege, 1997, p. 17).

The first three sections of this chapter will present the results of the spectral analysis in tables and in vowel maps for each vowel, comparing all speaker groups to each other. Section 5.4. will then turn to the vowel duration to demonstrate whether students made a length distinction in the production. The results of vowel duration will ultimately show whether a speaker group approach target values not only in terms of formant values but also vowel duration.

Table 5: L1 Vowel inventories of German and AE in comparison

AE Vowel	German Vowel
/ʌ/	/a/
/ɑ/	/aː/
/eɪ/ [e][6]	/eː/
/ɛ/	/ɛ/
	/ɛː/
/æ/	
/ɪ/	/ɪ/
/i/	/iː/
/oʊ/ [o][7]	/oː/
/ɔ/	/ɔ/

[6] Diphthongized monophthong phonetically, but only one phoneme.
[7] Diphthongized monophthong phonetically, but only one phoneme.

	/øː/
	/œ/
/u/	/uː/
/ʊ/	/ʊ/
	/y/
	/yː/
/ɝ/	

As can be seen from Table 5, English-speaking learners of German have to acquire five *new* vowels (/ɛː/; /øː/; /œ/; /y/; /yː/), whereas ten vowels are *similar* (/a/; /aː/; /eː/; /ɛ/; /ɪ/; /iː/; /oː/; /ɔ/; /uː/; /ʊ/) in German and English. The following descriptive data presentation will first present the *similar* vowels and afterwards the *new*.

For a subject group or a speaker to fall within the target range, their formant values have to fall within the formant values of the native speakers (the control group), taking into account the standard deviation[8]. Using standard deviation establishes an empirical way of determining what is normal (in other word within target range) and what is deviant from the norm (in other words out of the target range). In order to interpret the following results, the reader has to first look at the native speaker groups to determine the target range. Adding or subtracting the standard deviation to the mean values provides the target range for the learners. For easier reading the results that are within target range have been marked **bold**. Additionally, the results are not only organized by gender but also by the classification of speaker groups introduced in §4.2.

[8] If the standard deviation was less than 50 Hz for the native speakers, the subject groups were allowed to be 10% of the target values away from the values of the native speakers (e.g. for /ɪ/ CG Male F1: 352.79 → +/-35 Hz tolerance for the all F1 male values for /ɪ/.

5.1.The Similar Vowels

In the following section, data are reported for vowels that are *similar* (/a/; /a:/; /e:/; /ɛ/; /ɪ/; /i:/; /o:/; /ɔ/; /u:/; /ʊ/) between English and German, following Flege's definition, as noted in §1. However, two similar vowels (/e:/ and /o:/) will not be included in this section, as they are known to be diphthongized in English. Therefore, they warrant a separate presentation section (§5.3.) and discussion (§6.2.4.). Following the similar phenomena of the OPM, the student groups would be expected to have a linear development towards target values, while at first a slow improvement will be visible and the L1 will still be part of the vowel production. Consequently, even the formant values of the beginner speaker groups should indicate that they realize a *similar* L2 vowel as equivalent to an L1 vowel. Therefore, it is expected that the formant values approach the target values from speaker group to speaker group, even if the beginners are not too far from the formant values to start out with.

5.1.1. Vowel /a/ – a similar vowel (tokens: 'hart'; 'kalt'; 'Wald'; 'Stadt')

All groups realize the /a/ vowel consistent with the control group. One finding worth noting is that all L2 learners of German produce this vowel less fronted than the native speakers. Interestingly, the male beginner speakers are closer to target-like values than the intermediate speakers, as can be seen for the male as well as female section, even though the female beginner group should be treated separately, as it consisted only of one speaker with a different native language than all the other subjects (Cantonese Chinese).

Table 6: Production results of /a/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	a	4	**835.023**	**1478.26**	15.75921	138.0471
F	2. intermediate	a	12	**815.381**	**1285.38**	93.97932	171.1475
F	3. advanced	a	16	**833.281**	**1312.33**	122.2457	154.5934
F	4. heritage	a	6	**811.532**	**1386.89**	113.3668	143.3605
F	5. native	a	24	**765.468**	**1497.32**	126.0818	252.6047
M	1. beginner	a	20	**668.189**	**1125.29**	80.47763	154.6504
M	2. intermediate	a	8	**713.29**	**1101.2**	100.3245	115.6285
M	3. advanced	a	8	**657.829**	**1267.8**	78.9265	90.30777
M	4. heritage	a	9	**664.437**	**1171.63**	81.20091	110.612
M	5. native	a	20	**652.879**	**1358.23**	129.5545	194.383

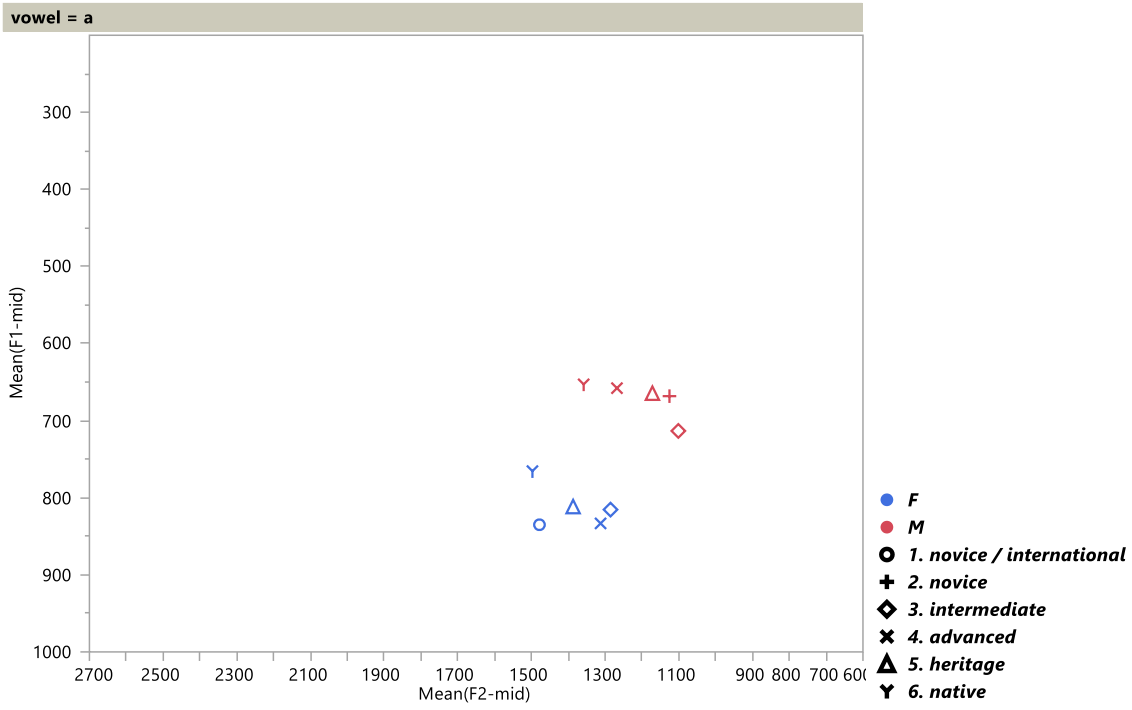


Figure 8: Vowel chart for /a/

5.1.2. Vowel /a:/ – a similar vowel (tokens: ‘Glas’; ‘Haar’)

Just like its short counterpart, this vowel was produced by all speakers near target values. All male L2 learners produce the vowel more fronted than the male native speakers. The female speakers did not show this correlation. Only two groups were not within target range (male intermediate and heritage speakers). Taking the standard deviation for the male intermediate and heritage speaker groups into consideration, it is clear why they fall out of the target range. The high standard deviation indicates speaker variation, which caused these groups to fall out of the target range for the second formant. The speaker variation within the two groups is also confirmed by the low number of token (three and four, respectively).

Table 7: Production results of /a:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	a:	2	**873.345**	**1464.68**	74.9512	252.925
F	2. intermediate	a:	6	**846.234**	**1335.06**	57.78716	159.54
F	3. advanced	a:	8	**874.387**	**1272.4**	250.3254	181.0884
F	4. heritage	a:	2	**897.921**	**1410.29**	104.847	82.4635
F	5. native	a:	12	**810.812**	**1369.4**	138.8677	131.0258
M	1. beginner	a:	10	**698.343**	**1207.98**	94.3983	165.9146
M	2. intermediate	a:	4	**681.825**	1434.97	128.6067	460.9651
M	3. advanced	a:	4	**694.666**	**1301.06**	126.2683	128.7181
M	4. heritage	a:	3	**626.869**	1432.35	193.8175	421.8839
M	5. native	a:	10	**692.596**	**1153.33**	101.0445	192.2983

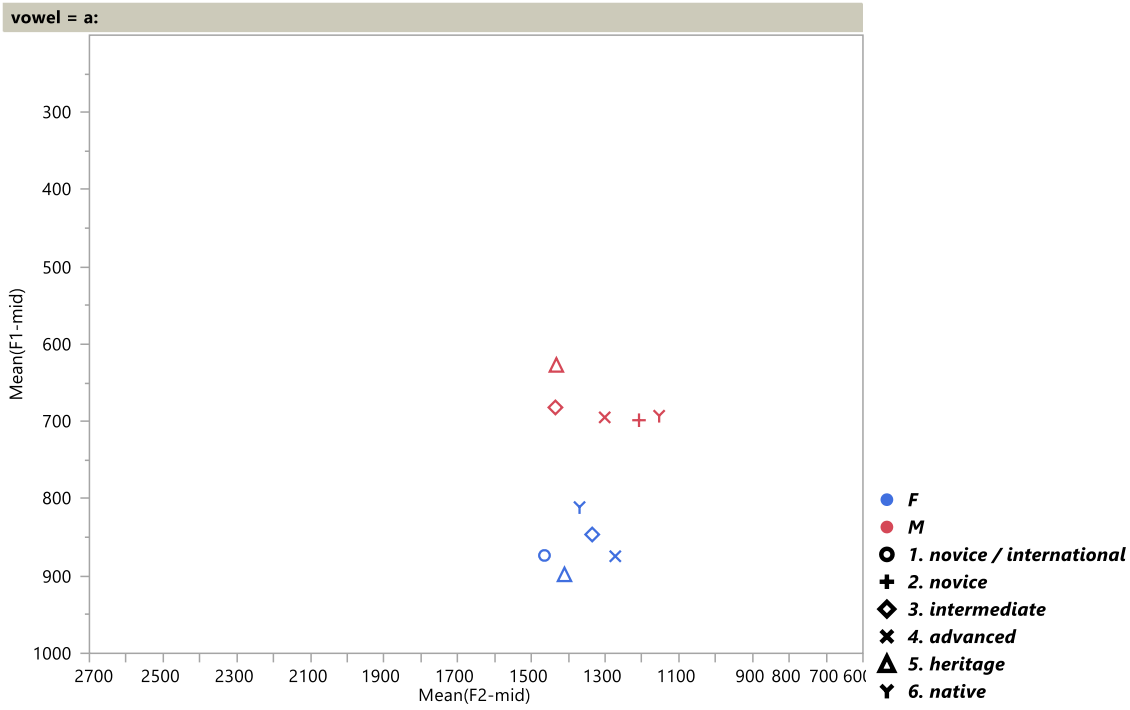


Figure 9: Vowel chart for /a:/

5.1.3. Vowel /ɔ/ – a similar vowel (tokens: ‘toll’; ‘Wolle’)

The female speakers in the third year of language instruction hit the target range. The male speakers, though, do not hit the range, as they produce it somewhat higher and more back in the oral cavity. Contrary to the statement at the beginning of this section (in §5.1.) that a linear development towards target values is expected, this vowel shows that the male beginner group produces the vowel closer to the expected values than any other group of the male speakers. However, no male consultants reach the F2 target values. So while the female speakers indicate a linear progression towards target values from group to group, the male speakers do not show a similar development.

Table 8: Production results of /ɔ/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	ɔ	2	489.222	947.72	54.37156	79.70508
F	2. intermediate	ɔ	6	520.764	900.6182	76.06555	102.1503
F	3. advanced	ɔ	8	**552.019**	**1204.791**	156.4867	400.5225
F	4. heritage	ɔ	2	**651.3**	**1149.52**	22.31417	12.96763
F	5. native	ɔ	12	**615.11**	**1223.553**	141.5104	155.7317
M	1. beginner	ɔ	10	**442.863**	877.276	59.75149	152.3219
M	2. intermediate	ɔ	4	374.829	663.481	78.66719	199.6858
M	3. advanced	ɔ	4	386.627	606.701	71.09824	123.1366
M	4. heritage	ɔ	3	**491.567**	**974.673**	50.45087	116.7925
M	5. native	ɔ	10	**485.137**	**1046.13**	40.78291	124.148

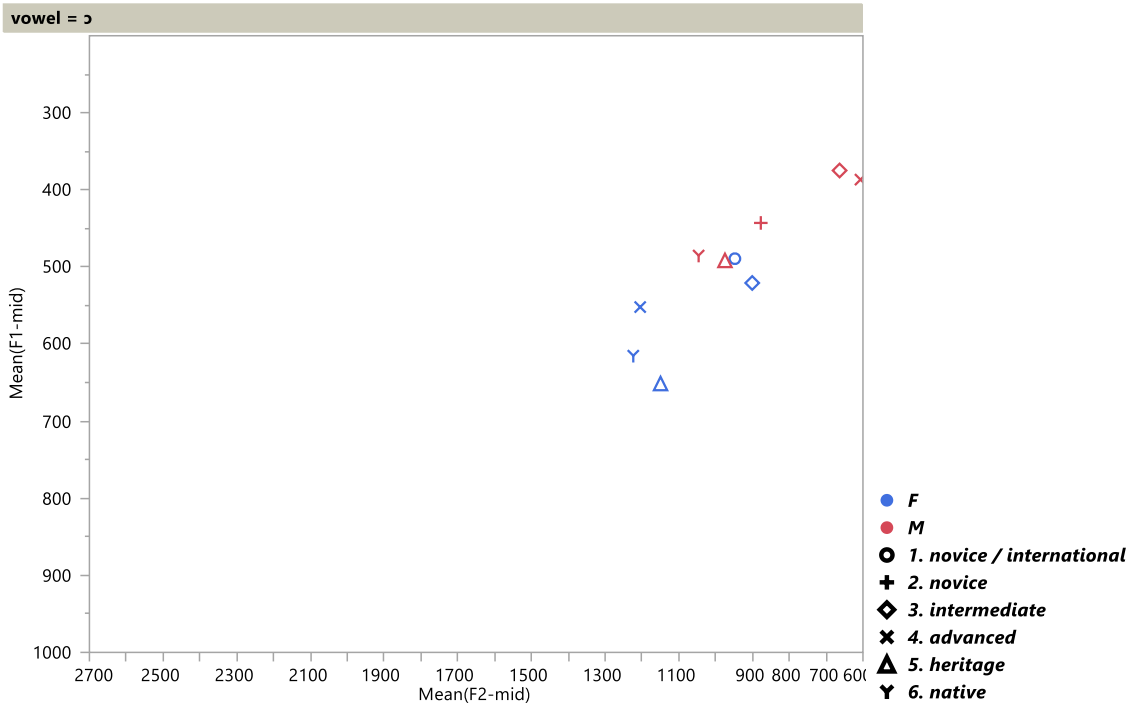


Figure 10: Vowel chart for /ɔ/

5.1.4. Vowel /ɛ/ – a similar vowel (tokens: ‘Bett’; ‘Städte’)

The vowel /ɛ/ shows that beginner speakers pronounce this vowel less target-like than any other speaker groups. As can be seen from the formant values, vowel height (F1) is acquired faster among the students than frontness (F2). In fact, only the intermediate and advanced male speakers produce this vowel with target values for F1 and F2. The female students did not produce this vowel like the native group. Speakers 1, 2, 3, 5, 6, 8 and 15 produce the /ɛ/ wide open at least once like a short /a/. Again, the orthographic form influences the pronunciation (‘Städte’). However, taking the other token into account, it can be seen that the vowel production approaches the values of the native speakers for speakers 1, 2, 3, 5 and 8 (see Appendix). The orthographic form seems to have influenced the pronunciation of ‘Bett’ as well, as it is a cognate of the English language (‘bed’) and the vowel English vowel /ɛ/ has a comparable vowel quality in German /ɛ/. Speaker 6, however, does not make a differentiation. This speaker is also a native speaker of Cantonese and will therefore also be treated separately from the other subjects of the study.

Table 9: Production results of /ɛ/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	ɛ	2	813.217	1957.005	2.866611	50.52278
F	2. intermediate	ɛ	6	**643.6845**	1983.015	94.76878	180.8538
F	3. advanced	ɛ	8	**624.5988**	1967.568	107.8556	308.5215
F	4. heritage	ɛ	4	**665.2348**	1889.525	45.587	78.35281
F	5. native	ɛ	12	**542.6753**	**2236.872**	138.7782	202.3354
M	1. beginner	ɛ	10	572.4417	1646.437	129.6836	287.9548
M	2. intermediate	ɛ	4	**508.7123**	**1903.072**	85.90992	216.1797
M	3. advanced	ɛ	4	**434.1933**	**1956.551**	57.90168	267.3829
M	4. heritage	ɛ	6	**455.6453**	1671.307	97.57349	327.637
M	5. native	ɛ	10	**412.4322**	**1896.385**	103.8981	149.5082

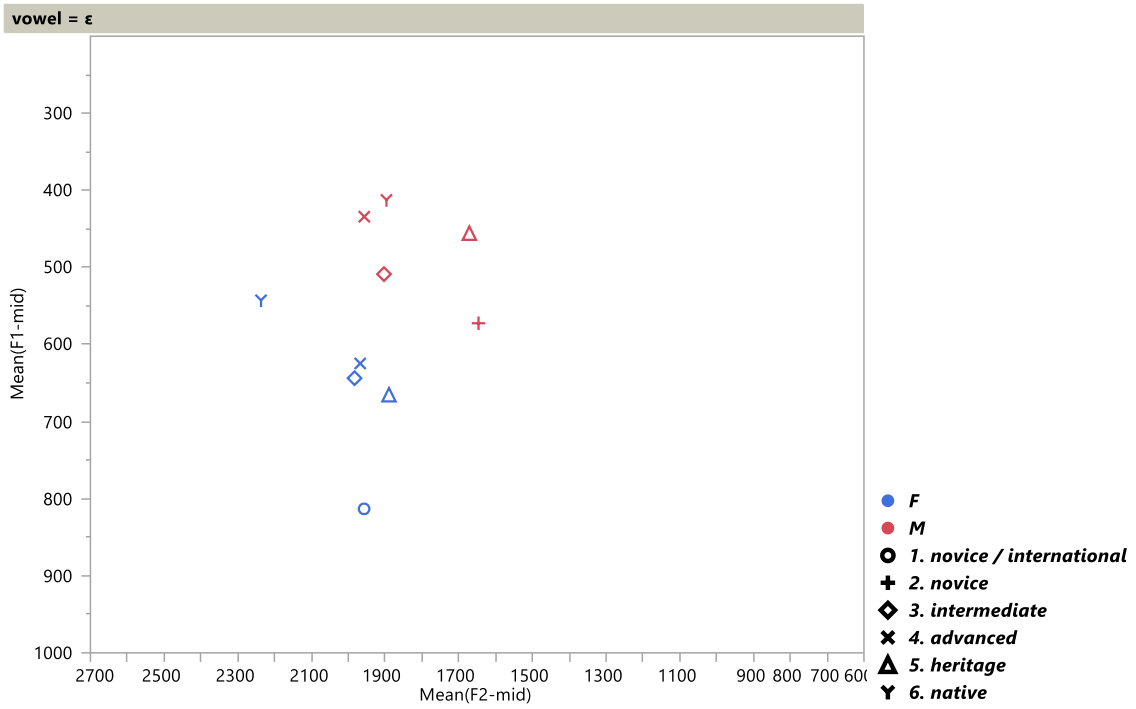


Figure 11: Vowel chart for /ɛ/

5.1.5. Vowel /ɪ/ – a similar vowel (token: ‘still’)

Looking at the overall results, it can be noted that most groups produced this vowel within target values. Interestingly, gender seemed to play a role, as all female L1 AE speakers realized this vowel /ɪ/ within target range.

Table 10: Production results of /ɪ/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	ɪ	1	**387.824**	**2514.818**		
F	2. intermediate	ɪ	3	**462.6703**	**2043.618**	20.77562	103.2859
F	3. advanced	ɪ	4	**422.7628**	**2194.739**	99.7302	392.3973
F	4. heritage	ɪ	2	**433.3245**	**2126.15**	15.53443	104.5238
F	5. native	ɪ	6	**412.1213**	**2092.366**	59.09309	150.3923
M	1. beginner	ɪ	5	**378.0182**	**1788.503**	47.75107	184.951

M	2. intermediate	ɪ	2	**322.8105**	1923.253	25.39291	536.6841
M	3. advanced	ɪ	2	**349.9765**	1928.939	20.40498	335.677
M	4. heritage	ɪ	3	**387.3507**	**1699.91**	7.647306	32.19893
M	5. native	ɪ	5	**352.7954**	**1778.834**	9.537691	110.3119

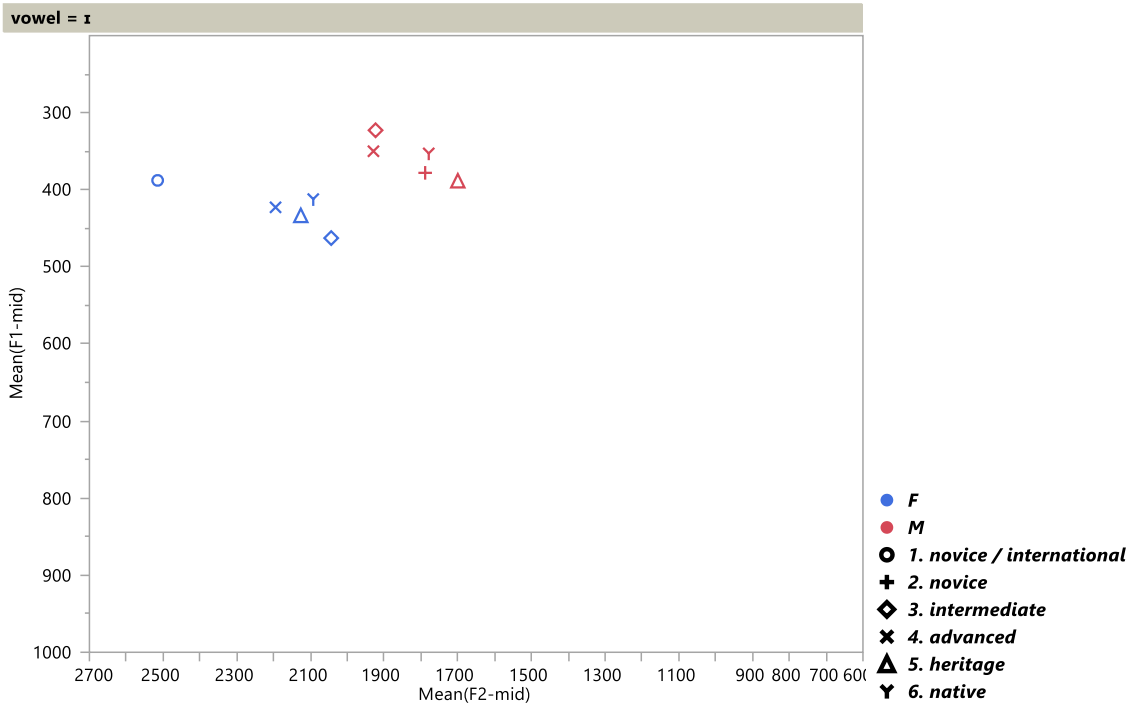


Figure 12: Vowel chart for /ɪ/

The L1 Cantonese speaker produced a more fronted variant of the vowel, which is similar to the Cantonese vowel /ɪ/. A boomerang-effect can be seen for the male speakers, who produce this vowel more target-like in the beginning than at a later stage (intermediate), but then later approach target values again (advanced).

5.1.6. Vowel /i:/ – a similar vowel (tokens: ‘stiehl’; ‘viel’)

Similarly to its short counterpart, the vowel /i:/ also revealed gender differences. While F2 values were within target range for all speakers, F1 values were not.

Table 11: Production results of /i:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	i:	2	**407.695**	**2603.57**	21.49251	185.2528
F	2. intermediate	i:	6	**350.642**	**2578.81**	29.34257	204.5025
F	3. advanced	i:	8	**418.506**	**2319.25**	219.2048	424.2681
F	4. heritage	i:	4	**334.868**	**2613.94**	25.99922	72.94759
F	5. native	i:	12	**326.673**	**2474.94**	104.4047	223.0656
M	1. beginner	i:	10	318.088	**2181.49**	43.18666	271.7009
M	2. intermediate	i:	4	284.302	**2190.93**	18.46374	163.9207
M	3. advanced	i:	4	290.165	**2241.32**	12.01224	218.5354
M	4. heritage	i:	6	298.274	**2082.46**	42.45464	219.3651
M	5. native	i:	10	**233.279**	**2056.64**	28.13512	221.2765

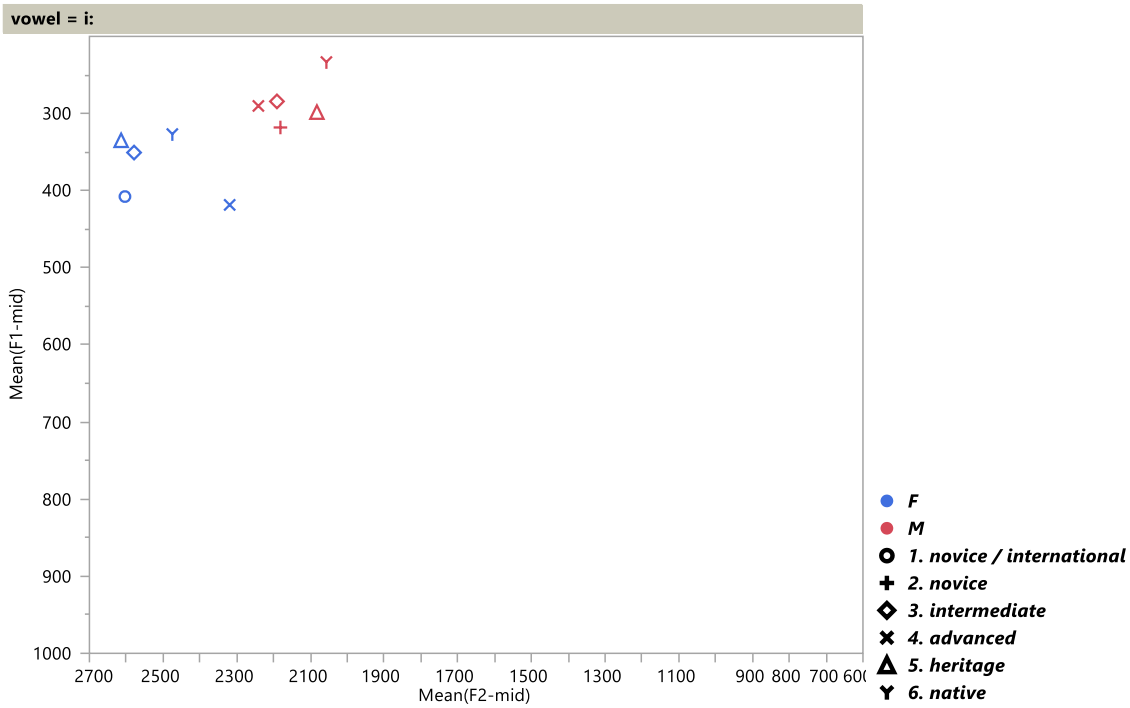


Figure 13: Vowel chart for /i:/

So while the male speakers realize that this vowel is produced at the very front of the vocal tract, they fail to produce the vowel as closed as the native speakers. By contrast, female speakers produced this vowel within target-range for vowel height (F1). In other words, females

produced this vowel as closed as native speakers, while males did not. This is especially worth noting, as this vowel had more token than others. Furthermore, the male speakers do not approach the target values any further after they have reached a certain point, which will also be discussed in the next section (§6).

5.1.7. Vowel /u:/ – a similar vowel (tokens: ‘Blume’; ‘nur’; ‘buhlen’)

The results of the vowel /u:/ revealed a similarly interesting result as for /ɪ/ and /i:/, as the female speaker group produced the vowel more often within target range than the male speakers. In general, a progression towards the target values with higher exposure to formal instruction can be noted from the values below. Nevertheless, female intermediate speakers as well as female advanced speakers do not seem to hit native-like F2 values.

Table 12: Production results of /u:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	u:	3	**365.899**	**1064.7833**	95.9807942	334.075986
F	2. intermediate	u:	9	**390.369**	1575.655	56.3804859	464.071925
F	3. advanced	u:	12	**406.79**	1527.658	52.4631814	306.637724
F	4. heritage	u:	6	**372.06**	**1088.364**	29.2236921	190.093834
F	5. native	u:	18	**328.914**	**937.8868**	93.3905671	199.716056
M	1. beginner	u:	15	351.188	1195.986	73.9578762	239.692694
M	2. intermediate	u:	6	329.727	1232.379	79.2453783	526.20137
M	3. advanced	u:	6	360.352	1217.163	60.5234175	414.97113
M	4. heritage	u:	8	327.621	1079.472	42.1260179	325.18457
M	5. native	u:	15	**267.776**	**839.3126**	41.135296	148.512084

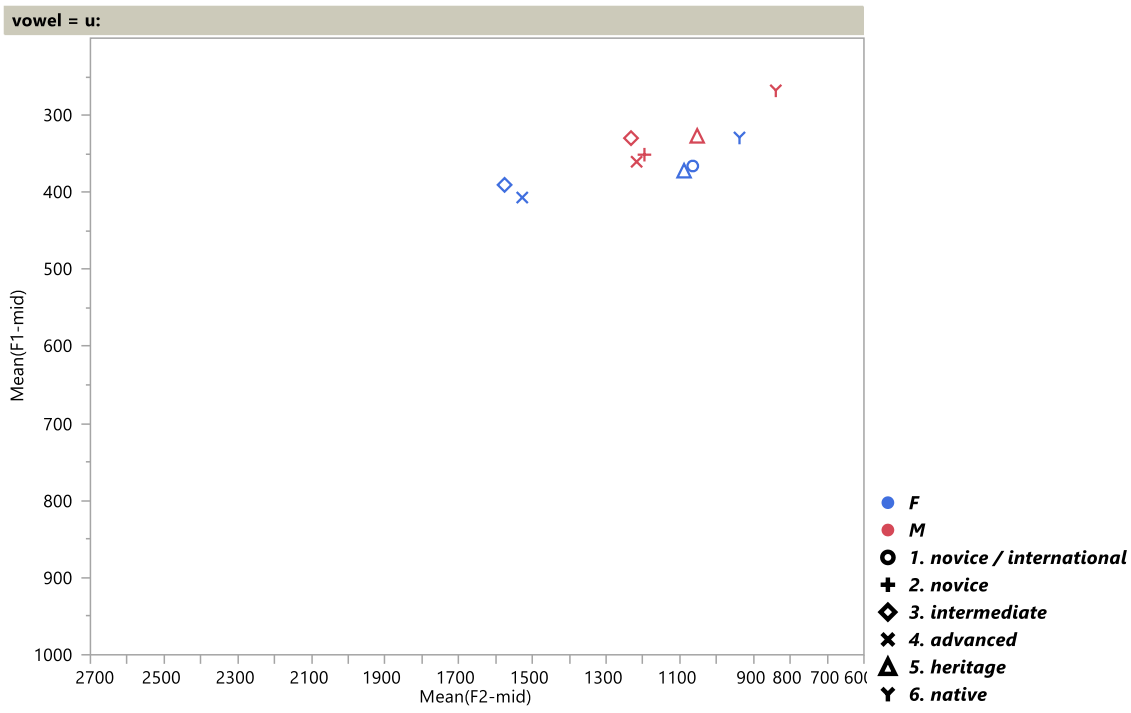


Figure 14: Vowel chart for /u:/

What is remarkable is that seven of the eleven most proficient (intermediate and advanced) speakers (Speaker 8, 10, 13, 14, 15, 16, 17) produced /u:/ in [bu:lən] like a front rounded /y:/. This is also confirmed by the high standard deviation. Only one heritage speaker produced this vowel like /y:/ (Heritage Speaker 4). Therefore, none of the male subjects hit the target range, whereas the female international student and the female heritage speakers did. It is also noteworthy that all female speaker groups are within target range for vowel height (F1), whereas all male speaker groups are less native-like than the female groups.

5.1.8. Vowel /ʊ/ – a similar vowel (tokens: ‘Fluss’; ‘null’)

This short counterpart of /u:/ revealed inconsistent formant values. No beginner subject produced it within target range for F2 values.

Table 13: Production results of /ʊ/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	ʊ	2	**360.761**	903.668	129.772479	353.501065
F	2. intermediate	ʊ	6	**420.894**	1473.38	49.712681	392.520136
F	3. advanced	ʊ	8	**407.083**	1349.98	50.7337666	294.916885
F	4. heritage	ʊ	4	**423.718**	**1298.53**	92.180517	99.5094604
F	5. native	ʊ	12	**445.418**	**1230.92**	114.175077	198.292405
M	1. beginner	ʊ	10	**336.809**	1245.8	56.1733045	186.580583
M	2. intermediate	ʊ	4	**390.52**	**1132.67**	69.1433646	132.449098
M	3. advanced	ʊ	4	**362.877**	**1184.11**	17.5592366	226.929137
M	4. heritage	ʊ	7	**379.978**	**1022.33**	33.5933322	158.465379
M	5. native	ʊ	10	**361.91**	**1111.71**	44.2353648	118.411959

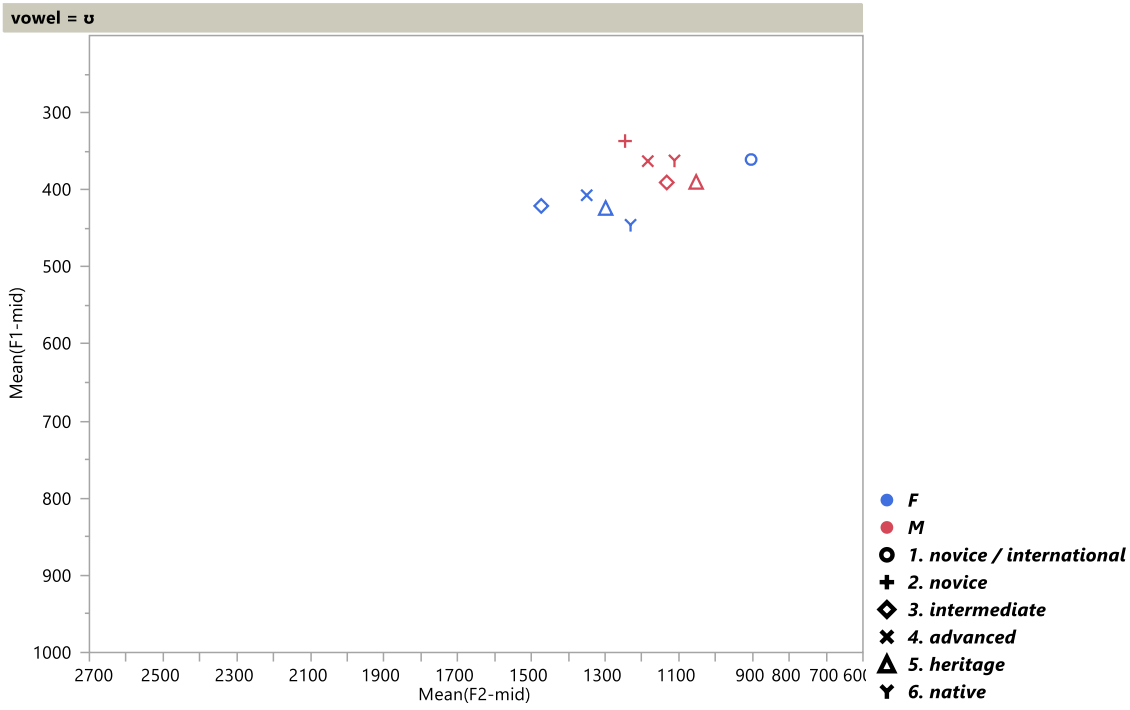


Figure 15: Vowel chart for /ʊ/

These F2 values indicate that several speaker groups produced this vowel more fronted (higher F2 values) than the native speakers with the exception of the Cantonese speaker. This

finding will be further explored in the next chapter of this thesis as a reason for the fronted production of this vowel could be L1 transfer (§6).

5.1.9. Results

As mentioned in §5.1., it was expected that the speaker values would improve towards target-values as indicated by the native speaker groups. While it was expected that even the beginner speaker groups would not have problems articulating similar vowels, as there is a somewhat close equivalent in the L1, results indicated otherwise. In fact, results indicate that the progression towards native values is not as straightforward as it seems. While /a/ and /a:/ confirm that a similar vowel can be produced with target values right from the start, vowels like /ɔ/ and /ɛ/ do not. Furthermore, different vowels indicated that a linear progression towards native values is not always the case. While for the male speakers, beginner speakers produced /ɔ/ overall with non-target-like values, those values were still considerably closer to the native speaker group than the intermediate and advanced speakers. Another noteworthy finding is that gender indeed plays a role in the acquisition of vowels, as can be seen in /ɪ/, /i:/ and /u:/, where female speakers outperformed male speakers.

5.2. The New Vowels

In the following section, data are reported for vowels that are *new*. As noted above, American L2 learners of German need to acquire five new vowels (/ɛ:/; /ø:/; /œ/; /y/; /y:/). As with the *similar* vowels, the students would be expected to have a linear development towards target values. The marked phenomena of OPM states the crucial difference to the similar vowels.

New vowels are non-existent in the L1, which leads to a fast increase of the L2, as predicted by the marked phenomena of the OPM. Therefore it is expected, that learners will produce new vowels faster as formal instruction increases. Moreover, the formant values of the beginner speaker groups should indicate formant values that are less target-like than the speaker groups afterwards, if the L2 component in the IL is gaining momentum. However, afterwards the U of the IL can play a more prevalent role than the L1 and/or L2 leading to boomerang effects, which means that a latter (apparent) developmental stage is worse than the previous, before the next one improves again. Category formation is also expected to improve with increasing exposure to the L2. Therefore, it is expected that the formant values approach the target values overall but with more inconsistencies and variation among speaker groups.

5.2.1. Vowel /ɛ:/ – a new vowel (tokens: ‘Bären’; ‘Käse’)

The first *new* vowel for L1 AE speakers /ɛ:/ revealed a linear progression towards the target values with higher exposure to formal instruction. This also means that no beginner subject produced it within target range.

Looking at the individual speaker values (see Appendix), Speakers 2, 5, 6 and 11 realize this vowel as /a:/, which could have been triggered by the orthographic form of the vowel ‘ä’ (‘spät’ and ‘Bären’).

Table 14: Production results of /ɛ:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	ɛ:	2	810.113	1897.042	35.43595	105.996
F	2. intermediate	ɛ:	6	618.8458	1914.986	201.3219	453.8633

F	3. advanced	ɛ:	8	**471.3713**	**2127.022**	115.9045	484.8689
F	4. heritage	ɛ:	4	**524.9535**	**2311.256**	139.1619	194.0563
F	5. native	ɛ:	12	**433.0652**	**2411.919**	82.10188	225.443
M	1. beginner	ɛ:	10	558.8895	1682.687	136.3633	403.5813
M	2. intermediate	ɛ:	4	**415.306**	**2040.576**	45.2561	191.2386
M	3. advanced	ɛ:	4	**395.5078**	**2075.603**	99.83001	261.3436
M	4. heritage	ɛ:	6	**372.4552**	**1972.341**	61.21455	199.1751
M	5. native	ɛ:	10	**357.3876**	**2065.713**	102.5777	136.1327

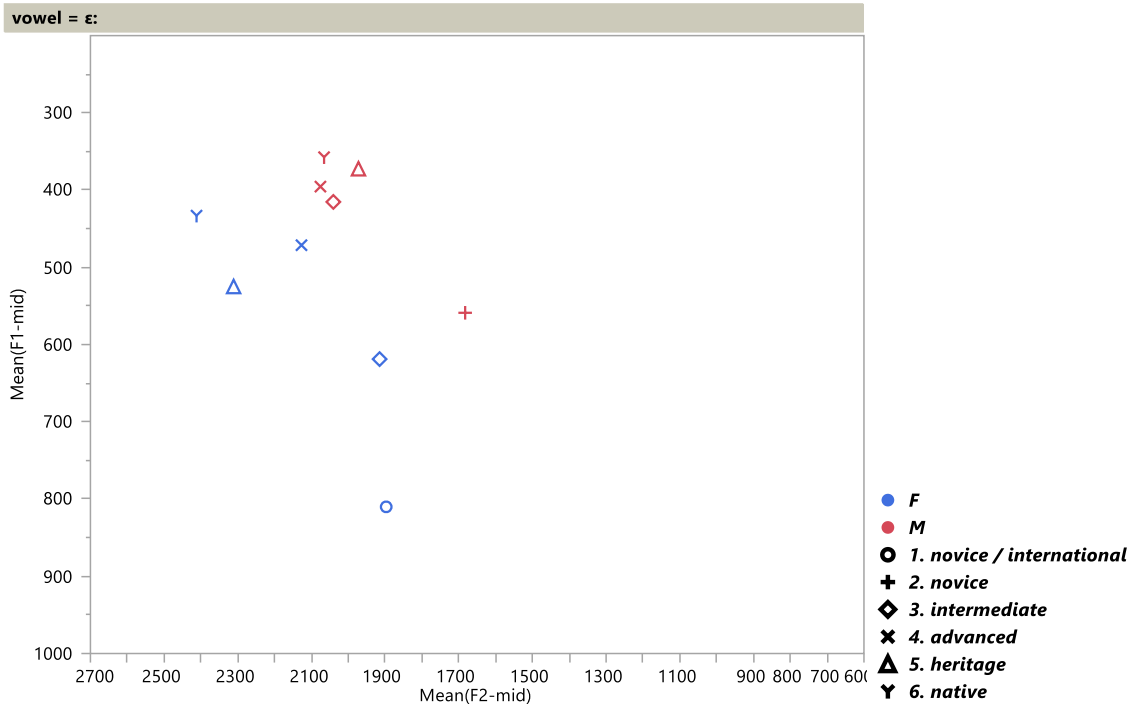


Figure 16: Vowel chart for /ɛ:/

Male students in the second and third year produce the vowel /ɛ:/ within the target range. Among female consultants, only the third year students produce this vowel within the target range. It is also evident that with growing exposure to the target language, a linear improvement in the pronunciation can be seen.

5.2.2. Vowel /ø:/ – a new vowel (token: ‘Höhle’)

The formant values indicated that most intermediate and beginner speakers did not produce target values with the exception of Speakers 1, 4 and 5 (see Appendix). The other speakers realized an /o:/ or /u:/ instead of the expected vowel.

Table 15: Production results of /ø:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	ø:	1	**431.977**	1356.971		
F	2. intermediate	ø:	3	**477.397**	1449.743	6.369596	417.1123
F	3. advanced	ø:	4	**414.475**	**1717.873**	38.52273	211.4411
F	4. heritage	ø:	2	**384.107**	**1769.87**	30.45226	51.87972
F	5. native	ø:	6	**443.187**	**1642.822**	59.8312	77.00753
M	1. beginner	ø:	5	**358.252**	1234.435	49.9218	322.1987
M	2. intermediate	ø:	2	**404.247**	876.5735	111.8431	72.04923
M	3. advanced	ø:	2	330.252	1634.784	2.322139	147.6149
M	4. heritage	ø:	3	**380.602**	**1485.161**	31.27883	165.953
M	5. native	ø:	5	**381.646**	**1437.716**	17.70688	51.15276

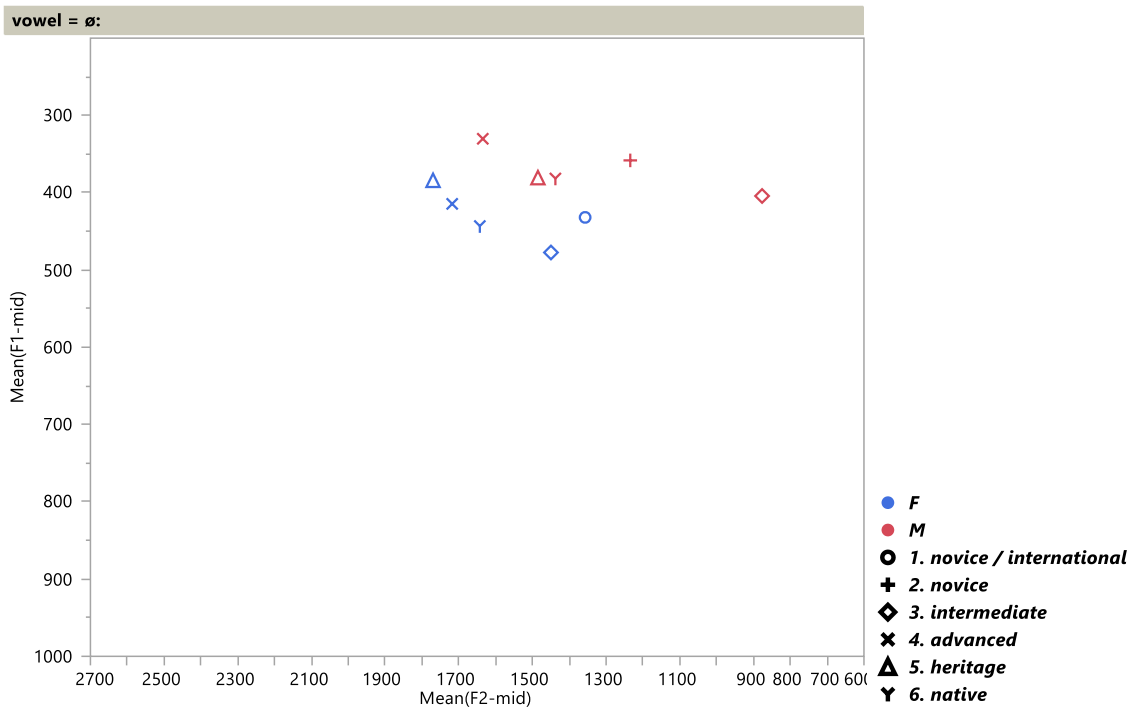


Figure 17: Vowel chart for /ø:/

The formant values in combination with the standard deviation above indicate that there is huge variation among the L2 speaker groups. This means that while the beginner groups assimilate the vowel into the closest L1 category (/o:/ and /u:/), intermediate speakers assimilate the vowel into a new category. Yet, the intermediate speakers produce it less fronted than native speakers do. Advanced female speakers, in contrast to the advanced male speakers, are in the native range for vowel frontness, but they produce the vowel even more closed than the native speakers. The advanced male speakers produce this vowel even less target-like than the beginner and intermediate groups, which at least are within target range for vowel height. On average, it seems that the beginner subjects produce the vowel more nativelike than the intermediate speakers. However, keeping in mind the individual results, as mentioned above in addition to the

high F2 standard deviation, it becomes clear that the average results are not representative for this vowel.

Therefore, it should be concluded that even though on average the beginner speakers were more target-like, this determination is deceiving as the standard deviation is very high. Both male and female intermediate groups pronounce this vowel more back than it is expected from the target language. Looking at the advanced male group, it is evident that the formant values are not within target range, even though they slowly approach the values. This is again an indicator for the boomerang effect in language learning, which will be further analyzed in the discussion section. Overall, the female speakers produce this vowel more target-like than the male speakers.

5.2.3. Vowel /œ/ – a new vowel (token: 'Hölle')

This short counterpart of /ø:/ revealed similarly inconsistent formant values. No beginner subject produced it within the target range. Furthermore, one speaker produced it as /a/, the others produced it as /ø:/, just like two speakers of the intermediate level, as indicated by the low F1 values. Only one subject from that group pronounced it with the expected values, with the other two realizing /o:/ instead.

Table 16: Production results of /œ/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	œ	1	406.035	**1713.659**		
F	2. intermediate	œ	3	425.4093	1301.166	50.58225	409.324
F	3. advanced	œ	4	434.1183	1573.408	72.58111	97.48283
F	4. heritage	œ	2	**564.7825**	**1742.65**	33.19796	24.49913
F	5. native	œ	6	**552.3913**	**1773.949**	104.1775	96.61371
M	1. beginner	œ	5	**448.9454**	1120.149	130.1235	254.6135

M	2. intermediate	œ	2	**391.031**	1016.752	13.7702	231.7748
M	3. advanced	œ	2	321.087	1705.977	28.87824	172.4549
M	4. heritage	œ	3	**411.7683**	1353.995	21.67356	153.4826
M	5. native	œ	5	**440.4728**	**1481.845**	69.70474	82.58092

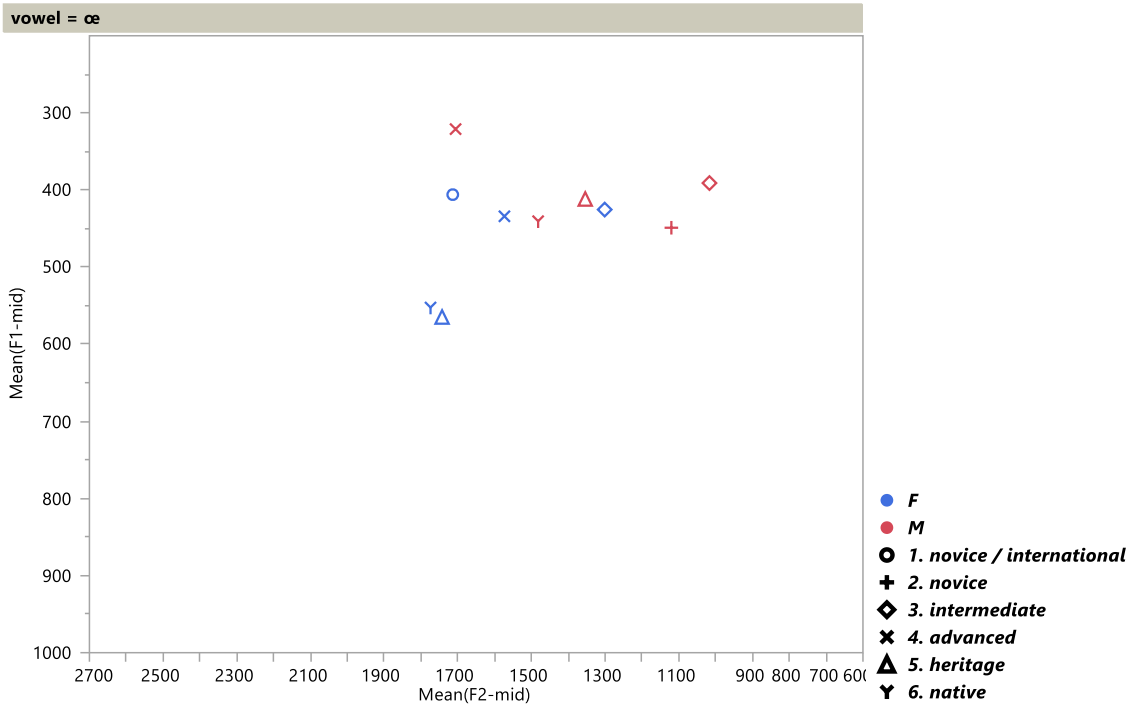


Figure 18: Vowel chart for /œ/

Overall, it can be said that only the female heritage speakers reach target values. All other speaker groups do not reach the target values for F1 in addition to F2. Similarly to /ø:/, a boomerang effect can be seen, as beginner speakers produce the vowel more target-like in terms of F1 values, while advanced speakers to not produce values within target range for F1 or F2.

5.2.4. Vowel /y/ – a new vowel (token: ‘füllen’)

The short and lax counterpart of /y:/ is /y/. Similar to /y:/, Speakers 1, 2 and 3 produce /y/ like they pronounce either /ɪ/ (Speaker 1) or /ʊ/ (Speakers 2; 3). In contrast to /y:/ (below), all

intermediate and advanced speakers, except for Speaker 8, pronounce this vowel with target values. Consequently, it can be said that target-like formant values correlate positively with increased exposure to the language. The L1 Cantonese speaker produced an /e:/.

Table 17: Production results of /y/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	y	1	**412.372**	2556.927		
F	2. intermediate	y	3	341.2927	**1801.166**	20.44082	373.1522
F	3. advanced	y	4	**413.7413**	**1805.728**	93.601	95.86838
F	4. heritage	y	2	375.8755	**1786.702**	119.571	2.535685
F	5. native	y	6	**465.1335**	**1641.447**	68.39113	186.6218
M	1. beginner	y	5	**314.4592**	1255.285	40.68844	771.8677
M	2. intermediate	y	2	**306.8785**	1340.223	12.8347	29.48494
M	3. advanced	y	2	**298.2405**	1668.414	1.228244	57.46869
M	4. heritage	y	3	**374.122**	**1495.452**	19.92984	101.4553
M	5. native	y	5	**326.3698**	**1435.15**	79.18733	76.94129

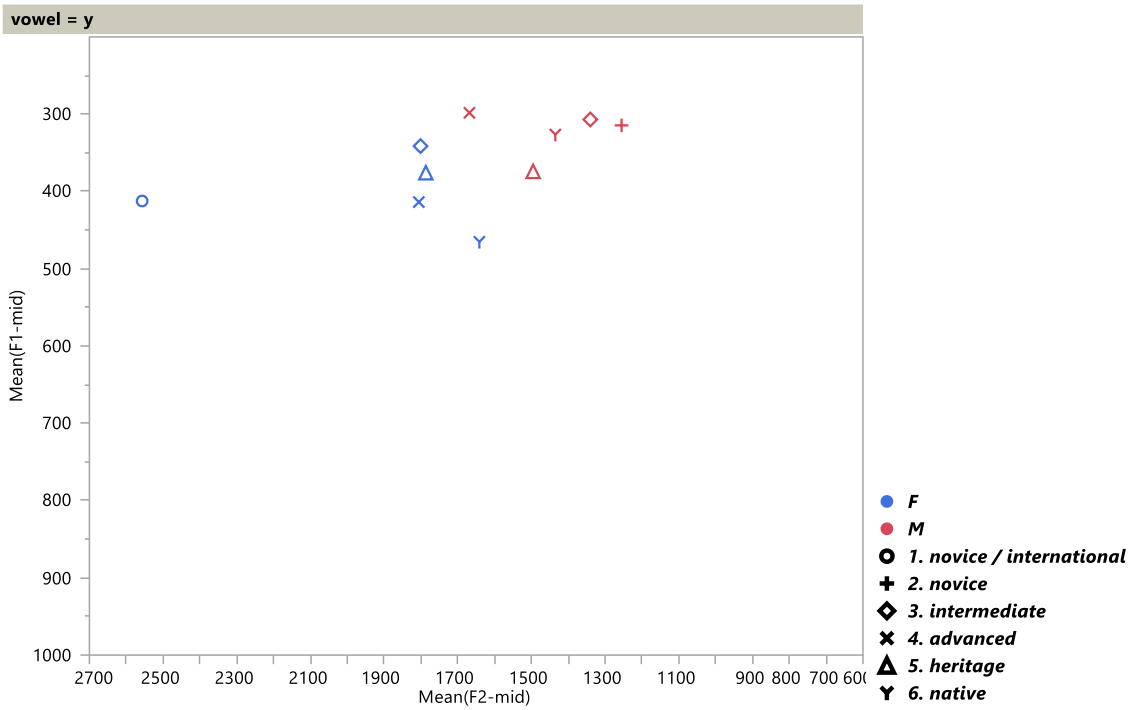


Figure 19: Vowel chart for /y/

Overall, this vowel was produced inconsistently among all student groups with the exception of the female advanced and male heritage speaker groups. Male speakers did not hit the target range within the first year, as can be seen from the detailed speaker results and the standard deviation for the second formant, since they produce either a fronted vowel /ɪ/ or back vowel /ʊ/.

However, intermediate male speakers hit the target range of the vowel for F1, whereas the second formant for the intermediate female speakers reveals that there are still inconsistencies regarding the production of this vowel with respect to frontness in the vocal tract (front vowel /ɪ/ vs. back vowel /ʊ/). While the advanced male speaker group reached the target vowel height, it did not reach the target horizontal vowel position. Instead, it is even farther away in terms of F2 values than beginner and intermediate groups.

5.2.5. Vowel /y:/ – a new vowel (token: 'fühlen')

The front rounded German vowel /y:/ is one of the vowels that is not existent in English. If at all, it can be found in a word like 'boot' as an allophone of /u/. Since American speakers do not have this vowel, it is even more interesting to compare it across various levels.

Table 18: Production results of /y:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	y:	1	**395.8045**	2123.617		
F	2. intermediate	y:	3	**339.8363**	1856.737	32.45881	510.8773
F	3. advanced	y:	4	**362.1423**	**1953.199**	54.92392	130.4755
F	4. heritage	y:	2	**351.7025**	1663.826	14.30689	17.43372
F	5. native	y:	6	**341.6097**	**1854.603**	120.4583	182.8317
M	1. beginner	y:	5	315.913	**1436.156**	35.09651	700.0356

M	2. intermediate	y:	2	313.4135	1074.277	27.95122	208.3787
M	3. advanced	y:	2	351.945	**1751.292**	61.86336	42.78915
M	4. heritage	y:	3	321.2277	**1442.717**	44.56555	37.69814
M	5. native	y:	5	**230.9988**	**1627.717**	43.10676	235.9263

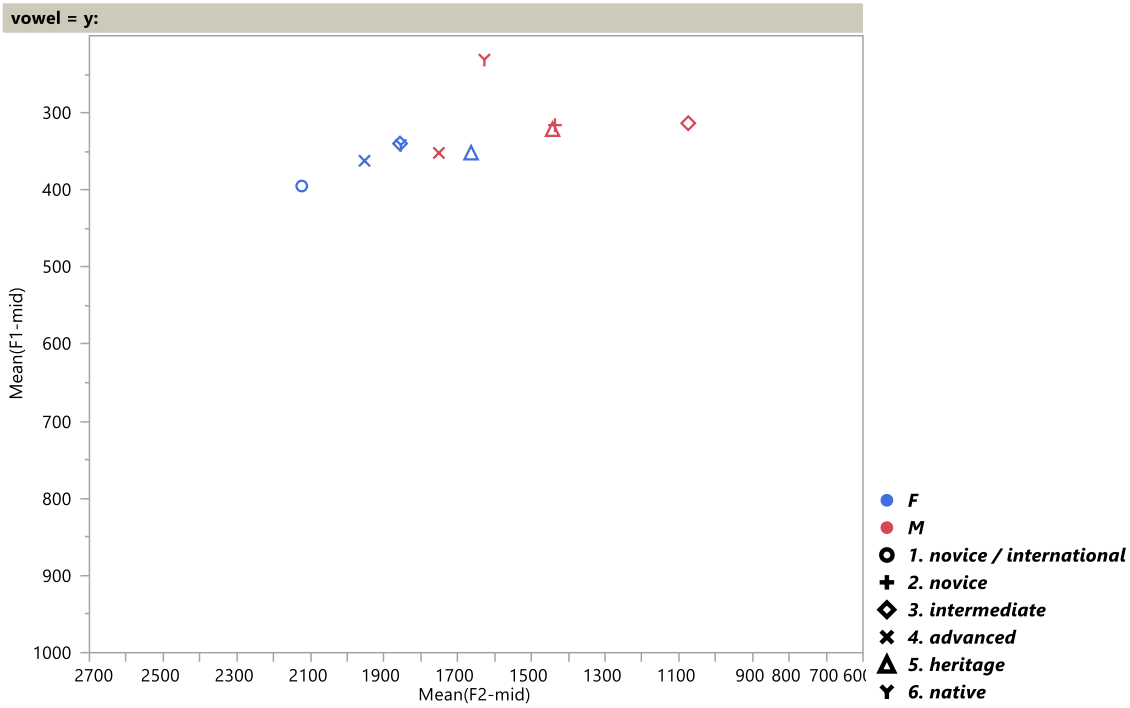


Figure 20: Vowel chart for /y:/

Looking at the standard deviation of the beginner speakers reveals that Speaker 1, 2 and 3[9] do not produce a vowel with formant values expected in the native language. Rather they produce it in a way that is similar to /i:/ (Speaker 1) or /u/ (Speakers 2; 3). The results for these speakers are similar to the production of each speaker for the short and lax counterpart /y/. Speakers 4 and 5, though, do produce the vowel already with native-like proficiency. Looking at the intermediate speakers demonstrates another interesting phonological occurrence. Whereas

[9] Extended results for each speaker can be found in the Appendix (Individual Speaker Production Results).

two speakers have acquired that vowel (Speaker 7; 8), two speakers epenthesize a glide (/j/)[10] before producing the back vowel /u/. Speaker 9 produces the back vowel /u:/ only.

The only student group that hits the target range for F1 and F2 is the advanced female speakers. Similarly to /ø:/, the intermediate female group as well as the beginner male group cannot be considered within native range, since the high F2 standard deviation indicates that the speakers of this group pronounced this vowel highly inconsistently. Therefore, it should be concluded that, even though on average the intermediate female speakers were more target-like, this determination is ultimately deceptive as the standard deviation is very high.

5.2.6. Results of the new vowels

As mentioned in §5.2., it was expected for the speaker values to improve towards target-values as indicated by the native speaker groups. Furthermore, it was projected that beginner speakers would produce the new vowels with more variation, as they have to establish a new L2 category first. However, after the first year, a progression towards target values was expected, as the L2 would take over the IL as proposed by the marked phenomena of OPM. Indeed, the results suggest that the beginners have difficulties categorizing the vowel into L2 categories, as seen in the high standard deviation. Furthermore, speaker variation leads to very large variation among speaker groups. While a linear development towards target values can be seen for /ɛ:/, the vowel /ø:/ revealed quite the opposite. The results of the advanced female speaker group show that they produce this vowel within the target range for F1 and F2 values, while the international student and the intermediate group only hit target range for F1 values. Beginner and intermediate

[10] Spectral analysis of the glide was not conducted by the researcher.

male speaker groups also hit the F1 target range. What was unexpected was the result for the advanced male speakers, as neither F1 nor F2 values were within target range. In summary, the new vowels revealed variation across speaker groups that was not expected. The discussion section will try to account for the findings.

5.3. The Phonemically Similar, but Phonetically Dissimilar Vowels

As mentioned in §5.1., there are two vowels in German that are phonemically similar. However, these cannot be included in the similar vowel section, as they are phonetically dissimilar in English. In particular, this means that while they are monophthongs in German, the L1 AE variety diphthongizes the vowels ([e]→/eɪ/; [o]→/oʊ/). Consequently, the L2 learners have to produce an L1 diphthong as a monophthong in order to sound more German.

5.3.1. Vowel /e:/ – a new vowel phonetically, a similar vowel phonemically (tokens: ‘fehlen’; ‘Beeren’)

Table 19: Production results of /e:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	e:	2	**471.747**	**2411.549**	93.50921	421.635
F	2. intermediate	e:	6	**496.6872**	**2305.278**	138.5418	373.8963
F	3. advanced	e:	8	**457.2085**	1985.916	105.7823	495.2464
F	4. heritage	e:	4	**467.932**	2285.506	63.50544	222.6144
F	5. native	e:	12	**440.1535**	**2460.24**	58.28701	138.7814
M	1. beginner	e:	10	389.5234	**2000.056**	102.9002	297.8482
M	2. intermediate	e:	4	423.4175	**2027.908**	76.22787	264.8613
M	3. advanced	e:	4	411.425	**2024.195**	46.04456	254.3331
M	4. heritage	e:	6	391.6517	1834.602	40.75236	155.2252
M	5. native	e:	10	**331.4362**	**2091.62**	34.57753	181.2287

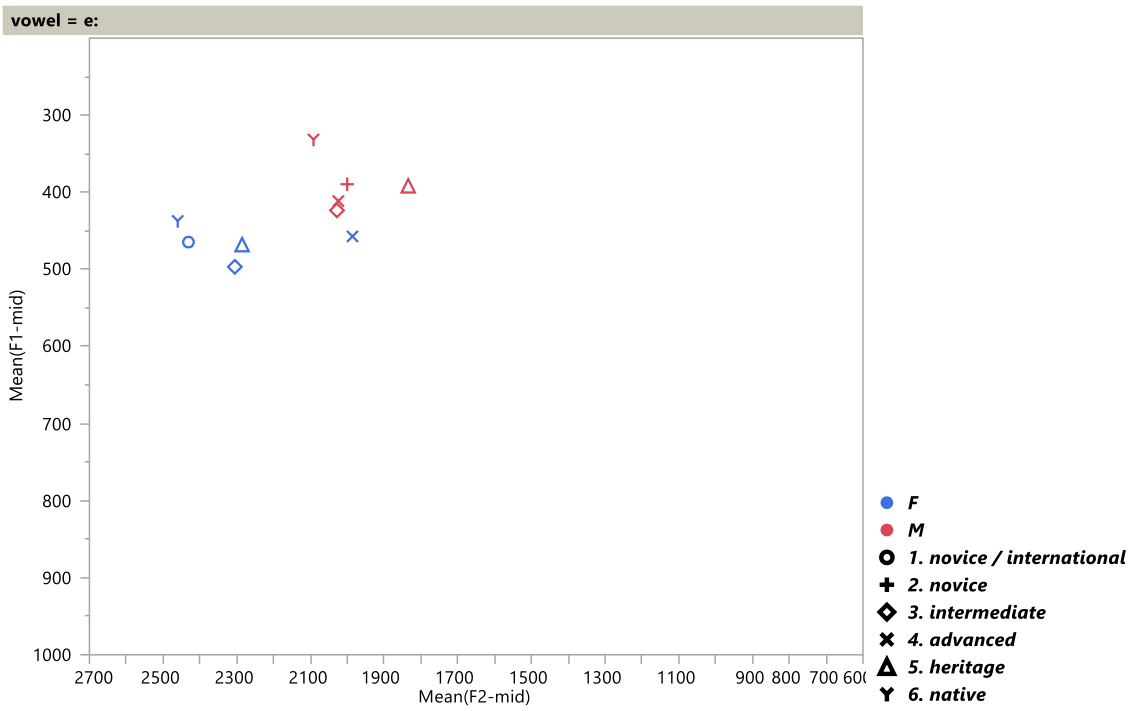


Figure 21: Vowel chart for /e:/

This vowel was produced with a lot of inconsistencies among speaker groups. Unfortunately, the orthography of the token played a role for the pronunciation. ‘Beeren’ was often produced like [bi:rən] instead of [be:rən] which reflects the English pronunciation of the spelling, ‘beer’ (Speakers 1; 3; 4; 5; 6; 8; 10; 11; 15; 16). Interestingly enough, these speakers did produce more German-like vowels for the second token (‘fehlen’), which could be explained by the fact that the orthography cannot be found in English. Only Speaker 5 produced the German /e:/ twice like an English /i:/.

Table 20: Production results of /e:/ (excluding ‘Beeren’) per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	e:	1	523.592	2152.65		
F	2. intermediate	e:	3	584.187	2186.02	88.8709208	446.74304
F	3. advanced	e:	4	**470.307**	1987.09	77.3421374	469.556978
F	4. heritage	e:	2	**421.425**	**2445.06**	18.3642702	159.345099

F	5. native	e:	12	**437.153**	**2460.24**	58.2870079	138.781419
M	1. beginner	e:	5	456.197	1849.67	102.874203	261.881991
M	2. intermediate	e:	2	445.534	**2005.14**	41.1896771	267.061503
M	3. advanced	e:	2	382.968	**2082.94**	30.9981471	285.359306
M	4. heritage	e:	3	381.5	1868.53	59.0228222	167.506143
M	5. native	e:	10	**331.436**	**2091.61**	34.5775331	181.228656

The results excluding the token ‘Beeren’ looked a lot different, as can be seen in the table below. Therefore, Table 20 only reflects one token, namely ‘fehlen’. What is noteworthy is that only the female heritage speakers match the female native speakers in terms of frontness and vowel height. For the male speakers, the intermediate speakers and advanced speaker groups are within target range for F2, but the heritage group does not hit the target range.

As can be seen from above, the formant values indicate non-target realization of the vowel for a number of speaker groups. The vowel has to be monophthongized by L2 German learners. As a consequence, these formant values were measured at the center of the first half of the vowel.

Interestingly, gender again played a role. This time it is not as straightforward as it was for similar vowels. Instead, it is evident, that females are more target-like in terms of vowel height (F1) (advanced), whereas males are more target-like in terms of frontness (F2) (intermediate; advanced).

5.3.1. Vowel /o:/ – a new vowel phonetically, a similar vowel phonemically (token: ‘wohl’)

All speakers produce the sound near the range of native speakers, but somewhat more open than the native speakers. A similar pattern can be seen between the male and female

speaker groups, as all groups are able to accurately produce target-like vowels in terms of frontness (F2). However, only after the third year are they able to hit the target range for vowel height (F1).

Table 21: Production results of /o:/ per subject group in Hz

Gender	Fluency level	Vowel	Number of token	F1 mean in Hz	F2 mean in Hz	F1 Standard Deviation	F2 Standard Deviation
F	1. beginner / international	o:	1	520.135	**895.875**		
F	2. intermediate	o:	3	562.659	**953.865**	59.0526	46.86072
F	3. advanced	o:	4	504.053	**930.724**	17.39259	221.1698
F	4. heritage	o:	2	**438.751**	**778.034**	19.37402	129.6148
F	5. native	o:	6	**441.154**	**929.757**	49.62974	214.4772
M	1. beginner	o:	5	457.097	**786.886**	65.69747	170.5335
M	2. intermediate	o:	2	422.744	**698.78**	21.41756	94.00985
M	3. advanced	o:	2	406.418	**702.654**	32.53752	22.81339
M	4. heritage	o:	3	**386.319**	**821.914**	27.52113	96.14702
M	5. native	o:	5	**342.927**	**725.185**	45.68803	118.0743

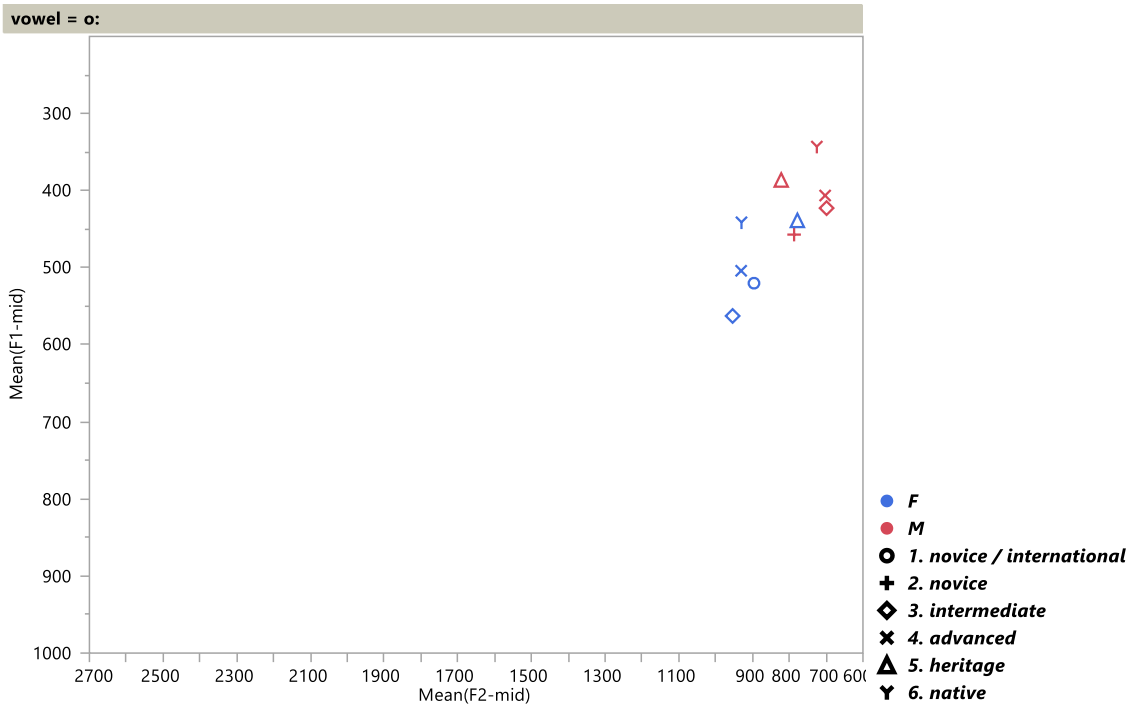


Figure 22: Vowel chart for /o:/

The formant values suggest that student subjects are approaching the target values as formal instruction increases. Interestingly, the Cantonese speaker is already pronouncing the vowel to more native-like degree than the females of the intermediate group, even though this vowel is not part of the Cantonese vowel inventory, as can be seen in the following section (§6.1.1.). Similarly to /e:/, only the first half of the vowel was measured, since the German vowel is monophthongized in German, in contrast to English.

5.3.2. Results

Comparing the two results to the results of the new and similar vowel prior to this section, it becomes clear that even though these vowels are phonemically similar, they pattern more with new vowels. To pronounce these two vowels in target-like fashion, the L2 learners have to monophthongize their L1 vowels, which was again subject to speaker variation as it was for the new vowels.

After presenting these results, the following section will examine why the results differed between vowels and speaker groups and discuss the findings in terms of vowel production studies and second language learning models, like OPM (Major, 2001) and SLM (Flege, 1995).

5.4. Vowel Duration

This section will treat each short vowels and long vowels to show how the learners differentiated between them. The following vowels were compared with each other:

Table 22: Long and short vowels of German

Long Vowel	Orthography	Short Vowel	Orthography
/aː/	a	/a/	a
/eː/	e	/ɛ/	e/ä
/ɛː/	ä		ä
/iː/	i	/ɪ/	i
/oː/	o	/ɔ/	o
/øː/	ö	/œ/	ö
/uː/	u	/ʊ/	u
/yː/	ü	/y/	ü

The following graphs show the vowel duration for all speaker groups in comparison. The detailed group results can be found in the Appendices.

5.4.1. /aː/ vs. /a/

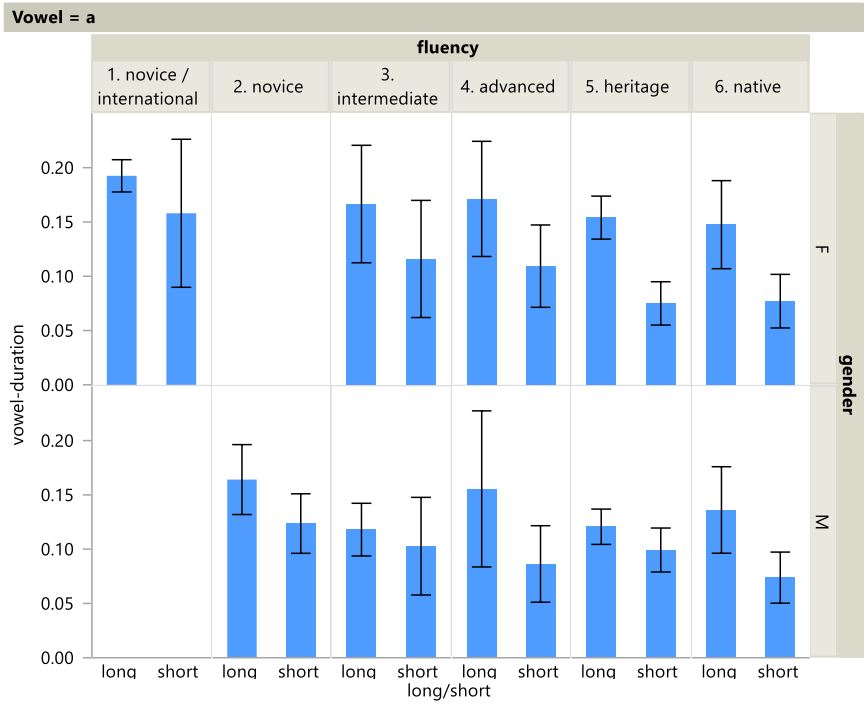


Figure 23: Vowel Duration /aː/ vs. /a/

5.4.2. /e:/ vs. /ɛ/

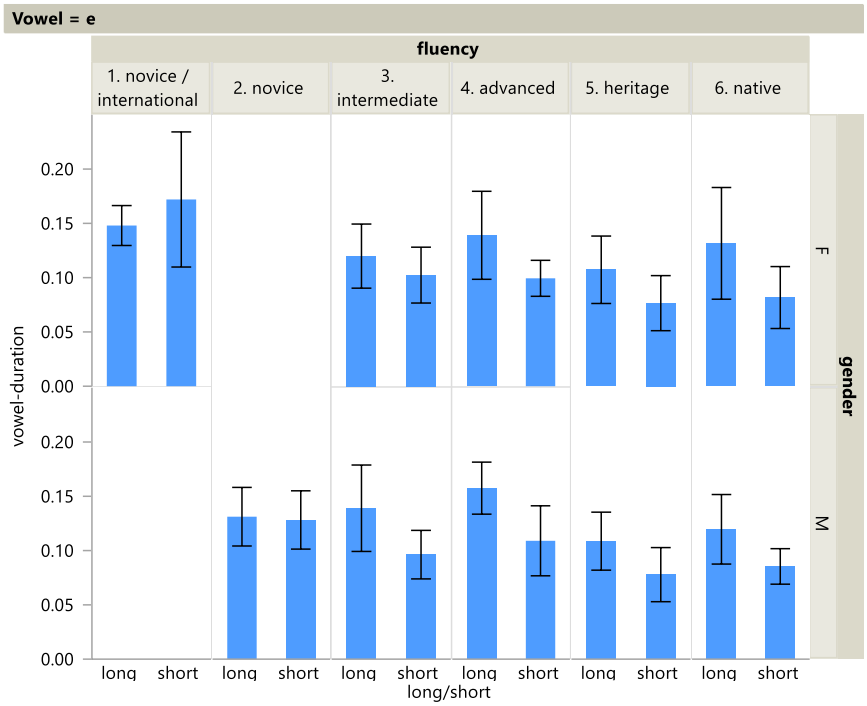


Figure 24: Vowel Duration /e:/ vs. /ɛ/

5.4.3. /i:/ vs. /ɪ/

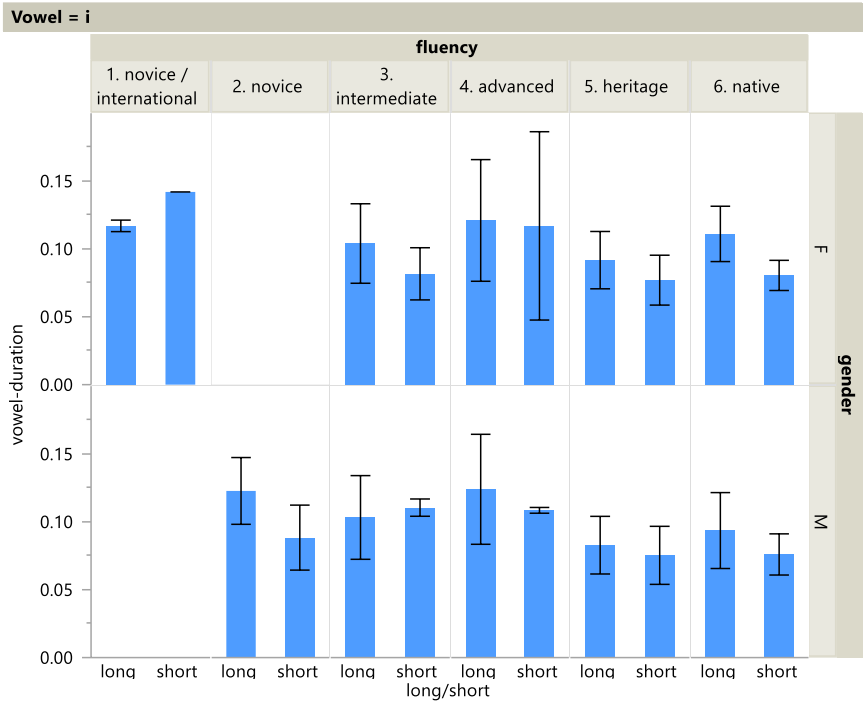


Figure 25: Vowel Duration /i:/ vs. /ɪ/

5.4.4. /o:/ vs. /ɔ/

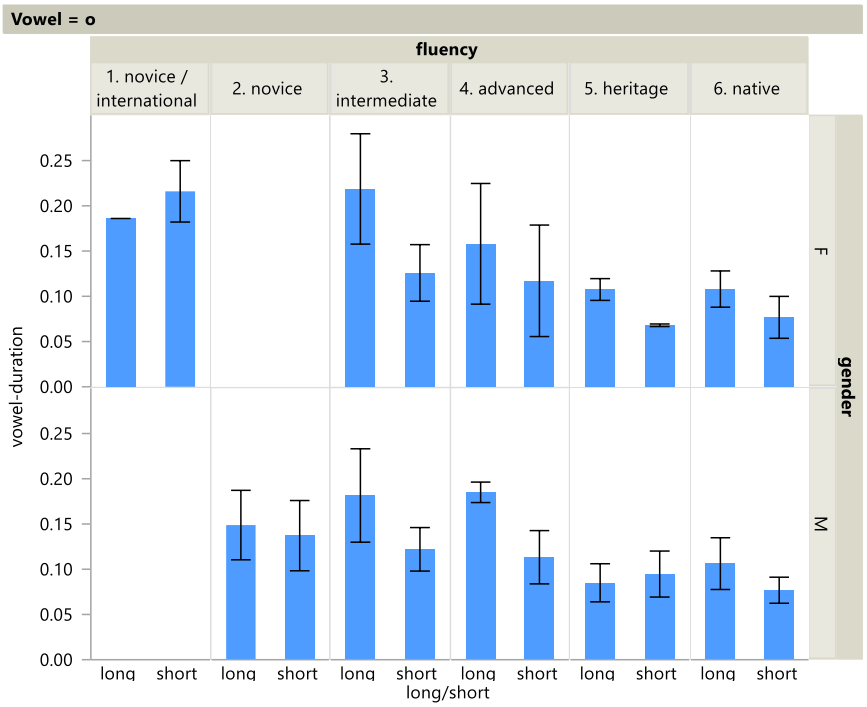


Figure 26: Vowel Duration /o:/ vs. /ɔ/

5.4.5. /ø:/ vs. /œ/

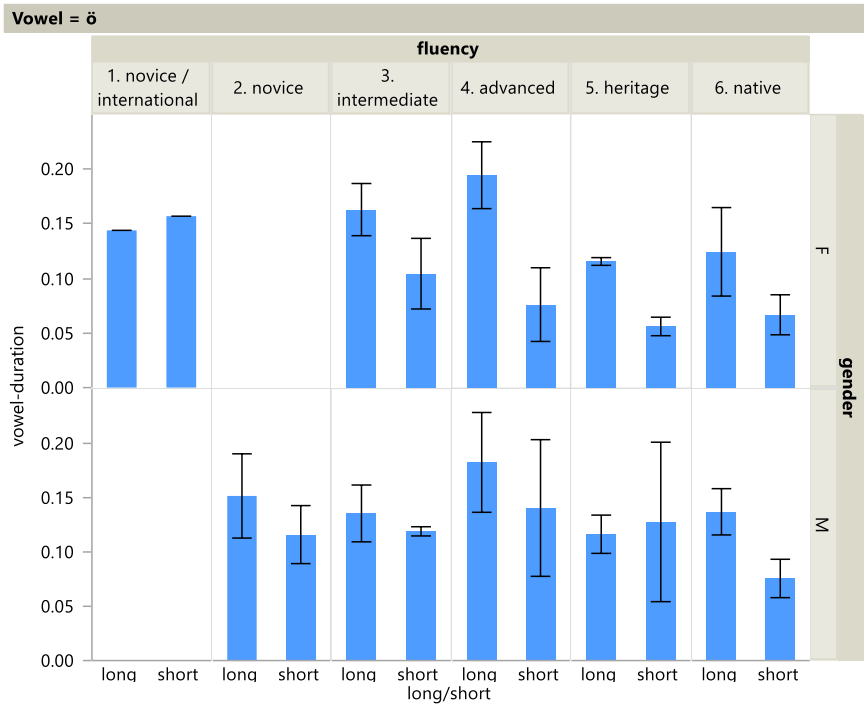


Figure 27: /ø:/ vs. /œ/

5.4.6. /u:/ vs. /ʊ/

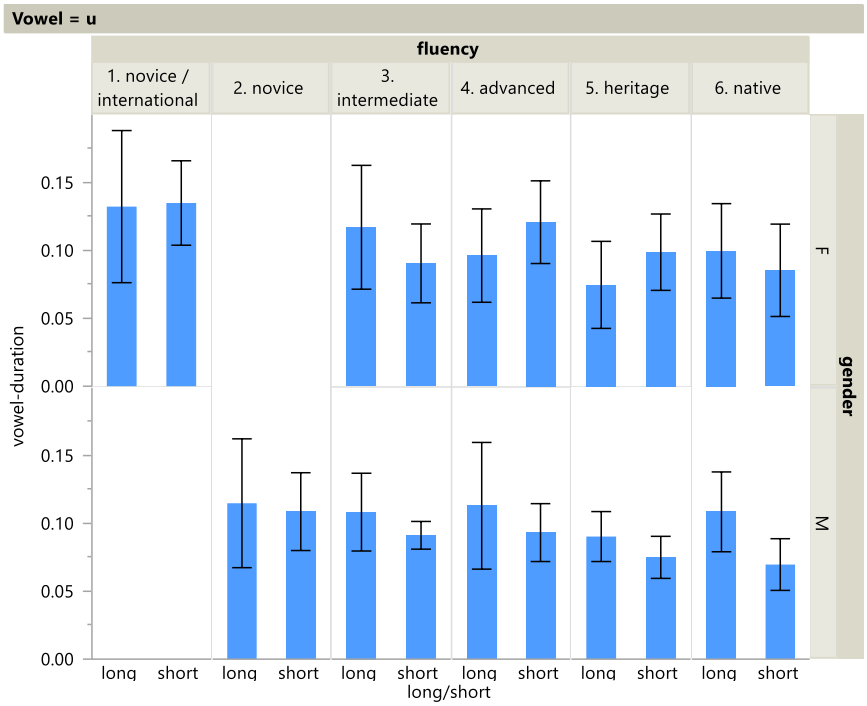


Figure 28: Vowel Duration /u:/ vs. /ʊ/

5.4.7. /y:/ vs. /y/

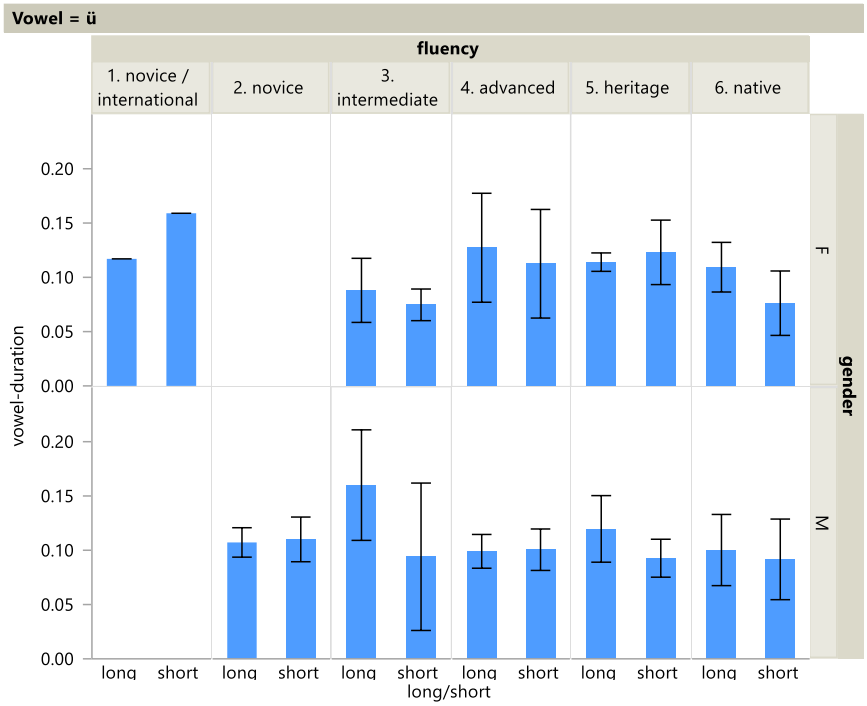


Figure 29: Vowel Duration /y:/ vs. /y/

5.4.8. /ɛ:/

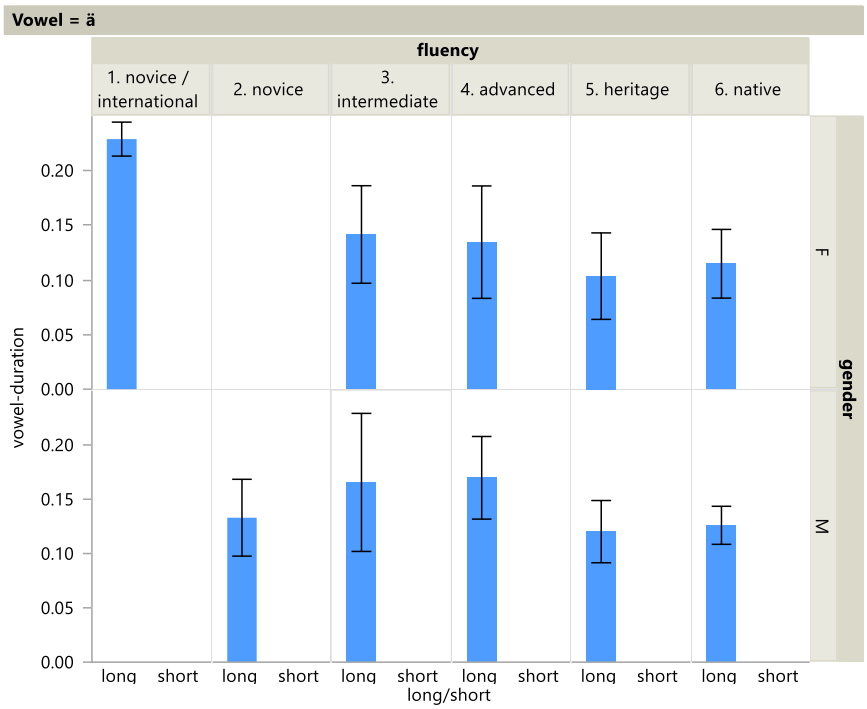


Figure 30: Vowel Duration /ɛ:/

The vowel duration measurements yielded results that were somewhat unexpected. Overall, the vowel duration for native speakers was the shortest for long as well as short vowels. Surprisingly, intermediate speakers are closer to the duration values for some vowels (/i:/; /ɪ/; /ø:/; /œ/) than the advanced speakers. Beginner groups outperformed the intermediate group for /ɛ:/, /y:/, /o:/ and /e:/ and advanced groups /ɛ:/ and /e:/.

It can be seen that those vowels, that were produced with target values by all speaker groups, also showed a more target-like vowel duration (/a:/; /a/; i:/; /ɪ/;). However, the results of the new vowels cannot be grouped together. Whereas the students pronounced short and long vowels near target duration for /y:/ and /y/ from the beginning, they did not for /ø:/ and /œ/. Gender differences are minimal and did not yield in different results for speaker groups.

6. DISCUSSION OF THE RESULTS

The following section will present and discuss the results in light of the language learning models introduced in Chapter 3.

6.1. The L1 Cantonese Speaker

While the current study of thesis lacked beginner female speakers with a native language of American English, one international beginner speaker volunteered to be part of the study. Her native tongue is the Cantonese dialect and the results provide a case study for this thesis.

6.1.1. The Vowel Systems of German vs. Cantonese

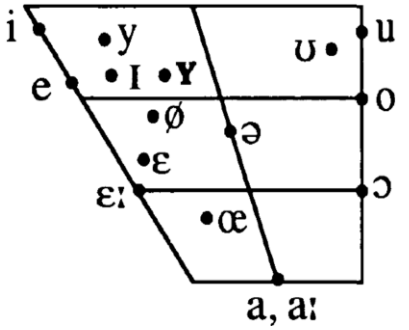
To account for the results produced by the native speaker of Cantonese Chinese, the vowel repertoires of German and Cantonese need to be compared to account for *new* and *similar* vowels. The Cantonese vowel system features 11 vowels, seven long and four short vowels[11] (Zee, 1999, p. 59).

Table 23: Illustrating the vowel inventory of German and Cantonese. [12]

Cantonese	German Vowel
	/a/
/a:/	/a:/

[11] According to Cheung (Cheung, 1986, p. 83), there are actually 13 vowels (7 tense and 6 lax). As the student was born in the late 90's, this work will proceed with Zee's categorization of the vowel system (Zee, 1999).
[12] Gaps indicate a missing vowel and therefore an L2 vowel that is new, while vowels on both sides of the tables are categorized similar.

	/e:/
	/ɛ/
/ɛ:/	/ɛ:/
/ɪ/	/ɪ/
/i:/	/i:/
	/o:/
/ɔ:/	/ɔ/
	/ø:/
/œ:/	/œ/
/u:/	/u:/
/ʊ/	/ʊ/
	/y/
/y:/	/y:/
/ɐ/	
/ɵ/	



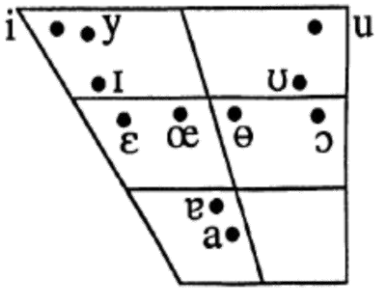


Figure 31 (left): Vowel System of German (Kohler, 1999, p. 87)

Figure 32 (right): Vowel System of Cantonese (Zee, 1999, p. 59)[13]

[13] Note, that unlike the German vowel representation, the Cantonese does not indicate the tense distinction of the vowels.

As can be seen from Table 22, Cantonese has a bigger overlap with German vowels than English. Nine vowels can be considered *similar* in German and Cantonese, whereas six vowels are *new* for L1 Cantonese speakers.

6.1.2. The Similar Vowels of the L1 Cantonese Speaker

Taking a closer look at the previous descriptive data presentation, it is clear that the L1 Cantonese speaker had difficulties with numerous vowels. However, with other vowels she seemed to be able to pronounce them already within target range in her first year of language instruction. The first part of the discussion section for the L1 Cantonese speaker will be dedicated to the *similar* vowels between German and Cantonese.

6.1.2.1. The vowels /a:/ and /a/

Even though Cantonese only has /a:/ and not /a/ (which is therefore a *new* vowel[14]), the speaker is able to produce both vowels in target range. Therefore, it is safe to assume that the speaker categorized the short and lax L2 vowel /a/ in the same L1 vowel category as the L2 vowel /a:/. This result is predicted by the fifth hypothesis of SLM (H5), which states that "category formation for an L2 sound may be blocked by the mechanism or equivalence classification" (Flege, 1995, p. 239). While this vowel is certainly a similar phenomenon, it cannot be accounted for by the model of "similar phenomena" of OPM, as that would assume a decreasing L1. Instead, as mentioned before, the OPM acknowledges the "free ride" of elements

[14] Since the results and implications for /a/ are comparable to /a:/, they are included here.

that exist in the L1 and transfer to the L2. This positive transfer is sufficient to account for the L2 production of /a:/ and /a/. Nevertheless, Best's PAM is also able to account for this assimilation of two vowels into one L1 category, as the Single-Category Assimilation (SC) categorizes two distinct L2 sounds into one L1 category, which leads to poor discrimination between the two by the learner.

6.1.2.2. The vowel /ɛ:/

The vowel /ɛ:[15]/ is a vowel that can be found in Cantonese. However, as can be seen from Figure 5, it is produced slightly higher in Cantonese than in German, although the sounds are similar in terms of frontness. The results of the L1 Cantonese subject indicated that the vowel was produced even more open and fronted than it would be expected from the L1 German values. Therefore, the student realizes that the vowel is produced more open in German, but overgeneralizes the L2 production of this vowel. This is predicted by the model OPM, as this hypercorrection is a result of the universals (U) influencing the interlanguage of the speaker (Major, 2001, p. 119). Above all, it is worth noting that the SLM cannot account for hypercorrection, as it does not assume the existence of an IL.

6.1.2.3. The vowels /ɪ/ and /i:/

Cantonese and German also have a *similar* vowel space for /ɪ/. Nevertheless, the subject produced this vowel much more fronted than Cantonese or German speakers would do, which

[15] Represents /ɛ/ in the Cantonese vowel chart of Figure 5.

supports again a claim for hypercorrection. The student does not assimilate this vowel into the same vowel space as her L1, which would have placed the vowel in L2 German range. Instead, she produces it much more fronted. The same result (hypercorrection of fronting) occurred in her production of /i:/. A similar abnormality occurred in a study by O'Brien and Smith (2010), where students from the North Central [AE] L1 dialect area could have produced the L1 variant of German /u:/ to produce a more target-like vowel, then they ended up producing through hypercorrection (O'Brien & Smith, 2010, p. 314). The F1 values of the L1 Cantonese student are on par with the expected values of the L2 German. As stated above, neither SLM nor PAM account for hypercorrection. However, it is the OPM that can justify the results by having U as part of the IL, which will later decrease again "to make room" for the increasing L2.

6.1.2.4. The vowel /ɔ/

The next vowel is /ɔ/[16] of which similar variants can be found in Cantonese as well as AE. The Cantonese vowel is more fronted and more closed. This means that one would expect to see lower F1 values and higher F2 values if the subject categorizes the vowel into an L1 space. Indeed, her F1 values indicate that she pronounced it somewhat more closed than the native German speakers, which argues for an L1 influence. The F2 values show another picture. Namely, that she overgeneralizes once again to produce the vowel even further back than the native speakers of German. Major's OPM is again the only model that accounts for both of these phenomena.

[16] Represents /ɔ/ in the Cantonese vowel chart of Figure 5 but /ɔ:/ in Table 22.

6.1.2.5. The vowel /œ/

The front rounded vowel /œ/ is part of the Cantonese vowel inventory. Looking at the vowel maps by Zee (1999) and Kohler (1999) (Figure 4 and 5), it becomes clear that she utilizes her native vowel space to produce this vowel. F1 as well as F2 values suggest that she uses her L1 category, which is produced more closed and reflected in lower F1 values than the target values in German. The F2 values, though, are similar to German, which still argues for an assimilation of the German vowel into an existing L1 category, as projected by the second hypothesis of SLM (H2), which states that "[a] new phonetic category can be established for an L2 sound that differs phonetically from the closest L1 sound if bilinguals discern at least some of the phonetic differences between the L1 and L2 sounds" (Flege, 1995, p. 239). Additionally, the similar phenomena of OPM accounts for the results because the L1 is decreasing slowly (Figure 2).

6.1.2.6. The vowel /u:/

The back vowel /u:/ can be found in German as well as Cantonese. As can be seen from the vowel map by Zee (1999), /u:/ is slightly more fronted in Cantonese than in German, which can also be seen in the F2 values of the subject, even though these values are not significantly different to the F2 values by the German control group and its standard deviation.

6.1.2.7. The vowel /ʊ/

Based on the results for /u:/, it would seem reasonable if she categorized /ʊ/, which is also a *similar* vowel, similarly to her L1 category. Surprisingly, for this vowel she fails to be within

her L1 or the expected L2 range. Instead, she hypercorrected this vowel in terms of frontness, as the F2 values indicate that she pronounced it farther back in the vocal tract, instead of farther front than /u:/. Similarly to the hypercorrections above, the OPM is able to account for both of these results, because of the IL and its U component.

6.1.2.8. The vowel /y:/

The last *similar* vowel is /y:[17]/. The *similar* vowel is produced in almost the same range of Cantonese and German as seen in Zee (1999, p. 59) and Kohler (1999, p. 87) (Figure 4 and 5). The similar vowel /y:/ was produced much closer to the expected target values, in terms of vowel height and frontness.

6.1.3. The New Vowels for the L1 Cantonese Speaker

The second part of the discussion section for the L1 Cantonese speaker will be dedicated to the *new* vowels between German and Cantonese.

6.1.3.1. The vowel /e:/

Cantonese does not have a *similar* vowel to the German vowel /e:/. Leaving aside one of the token that was produced with the English pronunciation, caused by the orthography (‘Beeren’), only one token is left to look at (‘fehlen’), which the speaker produced with an F1

[17] Represents /y/ in the German vowel chart of Figure 5.

value that is more open than the target values (523.592 Hz). The F2 value (2152.653 Hz) is less fronted than the target values, which agrees with the vowel chart by Kohler (1999, p. 87). This shows that German vowels are more edged than in other languages. In other words, the vowels are articulated at the edges of the vocal tract, either at the very front (high F2 values, e.g. /i:/) or at the very back (low F2 values, e.g. /u:/). Therefore, it can be assumed that the subject produces this vowel almost target-like, even though she does not have a direct correlate in her L1, which argues for a new L2 category of a new vowel. This is predicted by the second hypothesis of the SLM (H2).

6.1.3.2. The vowel /ɛ/

The vowel /ɛ/ is non-existent in Cantonese. The results for this vowel are very similar to the longer counterpart /ɛ:/. Consequently, it must be assumed that even though this vowel is lacking in L1 Cantonese, the subject overgeneralized it to the pronunciation of /ɛ:/ and therefore assimilated /ɛ/ into the existing L1 category of /ɛ:/. So while this vowel is *new* to the learner, she fails to create a new phonetic category. This assimilation is accounted for by the SC of PAM and also by H2 of SLM. At first sight, the claim that this result is supported by the H2 seems wrong. However, taking a second look at hypothesis H2 ("[a] new phonetic category can be established for an L2 sound that differs phonetically from the closest L1 sound if bilinguals discern at least some of the phonetic differences between the L1 and L2 sounds (Flege, 1995, p. 239)), things are clarified by creating the opposite of the H2: "[a] new phonetic category can[not] be established for an L2 sound that differs phonetically from the closest L1 sound if bilinguals [cannot] discern at least some of the phonetic differences between the L1 and L2 sounds" (Flege, 1995, p. 239)

Crucially, it is precisely the negation of this hypothesis that is the case here, as the student fails to discern the phonetic differences and therefore does not create a new category.

The Marked Phenomena of OPM states that the L1 is decreasing rapidly, which is not the case. A reason for this deficit could lie in that the vowel is actually regarded as a *similar* phone by the learner, which raises the question whether the categorization and classification of *new* and *similar* vowels by IPA symbols is sufficient.

6.1.3.3. The vowel /o:/

A German vowel that neither English nor Cantonese possesses is /o:/. The closest L1 Cantonese vowel would be /ɔ:/, which is slightly more fronted and more open than German /o:/. The student produced this vowel slightly more open than the control group, but within the target range for F2 values. However, the F1 value suggests that she used an L1 category to map the vowel in her vowel space, which is supported by (the negation of) the H2 of SLM.

6.1.3.4. The vowel /ø:/

While /œ/ is a *similar* sound for L1 Cantonese speakers, as mentioned above, the long counterpart /ø:/ is *new*. The international student produces the vowel with a target-like height, however it is produced more back, which indicates that the student used her vowel space from the perceptually similar L1 Cantonese sound /œ/, which is accounted for by (the negation of the) H2 of SLM.

6.1.3.5.The vowel /y/

The *new* vowel /y[18]/ is produced more open and more back than the similar equivalent /y:/. The production results of the international student revealed something interesting. Even though the student was instructed to skip a token if she did not know or felt uncomfortable with, she tried to pronounce it[19]. Unfortunately, she pronounced 'fehlen' instead of 'füllen', which could be reasoned in the unknown token.

Lastly, the results of the student also showed evidence for the very first hypothesis of the SLM (H1), as she had issues differentiating between the English liquids (/ɹ/ and /l/) as Cantonese, similar to Japanese, only has one liquid (Zee, 1999, p. 58). However, this finding will not be further discussed in this thesis.

While the first part of the discussion focused on the L1 Cantonese speaker, the second part will turn to student subjects who all had one thing in common. They were L1 AE speakers.

6.2. The L1 AE subjects

The following part of the discussion will illustrate the results of the American university students in light of the language learning models mentioned in the Chapter 3 of this thesis.

6.2.1. The Vowel Systems of German vs. English

Table 24: AE and German vowel inventory in comparison

AE Vowel	German Vowel
/ʌ/	/a/
/ɑ/	/a:/

[18] Represents /ʏ/ in the German vowel chart of Figure 5.
[19] In fact, none of the participants of this study skipped a token. Everybody tried at least to pronounce the tokens.

/eɪ/ [e][20]	/e:/
/ɛ/	/ɛ/
	/ɛ:/
/æ/	
/ɪ/	/ɪ/
/i/	/i:/
/oʊ/ [o][21]	/o:/
/ɔ/	/ɔ/
	/ø:/
	/œ/
/u/	/u:/
/ʊ/	/ʊ/
	/y/
	/y:/
/ɝ/	

As mentioned in the previous descriptive description, English L2 German learners have to acquire five *new* vowels (/ɛ:/; /ø:/; /œ/; /y/; /y:/), whereas ten vowels are *similar* (/a/; /a:/; /e:/; /ɛ/; /ɪ/; /i:/; /o:/; /ɔ/; /u:/; /ʊ/) in German and English. Overall the vowel repertoire of AE is smaller than the German, as it has 10 vowels (vs. 15 in German[22]).

6.2.2. The Similar Vowels of the L1 AE Speakers

The results of the production of similar vowels of AE and German confirmed partially what was expected before, namely that students of all levels would produce them to a degree target-like, as

[20] Diphthongized monophthong phonetically, but only one phoneme.
[21] Diphthongized monophthong phonetically, but only one phoneme.
[22] The schwa (/ə/) is disregarded for both, AE and German.

they have a similar vowel in the L1 and could utilize its vowel space to create a similar L2 vowel.

6.2.2.1. The vowel /a/

Similarly to the L1 Cantonese speaker, all L1 AE speakers pronounce /a/ with target values. Comparing the spectral formant values with the vowel maps above (Figure 6 and 7), it becomes evident that the student subjects map the vowel /a/ in the category that is closest in their L1 (/ʌ/). They do not create a new category, but rather assimilate the vowel into an existent category and adapt it, as proficiency level increases (H2 in SLM).

6.2.2.2. The vowel /a:/

The long /a:/, though, is a different story. All female speakers hit the target range. The male speakers, by contrast show an interesting phenomenon. In fact, it is the native speaker group that shows inconsistencies in terms of vowel position. Looking at the vowel map above (Kohler, 1999), it would be assumed that the F2 values would roughly be the same for /a/ and /a:/. However, this is not the case for the native speakers, who produce /a:/ a little more back than for /a/ and also than all student subjects. A reason for this inconsistency could lie in the recording setup. Whereas all students were recorded in a recording studio, the native speakers were interviewed with a different microphone at a private setting. Nevertheless, it would then also be expected that the F2 values for /a/ are lower, which is not the case. So the recording setup should not cause these differences.

6.2.2.3. The vowel /ɔ/

While for many AE dialects (e.g. the Inland North dialect (Labov, Ash, & Boberg, 2005, p. 123)) the vowel /ɔ/ would be merged with /ɑ/, it is not merged in the area in which this current study was conducted, namely Georgia. Therefore, the L1 German vowel /ɔ/ is not a *new* vowel to L1 AE speakers, but rather something with which they would be rather familiar. The intermediate and advanced speakers produce this vowel less fronted (lower F2) and higher (lower F1) than the native speakers. Both heritage speaker groups are in native range. The universals of the OPM are the deciding factor for this finding causing intermediate and advanced (male) speakers to produce this vowel non-target like.

6.2.2.4. The vowel /ɛ/

Another vowel that is *similar* in AE and German is /ɛ/. The L1 AE map shows that the F1 values must be higher (more open) and the F2 values smaller (less fronted). Keeping the results of the descriptive data in mind, it is clear that the beginner speaker group utilize their L1 category to produce the L2 vowel, is consistent with the expected values for L1 AE speakers of this vowel (negation of H2). However, shortly after the first year, a new phonetic category is created by all speaker groups to produce /ɛ/ within target range (H2). The beginners map the vowel within their native category for this vowel, which is also accounted for by the slow decrease of L1 in the similar phenomena of OPM. That the other groups produce this vowel within target range shortly after can also be explained by the same phenomena, which sees a fast increase of L2 (Stage 5 of the Similar Phenomena of OPM; Figure 2). This result stands in opposition to the study conducted by Bohn and Flege (1992), who found that the inexperienced speakers were better than the experienced, as mentioned in the second part of this thesis.

Deciding factors for the differences in the results could be two-fold, since Bohn and Flege found no differences in spectral analysis between inexperienced and experienced L2 groups, but in terms of vowel duration, which was also analyzed in this thesis. A second factor could be the different subject groups. While Bohn and Flege analyzed L1 German subjects, this thesis focuses on L1 AE subjects.

6.2.2.5. The vowel /ɪ/

Looking at the vowel maps above (Figure 6 and 7), it can be seen that the range for the German vowel /ɪ/ is slightly higher and more front than for the AE /ɪ/. Therefore, it is expected that the values for beginner L2 learners are higher for F1 and lower for F2 if they use their own L1 category to realize this vowel. This projection, however, cannot be validated, as all speakers realized this vowel within L2 range with the exception of the intermediate and advanced male speakers. They, however, overgeneralized the frontness of the vowel and produced this vowel much more fronted (Higher F2).

Considering this, it can be seen that the group that produced this vowel most nativelike among the male subjects is the beginner speakers. This phenomenon was also found by Major (2001, p. 39), who found in a study he conducted that "the beginning learners performed better than the advanced speakers for the similar sound" (Major, 1987). Nevertheless, it can be said that all speakers realized the subtle difference from the beginning, but hypercorrected the fronting as proficiency level increases. So, while it could be argued that direct transfer, or a "free ride because the learner does not have to acquire anything new", plays a role for beginners, this cannot be said for intermediate and advanced male speakers (Major, 2001, p. 3). This indicates

that the universal component of the OPM takes the place of the L1 to make the pronunciation even less target-like than it would have been with the sole L1 transfer (Figure 2). This vowel is the only vowel of AE and German that can be directly transferred and still be considered native to either language.

6.2.2.6. The vowel /i:/

Since the long vowel /i:/ is also part of the AE vowel repertoire and it is also in a similar vowel space, it is expected that the L1 speakers perform similarly to how they did for /ɪ/, namely reaching target values from the beginning. Interestingly, the results only indicate positive transfer to some degree. All students reach the frontness (roughly have similar F2 values). However, the F1 values indicate that native German speakers produce this vowel even higher than it is the case in AE. None of the male student groups actually reach that level of vowel height. It is therefore clear that this similar vowel seems to cause more inconsistencies than the short counterpart that should be a "free ride" for the students. All female groups produce this vowel within target values, which argues for a clear gender difference and a positive transfer from L1 to L2 for females, even though the results indicate a more closed German pronunciation (lower F1).

That similar vowels are more difficult to perceive and therefore to be able to produce more target-like was first proposed by SLM, which states that marked phenomena are easier to distinguish than similar. In particular, the fourth hypothesis of SLM (H4) accounts for the finding of non-target-like values for very proficient learners, as it states that "[t]he likelihood of phonetic differences between L1 and L2 sounds, and between L2 sounds that are non-contrastive in the Ll, being discerned decreases as AOL increases" (Flege, 1995, p. 239). Crucially, the

OPM seems to be lacking in this perspective. However, there are several factors that play a role in interpreting the Similar Phenomena of OPM. First, the OPM, in general, does not state an exact timeframe for reaching the target values of L2 sound, it just proposes components on how the language acquisition process is developing from the L1, through the IL, towards the L2. Second, the OPM takes learner variation into account, as hypomonitors and hypermonitors will differ in their acquisition process of sounds. Hypermonitors will have better chances of realizing subtle differences, such as the more closed pronunciation of German /i:/ than hypomonitors who do not pay attention to those differences. Along with awareness of a particular sound comes the motivation to acquire the sound and the motivation to listen to subtle differences. As can be seen, the L1 AE male speakers do not approach the F1 target values after the second year, which was also found by Bohn and Flege (1992, p. 152): "continued L2 exposure does not lead to continued phonetic learning beyond a certain point for similar vowels […] due to the workings of the general principle of least effort.[23]" In other words, subjects do not feel the necessity to put more effort into acquiring a certain phonetic segment, as it is sufficient for them to communicate as it is.

Overall, the results of the two vowels (/i:/ and /ɪ/) are consistent with Bohn and Flege (1992, p. 146), as no performance differences were found between beginners and advanced speakers in terms of spectral analyses.

[23] "indicates that people complete tasks by choosing the way of least effort among various options" (Chang, 2016, p. 1)

6.2.2.7. The vowel /u:/

The back rounded vowel of German /u:/ yielded interesting results for the student subjects. While students were familiar with two words (‘Blume’ and ‘nur’), one word was unfamiliar (‘buhlen’). Nevertheless, all students tried to produce the word, which yielded results, none of which were near native range. Interestingly, the overall vowel production was much more fronted than it would be in German. This is a strong indicator for using an existing L1 category. While northern AE speakers produce /u:/ back in the vocal tract, it is much more fronted in the Southern American English varieties of AE. As Allbritten points out: “The back vowels /u/, /ʊ/, and /o/ also move forward in acoustic space. Quite frequently, /u/ tokens are pronounced with such a fronted vowel that they overlap with space for /i/” (Allbritten, 2011, p. 20). This overlapping with /i/ is actually what makes the L2 /u:/ sound like /y:/ to native German speakers.

6.2.2.8. The vowel /ʊ/

Consequently, if Allbritten is correct with her analysis, it would also be true for the short vowel /ʊ/, which in turn would trigger higher F2 values for L2 German than for L1 German speakers. In fact, the results indicate a convincing result. For both vowels the F2 values suggest that L1 dialect indeed plays a role, as both vowels reveal higher F2 values for the student subjects than for the native speakers. Thus, the results of the F2 values for both vowels hint at direct transfer. While the native speakers actually produce /u:/ more back than /ʊ/, the student subjects produce it even more fronted, which is predicted by Figure 9 below. This means, that the students do perceive a categorical difference between the two back vowels. Nonetheless, they assimilate it into their own L1 categories, which they then use to transfer the vowel from L1 to

L2. In Figure 9 below, it can be seen how regular AE vowels are produced in Southern Dialects of AE.

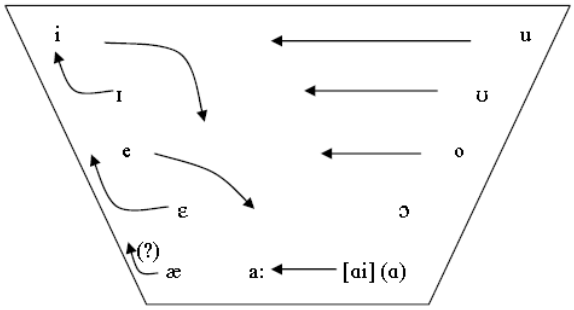


Figure 33: The Vowel Movement in Southern Varieties of AE (Allbritten, 2011, p. 19)

All the results for fronted vowels, like /u:/ and /ʊ/, shed light upon the influence of L1 dialect, which was also observed by Mary Grantham O'Brien and Laura Catharine Smith (2010). This is further explained in the Literature Review (§2). The L1 influence can also be seen in the slow decrease of the L1 in the Similar Phenomena of OPM.

6.2.2.9. The results of the similar vowels

As mentioned in the brief summary of the results in section §4.1.9, a linear progression cannot always be found, which can be rooted in different reasons.

While there is a more fronted L1 vowel for /u:/, speaker variation plays a huge role, as well as gender variation (e.g. for /i:/). Speaker and gender differences can also have their roots in motivation as well as what Major calls "hypomonitor"-ing and "hypermonitor"-ing, which means that learners will either "hardly monitor […] at all" or "monitor […] to the extreme". (Major, 2001, p. 117).

6.2.3. The New Vowels of the L1 AE Speakers

American L2 leaners of German have to acquire five new vowels of German if they want to pronounce German more target-like. Specifically, German has four front rounded vowels, which AE lacks. Therefore, AE L2 learners have to acquire the new vowels through different assimilation techniques. The fifth new vowel is /ɛ:/. This vowel first occurred near the Rhine-river in the 1960's (Pilch, 1966, p. 257) and it is nowadays part of the Standard German. Speakers of Northern varieties of German, however, do not produce this vowel, as it merged with /e:/ in these dialects.

6.2.3.1. The vowel /ɛ:/

While the *similar* vowel /ɛ/ is part of both phonemic inventories of AE and German, the longer equivalent /ɛ:/ is missing in AE. Therefore, this vowel is *new* to L1 AE speakers learning German. This vowel perfectly exemplifies the linear development towards native like proficiency. Subjects approach target values more and more for each year they study German. They are in target range within the 2nd year for the male and 3rd year for the female subjects. A continuous development is explained by the OPM for a marked phenomenon, as the L1 decreases with time, as L2 increases and U increases at first and then decreases again. This means a continuous development towards L2 values can be accounted for, which is suggested by the approaching values.

6.2.3.2. The vowel /ø:/

The *new* front rounded vowel /ø:/ causes several difficulties for learners, especially the beginner and intermediate groups. A reason for the problems could lie in the fact, that this vowel

does not exist in the L1 and therefore the students perceptually assimilate it into the closest L1 category. An explanation for this finding is PAM, which states for the SC (Single-Category Assimilation), two distinct L2 sounds are assimilated into one L1 category, which leads to poor discrimination by the learner. In particular, this vowel was perceptually recognized by beginner and intermediate speaker groups as /o:/ or /u:/. This finding is not surprising, as shown in Strange (2009, p. 1465), where 53% of naïve L1 AE speakers categorized this German vowel into /u:/. Therefore, it can be seen that the students have not created a new L2 category to assimilate the vowel, as they either assimilate it into /o:/ or into the fronted and rounded approximation, but not yet into the new category.

This leads to the conclusion that both male and female beginner and intermediate groups struggle with the pronunciation of this vowel, as it is pronounced more back than is expected from the target language, which agrees with the findings by Strange et. al., who also had subjects who assimilated the front rounded German vowels with back rounded AE vowels (/u:/ and /u/) (2004, p. 1805; 2009, p. 1474). "[T]he authors conclude that front, rounded vowels are assimilated to AE back vowels because AE back vowels include highly fronted allophones. That is, that portion of 'vowel space' occupied by (contrastive) front, rounded vowels in NG and PF has been subsumed by phonologically back, rounded vowels in AE" (Winifred Strange et al., 2009, p. 1475). This statement by Strange agrees with Allbritten's finding of fronted vowels in Southern Dialects of AE.

The most advanced male speakers also struggled with /ø:/, as they did not reach the expected values (F1 and F2). Perhaps that would change with even more exposure to the target language. This struggle to achieve target values is also explained by H4 of SLM and the OPM for marked phenomena (Figure 3), as the U has a major role during stages 3 and 4. The advanced

speakers are at these stages as shown by the formant values. If they do not approach target values at a later stage, the students again follow the principle of the least effort. To find out which principle is in place for this vowel, further (diachronic) investigations of the same subjects would be warranted.

6.2.3.3. The vowel /œ/

The findings for the vowel /œ/ are somewhat similar to the results of /ø:/. However, the crucial difference is that none of the student groups reaches target values, except for the heritage speakers. The beginner and intermediate groups show support for the argument by Strange (2009, p. 1474) that speakers confuse the front rounded German vowels with back rounded AE vowels (2004, p. 1805; 2009, p. 1474). Similarly to /ø:/, the speakers have perceptual difficulties differentiating this vowel from their L1 rounded vowel and even the most proficient speakers produce it in a non-native like fashion. In fact, the formant values suggest that they produce /œ/ with the same vowel quality as /ø:/, consequently realizing two distinct vowels as one (SC of PAM). Interestingly, Strange's results did not reflect the results of the study of this thesis, as 43% of his participants assimilated this vowel into /ɛ/ (2009, p. 1465).

6.2.3.4. The vowel /y/

Another front rounded vowel that has similar implications is the short /y/. If the students behave similarly as for /œ/, we would expect a fast increase of L2, according to the marked phenomena of OPM. However, it is also expected that speakers would have difficulties, in i.e., take a long time, acquiring formant values that are considered within target range. Interestingly,

the results confirm the claim partially (F1 values) but not for F2 values. Instead of assimilating the L2 vowel into an L1 category for back rounded vowels, some students assimilate it to a front unrounded vowel /ɪ/, which is indicated by the large standard deviation. Therefore, this vowel causes an inconsistent pronunciation that is only twice within target range for beginner speakers (Speaker 4; 5). Overall, the results indicate that among intermediate female speakers and beginner male speakers a lot of uncertainties in terms of frontness (F2) are apparent, which is caused by uncertainties regarding perception and the vowel categorization that comes with it. After these stages, the speaker groups are able to approach the target range. However, the advanced male speakers hypercorrect the fronting of the vowel and map it even further away from the expected values than intermediate and beginner groups did. The assimilation study conducted by Strange (2009, p. 1465) revealed that 62% of the naïve speakers assimilated it into the rounded back vowel /ʊ/.

6.2.3.5. The vowel /y:/

Looking at the vowel plot by Kohler (1999, p. 87), it can be seen that the long vowel /y:/ is produced more closed (lower F1 values) and more front (higher F2 values) than /y/, and the values for the native speakers confirm this. Similarly to /y/, a lot of speaker variation causes an inconsistent production of this vowel, especially by the beginner and intermediate groups, as confirmed by the high standard deviation of the F2 values. This indicates that while the above-mentioned observation by Strange (2009, p. 1474) of the assimilation of front rounded L2 vowels to back rounded vowels is true for some speakers, other speakers differ in the perception and assimilate them to front unrounded vowels like /ɪ/. The intermediate speakers reach the target values for frontness. This means that they categorize in the new L2 category that was not existent

in the L1. Similarly to /i:/, the vowel height of the native speakers is not reached by the male subjects for the same reason, namely the principle of the least effort. Speaker variation was also found in Strange's study, where 77% of the listeners assimilated /y:/ into the back rounded vowel /u:/ (Winifred Strange et al., 2009, p. 1465).

6.2.3.6. The results of the *new* vowels

The results of the new vowels yielded a variety of interesting findings. While category formation certainly took place for the assimilation of L2 front rounded vowels, it is not the only reason for the inconsistent results.

As evident in the results and in the discussion of the new vowels, speaker variation plays a major role. This speaker variation is explained by the universals (U) of the Marked Phenomena of the OPM (Major, 2001, p. 107) and the corresponding notion of hypomonitors and hypermonitors (Major, 2001, p. 117), as certain speakers will monitor differences in perception and production, whereas other do not focus on them. The only vowel that showed a linear trajectory towards target values was /ɛ:/. All other *new* vowels were produced inconsistently and with huge variance among speakers, which was unexpected. Therefore, it can be concluded that Flege's SLM claim that new phonetic categories will be more easily acquired cannot be validated. In fact, the SLM as it is (excluding the creation of the opposite SLM) can only account for the results of /ɛ:/, as the L2 learners were able to establish a new phonetic category for this L2 sound that differs phonetically from the closest L1 sound as these bilinguals discerned at least some of the phonetic differences between the L1 and L2 sounds (H2) (c.f. Flege, 1995, p. 239).

6.2.4. The Phonemically Similar, but Phonetically Dissimilar Vowels

An important factor that should be considered when talking about the perceptual task of the student is that while the vowels of this section have a similar phoneme in AE, they differ phonetically in that they are diphthongized. This changes the task for a learner, as he/she indeed has to find a new L2 category to produce the vowel near nativelike proficiency. Therefore, it can be argued that the following two vowels are phonemically *similar*, but phonetically *new* for learners, as it becomes a diphthong, as seen in the vowel chart for diphthongs above (Figure 8).

6.2.4.1. The vowel /e:/

English, in contrast to Cantonese, does have a *similar* vowel to the German vowel /e:/. "The nucleus of /e/ (which is, in reality, usually diphthongal [eɪ] in American English) tends to be backed and lowered so that it approaches the sound of (ay) tokens in Standard English" (Allbritten, 2011, p. 20). This means, while the vowel quality for the German vowel is consistent throughout the production of the vowel, "[…] there is a clear movement of the tongue [in English], producing an off-glide towards the end of the articulation of the vowel" (Roccamo, 2014, p. 42). Therfore, for a student to produce this vowel with target-like values, he/she needs to pronounce the monophthongized German vowel excluding any offglide. Also, Strange (2009, p. 1466) found in his study that 85% of naïve L1 AE speakers will categorize the German vowel /e:/ to /eɪ/, which supports the claim that it is a *new* vowel for L2 German learners.

This vowel caused a lot of variation in the results. Ten learners switched their language mode to English when reading the token 'Beeren' (*berries*). The students were instructed to skip token that were unfamiliar, yet every one of the subjects at least tried to produce this token with

a German language mood. Ventura et. al. realize that this is not the easiest task for L2 learners as "spoken word recognition is influenced by orthography" (e.g. Goswami, Ziegler, & Richardson, 2005; Ventura, Morais, Pattamadilok, & Kolinsky, 2004, p. 58). Therefore, an accurate L2 German vowel production measurement cannot be done including this token. To confirm the finding of the English mode in this token, further phonetic analysis is warranted. Ehresmann and Bousquette (2015, p. 248) found in their study on phonological non-integration of lexical borrowings in Wisconsin West Frisian that an English retroflex approximant /ɹ/ in West Frisian argues for English mode. This would also be the case in this example if the students kept the English mode while pronouncing L1 [be:rən] as [bi:ɹən].

Consequently, the second table of /e:/ is relevant (Table 20), which only includes the second token 'fehlen'. The results show that when English orthography is not realized by the learners, then the male speakers will hit the target range within in the second year of language instruction in terms of F2 values, but not for F1, whereas the female students miss the target values for the F1 and F2 during the intermediate stage. The only female group that is within range for both values are the heritage speakers. Another important factor to consider when interpreting Table 20, is the standard deviation, which are high for intermediate and advanced female speakers and beginner, intermediate and advanced male speakers. These standard deviations are important to account for variance within a group, which consequently means that groups (beginner (male); intermediate (male & female); advanced (male and female) with high F2 standard deviations pronounce a vowel, and in particular the vowel /e:/, inconsistently in terms of frontness. The results including the standard deviation suggest that this phonemically *similar* vowel is subject to speaker variation. Whereas the female groups seem to take a long time to acquire the target values (and given that heritage speakers are not L2 learners by

definition, they actually never reach the target values, according to this data). The female speakers did not create a new L2 category, as they did not perceptually realize the phonetic differences. Instead, they assimilated the vowel into an existing L1 category. The male speakers, by contrast, seem to be able to recognize and consequently produce the *similar* vowel much faster by mapping it into a new mental acoustic territory.

6.2.4.2. The vowel /o:/

The vowel /o:/ is a comparable to /e:/ since it is a *similar* vowel, following the overlapping IPA symbols, indicating that it is one phoneme. However, the vowel is phonetically diphthongized to /oʊ/. Therefore, a simple claim following the SLM or any other language learning model cannot be made. Instead, it seems likely that even though the vowel is *similar*, students will have to regard the vowel as *new* when categorizing the L2 vowel. This goes hand in hand with the "marked phenomena of the OPM", which sees a sudden rise in the L2 from the beginning. Spectral analyses results of the vowel /o:/ are similar for males and females. A linear improvement towards target range can be seen as years of instruction increase. However, vowel height is never within target range for the observed student subjects, with the exception of the heritage speakers. The explanation for this finding is the same like for /ɛ:/, as marked phenomena of OPM predict a fast increase of L2. The German vowel /o:/ is very interesting for English speakers, as it is diphthongized in their L1. This means, while the vowel quality for the German vowel is consistent throughout the production of the vowel, it changes for the AE variant. Just like for /e:/, L2 learners of German need to produce this vowel without any offglide. Strange found that even more naïve speakers categorize the German vowel /o:/ to AE /oʊ/ (98%) (Winifred Strange et al., 2009, p. 1465).

6.2.4.3. Categorization of /u:/

Lastly, it is uncertain whether also the German vowel /u:/ could even be categorized as phonemically *similar*, but phonetically *new*, as the L1 Southern American English dialect is fronted. Thus it would seem reasonable to argue for a new category of /u:/ for L1 Southern American English dialect speakers.

6.2.4.4. The results of the phonemically similar, but phonetically dissimilar vowels

If the results of these two vowels, as mentioned above, are to be compared to the new and similar vowels prior to this section, it becomes evident that /e:/ and /o:/ pattern much more like *new* vowels than *similar*. Not only are the overall results less target-like than for similar vowels, but the results also show that speaker variation plays a prominent role. The same claims as for new vowels regarding OPM and SLM can be made for these vowels, namely that the marked phenomena including the U is able to account for the findings, while the SLM cannot.

Summarizing the findings of the different student subjects, it becomes clear that not every language learning model introduced earlier, can account for the production and perception of L2 sounds. Strikingly, the OPM is the only model that does not see the only reason for errors and non-target-like acquisition in the L1 transfer. Instead, the OPM considers the IL, which includes universals that can account for speaker differences whether these are of developmental, motivational or linguistic nature (e.g. not all languages of adjectives) (Major, 2001, p. 3). Moreover, general claims regarding the linear progression cannot be made for all vowels. Therefore, these results shed light upon teaching implications, which instructors should keep in

mind while teaching different levels of a second language. The next chapter of this thesis will propose ideas and reflect on existing literature on pronunciation pedagogy.

7. PEDAGOGICAL IMPLICATIONS

Following the discussion in the previous section, it is clear that the general claim is that with longer exposure to the second language, proficiency will improve and approach target values.

While this is partially the case, especially for the *similar* vowels, *new* vowels do not provide consistent evidence to support that argument. In particular, it must be noted that speaker diversity played a tremendous role for *new* and *phonetically new* vowels and therefore it cannot be predicted that a speaker group is better at *new* vowels, while the other is better at *similar* vowels. Consequently, these results shed light upon what to teach when in terms of pronunciation.

Keeping previous studies on pronunciation pedagogy (e.g. Counselman, 2010; O'Brien, 2004; Roccamo, 2014) in mind, it is clear that instructors should start teaching pronunciation as early as possible. This goes hand in hand with the cognitive load theory (CLT), which "is mainly concerned with the learning of complex cognitive tasks, where learners are often overwhelmed by the number of information elements and their interactions that need to be processed simultaneously before meaningful learning can commence" (Paas, Renkl, & Sweller, 2004, p. 1).

So while the cognitive load is low at the beginning of the SLA process, the L2 learners will be able to focus on pronunciation. However, at a later point, students will have to focus on many other aspects of a language (e.g. grammar and pragmatics). Consequently, if they have not acquired part of the target pronunciation early on, they may not be able to master it later, as the cognitive load of learning more intensive (grammar) instruction might overwhelm a speaker's ability to attend to pronunciation. Teaching pronunciation early will provide the students with a

base of the phonetic setup of the language that they will always be able to come back to, even when learning other parts of the foreign language. Keeping the basic principle, “the earlier the better” in mind, it also seems necessary to reiterate pronunciation through pronunciation practices at later stages, so that vowels (whether *new* or *similar*) can still improve towards native like proficiency and not be forgotten by the learner.

Results of the current study indicated that at times advanced students pronounced *new* sounds worse than in the earlier stages (e.g. /øː/ and /œ/ for male speakers). Knowing that the students will become worse again at a later stage of acquisition can be very valuable to the instructor, as he/she can practice pronunciation then.

Furthermore, the instructor can then focus on specific segments. Such an explicit pronunciation training can be conducted to practice intonation, pragmatics, to identify L1/L2 differences and similarities, to practice recurring pronunciation difficulties (c.f. Shrum & Glisan, 2009, p. 337). Certain vowels, for example vowels that seem to cause more difficulties than others, e.g. /øː/ and /œ/ for male speakers, are vowels that need to be addressed by the teacher. Another reason for the boomerang effects, which sees beginner speakers producing segments more target-like than advanced, could be that students at later stages emphasize suprasegmental phonology more than single sounds (segmental phonology). Another reason can be the process of restructuring, which is also part of the cognitive psychological approach like CLT. Mclaughlin argues that, “practice can lead to improvement in performance as sub-skills become automated, but it is also possible for increased practice to create conditions for restructuring, with attendant decrements in performance as learners reorganize their internal representational framework” (Mclaughlin, 1990, p. 113). This framework explains why there can be a boomerang effect in performance, which is shaped like a U-curve, first declining “as more complex internal

representations [here: the grammar, or any other part of the language that is part of the later acquisition process] replace less complex ones [here: the production of vowels], and [later] increasing again as skill becomes expert" (Mclaughlin, 1990, p. 113).

However, later learners will perhaps focus even less on the pronunciation if they focus on grammatically correct sentences rather than pronunciation, which is another argument to take CLT into consideration. Additionally to keeping the mental capacity of the learner in mind, the instructor also has to consider the L1 and the L1 dialect of the learner, as certain segments are produced differently in other areas, as mentioned above in the discussion section (e.g. overlap of similar and new vowels of Cantonese and German vs. the overlap of German and English vowel inventories; or also the L1 Southern American English dialect, that shows a more fronted /u:/ than anywhere else in AE).

Another factor to consider while teaching pronunciation is the L2 input, which is crucial to be able to pronounce sounds like native speakers of a given second language. "Acquisition occurs only when learners receive an optimal quantity of comprehensible input that is interesting, a little beyond their current level of competence (*i* +1)" (Shrum & Glisan, 2009, p. 15). Authentic input, consequently, will lead to more authentic acquisition. To extend this point, foreign exchange or study abroad programs and long exposure to the authentic native language will help the students to acquire the speech sounds, as well as speech patterns (like intonation and stress). While O'Brien and Manning's study found that students do not improve "for difficult sounds in a short period of time" through study abroad (O'Brien & Manning, 2013, p. 41), other studies have found more rapid pronunciation development for students participating in a SA, in contrast to those studying in their home country (e.g. O'Brien, 2003).

It should also be noted, that not every study abroad is the same. Speaker 17 went on two study abroad trips to Germany and while she was exposed to the German language for both scenarios, she noted that she spoke much more German when she had to. That is to say, for the one study abroad trip, which was organized by the *Pädagogische Austauschdienst* (PAD - German Student Exchange Program), she had to speak German to all the other participants as they were from around the world.

Furthermore, the results seemed to indicate an interesting finding. Though it cannot be determined to which degree and why these differences occurred, it seems reasonable to assume that gender differences play a role in the acquisition and L2 production of vowels (e.g. /y/; /y:/; /i:/). As mentioned in the discussion section, hypermonitoring and hypomonitoring play a role. However, this does not explain why males performed more target-like for F2 values, while females performed more target-like F1 values for /y:/.

Nevertheless, the results revealed that there are certain vowels that can be more easily acquired than others. On the one hand, it sheds light upon what teachers can expect from the student with a certain L1 background. On the other hand, the results also showed which vowels require more training to acquire. While this current study was a synchronic study, observing five different levels (beginner, intermediate, advanced, heritage and native speakers), it tried to create a longitudinal picture of which phases a student has to undergo to reach native-like competency.

8. CONCLUSION

The goal of this thesis was to show how American university students produce L2 sounds, in particular vowels. Vowels are chosen for the segmental analysis of second language production studies, as mispronunciation of them can lead to comprehension difficulties that may lead to misunderstandings on what was meant to be said in contrast to what was actually said. Furthermore, the spectral analysis of vowels through formant values and vowel duration is more straightforward than the analysis for consonants. The study analyzed 21 American English students of German as a second language enrolled in various levels of German through which they were classified in this thesis. One subject was a Chinese student with an L1 of Cantonese. The production results were analyzed individually and also per group and then compared to target values, which came from recordings conducted in December 2015 of native speakers of German in Germany. This was done to minimize the influence of other languages on production.

Results of the current study revealed compelling differences between groups of speakers and vowels that were produced. Overall, similar vowels yielded more rapid acquisition of target-like production, while new vowels caused a lot of speaker diversity. Furthermore, results indicated that certain vowels were not acquired with target values by any students group. While the vowel /ɛ:/ showed a linear trajectory towards target-like proficiency, German front rounded vowels did not (/y/; /y:/; /ø:/; /œ/). A reason for the wide range of production for these vowels is the L1 vowel categorization which can be accounted for by the high standard deviation of the F2 values. Additionally, vowel durations measurement yielded similar results. New vowels caused more

variation, whereas similar vowels showed more target-like duration from the beginner level onwards.

Furthermore, this thesis aimed to provide direct support for the OPM, as previous studies have not been able to do so. Major (c.f. 2001, p. 92) claims that studies need to be longitudinal and include different proficiency levels so that stages can be determined. As mentioned above, the study, though it is not longitudinal, tried to connect synchronic results to draw a longitudinal progression picture. Additionally, the study includes different proficiency levels and therefore offers a missing link between the OPM and the determination of stages. While other studies have delved into the features of suprasegmental, the main goal for this project was to assess how students produce certain vowels and how (long) these are influenced by the native language.

Having presented and discussed the findings of the study in the previous chapters, it becomes clear that the research question posed in the introduction of thesis needs to be revisited.

1. "Can adults learn foreign language (L2) sounds [, specifically vowels during the course of the University career]?" (Bohn & Flege, 1992, p. 132)

While the general principle that more input and consequently longer exposure to the target language leads to more target-like acquisition can be seen in the production results of some vowels, it can certainly not be seen in all of them. In fact, the majority of the vowels showed a speaker variation that does not confirm this principle. Therefore, it seems reasonable that instructors could try to focus more on vowels that seem to be more difficult to acquire, as they cause recurring pronunciation difficulties (c.f. Shrum & Glisan, 2009, p. 337).

2. "Is their success or failure to do so explicable in terms of sound correspondences between the native language (L1) and the L2?" (Bohn & Flege, 1992, p. 132).

The answer to this question is relatively straightforward: Yes! While this is not a sufficient answer, it indicates that sounds that are not acquired with target-values are influenced by L1 sounds, as can be seen with the *similar* as well as the *new* vowels. L1 categories were often utilized to produce an L2 vowel. The language model by Major (2001) can not only account for the speaker variation, but also for the results of the *new* and *similar* vowels through its subdivision of marked and similar phenomena of OPM. Interestingly, the similar phenomena of the OPM states that the L1 is persistent for a longer period, than it is for the marked phenomena. If this claim is to be projected on the production results of /u:/ and /ʊ/, then it appears that the L1 still has its impact for advanced speakers, as they produce the vowels more fronted than expected by the target values. This, however, could also be explained by the L1 influence of the Southern varieties of American English.

3. Will the results of the different student groups indicate differences in categorization of L2 vowels?

Though at the start of the study it was expected that categorization differences occur, this cannot be validated across all vowels. In fact, the results of the front rounded vowels indicate that all speaker groups are not within target range for at least one of the formant values and that therefore, they categorized the vowel similarly.

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APPENDICES

Protocol of Study / Stimuli

Lieber/Liebe [NAME],

Hallo, ich bin Robert Klosinski und ich möchte dich zum Interview begrüßen.

Hello, my name is Robert Klosinski and I'd like to welcome to the interview.

First of all, thank you very much for taking the time to participate in the study and being part of my master research. Please read the Consent Form carefully and ask any questions that you may have.

As we get started, I would just like to ask you a little bit about yourself. And if we could do this in German, that will be best for the tasks that follow.

1.	Wie heißt du?	What's your name?
2.	Wie alt bist du?	When were you born? /How old are you?
3.	Wo wurdest du geboren?	Where were you born?
4.	Wie lange lebst du schon in Georgia?	How long have you lived in Georgia?
5.	Wo hast du noch gelebt, neben Georgia?	Have you lived anywhere besides Georgia?
6.	Hast du deutsche Vorfahren (Heritage)?	Do you have any German heritage?
7.	Hattest du Deutsch in der High School, oder bevor du zur UGA kamst?	Did you have any German in High School, or before coming to UGA?
8.	Welche Deutschkurse belegst du zurzeit?	Are you currently enrolled in German here at UGA? If so, which course(s)?
9.	Welche höheren Kurse hast du schon belegt? Wurden diese in Deutsch unterrichtet?	Which higher classes did you take? Were they taught in German?
10.	Sprichst du noch andere Sprachen, als Deutsch und Englisch?	Do you speak any other languages besides German or English?

Next, I would like you to read the following sentences aloud.

Here is an example:

“Kannst du Autonomie nochmal sagen?“

Now please read the following list, one after another. If you are unfamiliar with the token, please skip it:

token produced by subjects, * denotes distractor item	‘Can you say [token] again?’
1. Kannst du hart nochmal sagen?	hard
2. Kannst du Blume nochmal sagen?	flower
3. *Kannst du Braunschweig nochmal sagen?	Braunschweig
4. Kannst du Glas nochmal sagen?	glas
5. Kannst du Bären nochmal sagen?	bears
6. Kannst du Wald nochmal sagen?	forest
7. Kannst du still nochmal sagen?	still
8. *Kannst du Stau nochmal sagen?	Stau
9. Kannst du füllen nochmal sagen	to till
10. Kannst du kalt nochmal sagen?	cold
11. Kannst du Wolle nochmal sagen	wool
12. Kannst du Bett nochmal sagen?	bed
13. *Kannst du Handy nochmal sagen?	Handy
14. Kannst du Stiehl nochmal sagen?	stick
15. Kannst du Stadt nochmal sagen?	city
16. Kannst du blöd nochmal sagen?	dumb
17. Kannst du Käse nochmal sagen	cheese
18. *Kannst du Maus nochmal sagen?	Maus
19. Kannst du Beeren nochmal sagen?	berries
20. Kannst du Hölle nochmal sagen?	hell
21. Kannst du Städte nochmal sagen?	cities
22. *Kannst du Berlin nochmal sagen?	Berlin
23. Kannst du fühlen nochmal sagen?	feel
24. *Kannst du Auto nochmal sagen?	Auto
25. Kannst du fehlen nochmal sagen?	missing

26. *Kannst du Volkswagen nochmal sagen?	Volkswagen
27. Kannst du Fluss nochmal sagen?	river
28. Kannst du viel nochmal sagen?	much
29. Kannst du buhlen nochmal sagen	to tout for
30. Kannst du wohl nochmal sagen?	rather
31. Kannst du nur nochmal sagen?	only
32. Kannst du toll nochmal sagen?	great
33. *Kannst du Computer nochmal sagen?	Computer
34. Kannst du Haar nochmal sagen?	hair
35. Kannst du null nochmal sagen?	null

Thank you for reading this. Finally, I have a few more questions which you can respond to in English:

1. Do you intend to have German as a Major or Minor?
2. Have you been to a German-speaking country?
3. Did you do a study abroad there?
4. Has your instructor explicitly taught the pronunciation of German?
5. Has your teacher explicitly taught the pronunciation of German? If so, what sorts of activities did you do? Was he/she a native speaker? What about here at the University?
6. What do you think has helped you more with your pronunciation? (eg. study abroad experience, class room exercises, others)
7. Where do you see yourself in the future?
8. Do you prefer reading and writing in the German language or speaking?

Now I'd like to ask you to rate the following statements from 1 (low) through 5 (high).

9. Importance to sound like a native speaker of German
10. Motivation to earn a high degree of proficiency in German
11. Native-likeness of your own proficiency of German

Thank you for taking your time to participate in this study; I really appreciate you taking the time. If you have any questions about the study at this point, I would entertain them now. And certainly, please feel free to contact me or the Principle Investigator in the future.

Thanks again, and have a wonderful day!

Individual Speaker Production Results – Formant Values

File name	word	vowel	F1-mid	F2-mid	F3-mid	gender	age
word_list_speaker_6_F__20_1001	Stadt	a	813.621	1441.601	3069.254	F	20
word_list_speaker_6_F__20_1001	hart	a	833.955	1529.469	3078.223	F	20
word_list_speaker_6_F__20_1001	Wald	a	842.172	1308.054	3067.675	F	20
word_list_speaker_6_F__20_1001	kalt	a	850.345	1633.935	2757.033	F	20
word_list_speaker_6_F__20_1001	Glas	a:	820.347	1643.529	3195.644	F	20
word_list_speaker_6_F__20_1001	Haar	a:	926.344	1285.839	3148.804	F	20
word_list_speaker_6_F__20_1001	toll	ɔ	450.776	891.36	3247.487	F	20
word_list_speaker_6_F__20_1001	Wolle	ɔ	527.669	1004.08	3142.513	F	20
word_list_speaker_6_F__20_1001	Beeren	e:	405.626	2709.69	3246.302	F	20
word_list_speaker_6_F__20_1001	fehlen	e:	523.592	2152.653	2884.152	F	20
word_list_speaker_6_F__20_1001	Städte	ɛ	811.19	1992.73	3127.907	F	20
word_list_speaker_6_F__20_1001	Bett	ɛ	815.244	1921.28	3018.068	F	20
word_list_speaker_6_F__20_1001	Bären	ɛ:	785.056	1971.992	2846.51	F	20
word_list_speaker_6_F__20_1001	Käse	ɛ:	835.17	1822.091	2852.526	F	20
word_list_speaker_6_F__20_1001	still	ɪ	387.824	2514.818	3232.061	F	20
word_list_speaker_6_F__20_1001	stiehl	i:	392.493	2472.584	3128.809	F	20
word_list_speaker_6_F__20_1001	viel	i:	422.888	2734.571	3303.45	F	20
word_list_speaker_6_F__20_1001	wohl	o:	520.135	895.875	3538.68	F	20
word_list_speaker_6_F__20_1001	blöd	ø:	431.977	1356.971	2094.557	F	20
word_list_speaker_6_F__20_1001	Hölle	œ	406.035	1713.659	2730.474	F	20
word_list_speaker_6_F__20_1001	null	ʊ	268.998	653.705	1636.823	F	20
word_list_speaker_6_F__20_1001	Fluss	ʊ	452.524	1153.631	2224.832	F	20
word_list_speaker_6_F__20_1001	Blume	u:	255.388	1115.549	1847.65	F	20
word_list_speaker_6_F__20_1001	buhlen	u:	413.888	1370.571	2306.713	F	20
word_list_speaker_6_F__20_1001	nur	u:	428.421	708.23	3693.8	F	20
word_list_speaker_6_F__20_1001	füllen	y	412.372	2556.927	3369.152	F	20
word_list_speaker_6_F__20_1001	fühlen	y:	394.869	2123.617	3182.405	F	20
word_list_speaker_1_M_18_1001	Wald	a	541.871	1108.851	3175.039	M	18

word_list_speaker_1_M_18_1001	kalt	a	660.132	1152.496	2992.678	M	18
word_list_speaker_1_M_18_1001	Stadt	a	785.957	1521.339	1660.422	M	18
word_list_speaker_1_M_18_1001	hart	a	818.38	1440.972	2576.058	M	18
word_list_speaker_1_M_18_1001	Haar	a:	686.461	1313.748	2719.56	M	18
word_list_speaker_1_M_18_1001	Glas	a:	876.587	1591.665	2809.922	M	18
word_list_speaker_1_M_18_1001	toll	ɔ	490.646	729.761	2950.716	M	18
word_list_speaker_1_M_18_1001	Wolle	ɔ	556.225	1113.505	2914.152	M	18
word_list_speaker_1_M_18_1001	Beeren	e:	380.093	2550.584	3140.239	M	18
word_list_speaker_1_M_18_1001	fehlen	e:	532.367	1895.551	2918.312	M	18
word_list_speaker_1_M_18_1001	Bett	ɛ	655.343	1859.686	2046.619	M	18
word_list_speaker_1_M_18_1001	Städte	ɛ	735.009	1547.167	2402.159	M	18
word_list_speaker_1_M_18_1001	Käse	ɛ:	555.769	2406.803	2954.271	M	18
word_list_speaker_1_M_18_1001	Bären	ɛ:	577.832	1872.873	3031.907	M	18
word_list_speaker_1_M_18_1001	still	ɪ	436.754	1881.299	3024.724	M	18
word_list_speaker_1_M_18_1001	viel	i:	321.574	2601.764	2891.642	M	18
word_list_speaker_1_M_18_1001	stiehl	i:	415.067	2555.691	2927.096	M	18
word_list_speaker_1_M_18_1001	wohl	o:	566.555	901.825	2741.508	M	18
word_list_speaker_1_M_18_1001	blöd	ø:	359.853	1685.441	2838.011	M	18
word_list_speaker_1_M_18_1001	Hölle	œ	366.271	1491.589	2822.444	M	18
word_list_speaker_1_M_18_1001	null	ʊ	380.407	1581.632	2856.104	M	18
word_list_speaker_1_M_18_1001	Fluss	ʊ	310.718	1269.51	2753.216	M	18
word_list_speaker_1_M_18_1001	Blume	u:	242.334	1137.753	2779.655	M	18
word_list_speaker_1_M_18_1001	buhlen	u:	458.434	1251.298	2906.37	M	18
word_list_speaker_1_M_18_1001	nur	u:	523.626	1875.736	2829.464	M	18
word_list_speaker_1_M_18_1001	füllen	y	281.655	2602.481	2900.008	M	18
word_list_speaker_1_M_18_1001	fühlen	y:	301.968	2549.987	2989.011	M	18
word_list_speaker_2_M_18_1001	Wald	a	630.68	1019.774	2183.481	M	18
word_list_speaker_2_M_18_1001	hart	a	637.774	1187.036	1892.024	M	18
word_list_speaker_2_M_18_1001	kalt	a	694.045	1093.521	2177.543	M	18
word_list_speaker_2_M_18_1001	Stadt	a	710.945	1264.195	2255.148	M	18

word_list_speaker_2_M_18_1001	Glas	a:	668.626	1107.607	2184.145	M	18
word_list_speaker_2_M_18_1001	Haar	a:	774.496	1198.435	2078.489	M	18
word_list_speaker_2_M_18_1001	toll	ɔ	466.591	933.902	2130.749	M	18
word_list_speaker_2_M_18_1001	Wolle	ɔ	478.039	924.496	2138.323	M	18
word_list_speaker_2_M_18_1001	Beeren	e:	342.323	1933.604	2388.583	M	18
word_list_speaker_2_M_18_1001	fehlen	e:	556.775	1456.4	2218.552	M	18
word_list_speaker_2_M_18_1001	Bett	ɛ	581.848	1699.602	2557.523	M	18
word_list_speaker_2_M_18_1001	Städte	ɛ	726.493	1125.324	2315.056	M	18
word_list_speaker_2_M_18_1001	Käse	ɛ:	652.691	1271.169	2081.897	M	18
word_list_speaker_2_M_18_1001	Bären	ɛ:	664.187	1111.518	2178.91	M	18
word_list_speaker_2_M_18_1001	still	ɪ	370.832	1627.357	2353.184	M	18
word_list_speaker_2_M_18_1001	stiehl	i:	344.813	1780.736	2100.374	M	18
word_list_speaker_2_M_18_1001	viel	i:	356.266	1834.881	2177.152	M	18
word_list_speaker_2_M_18_1001	wohl	o:	389.368	522.926	2110.477	M	18
word_list_speaker_2_M_18_1001	blöd	ø:	281.065	866.597	1989.401	M	18
word_list_speaker_2_M_18_1001	Hölle	œ	660.491	1033.322	2248.48	M	18
word_list_speaker_2_M_18_1001	Fluss	ʊ	276.062	1010.337	1950.517	M	18
word_list_speaker_2_M_18_1001	null	ʊ	350.92	1317.009	2068.776	M	18
word_list_speaker_2_M_18_1001	Blume	u:	305.672	1065.857	2205.37	M	18
word_list_speaker_2_M_18_1001	buhlen	u:	275.554	884.537	2014.724	M	18
word_list_speaker_2_M_18_1001	nur	u:	371.667	1368.594	2045.65	M	18
word_list_speaker_2_M_18_1001	füllen	y	283.066	765.092	2021.233	M	18
word_list_speaker_2_M_18_1001	fühlen	y:	301.691	868.799	2067.503	M	18
word_list_speaker_3_M_18_1001	Wald	a	578.866	998.549	2652.304	M	18
word_list_speaker_3_M_18_1001	kalt	a	620.692	1035.424	2631.661	M	18
word_list_speaker_3_M_18_1001	hart	a	634.94	1125.629	2419.675	M	18
word_list_speaker_3_M_18_1001	Stadt	a	679.892	1188.853	2179.028	M	18
word_list_speaker_3_M_18_1001	Haar	a:	614.948	1092.961	2245.28	M	18
word_list_speaker_3_M_18_1001	Glas	a:	683.491	1099.828	2581.604	M	18
word_list_speaker_3_M_18_1001	Wolle	ɔ	410.374	785.772	2565.85	M	18

word_list_speaker_3_M_18_1001	toll	ɔ	455.909	887.692	2491.878	M	18
word_list_speaker_3_M_18_1001	Beeren	e:	273.9	2206.062	2726.976	M	18
word_list_speaker_3_M_18_1001	fehlen	e:	453.327	1897.652	2237.999	M	18
word_list_speaker_3_M_18_1001	Städte	ɛ	452.873	2011.555	2595.708	M	18
word_list_speaker_3_M_18_1001	Bett	ɛ	553.954	1615.011	2222.107	M	18
word_list_speaker_3_M_18_1001	Käse	ɛ:	419.04	1995.961	2292.73	M	18
word_list_speaker_3_M_18_1001	Bären	ɛ:	453.963	1855.678	2498.237	M	18
word_list_speaker_3_M_18_1001	still	ɪ	366.29	1735.066	2555.018	M	18
word_list_speaker_3_M_18_1001	stiehl	i:	280.167	2285.445	2754.668	M	18
word_list_speaker_3_M_18_1001	viel	i:	308.844	2146.558	2664.1	M	18
word_list_speaker_3_M_18_1001	wohl	o:	434.44	860.644	2565.97	M	18
word_list_speaker_3_M_18_1001	blöd	ø:	420.887	1002.164	2496.734	M	18
word_list_speaker_3_M_18_1001	Hölle	œ	328.683	1097.924	2370.509	M	18
word_list_speaker_3_M_18_1001	Fluss	ʊ	308.401	1124.492	2379.497	M	18
word_list_speaker_3_M_18_1001	null	ʊ	462.795	1141.512	2456.125	M	18
word_list_speaker_3_M_18_1001	buhlen	u:	301.983	891.924	2338.941	M	18
word_list_speaker_3_M_18_1001	Blume	u:	306.38	1135.245	2403.557	M	18
word_list_speaker_3_M_18_1001	nur	u:	308.561	1130.848	2382.912	M	18
word_list_speaker_3_M_18_1001	füllen	y	291.686	737.46	2339.318	M	18
word_list_speaker_3_M_18_1001	fühlen	y:	297.045	838.725	2374.824	M	18
word_list_speaker_4_M_18_1001	Stadt	a	624.208	1178.06	2054.872	M	18
word_list_speaker_4_M_18_1001	Wald	a	624.797	1002.815	2118.262	M	18
word_list_speaker_4_M_18_1001	kalt	a	633.853	950.281	2093.276	M	18
word_list_speaker_4_M_18_1001	hart	a	704.093	1224.206	2149.129	M	18
word_list_speaker_4_M_18_1001	Haar	a:	531.704	1009.287	2036.982	M	18
word_list_speaker_4_M_18_1001	Glas	a:	685.517	1297.463	2116.951	M	18
word_list_speaker_4_M_18_1001	Wolle	ɔ	347.956	1130.377	2644.36	M	18
word_list_speaker_4_M_18_1001	toll	ɔ	409.128	789.795	2581.273	M	18
word_list_speaker_4_M_18_1001	Beeren	e:	341.151	1858.978	2340.222	M	18
word_list_speaker_4_M_18_1001	fehlen	e:	444.392	1811.711	2360.489	M	18

word_list_speaker_4_M_18_1001	Städte	ɛ	375.326	1941.807	2533.024	M	18
word_list_speaker_4_M_18_1001	Bett	ɛ	487.89	1521.311	2466.065	M	18
word_list_speaker_4_M_18_1001	Käse	ɛ:	342.801	1967.064	2629.816	M	18
word_list_speaker_4_M_18_1001	Bären	ɛ:	503.046	1587.898	2304.371	M	18
word_list_speaker_4_M_18_1001	still	ɪ	406.526	1634.948	2580.921	M	18
word_list_speaker_4_M_18_1001	viel	i:	289.041	2018.263	2613.683	M	18
word_list_speaker_4_M_18_1001	stiehl	i:	290.396	2112.155	2928.307	M	18
word_list_speaker_4_M_18_1001	wohl	o:	446.791	936.698	2321.375	M	18
word_list_speaker_4_M_18_1001	blöd	ø:	365.998	1384.72	1963.518	M	18
word_list_speaker_4_M_18_1001	Hölle	œ	415.99	1187.559	1506.592	M	18
word_list_speaker_4_M_18_1001	null	ʊ	278.184	980.778	2036.565	M	18
word_list_speaker_4_M_18_1001	Fluss	ʊ	338.474	1324.272	2373.241	M	18
word_list_speaker_4_M_18_1001	buhlen	u:	380.394	1248.983	1993.066	M	18
word_list_speaker_4_M_18_1001	Blume	u:	352.829	1373.019	2495.352	M	18
word_list_speaker_4_M_18_1001	nur	u:	406.52	1324.654	1774.178	M	18
word_list_speaker_4_M_18_1001	füllen	y	369.346	1052.315	2079.838	M	18
word_list_speaker_4_M_18_1001	fühlen	y:	378.598	1321.164	1660.26	M	18
word_list_speaker_5_M_21_1001	Wald	a	527.379	906.36	2576.378	M	21
word_list_speaker_5_M_21_1001	kalt	a	709.952	988.863	2457.565	M	21
word_list_speaker_5_M_21_1001	hart	a	724.643	1063.868	2427.252	M	21
word_list_speaker_5_M_21_1001	Stadt	a	820.698	1054.894	2437.085	M	21
word_list_speaker_5_M_21_1001	Haar	a:	683.959	1237.622	2263.965	M	21
word_list_speaker_5_M_21_1001	Glas	a:	777.65	1131.227	2331.163	M	21
word_list_speaker_5_M_21_1001	Wolle	ɔ	382.01	678.592	2814.011	M	21
word_list_speaker_5_M_21_1001	toll	ɔ	431.753	798.874	2612.45	M	21
word_list_speaker_5_M_21_1001	Beeren	e:	276.78	2202.976	2663.284	M	21
word_list_speaker_5_M_21_1001	fehlen	e:	294.126	2187.041	2342.656	M	21
word_list_speaker_5_M_21_1001	Bett	ɛ	448.343	1861.368	2672.805	M	21
word_list_speaker_5_M_21_1001	Städte	ɛ	707.338	1281.536	2448.117	M	21
word_list_speaker_5_M_21_1001	Käse	ɛ:	606.871	1318.23	2252.085	M	21

word_list_speaker_5_M_21_1001	Bären	ɛ:	812.695	1439.676	2237.187	M	21
word_list_speaker_5_M_21_1001	still	ɪ	309.689	2063.846	2575.475	M	21
word_list_speaker_5_M_21_1001	stiehl	i:	278.028	2331.202	3169.809	M	21
word_list_speaker_5_M_21_1001	viel	i:	296.685	2148.277	2539.257	M	21
word_list_speaker_5_M_21_1001	wohl	o:	448.333	712.341	2638.943	M	21
word_list_speaker_5_M_21_1001	blöd	ø:	363.273	1233.252	2380.83	M	21
word_list_speaker_5_M_21_1001	Hölle	œ	473.292	790.35	2608.682	M	21
word_list_speaker_5_M_21_1001	null	ʊ	301.546	1437.744	2361.415	M	21
word_list_speaker_5_M_21_1001	Fluss	ʊ	360.589	1270.767	2416.912	M	21
word_list_speaker_5_M_21_1001	buhlen	u:	291.24	1037.605	2289.806	M	21
word_list_speaker_5_M_21_1001	Blume	u:	352.45	1102.343	2393.725	M	21
word_list_speaker_5_M_21_1001	nur	u:	390.185	1111.407	2409.15	M	21
word_list_speaker_5_M_21_1001	füllen	y	346.543	1119.075	2476.614	M	21
word_list_speaker_5_M_21_1001	fühlen	y:	300.263	1602.105	2304.253	M	21
word_list_Speaker_10_19_F_2002	kalt	a	690.663	1102.568	2771.138	F	19
word_list_Speaker_10_19_F_2002	hart	a	747.207	1397.748	2381.289	F	19
word_list_Speaker_10_19_F_2002	Wald	a	753.155	1113.194	3109.832	F	19
word_list_Speaker_10_19_F_2002	Stadt	a	837.395	1356.796	2558.515	F	19
word_list_Speaker_10_19_F_2002	Haar	a:	791.044	1247.498	2337.274	F	19
word_list_Speaker_10_19_F_2002	Glas	a:	835.441	1289.168	2612.026	F	19
word_list_Speaker_10_19_F_2002	Wolle	ɔ	587.413	1018.672	3110.307	F	19
word_list_Speaker_10_19_F_2002	toll	ɔ	633.84	822.631	3154.841	F	19
word_list_Speaker_10_19_F_2002	Beeren	e:	332.724	2407.474	2678.426	F	19
word_list_Speaker_10_19_F_2002	fehlen	e:	685.334	1674.02	2568.071	F	19
word_list_Speaker_10_19_F_2002	Städte	ɛ	519.699	1947.856	2626.562	F	19
word_list_Speaker_10_19_F_2002	Bett	ɛ	714.499	1823.371	2557.141	F	19
word_list_Speaker_10_19_F_2002	Käse	ɛ:	442.724	2220.3	2707.205	F	19
word_list_Speaker_10_19_F_2002	Bären	ɛ:	516.516	2178.757	2448.437	F	19
word_list_Speaker_10_19_F_2002	still	ɪ	439.354	1928.543	2541.089	F	19
word_list_Speaker_10_19_F_2002	stiehl	i:	329.041	2374.381	2613.639	F	19

word_list_Speaker_10_19_F_2002	viel	i:	339.03	2333.968	2636.939	F	19
word_list_Speaker_10_19_F_2002	wohl	o:	611.853	934.205	3147.548	F	19
word_list_Speaker_10_19_F_2002	blöd	ø:	472.668	1906.857	2803.004	F	19
word_list_Speaker_10_19_F_2002	Hölle	œ	466.842	1772.977	2690.008	F	19
word_list_Speaker_10_19_F_2002	null	ʊ	378.057	1933.878	2647.923	F	19
word_list_Speaker_10_19_F_2002	Fluss	ʊ	427.11	1457.79	3046.341	F	19
word_list_Speaker_10_19_F_2002	buhlen	u:	308.559	2226.167	2700.359	F	19
word_list_Speaker_10_19_F_2002	Blume	u:	411.779	1394.82	2468.496	F	19
word_list_Speaker_10_19_F_2002	nur	u:	429.135	2171.248	2533.387	F	19
word_list_Speaker_10_19_F_2002	füllen	y	348.196	2066.009	2562.469	F	19
word_list_Speaker_10_19_F_2002	fühlen	y:	316.324	2244.856	2609.82	F	19
word_list_Speaker_11_20_F__2002	kalt	a	776.691	1172.687	3062.11	F	20
word_list_Speaker_11_20_F__2002	hart	a	797.568	1293.651	2650.941	F	20
word_list_Speaker_11_20_F__2002	Wald	a	839.881	1313.835	2942.954	F	20
word_list_Speaker_11_20_F__2002	Stadt	a	988.17	1620.518	2753.289	F	20
word_list_Speaker_11_20_F__2002	Haar	a:	802.627	1184.092	2601.664	F	20
word_list_Speaker_11_20_F__2002	Glas	a:	909.776	1612.219	2717.141	F	20
word_list_Speaker_11_20_F__2002	toll	ɔ	424.971	972.258	2914.607	F	20
word_list_Speaker_11_20_F__2002	Wolle	ɔ	498.806	984.823	3039.062	F	20
word_list_Speaker_11_20_F__2002	Beeren	e:	334.579	2760.222	3486.491	F	20
word_list_Speaker_11_20_F__2002	fehlen	e:	548.618	2496.506	3184.181	F	20
word_list_Speaker_11_20_F__2002	Städte	ɛ	667.557	2009.68	3204.249	F	20
word_list_Speaker_11_20_F__2002	Bett	ɛ	687.316	1873.226	2935.493	F	20
word_list_Speaker_11_20_F__2002	Bären	ɛ:	788.259	1250.747	2947.602	F	20
word_list_Speaker_11_20_F__2002	Käse	ɛ:	945.479	1460.502	2671.586	F	20
word_list_Speaker_11_20_F__2002	still	ɪ	469.441	2128.29	3202.42	F	20
word_list_Speaker_11_20_F__2002	viel	i:	319.939	2801.347	3452.58	F	20
word_list_Speaker_11_20_F__2002	stiehl	i:	341.684	2774.762	3627.879	F	20
word_list_Speaker_11_20_F__2002	wohl	o:	497.17	1007.354	2635.521	F	20
word_list_Speaker_11_20_F__2002	blöd	ø:	484.642	1352.593	2962.034	F	20

word_list_Speaker_11_20_F__2002	Hölle	œ	369.041	1089.595	3177.789	F	20
word_list_Speaker_11_20_F__2002	Fluss	ʊ	366.604	1486.334	2895.716	F	20
word_list_Speaker_11_20_F__2002	null	ʊ	503.369	1365.471	2899.527	F	20
word_list_Speaker_11_20_F__2002	Blume	u:	315.131	1204.583	2337.839	F	20
word_list_Speaker_11_20_F__2002	buhlen	u:	326.632	1083.356	2771.117	F	20
word_list_Speaker_11_20_F__2002	nur	u:	447.059	1033.925	2645.975	F	20
word_list_Speaker_11_20_F__2002	füllen	y	318.294	1374.404	2632.117	F	20
word_list_Speaker_11_20_F__2002	fühlen	y:	326.315	1277.946	2630.744	F	20
word_list_Speaker_7_19_M_2001	Wald	a	673.042	1061.656	2295.952	M	19
word_list_Speaker_7_19_M_2001	hart	a	700.837	1019.19	2161.683	M	19
word_list_Speaker_7_19_M_2001	kalt	a	785.004	959.299	2436.602	M	19
word_list_Speaker_7_19_M_2001	Stadt	a	911.672	1192.124	2148.6	M	19
word_list_Speaker_7_19_M_2001	Haar	a:	492.062	2122.626	2483.71	M	19
word_list_Speaker_7_19_M_2001	Glas	a:	777.383	1219.663	2064.357	M	19
word_list_Speaker_7_19_M_2001	Wolle	ɔ	303.092	455.605	2573.957	M	19
word_list_Speaker_7_19_M_2001	toll	ɔ	310.456	530.318	2770.672	M	19
word_list_Speaker_7_19_M_2001	Beeren	e:	318.298	2312.455	2816.514	M	19
word_list_Speaker_7_19_M_2001	fehlen	e:	474.66	2193.984	2579.29	M	19
word_list_Speaker_7_19_M_2001	Städte	ɛ	485.399	2112.577	2598.89	M	19
word_list_Speaker_7_19_M_2001	Bett	ɛ	623.511	1991.241	2333.657	M	19
word_list_Speaker_7_19_M_2001	Käse	ɛ:	365.853	2304.405	2515.475	M	19
word_list_Speaker_7_19_M_2001	Bären	ɛ:	457.853	2053.937	2733.123	M	19
word_list_Speaker_7_19_M_2001	still	ɪ	304.855	2302.746	2964.623	M	19
word_list_Speaker_7_19_M_2001	stiehl	i:	258.764	2368.693	2944.523	M	19
word_list_Speaker_7_19_M_2001	viel	i:	302.689	2291.41	3233.816	M	19
word_list_Speaker_7_19_M_2001	wohl	o:	407.6	632.305	2594.034	M	19
word_list_Speaker_7_19_M_2001	blöd	ø:	325.185	825.627	2529.635	M	19
word_list_Speaker_7_19_M_2001	Hölle	œ	381.294	1180.641	2456.348	M	19
word_list_Speaker_7_19_M_2001	Fluss	ʊ	331.572	1026.181	2502.623	M	19
word_list_Speaker_7_19_M_2001	null	ʊ	476.291	1235.2	2490.621	M	19

word_list_Speaker_7_19_M_2001	buhlen	u:	325.407	830.162	2425.722	M	19
word_list_Speaker_7_19_M_2001	Blume	u:	352.449	784.555	2274.143	M	19
word_list_Speaker_7_19_M_2001	nur	u:	469.582	1948.726	2070.898	M	19
word_list_Speaker_7_19_M_2001	füllen	y	297.803	1361.072	2314.879	M	19
word_list_Speaker_7_19_M_2001	fühlen	y:	293.649	1221.623	2328.154	M	19
word_list_Speaker_8_19_F_2001	kalt	a	707.018	1068.707	3198.287	F	19
word_list_Speaker_8_19_F_2001	Wald	a	794.679	1128.58	2955.785	F	19
word_list_Speaker_8_19_F_2001	hart	a	883.38	1468.253	2440.424	F	19
word_list_Speaker_8_19_F_2001	Stadt	a	968.772	1388.043	2683.189	F	19
word_list_Speaker_8_19_F_2001	Haar	a:	812.096	1244.21	2692.815	F	19
word_list_Speaker_8_19_F_2001	Glas	a:	926.42	1433.191	2823.142	F	19
word_list_Speaker_8_19_F_2001	Wolle	ɔ	481.939	821.916	3098.51	F	19
word_list_Speaker_8_19_F_2001	toll	ɔ	497.618	783.409	3254.443	F	19
word_list_Speaker_8_19_F_2001	fehlen	e:	518.611	2387.547	3023.659	F	19
word_list_Speaker_8_19_F_2001	Beeren	e:	560.257	2105.901	2797.538	F	19
word_list_Speaker_8_19_F_2001	Städte	ɛ	531.775	2328.657	2848.908	F	19
word_list_Speaker_8_19_F_2001	Bett	ɛ	741.261	1915.302	2863.72	F	19
word_list_Speaker_8_19_F_2001	Käse	ɛ:	477.657	2004.946	2501.735	F	19
word_list_Speaker_8_19_F_2001	Bären	ɛ:	542.44	2374.666	2819.793	F	19
word_list_Speaker_8_19_F_2001	still	ɪ	479.216	2074.021	3055.126	F	19
word_list_Speaker_8_19_F_2001	stiehl	i:	383.542	2691.608	3255.344	F	19
word_list_Speaker_8_19_F_2001	viel	i:	390.619	2496.808	3133.584	F	19
word_list_Speaker_8_19_F_2001	wohl	o:	578.955	920.038	3315.821	F	19
word_list_Speaker_8_19_F_2001	blöd	ø:	474.889	1089.779	3004.024	F	19
word_list_Speaker_8_19_F_2001	Hölle	œ	440.345	1040.927	3289.821	F	19
word_list_Speaker_8_19_F_2001	Fluss	ʊ	406.433	1790.891	2913.366	F	19
word_list_Speaker_8_19_F_2001	null	ʊ	443.795	805.972	1987.637	F	19
word_list_Speaker_8_19_F_2001	buhlen	u:	414.374	2051.556	2466.201	F	19
word_list_Speaker_8_19_F_2001	Blume	u:	436.216	1468.629	2553.013	F	19
word_list_Speaker_8_19_F_2001	nur	u:	424.441	1546.614	2531.683	F	19

word_list_Speaker_8_19_F_2001	füllen	y	357.388	1963.084	2760.547	F	19
word_list_Speaker_8_19_F_2001	fühlen	y:	376.87	2047.409	2966.609	F	19
word_list_Speaker_9_20_M_2001	Wald	a	574.293	1041.935	2263.809	M	20
word_list_Speaker_9_20_M_2001	kalt	a	647.796	1086.214	2426.91	M	20
word_list_Speaker_9_20_M_2001	hart	a	691.204	1118.03	2638.381	M	20
word_list_Speaker_9_20_M_2001	Stadt	a	722.472	1331.15	2238.622	M	20
word_list_Speaker_9_20_M_2001	Haar	a:	724.433	1140.979	2296.297	M	20
word_list_Speaker_9_20_M_2001	Glas	a:	733.422	1256.622	2163.629	M	20
word_list_Speaker_9_20_M_2001	Wolle	ɔ	440.423	817.821	2479.611	M	20
word_list_Speaker_9_20_M_2001	toll	ɔ	445.348	850.183	2426.688	M	20
word_list_Speaker_9_20_M_2001	fehlen	e:	416.409	1816.302	2594.6	M	20
word_list_Speaker_9_20_M_2001	Beeren	e:	484.303	1788.891	2386.691	M	20
word_list_Speaker_9_20_M_2001	Städte	ɛ	416.956	1902.944	2424.345	M	20
word_list_Speaker_9_20_M_2001	Bett	ɛ	508.983	1605.524	2359.354	M	20
word_list_Speaker_9_20_M_2001	Käse	ɛ:	388.225	1929.499	2321.536	M	20
word_list_Speaker_9_20_M_2001	Bären	ɛ:	449.293	1874.461	2176.035	M	20
word_list_Speaker_9_20_M_2001	still	ɪ	340.766	1543.76	2410.072	M	20
word_list_Speaker_9_20_M_2001	stiehl	i:	286.023	2062.016	2343.649	M	20
word_list_Speaker_9_20_M_2001	viel	i:	289.733	2041.614	2260.573	M	20
word_list_Speaker_9_20_M_2001	wohl	o:	437.889	765.255	2809.263	M	20
word_list_Speaker_9_20_M_2001	blöd	ø:	483.355	927.52	2430.426	M	20
word_list_Speaker_9_20_M_2001	Hölle	œ	400.768	852.862	2366.111	M	20
word_list_Speaker_9_20_M_2001	Fluss	ʊ	337.416	1010.62	2338.268	M	20
word_list_Speaker_9_20_M_2001	null	ʊ	416.804	1258.685	2237.707	M	20
word_list_Speaker_9_20_M_2001	Blume	u:	279.5	1086.994	2270.175	M	20
word_list_Speaker_9_20_M_2001	buhlen	u:	314.098	898.167	2194.333	M	20
word_list_Speaker_9_20_M_2001	nur	u:	237.327	1845.671	2300.342	M	20
word_list_Speaker_9_20_M_2001	füllen	y	315.954	1319.374	2238.888	M	20
word_list_Speaker_9_20_M_2001	fühlen	y:	333.178	926.931	2261.554	M	20
word_list_Speaker_12_22_M_3020	Wald	a	558.715	1068.916	2595.078	M	22

word_list_Speaker_12_22_M_3020	kalt	a	567.72	1340.249	2549.018	M	22
word_list_Speaker_12_22_M_3020	hart	a	600.247	1274.554	2527.99	M	22
word_list_Speaker_12_22_M_3020	Stadt	a	639.747	1274.254	2478.073	M	22
word_list_Speaker_12_22_M_3020	Haar	a:	508.287	1154.87	2513.966	M	22
word_list_Speaker_12_22_M_3020	Glas	a:	732.133	1240.928	2565.817	M	22
word_list_Speaker_12_22_M_3020	toll	ɔ	290.643	507.602	2507.285	M	22
word_list_Speaker_12_22_M_3020	Wolle	ɔ	377.369	501.29	2582.904	M	22
word_list_Speaker_12_22_M_3020	fehlen	e:	361.049	1881.163	2651.286	M	22
word_list_Speaker_12_22_M_3020	Beeren	e:	472.747	1743.162	2552.728	M	22
word_list_Speaker_12_22_M_3020	Städte	ɛ	387.168	1889.985	2665.161	M	22
word_list_Speaker_12_22_M_3020	Bett	ɛ	471.412	1625.046	2630.312	M	22
word_list_Speaker_12_22_M_3020	Käse	ɛ:	287.381	1936.493	2642.3	M	22
word_list_Speaker_12_22_M_3020	Bären	ɛ:	526.035	1789.508	2633.546	M	22
word_list_Speaker_12_22_M_3020	still	ɪ	335.548	1691.579	2627.976	M	22
word_list_Speaker_12_22_M_3020	stiehl	i:	272.975	2149.764	2784.399	M	22
word_list_Speaker_12_22_M_3020	viel	i:	292.508	1980.828	2856.696	M	22
word_list_Speaker_12_22_M_3020	wohl	o:	383.411	718.786	2483.284	M	22
word_list_Speaker_12_22_M_3020	blöd	ø:	328.614	1530.404	2472.144	M	22
word_list_Speaker_12_22_M_3020	Hölle	œ	300.667	1584.033	2474.972	M	22
word_list_Speaker_12_22_M_3020	Fluss	ʊ	361.803	1391.524	2737.166	M	22
word_list_Speaker_12_22_M_3020	null	ʊ	369.747	862.333	2373.316	M	22
word_list_Speaker_12_22_M_3020	Blume	u:	328.175	1205.289	2492.381	M	22
word_list_Speaker_12_22_M_3020	buhlen	u:	322.214	742.807	2265.091	M	22
word_list_Speaker_12_22_M_3020	nur	u:	331.557	712.094	2372.7	M	22
word_list_Speaker_12_22_M_3020	füllen	y	297.372	1627.777	2525.361	M	22
word_list_Speaker_12_22_M_3020	fühlen	y:	308.201	1781.548	2301.186	M	22
word_list_Speaker_13_24_M_3020	kalt	a	669.446	1360.05	2554.841	M	24
word_list_Speaker_13_24_M_3020	hart	a	723.948	1253.746	2532.56	M	24
word_list_Speaker_13_24_M_3020	Stadt	a	751.037	1323.245	2631.325	M	24
word_list_Speaker_13_24_M_3020	Wald	a	751.773	1247.41	2939.376	M	24

word_list_Speaker_13_24_M_3020	Haar	a:	751.765	1362.794	2651.537	M	24
word_list_Speaker_13_24_M_3020	Glas	a:	786.48	1445.651	2762.258	M	24
word_list_Speaker_13_24_M_3020	Wolle	ɔ	426.441	666.275	2944.704	M	24
word_list_Speaker_13_24_M_3020	toll	ɔ	452.057	751.638	2883.111	M	24
word_list_Speaker_13_24_M_3020	fehlen	e:	404.887	2284.722	3284.667	M	24
word_list_Speaker_13_24_M_3020	Beeren	e:	407.017	2187.731	2983.193	M	24
word_list_Speaker_13_24_M_3020	Städte	ɛ	382.47	2257.87	2827.919	M	24
word_list_Speaker_13_24_M_3020	Bett	ɛ	495.723	2053.304	3034.215	M	24
word_list_Speaker_13_24_M_3020	Käse	ɛ:	362.878	2369.754	3075.418	M	24
word_list_Speaker_13_24_M_3020	Bären	ɛ:	405.737	2206.655	2877.529	M	24
word_list_Speaker_13_24_M_3020	still	ɪ	364.405	2166.298	3026.815	M	24
word_list_Speaker_13_24_M_3020	stiehl	i:	294.301	2467.64	3347.184	M	24
word_list_Speaker_13_24_M_3020	viel	i:	300.879	2367.073	3358.926	M	24
word_list_Speaker_13_24_M_3020	wohl	o:	429.426	686.523	2839.978	M	24
word_list_Speaker_13_24_M_3020	blöd	ø:	331.898	1739.163	2473.706	M	24
word_list_Speaker_13_24_M_3020	Hölle	œ	341.507	1827.921	2283.815	M	24
word_list_Speaker_13_24_M_3020	Fluss	ʊ	339.245	1267.639	2274.676	M	24
word_list_Speaker_13_24_M_3020	null	ʊ	380.714	1214.971	2516.349	M	24
word_list_Speaker_13_24_M_3020	buhlen	u:	338.134	1617.48	2259.266	M	24
word_list_Speaker_13_24_M_3020	Blume	u:	361.259	1361.213	2324.575	M	24
word_list_Speaker_13_24_M_3020	nur	u:	480.776	1664.099	2361.707	M	24
word_list_Speaker_13_24_M_3020	füllen	y	299.109	1709.05	2271.981	M	24
word_list_Speaker_13_24_M_3020	fühlen	y:	395.689	1721.035	2255.089	M	24
word_list_Speaker_14_20_F_3020	kalt	a	661.57	1223.366	2565.913	F	20
word_list_Speaker_14_20_F_3020	Wald	a	681.84	1175.122	2683.848	F	20
word_list_Speaker_14_20_F_3020	hart	a	741.002	1266.487	2374.84	F	20
word_list_Speaker_14_20_F_3020	Stadt	a	748.724	1229.347	2815.162	F	20
word_list_Speaker_14_20_F_3020	Glas	a:	849.665	1317.342	2823.9	F	20
word_list_Speaker_14_20_F_3020	Haar	a:	1048.907	1237.129	2673.562	F	20
word_list_Speaker_14_20_F_3020	Wolle	ɔ	467.305	777.751	2794.718	F	20

word_list_Speaker_14_20_F_3020	toll	ɔ	529.422	1029.805	2789.849	F	20
word_list_Speaker_14_20_F_3020	Beeren	e:	423.338	2065.584	2733.244	F	20
word_list_Speaker_14_20_F_3020	fehlen	e:	476.107	2038.161	2812.946	F	20
word_list_Speaker_14_20_F_3020	Städte	ɛ	490.02	1953.156	2724.924	F	20
word_list_Speaker_14_20_F_3020	Bett	ɛ	546.044	1718.683	2756.625	F	20
word_list_Speaker_14_20_F_3020	Käse	ɛ:	421.575	2335.386	2794.725	F	20
word_list_Speaker_14_20_F_3020	Bären	ɛ:	494.409	2107.397	2938.925	F	20
word_list_Speaker_14_20_F_3020	still	ɪ	388.744	1795.097	3086.233	F	20
word_list_Speaker_14_20_F_3020	viel	i:	336.673	2510.508	2953.711	F	20
word_list_Speaker_14_20_F_3020	stiehl	i:	387.629	2044.618	2708.724	F	20
word_list_Speaker_14_20_F_3020	wohl	o:	497.963	985.169	2698.738	F	20
word_list_Speaker_14_20_F_3020	blöd	ø:	408.887	1643.277	2673.534	F	20
word_list_Speaker_14_20_F_3020	Hölle	œ	418.142	1471.085	2760.622	F	20
word_list_Speaker_14_20_F_3020	null	ʊ	372.376	1246.77	2755.816	F	20
word_list_Speaker_14_20_F_3020	Fluss	ʊ	380.978	1299.676	2818.863	F	20
word_list_Speaker_14_20_F_3020	Blume	u:	344.853	1391.818	2492.172	F	20
word_list_Speaker_14_20_F_3020	buhlen	u:	345.883	1689.428	2700.098	F	20
word_list_Speaker_14_20_F_3020	nur	u:	461.54	1536.617	2568.269	F	20
word_list_Speaker_14_20_F_3020	füllen	y	326.792	1808.796	2476.532	F	20
word_list_Speaker_14_20_F_3020	fühlen	y:	338.764	1760.601	2589.481	F	20
word_list_Speaker_15_22_F_3020	hart	a	826.154	1225.226	2518.409	F	22
word_list_Speaker_15_22_F_3020	Wald	a	862.088	1280.528	2678.227	F	22
word_list_Speaker_15_22_F_3020	kalt	a	880.092	1465.965	2547.215	F	22
word_list_Speaker_15_22_F_3020	Stadt	a	983.157	1424.142	2571.865	F	22
word_list_Speaker_15_22_F_3020	Glas	a:	284.016	918.81	1270.12	F	22
word_list_Speaker_15_22_F_3020	Haar	a:	982.293	1183.609	2759.698	F	22
word_list_Speaker_15_22_F_3020	Wolle	ɔ	491.878	1994.381	2881.183	F	22
word_list_Speaker_15_22_F_3020	toll	ɔ	528.755	1438.733	2569.265	F	22
word_list_Speaker_15_22_F_3020	Beeren	e:	270.424	2601.141	3607.149	F	22
word_list_Speaker_15_22_F_3020	fehlen	e:	480.012	2224.552	3089.223	F	22

word_list_Speaker_15_22_F_3020	Bett	ɛ	636.153	1982.249	2864.109	F	22
word_list_Speaker_15_22_F_3020	Städte	ɛ	773.194	1361.923	2499.349	F	22
word_list_Speaker_15_22_F_3020	Käse	ɛ:	469.598	1583.638	2402.837	F	22
word_list_Speaker_15_22_F_3020	Bären	ɛ:	725.67	1189.308	2529.117	F	22
word_list_Speaker_15_22_F_3020	still	ɪ	301.242	2575.956	2688.066	F	22
word_list_Speaker_15_22_F_3020	stiehl	i:	322.594	2600.712	2877.507	F	22
word_list_Speaker_15_22_F_3020	viel	i:	327.829	2506.814	2949.721	F	22
word_list_Speaker_15_22_F_3020	wohl	o:	528.494	1117.056	2816.112	F	22
word_list_Speaker_15_22_F_3020	blöd	ø:	468.578	1864.388	2637.635	F	22
word_list_Speaker_15_22_F_3020	Hölle	œ	478.873	1687.986	2560.654	F	22
word_list_Speaker_15_22_F_3020	null	ʊ	426.748	1830.374	2536.425	F	22
word_list_Speaker_15_22_F_3020	Fluss	ʊ	424.458	1402.978	2933.878	F	22
word_list_Speaker_15_22_F_3020	Blume	u:	387.494	1755.839	2386.266	F	22
word_list_Speaker_15_22_F_3020	buhlen	u:	441.193	1744.507	2640.07	F	22
word_list_Speaker_15_22_F_3020	nur	u:	482.042	2120.747	2818.35	F	22
word_list_Speaker_15_22_F_3020	füllen	y	434.1	1939.416	2607.225	F	22
word_list_Speaker_15_22_F_3020	fühlen	y:	442.763	1984.624	2587.862	F	22
word_list_Speaker_16_20_F_3020	Wald	a	717.883	1176.106	2606.098	F	20
word_list_Speaker_16_20_F_3020	kalt	a	747.865	1176.766	2608.117	F	20
word_list_Speaker_16_20_F_3020	hart	a	847.529	1565.058	2350.883	F	20
word_list_Speaker_16_20_F_3020	Stadt	a	960.149	1298.622	2500.902	F	20
word_list_Speaker_16_20_F_3020	Glas	a:	858.538	1218.261	2513.274	F	20
word_list_Speaker_16_20_F_3020	Haar	a:	924.211	1396.108	2398.302	F	20
word_list_Speaker_16_20_F_3020	toll	ɔ	392.981	820.858	2809.296	F	20
word_list_Speaker_16_20_F_3020	Wolle	ɔ	483.446	1087.19	2967.599	F	20
word_list_Speaker_16_20_F_3020	fehlen	e:	368.487	2372.366	2595.072	F	20
word_list_Speaker_16_20_F_3020	Beeren	e:	610.281	2097.564	2443.354	F	20
word_list_Speaker_16_20_F_3020	Städte	ɛ	493.245	2351.299	2456.641	F	20
word_list_Speaker_16_20_F_3020	Bett	ɛ	687.07	2021.497	2227.133	F	20
word_list_Speaker_16_20_F_3020	Käse	ɛ:	407.243	2508.198	2843.819	F	20

word_list_Speaker_16_20_F_3020	Bären	ɛ:	504.904	2401.8	2630.753	F	20
word_list_Speaker_16_20_F_3020	still	ɪ	470.387	1924.025	3180.316	F	20
word_list_Speaker_16_20_F_3020	viel	i:	383.612	2330.194	2516.783	F	20
word_list_Speaker_16_20_F_3020	stiehl	i:	955.852	1493.661	2423.199	F	20
word_list_Speaker_16_20_F_3020	wohl	o:	487.643	1010.434	2896.188	F	20
word_list_Speaker_16_20_F_3020	blöd	ø:	377.632	1453.325	2717.214	F	20
word_list_Speaker_16_20_F_3020	Hölle	œ	338.699	1518.109	2326.341	F	20
word_list_Speaker_16_20_F_3020	Fluss	ʊ	374.091	1673.247	2716.455	F	20
word_list_Speaker_16_20_F_3020	null	ʊ	457.308	1103.735	2528.446	F	20
word_list_Speaker_16_20_F_3020	buhlen	u:	354.15	1389.919	2623.207	F	20
word_list_Speaker_16_20_F_3020	Blume	u:	424.516	1492.731	2838.08	F	20
word_list_Speaker_16_20_F_3020	nur	u:	473.443	1751.814	2480.876	F	20
word_list_Speaker_16_20_F_3020	füllen	y	357.338	1750.377	2600.306	F	20
word_list_Speaker_16_20_F_3020	fühlen	y:	320.006	2032.79	2576.697	F	20
word_list_Speaker_17_19_F_4001	Stadt	a	760.194	1227.456	2165.619	F	19
word_list_Speaker_17_19_F_4001	Wald	a	828.925	1132.98	2679.547	F	19
word_list_Speaker_17_19_F_4001	kalt	a	1025.509	1635.598	2700.658	F	19
word_list_Speaker_17_19_F_4001	hart	a	1059.815	1494.506	2602.215	F	19
word_list_Speaker_17_19_F_4001	Glas	a:	1018.897	1521.807	2911.194	F	19
word_list_Speaker_17_19_F_4001	Haar	a:	1028.572	1386.149	1983.607	F	19
word_list_Speaker_17_19_F_4001	toll	ɔ	616.144	1061.329	2981.355	F	19
word_list_Speaker_17_19_F_4001	Wolle	ɔ	906.228	1428.28	2774.104	F	19
word_list_Speaker_17_19_F_4001	Beeren	e:	472.397	1174.675	2694.079	F	19
word_list_Speaker_17_19_F_4001	fehlen	e:	556.622	1313.282	2591.196	F	19
word_list_Speaker_17_19_F_4001	Städte	ɛ	629.179	2185.617	3403.608	F	19
word_list_Speaker_17_19_F_4001	Bett	ɛ	741.885	2166.119	3293.442	F	19
word_list_Speaker_17_19_F_4001	Käse	ɛ:	341.593	2400.463	2691.484	F	19
word_list_Speaker_17_19_F_4001	Bären	ɛ:	405.978	2489.985	3281.416	F	19
word_list_Speaker_17_19_F_4001	still	ɪ	530.678	2483.877	3390.827	F	19
word_list_Speaker_17_19_F_4001	stiehl	i:	298.342	2894.227	3819.11	F	19

word_list_Speaker_17_19_F_4001	viel	i:	335.524	2173.288	3248.742	F	19
word_list_Speaker_17_19_F_4001	wohl	o:	502.112	610.239	2837.591	F	19
word_list_Speaker_17_19_F_4001	blöd	ø:	402.803	1910.5	2660.692	F	19
word_list_Speaker_17_19_F_4001	Hölle	œ	500.759	1616.45	2828.331	F	19
word_list_Speaker_17_19_F_4001	null	ʊ	333.511	906.419	2653.597	F	19
word_list_Speaker_17_19_F_4001	Fluss	ʊ	487.201	1336.665	3866.024	F	19
word_list_Speaker_17_19_F_4001	buhlen	u:	337.42	1326.322	1343.378	F	19
word_list_Speaker_17_19_F_4001	Blume	u:	409.195	1094.892	2663.129	F	19
word_list_Speaker_17_19_F_4001	nur	u:	419.762	1037.264	1754.418	F	19
word_list_Speaker_17_19_F_4001	füllen	y	536.735	1724.324	2859.091	F	19
word_list_Speaker_17_19_F_4001	fühlen	y:	347.036	2034.779	2673.578	F	19
CG_Speaker_1_18_F	Stadt	a	797.67	1743.224	2734.351	F	18
CG_Speaker_1_18_F	Wald	a	812.158	1804.239	2868.25	F	18
CG_Speaker_1_18_F	kalt	a	915.558	1829.933	2672.998	F	18
CG_Speaker_1_18_F	hart	a	1036.487	1595.371	2506.035	F	18
CG_Speaker_1_18_F	Glas	a:	864.508	1468.668	2790.182	F	18
CG_Speaker_1_18_F	Haar	a:	940.101	1321.316	2677.857	F	18
CG_Speaker_1_18_F	toll	ɔ	551.728	1509.442	2531.599	F	18
CG_Speaker_1_18_F	Wolle	ɔ	662.413	1347.935	2964.368	F	18
CG_Speaker_1_18_F	Beeren	e:	483.78	2434.996	3123.248	F	18
CG_Speaker_1_18_F	fehlen	e:	497.182	2424.115	3010.44	F	18
CG_Speaker_1_18_F	Städte	ɛ	507.995	2095.036	2656.566	F	18
CG_Speaker_1_18_F	Bett	ɛ	716.425	2039.337	2923.73	F	18
CG_Speaker_1_18_F	Bären	ɛ:	486.972	1802.655	2531.488	F	18
CG_Speaker_1_18_F	Käse	ɛ:	492.623	2473.387	2959.635	F	18
CG_Speaker_1_18_F	still	ɪ	510.224	2082.703	2756.49	F	18
CG_Speaker_1_18_F	viel	i:	507.326	2512.256	3402.964	F	18
CG_Speaker_1_18_F	stiehl	i:	542.839	2561.92	3129.569	F	18
CG_Speaker_1_18_F	wohl	o:	511.959	1191.595	2744.688	F	18
CG_Speaker_1_18_F	blöd	ø:	519.693	1718.602	2751.06	F	18

CG_Speaker_1_18_F	Hölle	œ	518.696	1893.531	2714.084	F	18
CG_Speaker_1_18_F	null	ʊ	448.668	1344.378	2813.346	F	18
CG_Speaker_1_18_F	Fluss	ʊ	539.068	1327.978	2844.798	F	18
CG_Speaker_1_18_F	buhlen	u:	366.521	993.875	2555.551	F	18
CG_Speaker_1_18_F	Blume	u:	488.071	1075.786	2675.638	F	18
CG_Speaker_1_18_F	nur	u:	536.768	1005.418	2700.622	F	18
CG_Speaker_1_18_F	füllen	y	566.458	1994.119	2470.01	F	18
CG_Speaker_1_18_F	fühlen	y:	567.985	1619.874	2723.143	F	18
CG_Speaker_10_26_M	Stadt	a	525.423	1538.17	2561.084	M	26
CG_Speaker_10_26_M	Wald	a	545.199	1507.594	2585.984	M	26
CG_Speaker_10_26_M	kalt	a	559.297	1525.857	2406.061	M	26
CG_Speaker_10_26_M	hart	a	604.037	1046.095	2650.349	M	26
CG_Speaker_10_26_M	Glas	a:	592.738	1514.366	2532.918	M	26
CG_Speaker_10_26_M	Haar	a:	600.816	1063.305	2552.656	M	26
CG_Speaker_10_26_M	Wolle	ɔ	431.022	1135.51	2450.644	M	26
CG_Speaker_10_26_M	toll	ɔ	478.025	1161.047	2151.791	M	26
CG_Speaker_10_26_M	Beeren	e:	312.672	2122.039	3242.113	M	26
CG_Speaker_10_26_M	fehlen	e:	320.527	2077.39	2109.843	M	26
CG_Speaker_10_26_M	Städte	ɛ	279.998	2120.916	2855.801	M	26
CG_Speaker_10_26_M	Bett	ɛ	419.726	1845.618	2325.24	M	26
CG_Speaker_10_26_M	Bären	ɛ:	291.343	2139.759	2318.06	M	26
CG_Speaker_10_26_M	Käse	ɛ:	361.034	2068.488	2555.121	M	26
CG_Speaker_10_26_M	still	ɪ	351.385	1886.065	2381.014	M	26
CG_Speaker_10_26_M	stiehl	i:	190.089	2087.452	3280.746	M	26
CG_Speaker_10_26_M	viel	i:	197.122	2089.295	2702.703	M	26
CG_Speaker_10_26_M	wohl	o:	370.902	926.176	2221.38	M	26
CG_Speaker_10_26_M	blöd	ø:	402.859	1456.651	2166.108	M	26
CG_Speaker_10_26_M	Hölle	œ	431.35	1521.54	2185.733	M	26
CG_Speaker_10_26_M	null	ʊ	352.693	1247.762	2075.989	M	26
CG_Speaker_10_26_M	Fluss	ʊ	386.703	1208.127	2224.503	M	26

CG_Speaker_10_26_M	Blume	u:	271.597	1175.761	2443.342	M	26
CG_Speaker_10_26_M	buhlen	u:	197.284	716.254	2226.207	M	26
CG_Speaker_10_26_M	nur	u:	255.097	970.518	2275.419	M	26
CG_Speaker_10_26_M	füllen	y	206.49	1524.088	2042.29	M	26
CG_Speaker_10_26_M	fühlen	y:	193.949	1857.991	2011.987	M	26
CG_Speaker_11_29_M	Wald	a	706.341	1496.278	1925.439	M	29
CG_Speaker_11_29_M	Stadt	a	779.235	1526.272	2562.973	M	29
CG_Speaker_11_29_M	kalt	a	940.914	1481.11	2618.04	M	29
CG_Speaker_11_29_M	hart	a	1008.678	1315.336	2877.633	M	29
CG_Speaker_11_29_M	Haar	a:	846.652	1207.116	2428.143	M	29
CG_Speaker_11_29_M	Glas	a:	892.311	1350.733	2761.977	M	29
CG_Speaker_11_29_M	Wolle	ɔ	520.286	877.235	2672.606	M	29
CG_Speaker_11_29_M	toll	ɔ	576.226	947.335	2532.489	M	29
CG_Speaker_11_29_M	Beeren	e:	343.823	2390.393	2410.359	M	29
CG_Speaker_11_29_M	fehlen	e:	371.871	2400.893	2841.853	M	29
CG_Speaker_11_29_M	Städte	ɛ	537.288	1896.675	2705.23	M	29
CG_Speaker_11_29_M	Bett	ɛ	585.133	1925.214	2657.09	M	29
CG_Speaker_11_29_M	Käse	ɛ:	397.192	2373.231	2442.938	M	29
CG_Speaker_11_29_M	Bären	ɛ:	633.389	2092.226	2806.518	M	29
CG_Speaker_11_29_M	still	ɪ	353.073	1881.247	2791.109	M	29
CG_Speaker_11_29_M	viel	i:	217.838	2352.521	2798.25	M	29
CG_Speaker_11_29_M	stiehl	i:	234.836	2490.659	3134.575	M	29
CG_Speaker_11_29_M	wohl	o:	367.491	664.517	2553.799	M	29
CG_Speaker_11_29_M	blöd	ø:	396.513	1365.339	2424.852	M	29
CG_Speaker_11_29_M	Hölle	œ	542.026	1454.881	2577.755	M	29
CG_Speaker_11_29_M	Fluss	ʊ	403.859	1131.489	2653.878	M	29
CG_Speaker_11_29_M	null	ʊ	407.837	1025.059	2297.459	M	29
CG_Speaker_11_29_M	Blume	u:	290.064	660.69	2292.151	M	29
CG_Speaker_11_29_M	buhlen	u:	312.65	770.14	2500.989	M	29
CG_Speaker_11_29_M	nur	u:	239.618	734.367	2322.454	M	29

CG_Speaker_11_29_M	füllen	y	370.601	1316.045	2446.539	M	29
CG_Speaker_11_29_M	fühlen	y:	203.379	1315.099	2105.441	M	29
CG_Speaker_2_29_F	Wald	a	617.847	1303.935	2732.548	F	29
CG_Speaker_2_29_F	Stadt	a	690.777	1562.577	2876.761	F	29
CG_Speaker_2_29_F	kalt	a	772.899	1840.037	2992.107	F	29
CG_Speaker_2_29_F	hart	a	874.703	1252.413	2887.698	F	29
CG_Speaker_2_29_F	Haar	a:	763.9	1350.61	2801.825	F	29
CG_Speaker_2_29_F	Glas	a:	993.16	1555.248	2924.086	F	29
CG_Speaker_2_29_F	Wolle	ɔ	476.769	1015.899	3045.82	F	29
CG_Speaker_2_29_F	toll	ɔ	481.571	1122.786	2920.366	F	29
CG_Speaker_2_29_F	fehlen	e:	353.628	2498.271	3278.632	F	29
CG_Speaker_2_29_F	Beeren	e:	421.738	2464.708	3184.759	F	29
CG_Speaker_2_29_F	Städte	ɛ	357.835	2396.459	3031.335	F	29
CG_Speaker_2_29_F	Bett	ɛ	536.212	2125.046	3061.722	F	29
CG_Speaker_2_29_F	Käse	ɛ:	372.598	2550.805	3116.596	F	29
CG_Speaker_2_29_F	Bären	ɛ:	420.85	2412.421	3214.603	F	29
CG_Speaker_2_29_F	still	ɪ	347.446	2098.898	2965.287	F	29
CG_Speaker_2_29_F	viel	i:	224.785	2433.824	3534.04	F	29
CG_Speaker_2_29_F	stiehl	i:	228.367	1955.681	3195.764	F	29
CG_Speaker_2_29_F	wohl	o:	376.514	906.305	3208.513	F	29
CG_Speaker_2_29_F	blöd	ø:	349.617	1586.61	2740.721	F	29
CG_Speaker_2_29_F	Hölle	œ	469.407	1712.159	2827.823	F	29
CG_Speaker_2_29_F	null	ʊ	332.912	1149.119	2274.006	F	29
CG_Speaker_2_29_F	Fluss	ʊ	410.953	1101.614	2967.694	F	29
CG_Speaker_2_29_F	Blume	u:	214.606	1290.351	2793.954	F	29
CG_Speaker_2_29_F	buhlen	u:	229.442	750.171	1952.853	F	29
CG_Speaker_2_29_F	nur	u:	244.783	943.983	2464.812	F	29
CG_Speaker_2_29_F	füllen	y	355.592	1578.724	2852.42	F	29
CG_Speaker_2_29_F	fühlen	y:	223.561	1831.208	2398.173	F	29
CG_Speaker_3_27_F	Stadt	a	649.171	1589.3	1924.938	F	27

CG_Speaker_3_27_F	kalt	a	655.381	1477.03	2026.973	F	27
CG_Speaker_3_27_F	Wald	a	766.694	1575.278	2996.563	F	27
CG_Speaker_3_27_F	hart	a	988.876	1537.268	2430.524	F	27
CG_Speaker_3_27_F	Haar	a:	804.722	1289.794	2762.763	F	27
CG_Speaker_3_27_F	Glas	a:	931.156	1576.648	2701.265	F	27
CG_Speaker_3_27_F	Wolle	ɔ	607.448	1117.933	3026.317	F	27
CG_Speaker_3_27_F	toll	ɔ	639.726	1318.251	2772.96	F	27
CG_Speaker_3_27_F	fehlen	e:	360.367	2598.884	3087.676	F	27
CG_Speaker_3_27_F	Beeren	e:	398.668	2512.363	3036.084	F	27
CG_Speaker_3_27_F	Städte	ɛ	429.374	2479.927	2979.411	F	27
CG_Speaker_3_27_F	Bett	ɛ	623.583	2142.607	3084.4	F	27
CG_Speaker_3_27_F	Käse	ɛ:	390.616	2492.802	2785.217	F	27
CG_Speaker_3_27_F	Bären	ɛ:	624.511	2229.417	3130.064	F	27
CG_Speaker_3_27_F	still	ɪ	414.444	2220.781	2760.93	F	27
CG_Speaker_3_27_F	viel	i:	241.581	2527.247	3440.51	F	27
CG_Speaker_3_27_F	stiehl	i:	249.994	2601.469	2751.751	F	27
CG_Speaker_3_27_F	wohl	o:	477.638	706.845	3113.261	F	27
CG_Speaker_3_27_F	blöd	ø:	425.237	1571.613	2768.819	F	27
CG_Speaker_3_27_F	Hölle	œ	589.403	1716.735	2858.946	F	27
CG_Speaker_3_27_F	null	ʊ	425.148	1379.005	2925.741	F	27
CG_Speaker_3_27_F	Fluss	ʊ	511.735	1236.9	2772.178	F	27
CG_Speaker_3_27_F	buhlen	u:	289.914	750.907	2697.743	F	27
CG_Speaker_3_27_F	Blume	u:	316.327	934.671	2975.316	F	27
CG_Speaker_3_27_F	nur	u:	322.306	854.465	2664.902	F	27
CG_Speaker_3_27_F	füllen	y	472.589	1528.036	2686.802	F	27
CG_Speaker_3_27_F	fühlen	y:	295.177	1929.459	2599.397	F	27
CG_Speaker_4_18_F	kalt	a	491.471	1355.539	2671.443	F	18
CG_Speaker_4_18_F	Stadt	a	688.795	1746.056	3394.664	F	18
CG_Speaker_4_18_F	Wald	a	729.459	1410.584	2889.589	F	18
CG_Speaker_4_18_F	hart	a	762.474	1269.831	3202.056	F	18

CG_Speaker_4_18_F	Haar	a:	606.998	1219.698	2978.759	F	18
CG_Speaker_4_18_F	Glas	a:	621.625	1293.791	3048.109	F	18
CG_Speaker_4_18_F	toll	ɔ	500.686	1224.508	2889.957	F	18
CG_Speaker_4_18_F	Wolle	ɔ	539.877	1034.264	3194.486	F	18
CG_Speaker_4_18_F	Beeren	e:	372.156	2231.536	3148.527	F	18
CG_Speaker_4_18_F	fehlen	e:	431.728	2327.136	3004.451	F	18
CG_Speaker_4_18_F	Städte	ɛ	404.543	2294.143	2989.976	F	18
CG_Speaker_4_18_F	Bett	ɛ	569.644	1937.726	3333.55	F	18
CG_Speaker_4_18_F	Bären	ɛ:	352.431	2545.899	3333.832	F	18
CG_Speaker_4_18_F	Käse	ɛ:	454.12	2328.077	2874.119	F	18
CG_Speaker_4_18_F	still	ɪ	374.763	1922.546	3068.319	F	18
CG_Speaker_4_18_F	stiehl	i:	273.035	2588.82	3226.188	F	18
CG_Speaker_4_18_F	viel	i:	316.547	2358.932	2834.124	F	18
CG_Speaker_4_18_F	wohl	o:	442.752	1189.058	2929.669	F	18
CG_Speaker_4_18_F	blöd	ø:	432.701	1668.162	3043.53	F	18
CG_Speaker_4_18_F	Hölle	œ	496.077	1650.481	3069.004	F	18
CG_Speaker_4_18_F	null	ʊ	210.142	1590.077	2853.402	F	18
CG_Speaker_4_18_F	Fluss	ʊ	415.153	1108.577	2185.533	F	18
CG_Speaker_4_18_F	buhlen	u:	280.169	865.5	2152.906	F	18
CG_Speaker_4_18_F	Blume	u:	260.127	780.029	3591.135	F	18
CG_Speaker_4_18_F	nur	u:	273.693	781.176	2787.532	F	18
CG_Speaker_4_18_F	füllen	y	446.122	1477.093	2755.547	F	18
CG_Speaker_4_18_F	fühlen	y:	340.482	2103.238	2806.864	F	18
CG_Speaker_5_25_F	kalt	a	587.867	967.695	1812.187	F	25
CG_Speaker_5_25_F	Stadt	a	904.243	1233.818	1901.379	F	25
CG_Speaker_5_25_F	hart	a	699.751	1164.059	1636.325	F	25
CG_Speaker_5_25_F	Wald	a	871.496	1126.946	1740.728	F	25
CG_Speaker_5_25_F	Haar	a:	602.838	1213.829	1688.119	F	25
CG_Speaker_5_25_F	Glas	a:	821.203	1218.529	1746.754	F	25
CG_Speaker_5_25_F	Wolle	ɔ	796.83	1042.03	2726.95	F	25

CG_Speaker_5_25_F	toll	ɔ	955.824	1321.553	2601.638	F	25
CG_Speaker_5_25_F	fehlen	e:	424.024	2522.021	3263.247	F	25
CG_Speaker_5_25_F	Beeren	e:	504.181	2655.008	3035.507	F	25
CG_Speaker_5_25_F	Städte	ɛ	470.875	2587.599	3267.903	F	25
CG_Speaker_5_25_F	Bett	ɛ	829.992	2204.51	2682.22	F	25
CG_Speaker_5_25_F	Bären	ɛ:	399.645	2675.127	3328.355	F	25
CG_Speaker_5_25_F	Käse	ɛ:	401.079	2549.965	2686.303	F	25
CG_Speaker_5_25_F	still	ɪ	379.38	2297.161	3031.294	F	25
CG_Speaker_5_25_F	stiehl	i:	324.589	2800.425	3462.372	F	25
CG_Speaker_5_25_F	viel	i:	347.433	2189.246	2780.975	F	25
CG_Speaker_5_25_F	wohl	o:	439.176	848.121	2636.551	F	25
CG_Speaker_5_25_F	blöd	ø:	496.115	1741.675	2786.673	F	25
CG_Speaker_5_25_F	Hölle	œ	747.772	1870.639	2576.366	F	25
CG_Speaker_5_25_F	null	ʊ	675.141	1186.362	2563.558	F	25
CG_Speaker_5_25_F	Fluss	ʊ	439.338	786.619	1619.377	F	25
CG_Speaker_5_25_F	Blume	u:	336	972.707	2817.63	F	25
CG_Speaker_5_25_F	buhlen	u:	343.978	732.881	2734.818	F	25
CG_Speaker_5_25_F	nur	u:	492.458	779.333	2610.159	F	25
CG_Speaker_5_25_F	füllen	y	459.079	1689.569	2771.63	F	25
CG_Speaker_5_25_F	fühlen	y:	352.252	1966.717	2472.385	F	25
CG_Speaker_6_25_F	Stadt	a	731.192	1660.216	2661.151	F	25
CG_Speaker_6_25_F	Wald	a	744.743	1807.05	2906.145	F	25
CG_Speaker_6_25_F	kalt	a	788.872	1755.315	2516.508	F	25
CG_Speaker_6_25_F	hart	a	792.666	1328.176	3358.949	F	25
CG_Speaker_6_25_F	Glas	a:	821.231	1454.447	2805.083	F	25
CG_Speaker_6_25_F	Haar	a:	958.307	1470.261	2800.347	F	25
CG_Speaker_6_25_F	toll	ɔ	526.702	1287.357	2658.242	F	25
CG_Speaker_6_25_F	Wolle	ɔ	641.752	1340.678	2847.003	F	25
CG_Speaker_6_25_F	fehlen	e:	485.325	2617.346	3095.61	F	25
CG_Speaker_6_25_F	Beeren	e:	513.065	2236.5	3083.838	F	25

CG_Speaker_6_25_F	Städte	ɛ	434.93	2452.022	3044.008	F	25
CG_Speaker_6_25_F	Bett	ɛ	630.695	2088.046	2914.65	F	25
CG_Speaker_6_25_F	Bären	ɛ:	316.254	2370.819	3141.111	F	25
CG_Speaker_6_25_F	Käse	ɛ:	485.083	2511.648	2975.595	F	25
CG_Speaker_6_25_F	still	ɪ	446.471	1932.107	2934.908	F	25
CG_Speaker_6_25_F	viel	i:	287.587	2513.27	3364.969	F	25
CG_Speaker_6_25_F	stiehl	i:	375.993	2656.212	3153.124	F	25
CG_Speaker_6_25_F	wohl	o:	398.889	736.62	3014.647	F	25
CG_Speaker_6_25_F	blöd	ø:	435.649	1570.271	2586.753	F	25
CG_Speaker_6_25_F	Hölle	œ	492.993	1800.149	2833.387	F	25
CG_Speaker_6_25_F	null	ʊ	414.417	1189.03	2627.421	F	25
CG_Speaker_6_25_F	Fluss	ʊ	522.352	1371.434	2877.001	F	25
CG_Speaker_6_25_F	Blume	u:	271.453	1433.378	2878.36	F	25
CG_Speaker_6_25_F	buhlen	u:	271.836	1167.94	2978.813	F	25
CG_Speaker_6_25_F	nur	u:	382.012	769.392	1934.194	F	25
CG_Speaker_6_25_F	füllen	y	490.961	1581.141	2669.55	F	25
CG_Speaker_6_25_F	fühlen	y:	270.201	1677.121	2611.451	F	25
CG_Speaker_7_26_M	kalt	a	580.335	1304.325	2352.2	M	26
CG_Speaker_7_26_M	Stadt	a	597.313	1418.811	2563.176	M	26
CG_Speaker_7_26_M	Wald	a	624.889	1313.609	2363.523	M	26
CG_Speaker_7_26_M	hart	a	707.798	949.901	2477.222	M	26
CG_Speaker_7_26_M	Haar	a:	623.845	959.738	2236.233	M	26
CG_Speaker_7_26_M	Glas	a:	626.433	923.885	2354.099	M	26
CG_Speaker_7_26_M	toll	ɔ	479.61	1018.966	2561.238	M	26
CG_Speaker_7_26_M	Wolle	ɔ	486.412	1055.306	2181.53	M	26
CG_Speaker_7_26_M	fehlen	e:	311.067	1861.758	2635.109	M	26
CG_Speaker_7_26_M	Beeren	e:	318.493	1877.598	2625.635	M	26
CG_Speaker_7_26_M	Städte	ɛ	304.577	1919.563	2721.411	M	26
CG_Speaker_7_26_M	Bett	ɛ	470.804	1608.066	2467.081	M	26
CG_Speaker_7_26_M	Käse	ɛ:	302.73	1926.342	2640.011	M	26

CG_Speaker_7_26_M	Bären	ɛ:	340.529	1852.59	2547.957	M	26
CG_Speaker_7_26_M	still	ɪ	343.354	1674.386	2691.092	M	26
CG_Speaker_7_26_M	viel	i:	241.227	1888.759	2920.796	M	26
CG_Speaker_7_26_M	stiehl	i:	243.344	1846.145	2878.568	M	26
CG_Speaker_7_26_M	wohl	o:	327.663	732.94	2835.79	M	26
CG_Speaker_7_26_M	blöd	ø:	363.612	1441.521	2470.039	M	26
CG_Speaker_7_26_M	Hölle	œ	351.42	1360.81	2466.598	M	26
CG_Speaker_7_26_M	null	ʊ	282.447	1183.984	2101.445	M	26
CG_Speaker_7_26_M	Fluss	ʊ	356.406	1200.808	2342.911	M	26
CG_Speaker_7_26_M	buhlen	u:	238.29	666.078	2045.463	M	26
CG_Speaker_7_26_M	Blume	u:	252.744	836.048	1874.423	M	26
CG_Speaker_7_26_M	nur	u:	329.458	792.897	1998.137	M	26
CG_Speaker_7_26_M	füllen	y	301.375	1459.134	2169.243	M	26
CG_Speaker_7_26_M	fühlen	y:	277.839	1511.991	1905.725	M	26
CG_Speaker_8_25_M	Stadt	a	554.022	1383.79	2224.644	M	25
CG_Speaker_8_25_M	hart	a	612.362	1156.984	2715.6	M	25
CG_Speaker_8_25_M	Wald	a	622.588	1475.424	2402.914	M	25
CG_Speaker_8_25_M	kalt	a	720.174	1623	2509.272	M	25
CG_Speaker_8_25_M	Glas	a:	678.076	1272.709	2559.671	M	25
CG_Speaker_8_25_M	Haar	a:	678.16	1173.353	2699.836	M	25
CG_Speaker_8_25_M	toll	ɔ	445.168	1101.133	2169.981	M	25
CG_Speaker_8_25_M	Wolle	ɔ	464.5	1272.758	2208.108	M	25
CG_Speaker_8_25_M	fehlen	e:	310.103	2058.558	2980.338	M	25
CG_Speaker_8_25_M	Beeren	e:	400.923	2031.945	2866.841	M	25
CG_Speaker_8_25_M	Städte	ɛ	323.583	2046.434	2884.672	M	25
CG_Speaker_8_25_M	Bett	ɛ	452.709	1880.425	2787.073	M	25
CG_Speaker_8_25_M	Bären	ɛ:	290.926	2057.724	2949.346	M	25
CG_Speaker_8_25_M	Käse	ɛ:	306.978	2059.767	3024.223	M	25
CG_Speaker_8_25_M	still	ɪ	368.493	1797.81	2455.006	M	25
CG_Speaker_8_25_M	stiehl	i:	231.245	2099.653	3209.179	M	25

CG_Speaker_8_25_M	viel	i:	270.301	1925.549	3117.876	M	25
CG_Speaker_8_25_M	wohl	o:	379.226	632.918	2252.39	M	25
CG_Speaker_8_25_M	blöd	ø:	379.538	1419.974	2191.202	M	25
CG_Speaker_8_25_M	Hölle	œ	415.304	1583.227	2210.79	M	25
CG_Speaker_8_25_M	null	ʊ	320.908	1117.866	2106.234	M	25
CG_Speaker_8_25_M	Fluss	ʊ	420.974	851.883	1726.046	M	25
CG_Speaker_8_25_M	nur	u:	231.327	928.085	1921.288	M	25
CG_Speaker_8_25_M	Blume	u:	251.748	720.828	1680.747	M	25
CG_Speaker_8_25_M	buhlen	u:	330.843	844.429	1921.207	M	25
CG_Speaker_8_25_M	füllen	y	337.54	1415.997	2061.216	M	25
CG_Speaker_8_25_M	fühlen	y:	278.282	1587.323	2485.126	M	25
CG_Speaker_9_28_M	Stadt	a	530.958	1227.212	2420.325	M	28
CG_Speaker_9_28_M	kalt	a	573.081	1532.492	2420.129	M	28
CG_Speaker_9_28_M	Wald	a	617.255	1337.99	2465.77	M	28
CG_Speaker_9_28_M	hart	a	647.688	1004.355	2894.538	M	28
CG_Speaker_9_28_M	Glas	a:	680.23	1132.21	2599.614	M	28
CG_Speaker_9_28_M	Haar	a:	706.706	935.904	2623.905	M	28
CG_Speaker_9_28_M	Wolle	ɔ	470.885	901.419	2592.589	M	28
CG_Speaker_9_28_M	toll	ɔ	499.238	990.588	2380.667	M	28
CG_Speaker_9_28_M	Beeren	e:	281.511	2082.575	2390.065	M	28
CG_Speaker_9_28_M	fehlen	e:	343.372	2013.048	2454.582	M	28
CG_Speaker_9_28_M	Städte	ɛ	316.833	1998.92	2367.486	M	28
CG_Speaker_9_28_M	Bett	ɛ	433.671	1722.018	2310.148	M	28
CG_Speaker_9_28_M	Käse	ɛ:	314.402	2050.441	2580.629	M	28
CG_Speaker_9_28_M	Bären	ɛ:	335.353	2036.557	2543.268	M	28
CG_Speaker_9_28_M	still	ɪ	347.672	1654.663	2386.636	M	28
CG_Speaker_9_28_M	stiehl	i:	227.301	1987.456	2597.868	M	28
CG_Speaker_9_28_M	viel	i:	279.493	1798.915	2660.003	M	28
CG_Speaker_9_28_M	wohl	o:	269.354	669.374	2889.264	M	28
CG_Speaker_9_28_M	blöd	ø:	365.726	1505.097	2273.484	M	28

CG_Speaker_9_28_M	Hölle	œ	462.264	1488.766	2324.855	M	28
CG_Speaker_9_28_M	null	ʊ	322.9	1134.653	2360.838	M	28
CG_Speaker_9_28_M	Fluss	ʊ	364.378	1015.532	2466.868	M	28
CG_Speaker_9_28_M	Blume	u:	302.936	846.18	2823.569	M	28
CG_Speaker_9_28_M	buhlen	u:	297.042	840.408	2640.472	M	28
CG_Speaker_9_28_M	nur	u:	215.948	1087.007	2413.537	M	28
CG_Speaker_9_28_M	füllen	y	415.843	1460.484	2360.9	M	28
CG_Speaker_9_28_M	fühlen	y:	201.545	1866.18	2504.238	M	28
Speaker_1_20_F_Heritage_3020	Wald	a	837.545	1290.706	2554.23	F	20
Speaker_1_20_F_Heritage_3020	hart	a	883.813	1512.922	2526.032	F	20
Speaker_1_20_F_Heritage_3020	Stadt	a	888.971	1467.81	2787.585	F	20
Speaker_1_20_F_Heritage_3020	Haar	a:	972.059	1468.606	2879.299	F	20
Speaker_1_20_F_Heritage_3020	toll	ɔ	635.522	1158.689	2826.343	F	20
Speaker_1_20_F_Heritage_3020	fehlen	e:	434.411	2557.737	2898.061	F	20
Speaker_1_20_F_Heritage_3020	Beeren	e:	475.004	2229.503	3039.343	F	20
Speaker_1_20_F_Heritage_3020	Städte	ɛ	641.307	1998.744	2919.618	F	20
Speaker_1_20_F_Heritage_3021	Bett	ɛ	662.525	1882.512	3042.374	F	20
Speaker_1_20_F_Heritage_3020	Käse	ɛ:	423.293	2461.191	2641.812	F	20
Speaker_1_20_F_Heritage_3020	Bären	ɛ:	586.687	2352.017	2811.551	F	20
Speaker_1_20_F_Heritage_3020	still	ɪ	444.309	2200.059	2959.862	F	20
Speaker_1_20_F_Heritage_3020	stiehl	i:	350.699	2539.075	2857.487	F	20
Speaker_1_20_F_Heritage_3020	viel	i:	357.307	2679.197	2917.424	F	20
Speaker_1_20_F_Heritage_3020	wohl	o:	452.451	869.686	3143.354	F	20
Speaker_1_20_F_Heritage_3020	blöd	ø:	362.574	1733.185	2646.988	F	20
Speaker_1_20_F_Heritage_3020	Hölle	œ	541.308	1725.326	2567.132	F	20
Speaker_1_20_F_Heritage_3020	null	ʊ	302.347	1255.243	2881.488	F	20
Speaker_1_20_F_Heritage_3020	Fluss	ʊ	403.223	1414.555	2540.041	F	20
Speaker_1_20_F_Heritage_3020	Blume	ʊ	364.526	1128.04	2718.237	F	20
Speaker_1_20_F_Heritage_3020	buhlen	u:	330.635	1169.73	2774.137	F	20
Speaker_1_20_F_Heritage_3020	nur	u:	388.021	1390.246	2700.514	F	20

Speaker_1_20_F_Heritage_3020	füllen	y	291.326	1788.495	2537.088	F	20
Speaker_1_20_F_Heritage_3020	fühlen	y:	361.819	1651.498	2726.769	F	20
Speaker_2_19_F_Heritage_3020	Wald	a	593.257	1154.085	2665.072	F	19
Speaker_2_19_F_Heritage_3020	hart	a	789.139	1516.587	2517.559	F	19
Speaker_2_19_F_Heritage_3020	Stadt	a	876.468	1379.259	2359.355	F	19
Speaker_2_19_F_Heritage_3020	Haar	a:	823.783	1351.985	2998.204	F	19
Speaker_2_19_F_Heritage_3020	toll	ɔ	667.079	1140.35	2500.894	F	19
Speaker_2_19_F_Heritage_3020	fehlen	e:	408.44	2332.389	2539.184	F	19
Speaker_2_19_F_Heritage_3020	Beeren	e:	553.873	2022.395	2753.331	F	19
Speaker_2_19_F_Heritage_3020	Städte	ɛ	627.076	1813.76	2776.861	F	19
Speaker_2_19_F_Heritage_3020	Bett	ɛ	730.031	1863.083	2423.563	F	19
Speaker_2_19_F_Heritage_3020	Käse	ɛ:	398.024	2403.857	3011.04	F	19
Speaker_2_19_F_Heritage_3020	Bären	ɛ:	691.81	2027.96	2791.9	F	19
Speaker_2_19_F_Heritage_3020	still	ɪ	422.34	2052.24	2812.317	F	19
Speaker_2_19_F_Heritage_3020	stiehl	i:	299.279	2673.777	2845.701	F	19
Speaker_2_19_F_Heritage_3020	viel	i:	332.19	2563.737	2710.922	F	19
Speaker_2_19_F_Heritage_3020	wohl	o:	425.052	686.383	3515.25	F	19
Speaker_2_19_F_Heritage_3020	blöd	ø:	405.64	1806.554	2906.56	F	19
Speaker_2_19_F_Heritage_3020	Hölle	œ	588.257	1759.973	2477.005	F	19
Speaker_2_19_F_Heritage_3020	null	ʊ	506.429	1185.6	2473.912	F	19
Speaker_2_19_F_Heritage_3020	Fluss	ʊ	482.876	1338.75	2584.338	F	19
Speaker_2_19_F_Heritage_3020	Blume	ʊ	418.226	890.575	2452.159	F	19
Speaker_2_19_F_Heritage_3020	buhlen	u:	361.97	1067.69	2673.02	F	19
Speaker_2_19_F_Heritage_3020	nur	u:	368.983	883.906	2562.535	F	19
Speaker_2_19_F_Heritage_3020	füllen	y	460.425	1784.909	2554.129	F	19
Speaker_2_19_F_Heritage_3020	fühlen	y:	341.586	1676.153	2357.417	F	19
Speaker_4_19_M_Heritage	Wald	a	619.7	1062.377	2408.593	M	19
Speaker_4_19_M_Heritage	hart	a	691.09	1096.259	2240.756	M	19
Speaker_4_19_M_Heritage	Stadt	a	738.708	1153.705	2339.085	M	19
Speaker_4_19_M_Heritage	Haar	a:	408.868	1919.491	2482.499	M	19

Speaker_4_19_M_Heritage	toll	ɔ	434.453	954.862	2708.698	M	19
Speaker_4_19_M_Heritage	fehlen	e:	377.902	1908.957	2559.661	M	19
Speaker_4_19_M_Heritage	Beeren	e:	386.788	1832.378	2684.436	M	19
Speaker_4_19_M_Heritage	Städte	ɛ	357.363	2108.997	2462.391	M	19
Speaker_4_19_M_Heritage	Bett	ɛ	449.964	1329.286	2356.578	M	19
Speaker_4_19_M_Heritage	Käse	ɛ:	320.189	2202.404	2311.855	M	19
Speaker_4_19_M_Heritage	Bären	ɛ:	409.66	2114.286	2475.04	M	19
Speaker_4_19_M_Heritage	still	ɪ	393.119	1678.642	2411.894	M	19
Speaker_4_19_M_Heritage	stiehl	i:	273.342	2201.067	2313.769	M	19
Speaker_4_19_M_Heritage	viel	i:	298.262	2019.632	2607.616	M	19
Speaker_4_19_M_Heritage	wohl	o:	376.08	837.588	2663.995	M	19
Speaker_4_19_M_Heritage	blöd	ø:	384.94	1662.033	2236.497	M	19
Speaker_4_19_M_Heritage	Hölle	œ	402.927	1186.315	2769.555	M	19
Speaker_4_19_M_Heritage	null	ʊ	389.999	1015.557	2506.658	M	19
Speaker_4_19_M_Heritage	Fluss	ʊ	413.444	952.258	2391.886	M	19
Speaker_4_19_M_Heritage	Blume	ʊ	347.14	1039.92	2115.51	M	19
Speaker_4_19_M_Heritage	buhlen	u:	301.106	1634.468	2264.311	M	19
Speaker_4_19_M_Heritage	nur	u:	402.137	1528.471	2208.67	M	19
Speaker_4_19_M_Heritage	füllen	y	389.314	1611.815	2206.184	M	19
Speaker_4_19_M_Heritage	fühlen	y:	372.472	1450.733	2102.53	M	19
Speaker_5_25_M_Heritage	Wald	a	686.475	1140.53	2612.922	M	25
Speaker_5_25_M_Heritage	hart	a	725.463	1431.322	2546.626	M	25
Speaker_5_25_M_Heritage	Stadt	a	775.432	1222.858	2573.64	M	25
Speaker_5_25_M_Heritage	Haar	a:	779.708	1191.234	2541.808	M	25
Speaker_5_25_M_Heritage	toll	ɔ	510.185	869.053	2509.057	M	25
Speaker_5_25_M_Heritage	fehlen	e:	324.359	2012.128	2595.524	M	25
Speaker_5_25_M_Heritage	Beeren	e:	395.528	1952.062	2500.044	M	25
Speaker_5_25_M_Heritage	Städte	ɛ	336.209	2017.862	2529.898	M	25
Speaker_5_25_M_Heritage	Bett	ɛ	589.175	1688.725	2617.195	M	25
Speaker_5_25_M_Heritage	Käse	ɛ:	314.615	2052.181	2505.391	M	25

Speaker_5_25_M_Heritage	Bären	ɛː	346.333	1969.665	2565.254	M	25
Speaker_5_25_M_Heritage	still	ɪ	379.53	1736.955	2536.599	M	25
Speaker_5_25_M_Heritage	stiehl	iː	256.451	2343.072	2587.114	M	25
Speaker_5_25_M_Heritage	viel	iː	274.637	2252.268	2627.586	M	25
Speaker_5_25_M_Heritage	wohl	oː	365.385	718.893	2560.015	M	25
Speaker_5_25_M_Heritage	blöd	øː	347.382	1460.58	2193.136	M	25
Speaker_5_25_M_Heritage	Hölle	œ	436.465	1487.529	2516.708	M	25
Speaker_5_25_M_Heritage	null	ʊ	376.834	862.506	2446.59	M	25
Speaker_5_25_M_Heritage	Fluss	ʊ	393.623	1030.921	2484.567	M	25
Speaker_5_25_M_Heritage	Blume	ʊ	320.402	839.12	2499.008	M	25
Speaker_5_25_M_Heritage	buhlen	uː	275.195	727.877	2528.033	M	25
Speaker_5_25_M_Heritage	nur	uː	335.799	895.008	2387.436	M	25
Speaker_5_25_M_Heritage	füllen	y	381.496	1425.525	2459.72	M	25
Speaker_5_25_M_Heritage	fühlen	yː	291.531	1475.763	2004.108	M	25
Speaker_6_18_M_Heritage	Wald	a	531.469	1092.671	2021.984	M	18
Speaker_6_18_M_Heritage	Stadt	a	564.364	1209.073	2104.597	M	18
Speaker_6_18_M_Heritage	hart	a	647.235	1135.939	2038.866	M	18
Speaker_6_18_M_Heritage	Haar	aː	692.032	1186.324	2194.33	M	18
Speaker_6_18_M_Heritage	toll	ɔ	530.063	1100.104	1990.72	M	18
Speaker_6_18_M_Heritage	Beeren	eː	423.093	1617.572	2352.172	M	18
Speaker_6_18_M_Heritage	fehlen	eː	442.24	1684.514	2519.209	M	18
Speaker_6_18_M_Heritage	Städte	ɛ	470.767	1474.205	2393.848	M	18
Speaker_6_18_M_Heritage	Bett	ɛ	530.394	1408.769	2270.221	M	18
Speaker_6_18_M_Heritage	Käse	ɛː	368.631	1842.666	2440.1	M	18
Speaker_6_18_M_Heritage	Beeren	ɛː	475.303	1652.843	2388.57	M	18
Speaker_6_18_M_Heritage	still	ɪ	392.403	1684.134	2521.275	M	18
Speaker_6_18_M_Heritage	stiehl	iː	311.888	1901.274	2443.826	M	18
Speaker_6_18_M_Heritage	viel	iː	375.067	1777.487	2438.586	M	18
Speaker_6_18_M_Heritage	wohl	oː	417.492	909.261	1954.836	M	18
Speaker_6_18_M_Heritage	blöd	øː	409.487	1332.869	2247.766	M	18

Speaker_6_18_M_Heritage	Hölle	œ	395.913	1388.14	2187.686	M	18
Speaker_6_18_M_Heritage	null	ʊ	352.858	1259.138	2160.303	M	18
Speaker_6_18_M_Heritage	Fluss	ʊ	412.686	1196.83	2055.141	M	18
Speaker_6_18_M_Heritage	Blume	u:	281.581	1003.013	2020.508	M	18
Speaker_6_18_M_Heritage	buhlen	u:	321.813	860.999	2104.445	M	18
Speaker_6_18_M_Heritage	nur	u:	356.2	946.027	2181.69	M	18
Speaker_6_18_M_Heritage	füllen	y	351.556	1449.017	2214.357	M	18
Speaker_6_18_M_Heritage	fühlen	y:	299.68	1401.656	2182.82	M	18

Individual Speaker Production Results – Vowel Duration

gender	fluency	vowel	Mean(vowel-duration)	Std Dev(vowel-duration)	long/short
F	1. novice / international	a:	0.1925	0.014849	long
F	1. novice / international	a	0.158	0.068166	short
F	3. intermediate	a:	0.1665	0.054114	long
F	3. intermediate	a	0.115917	0.053949	short
F	4. advanced	a:	0.17125	0.053044	long
F	4. advanced	a	0.109313	0.037926	short
F	5. heritage	a:	0.154	0.019799	long
F	5. heritage	a	0.075	0.01996	short
F	6. native	a:	0.1475	0.040545	long
F	6. native	a	0.077042	0.024671	short
M	2. novice	a:	0.1641	0.032206	long
M	2. novice	a	0.1236	0.027416	short
M	3. intermediate	a:	0.118	0.024262	long
M	3. intermediate	a	0.10275	0.044969	short
M	4. advanced	a:	0.1555	0.071896	long
M	4. advanced	a	0.086375	0.035238	short
M	5. heritage	a:	0.120667	0.016258	long
M	5. heritage	a	0.099222	0.020253	short
M	6. native	a:	0.1361	0.039848	long
M	6. native	a	0.0738	0.023523	short
F	1. novice / international	ɛ:	0.229	0.015556	long
F	1. novice / international	ɛ	0.172	0.062225	short
F	3. intermediate	ɛ:	0.141667	0.044671	long
F	3. intermediate	ɛ	0.102333	0.025719	short
F	4. advanced	ɛ:	0.134625	0.051475	long
F	4. advanced	ɛ	0.099375	0.016561	short
F	5. heritage	ɛ:	0.1035	0.039602	long
F	5. heritage	ɛ	0.0765	0.025371	short
F	6. native	ɛ:	0.114833	0.031464	long
F	6. native	ɛ	0.081667	0.028532	short
M	2. novice	ɛ:	0.133	0.035368	long
M	2. novice	ɛ	0.1282	0.026849	short
M	3. intermediate	ɛ:	0.1655	0.063564	long
M	3. intermediate	ɛ	0.09625	0.022351	short
M	4. advanced	ɛ:	0.16975	0.038047	long
M	4. advanced	ɛ	0.109	0.032239	short

M	5. heritage	ɛ:	0.120167	0.028653	long
M	5. heritage	ɛ	0.077833	0.024919	short
M	6. native	ɛ:	0.126	0.017518	long
M	6. native	ɛ	0.0854	0.016352	short
F	1. novice / international	e:	0.148	0.018385	long
F	3. intermediate	e:	0.119833	0.029526	long
F	4. advanced	e:	0.139	0.040529	long
F	5. heritage	e:	0.10725	0.031063	long
F	6. native	e:	0.131583	0.051437	long
M	2. novice	e:	0.1312	0.026985	long
M	3. intermediate	e:	0.139	0.039799	long
M	4. advanced	e:	0.1575	0.023965	long
M	5. heritage	e:	0.108667	0.026711	long
M	6. native	e:	0.1196	0.032028	long
F	1. novice / international	i:	0.117	0.004243	long
F	1. novice / international	ɪ	0.142		short
F	3. intermediate	i:	0.104	0.029285	long
F	3. intermediate	ɪ	0.081667	0.019218	short
F	4. advanced	i:	0.121	0.044827	long
F	4. advanced	ɪ	0.117	0.069388	short
F	5. heritage	i:	0.09175	0.021125	long
F	5. heritage	ɪ	0.077	0.018385	short
F	6. native	i:	0.111083	0.020394	long
F	6. native	ɪ	0.0805	0.011113	short
M	2. novice	i:	0.1228	0.024603	long
M	2. novice	ɪ	0.0884	0.023944	short
M	3. intermediate	i:	0.10325	0.030837	long
M	3. intermediate	ɪ	0.1105	0.006364	short
M	4. advanced	i:	0.124	0.040522	long
M	4. advanced	ɪ	0.1085	0.002121	short
M	5. heritage	i:	0.082833	0.021236	long
M	5. heritage	ɪ	0.075333	0.021385	short
M	6. native	i:	0.0936	0.027969	long
M	6. native	ɪ	0.076	0.015166	short
F	1. novice / international	o:	0.186		long
F	1. novice / international	ɔ	0.216	0.033941	short
F	3. intermediate	o:	0.218667	0.060995	long
F	3. intermediate	ɔ	0.125833	0.031269	short
F	4. advanced	o:	0.158	0.066703	long
F	4. advanced	ɔ	0.117125	0.061615	short
F	5. heritage	o:	0.1075	0.012021	long
F	5. heritage	ɔ	0.068	0.001414	short
F	6. native	o:	0.108	0.02004	long

F	6. native	ɔ	0.07675	0.023164	short
M	2. novice	o:	0.1488	0.038389	long
M	2. novice	ɔ	0.1371	0.038837	short
M	3. intermediate	o:	0.1815	0.051619	long
M	3. intermediate	ɔ	0.122	0.024042	short
M	4. advanced	o:	0.185	0.011314	long
M	4. advanced	ɔ	0.11325	0.029443	short
M	5. heritage	o:	0.085	0.021071	long
M	5. heritage	ɔ	0.094667	0.025423	short
M	6. native	o:	0.1062	0.028595	long
M	6. native	ɔ	0.0768	0.01439	short
F	1. novice / international	ø:	0.144		long
F	1. novice / international	œ	0.157		short
F	3. intermediate	ø:	0.163	0.023896	long
F	3. intermediate	œ	0.104333	0.032332	short
F	4. advanced	ø:	0.1945	0.0306	long
F	4. advanced	œ	0.076	0.033744	short
F	5. heritage	ø:	0.1155	0.003536	long
F	5. heritage	œ	0.056	0.008485	short
F	6. native	ø:	0.124333	0.040515	long
F	6. native	œ	0.066667	0.018327	short
M	2. novice	ø:	0.1516	0.038785	long
M	2. novice	œ	0.116	0.026711	short
M	3. intermediate	ø:	0.1355	0.026163	long
M	3. intermediate	œ	0.119	0.004243	short
M	4. advanced	ø:	0.1825	0.045962	long
M	4. advanced	œ	0.1405	0.062933	short
M	5. heritage	ø:	0.116333	0.017616	long
M	5. heritage	œ	0.127667	0.073419	short
M	6. native	ø:	0.137	0.021307	long
M	6. native	œ	0.0756	0.017672	short
F	1. novice / international	u:	0.132333	0.056048	long
F	1. novice / international	ʊ	0.135	0.031113	short
F	3. intermediate	u:	0.117111	0.045619	long
F	3. intermediate	ʊ	0.0905	0.029064	short
F	4. advanced	u:	0.09625	0.034402	long
F	4. advanced	ʊ	0.120875	0.030465	short
F	5. heritage	u:	0.074667	0.032067	long
F	5. heritage	ʊ	0.09875	0.028135	short
F	6. native	u:	0.099722	0.034813	long
F	6. native	ʊ	0.085417	0.034031	short
M	2. novice	u:	0.114867	0.047466	long
M	2. novice	ʊ	0.1087	0.028667	short

M	3. intermediate	u:	0.108333	0.028654	long
M	3. intermediate	ʊ	0.09125	0.01021	short
M	4. advanced	u:	0.113	0.046678	long
M	4. advanced	ʊ	0.09325	0.021329	short
M	5. heritage	u:	0.090333	0.018405	long
M	5. heritage	ʊ	0.075	0.015492	short
M	6. native	u:	0.108533	0.029411	long
M	6. native	ʊ	0.0697	0.019044	short
F	1. novice / international	y:	0.117		long
F	1. novice / international	y	0.159		short
F	3. intermediate	y:	0.088	0.029513	long
F	3. intermediate	y	0.074667	0.014572	short
F	4. advanced	y:	0.12725	0.050182	long
F	4. advanced	y	0.1125	0.050017	short
F	5. heritage	y:	0.114	0.008485	long
F	5. heritage	y	0.123	0.029698	short
F	6. native	y:	0.109333	0.022853	long
F	6. native	y	0.076167	0.029674	short
M	2. novice	y:	0.1072	0.013554	long
M	2. novice	y	0.11	0.020579	short
M	3. intermediate	y:	0.16	0.050912	long
M	3. intermediate	y	0.094	0.067882	short
M	4. advanced	y:	0.099	0.015556	long
M	4. advanced	y	0.1005	0.019092	short
M	5. heritage	y:	0.119667	0.030665	long
M	5. heritage	y	0.092667	0.017474	short
M	6. native	y:	0.1002	0.032783	long
M	6. native	y	0.0916	0.037125	short

Extralinguistic Data Part 1

Speaker	Do you speak other languages?	Did you have German in High School?	Have you been to Germany?	What kind of pronunciation practice did you have?
Speaker 1	none	no	no	a lot of talking in class
Speaker 2	speaks and understands some Portuguese and speaks some Spanish	no	no	explicit rules laid out by teacher
Speaker 3	Tamil (native Indian language) which he learned from his parents in the us	no	3 times (overall a week)	hear professor speak, who speaks predominantly German Certain patterns in speech. Interactive part. Hearing them say a word and Picking definition helps the pronunciation. Better than just reading
Speaker 4	little Spanish	no	no	pronunciation exercise in middle school (had it from 6.-9. grade)
Speaker 5	4 semesters Spanish	no	yes, Berlin for 3 days	repetitions, acting things out
Speaker 6	ESL started in 2nd grade when she was 7	no	just at airport	
Speaker 7	Spanish 2 yrs in High School	no	no	not prior to latest level, class discussions help
Speaker 8	none	no	no	Practiced a lot of vowels, vowels with umlaut at first: listening, repeating. Phonetic instructions put your lips closer together
Speaker 9	none	yes, 3 years	yes, 4 days in berlin, 1 day in Dresden, 1 day in Frankfurt, 1 day in Nürnberg.	Repetitions. Audio recordings, would record their own voice with partners on audacity. Conversation. How well they can form sentences and how well to pronounce. Pronunciation was part of the final grade.
Speaker 10	none	yes, 4 years	no	Activities: for each letter. Practicing and correcting over and over when she messed up. Umlaut sounds different, when it doesn't have umlaut

Speaker 11	none	yes, 10 years	yes, 3 week High school exchange	songs, poems when she was little. At university level repeating Umlaut
Speaker 12	Some French	yes, 3 years	yes, study abroad in Freiburg for a month	teacher modeled pronunciation. Subject always thought "German had a straightforward pronunciation)
Speaker 13	Some French	yes, 1 year	yes, one year (Bremerhaven and Friedrichshafen)	no, were required to study for themselves
Speaker 14	Some French, some Russian	no	yes, 8 years (3-11 yrs old) but mostly on American base in Rammstein	no, had to teach German to herself during a senior project. School did not offer German
Speaker 15	Some Japanese	yes, 3 years (9-11th grade)	yes, one week in frankfurt, 1 day in berlin	no, more grammar at university level
Speaker 16	none	no	yes, Freiburg exchange	Board games other games, fun activities
Speaker 17	none	yes, 3 years	yes, Freiburg Exchange and Pädagogischer Austauschdienst (each 4 weeks)	High School mispronunciation would be corrected, sang a few songs, read poems
Speaker 18				
Speaker 19				
Speaker 20				
Speaker 21				
Speaker 22				

Extralinguistic Data Part 2

Speaker	What has helped you most with the pronunciation?	Do you prefer writing (w), reading (r) or speaking (s)?	Noteworthy	Importance to sound like a native speaker of German	Motivation to earn a high degree of proficiency in German	Native-likeness of your own proficiency of German
Speaker 1	constant practice	r		4	4	1
Speaker 2	practice	w&r		3	5	1
Speaker 3		s		4	4	2
Speaker 4	Teacher was quick to repeat, also here at UGA. Weird stuff like umlaut that "we don't have in English" repetition helps. Software interactive helps a lot, since they are native speakers with different accents	s		3	4	2
Speaker 5	talking to people, just listening to people	s		5	5	1
Speaker 6		no preference		4	4	1
Speaker 7		s & r (more s)		3	4	1
Speaker 8	Listening and repeating	r & w		2	3	2
Speaker 9	New words would be repeated. Umlaut would be practiced quite a bit.	r & s	thinking about grad school in Germany	3	4	2
Speaker 10		s		3	5	3

Speaker 11	being in Germany, Germans would correct her	s	10 years of German	3	3	4
Speaker 12	Pronunciation was a thing he had to work on it hard, since it was easy to pick up. Came naturally to him	r&w	3 years of German, There are 5 Levels but skipped 2 of them	4	4	3
Speaker 13	Lieder, Zeichentrickfilme. „Lass jetzt los“. Auslandsaufenthalt	r	1 year of German in High School	2	5	3
Speaker 14	Listening to German music and repeating words in class	r & w	mother taught her German till she was 3	mother spoke German to her till they were 3, but then the sister and her only spoke English back to her and so the mother didn’t respond in German after and stopped after the third year.	4	3
Speaker 15	Linguistics /linguistic classes have helped her most. Explaining certain concepts. Umlauts and final devoicing	r & w		3	4	2
Speaker 16	Videos online, interactive at UGA. Freiburg exchange helped a lot	r & w		3	2	3
Speaker 17	Immersion, first 4 weeks of PAD, being surrounded by native speakers. She picked up on patterns. native speaker as a teacher in High School.	s		4	5	3.5
Speaker 18						

Speaker 19
Speaker 20
Speaker 21
Speaker 22