Phonetic transfer of diphthongisation of [eː], [oː], and [øː] in Dutch Learners of L2 German

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Elisa Fuhrmann

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Supervisor: Dr D. Smakman

Second reader: Dr H.N.M. de Mulder

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Abstract

This thesis examines to what extent the long midvowels [eː], [oː], and [øː] are diphthongised in L1 Dutch and whether phonetic transfer of these diphthongisation patterns from L1 Dutch to L2 German occurs. In order to collect data to answer the research questions, two recorded scripts, one in L1 Dutch and one in L2 German, from 29 participants between 18 and 25 years old are analysed. The script involves 15 words, five per phoneme, in both languages. These phonemes are measured for their vowel duration and the corresponding formant values for F_1 and F_2 at 25% and 75% of the vowel duration. In doing so, figures are constructed signifying a line of diphthongisation for each phoneme. Additionally, the data are analysed per word and per participant, and are compared to the average results of all participants together. The results suggest that the phonemes [eː], [oː], and [øː] are diphthongised in L1 Dutch and that phonetic transfer occurs as predicted by Flege's (1988, 1990, 1991, 2007) Speech Learning Model.

Keywords: diphthongisation, L1 Dutch, L2 German, phonetic transfer, long midvowels, formants, F_1, F_2, vowel duration, audio files, speech learning model, sociophonetics.

List of abbreviations

F_1	First formant
F_2	Second formant
L1	First Language
L2	Second Language
SLM	Speech Learning Model

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1 Introduction

1.1 Overview

The aim of this thesis is to examine whether the phonemes [eː], [oː], and [øː] are diphthongised in German as a second language (L2) by Dutch native speakers as compared to the pronunciation of these phonemes in the speakers' first language (L1) Dutch. In finding the answer to this question, we try to establish whether phonetic transfer of diphthongisation patterns occurs from L1 Dutch to L2 German in the pronunciation of the long midvowels [eː], [oː], and [øː]. This information could support the learning process of acquiring and producing a second language.

The goal of the present study is to examine the influence of speaking a second language, namely German, on the pronunciation of the long midvowels [eː], [oː], and [øː] for Dutch native speakers. This will be done by asking a set of 33 participants to record two scripts, one in L1 Dutch and one in L2 German. The recorded data from these participants will be analysed on two characteristics, namely the vowel duration of the phonemes under observation, as well as the formant values of F_1 and F_2 at 25% and 75% of the vowel duration of the uttered phonemes. This allows me to conclude whether the phonemes under observation are diphthongised in Dutch by the participants and whether phonetic transfer of diphthongisation patterns occurs from L1 Dutch to L2 German. This thesis may serve as a pilot study that lays the foundation for a more complex and larger-scale study future analysis on second language acquisition of L2 German for Dutch speakers and the sociolinguistic implications in speaking L2 German.

The thesis is organised as follows. Firstly, previous literature on the Dutch and German long midvowels [eː], [oː], and [øː], which lay the scholarly foundation for this thesis, are critically reviewed in Chapter 1. Then, in Chapter 2, I provide a detailed explanation of the set-up of the sociophonetic study that I have conducted to examine the research questions. In Chapter 3, the results are presented. Lastly, in Chapter 4, I critically review the results, provide answers to the research questions, and conclude the thesis.

1.2 Diphthongisation in Dutch – Historical background

This section starts with some historical information on orthography as a way to explain the choices made by linguists in categorising phonemes as monophthongs or diphthongs. Then, the development of the phonemes [eː], [oː], and [øː] is discussed with the help of academic sources,

such as Smakman (2006) and Van de Velde (1996). By this development, we mean the degree to which these phonemes have been diphthongised over the last century. These sources explain the characteristics of the long midvowels [eː], [oː], and [øː] and reveal what makes them interesting for the current thesis and for future research.

In the nineteenth century, phonetic descriptions for pronunciation models were regularly based on the orthography of the word (Smakman, 2006). As a consequence, some phonemes were referred to as diphthongs, although they were more likely to be monophthongal in reality. One such instance is [øː] (<eu>) in Dutch, in words such as *keuken* [ˈkøːkən] (meaning 'kitchen' in English).

Today, the slight diphthongisation of the long mid-vowels [eː], [øː], and [oː] is accepted as part of contemporary Standard Dutch, despite it being a rather unnoticed phenomenon. Indeed, it is usually only recognised when northern Dutch realisations are placed in juxtapositions to their French, German, or Flemish equivalents (Smakman, 2006). These phonemes were originally denoted as monophthongal and it is unclear when this acceptance of diphthongisation started. In his dissertation on variation in Standard Dutch, Van de Velde (1996) claimed that a change has been taking place from a monophthongal to a subtly diphthongal pronunciation in the Netherlands since the 1920s. However, Smakman (2006) discussed the possibility of the presence of this phenomenon before the 1920s and it being ignored or rejected in writing, or the diphthongisation being attributed to diphthongising effects of subsequent consonants. Apparently, the English phonetician Henry Sweet noted the diphthongal nature of the long mid-vowels in Dutch as early as 1977 (Collins and Mees, 2003; Sweet, 1877). As previously mentioned, orthography has played a big role in phonetic descriptions. For instance, both Beyer (1820, 1839) and Mulder (1846) classified Dutch [øː] as a diphthong, supposedly based on its spelling <eu>. Other writers, such as Brill (1846), categorised Dutch [øː] as a semi-diphthong because its resonation was similar to other semi-diphthongs he spelled as <ej> and <ui>, which sounded like a semi-vowel such as [j]. Brill (1846) argued that their diphthongisations were not strong enough to call them proper diphthongs, hence their position between diphthongs and monophthongs. In addition, Brill (1846) assumed that the addition of the semi-vowels [j] or [w] in Dutch to long vowels was the first step in a diphthongising mechanism. Regarding this mechanism, Bilderdijk (1826) claimed that in Dutch the long vowel [oː] tended towards the diphthong [øː] and that the long vowel [eː] tended towards the diphthong [eɪ].

In contrast, some writers were not accepting of the diphthongising process. For instance, Hoogvliet (1908) put the Dutch long vowels [eː] and [oː] alongside the French monophthongs

<é> and <o>. Moreover, Hoogvliet compared Dutch <eu> to the French monophthong <eu>. Hoogvliet and like-minded colleagues might have facilitated the idea at the start of the twentieth century that Standard Dutch long vowels were still mere monophthongs.

Despite this opposition to the idea of a diphthongisation process, it became generally accepted that [eː], [oː], and [øː] were pronounced with some diphthongisation in Standard Dutch (Rijpma & Schuringa, 1917). Works on the diphthongisation process were published by authors such as Zwaardemaker and Eijkman (1928) who claimed that the light diphthongisation in Dutch would not even be noticed by most people. When [eː], [oː], and [øː] are preceded by a pause, this diphthongisation is more likely to be revealed. Moreover, they theorised that the diphthongisation of [oː] had developed further than the diphthongisation of [eː]. In addition, De Vooijs (1946) considered the position in the syllable and claimed the idea of 'false' diphthongs at the end of words, before a pause, most apparent in the instances of [eː] and [oː] in Dutch. De Vooijs also remarked that the exaggeration of the diphthongising effect sounds less sophisticated than no or light diphthongisation.

Most of the research on the diphthongisation of [eː], [oː], and [øː] in the Netherlands has been performed on prototypical speakers of Standard Dutch. For example, Cassier and Van de Craen (1986) examined the speech of Dutch politicians since these were considered to be speakers of Standard Dutch. Their results showed that their 1930s speaker did not diphthongise at all, as opposed to their 1950s speaker, who diphthongised most of their [eː]'s and [oː]'s. Lastly, their 1980s speaker fell right in the middle of the other participants, and only lightly diphthongised their [eː]'s and[oː]'s. In a similar research, Van de Velde (1996) analysed the speech of Dutch radio presenters between 1935 and 1993. His study revealed an increasing degree of diphthongisation of [eː]'s and [oː]'s, with an acceleration in the second half of the 1960s.

Smakman (2006) considered that, due to the light diphthongisation being continually described as a probable change in motion, perhaps the light diphthongisation in Dutch of [eː], [oː], and [øː] has always been subtly present in the speech of 'sophisticated' or 'educated' speakers, while completely monophthongal realisations have been the written norm that is only met by few. This might explain hypercorrect monophthongised realisations in formal situations, such as early radio broadcasts. As previously mentioned, these light diphthongisations regularly go unnoticed, which Kloeke (1951) was able to show in his study. His research involved Dutch student subjects, who voiced the opinion that the monophthongal pronunciation of [eː] and [oː] was correct and more civilised. Still, the majority of these students diphthongised more strongly

than they themselves found acceptable by their own pronunciation criteria. This shows that slight deviations from the norm may be unnoticed by speakers.

1.3 Vowel characteristics in Dutch

This section provides an overview of the articulatory features of [eː], [oː], and [øː] in the Dutch language.

In Dutch, there are said to be 22 vowels as well as 3 marginalised vowels (Collins and Mees, 2003). An overview of these vowels can be found in the following table:

Table 1.1: System of Dutch (Collins and Mees, 2003).

Checked Steady-state		**Free** Steady-state		**Free** Potential diphthongs		**Free** Essential diphthongs		**Free** Vowel sequences	
ɪ	ZIT	i	ZIE	eː	ZEE	ɛi	MEI	aːi	SAAI
ɛ	ZET	y	NU	øː	BEU	œy	LUI	oːi	MOOI
ɑ	ZAT	u	MOE	oː	ZO	ɑu	KOU	ui	BOEI
ɔ	ZOT	aː	LA					iu	NIEUW
ʉ	NUT							yu	RUW
ə	werkelijk							eːu	MEEUW

The three marginalised vowels missing in this table are /ɛː, œː, ɔː/, which can be found in words such as *beige* [ˈbɛːʒə], *manoeuvre* [mɑˈnœːvrə] (English ‘maneuver’), *roze* [ˈrɔːzə] (English ‘pink’). As can be seen from the table, Collins and Mees (2003) refer to [eː], [oː], and [øː] as free, potential diphthongs in Dutch. However, they also claim that these sounds are actually closing diphthongs, but due to Dutch phoneticians traditionally treating them as steady-state vowels, these sounds are referred to as potential diphthongs. The transcription of these vowels is further complicated by the Belgian counterpart of Standard Dutch, where [eː], [oː], and [øː] are realised in a steady-state nature, not in a closing diphthong manner.

First of all, the following figure shows the place and manner of articulation of [eː], [oː], and [øː] in Dutch:

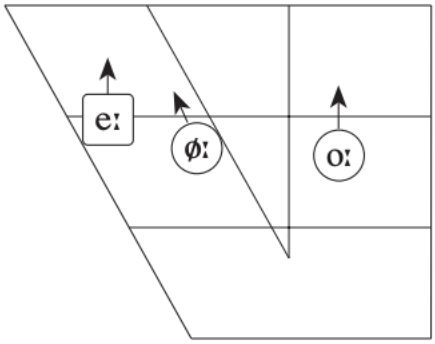

Figure 1.1: Dutch potential diphthongs / eː, øː, oː/ as in ZEE, BEU, ZO (Collins and Mees, 2003).

As this vowel chart reveals, both /øː/ and /oː/ are pronounced with rounded lips, whereas /eː/ is realised with unrounded lips. In addition, /eː/ begins front, close-mid and ends front, above close-mid. In comparison, /øː/ begins front-central, below close-mid and ends front-central, above close-mid. In contrast, /oː/ begins back-central, between close-mid and open-mid and ends back-central, close-mid (Collins and Mees, 2003). In his research, Smakman (2006) looked at differences between male and female participants in their production of the midvowels [eː], [oː], and [øː] pertaining to their diphthongisation and compared these results to those by Adank et al. (2004). Figure 1.2 displays the long midvowels by Smakman's five and Adank et al.'s 10 male speakers at 25% and 75% of the vowel duration. The connecting lines signify diphthongisation.

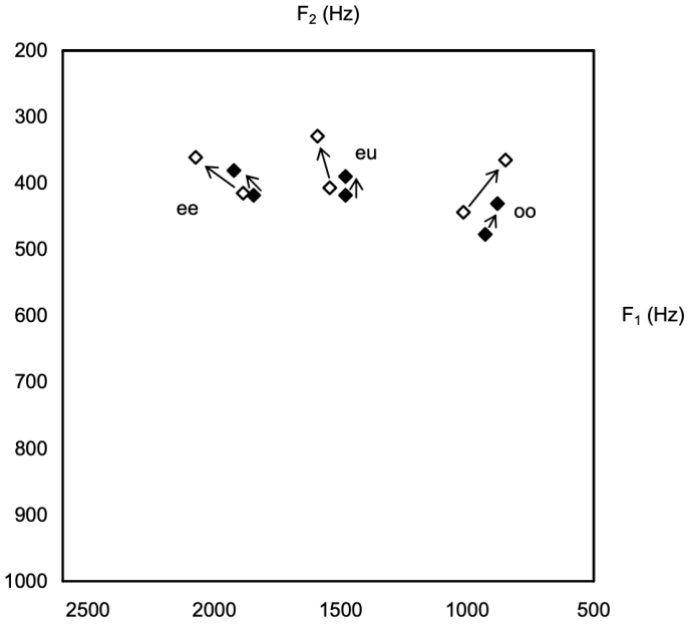

Figure 1.2: F_1 and F_2 at 25% and 75% of three midvowels [(ee), (eu), and (oo)] by our [Smakman's, 2006] male speakers (N=5, up to 20 tokens per speaker) and Adank et al's (2004) (N=10, two tokens per speaker). The transparent squares are Adank et al.'s, the opaque ones are ours [Smakman's].

As can be seen, both groups of speakers produce light diphthongs in the top half of the vowel diagram. Moreover, the data suggest that the long midvowels by Adank et al's speakers begin in a similar position as Smakman's speakers and end in a more closed position.

Figure 1.3 displays the long midvowels by Smakman's two and Adank et al's 10 female speakers at 25% and 75% of the vowel duration.

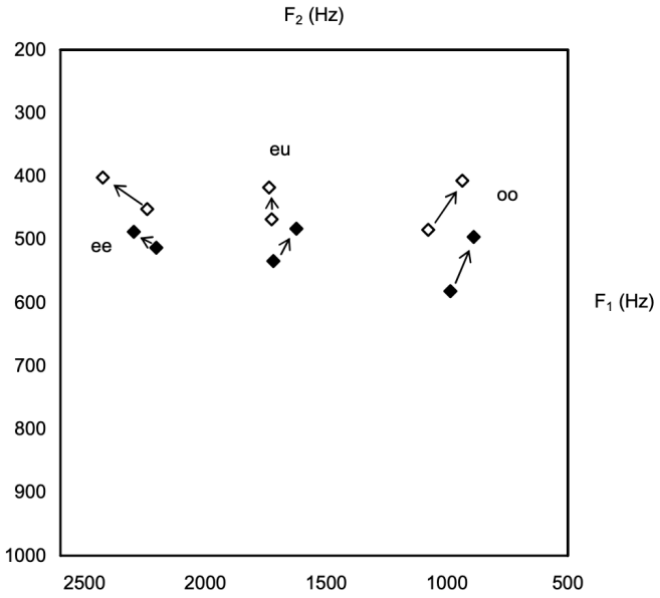

Figure 1.3: F_1 and F_2 at 25% and 75% of three midvowels [(ee), (eu), and (oo)] by our [Smakman's, 2006] speakers (two female speakers, up to 20 tokens per speaker) and Adank et al's (2004) (10 female speakers, two tokens per vowel per speaker). The transparent squares are Adank et al.'s, the opaque ones are ours [Smakman's].

Based on these data, no strong diphthongisation differences between the two groups were found, although Smakman's female speakers did seem to diphthongise [eː] and [øː] more than Smakman's male speakers, while Adank et al's male and female speakers revealed a mutually similar pattern in that respect. Smakman (2006) concluded that in modern Standard Dutch, light diphthongisation could be established with a tendency towards more diphthongisation.

Secondly, all three vowels are lowered and centralised before dark [ɬ] and the vowels are raised and have a central gliding before /r/. Furthermore, the distinction between /oː/ and /ɔ/ may be blurred before /r/ in some Randstad dialects, such as Leiden, The Hague, and Rotterdam. However, a length distinction is still retained in these dialects. A visual representation in the vowel chart of the allophones before /r/ can be found in the following figure:

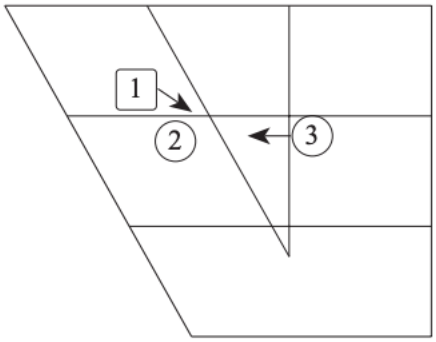

Figure 1.4: Allophones before /r/:
(1) / eːr/, e.g. ‘eer’
(2) / øːr/, e.g. ‘deur’
(3) /oːr/, e.g. ‘door’ (Collins and Mees, 2003).

In addition to the aforementioned contextual variation, some accent variation can be found as well. For instance, some areas have little or no glide at all, such as southern and eastern provinces, except for Groningen. This might result in extremely narrow diphthongs. Contrastingly, urban Randstad dialects often have glides with open-mid starting-points (Collins and Mees, 2003).

1.4 Vowel characteristics in German

This section provides an overview of the articulatory features of the sounds under observation in this study, namely [eː], [oː], and [øː], in the German language.

In Standard German, vowels are described by using five distinct characteristics: vowel quantity, vowel quality, dorsality, the amount of dorsality, and lip rounding or the position of the lips (Żyromski, 2017).

Firstly, the vowel quantity is the length of articulation. This does not refer to absolute numbers, but to relative values, namely long, semi-long, and short, when compared to each other. In transcriptions, the symbols pertaining to these values are [ː] for long vowels, [·] for semi-long vowels, and no symbols are used after short values (Żyromski, 2017). However, it might be imperative to add that, depending on the stress in a word, the length of long vowels can vary (Krech, Stock, Hirschfeld, and Anders; 2009). For instance, long vowels that are stressed are clearly longer than long vowels that are unstressed, as in the German word *worin* [ˈvoːʁɪn] (English ‘wherein’). If the stress is on the first syllable, then a long [o] is pronounced. If the stress is changed to the second syllable, then [o] is shortened. The degree to which the [o] is cut short might come close to the length of a short vowel, but it remains a long vowel

nonetheless. This is because short vowels are not only shorter in length, compared to long vowels, but they can also not be lengthened. Moreover, short vowels have a permanent connection to the following consonant, whereas long vowels are loosely connected to the following consonant (Krech et al., 2009).

Secondly, a crucial factor in determining the vowel quality is the amount of tension in the speech organs. A vowel has either an open or a closed quality. When pronouncing a vowel with a closed quality, the muscles in the speech organs are tensed, as opposed to a vowel with an open quality, which requires the relaxation of the muscles. For that reason, closed vowels are called tense and open vowels are called relaxed (Żyromski, 2017). According to Żyromski (2017), there are two exceptions to this distinction. One of them is the extra short weakly toned schwa [ə]. He also stated that both [ɑ] and [a] are relaxed and for that reason, they are distinguished by using the terms *dark* and *light.* However, according to Krech et al. (2009) there is another exception. They stated that both [u] and [ʊ] are relaxed as well, thus the same distinction of *dark* and *light* could be applied to the two vowels.

The third characteristic - dorsality, shows the behaviour of the back of the tongue, the dorsum, in the articulation of vowels. In Standard German, only part of the dorsum is raised. Vowels where the front of the dorsum is raised are called predorsal; vowels where the middle part of the dorsum is raised are called medio-dorsal; and those where the back part of the dorsum is raised, are called post-dorsal. The generated sounds can be characterised by specifying their frequency, for which the formants F_1 and F_2 are used. Figure 1.5 shows which part of the dorsum is used in the articulation of the respective vowels:

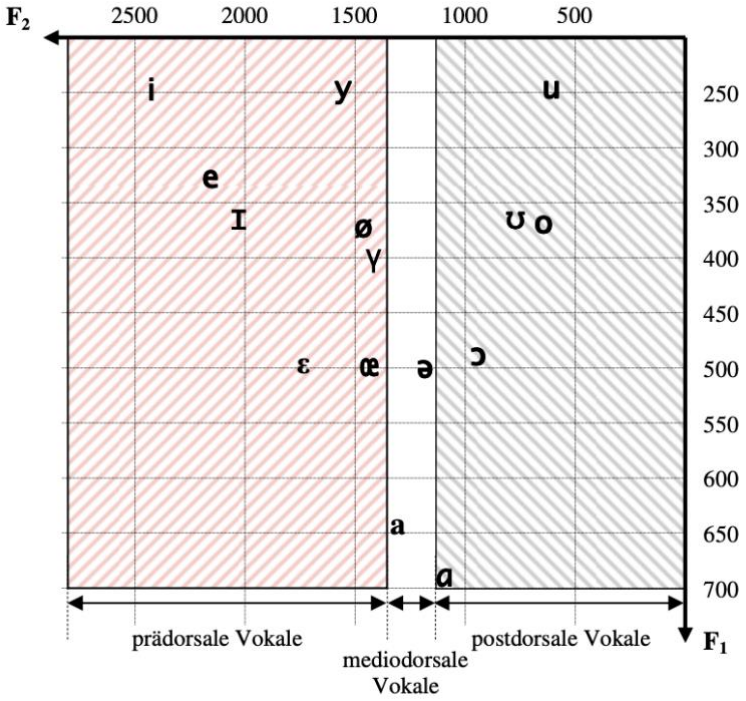

Figure 1.5: The coordinate system of the formant frequencies of the German vowels (Żyromski, 2017).

As Figure 1.5 shows, [e] and [ø] are predorsal vowels, whereas [o] is a post-dorsal vowel.

The fourth characteristic describing vowels is the amount of dorsality. This means that, when comparing two vowels, we discern how high the dorsum is raised. For instance, when looking at Figure 1.5, we can see that the dorsum is raised higher when pronouncing the vowel [i] than when pronouncing the vowel [e]. Thus, [i] is described as *high* and [e] as *mid-high*. The vowels are compared in pairs, based on a set of three characteristics which have to be the same for both vowels: vowel quality, dorsality, and lip rounding (Żyromski, 2017). When applying these characteristics, we are left with the following pairs:

[i] – [e]

[I] – [ɛ]

[y] – [ø]

[Y] – [œ]

[u] – [o]

[ʊ] – [ɔ]

[a] – [ɑ]

The only vowel that is not in a pair is *schwa* [ə], which can be described as a mid-high vowel. Additionally, the vowels [a] and [ɑ] are described as *flat* and *deep*, respectively, due to their lower position in the chart in comparison to the other vowels (Żyromski, 2017).

Lastly, in reference to their articulation, vowels can be described as *rounded, neutral*, or *unrounded*. The level of roundness for the German vowels can be observed in the following Figure:

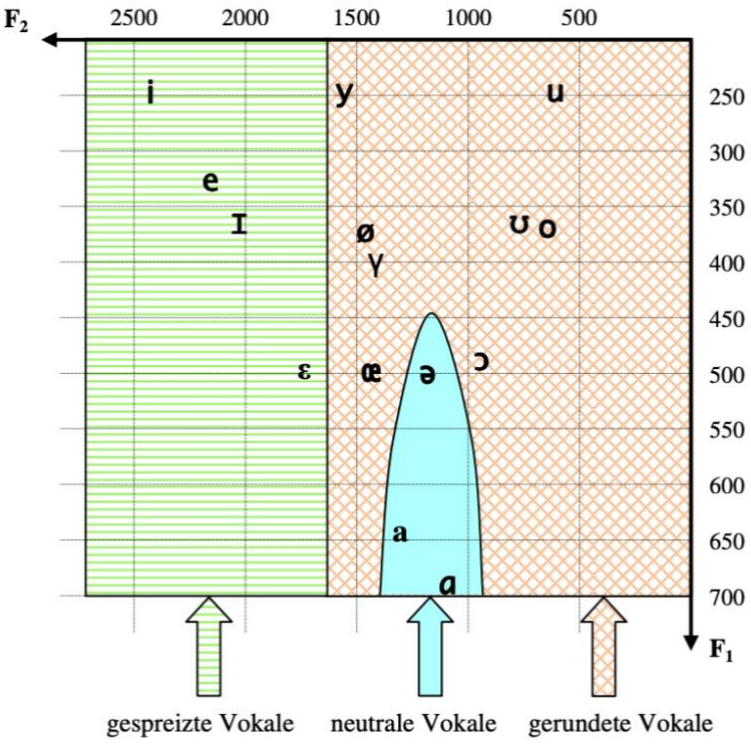

Figure 1.6: The coordinate system of the formant frequencies of the German vowels including the division of roundedness of the lips (Żyromski, 2017).

As can be seen in Figure 1.6, of the vowels that are under study in this thesis, [e] is the only unrounded one, while [ø] and [o] are both rounded vowels.

The aforementioned differences between the German vowels are largely reproduced by their orthography. Even though the Latin alphabet does not make a distinction between long and short vowels, the spelling has developed multiple possibilities to indicate the different quantities in the standard pronunciation (Krech et al., 2009).

For instance, in the case of short vowels, if a stressed vowel is short before a single consonant, the letter for the consonant has almost always been doubled, where <ck> is written for <kk>, such as in *Speck* [ˈʃpek] (English ‘bacon’), and <tz> is written for <zz> as in *Lakritz* [la'kʁɪts] (English ‘liquorice’). Since 2006, this is also the case for /s/ in a word such as *Riss* ['ʁɪs] (‘crack’ in English), which was written as <Riß> before 2006. Exceptions to this rule are names and monosyllabic words such as *bin* ['bɪn] (English ‘am’), *hat* ['hat] (English ‘have’), *ab* ['ap] (English ‘from’), *dran* ['dran] (English ‘turn’), and *bis* ['bɪs] (English ‘to’) (Krech et al., 2009). In addition, in quite a few German loanwords such as *Fassade* [fa'saːdə] (English

‘façade’) and *Batterie* [batə'ʁi:] (English ‘battery’), the letter for the single consonant has also been doubled, even though the short vowels are not stressed.

Graphically, long vowels are marked differently. For example, the letters for stressed /aː/, /eː/, and /oː/ in front of a single consonant were doubled in a small group of words, such as *Saal* ['zaːl] (English ‘room’), *Beet* ['beːt] (English ‘patch’), and *Boot* ['boːt] (English ‘boat’). Furthermore, /iː/ is spelled in some words with <ih> or <ieh>, such as in *Vieh* ['fiː] (English ‘cattle’), although in most words, /iː/ is spelled with <ie>, such as *schief* ['ʃi:f] (English ‘crooked’). Suffixes with /iː/ are also spelled with <ie>, such as *Philosphie* [ˌfiːloːzoː'fiː] (English ‘philosophy’) and *marschieren* [maʁ'ʃiːʁən] (English ‘to march’). Additionally, in about half of the cases where the individual consonant following a stressed long vowel was either an /m/, /n/, /l/, or /r/, an expansion-*h* was used, such as *lahm* ['laːm] (English ‘lame’, *Wahn* ['vaːn] (English ‘delusion’), and *Höhle* ['høːlə] (English ‘cave’). Lastly, following a long vowel, /s/ is spelled with <ß> as in *Fuß* ['fuːs] (English ‘foot’) (Krech et al., 2009). A more extensive overview of these phoneme-grapheme relationships including examples can be found in Appendix A.

1.5 Phonetic transfer

Various studies in the field of bilingualism have demonstrated that L2 learners may experience difficulty with non-native sounds with their second language (Mooney, 2019). These difficulties are generally observed in both perception (Pallier, Bosch & Sebastián-Gallés, 1997, Sebastián-Gallés & Soto-Faraco, 1999, for example) and production (Flege, Yeni-Komshian & Liu, 1999, for example).

In his speech learning model (SLM), Flege (1988, 1990, 1991) proposed that the L1 and L2 phonetic subsystems of a bilingual will interact through the mechanism of category assimilation when phonetic category formation has been blocked by equivalence classification. SLM predicts that an L2 learner will at first use the closest L1 sound to produce L2 sounds, without evidence of modification or learning. This is called ‘interlingual identification’ (Flege, 2007; Moody, 2019). However, equivalence classification does not prevent L2 learners from auditorily detecting cross-language phonetic difference. The model also predicts that, when L2 category formation is blocked, production of an L2 sound will be modified slowly over time if the L2 sound differs audibly from the L1 sound with which it has been equated. The modification will be limited, however, because a single long-term memory representation will be used to process instances of the L2 sound and its L1 counterpart. When a category is not

formed for an L2 sound because it is ‘too similar’ to an L1 counterpart, the L1 and L2 sounds will assimilate, leading to a ‘merged’ L1–L2 category (Flege, 2005). Consequently, SLM proposes bilateral transfer, meaning that the L2 sound will continue to resemble the L1 sound, whilst the L1 sound will begin to resemble the L2 sound. Flege (2007) notes that depending on the nature of the input received, the merged category may resemble more closely the long-term representation of L1 or L2 monolinguals.

1.6 False friends

False friends, also known as false cognates, are words that have one meaning in one language and a different meaning in another language, whilst sounding similar (“False cognate,” n.d.). For instance, English ‘actual’ and German ‘*aktuell*’ (meaning ‘current’ or ‘latest’ in English). These similarities can confuse language learners and often cause errors. Dijkstra, Grainger, and Van Heuven (1999) classified only orthographically identical items as true false cognates. One would expect to find L1 interference on L2 caused by these false cognates (Janke and Kolokonte, 2015). This is made possible when a learner is presented with L2 material that exceeds his or her knowledge of L2 (Kellerman, 1979).

1.7 Research questions and hypotheses

The present study is driven by two research questions:

1. *To what extent are the long midvowels [eː], [oː], and [øː] diphthongised in Dutch by Dutch native speakers?*
2. *Are the diphthongisation patterns in L1 Dutch transferred to L2 German by these same speakers?*

The first research question examines whether diphthongisation can be observed in the production of the long midvowels [eː], [oː], and [øː] in L1 Dutch. Previous research has shown that historically, there has been some disagreement as to [eː], [oː], and [øː] being monophthongs or diphthongs in Dutch. In contemporary literature, however, linguists seem to agree that these phonemes are typically produced with light diphthongisation with a tendency towards more diphthongisation (Van de Velde, 1996; Adank et al., 2004; Smakman, 2006). Therefore, we also expect to find diphthongisation in the production of these sounds.

The second research question is concerned with the potential transfer of diphthongisation patterns from L1 Dutch to L2 German in the production of the long midvowels [eː], [oː], and [øː]. In L1 Standard German, no diphthongisation in the pronunciation of the vowels has been found and they are described as long monophthongs (Żyromski, 2017). In general, we would expect L2 learners to produce an assimilated sound, based on the sounds being so similar in both languages, and thus partly transferring the diphthongisation pattern of L1 Dutch to L2 German. Following the notion of SLM (Flege, 2007) that depending on the nature of the input received, this assimilated output may resemble more closely the long-term representation of L1 or L2 monolinguals, we expect this assimilated output bearing a greater resemblance to the long-term representation of L1 Dutch monolinguals.

1.8 Aims of the research

The goal of the present study is to examine whether diphthongisation patterns in L1 Dutch are transferred to L2 German in the production of the long midvowels [eː], [oː], and [øː]. This serves as a pilot study to examine what underlying sociolinguistic reasons there are in the acquisition of L2 German for Dutch speakers.

1.9 Thesis overview

In the next chapter, I provide a detailed explanation of the set-up of the sociophonetic study that I have conducted to examine the research questions. Then, the results are presented in the third chapter. Lastly, in Chapter 4, I critically review the results, provide answers to the research questions, and conclude the thesis.

2 Methodology

2.1 Overview

This chapter provides an explanation of the set-up of the sociophonetic study that I have conducted in order to investigate the research questions. First of all, this chapter gives an extensive overview of the participants and their backgrounds. Next, the method of designing the materials used for the oral tasks is described: the collection of German words, the categorisation of German words, the selection of German and Dutch words for both scripts, and the writing of the scripts themselves. After this, the process of the data collection is discussed. Additionally, the chapter describes how the data were analysed in order to acquire more insight into the pronunciation of the three vowels: [eː], [oː], and [øː] in both German and Dutch by Dutch speakers. Lastly, the measures that were used for the analysis are discussed.

2.2 Participants

30 L1 Dutch speakers participated in the study. All speakers were between 18 and 25 years old. The group consisted solely of female students from Leiden, Delft, and Utrecht. The participants were recruited via e-mail and WhatsApp. The decision to recruit only female students was based on the fact that my personal network consists of more women than men. All participants received at least one year of formal education of L2 German in secondary school. Additionally, none grew up in areas near the German border, such as Nijmegen, Enschede, or Maastricht.

Out of these 30 participants, all but one were selected for the present study. This selection was based on the quality of the audio files that were submitted by the participants, where one participant's audio files were not of a sufficient quality to be able to perform reliable measurements. The following table provides an overview of all participants, their ages, the region where they grew up and received their formal education in L2 German, as well as their residence at the time of the present study.

Table 2.1: Overview of participants (N=29), age, region where they grew up and current residence.

Code	Age	Region of origin	Current residence
AE	19	South-Holland	Leiden
AR	25	South-Holland	Leiden
AV	23	Gelderland (Amersfoort)	Leiden
BJ	19	North-Brabant	Leiden
BL	22	Utrecht	Leiden
BM	20	South-Holland	Leiden
BT	19	South-Holland	Leiden
EF	25	South-Holland	Leiden
EN	25	South-Holland	Leiden
GS	24	North-Holland	Utrecht
HE	22	South-Holland	Leiden
HS	19	South-Holland	Leiden
JE	23	South-Holland	Leiden
KA	25	Utrecht	Utrecht
KC	25	Zeeland	Leiden
KF	24	South-Holland	Leiden
KM	19	South-Holland	Leiden
KS	23	South-Holland	Leiden
LL	20	South-Holland	Leiden
MM	22	Utrecht	Utrecht
ON	21	South-Holland	Leiden
RW	21	South-Holland	Leiden
SA	22	Gelderland (Harderwijk)	Delft
SM	22	South-Holland	Leiden
SS	19	Utrecht	Leiden
TM	19	North-Brabant	Leiden
VV	21	North-Brabant	Leiden
WK	23	South-Holland	Leiden
ZM	21	South-Holland	Leiden

2.3 Materials for oral tasks

Collection of German words

For the oral tasks, a Dutch script and a German script were written. For these scripts, 15 words were selected in each language, while controlling for different linguistic environments as explained below, to include in the scripts. From these 15 words in Dutch and German, five included the [eː] sound, five included the [oː] sound, and four included the [øː] sound.

For the selection process, one native speaker of German and one bilingual speaker of German and Dutch were contacted via telephone. The speakers were not given any specific instructions in order to ensure a 'free flow' of the brain in producing these words. They were asked to produce as many German words as possible including the [eː] sound, the [oː] sound, and the [øː] sound. In total, 64 words were collected including the [eː] sound, 48 words including the [oː] sound, and 50 words including the [øː] sound.

Subsequently, the 162 German words were translated into Dutch, sometimes making use of the online dictionary Interglot. In case of doubt, the previous native speakers of German and Dutch were asked for their opinion on the matter. The complete list of the 162 German words and their corresponding Dutch translations can be found in Appendix B.

Categorisation of German words

For all 162 German words, the linguistic environment was determined. Firstly, for each German word it was determined whether the sound under observation could be found in an open or closed syllable, since only words with open syllables would be selected for the scripts. Additionally, for those words in which the sound under observation was situated in an open syllable, it was determined whether there might be the opportunity of a closed syllable in spoken language, as this is often the case in German. For instance, the German word *nehmen* (English 'to take') is pronounced /ne.mən/ in High German, but in colloquial language, this often changes to /neem/. Furthermore, in the categorisation process, it was determined whether the sound under observation was followed by a liquid sound, e.g., /l/ or /r/, or by a nasal sound, e.g., /m/, /n/, or /ŋ/. These sounds influence their preceding sounds (Collins and Mees, 2003; Zsiga, 2013; Krämer, 2017), as in this case are the researched sounds, and as such, they would have to be excluded for the research. Then, it was determined whether the consonant following the sound under observation was voiced or voiceless. With each categorisation step, the pool of usable words decreased for the three sounds under observation, [eː], [oː], and [øː]. Only the Dutch counterparts of German words that remained after these steps underwent the same

categorisation procedure in order to exclude even more words from the collection. A visual overview of these steps can be found in Appendix C.

Selection of words for both scripts

Commonalities and differences between the remaining words were analysed. Based on these commonalities and differences, 15 words were selected to be implemented into a script.

For the [eː] sounds, the remaining words can be seen in the following table:

Table 2.2: Remaining words including phoneme [eː] after categorisation process.

German word	**Dutch counterpart**	**English translation**
Tätigkeit ['teːtɪçˌkaɪt]	*bezigheid* ['beːzəxˌhɛɪt]	activity
Armee [aʁ'meː]	*leger* ['leːxər]	army
Medizin [meːdi'tsiːn]	*medicijnen* [ˌmeːdi'sɛɪnən]	medicine
See ['zeː]	*zee* ['zeː]	sea
Rede ['ʁeːdə]	*lezing* ['leːzɪŋ]	speech
Reederei [ʁeːdəˈʁaɪ̯]	*rederij* [reːdəˈrɛɪ]	shipping company
Reh [ˈʁeː]	*ree* [ˈreː]	deer
Fehde [ˈfeːdə]	*vete* [ˈfeːtə]	feud
Edel [ˈeːdl̩]	*edel* [ˈeːdəl]	noble
Ebene [ˈeːbənə]	*etage* [eːˈtaːʒə]	floor or level
Esel [ˈeːzl̩]	*ezel* [ˈeːzəl]	donkey
kegeln [ˈkeːgəln]	*kegelen* [ˈkeːgələn]	bowling

The German word *Ebene* got excluded hereafter, because in its Dutch counterpart *etage*, the stress is not on the syllable with the [eː] sound in it, but on the syllable after the [eː] sound. Eventually, I chose to select the words *Tätigkeit – bezigheid, Armee – leger, Rede – lezing, Esel – ezel,* and *Kegeln – kegelen* to be implemented into the script, since these seemed to go well into a fictional story together, and there was a mix of words in which the sound under observation was followed by a voiced or a voiceless consonant. The complete selection process for words including the [eː] sound can be found in Appendix D.

For the [oː] sounds, the remaining words after categorisation can be seen in Table 2.3:

Table 2.3: Remaining words including phoneme [oː] after categorisation process.

German word	Dutch counterpart	English translation
Dialoge [diaˈloːgə]	*dialogen* [diaˈloːxən]	dialogues
Logisch [ˈloːgɪʃ]	*logisch* [ˈloːxɪs]	logical
Verlobung [fɛɐ̯ˈloːbʊŋ]	*verloving* [fərˈloːfɪŋ]	engagement
Boten [ˈboːtən]	*bode* [ˈboːdə]	courier

Since the desired number of words per sound was five, German *Dosen* [ˈdoːzən] (English ‘cans’) was also selected. Its Dutch counterpart *blikjes* [‘blɪkjəs], does not include the phoneme [oː], however. Therefore, Dutch *dozen* [ˈdoːzən] (English ‘boxes’) was selected. Their differences in meaning do not differ too greatly to result in two substantive differences in the script. The complete selection process for words including the [oː] sound can be found in Appendix E.

For the [øː] sounds, the words remaining after categorisation can be seen in the following table:

Table 2.4: Remaining words including phoneme [øː] after categorisation process.

German word	Dutch counterpart	English translation
trödeln [ˈtʁøːdəln]	*treuzelen* [ˈtrøːzələn]	dallying or dawdling
Möbel [ˈmøːbəl]	*meubels* [ˈmøːbəls]	furniture
Pöbel [ˈpøːbəl]	*gepeupel* [xəˈpøːpəl]	hoi polloi
fröbeln [ˈfʁøːbəln]	*freubelen* [ˈfʁøːbələn]	tinkering

Again, the desired number of words including [øː] was five. Therefore, it was decided to implement *trödeln* and *treuzelen* twice into the script. In addition, the official Dutch spelling for *freubelen* is <fröbelen>. However, to avoid confusion in terms of its pronunciation, the spelling was adjusted to <freubelen>. This adjustment was not possible in German, since <eu> is pronounced /oi/ in German. An overview of the complete selection process for words including the [øː] sound can be found in Appendix F.

The following table shows the final 15 words to be implemented into the scripts:

Table 2.5: Selected words (N=15 per language) to be implemented into the scripts.

German word	**Dutch counterpart**
Tätigkeit	*bezigheid*
Armee	*leger*
Rede	*lezing*
Esel	*ezel*
kegeln	*kegelen*
Dialoge	*dialogen*
logisch	*logisch*
Verlobung	*verloving*
Boten	*bode*
Dosen	*dozen*
trödeln	*treuzelen*
Möbel	*meubels*
Pöbel	*gepeupel*
fröbeln	*freubelen*
trödelte	*treuzelde*

The German and Dutch scripts

The scripts were written in a 'freewriting' fashion. To ensure that the participants would not focus on their pronunciation, especially in their L2 German, I tried to write a story that made no sense in terms of content. The first version of the German script looked as follows:

> *Es war einmal eine Königin die sich ganz allein fühlte. Sie hatte sich aber etwas ausgedacht. Eines Tages ging sie in den Stall, und holte sich einen Esel. Dieser gehörte eigentlich einem Boten. Er kam zu spät weil er trödelte. Dieser Bote gehörte zum gemeinen Pöbel. Am liebsten wollte er zur Armee gehören. Leider wartete auf ihn noch eine andere Tätigkeit: er musste Dosen transportieren. Um dieses Ziel zu erreichen, ging er zur Königin. Es folgten mehrere Dialoge. Danach durfte er statt Dosen Möbel transportieren. Die Königin kam auf ihrem Esel zum Markt. Ein hübscher junger Mann hielt eine Rede. Es handelte sich um seine Verlobung. Logisch, dass er diese Rede auf dem Markt hielt. Die Königin sehnte sich auch nach einer Verlobung. Die Königin liebte das Fröbeln und bastelte eine Karte. Sie trödelte kein Moment und schickte die Karte*

einem König. Es gelang ihr, den König zu erobern. Um das zu feiern, gingen sie alle kegeln.

The first version of the Dutch script looked as follows:

Er was eens een koningin die zich heel eenzaam voelde, maar daar had ze iets op bedacht. Op een dag ging ze naar de stal en haalde ze een ezel. Deze ezel was eigenlijk van een bode, maar hij kwam te laat omdat hij aan het treuzelen was. De bode behoorde tot het gemene gepeupel. Het liefst wilde hij bij het leger horen. Helaas wachtte hem nog een andere bezigheid; hij moest dozen transporteren. Om dit voor elkaar te krijgen, ging hij naar de koningin. Ze voerden meerdere dialogen. Hierna mocht hij in plaats van dozen, meubels transporteren. De koningin kwam op haar ezel aan bij de markt. Een knappe, jonge man hield een lezing. Het ging over zijn verloving. Logisch, dat hij deze lezing op de markt hield. De koningin verlangde ook naar een verloving. De koningin hield van freubelen en knutselde een kaart in elkaar. Ze treuzelde geen moment en stuurde de kaart naar een koning. Het lukte haar de koning te veroveren. Om dat te vieren, gingen ze samen kegelen.

In English, these scripts would roughly translate to the following text:

‘Once upon a time, there was a princess who felt very lonely, but she came up with a plan. One day, she went to the stables and took out a donkey. This donkey actually belonged to a courier, but he arrived too late because he was dallying. The courier belonged to the hoi polloi. He aspired to join the army. Unfortunately, he had to carry out another task; he had to transport boxes. To make this happen, he went to the princess. They had several dialogues. After this, he was allowed to transport furniture rather than boxes. The princess arrived at the market on her donkey. A handsome, young man held a speech. It was about his engagement. Logically, this speech was held at the market. The princess yearned after an engagement for herself. The princess liked to tinker and crafted a card. She hesitated not a moment and send the card to a prince. She managed to conquer the prince. To celebrate this, they went bowling together’.

The German script was recorded by a few Dutch acquaintances to test whether the stress in the sentences was on the 15 selected words and to check whether any problems would occur

in the execution of the task. This test revealed that the stress was indeed on the right words. However, the test subjects had a lot of difficulties pronouncing the German word *Prinzessin* [pʁɪnˈtsɛsɪn] (Dutch 'prinses' [prɪnˈsɛs]; English 'princess'), which led to mispronunciations in the words that followed thereafter. Thus, German *Prinzessin* was replaced with German *Königin* [ˈkøːniːgɪn] (Dutch 'koningin' [koːnɪŋˈɪn; English 'queen') and German *Prinz* [ˈpʁɪnts] was replaced with German *König* [ˈkøːnɪç] (Dutch 'koning' [ˈkoːnɪŋ]; English 'king').

2.4 Procedures

Data collection

The data were collected by asking all participants to record the German and Dutch scripts and to hand them in via e-mail, since it was not possible to travel and meet other people due to the ongoing threat of COVID-19. The participants were informed beforehand that the procedures would take about 15 minutes in total.

Acoustic description

Acoustic measurements were performed on the three phonemes [eː], [oː], and [øː] in both languages. Both the vowel duration and F_1 and F_2 were measured. All tokens occurred in stressed, open syllables. These were all followed by obstruents.

Formant-based description

In order to characterise the vowels, a formant-based method was used. The connection between vowel openness and F_1 or between vowel frontness and F_2 is not absolute (Smakman, 2006; Kent and Read, 1992; Deterding, 1997), since a single vowel quality can be associated with more than one formant pattern. Nevertheless, multiple researchers have deemed it a suitable method to represent differences between vowels, such as Adank (2003), Labov (1994), and Pols, Tromp, and Plomp (1973). An advantage of formant frequencies is the ability to compactly plot F_1 against F_2 to visualise vowels (Smakman, 2006).

Measuring points and tokens

To provide a general qualification of the three vowels in question, formant values were looked for. In doing so, the vowels could be mutually compared in their respective languages as well as between the two languages. Two points in time relative to the total vowel duration were chosen as measuring points, namely 25% and 75%. The edges of the vowels, below 25% and

above 75%, were avoided, since adjacent phonemes might affect the vowels under observation. These fixed points in time are convenient for both making comparisons of the main component of the vowels as well as for comparing degrees of diphthongisation (Smakman, 2006; Adank, Van Hout, and Smits, 2004).

Deterding (1997) considered around ten occurrences to be adequate to gain a decent idea of the nature of a certain vowel phoneme by a speaker. For the present study, five tokens per language of each vowel phoneme were selected in open syllables. With ten tokens per vowel phoneme and two formants at two measuring points in each token, a total of 1,740 formants were measured (F_1-F_2).

Analysts

Three analysts supported me in the formant-based descriptions. All analysts possessed considerable expertise with regard to the pronunciation of Dutch and/or German. Each analysed their own group of participants. All analysts used headphones. An overview of the transcribed audio files per analyst can be found in Appendix G.

The Praat programme

The software that was used to measure the formants of the vowels was Praat (Boersma, 2001; Boersma & Weenink, 2018), which is, amongst others, a speech analysis, synthesis, and manipulation package developed at the Institute of Phonetic Sciences of the University of Amsterdam in the Netherlands. Three of the four analysts ran Praat on their Windows laptops, whilst one analyst ran the programme on their Macbook Pro.

Manual measurements

The retrievement of the formant values was done manually. This meant that for each token, the analysts had to isolate the phonemes [eː], [oː], and [øː] by ear. By zooming in on the relevant sound, Praat revealed a spectrogram for the sound under observation.

Then, by using a ruler, the analysts determined the 25% and 75% points in time of the vowel. By clicking on the spectrogram at 25% and pressing F_1 and F_2 on their keyboards, the programme revealed the formant values at 25% of the vowel duration of that particular sound. An example of this can be seen in the following picture:

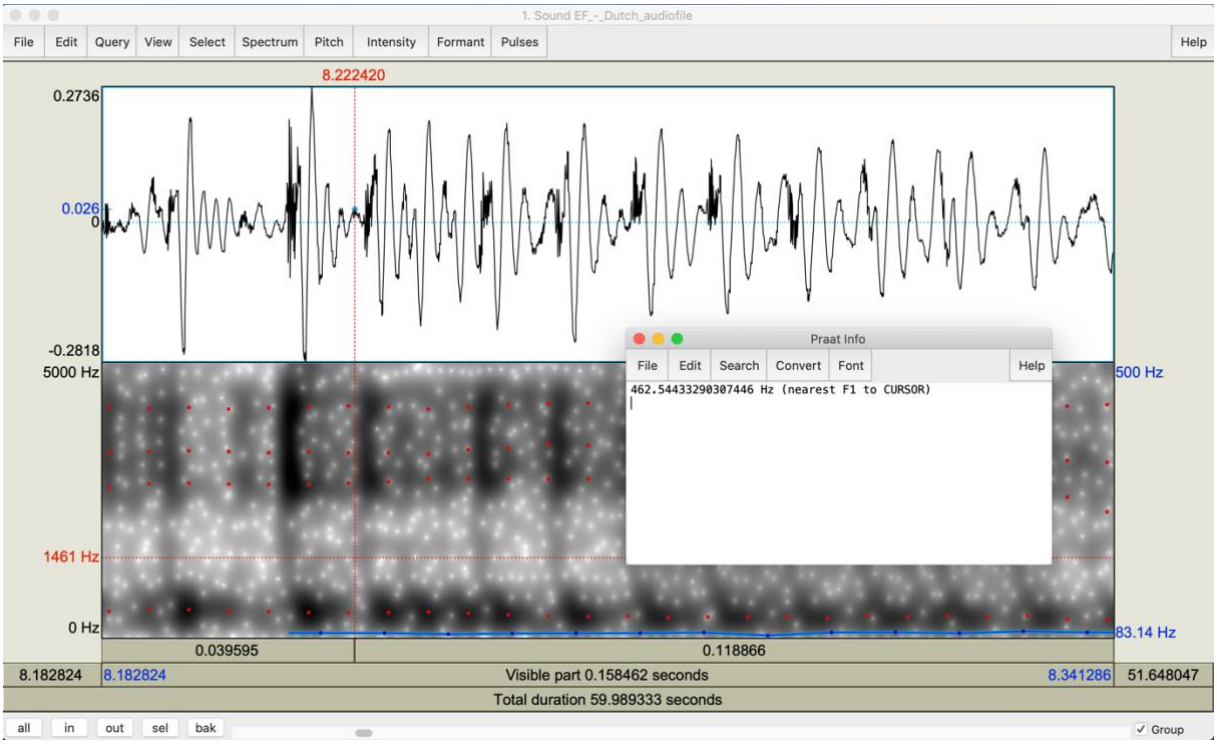

Figure 2.1: Spectrogram in PRAAT of [eː] in Dutch *ezel* by participant EF and F_1 at 25% of the vowel duration.

This screenshot shows the spectrogram belonging to phoneme [eː] in Dutch *ezel* by participant EF. The total duration of the Dutch script for EF was around 60 seconds, the vowel duration of [eː] in *ezel* was around 0.16 seconds, and F_1 at 25% of that vowel duration is 462.5 Hz.

The same steps were taken at 75% of the vowel duration for every sound. All data were recorded in an Excel-file.

2.5 Conclusion

In this chapter, I provided a delineated description of the sociophonetic study and data analysis in this thesis. A formant-description method was used to analyse the level of diphthongisation in L1 Dutch and L2 German of 29 participants. The data were obtained by manually retrieving the vowel duration, as well as F_1 and F_2 at 25% and 75% of the vowel duration, of 1,740 formants. To ensure that the data were representative of the female population between 18 and 25 years old in the Netherlands, 3 female students were asked to take part in this study. This methodology allowed me to answer the research questions stated in Chapter 1 in an effective and reliable approach. The results are presented in the following chapter.

3 Results

3.1 Overview

In this chapter, I present the results of the current sociophonetic study. To analyse characteristics regarding diphthongisation of [eː], [oː], and [øː] in L1 Dutch and L2 German, acoustic data were obtained from 29 Dutch participants. Next, the sounds under observation were isolated and the vowel duration was measured as well as F_1 and F_2 at 25% and 75% of the vowel duration. Then, the measurements were analysed per participant, per word, and per phoneme. The results of these analyses are described in more detail in the present chapter.

3.2 Findings

The acoustic analyses are necessary in order to answer the questions to what extent speakers of L1 Dutch show signs of diphthongisation in the pronunciation of the phonemes [eː], [oː], and [øː] and whether it can be concluded that phonetic transfer of these diphthongisation patterns in L1 Dutch to L2 German is found. Therefore, the results of the analyses per phoneme are described in more detail below.

In addition, to look for outliers in the data of all participants, the data were analysed per participant and these results can be found in Appendix H. Similarly, to look for outliers in the data of all words involving the same phoneme under observation, the data were analysed per word and these results can be found in Appendix I.

The following figure reveals the resulting averages of the analyses per phoneme of all participants together:

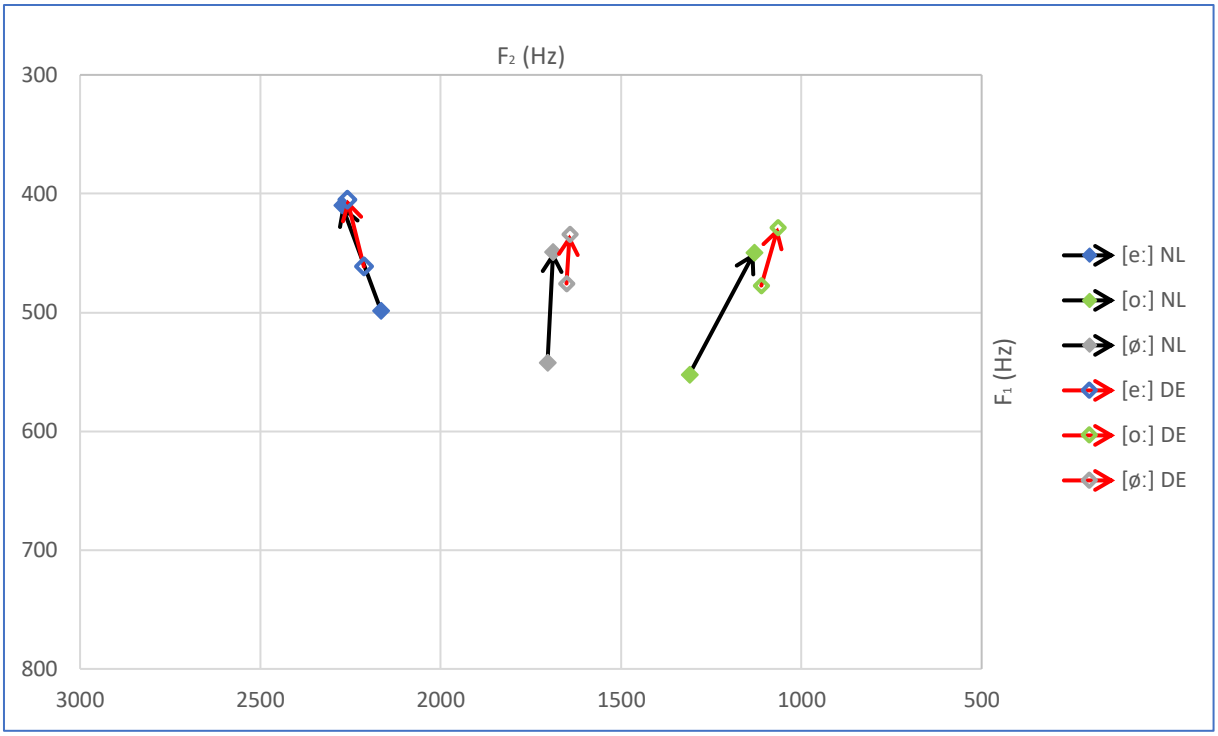

Figure 3.1: The average F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] in L1 Dutch *ezel, leger, bezigheid, lezing, kegelen, bode, dozen, dialogen, verloving, logisch, treuzelen, gepeupel, meubels, freubelen, treuzelde* and L2 German *Esel, Armee, Tätigkeit, Rede, kegeln, Boten, Dosen, Dialoge, Verlobung, logisch, trödelte, Pöbel, Möbel, fröbeln, trödelte* by all participants (N=29). The red line between the transparent squares represents the German phonemes, the black line between the coloured squares represents the Dutch phonemes.

These data suggest that speakers produced light diphthongs in both languages, but more so in L1 Dutch than in L2 German. This mainly concerns the opening degree (F_1) of the phonemes, since these midvowels are similar to the narrow closing diphthongs [eɪ], [oʊ], and [øʏ]. For instance, if we consider the following figure (Smakman, 2006), we can see a distinction between L1 Dutch [e:], [o:], and [ø:] as shown in Figure 3.1 and L1 Dutch [eɪ], [oʊ], and [øʏ]:

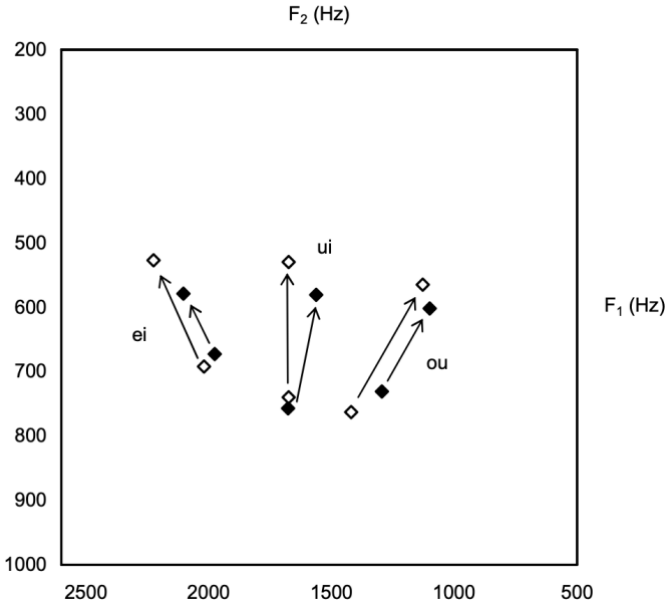

Figure 3.2: F_1 and F_2 (Hz) at 25% and 75% of three long diphthongs [(ei), (ui), and (ou)] by our [Smakman's] speakers (two female speakers, up to 20 tokens per speaker) and Adank et al.'s (2004) (ten female speakers, two tokens per vowel per speaker). The transparent squares are Adank et al.'s, the opaque ones are ours [Smakman's].

These data suggest that Adank et al.'s female speakers diphthongise more than Smakman's female speakers. Especially the second elements seem to be closer consistently for Adank et al's speakers than for Smakman's speakers. Compared to the data in Figure 3.1, both Adank et al's and Smakman's speakers seem to diphthongise L1 Dutch [eɪ], [oʊ], and [øʏ] more than our speakers do for L1[eː], [oː], and [øː].

In the next subsections, the data from Figure 3.1 are explained in more detail, starting with [eː], followed by [oː], and finally [øː].

3.2.1 [eː]

For the first phoneme [eː], the vowel duration was measured, as well as F_1 and F_2 at 25% and 75% of the vowel duration in the Dutch words *ezel*, *leger*, *bezigheid*, *lezing*, and *kegelen* and their German counterparts *Esel*, *Armee*, *Tätigkeit, Rede,* and *kegeln*. Figure 3.3 displays the long midvowel [eː] in L1 Dutch and L2 German by the 29 participants at 25% and 75%. The connecting lines signify diphthongisation.

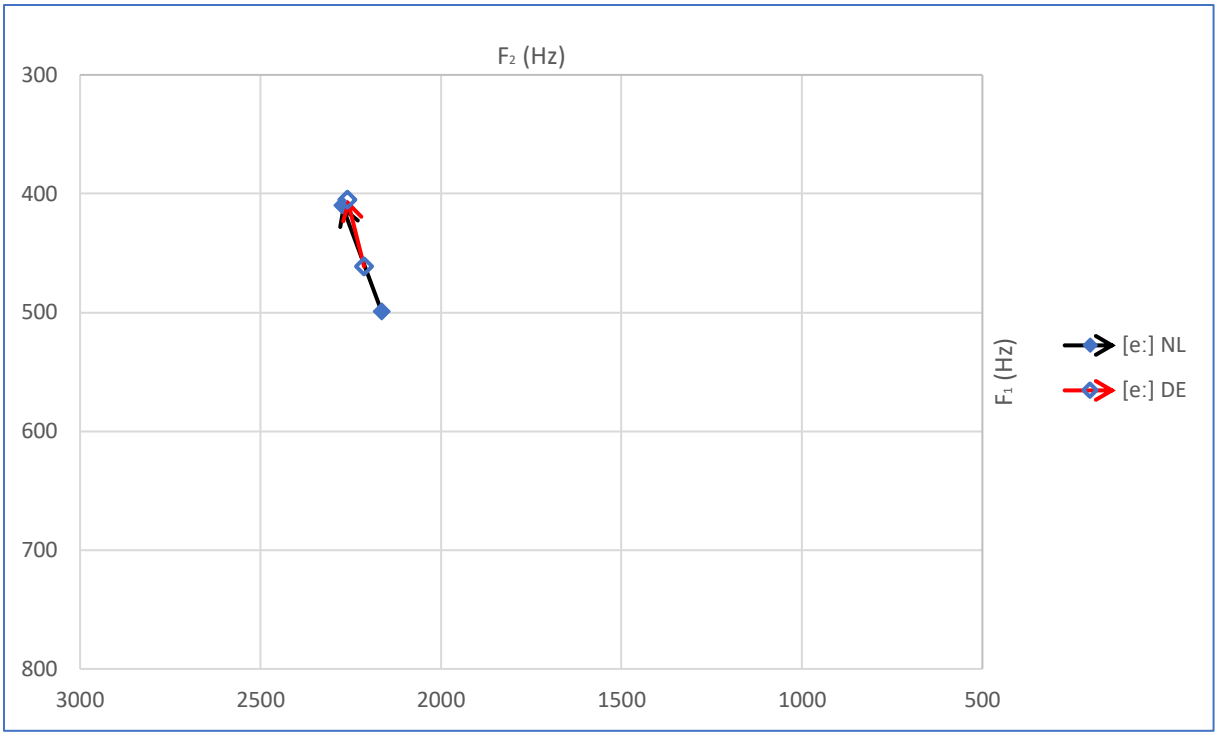

Figure 3.3: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [e:] by all participants (N=29, 5 tokens per speaker per language). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

In both languages, speakers produced light diphthongs. These data suggest that the midvowel in L1 Dutch begins in a more open position than in L2 German and ends in a similar, more closed, position. However, if we take a closer look at the averages per word, the figures suggest something else.

The first example can be seen in Figure 3.4, which displays the long midvowel [e:] in the L1 Dutch word *lezing* and L2 German word *Rede* by the participants at 25% and 75%.

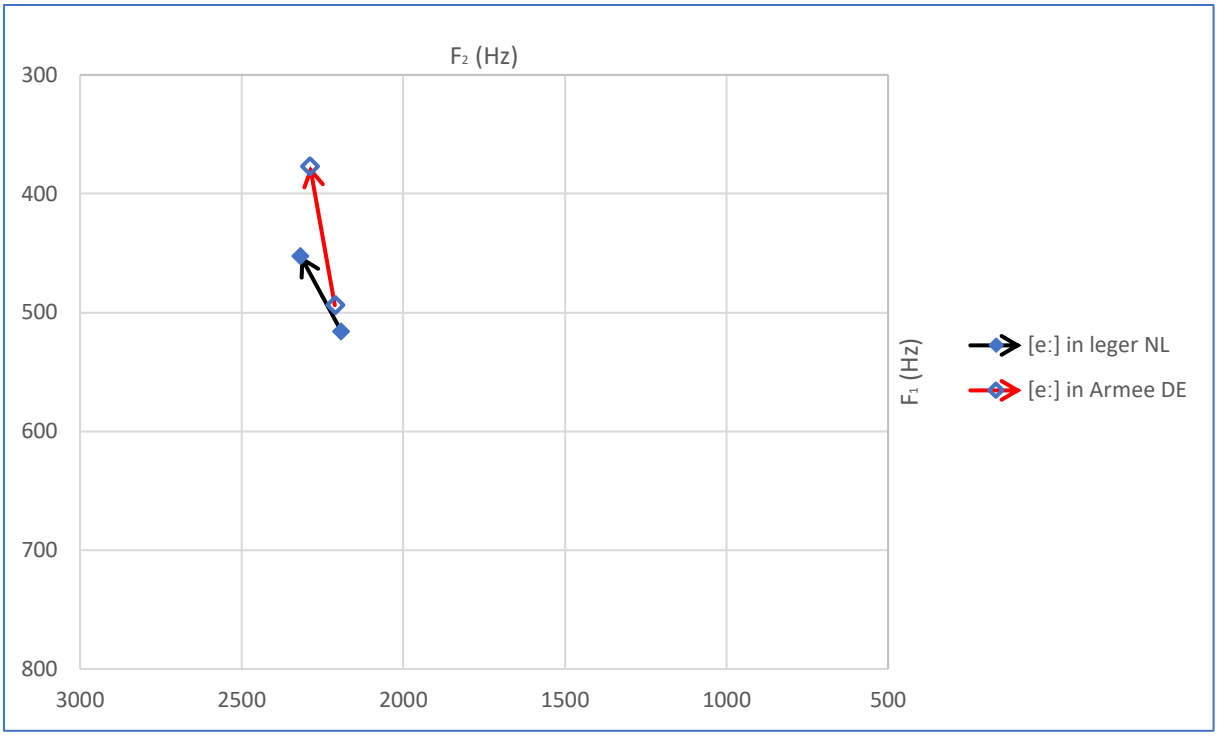

Figure 3.4: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *lezing* and L2 German *Rede* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

These data suggest that the midvowel [e:] in L1 Dutch *lezing* begins slightly more open than L2 German *Rede* and ends more closed. Moreover, L2 German [e:] in *Rede* begins more rounded than it ends, but in terms of openness, the phoneme stays rather stable.

Another example can be seen in Figure 3.5, which displays the long midvowel [e:] in the L1 Dutch word *kegelen* and L2 German word *kegeln* by all participants at 25% and 75%.

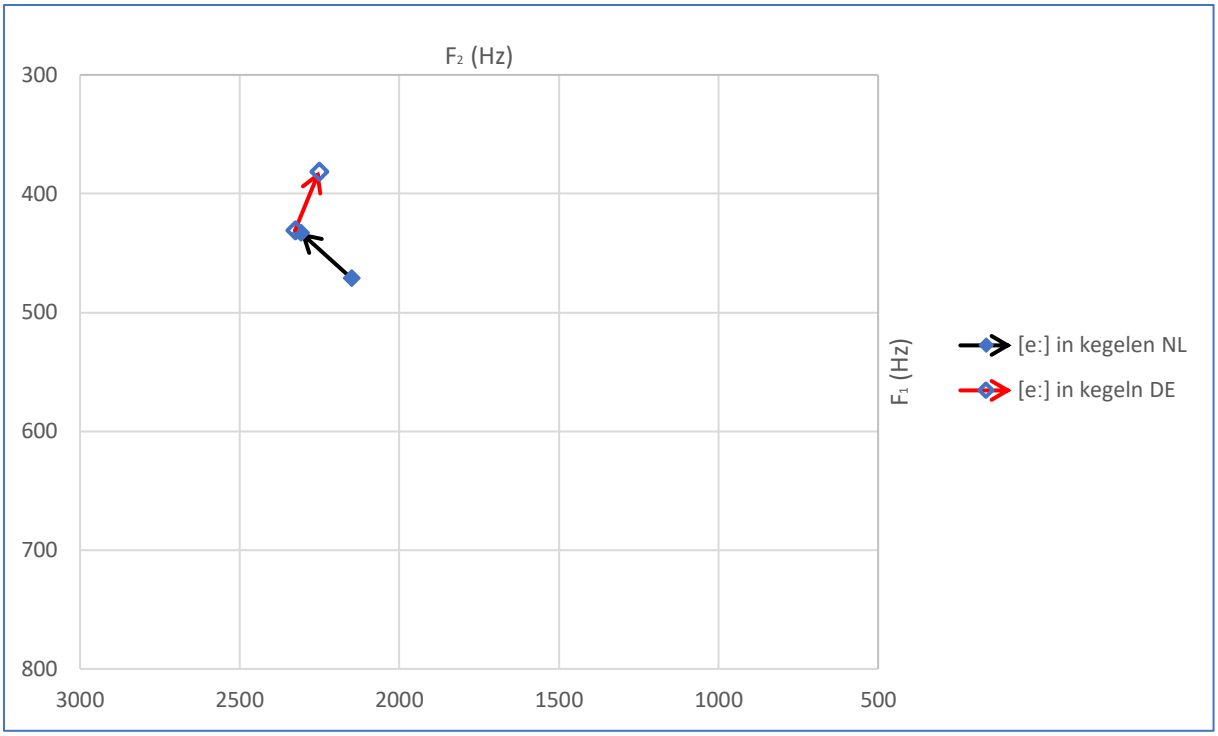

Figure 3.5: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *kegelen* and L2 German *kegeln* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

Once again, light diphthongisation can be observed in both languages. However, the pronunciation of the long midvowel moves in opposite directions in the two languages. L1 Dutch [e:] goes from slightly more rounded to unrounded and from open to slightly more closed, whereas L2 German [e:] goes from unrounded to slightly more rounded and becomes slightly more closed toward its end as well.

3.2.2 [o:]

For the second phoneme [o:], like the previous phoneme, the vowel duration was measured, as well as F_1 and F_2 at 25% and 75% of the vowel duration in the Dutch words *bode, dozen, dialogen, verloving*, and *logisch* and their German counterparts *Boten, Dosen, Dialoge, Verlobung*, and *logisch*. Figure 3.6 displays the long midvowel [o:] in L1 Dutch and L2 German by the 29 participants at 25% and 75%. Again, the connecting lines signify diphthongisation.

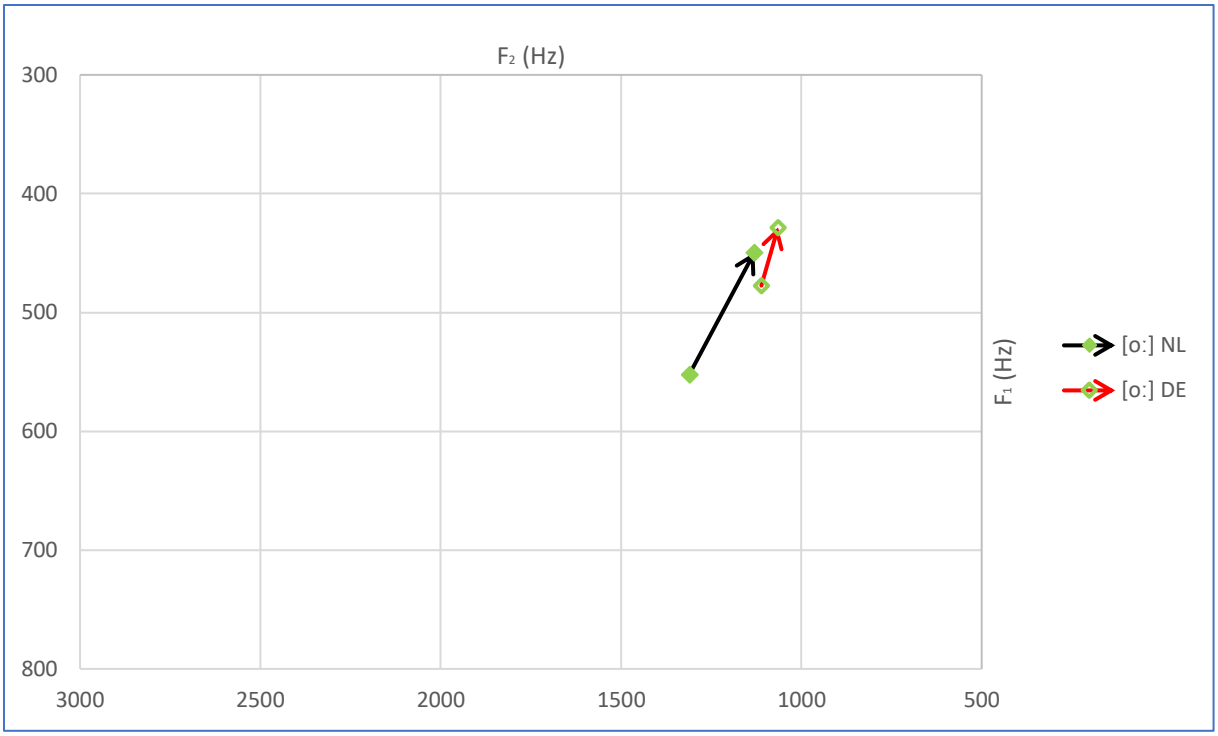

Figure 3.6: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [o:] by all participants (N=29, 5 tokens per speaker per language). The red line between the transparent squares represents the German [o:], the black line between the coloured square represents the Dutch [o:].

In both languages, speakers produced diphthongs, however, in L1 Dutch more so than in L2 German. These data suggest that the midvowel in L1 Dutch begins in a more open position than in L2 German and ends in a similar, more closed, position. The degree to which the L2 German midvowel moves into a more closed position in comparison to its L1 Dutch equivalent is much smaller. In both languages, the phoneme moves from an unrounded position to a slightly more rounded position. However, the individual words making up the average numbers underlying this figure reveal some interesting exceptions to these findings.

Firstly, the diphthongisation pattern in L2 German *Boten* looks different from the average that was shown in the previous paragraph. This difference can be seen in the following figure:

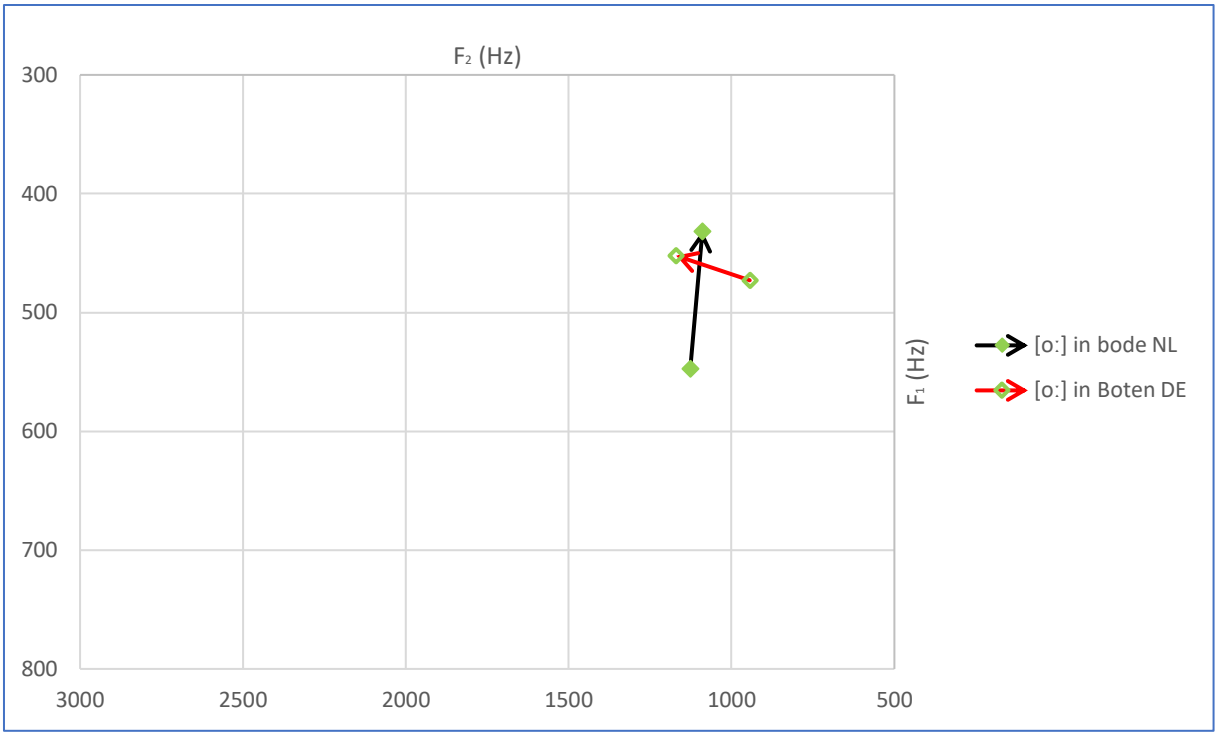

Figure 3.7: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *bode* and L2 German *Boten* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured square represents the Dutch [o:].

These data suggest that the midvowel [o:] in L2 German *Boten* moves from a rounded position to an unrounded position, as opposed to data in the previous figure. In addition, in this particular word, the connecting line is significantly longer than the line in Figure 3.6, suggesting that the sound is undergoing more diphthongisation than perhaps suggested by the overall average. The line signifying the diphthongisation in L1 Dutch *bode* looks very similar to the overall average diphthongisation in L1 Dutch [o:] in the previous figure.

Second, the diphthongisation in L2 German *Dosen*, again looks different from the average that was shown in Figure 3.6. This difference is shown in Figure 3.8:

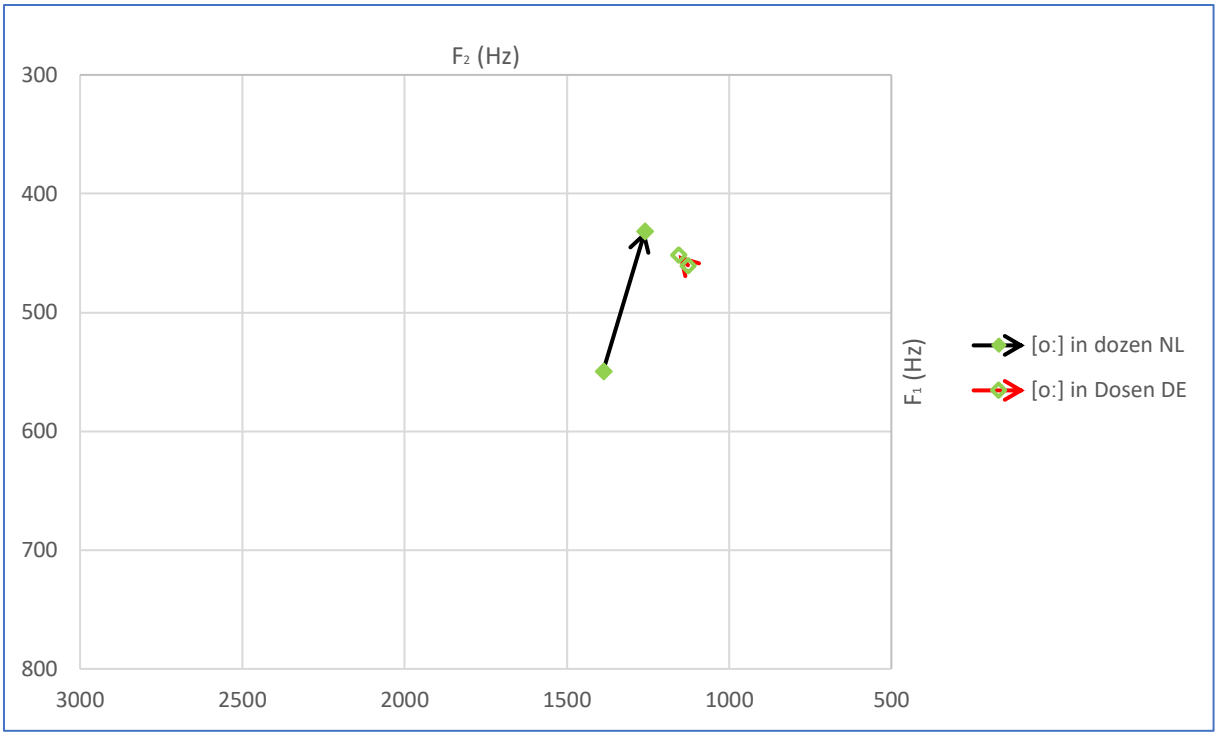

Figure 3.8: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *dozen* and L2 German *Dosen* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured square represents the Dutch [o:].

These data suggest that the midvowel [o:] in L2 German *Dosen* undergoes no real identifiable diphthongisation. Again, the midvowel in L1 Dutch *dozen* is nearly identical to diphthongisation line in Figure 3.6.

3.2.3 [ø:]

For the last phoneme [ø:], the same measurements were taken in the Dutch words *treuzelen*, *gepeupel*, *meubels*, *freubelen*, and *treuzelde* and their German counterparts *trödelte*, *Pöbel*, *Möbel*, *fröbeln*, and *trödelte*. Figure 3.9 displays the long midvowel [ø:] in L1 Dutch and L2 German by the 29 participants at 25% and 75%. Again, the connecting lines signify diphthongisation.

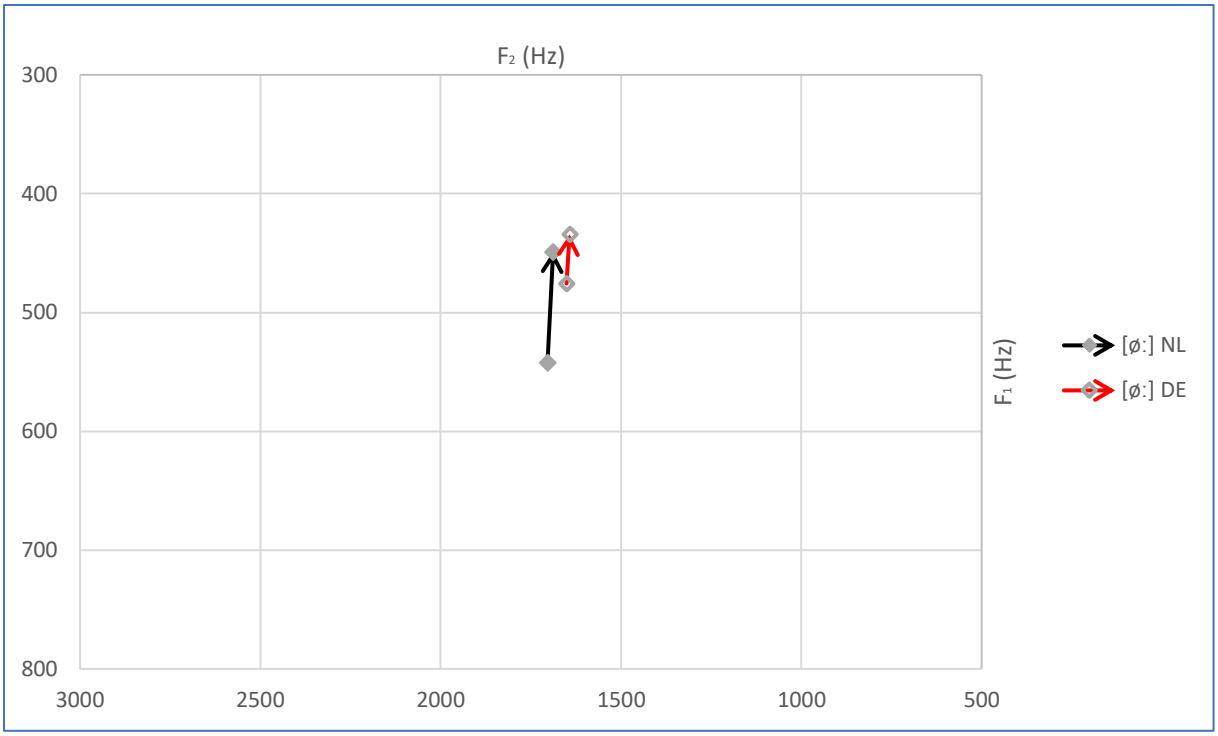

Figure 3.9: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [ø:] by all participants (N=29, 5 tokens per speaker per language). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

These data suggest that speakers produced diphthongs in both languages, albeit more profound in L1 Dutch than in L2 German. In both languages, the long midvowel [ø:] moves from a more open to a closed position and ends slightly more rounded than it begins. The words in which a different diphthongisation pattern seems to be present are L1 Dutch *treuzelen* and L1 Dutch *treuzelde* and their L2 German counterpart *trödelte*.

The first instance of this deviating diphthongisation pattern is shown in Figure 3.10:

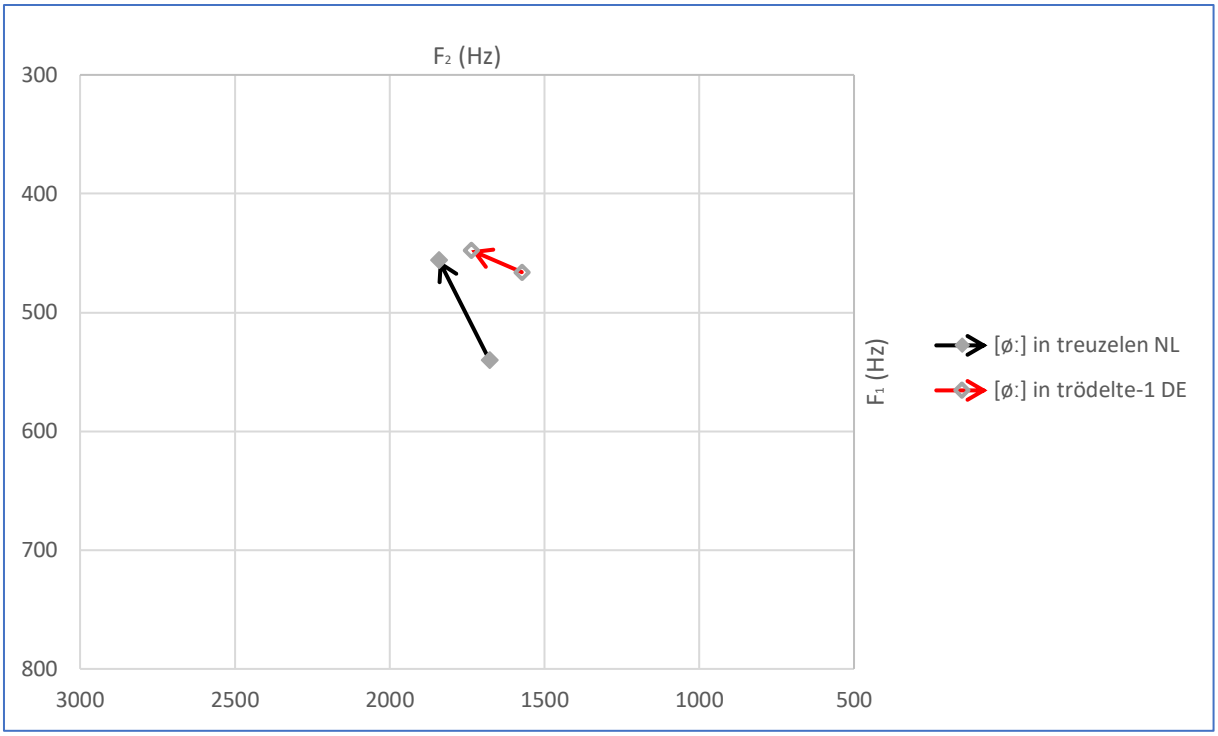

Figure 3.10: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *treuzelen* and L2 German *trödelte* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

Here, in both languages, the vowel moves from a more rounded position to an unrounded position, not at all similar to the overall average depicted in Figure 3.9. Moreover, in L2 German *trödelte*, [ø:] seems to be subject to diphthongisation almost as much as L1 Dutch *treuzelen*, which is also very different from the overall average shown in the previous figure.

The second instance of L1 Dutch *treuzelde* and L2 German *trödelte* can be seen in Figure 3.11:

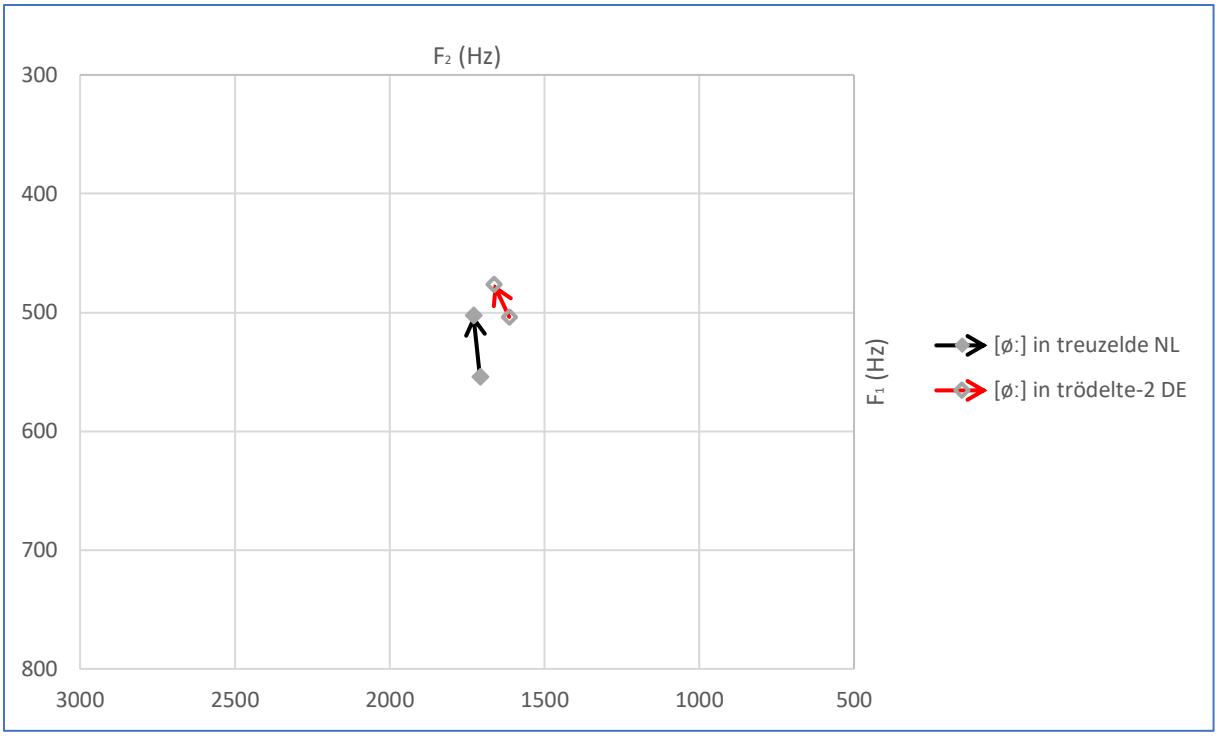

Figure 3.11: F_1 [opening degree] and F_2 [front-to-back-dimension] (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *treuzelde* and L2 German *trödelte* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

These data suggest that in both languages, the midvowel [ø:] is only slightly diphthongised, unlike the overall average in Figure 3.9 where L1 Dutch [ø:] is clearly more diphthongised than its L2 German counterpart. In addition, in both languages, the vowel moves from a slightly more rounded to an unrounded position.

3.3 Conclusion

In this chapter, I have described the current status of the phonemes [e:], [o:], and [ø:] in L1 Dutch and L2 German. To analyse characteristics regarding diphthongisation of these sounds, acoustic data were obtained from 29 Dutch participants and the sounds under observation were isolated. Then, the vowel duration was measured as well as F_1 and F_2 at 25% and 75% of the vowel duration. After explaining the averaged outcomes, outliers to these data were explained in more detail per phoneme to highlight the fact that the averages do not always provide us with a true representation of the diphthongisation patterns of the phonemes under observation in this thesis.

4 Conclusion

4.1 Overview

In this chapter, the results are analysed in greater detail and additional findings are discussed. In doing so, answers are provided to the research questions and the original hypotheses are evaluated. Moreover, a comparison is drawn between the literature and the findings of the present study, its limitations are analysed, and suggestions for future research are proposed. Consequently, the final conclusion is presented.

4.2 Results

The phonemes [eː], [oː], and [øː] in L1 Dutch and L2 German were individually examined. In this section, the level of diphthongisation is compared between L1 Dutch and L2 German for each sound in more detail.

The first phoneme analysed in the Dutch words *ezel, leger, bezigheid, lezing,* and *kegelen* and their German counterparts *Esel, Armee, Tätigkeit, Rede,* and *kegeln* is the long midvowel [eː]. Figure 3.3 revealed that [eː] undergoes light diphthongisation in both languages, but more so in L1 Dutch than in L2 German. However, Figures 3.4 on the word *lezing/Rede* and 3.4 on *kegelen/kegeln* displayed a different diphthongisation pattern from the overall means in Figure 3.3.

Specifically, L2 German *Rede* is pronounced differently from the other [eː] words. This might be due to the fact that [eː] is preceded by /r/, which is pronounced either trilled or guttural in L1 Dutch and non-rhotic in L2 German. Additionally, L2 German *kegeln* is pronounced differently from the other [eː] words. If *kegeln* is compared to L1 Dutch *kegelen,* the difference is striking, since these words are almost identical. The only difference is that Dutch *kegelen* consists of three syllables, whereas its German counterpart *kegeln* consists of two syllables.

The second phoneme analysed in the Dutch words *bode, dozen, dialogen, verloving,* and *logisch* and their German counterparts *Boten, Dosen, Dialoge, Verlobung,* and *logisch* is the long midvowel [oː]. Here, diphthongisation in L1 Dutch and a slight diphthongisation in L2 German were found. Exceptions to these average data were found in L2 German *Boten* (Figure 3.7) and *Dosen* (Figure 3.8). In Figure 3.6, L2 German [oː] moves from an unrounded to a slightly more rounded sound. In L2 German *Boten* however, [oː] starts off more rounded and moves to an unrounded position. This difference in roundedness as compared to the average

pronunciation of [oː] might be explained by [oː] being followed by a voiceless /t/, whereas the other words including the phoneme [oː] are all followed by a voiced sound. Regarding the pronunciation of L2 German *Dosen*, there is one striking observation to be made on Figure 3.8, namely that no diphthongisation is recorded for [oː] in L2 German *Dosen*. In other words, no phonetic transfer is taking place and this word is pronounced as a monophthong. This is exactly how you would expect an L1 speaker of German to pronounce the word. Considering the fact that Dutch *dozen* and German *Dosen* are false friends, it is even more interesting that no diphthongisation was recorded for [oː] in L2 German *Dosen,* because one would expect to find L1 interference on L2 caused by these false cognates (Janke and Kolokonte, 2015; Dijkstra, Grainger, and Van Heuven, 1999).

The last phoneme analysed in the Dutch words *treuzelen, gepeupel, meubels, freubelen,* and *treuzelde* and their German counterparts *trödelte, Pöbel, Möbel, fröbeln,* and *trödelte* is the long midvowel [øː]. For [øː], the data in Figure 3.9 suggested that speakers produced diphthongs in both languages, albeit more profound in L1 Dutch than L2 German. In addition, the phoneme moves from a more open to a closed position and ends slightly more rounded than it begins. Again, exceptions to this average were found. In the first instance of L1 Dutch *treuzelen* and L2 German *trödelte*, the phoneme [øː] is pronounced with the same amount of diphthongisation in both languages. In that sense, L2 German [øː] in *trödelte* is more diphthongised than the average data suggest. Moreover, both pronunciations of [øː] in L1 Dutch *treuzelen* and L2 German *trödelte* move from a more rounded position to an unrounded position, rather than the other way around as suggested by the average data. In the second instance of L1 Dutch *treuzelde* and L2 German *trödelte*, [øː] is pronounced only slightly diphthongised in both languages. In that sense, L1 Dutch [øː] in *treuzelde* is less diphthongised than the average data suggest. Additionally, in both words, [øː] moves from a more rounded position to an unrounded position, much like the first instance of L1 Dutch *treuzelen* and L2 German *trödelte*, opposite from what the average data suggest. Why the amount of diphthongisation in the two instances of L2 German *trödelte* differ so much is unclear. Similarly, it is unclear why the amount of diphthongisation in L1 Dutch *treuzelen* and *treuzelde* differ so much either.

4.3 Additional findings

In analysing the datasets thoroughly, several observations were made, which are discussed in this section.

Firstly, some participants had certain difficulties pronouncing L2 German words with an Umlaut, particularly those involving the phoneme [øː]. In some cases, this meant that no measures could be taken for these sounds. In total, there were 5 out of 29 participants (BJ, BM, BT, HS, and SA), where at least two out of five [øː] tokens were uttered incorrectly, resulting in 25 out of 145 [øː] tokens being pronounced incorrectly. In 19 of these 25 cases, [øː] was pronounced as [oː]. Additionally, [øː] was pronounced as [ɔ] in four cases. In two instances, [øː] was even pronounced as [y]. Overall, these mispronunciations seem to be the result of confusion on the basis of the words' orthography. For participants BM and HS, no data were recorded, since they did not pronounce a single word involving [øː] in L2 German correctly. For the other three participants who mispronounced at least two out of five [øː] tokens, a comparison with the overall average in Figure 3.9 was made. In comparison to the data in this figure, BJ's L2 German [øː] underwent more diphthongisation. This can be seen in Figure H.4 in Appendix H. In addition, her [øː] went from unrounded to slightly more rounded rather than the other way around. This was also the case for her pronunciation of L1 Dutch [øː]. For BT, a difference was found in the level of roundedness of [øː]. The sound moved from more rounded to unrounded, just as the average data in Figure 3.9 suggest, but the difference from the start to the end of the phoneme was greater. This can be seen in Figure H.7 in Appendix H. For participant SA, German [øː] moved from more rounded to unrounded and from closed to slightly more open. In both cases, the opposite was found in the average data for all participants taken together. This can be seen in Figure H.23 in Appendix H.

Secondly, a few participants had some difficulties pronouncing L2 German words involving the phoneme [oː]. Participants EN, GS, HE, JE, and KA pronounced [oː] as [øː] in one or both of the L2 German words *Dosen* and *Verlobung*. For each participant, a comparison with the overall average in Figure 3.6 was made. In the overall average in this figure, [oː] moved from more unrounded to more rounded. For participants EN (Figure H.9 in Appendix H) and JE (Figure H.13 in Appendix H) it was the other way around. Considering that these participants produced an [øː] rather than an [oː], the movement from more rounded to unrounded is still not what is to be expected when looking at Figure 3.9. For participant GS (Figure H.10 in Appendix H), differences were observed in the Dutch data rather than the German data in comparison to the overall average in Figure 3.6. For GS, as little diphthongisation was found for the Dutch data as for the German data. The line depicting diphthongisation in German [oː] for GS corresponded with the overall average. In the case of participant HE (Figure H.11 in Appendix H), a different similarity in comparison to the overall average was found. In Figure 3.6, it can be seen that Dutch [oː] is less rounded than German [oː]. For participant HE, the opposite was

the case. Other than that, similar results were present. Then, L2 German [oː] for participant KA (Figure H.14 in Appendix H) underwent more diphthongisation than the data of all participants combined revealed in Figure 3.6. Additionally, German [oː] for participant KA moves only slightly from more rounded to unrounded, but its position stays more or less the same.

Thirdly, some participants (BJ, BM, BT, HS, KC, KM, and SA) struggled with the pronunciation of L2 German *Tätigkeit*. Here, <ä> should be pronounced [eː], but in five realisations <ä> was pronounced [aː]. Presumably, this wrong pronunciation is due to the orthography of L2 German *Tätigkeit*. In addition, participant KC pronounced the phoneme as [ɑ] rather than [eː] and participant SA pronounced it as [ɑu]. Likely, these last utterances can be classified as slip-ups.

Lastly, participants EN and JE mispronounced [eː] in L2 German *Esel* as [aɪ]. Most likely, this can be classified as a slip-up as well. Also, participant SA mistakenly pronounced [eː] in L2 German *Armee* as [e]. Since the orthography of this word would suggest the correct phoneme to be [eː] rather than [e], this could also be classified as a slip-up.

4.4 Research questions and hypotheses

In this section, answers are provided to the research questions using the comprehensive discussion of the findings above. The answers are related back to the hypotheses stated in Chapter 1.

Question 1. To what extent are the long midvowels [eː], [oː], and [øː] diphthongised in Dutch by Dutch native speakers?

The data and the corresponding analyses seem to suggest that the three long midvowels [eː], [oː], and [øː] are indeed all diphthongised in L1 Dutch by native speakers of Dutch. The diphthongisation pattern slightly differs for each phoneme.

Firstly, phoneme [eː] in L1 Dutch begins in a more open position and ends in a closed position. Simultaneously, the phoneme moves from a more rounded to an unrounded position.

Secondly, phoneme [oː] in L1 Dutch begins in a more open position and ends in a closed position. At the same time, the phoneme becomes progressively more rounded towards the end of its pronunciation.

Lastly, phoneme [øː] in L1 Dutch moves from a more open to a closed position and ends slightly more rounded than it begins.

In Chapter 1, it was discussed how previous research has shown that historically, there has been some disagreement as to the [eː], [oː], and [øː] being monophthongs or diphthongs in Dutch. In contemporary literature, however, linguists seem to agree that these phonemes are typically produced with light diphthongisation with a tendency towards more diphthongisation (Van de Velde, 1996; Adank et al., 2004; Smakman, 2006). On the basis of this, diphthongisation in the production of these sounds was expected. The results of the present study support this hypothesis. The next question examines whether the diphthongisation patterns of the phonemes are transferred to L2 German by the same speakers.

Question 2. Are the diphthongisation patterns in L1 Dutch transferred to L2 German by these same speakers?

According to the results of the present study, this seems to be the case as well.

Firstly, phoneme [eː] in L2 German begins in a more open position and ends in a closed position, similar to its pronunciation in L1 Dutch. However, the extent to which the vowel moves from a slightly open to a closed position is half as much in L2 German in comparison with L1 Dutch. The two phonemes end in the same closed position. Additionally, the L2 German phoneme begins slightly less rounded than its L1 Dutch counterpart but they end in the same unrounded position.

Secondly, phoneme [oː] in L2 German begins in a slightly more open position and ends in a closed position. However, the degree to which this change takes place is limited. As such, the phoneme can be classified as undergoing only slight diphthongisation. Moreover, L2 German [oː] is a rounded vowel and becomes slightly more rounded as its pronunciation progresses. Once again, the difference in positions is minimal.

Lastly, phoneme [øː] in L2 German moves from a more open to a closed position and ends slightly more rounded than it begins, similarly to its L1 Dutch counterpart. Again, the level to which these changes occur is much smaller in L2 German than in L1 Dutch, but a small diphthongisation takes place nonetheless.

In certain situations, exceptions occurred between participants or between tokens of the same phoneme. Most of these exceptions could be explained as incorrect pronunciations for orthographic reasons. In a few instances, incorrect utterances appeared to be slip-ups.

In the first chapter, it was discussed how in L1 Standard German, no diphthongisation in the pronunciation of [eː], [oː], and [øː] has been found and that they are described as long monophthongs (Żyromski, 2017). Based on Flege's speech learning model (2007), it was hypothesised that L2 learners would produce an assimilated sound, since the sounds are very

similar in both languages, and thus, the diphthongisation pattern of L1 Dutch would partly be transferred to L2 German. Furthermore, depending on the nature of the input received, this assimilated output would resemble the long-term representation of L1 or L2 monolinguals more closely. Therefore, we expected this assimilated output to bear a greater resemblance to the long-term representation of L1 Dutch monolinguals. The results of the current study support both hypotheses.

4.5 Comparison with the literature

The results of the present study suggest that, for the three phonemes under observation in this study, diphthongisation can be established in both L1 Dutch. In doing so, this study supports Van de Velde's (1995), Adank et al.'s (2004), and Smakman's (2004) claim for diphthongisation in the pronunciation of the three long midvowels [eː], [oː], and [øː] in L1 Dutch.

The present study also finds that the diphthongisation patterns of these phonemes are partly transferred to L2 German. The phonetic transfer of this phenomenon results in an assimilated sound, as predicted by Flege's (2007) speech learning model. Moreover, this assimilated sound resembles the long-term representation of L1 Dutch monolinguals rather than the long-term representation of L1 German monolinguals, as predicted by Flege's (2007) SLM as well.

Since no previous literature could be found on the sociophonetics of [eː], [oː], and [øː] for L1 Dutch speakers of L2 German, this study fills this research gap and shows that the three phonemes undergo slight diphthongisation in the pronunciation of the three phonemes in L2 German, rather than being pronounced as monophthongs like Żyromski (2017) demonstrated.

4.6 Limitations and future research

The first limitation is the fact that this thesis only investigated female speakers between 18 and 25 years old. Future research could investigate a greater variety of age groups and could include male participants to gain more insights into differences or similarities between these groups.

In addition, there was no control group of L1 German speakers. This diminishes the results of this thesis. Therefore, future studies should include a control group to support their findings.

Additionally, no research was done on the language background of the participants and what type of learners they were. Also, the analysis of differences between individual participants was kept to a minimum, because there was a lack of time and space in the current study to address this as well. Consequently, this thesis serves as a pilot study that lays the foundation for a more complex and larger-scale study in the future, which could focus on these aspects to gain more insights into the language learning process, which would support future education programmes on the acquisition of L2 German by Dutch native speakers.

Lastly, there was no control over the procedures performed by the participants. Due to COVID-19, these had to be executed from home. Therefore, a large number of different devices were used by the participants and the participants had to be trusted to perform the tasks in the right order and as instructed. Ideally, the circumstances would have been the same for every participant, which is advisable for future studies.

4.7 Conclusion

The aim of the present study was to investigate to what extent the long midvowels [eː], [oː], and [øː] are diphthongised in L1 Dutch and whether these diphthongisation patterns are transferred to L2 German by the same speakers. Dutch and German audio files were collected from 29 female participants between 18 and 25 years old. For each sound, 5 tokens in each language were measured for their vowel duration and F_1 and F_2 were measured at 25% and 75% of the vowel duration. The most important finding was that the diphthongisation patterns that were found in L1 Dutch were indeed transferred to L2 German. In addition, this transfer resulted in an assimilated sound as expected on the basis of Flege's (2007) speech learning model. Furthermore, the present study discussed certain outliers, most of which could be explained by orthographic difficulties. The findings support the hypotheses driving this study.

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Appendix

Appendix A. Phoneme-Grapheme relationships in German vowels

Table A.1: Phoneme-Grapheme relationships in vowels in German words (Krech et al., 2009)

Phoneme	Grapheme	Example
iː	i, ie, ih, ieh, y	*wir, sieben, ihm, Vieh, Schwyz*
I	i	*Bitte*
eː	e, ee, eh	*leben, Beere, Reh*
ɛ	e, ä	*stellen, kräftig*
ɛː	ä, äh	*Käse, lähmen*
aː	a, aa, ah, ae	*baden, Staat, Bahn, Baesweiler*
a	a	*Klasse*
yː	ü, üh, ui	*Schüler, früh, Duisburg*
Y	ü	*Glück*
øː	ö, öh, oe, oey	*lösen, Höhle, Goethe, Oeynhausen*
œ	ö	*Löffel*
uː	u, uh, ue	*Buch, Stuhl, Hueber*
ʊ	u	*Gruppe*
oː	o, oo, oh, oe, oi	*Boden, Boot, wohnen, Soest, Voigt*
ɔ	o	*voll*
ə	e	*Gabe*
a͡ɛ	ei, ai, ey, ay	*Wein, Mai, Norderney, Bayern*
a͡ɔ	au	*Auge*
ɔ͡œ	eu, äu	*heute, träumen*

Table A.2: Phoneme-Grapheme relationships in vowels in German loanwords (Krech et al., 2009)

Phoneme	**Grapheme**	**Example**
i	i (in an open, unstressed syllable)	*Idol*
e	e (in an open, unstressed syllable)	*Republik*
eː	é	*Doublé*
øː	eu	*Amateur*
ɛ (ɛː in a stressed syllable)	aː (only before <r>)	*Pair*
y	ü (in an open, unstressed syllable), y	*Büffet*, *Typologie*
yː	y	*Typ*
Y	y	*Ägypten*
ø	ö (in an open, unstressed syllable)	*Böotien*
u	u (in an open, unstressed syllable)	*Hubertus*
o	o (in an open, unstressed syllable)	*porös*
oː	eau	*Niveau*
ɔ	au	*Chauffeur*
u	ou	*Bourscheid*

Appendix B. Complete list of the 162 German words and their Dutch counterparts

Table B.1: Complete list of German words with [e:] and their Dutch counterparts

German words with [e:]	**Dutch counterpart**
eben	even
so eben	zo even
Tätigkeit (teeetigkeit)	bezigheid
geben	geven
reden	praten
zählen	tellen
heben	tillen / heffen
nehmen	nemen
Ofen herd	kachel
Wert	waarde
Währung	valuta / munteenheid
Sich wehren	verweren
Gegen	tegen
Gegeben	gegeven
Herde	kudde
Bären	beren
Gebärdensprache	gebarentaal
Bundeswehr	bondsleger
Fähre	veerpont
Armee	leger
das Wehr	stuwdam
geehrt	geëerd
eklig	smerig
ekelhaft	weerzinwekkend
Lehrplan	leerplan
sehen	zien / kijken
gesehen	zien / kijken
übersehen	overzien of negeren

Medizin	medicijn(en)
Belegschaft	personeel
Der Beleg	bewijs(stuk) / kwitantie
Ehren	eren / eerbiedigen
Das Meer/die Meere	zee
Die See/die Seen	meer / zee
Dehnen	verwijden / (uit)rekken
Die Rede	spreekbeurt / lezing / redevoering
Reederei	rederij
Gehen	gaan / lopen
Reden	spreken
Kehle	keel
Reh	ree
Seele	ziel
Lehre	stage
Leere	leegte
Umkehren	omkeren
Zulegen	toeleggen / toevoegen
Verehre	vereren
Elend	zorgen / problemen
Leben	leven
Lehnen	leunen
Denen	die
Fehlen	ontbreken
Fehde	vete
Edel	edel
Ebene	etage
Esel	ezel
Segen	zegen
Ekel	walging / afkeer
Hehlerei	oplichting / heling
Jedes/jeder	ieder / elk / iedereen
Kegeln	kegelen

Segeln	zeilen
Zehn	tien
Zehren	verdragen / doorstaan

Table B.2: Complete list of German words with [o:] and their Dutch counterparts

German words with [o:]	**Dutch counterpart**
Oben	boven
Ofen	oven
Auto	auto
Dialoge	dialogen
Logisch	logisch
Loben	loven
Sich verloben	zich verloven
Verlobung	verloving
Sodass	zodat
Soeben	net
Zoo	dierentuin
Zootiere	dierentuindieren
Poo	kont
Posieren	poseren
Bohren	boren
Nachbohren	naboren
Doof	dom / stom / vervelend
Kanone	kanon
Schon	al
Polen	Polen
Dosen/dose	blik
Dosieren	doseren
Dekorieren	versieren / decoreren
Dekoration	versiering / decoratie
Projekt	project
Bot	boot
Cola	cola

Ohren	oren
Oratorium	oratorium
Kohle	geld / kool / steenkool / houtskool
Rohr	buis / riet
Chor	koor
Lore	lorrie / rolwagentje
Omen	omen
Not	nood
Rot	rood
Tod	dood
Das Los	lot
Lohn	loon
Das Moor	moeras / veen
Kot	poep / modder / slijk / drol
Sohle	(voet)zool
Sog	kielzog / zuigingen
Das Lot	lood
Idol	idool / afgod
Brot	brood
Moos	mos
Bote	bode

Table B.3: Complete list of German words with [øː] and their Dutch counterparts

German words with [øː]	**Dutch counterpart**
Söhne	zonen
Schön	mooi
Schönheit	schoonheid
Schönheitsfehler	schoonheidsfoutje
Schönheits-OP	cosmetische chirurgie
Töne	geluiden / tonen
Sich wölben	welven / bulken
Föhn	föhn
Öfter	frequenter / vaker

Öffnung	opening
Öffnen	openen
Türöffnung	deuropening
Ökonomie	economie
Ökologie	ecologie
Ökologisch	ecologisch
Ökonomisch	economisch
Öffentlich	openbaar
Veröffentlichen	publiceren
Eröffnung	inzet / opening/ openbaring
Börse	beurs
Trödel	rommel
Trödeln	treuzelen
Porös	poreus
Löhne	lonen
Löwe	leeuw
Röhren	pijp
Möhren	wortels
Töten	doden
Nöte	noten
Mögen	mogen / lusten / kunnen
Verpönt	ongewenst / onwenselijk
Töricht	achterlijk
Vermögend	vermogend
Möglich	mogelijk
Löblich	loffelijk / prijzenswaardig
Nötigung	dwang
Fröhlich	vrolijk
Zögerlich	aarzelend / huiverig
König	koning
Einölen	insmeren met olie
Die Öde	saai / droog
Die Einöde	woestijn

dröhnen	dreunen
stöhnen	kreunen
Möbel	meubel
Likör	likeur
Manöver	manoeuvre
Knödel	knoedel
Pöbel	gepeupel
Fröbeln	fröbelen

Appendix C. Categorisation process of German words and their corresponding Dutch translations

Table C.1: Categorisation process of German words with [e:] and their Dutch counterparts

German word	Dutch counterpart	Open syllable	No closed option	No nasals after the sound under observation	No liquids after the sound under observation	No confusing spelling (Dutch)	Voiced consonant (German)	Voiced consonant (Dutch)	Voiceless consonant (German)	Voiceless consonant (Dutch)
eben	even	x				x	x			x
so eben	zo even	x				x	x			x
Tätigkeit (teeetigkeit)	bezigheid	x	x	x		x		x	x	
geben	geven	x				x	x			x
reden	praten	x					x			
zählen	tellen	x			x		x			
heben	tillen / heffen	x					x			
nehmen	nemen	x				x				
Ofen herd	kachel			x						
Wert	waarde			x						
Währung	valuta / munteenheid	x	x	x	x		x			
Sich wehren	verweren	x			x	x	x			
Gegen	tegen	x				x	x	x		
Gegeben	gegeven	x				x	x			x
Herde	kudde			x	x		x			
Bären	beren	x			x	x	x			
Gebärdensprache	gebarentaal									
Bundeswehr	bondsleger			x		x		x		
Fähre	veerpont	x	x	x	x	x	x			
Armee	leger	x	x	x		x		x		
das Wehr	stuwdam			x						
geehrt	geëerd			x	x	x	x			
eklig	smerig	x	x	x		x			x	
ekelhaft	weerzinwekkend	x	x	x		x			x	
Lehrplan	leerplan			x	x	x	x			
sehen	zien / kijken	x								

gesehen	zien / kijken	x								
übersehen	overzien of negeren	x				x				
Medizin	medicijn(en)	x	x	x		x	x	x		
Belegschaft	personeel			x		x	x			
Der Beleg	bewijs(stuk) / kwitantie			x			x			
Ehren	eren / eerbiedigen	x			x	x	x			
Das Meer/die Meere	zee			x	x	x	x			
Die See/die Seen	meer / zee	x	x	x		x				
Dehnen	verwijden / (uit)rekken	x								
Die Rede	spreekbeurt / lezing / redevoering	x	x	x		x	x	x		
Reederei	rederij	x	x	x		x	x	x		
Gehen	gaan / lopen									
Reden	spreken	x				x	x			x
Kehle	keel	x	x	x	x	x	x			
Reh	ree	x	x	x		x				
Seele	ziel	x	x	x	x		x			
Lehre	stage	x	x	x	x		x			
Leere	leegte	x	x	x	x	x	x			x
Umkehren	omkeren	x			x	x	x			
Zulegen	toeleggen / toevoegen	x					x			
Verehre	vereren	x	x	x	x	x	x			
Elend	zorgen / problemen	x	x	x	x	x	x			
Leben	leven	x				x	x			x
Lehnen	leunen	x	x							
Denen	die	x								
Fehlen	ontbreken	x			x	x	x			x
Fehde	vete	x	x	x		x	x			x
Edel	edel	x	x	x		x	x	x		
Ebene	etage	x	x	x		x	x			x
Esel	ezel	x	x	x		x	x	x		
Segen	zegen	x				x	x	x		
Ekel	walging / afkeer	x	x	x		x			x	
Hehlerei	oplichting / heling	x	x	x	x	x	x			
Jedes/jeder	ieder / elk / iedereen	x	x	x		x	x			
Kegeln	kegelen	x	x	x		x	x	x		

Segeln	zeilen	x	x	x			x				
Zehn	tien										
Zehren	verdragen / doorstaan	x			x		x				

Table C.2: Categorisation process of German words with [o:] and their Dutch counterparts

German word	Dutch counterpart	Open syllable	No closed option	No nasals after the sound under observation	No liquids after the sound under observation	No confusing spelling (Dutch)	Voiced consonant (German)	Voiced consonant (Dutch)	Voiceless consonant (German)	Voiceless consonant (Dutch)
Oben	boven	x					x			x
Ofen	oven	x							x	x
Auto	auto	x	x	x						
Dialoge	dialogen	x	x	x			x			x
Logisch	logisch	x	x	x			x	x		
Loben	loven	x					x			x
Sich verloben	zich verloven	x					x			x
Verlobung	verloving	x	x	x			x			x
Sodass	zodat	x	x	x			x	x		
Soeben	net	x	x	x	/					
Zoo	dierentuin	x	x	x						
Zootiere	dierentuindieren	x	x	x					x	
Poo	kont	x	x	x						
Posieren	poseren	x	x	x			x	x		
Bohren	boren	x			x		x			
Nachbohren	naboren	x			x		x			
Doof	dom / stom / vervelend								x	
Kanone	kanon	x	x							
Schon	al									
Polen	Polen	x			x		x			
Dosen/dose	blik	x	x	x			x			
Dosieren	doseren	x	x	x			x	x		
Dekorieren	versieren / decoreren	x	x	x	x		x			
Dekoration	versiering / decoratie	x	x	x	x		x			
Projekt	project	x	x	x	/		x			
Bot	boot			x					x	x
Cola	cola	x	x	x	x		x			
Ohren	oren	x			x		x			
Oratorium	oratorium	x	x	x	x		x			
Kohle	geld / kool / steenkool / houtskool	x	x	x	x		x			

Rohr	buis / riet			x						
Chor	koor			x						
Lore	lorrie / rolwagentje	x	x		x		x			
Omen	omen	x	x				x	x		
Not	nood			x					x	x
Rot	rood			x					x	x
Tod	dood			x					x	x
Das Los	lot			x					x	
Lohn	loon									
Das Moor	moeras / veen			x						
Kot	poep / modder / slijk / drol			x						
Sohle	(voet)zool	x	x	x	x		x			
Sog	kielzog / zuigingen			x	x		x			
Das Lot	lood			x					x	x
Idol	idool / afgod			x	x		x			
Brot	brood			x					x	x
Moos	mos			x					x	
Bote	bode	x	x	x				x	x	

Table C.3: Categorisation process of German words with [øː] and their Dutch counterparts

German word	Dutch translation	Open syllable	No closed option	No nasals after the sound under observation	No liquids after the sound under observation	No confusing spelling (Dutch)	Voiced consonant (German)	Voiced consonant (Dutch)	Voiceless consonant (German)	Voiceless consonant (Dutch)
Söhne	zonen	x	x				x			
Schön	mooi						x			
Schönheit	schoonheid						x			
Schönheitsfehler	schoonheidsfoutje						x			
Schönheits-OP	cosmetische chirurgie						x			
Töne	geluiden / tonen	x	x				x			
Sich wölben	welven / bulken			x	x		x			
Föhn	föhn					x	x	x		
Öfter	frequenter / vaker									
Öffnung	opening									
Öffnen	openen									
Türöffnung	deuropening							x		
Ökonomie	economie	x	x	x					x	
Ökologie	ecologie	x	x	x					x	
Ökologisch	ecologisch	x	x	x					x	
Ökonomisch	economisch	x	x	x					x	
Öffentlich	openbaar									
Veröffentlichen	publiceren									
Eröffnung	inzet / opening/ openbaring									
Börse	beurs			x	x	x	x	x		
Trödel	rommel	x	x	x			x			
Trödeln	treuzelen	x	x	x		x	x	x		
Porös	poreus			x		x			x	x
Löhne	lonen	x	x				x			
Löwe	leeuw	x	x	x			x			
Röhren	pijp	x		x	x		x			
Möhren	wortels	x		x	x		x			
Töten	doden	x		x					x	
Nöte	noten	x	x	x					x	
Mögen	mogen / lusten / kunnen	x		x			x			

Verpönt	ongewenst / onwenselijk						x			
Töricht	achterlijk	x	x	x	x		x			
Vermögend	vermogend	x	x	x			x			
Möglich	mogelijk			x			x			
Löblich	loffelijk / prijzenswaardig			x			x			
Nötigung	dwang	x	x	x					x	
Fröhlich	vrolijk	x	x	x	x		x			
Zögerlich	aarzelend / huiverig	x	x	x			x			
König	koning	x	x				x			
Einölen	insmeren met olie	x		x	x		x			
Die Öde	saai / droog	x	x	x			x			
Die Einöde	woestijn	x	x	x			x			
dröhnen	dreunen	x				x	x	x		
stöhnen	kreunen	x				x	x	x		
Möbel	meubel	x	x	x		x	x	x		
Likör	likeur			x		x	x	x		
Manöver	manoeuvre	x	x	x		x	x	x		
Knödel	knoedel	x	x	x			x			
Pöbel	gepeupel	x	x	x		x	x			x
Fröbeln	fröbelen	x	x	x		x	x	x		

Appendix D. Selection process of German words with [e:] and their Dutch counterparts

Table D.1: Selection process of German words with [e:] and their Dutch counterparts

German - open syllable + no closed option	**No liquids after [e:]**	**No nasals after [e:]**	**Stress on [e:]**	**German words with usable Dutch counterpart**	**Dutch counterpart**	**Selected for the transcript**	**Dutch counterpart**
Tätigkeit	Tätigkeit	Tätigkeit	Tätigkeit	Tätigkeit	bezigheid	Tätigkeit	bezigheid
Währung	Armee	Armee	Armee	Armee	leger	Armee	leger
Fähre	eklig	eklig	eklig	Medizin	medicijnen	Die Rede	lezing/redevoering
Armee	ekelhaft	ekelhaft	ekelhaft	Die See/die Seen	zee	Esel	ezel
eklig	Medizin	Medizin	Die See/die Seen	Die Rede	lezing/redevoering	Kegeln	kegelen
ekelhaft	Die See/die Seen	Die See/die Seen	Die Rede	Reederei	rederij		
Medizin	Die Rede	Die Rede	Reh	Reh	ree		
Die See/die Seen	Reederei	Reederei	Fehde	Fehde	vete		
Die Rede	Reh	Reh	Edel	Edel	edel		
Reederei	Lehnen	Fehde	Ebene	Ebene	etage		
Kehle	Fehde	Edel	Esel	Esel	ezel		
Reh	Edel	Ebene	Ekel	Kegeln	kegelen		
Seele	Ebene	Esel	Jedes/jeder				
Lehre	Esel	Ekel	Kegeln				
Leere	Ekel	Jedes/jeder	Segeln				
Verehre	Jedes/jeder	Kegeln					
Elend	Kegeln	Segeln					
Lehnen	Segeln						
Fehde							

Edel							
Ebene							
Esel							
Ekel							
Hehlerei							
Jedes/jeder							
Kegeln							
Segeln							

Appendix E. Selection process of German words with [o:] and their Dutch counterparts

Table E.1: Selection process of German words with [o:] and their Dutch counterparts

German - open syllable + no closed option	No liquids after [o:]	No nasals after [o:]	Stress on [o:]	German words with Dutch usable translation	Dutch counterpart	Comment
Auto	Auto	Auto	Dialoge	Dialoge	dialogen	
Dialoge	Dialoge	Dialoge	Logisch	Logisch	logisch	
Logisch	Logisch	Logisch	Verlobung	Verlobung	verloving	
Verlobung	Verlobung	Verlobung	Zoo	Bote	bode	
Sodass	Sodass	Sodass	Zootiere	dosen	dozen	false friends
Soeben	Soeben	Soeben	Poo			
Zoo	Zoo	Zoo	Dosen/dose			
Zootiere	Zootiere	Zootiere	Bote			
Poo	Poo	Poo				
Posieren	Posieren	Posieren				
Kanone	Kanone	Dosen/dose				
Dosen/dose	Dosen/dose	Dosieren				
Dosieren	Dosieren	Bote				
Dekorieren	Omen					
Dekoration	Bote					
Projekt						
Cola						
Oratorium						
Kohle						
Lore						
Omen						
Sohle						
bote						

Appendix F. Selection process of German words with [øː] and their Dutch counterparts

Table F.1: Selection process of German words with [øː] and their Dutch counterparts

German - open syllable + no closed option	No liquids after [øː]	No nasals after [øː]	Stress on [øː]	German words with usable Dutch counterpart	Dutch counterpart
Söhne	Söhne	Ökonomie	Trödel	Trödeln	treuzelen
Töne	Töne	Ökologie	Trödeln	Möbel	meubel
Ökonomie	Ökonomie	Ökologisch	Löwe	Pöbel	gepeupel
Ökologie	Ökologie	Ökonomisch	Nöte	Fröbeln	fröbelen
Ökologisch	Ökologisch	Trödel	Vermögend		
Ökonomisch	Ökonomisch	Trödeln	Nötigung		
Trödel	Trödel	Löwe	Zögerlich		
Trödeln	Trödeln	Nöte	Die Öde		
Löhne	Löhne	Vermögend	Möbel		
Löwe	Löwe	Nötigung	Manöver		
Nöte	Nöte	Zögerlich	Knödel		
Töricht	Vermögend	Die Öde	Pöbel		
Vermögend	Nötigung	Die Einöde	Fröbeln		
Nötigung	Zögerlich	Möbel			
Fröhlich	König	Manöver			
Zögerlich	Die Öde	Knödel			
König	Die Einöde	Pöbel			
Die Öde	Möbel	Fröbeln			
Die Einöde	Manöver				
Möbel	Knödel				
Manöver	Pöbel				
Knödel	Fröbeln				
Pöbel					
Fröbeln					

Appendix G. Overview of transcribed audio files per analyst

Table G.1: Overview of the transcribed audio files per analyst.

Analyst	Participant	Dutch audio file	German audio file
Analyst 1	BJ	Yes	Yes
	KS	Yes	No
	SM	Yes	Yes
Analyst 2	BT	Yes	Yes
	LL	Yes	No
	SA	Yes	Yes
Analyst 3	HE	Yes	Yes
	JE	Yes	Yes
	KS	No	Yes
	MM	Yes	Yes
Analyst 4	AV	Yes	Yes
	AR	Yes	Yes
	AE	Yes	Yes
	BM	Yes	Yes
	BL	Yes	Yes
	EN	Yes	Yes
	EF	Yes	Yes
	GS	Yes	Yes
	HS	Yes	Yes
	KM	Yes	Yes
	KA	Yes	Yes
	KC	Yes	Yes
	KF	Yes	Yes
	LL	No	Yes
	ON	Yes	Yes
	RW	Yes	Yes
	SS	Yes	Yes
	TM	Yes	Yes
	VV	Yes	Yes
	WK	Yes	Yes
	ZM	Yes	Yes

Appendix H. Results per participant

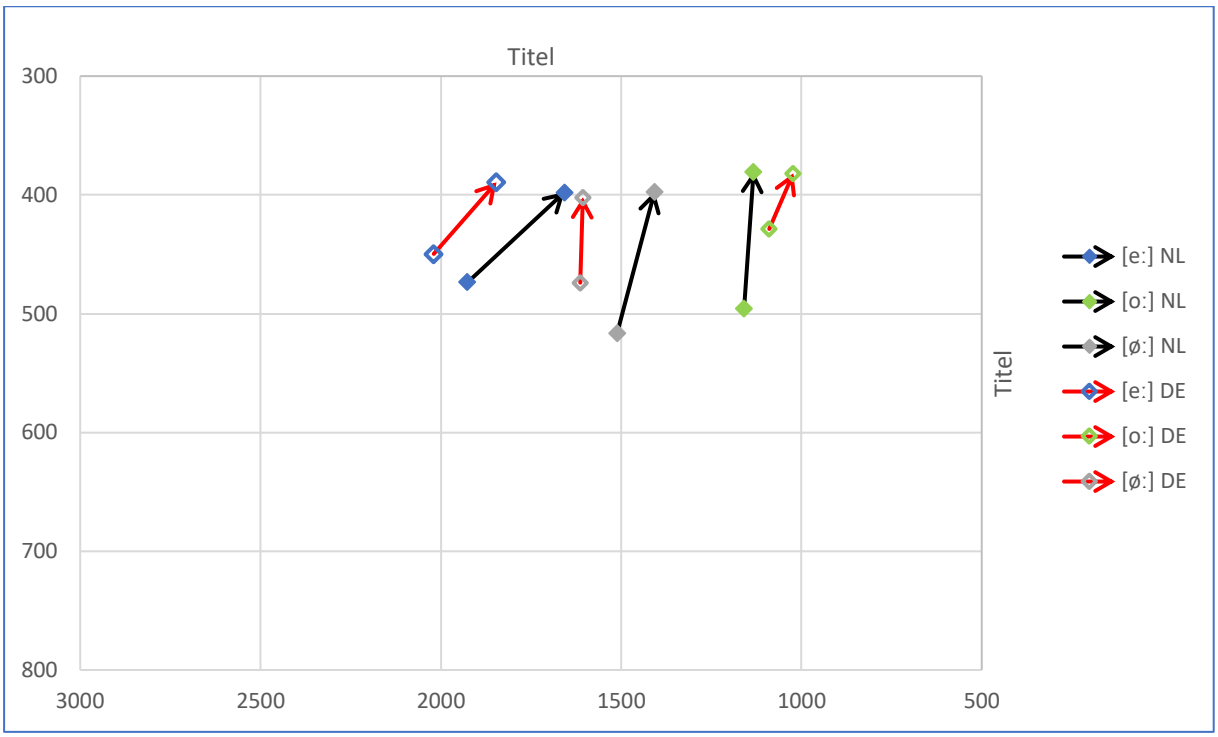

Figure H.1: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant AE. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

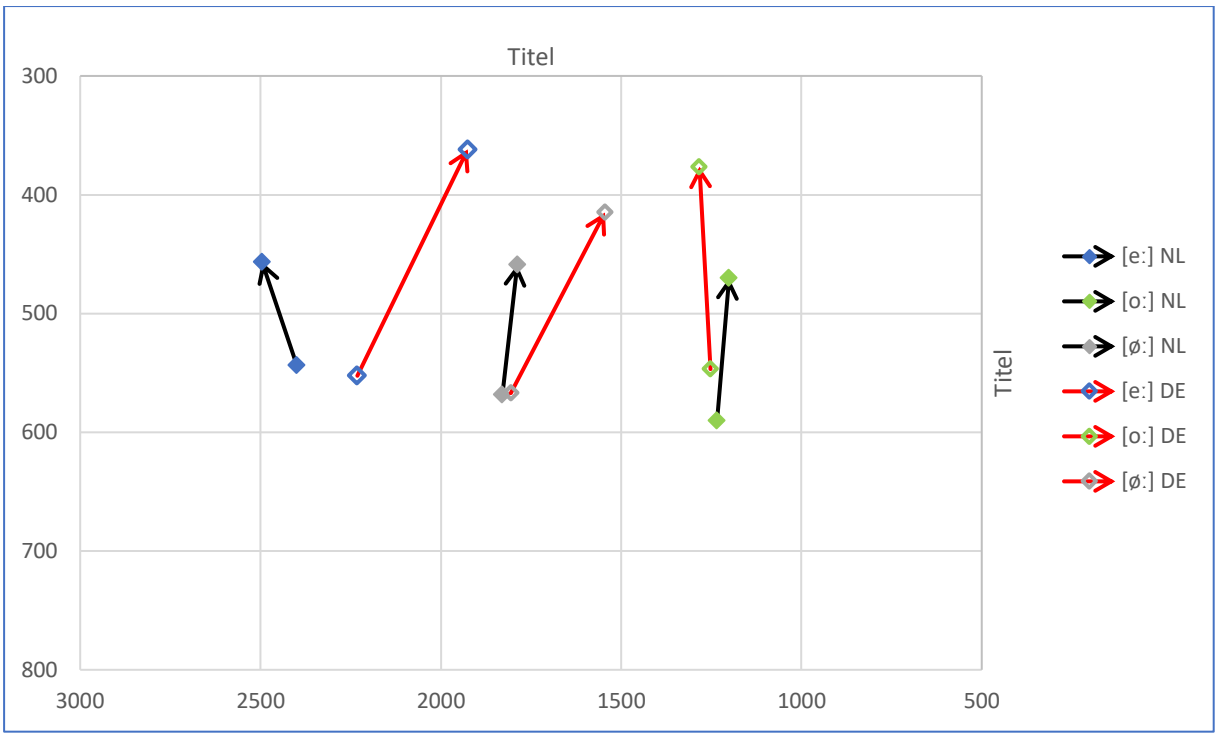

Figure H.2: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant AR. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

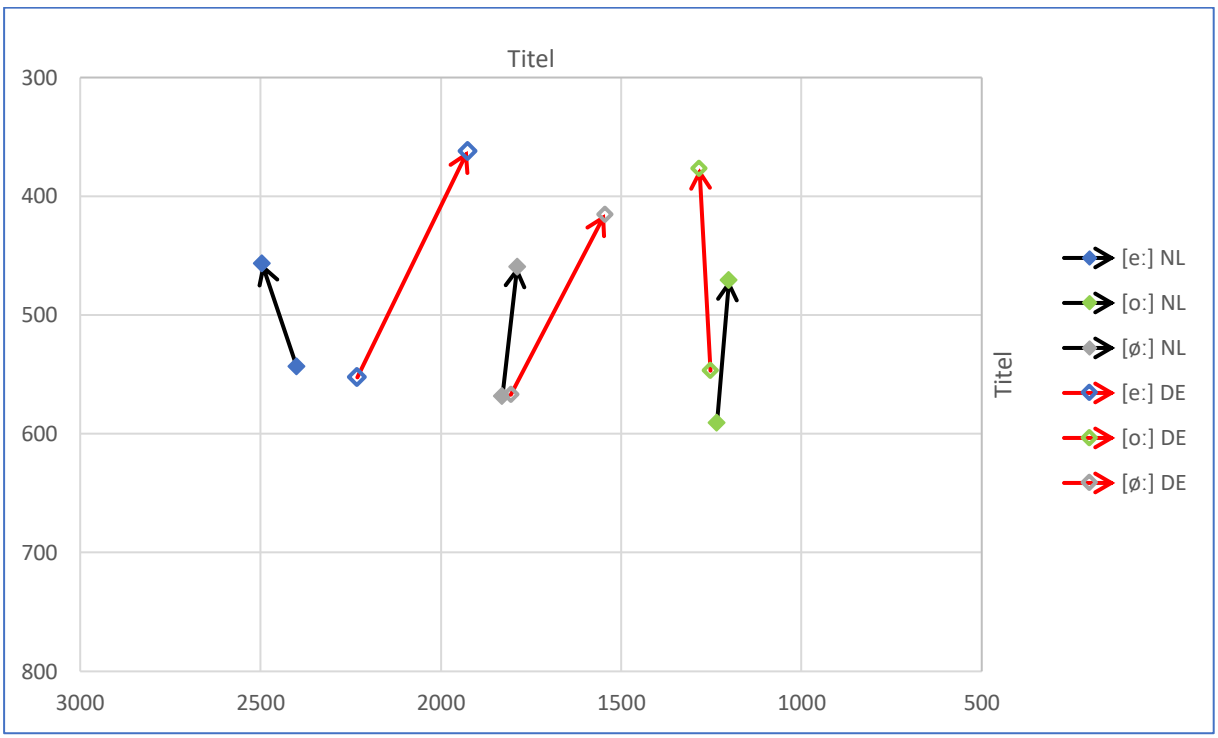

Figure H.3: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant AV. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

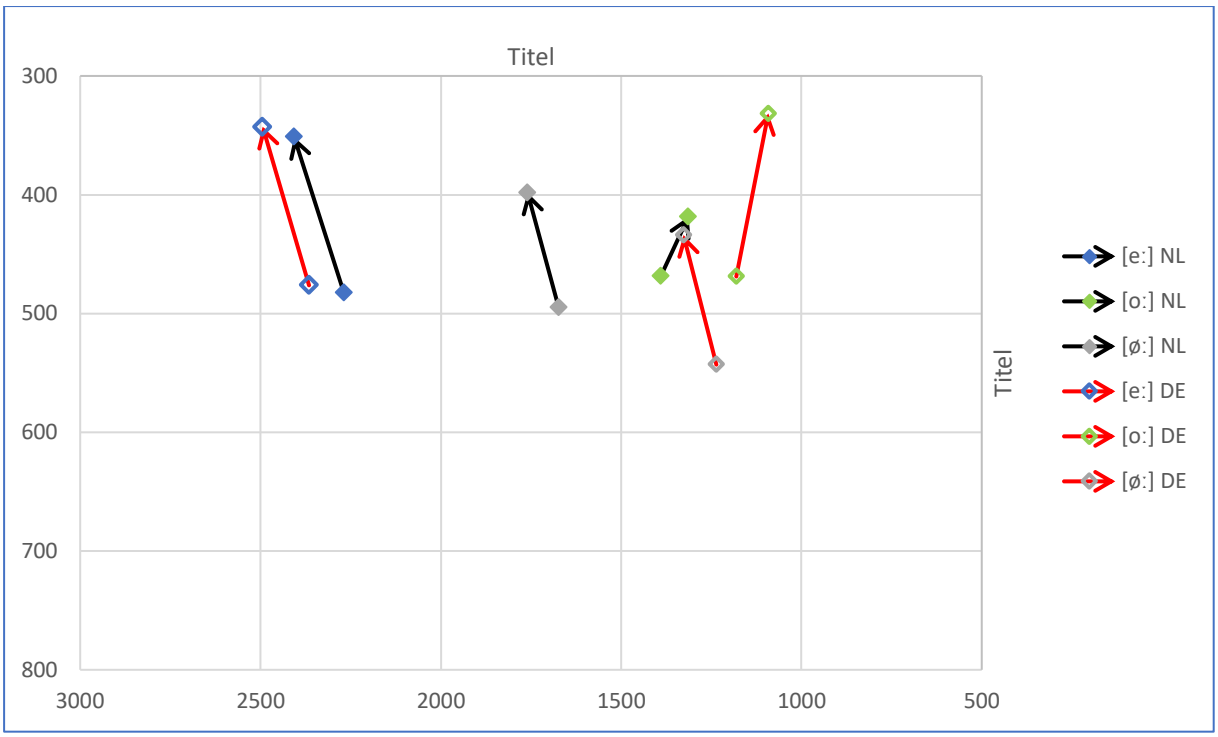

Figure H.4: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant BJ. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

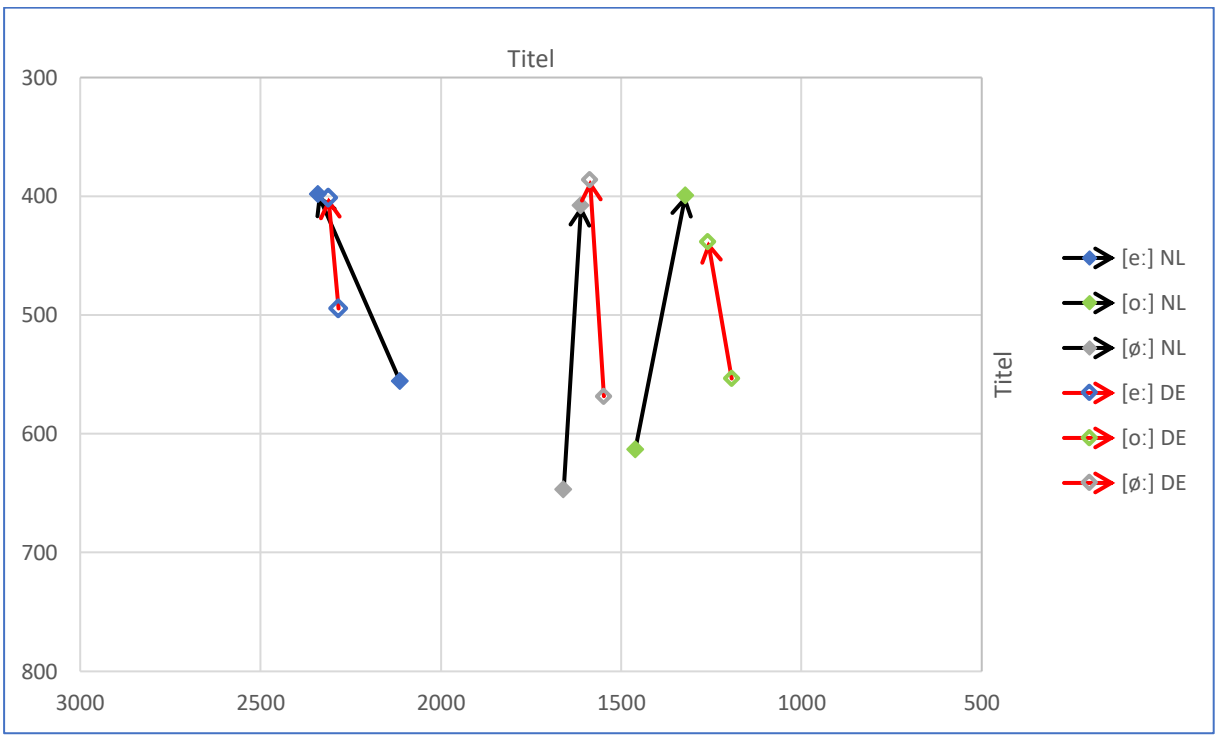

Figure H.5: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant BL. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

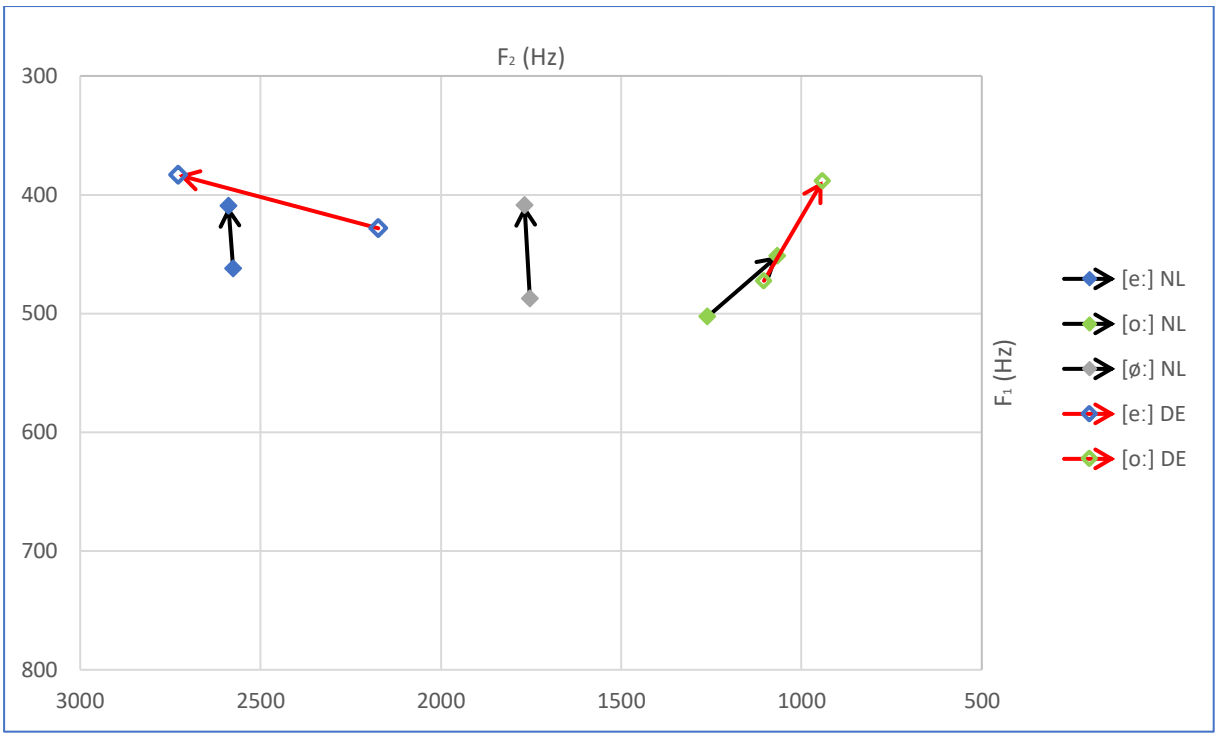

Figure H.6: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant BM. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

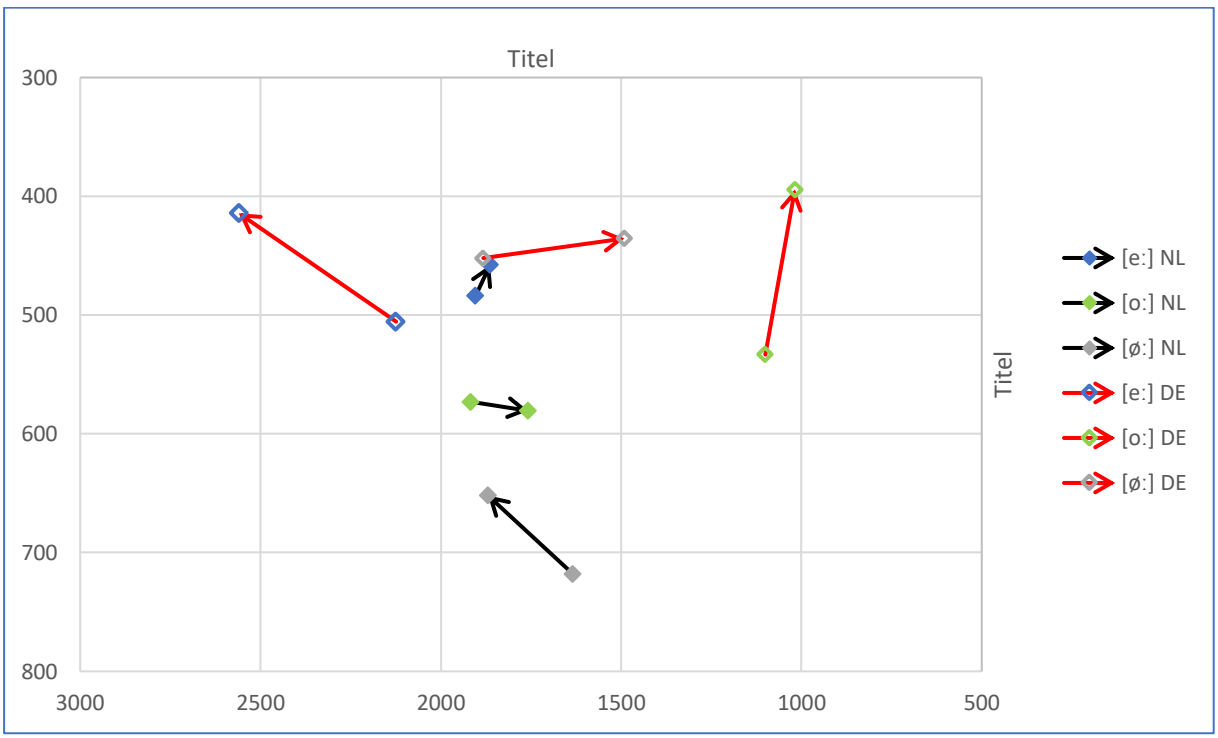

Figure H.7: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant BT. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

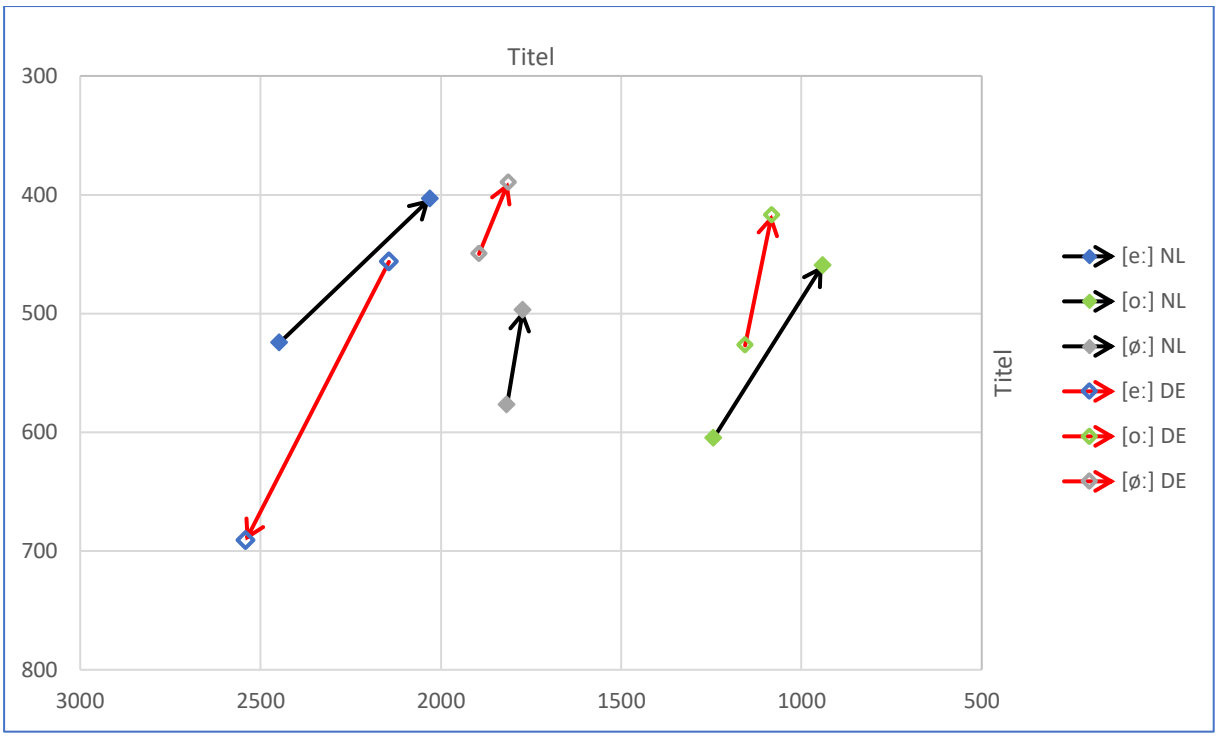

Figure H.8: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant EF. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

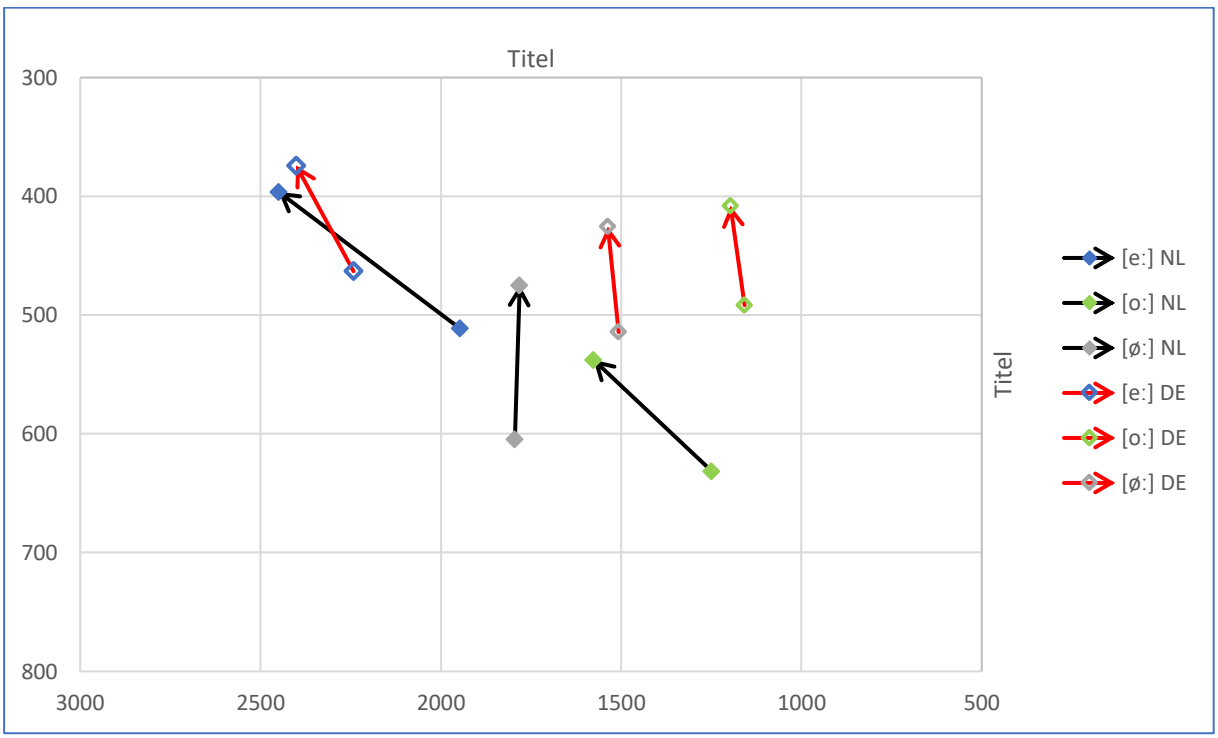

Figure H.9: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant EN. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

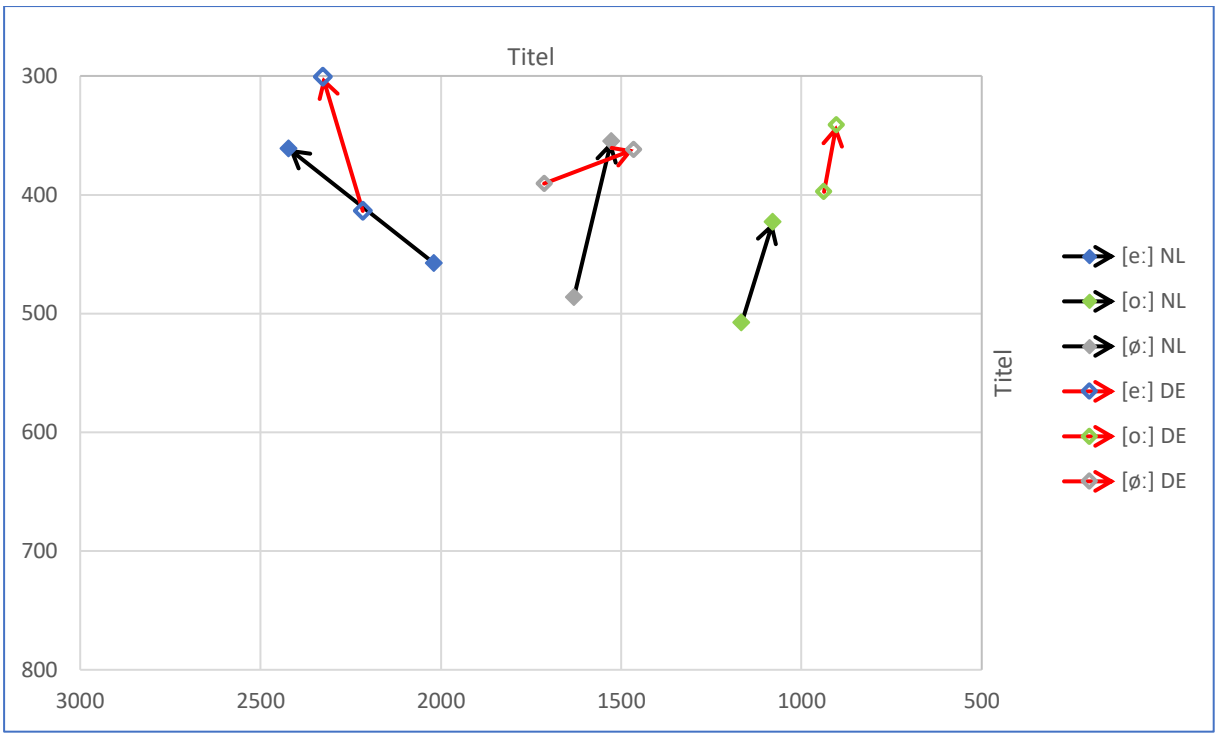

Figure H.10: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant GS. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

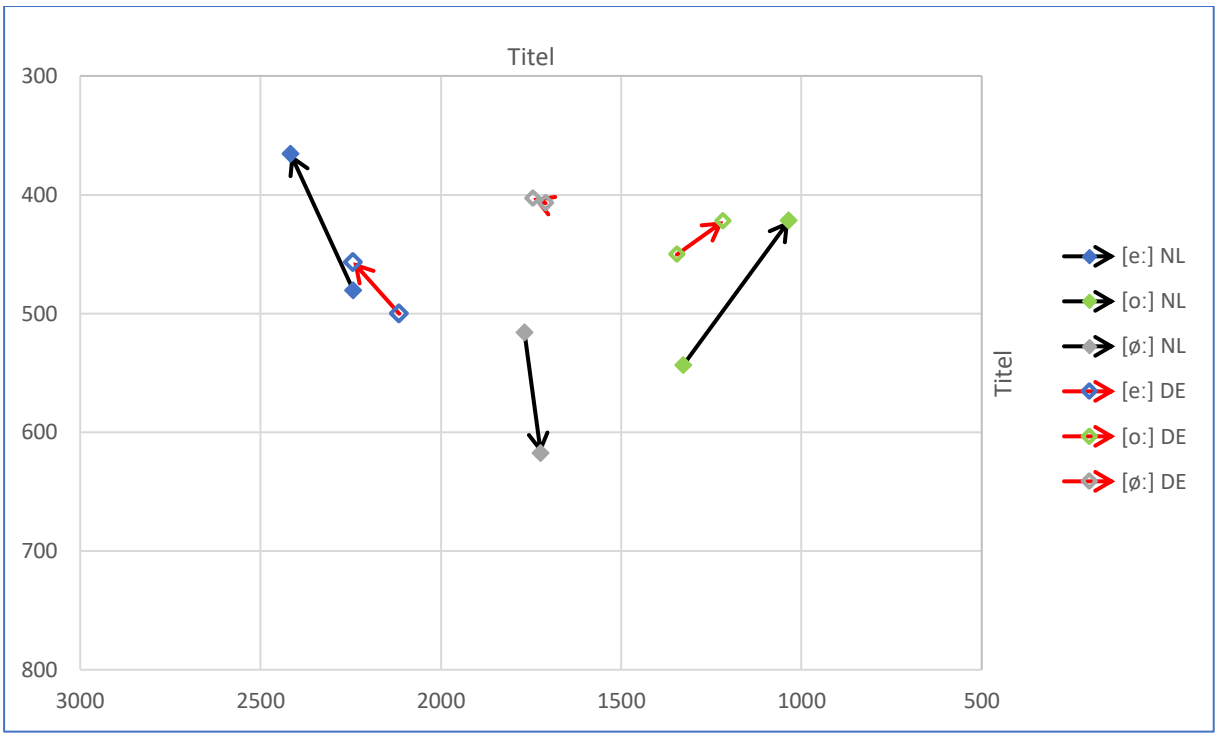

Figure H.11: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant HE. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

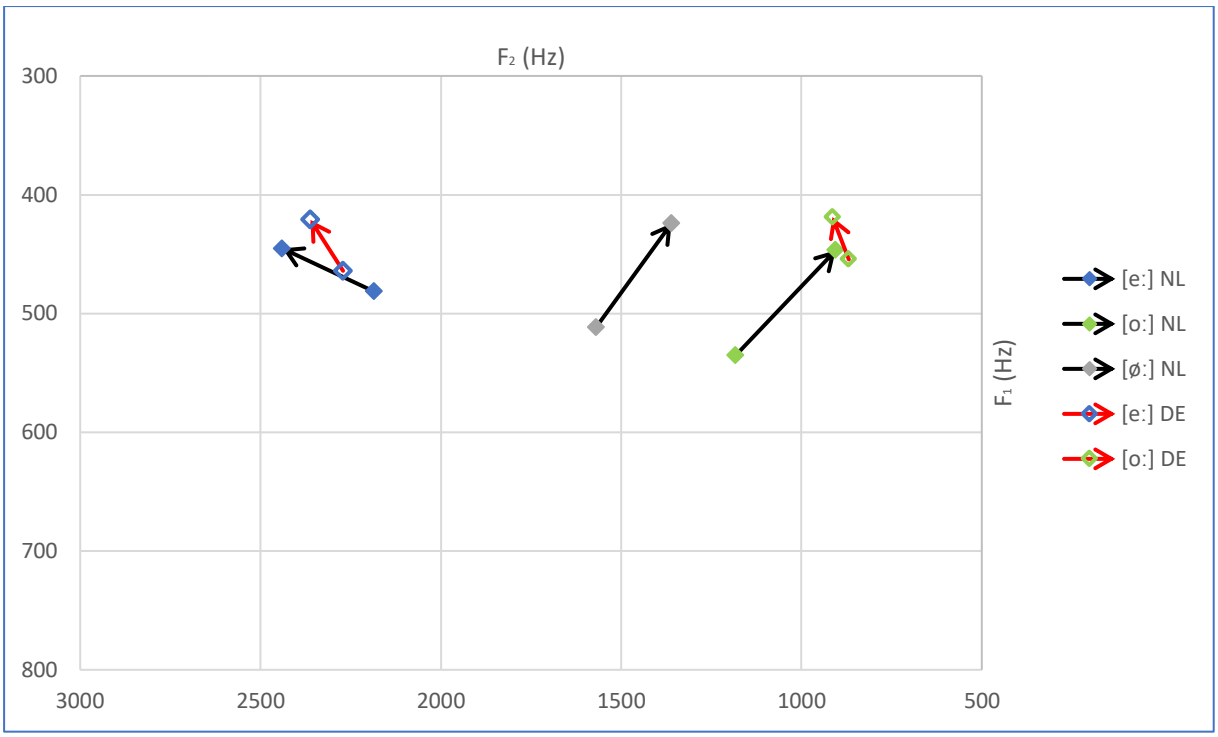

Figure H.12: F1 and F2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant HS. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

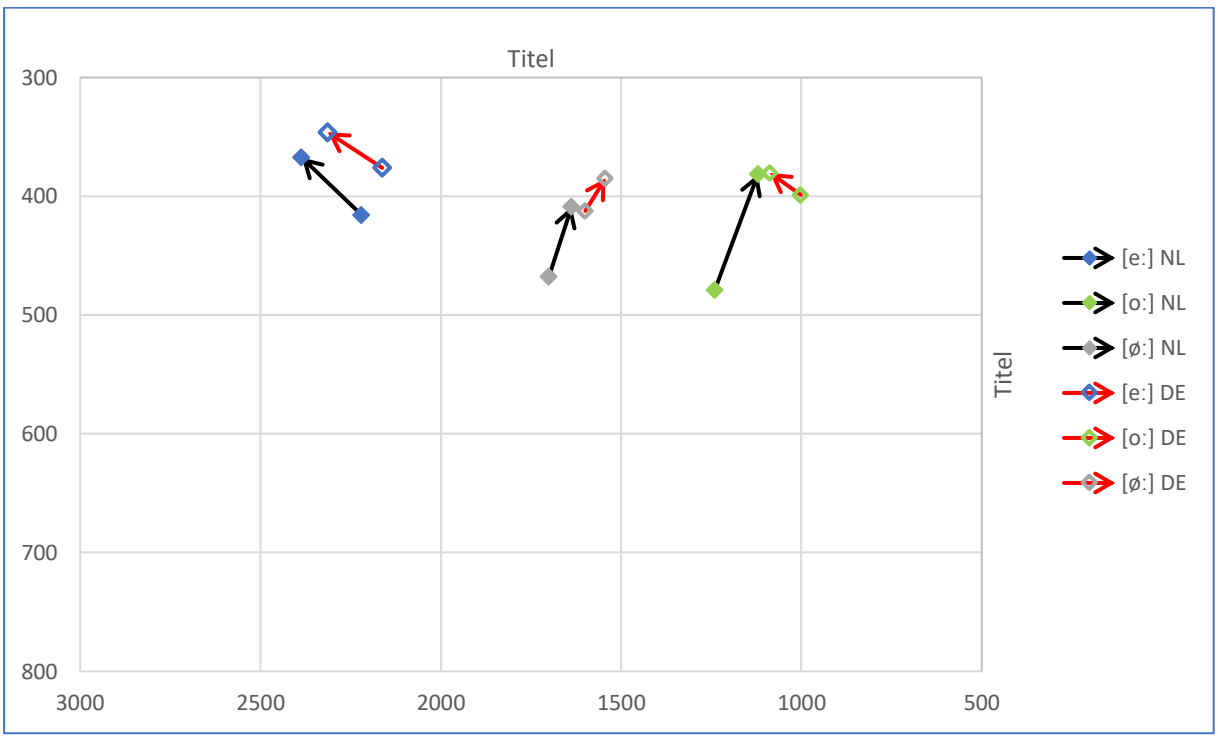

Figure H.13: F1 and F2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant JE. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

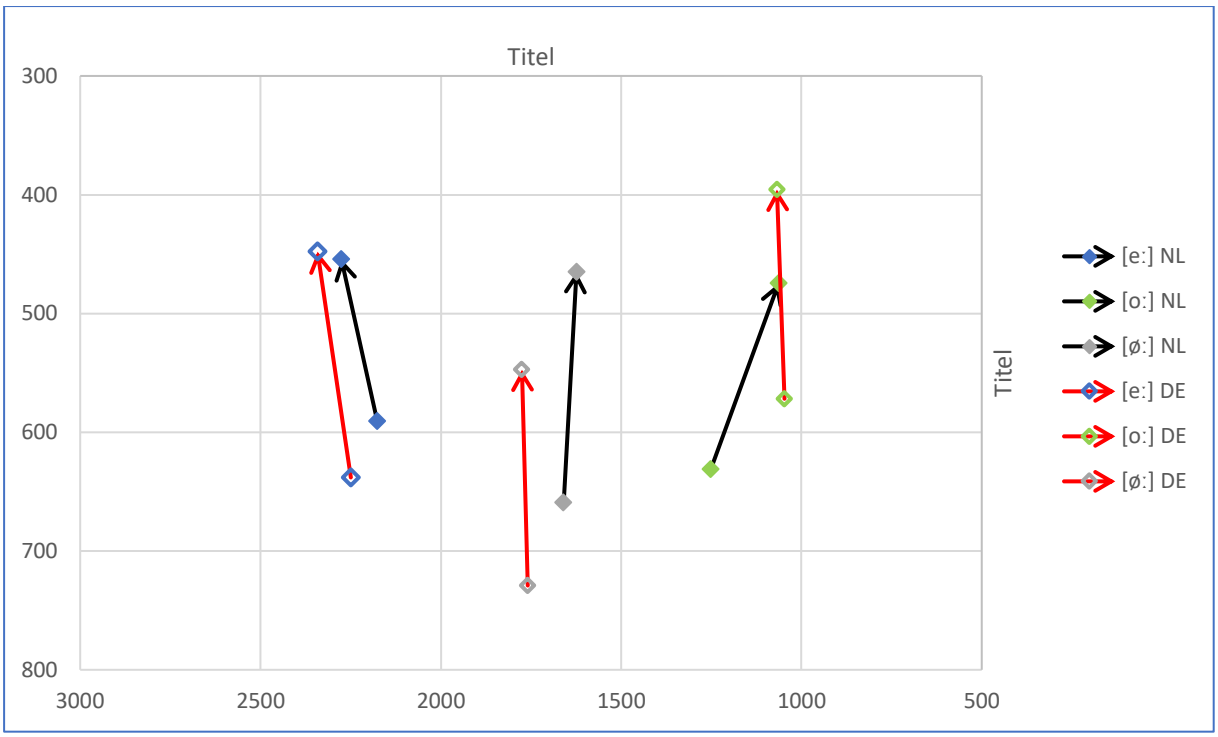

Figure H.14: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant KA. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

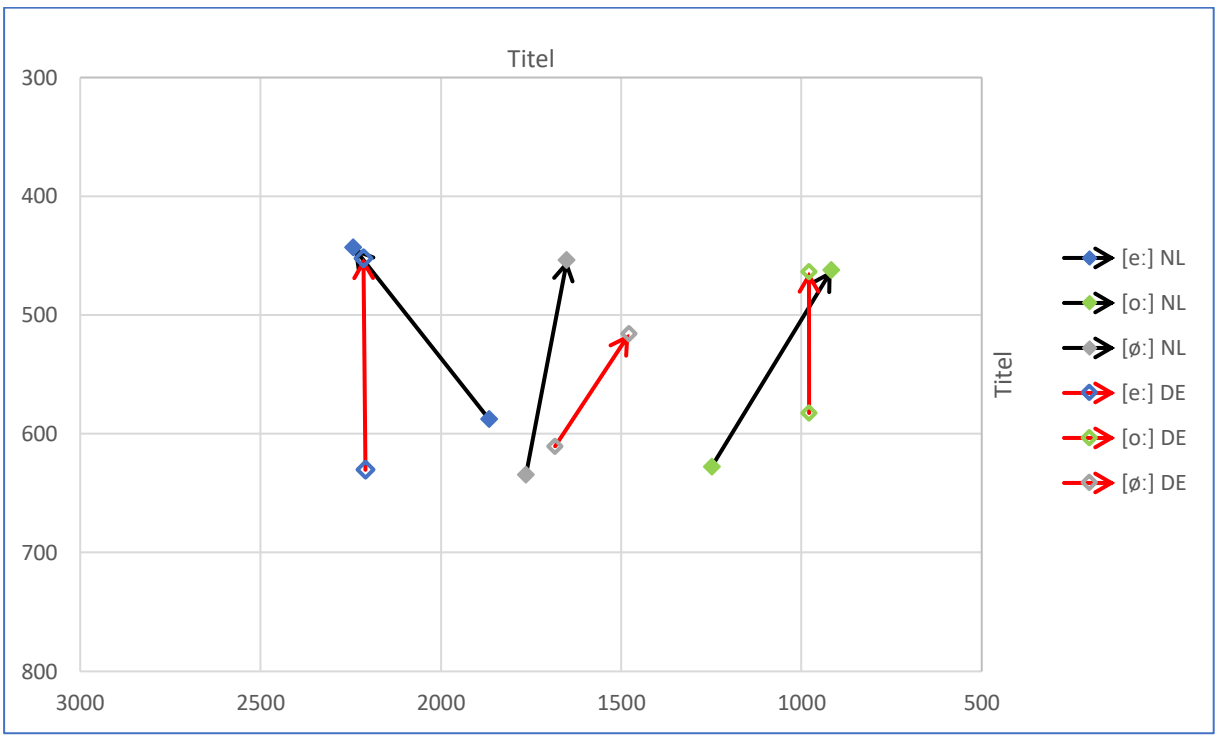

Figure H.15: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant KC. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

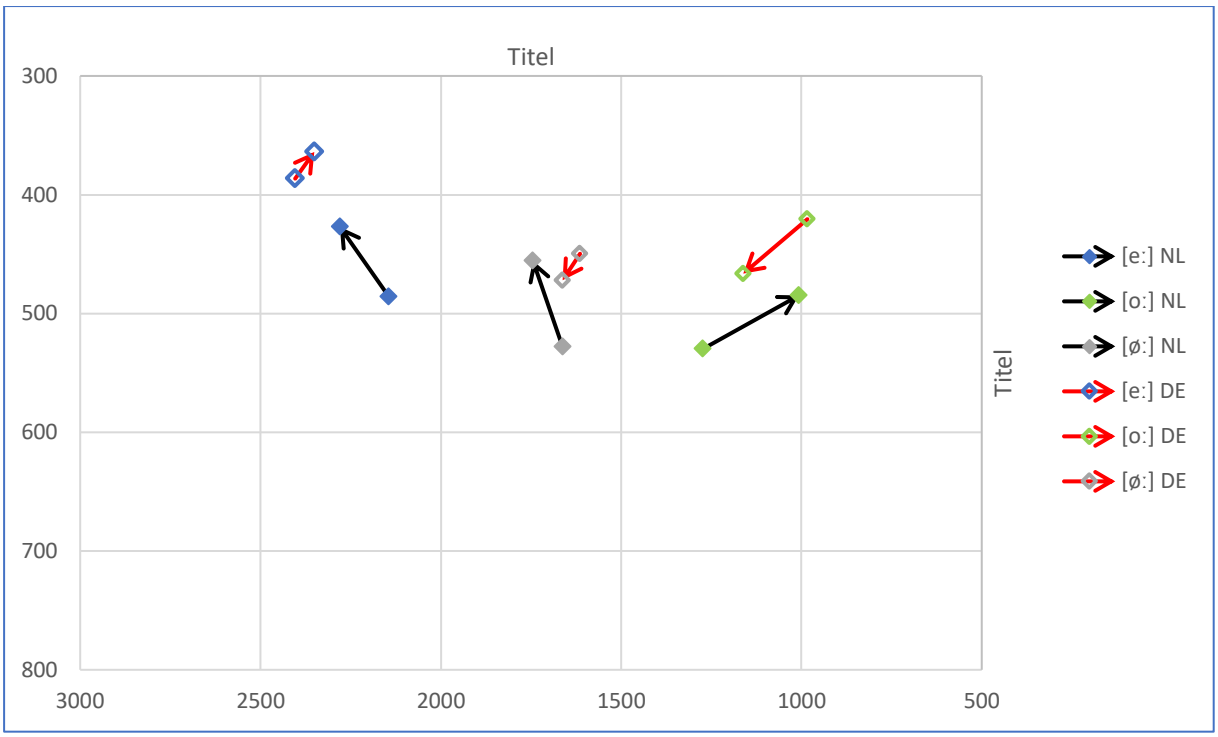

Figure H.16: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant KF. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

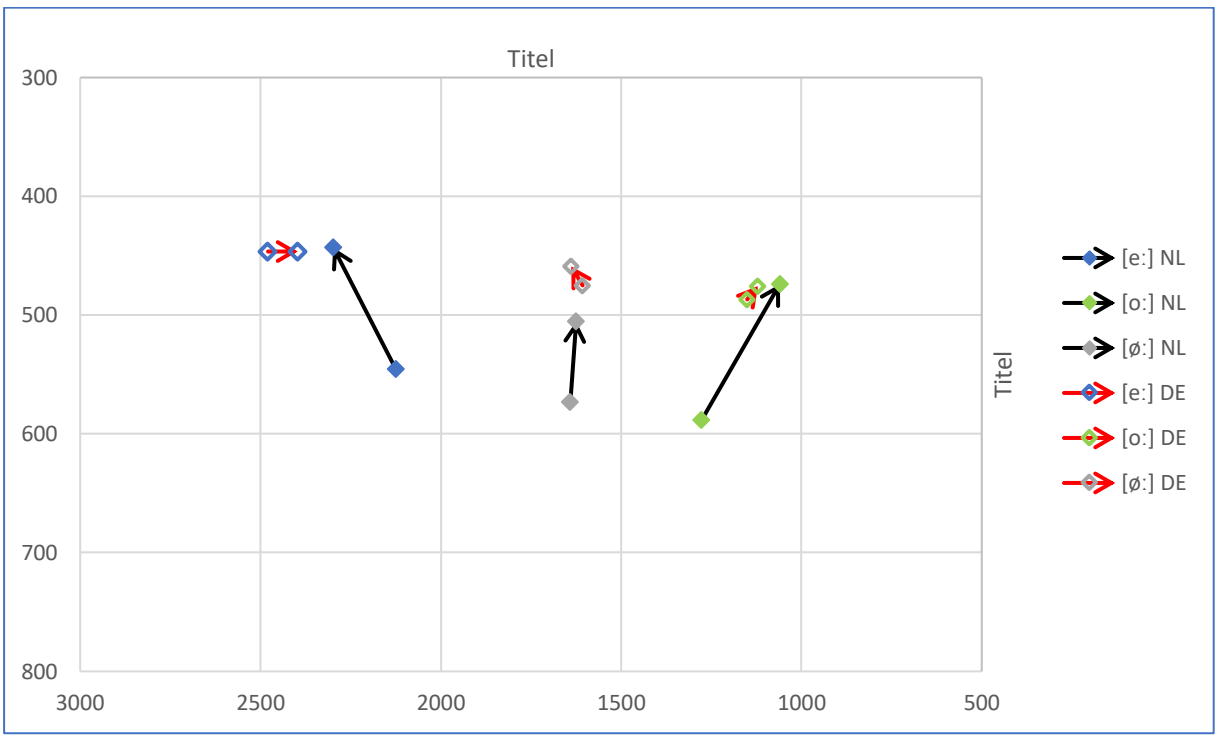

Figure H.17: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant KM. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

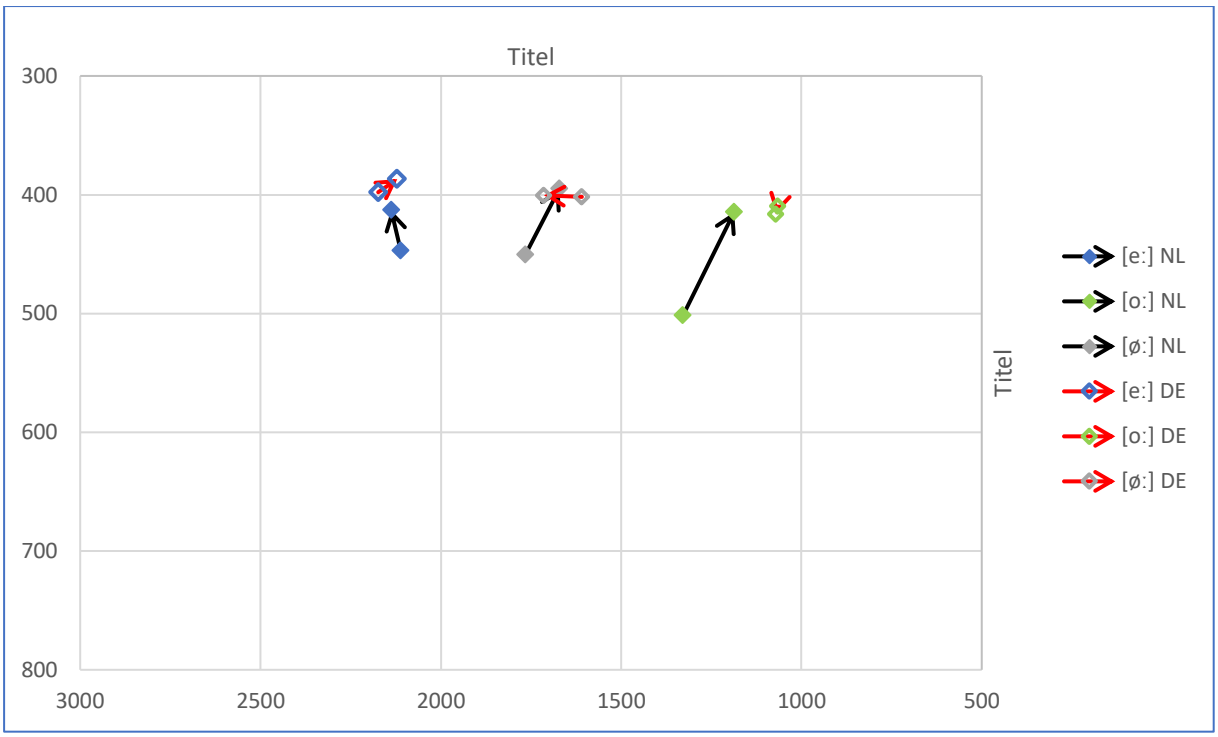

Figure H.18: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant KS. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

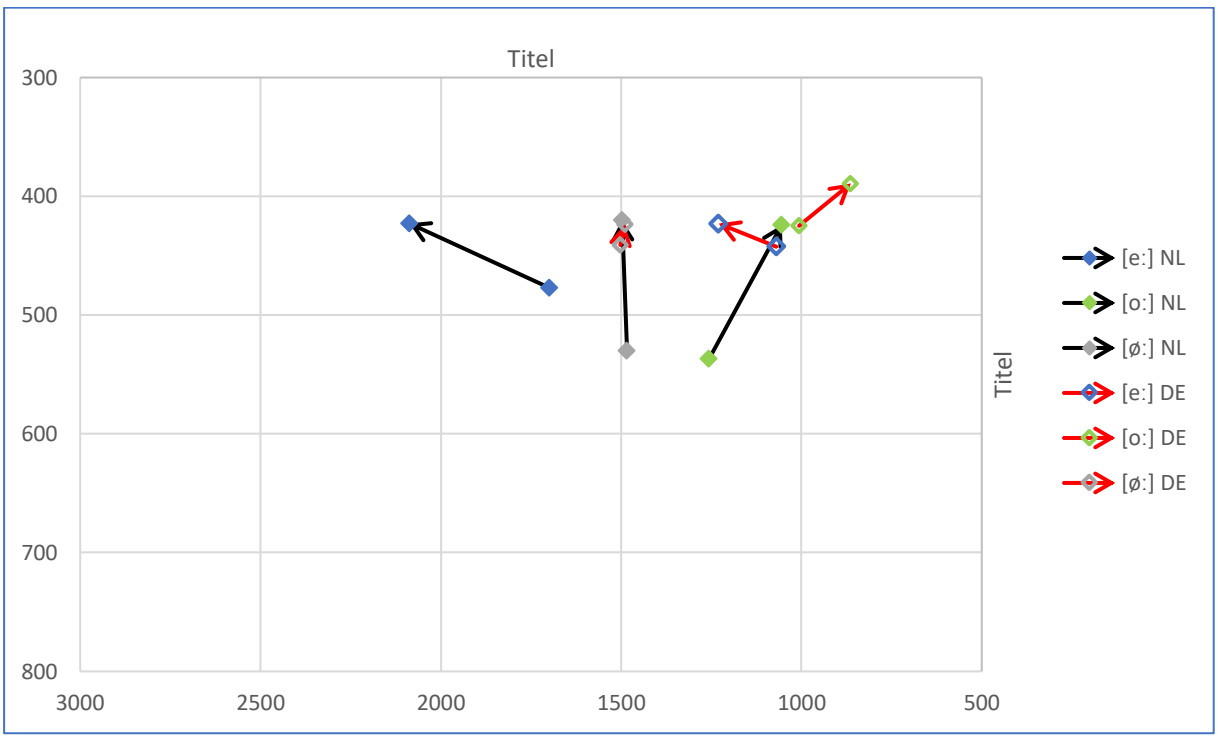

Figure H.19: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant LL. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

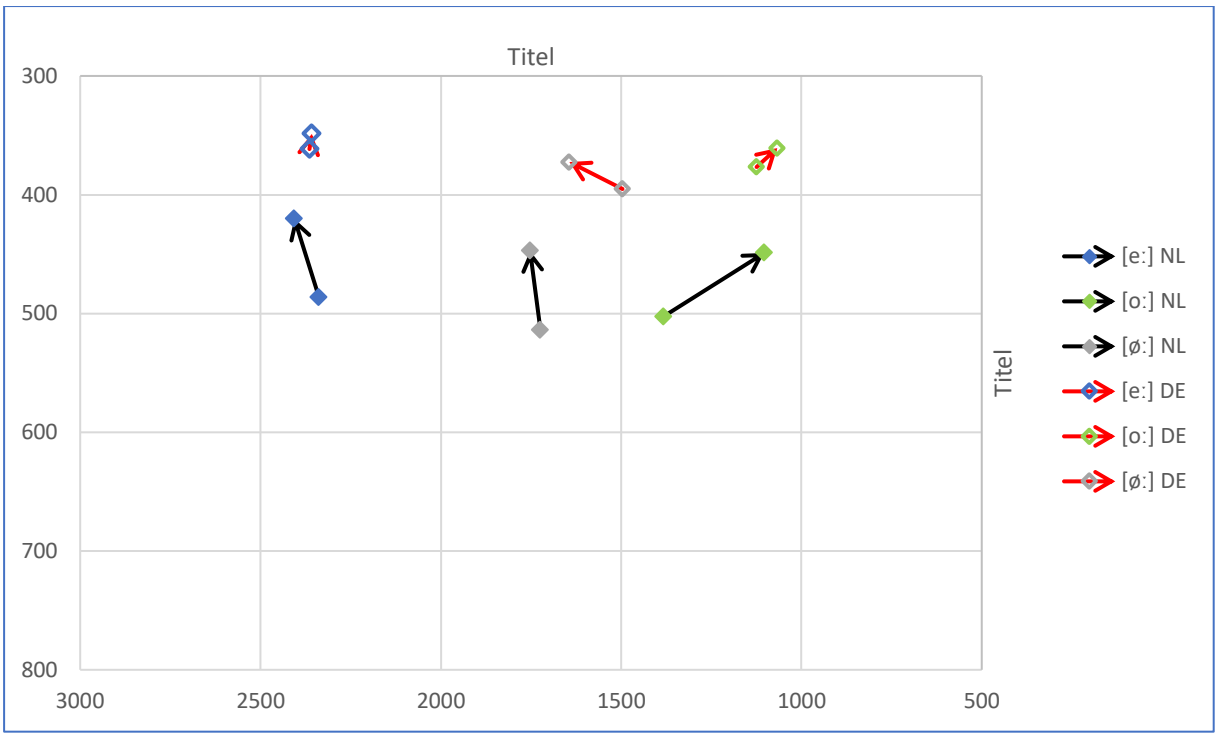

Figure H.20: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant MM. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

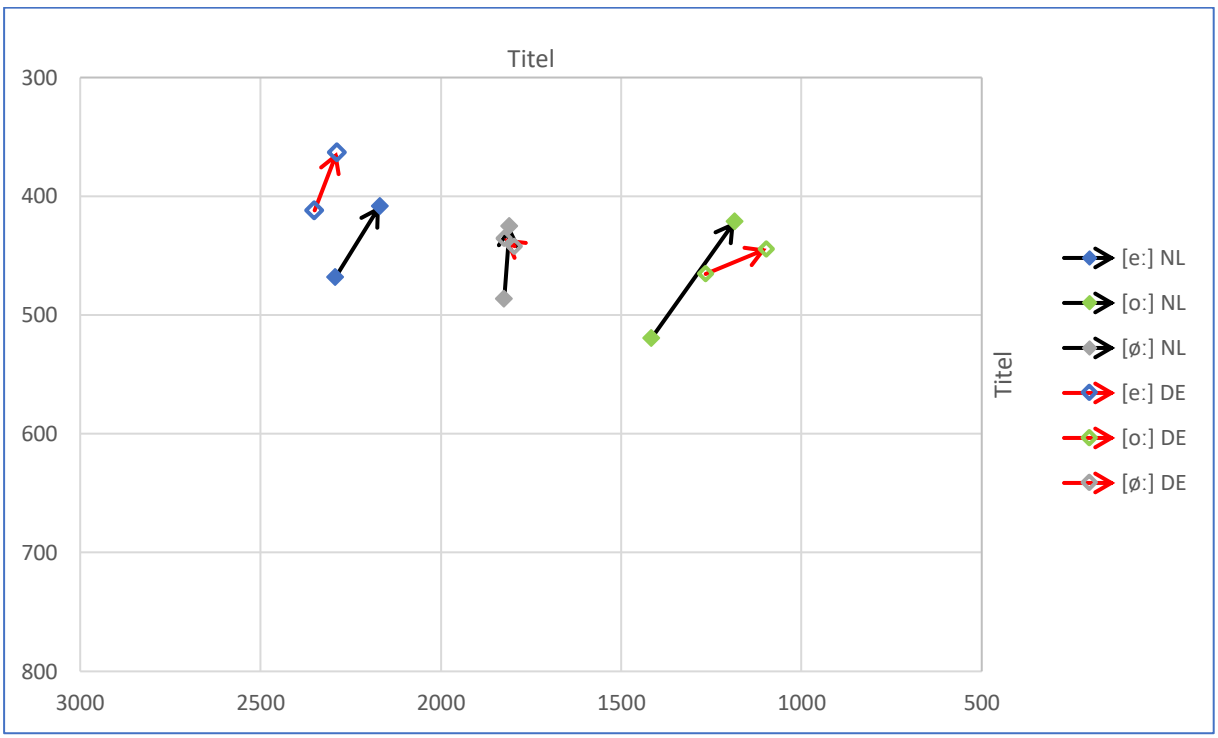

Figure H.21: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant ON. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

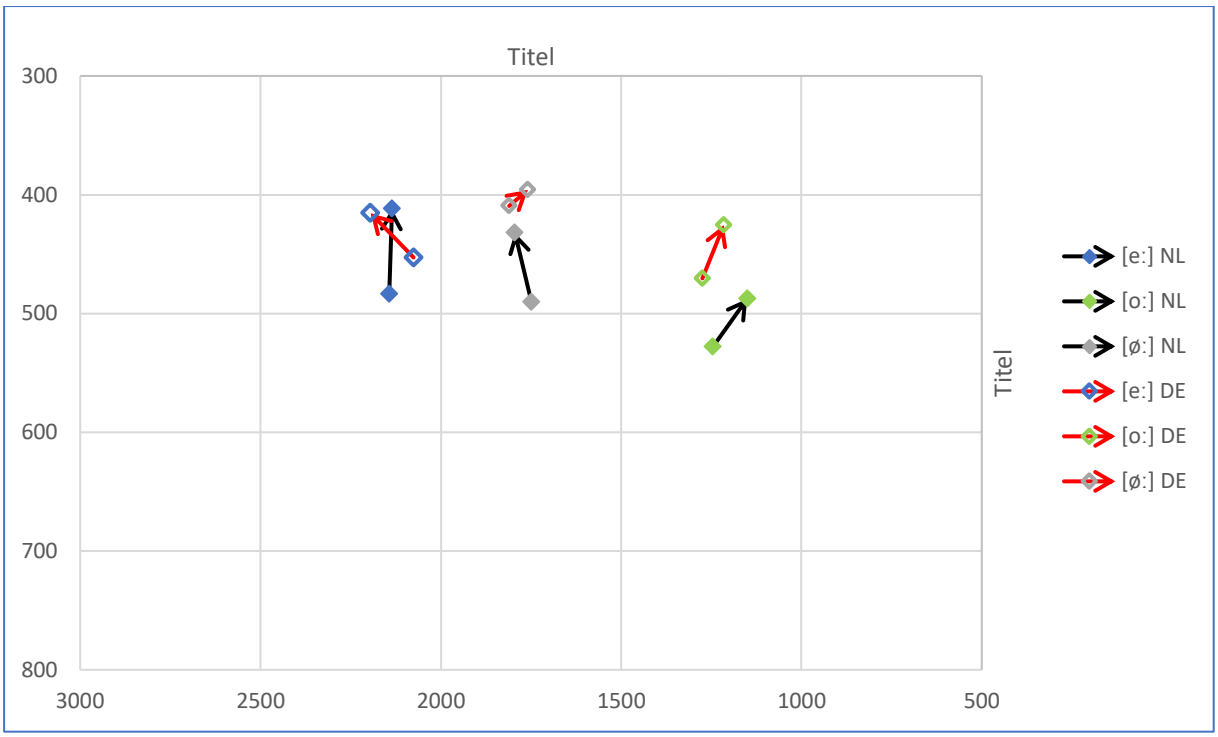

Figure H.22: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant RW. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

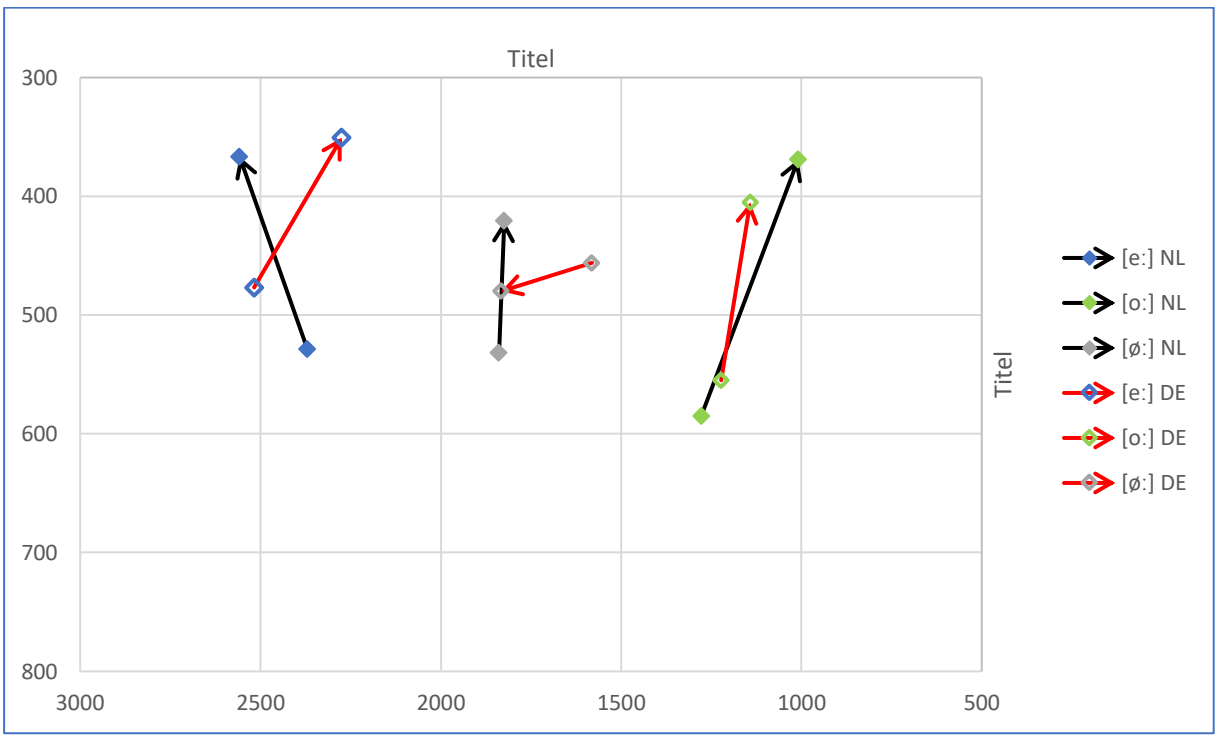

Figure H.23: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant SA. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

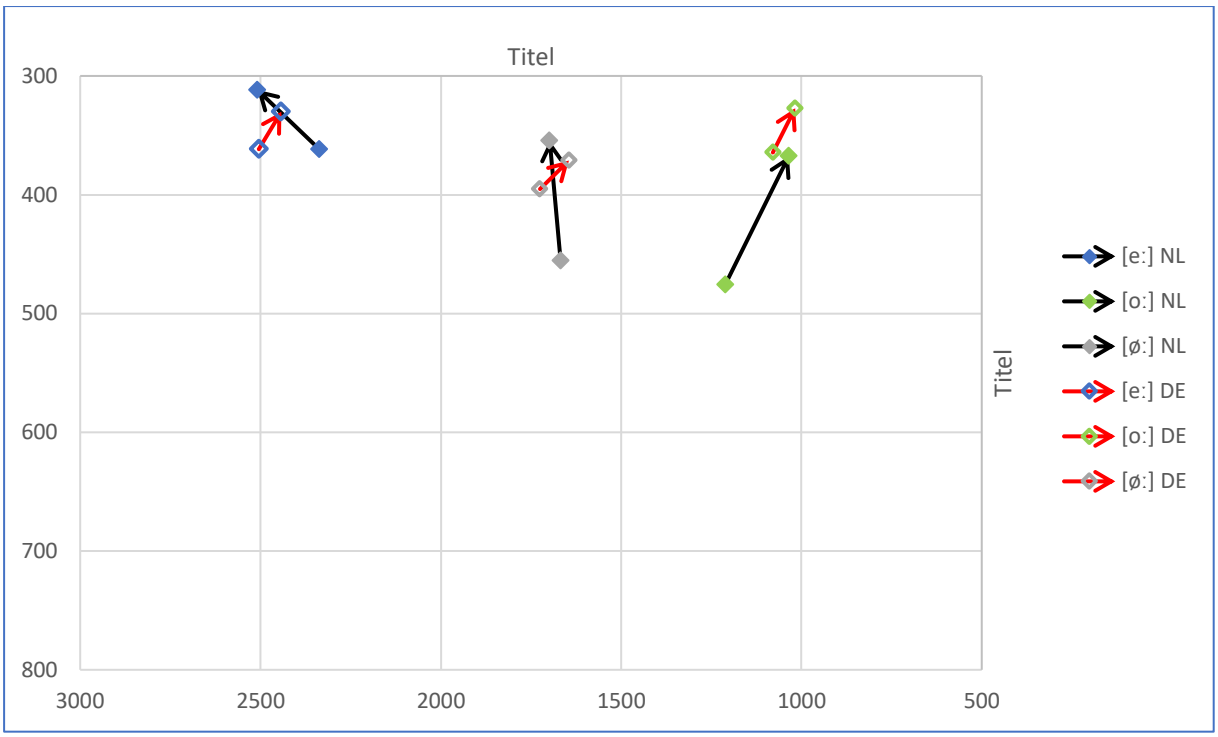

Figure H.24: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant SM. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

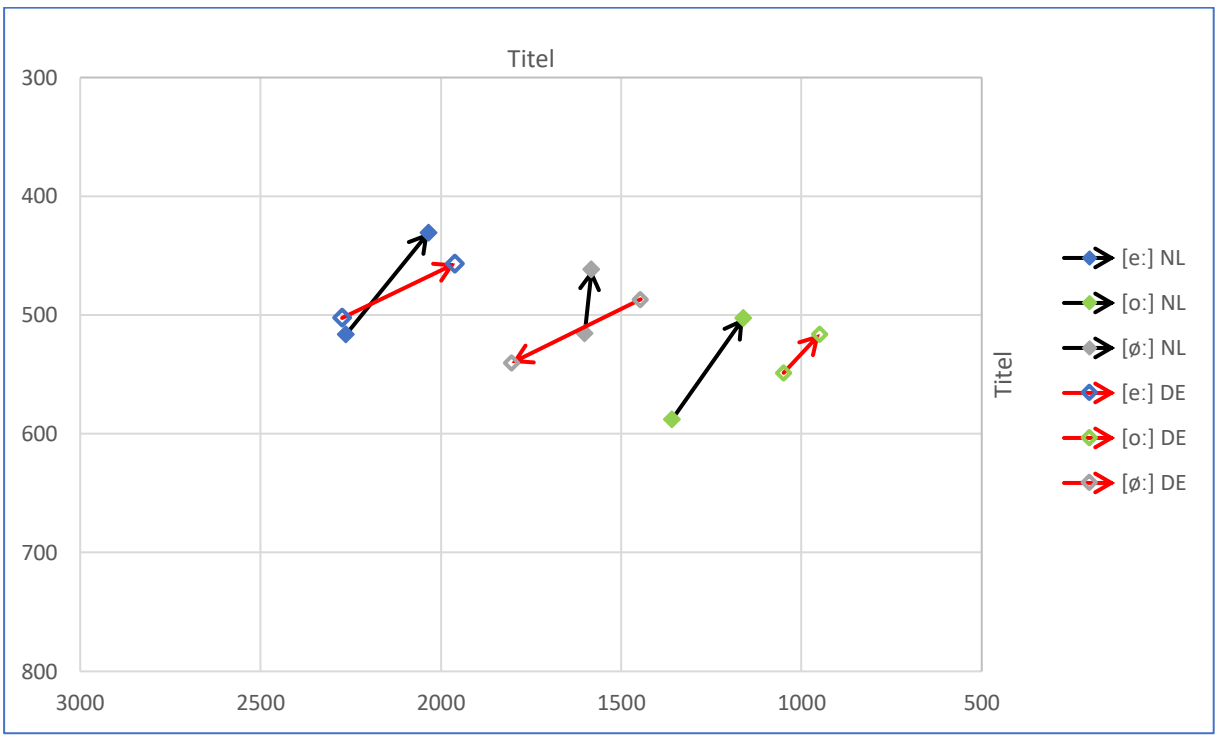

Figure H.25: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant SS. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

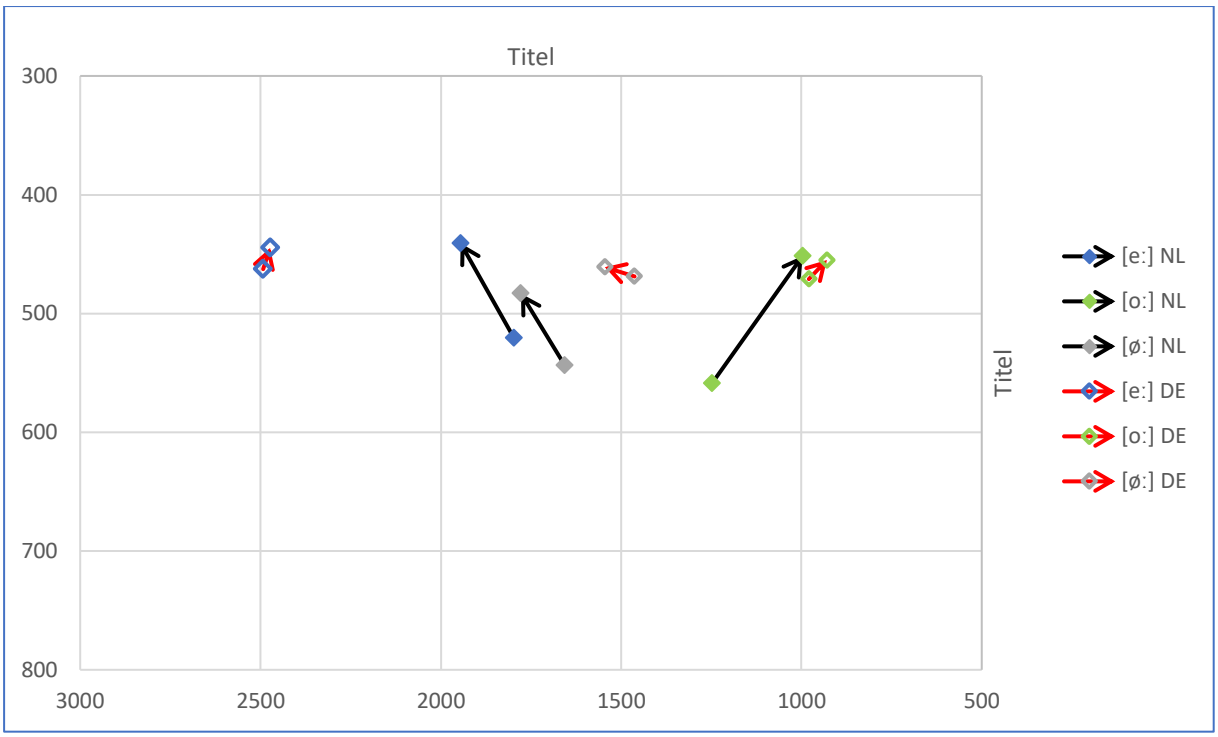

Figure H.26: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant TM. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

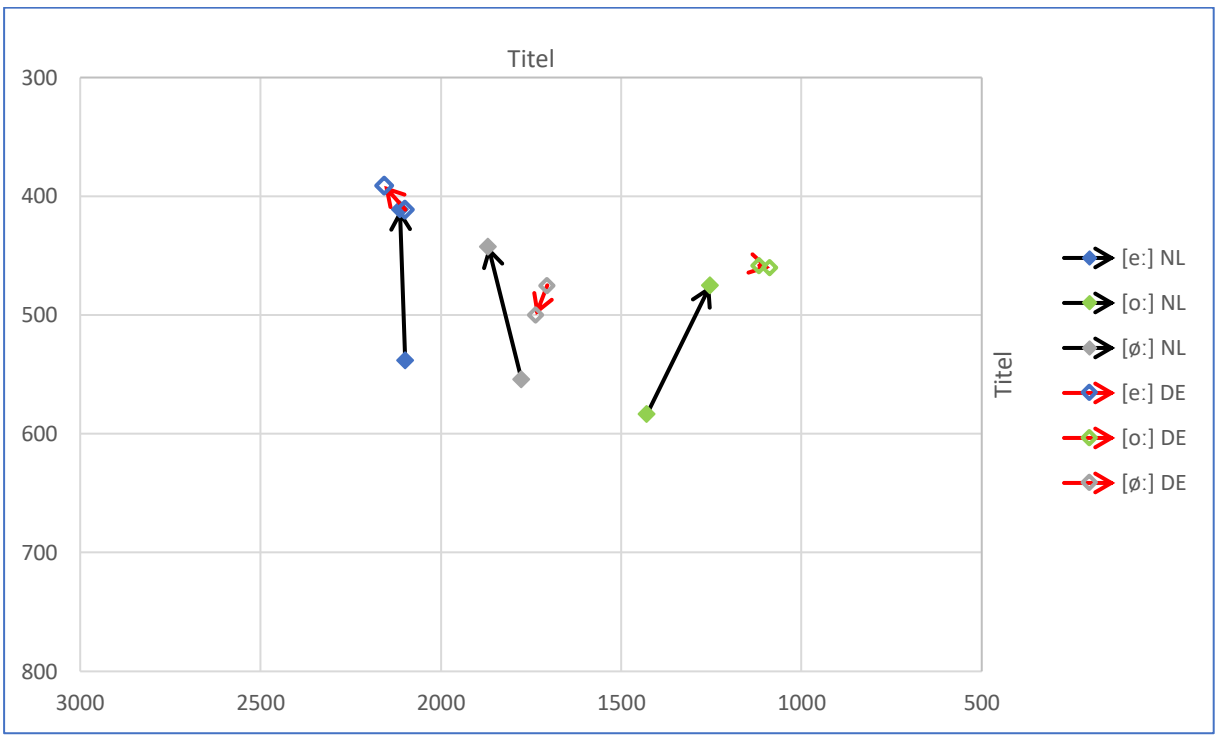

Figure H.27: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant VV. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

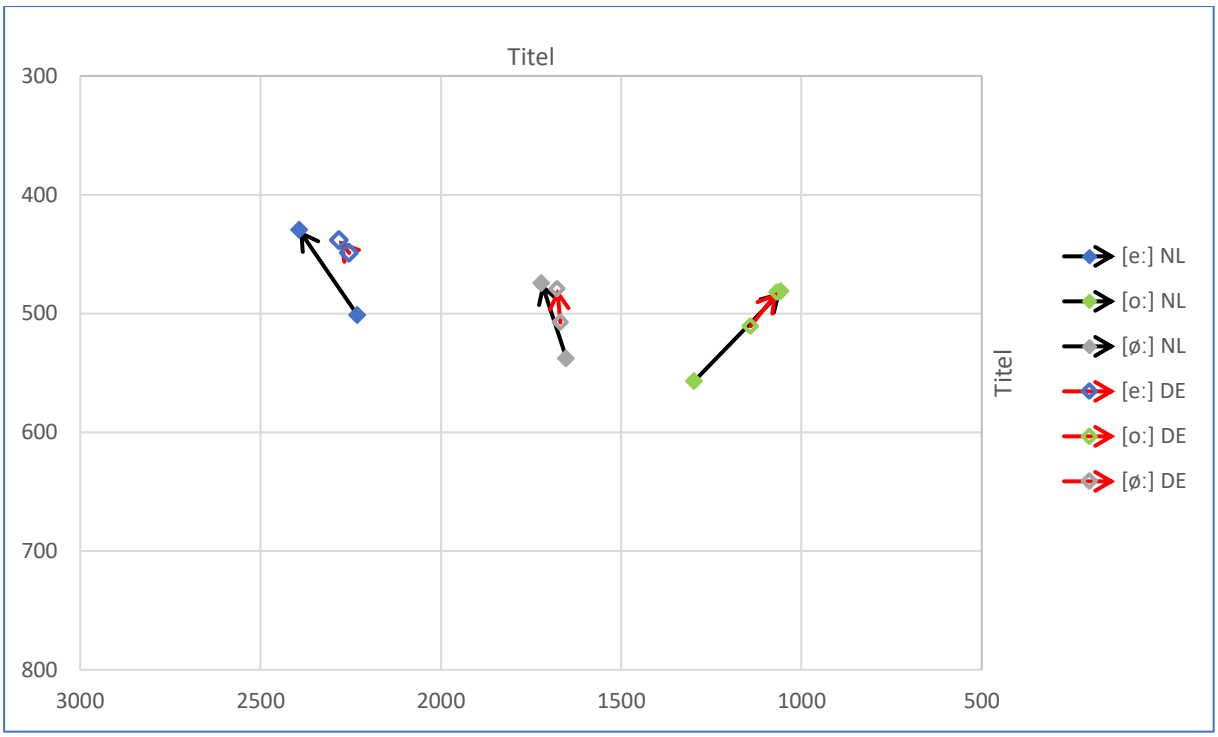

Figure H.28: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant WK. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

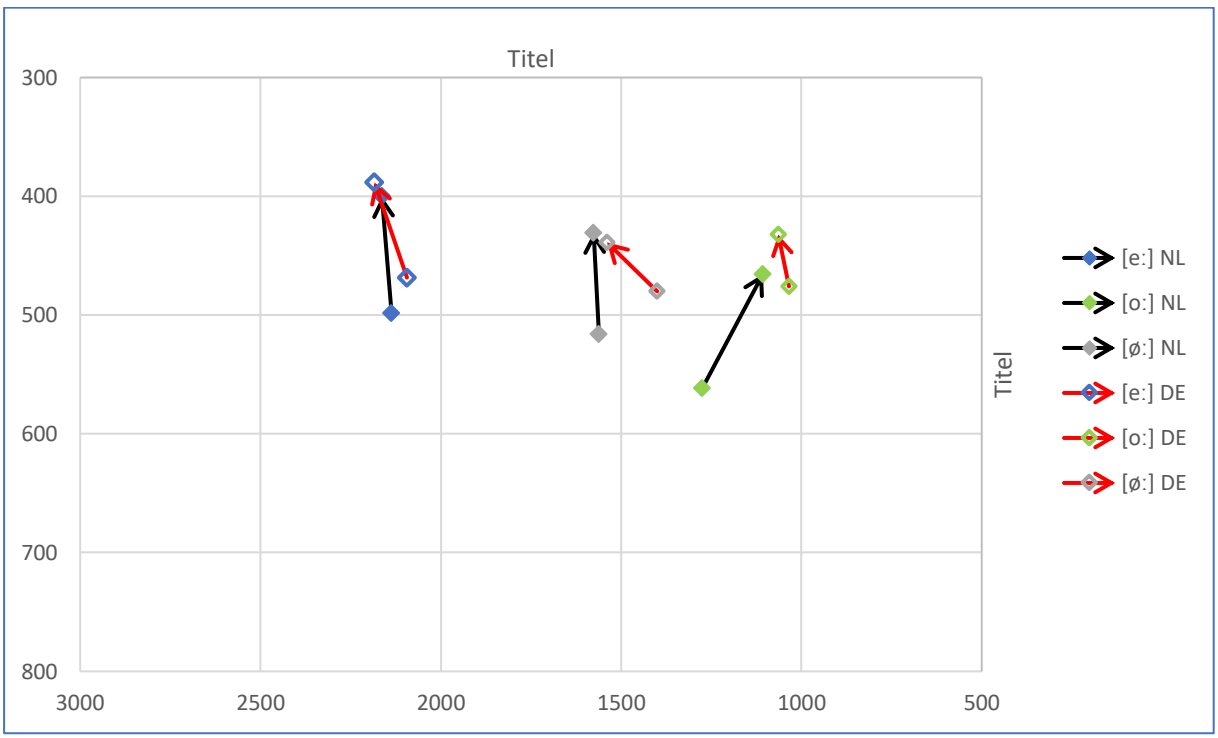

Figure H.29: F_1 and F_2 (Hz) at 25% and 75% of the long midvowels [e:], [o:], and [ø:] by participant ZM. The red line between the transparent squares represents the L2 German phoneme data, the black line between the coloured squares represent the L1 Dutch phoneme data.

Appendix I. F_1 and F_2 measurements per word

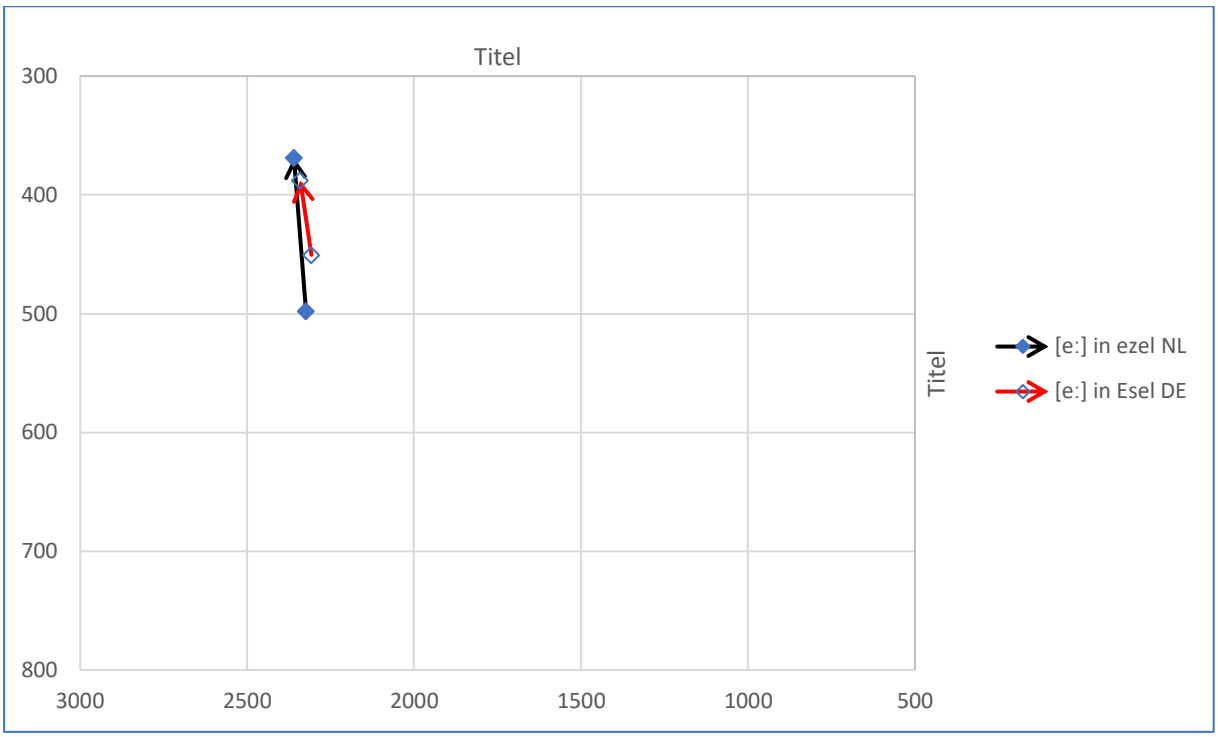

Figure I.1: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *ezel* and L2 German *Esel* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

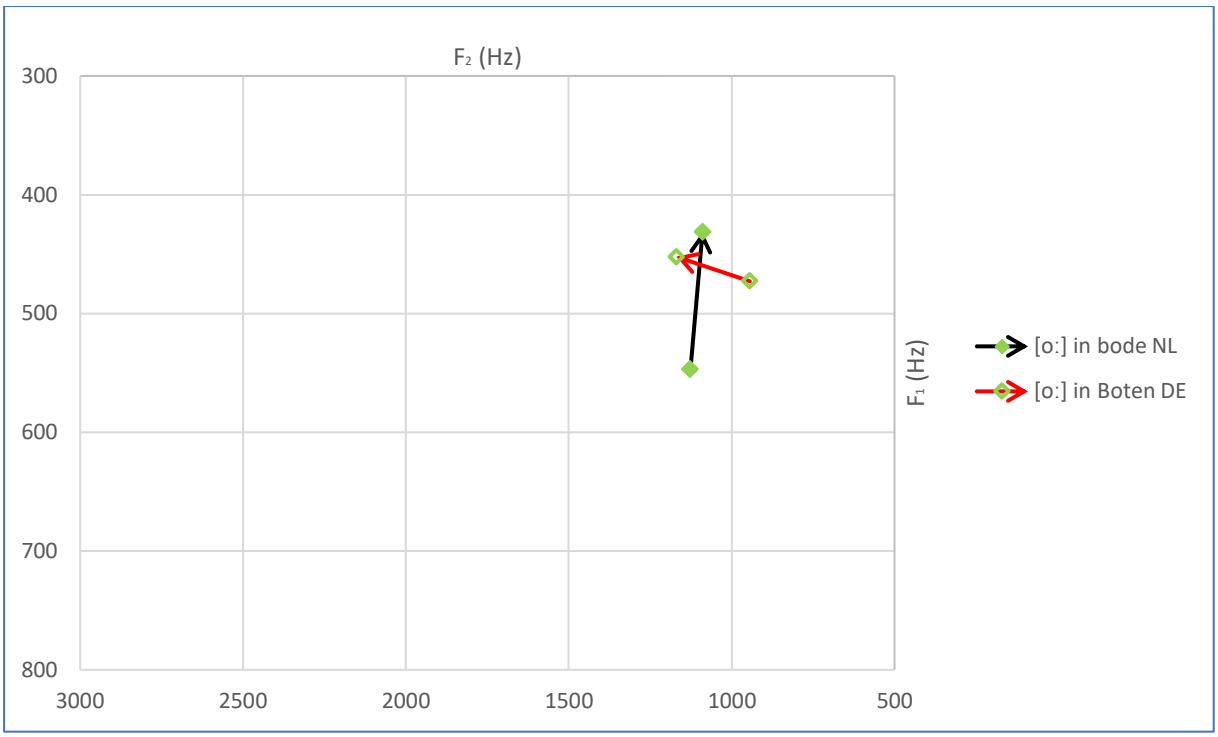

Figure I.2: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *bode* and L2 German *Boten* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured squares represents the Dutch [o:].

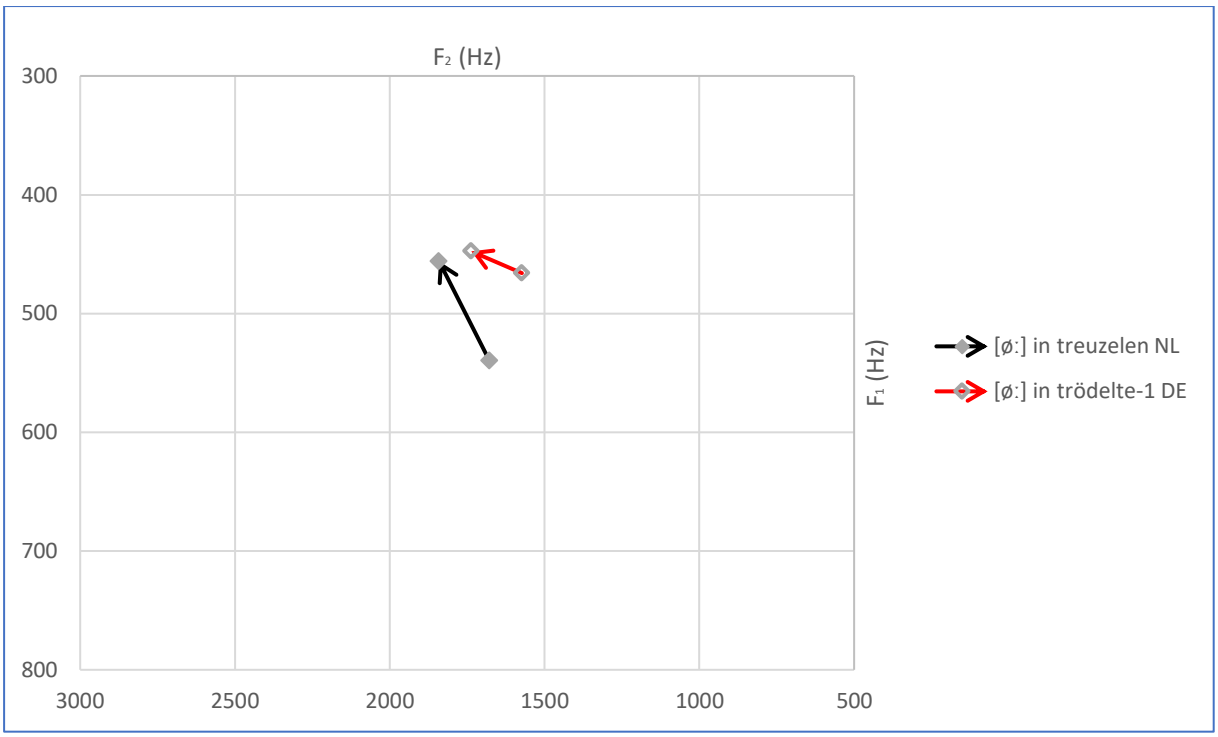

Figure I.3: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *treuzelen* and L2 German *trödelte* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

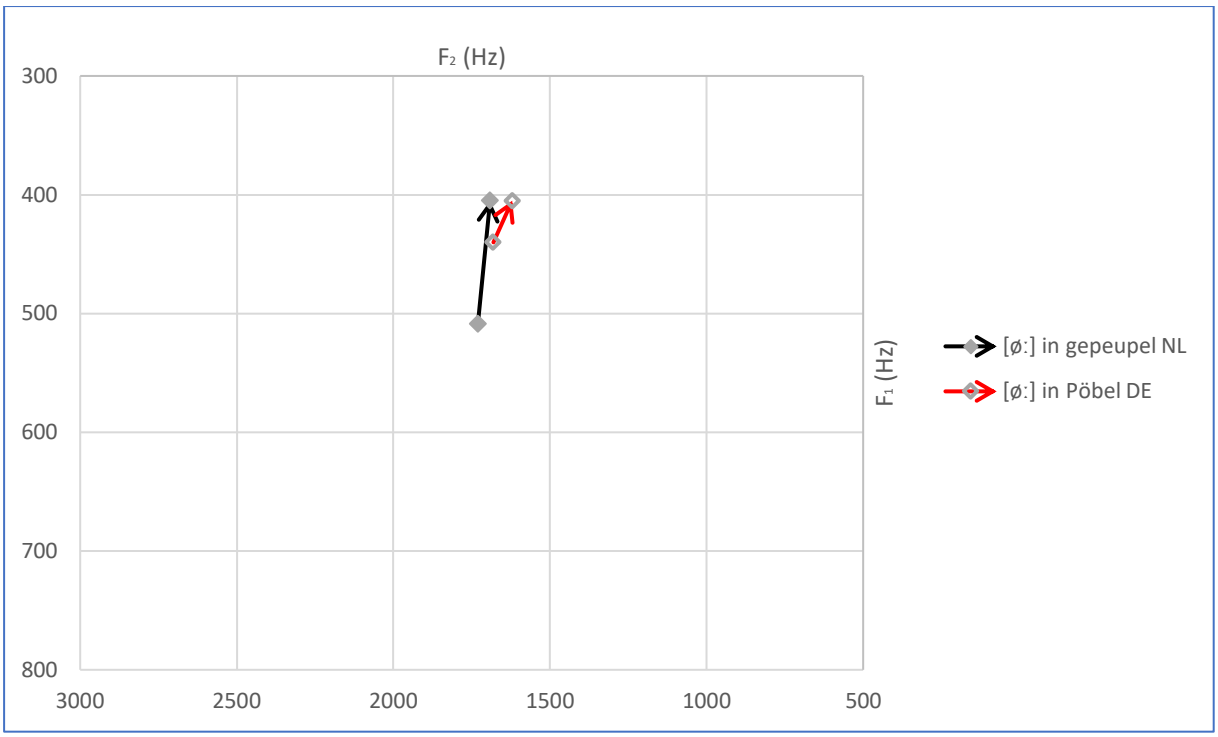

Figure I.4: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *gepeupel* and L2 German *Pöbel* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

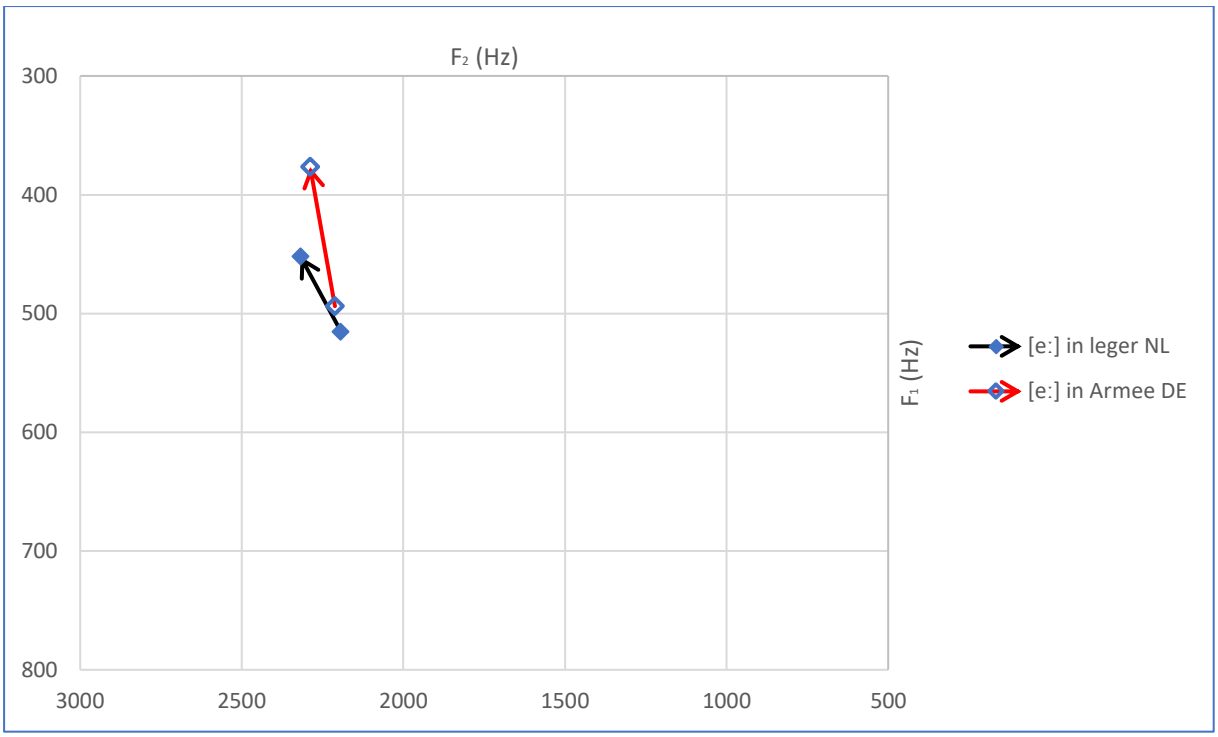

Figure I.5: F1 and F2 (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *leger* and L2 German *Armee* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

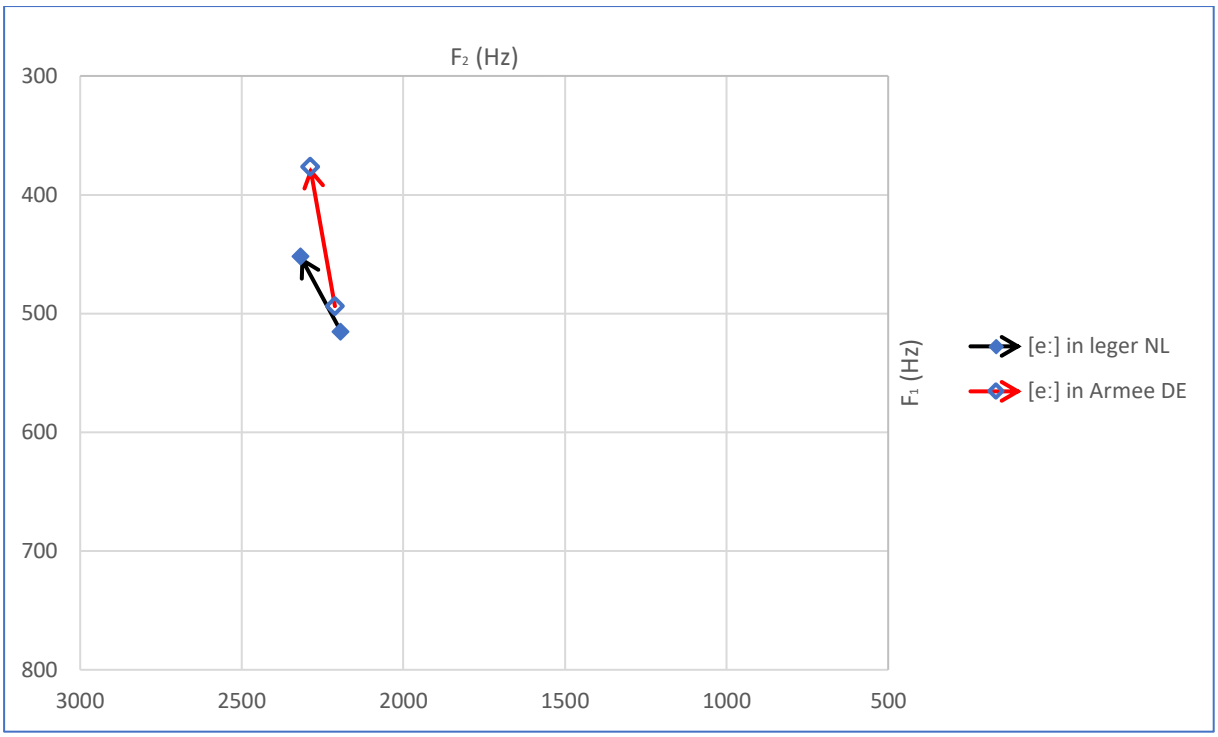

Figure I.6: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *bezigheid* and L2 German *Tätigkeit* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

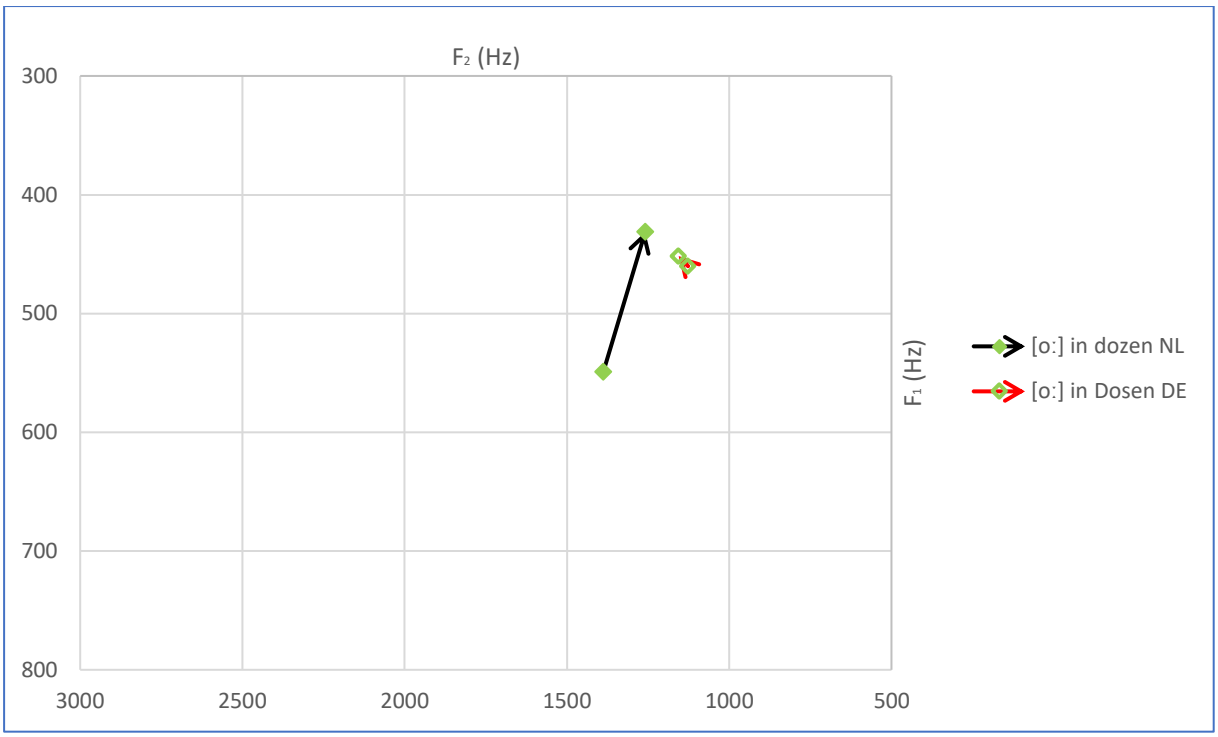

Figure I.7: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *dozen* and L2 German *Dosen* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured squares represents the Dutch [o:].

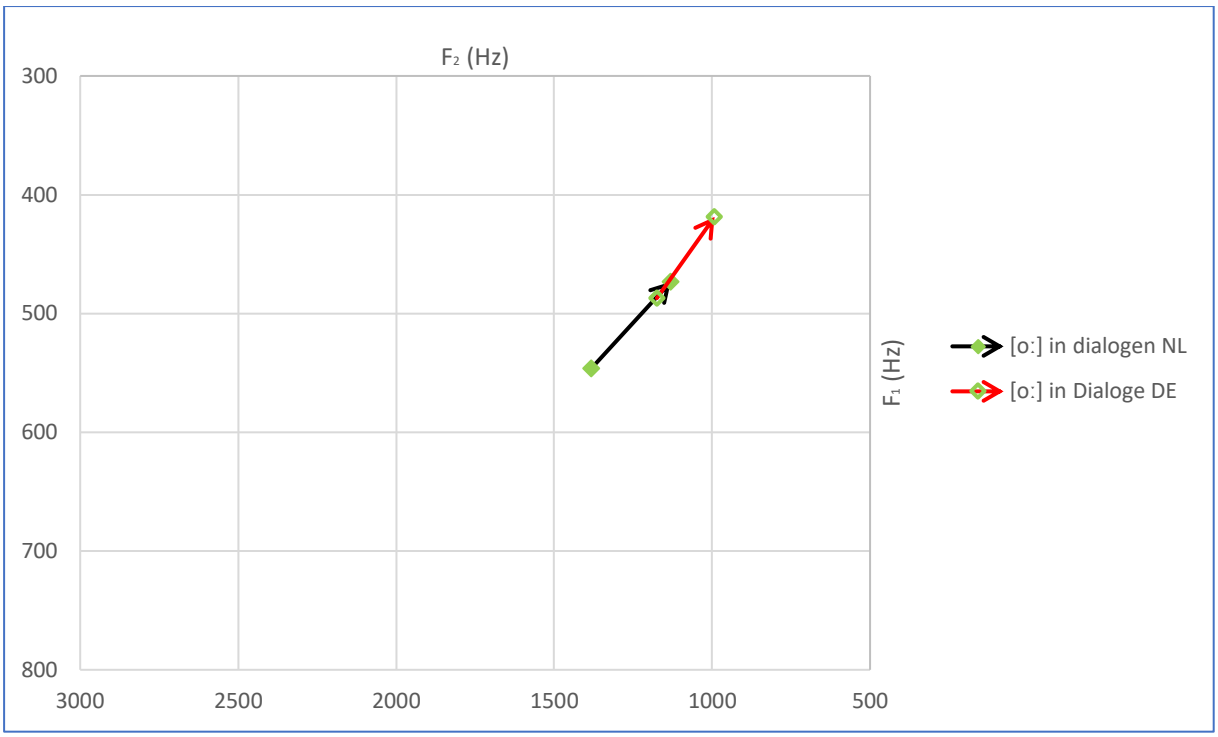

Figure I.8: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *dialogen* and L2 German *Dialoge* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured squares represents the Dutch [o:].

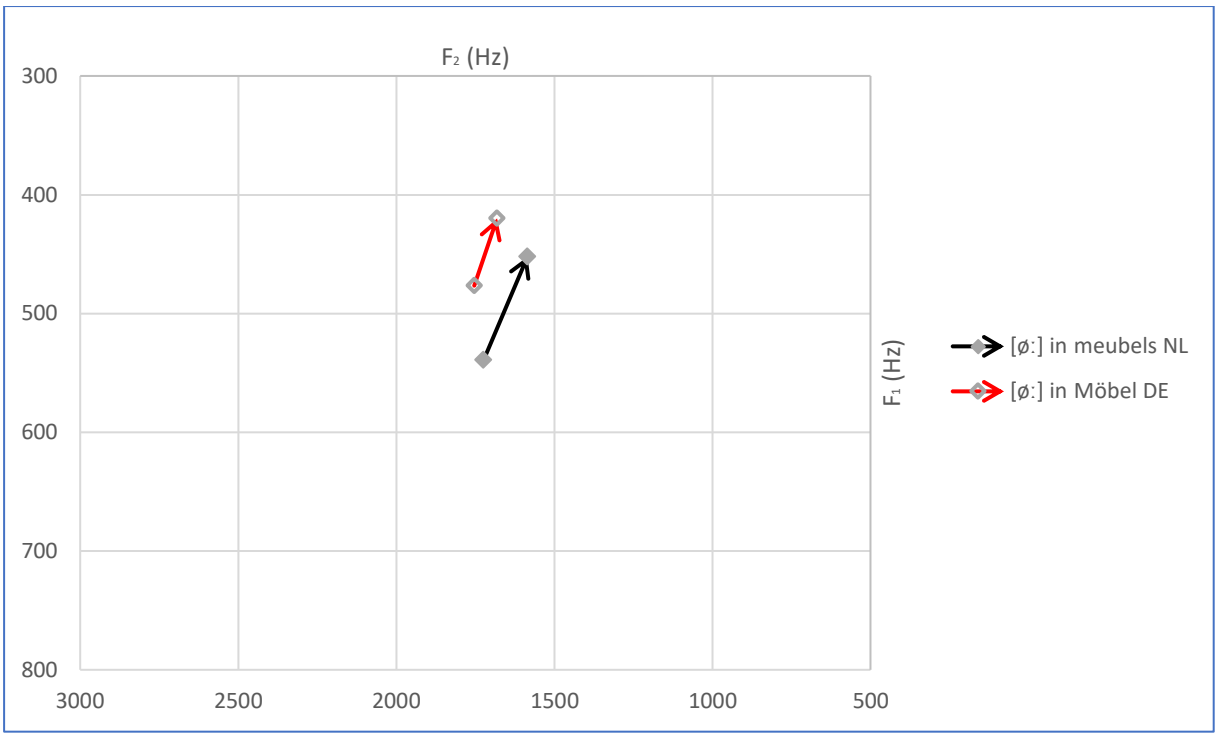

Figure I.9: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *meubels* and L2 German *Möbel* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

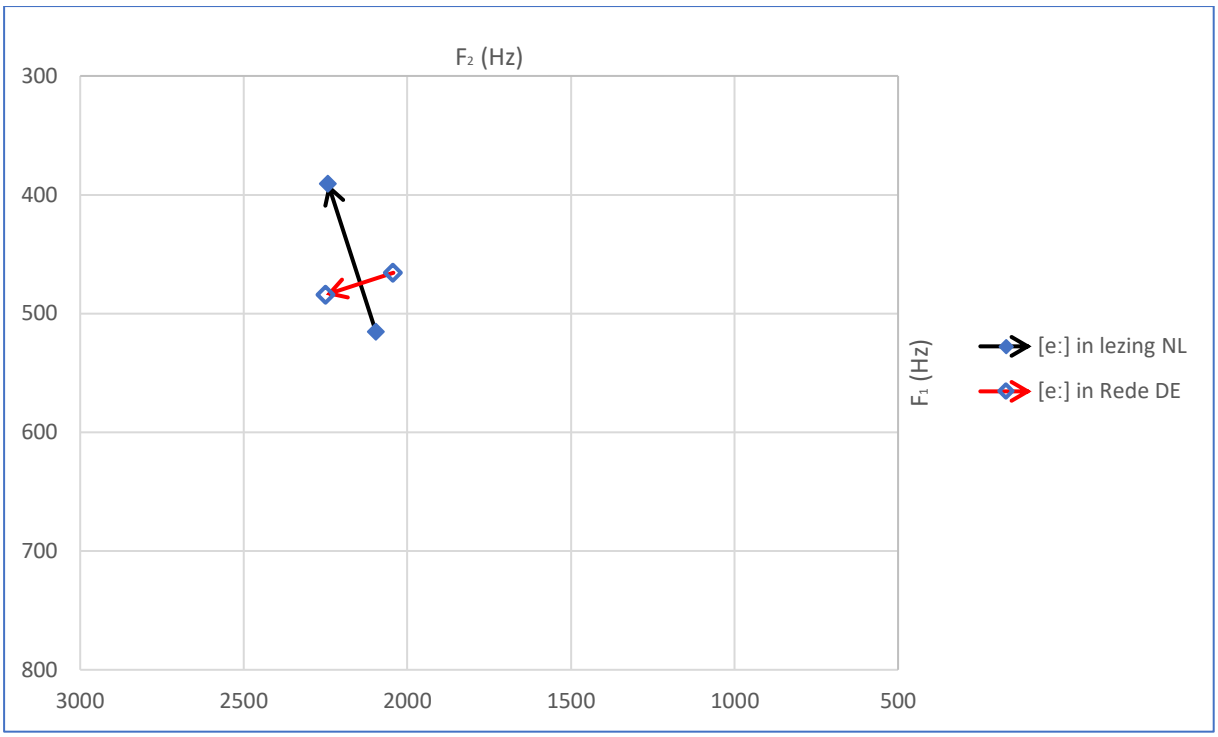

Figure I.10: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *lezing* and L2 German *Rede* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].

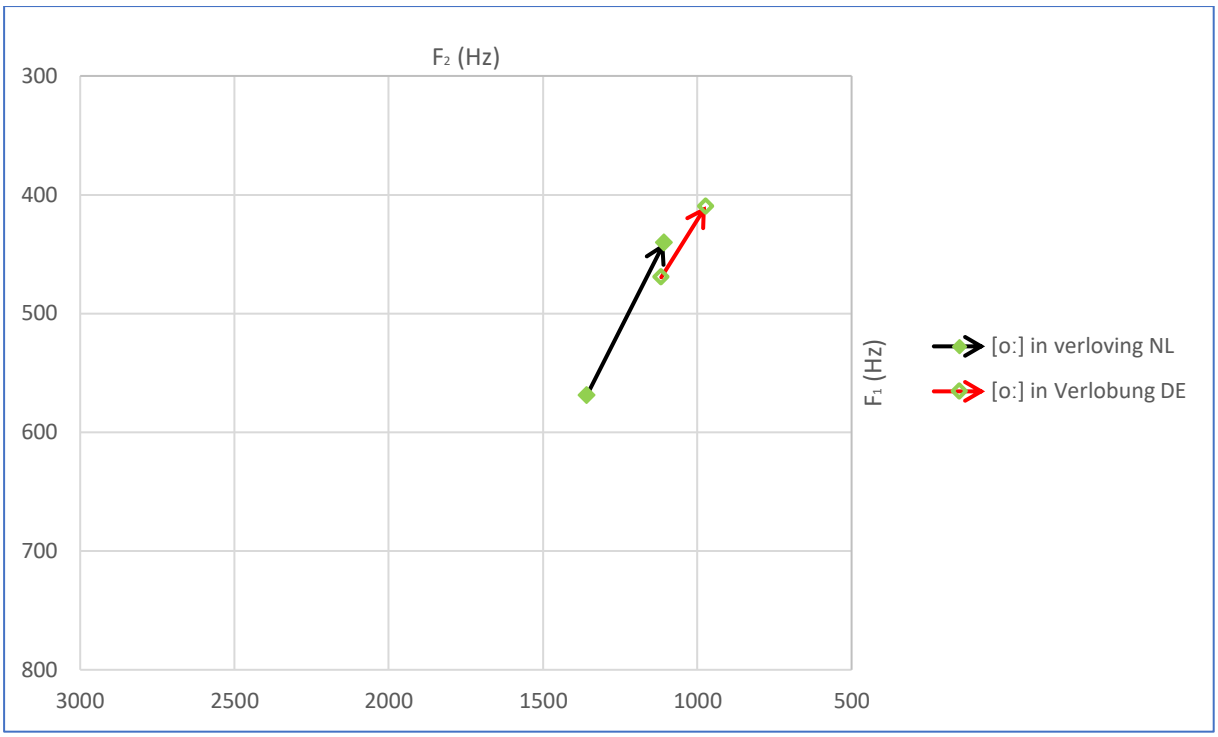

Figure I.11: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *verloving* and L2 German *Verlobung* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured squares represents the Dutch [o:].

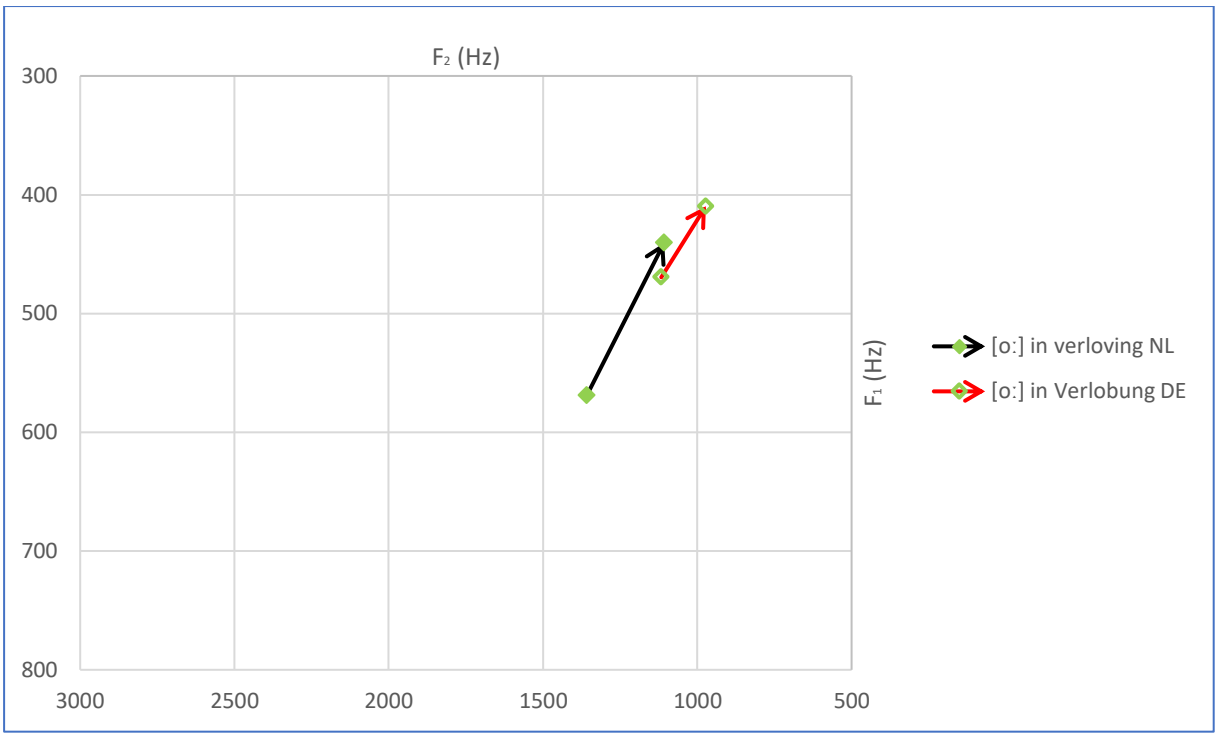

Figure I.12: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [o:] in L1 Dutch *logisch* and L2 German *logisch* by all participants (N=29). The red line between the transparent squares represents the German [o:], the black line between the coloured squares represents the Dutch [o:].

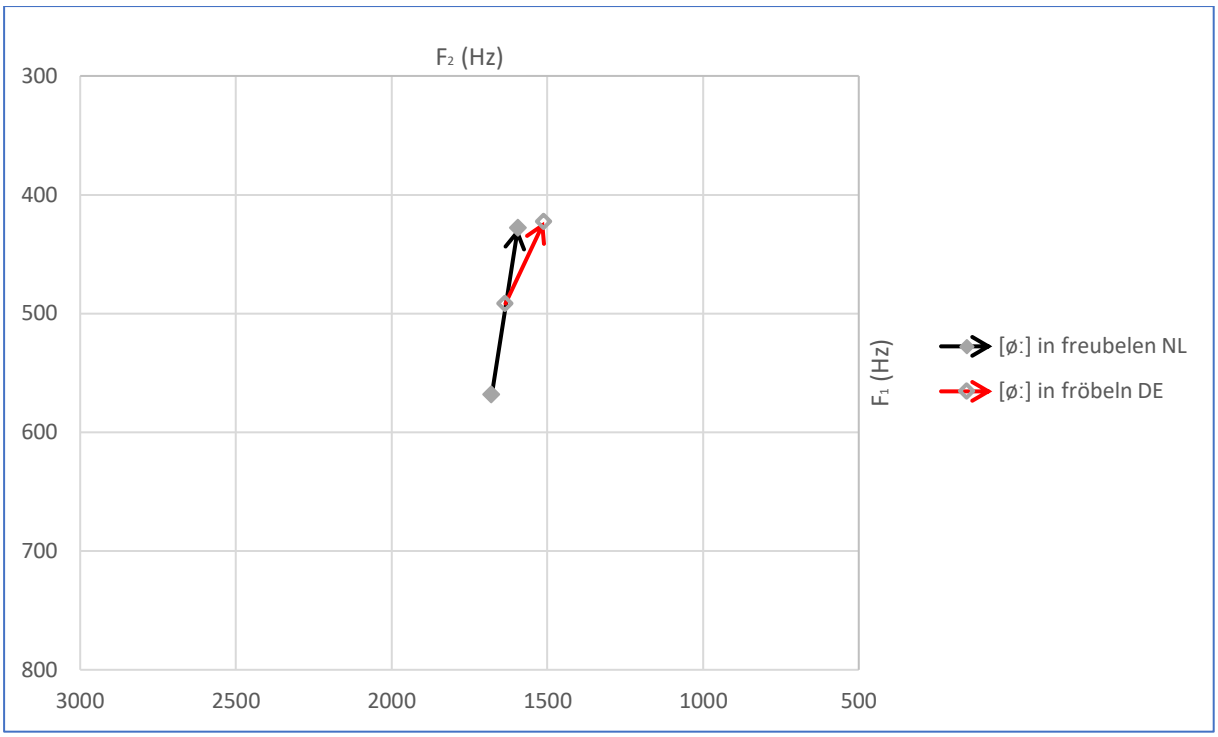

Figure I.13: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *freubelen* and L2 German *fröbeln* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

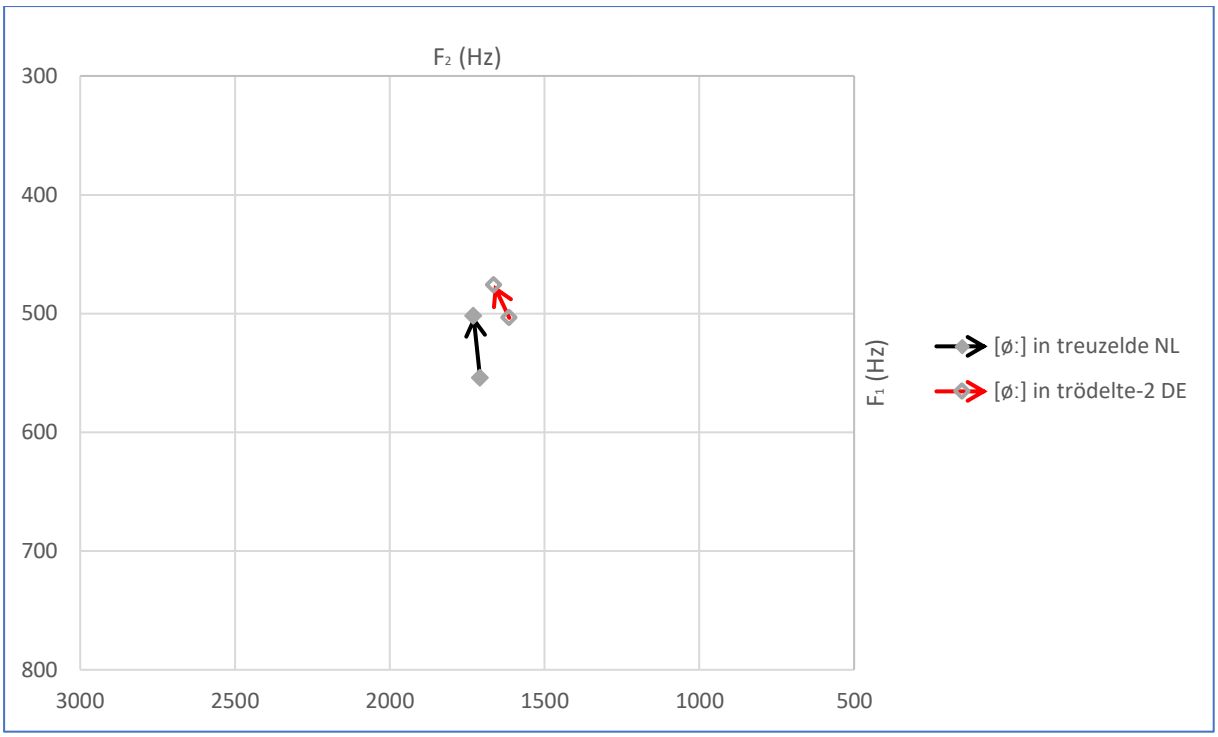

Figure I.14: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [ø:] in L1 Dutch *treuzelde* and L2 German *trödelte* by all participants (N=29). The red line between the transparent squares represents the German [ø:], the black line between the coloured squares represents the Dutch [ø:].

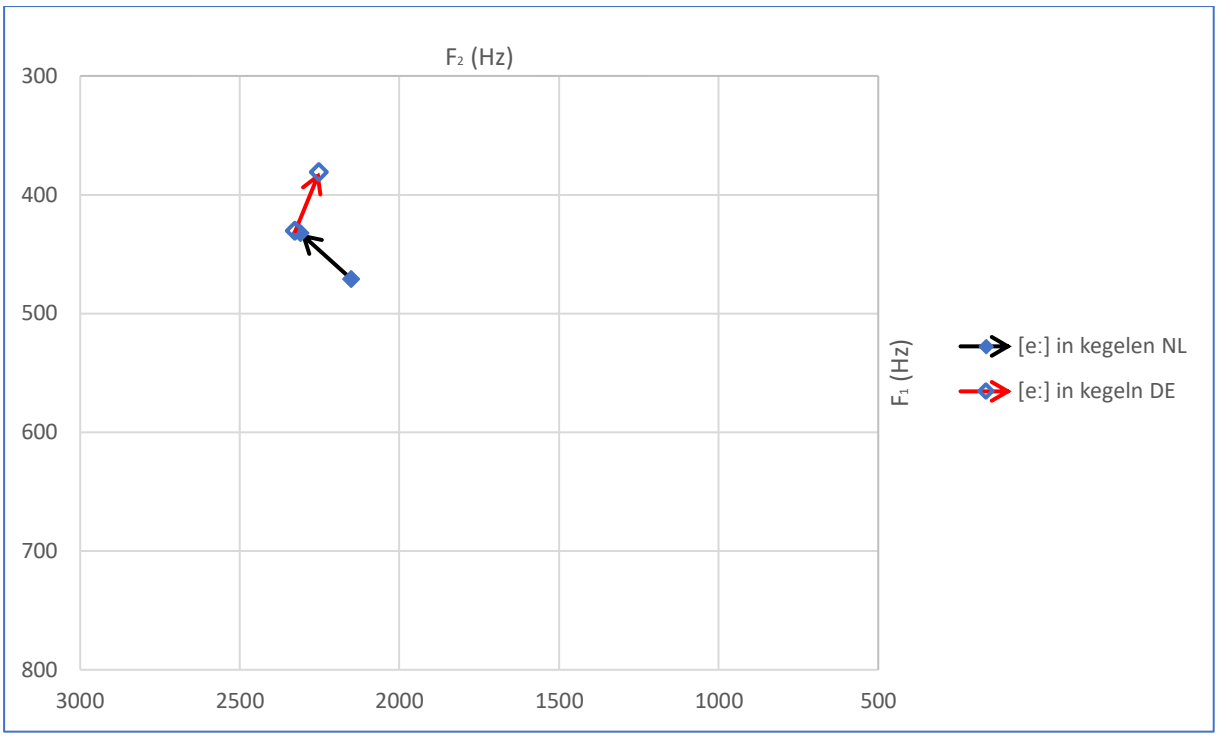

Figure I.15: F_1 and F_2 (Hz) at 25% and 75% of the long midvowel [e:] in L1 Dutch *kegelen* and L2 German *kegeln* by all participants (N=29). The red line between the transparent squares represents the German [e:], the black line between the coloured squares represents the Dutch [e:].