Are new sounds learned in an FL context? Evidence from an exploratory study on multilingual learners of German in the Philippines

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Abstract

An increasing number of foreign language learners with multilingual backgrounds have generated much interest in teaching approaches that activate the learners' knowledge of linguistic features in their previously learned languages, while reinforcing cognitive skills attained during previous language learning experiences. Although approaches to multilingual students have commonly involved fostering an awareness of related lexical and syntactical structures between source and target languages, exploring the activation of previous phonetic and phonological knowledge has been far less common. This exploratory study pays particular attention to the acquisition of L3-German vowels in learners with an English L2 and a Philippine language-L1. It charts phonetic production in a population of 22 Filipino students who have received explicit phonetic instruction, albeit with varying L3-German proficiency levels. The results suggest that appropriate training and increased proficiency can lead to the creation of new phonetic categories for previously unknown sounds that are distinct from already existing vowel spaces in the L1, L2 and L3.

Keywords: Multilingualism, L3, German as a Foreign Language, Language Learning in Southeast Asia, Phonetics, Phonology

1. Introduction

In an increasingly globalized world, the Southeast Asian region presents a context where multilingualism is the norm amongst foreign language learners. The average Southeast Asian student acquires one or multiple L1s or 'mother tongues' before going to a school where English or other languages are taught, and may consider taking further languages in the course of their secondary or tertiary education (Kärchner-Ober, 2009). The result is a situation where previous knowledge of a language has increasingly become a norm in foreign language (FL) classes – i.e., FL classes are *always already* L3 classes, where the L3 is defined a language that is currently being learned (Hammarberg, 2001), as opposed to the third language in succession. An FL class as an always already L3 class means that L2s, defined here as "any other language that the person has acquired after L1" (Hammarberg, 2001, p. 22), ought to be considered alongside the L1 as a source of potential influence or differentiation when learning the linguistic elements of the L3 target language.

Due to the ubiquity of multilingualism in Southeast Asia, studies on local foreign language learning contexts and the metaknowledge of other languages that learners bring into a foreign language classroom may serve as an appropriate springboard for examining how L1s and L2s affect the production of an L3. The activation of multilingual (L1 + L2) linguistic elements while learning an L3 is particularly interesting in the domain of phonetics, as sound production in foreign language learners is normally assumed to be heavily influenced by the L1. This study thus uses measurements of frequency bands, or formants, to determine similarities and differences in the intra- and interlingual vowel qualities of students with a Philippine language-L1 and English-L2 who are learning German as an L3.

2. Learning in Multilingual Contexts

A cursory glance into Second Language Acquisition (SLA) research reveals a primary focus on the differences between the rapid and dynamic processing of an L1 during infancy and the distinctively less rapid and more structural approach to learning an L2, which has been commonly understood to refer to a language learned after the mother tongue (Lenneberg, 1967). Moreover, the assumption that learning an L2 does not present a significant qualitative difference from learning other languages beyond it (Hammarberg, 2001, p.22) tends to undergird the limitations of

scope to two languages in SLA research. Such a limitation further serves a practical purpose in that it reduces the variables that may result from knowledge of other languages, while also allowing researchers to make direct inferences about differences in cognitive processing and capabilities, and to minimize possible transfer effects of an additional language.

Since the early 2000s, however, there has been a rising interest in the potential effects of bi- or multilingualism in language learning that occurs after the L1 and L2. This expansion of scope has inevitably introduced multiple layers of complexity as new languages may be learned at different ages, under different circumstances, and with diverse combinations of previously learned languages. Some have argued that the tendency to pattern L3 production after L2 linguistic norms (as opposed to L1 norms) mostly depends on the perceived relationship between the L2 and the L3, or psychotypology (Cenoz, 2001, pp. 8-9; Ringbom, 2001), as studies on lexical borrowings from L2 languages that are regarded as having similar features have demonstrated (Fouser, 2001; Berthoud & Lüdi, 2011). If the L1, L2 and L3, however, are perceived as equally similar in any one aspect of language learning, then it is less clear which languages are used or activated in L3 learning. This feature of language learning may explain why empirical work done on learners whose L1, L2 and L3 come from within the same linguistic families, or share similar rules in the linguistic domain under study, tends to show fewer L2 influences than in those whose first languages were not from the same language family as the L2 and L3 (Llisteri & Poch-Olivé, 1987; Marx, 2000). Other researchers have stressed environmental or cognitive features of L3 learning: Hufeisen's factor model (1998), for instance, posits that regardless of the relationship between the L1, L2 and L3, the very process of learning an L2 may equip future L3 learners with metacognitive skills that facilitate language learning (Klein, 1995), while others have emphasized the necessity of considering the environment in which the language is learned (Aronin & Ó Laoire, 2004).

Despite notable studies on the complexity of L1-L2-L3 interactions, the study of cross-linguistic research in L3-phonetics has until recently tended to elude the attention received by lexical, morphological, and syntactical transfer. One of the main reasons behind this is that phonology has empirically served as a hard case of L1 transfer (Scovel, 1969). The evidence for the lingering effects of the L1 is present in fossilization studies in which long-term migrants and naturalized citizens retain phonetic features of their L1s in L2 production despite living for long periods in a country where the L2 is spoken (Han, 2004). Secondly, as mentioned above, any number of variables may have to be considered in the relationships between L1<->L2<->L3

phonology. Cognitive (Lenneberg, 1967), environmental and psychological factors, such as the need to maintain L1 pronunciation norms for establishing cultural identity (Guiora, Beit-Hallahmi, Brannon, Dull, & Scovel, 1972) may thus all play a role in the formation of phonetic categories and speech rhythm in L3s.

While not an immediately obvious focal point of the Common European Reference Framework on Languages, pronunciation is prevalently considered as a reflection of linguistic and symbolic capital. Not only is there a repeated tendency in FLL research to implicitly compare or promote native-like norms (Kelz, 1982), but the acquisition of phonetic norms – whether segmental or suprasegmental - is often taken as evidence of successful integration in migration contexts. The normative imposition of native-speaker features of European languages, however, has been variously contested, particularly in post-colonial localities where languages such as English, French, and Spanish act as official languages or lingua franca. The contestation that the norms of the Anglosphere act as global standards has led to various discourses that assert the recognition of local varieties of English that do not necessarily emulate the norms of 'native' speech (Kachru, 1985), which include the domain of phonetics and phonology. Investigating the learning processes of pronunciation may thus provide useful insights into the phonetic interactions between L1<->L2<->L3 in multilingual spaces and contribute to an understanding of the dynamics of European Languages in contexts beyond their countries of origin.

In the Philippines, for example, English is beginning to show signs of regional variation and internal differentiation (Gonzales, 2017) in the form of Philippine English, or the English language as spoken in the Philippines (Llamzon, 1997). In general, 'acrolect' Filipinos tend to emulate the norms of General American speech, although proficiency and phonological production vary widely across the population (Tayao, 2008). Vowel production, in particular, reveals that Filipinos tend to produce anywhere from three vowel phonemes to the entire vowel inventory of General American, depending mainly on the setting and frequency of English language usage (Llamzon, 1997; Tayao, 2008). The variability in production is a caveat for further research in L3 phonology, as L1-Filipino and L2-English may demonstrate vowel category overlaps and appear almost indistinguishable from another, although it is a reasonable assumption that particular sectors, such as college-level students, are able to make significant phonemic distinctions between L1 and L2 in production due to their frequent usage and exposure to English (Tayao, 2008). This exploratory study thus aims to investigate L1-L2-L3 interactions in such a context.

Three interactions among the phonetic features of the L1, L2 and L3 that are relevant to this study are discernable from the extant literature. First, the foreign language effect, in which the recency of an L2 has been found to affect L3 speech at least in the initial stages (Hammarberg, 2001, p. 33-34; Wrembel, 2010, p. 75). The studies showed that L1 sounds were suppressed in the early stages of L3 learning, mainly due to interferences from a recently-learned L2. Beginners were thus significantly influenced by L2 sounds, while more advanced learners tended to manifest a higher proportion of L1 properties in their speech. Secondly, the psychotypology of the L1 and L2 and perceived nearness of their phoneme inventory or linguistic affinity to that of an L3 may account for a particular accent during the language learning period (Cenoz, 2001). An L1 that does not come from the same linguistic family as the target language may, therefore, not be activated when producing sounds in the L3 that is perceived to be 'more similar' to the learner's L2. Thirdly, the dimension of time and its relationship to the acquisition of new sounds, in particular, has shed light on the issues of fossilization, or the cessation of interlanguage learning "in spite of the learner's ability, opportunity, and motivation to learn the target language[…]." (Selinker & Lamendella, 1978, p. 374). Flege's (1995, 2007) Speech Learning Model, for instance, describes the effect of time spent where the dominant L1 was spoken. The model predicts that beginners tend to produce phones that are psychotypologically similar to ones that they are already familiar with as they are able to discern qualities that make the vowel phonemic. "New" sounds, or sounds first encountered in the L2, however, only attain a separate phonetic category after the language learner has had considerable experience in an L2 context, for example, if the learner has lived in a country where the L2 is spoken (239). Best's (1995) Perceptual Assimilation Model similarly predicts possibilities for the acquisition of new sounds, in that they are either treated as a single category of native phones, as a similar sound to two different native speech sounds, as a non-speech sound, or in terms of category goodness, wherein the learner evaluates 'new' sounds against similar native phones (p. 14). Taking into consideration both Flege (1995, 2007) and Best (1995), there is reason to assume that both a time dimension as well as the intrinsic properties of all languages that a learner knows will influence the formation of phonetic categories for previously unknown sounds found in an L3.

3.   The Local Context

Renate Kärchner-Ober's (2009) Malaysian case study of students learning German after an English L2 and a variety of L1s (including various Malaysian, Chinese and Indian languages), explores language policies and foreign language instruction as a background to teaching and learning an L3 in Southeast Asia. The results of the study, whose methods involved triangulating data from learners' journals, written exercises, and short interviews to determine the factors involved in tertiary language acquisition, showed the learners' use of English in learning German as a third language was highly variable: for instance, learners tended to limit L2 comparisons to lexical and morpho-syntactical productions (p. 264). Kärchner-Ober (2009) likewise determined that the relationship between L1 and L2 was significant in the sense that L1 norms continued to influence the production of the L2. Moreover, the quality of training in the English language was inferred to be a critical element of the learner's L2 proficiency. This finding made the L3's structural components difficult to trace back to any one of the previously learned languages.

The case of a non-Indo-European-L1, English-L2 and German-L3 was further elaborated in Marx (2000), who found that there were more instances of grapheme, lexeme and syntactical transfer from the L2 than the L1 in L3 acquisition, while the L2 influence was particularly strong in the lexico-semantic and sentence-level syntactic aspects of L3-German production (Marx, 2000). In the Philippine context, L1 and L2 influences on L3-German vowel length can be found in Cruz (2015), where the speech of the surveyed population mirrored both English and Filipino vowel lengths, and exposure to L2 media was found to play a vital role in increasing phonemic awareness. The importance of awareness mechanisms and additional phonetic training were emphasized in both Marx and Mehlhorn (2010) and Lipinska (2015), the latter of which conducted a study on the acoustic features of the L3-German vowel /œ/ in learners with a Polish L1 and an English-L2. The study found that the production of the 'new' vowel (not present in the L1 or L2) completely merged with known phonetic categories, thus emphasizing the high variability of L1-L2-L3 relationships and the difficulty of creating distinct phonetic spaces in learners despite considerable experience with the language. The studies described above thus emphasize the fact that L3 learning is complex and requires context-specific nuancing to be of use to understanding language acquisition in multilingual learners and developing appropriate didactic strategies.

The present exploratory study thus concerns itself with the acquisition of sounds in the L3 that are not present in L1s comprising Philippine languages[1], and L2-English, which is one of the official languages of the Philippines and is used widely in schools, official communications, and media, in a case study of learners of German as an L3, defined by Hammarberg (2001, see above) in the Philippines. Amongst the three languages, /y:/, or the close near-front rounded vowel phoneme, and /ø:/, the close-mid near-front rounded vowel phoneme, are found only in German, with the nearest existing vowel categories in Filipino and English being those in the close or high range, such as front and mid-front unrounded vowels /i/ (Filipino and English) and /e/ (Filipino), the diphthong /eɪ/ in English, and the back and mid-back rounded /u/ and /o/ (Filipino and English), respectively (cf. Table 1).

Table 1: L1, L2, and L3 Vowel Phonemes

Vowels	L1 – Filipino	L2 – English	L3 – German
Close-mid front unrounded/fronting diphthong (English)	/e/	/eɪ/	/e:/
Close front unrounded	/i/	/i/	/i:/
Close-mid back rounded	/o/	/o/	/o:/
Close-back rounded	/u/	/u/	/u:/

This selection of vowels thus allows for the examination of formant differences reflecting changes in the vocal tract which demonstrate how close vowels already present in the learners' inventory, namely, /e/, /i/, /o/ and /u/, are articulated in comparison to the L3-long close rounded front vowels of concern in this study, /y:/ and /ø:/. In light of this, the following research questions for this exploratory study serve to guide the discussion.

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[1] The L1s in this study that are Philippine languages other than Filipino or Tagalog possess similar primary cardinal vowels to Tagalog that are of concern to this study, i.e.,/i/, /e/, /o/, /u/ (Delos Reyes, Santiago, Tadena & Zubiri, 2009)

1) What are the differences between the production of phonemes close in vowel space (in L1-Filipino and L2-English) and the L3 target vowels?
2) Are vowel spaces created for the target L3 sounds?
3) Are there differences between vowel production in beginner and intermediate learners?

4.   Method

A group of twenty-two students from the University of the Philippines Diliman participated in the study, comprising ten males and twelve females. The data were collected using a modified Language Experience and Proficiency Survey (LEAP) (Marian, Blumenfeld & Kaushanskaya, 2007). The students' ages ranged from 17-27 years old at the time of data gathering with a mean age of 20.18. Eleven of the students were German language majors in intermediate classes at the time of data collection (B1+) (six females, four males), while eleven were in beginner's level classes (A1) (five females, six males), taking German as an elective subject.

Languages known besides Filipino, English and German were additional foreign languages (L3s) such as Mandarin Chinese (two students), Italian (three students), Spanish (four students), French (seven students), Japanese (two students) and Russian (one student), with Bisaya/Cebuano (four students) and Hiligaynon (one student) given as additional L1s. Survey results showed that a majority of the participants showed greater familiarity with Philippine languages and English (cf. Table 2).

Table 2: LEAP Survey Data

LEAP Survey Data	
Average number of years learning English	17.55
Average number of years learning Filipino	17.91
Average number of years learning German	2.4
Average English use (at home)	3.59*
Average Filipino use (at home)	4.18*
Average Media Consumption (English)	4.73*
Average Media Consumption (Filipino)	3*
Average Media Consumption (German)	1.86*

(*=From a scale of 0-10, with 0 being 'never' and 10 'always')

All the students have received some degree of phonetic training in German. A1 students went through at least one two-hour session dedicated to German phoneme-grapheme relationships, and the B1+ students had all taken a three-unit class (a total of 48 class hours) on German Linguistics with a phonetic concentration (equivalent to at least half of the semester, or 24 hours).

In consideration of the Filipino-English-German learner biography, the participants were presented separate wordlists to read out loud in Filipino, German, and English, respectively. The words were read out loud once by the participants and contained target vowels and the vowel phonemes in the L1, L2, and L3 closest in vowel space to /y:/ and /ø:/ (cf. Table 1 above), which were embedded in a /kVl/ context of mostly mono- and disyllabic words[2]. The wordlists further contained distractors and stimuli that were used for further studies. Target words were selected not on the basis of their frequency, but in consideration of the availability of existing lexical items with one to two syllables in the target languages to minimize the effects of suprasegmental features that may come with words of longer length (cf. Appendix 1)[3].

The participants were given up to three minutes before the exercise to scan the word lists but were not allowed to use dictionaries or other gadgets to assist them with the exercise. Of all the languages known by the participants, only French and Mandarin possess one of the phonemes under study – the close front rounded but non-long /y/, while the rest of the participants' known languages included neither /y:/ nor /ø:/ as vowel phonemes. Each word in the /kVl/ context was read out loud once so as not to induce corrections for repeated stimuli, as well as to mimic a classroom situation where potentially new words are encountered while reading out loud. The words were not embedded within phrases or sentences to minimize effects arising from suprasegmental features.

While there are certain limitations to a read-out-loud activity due to the additional factor of the cognitive processing of grapheme-phoneme correspondences, reading out loud is a common activity in classroom settings and can simulate not only actual learning practices, but also bring to light phonetic issues that arise from attempts to pronounce a mixture of known and unknown words. In contrast to English, which possesses a fairly irregular correspondence between orthography and pronunciation, or a deep orthography (Frost & Katz, 1992), grapheme-phoneme distinctions are

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[2] An exception can, however, be found in one of the Filipino stimuli due to limitations on available words.
[3] The list comprises of /kVl/, /lVr/ and /rVd/ stimuli with distractors that are employed for further research. The present study concentrates on a subsection of the master list with results from the /kVl/ context.

more regular in German, with only two possible graphemes representing /y:/ and /ø:/ in written German - <ü> <üh> for /y:/, and <ö> <öh> for /ø:/, respectively (Naumann, 1989, 92-93). Considering the fairly straightforward nature of grapheme-phoneme correspondences, the learners may have a greater capacity to pronounce unknown German words in a reading activity, as long as the target words follow regular orthographic rules. As Frost and Katz (1992) argue, shallow orthographies allow the learner to 'assemble' (p. 150) a word's phonology from its letters. This form of reading can thus act as a strategy for the pronunciation of unknown words if visual-orthographic information (whole word recognition), which is often activated for known words, fails.

In relation to the graphemic equivalents of the target vowels in this study, the German monographemes <ü> and <ö> account for an estimated 80% and 85% of words that contain a /y:/ and /ø:/ respectively (Naumann, 1998, p. 92-93), yet may also stand for the vowel phonemes /ʏ/ and /œ/[4] (Primus, 2000, p. 19). The addition of the 'Dehnungs[5]-h' (Primus, 2000, p. 19), however, in <ü**h**> and <ö**h**>, is a graphemic indication of an increase in vowel quantity. This rules out the possibility that the digraphemes <ü**h**> and <ö**h**> (found in the wordlist) stand for /ʏ/ and /œ/ (19). Thus, when learners of German as a Foreign Language encounter the digrapheme <üh> or <öh>, no phonemic possibility other than /y:/ and /ø:/ presents itself. Accordingly, once learners are already acquainted with fairly regular correspondences between graphemes and phonemes in German orthography, they may be able to "pre-lexically" (Frost & Katz, 1992, p. 150) assemble the word's phonology, regardless of whether or not the word is familiar to them. The read-out-loud activity thereby induces a situation in which the participant is made aware of the need to produce an L3 vowel, providing insights into their capability to produce the respective sound[6].

The relationships between these vowels and the phonemes /y:/ and /ø:/ are then illustrated with the help of formants captured by PRAAT (Boersma & Weenink, 2015). Formants can be generally defined as concentrations of acoustic energy within a particular frequency band (Trask, 1996, p. 148), or as 'peaks' in the acoustic spectrum (Kent & Read, 2002, p. 24). Due to their sensitivity to changes in the shape of the vocal tract that determine the unique characteristics of

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[4] These may also be considered as L3-specific sounds, as they do not exist in any of the known languages of the students.

[5] Dehnung means 'lengthening' or 'stretching.'

[6] A limitation of this approach would be if the learner produces L3-vowels /ʏ/ and /œ/ as opposed to /y:/ and /ø:/, although arguably the production of the former vowels could nevertheless still be considered as an attempt to construct an L3-specific category.

particular vowels (Ladefoged, 1996, p. 94), the first two formants (F1 and F2) are typically employed in acoustic studies to plot vowel sounds on a plane, allowing for their visual representation.

For comparisons between speakers, the first three formants (F1, F2, and F3) were elicited from the recorded data in PRAAT and transformed into Bark units in the NORM[7] - the vowel normalization program of the University of Oregon (Thomas & Kendall, 2015) - with the formula below (Traunmüller 1997), where F_i is the value for a given formant *i*:

$$Z_i = \frac{26.81}{1 + \frac{1960}{F_i}} - 0.53$$

The resulting values were then modeled using the Bark difference metric, which serves in the study to measure the auditory perception of vowels by humans and normalize the acoustic data for comparison (Syrdal & Gopal, 1986, p. 1086). The Bark difference metric is a vowel-intrinsic method that makes use of the Bark scale, a psychoacoustical measurement of auditory perception developed by Zwicker (1961) that corresponds to 24 critical hearing bands of the human ear. A slightly modified version of the perceptual acoustic model developed by Syrdal and Gopal that uses differences between formants converted into the Bark scale was used for the calculations for normalization and visual representation in NORM (Thomas & Kendall, 2015)[8]. For this study, level-based differences in vowel production were emphasized over gender-based differences in vowel production and formant range. The vowel formants of both males and females were thus normalized together. Non-normalized average formant values between males and females per language and level are found in section five below.

Other stimuli included in the wordlists will be used for further studies. Recordings were conducted in a quiet room at 4400 Hz with a C01U Pro Samson condenser microphone and saved in the .wav format.
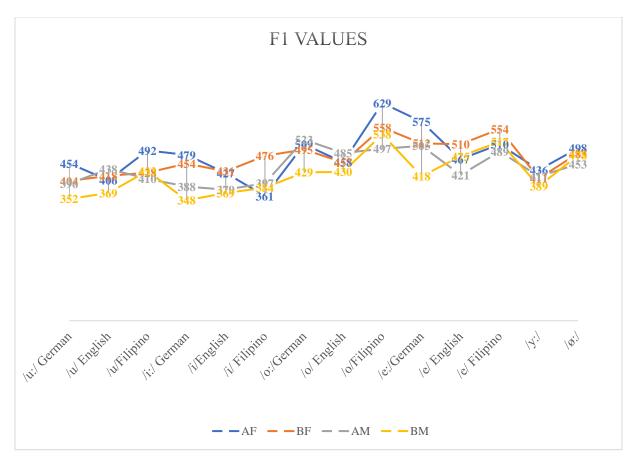
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[7]. NORM computes the differences Z_3 - Z_1, Z_3 - Z_2, and Z_2 - Z_1. Z_3 - Z_2 is used to plot the normalized front-back dimension, and Z_3 - Z_1 is used to plot the normalized height dimension.
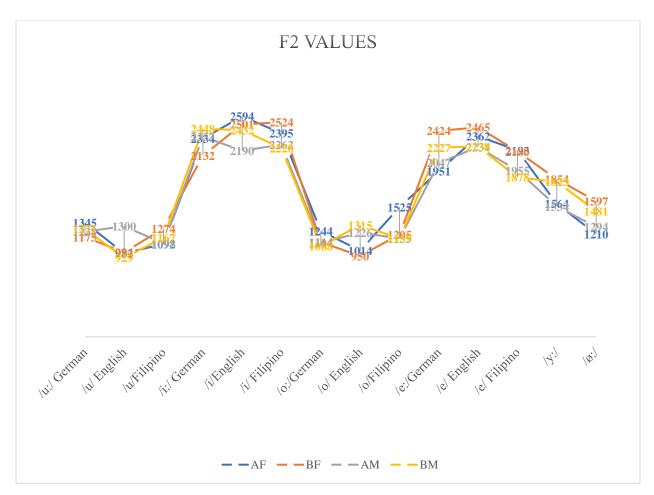
5. Results

Diagrams 1 and 2 below show the average F1 and F2 formant values of the vowels elicited in the study. A noticeable feature of the F1 results is that while English vowel measurements are generally consistent across the target groups, as evidenced by relatively tight clustering, German F1 differences are more skewed. Some interlingual variability can also be observed in F1, showing evidence of phonetic distinctions in vowel height. In terms of the target vowels, lower F1 values for /y:/ and higher F1 values for /ø:/ are evident across all groups, which corresponds to expected features of both vowels in German (Delattre, 1964; cf. Figure 1).

Differences among the close vowels /u:/, /y:/ and /i:/ and the close-mid vowels /o:/, /e:/, /ø:/ are observable in F2 values, with F2 measures displaying less variance among the groups than their corresponding F1 values (cf. Figure 2). A noteworthy aspect of the results is that the average F2 values for the B group's /ø:/ productions are higher than those in the A group, suggesting that the production of the vowel was more likely to be fronted and resulted in an F2 space that is distinct from the back vowels in intermediate learners. The /y:/ averages demonstrate that while B group /y:/ production is more fronted, the A group appears to have made a clear distinction among the F2 values of /y:/, /u:/ and /i:/. Differences between A groups and B groups thus reveal that learners were sensitive to F2 changes when producing the target L3 vowels and could adjust accordingly. However, A-group learners tended to produce sounds that were closer to the back vowels than the B group. The results below show the vowel plots of the averages of all individual vowels vis-à-vis their inter-lingual counterparts to provide an overview of the formant differences per vowel.

Figure 1: Average Formant Values, F1

*AF= Beginner's Group, female; BF= Intermediate Group, female; AM= Beginner's Group, male;
BM = Intermediate Group, male*

* *AF= Beginner's Group, female; BF= Intermediate Group, female; AM= Beginner's Group, male; BM = Intermediate Group, male*

Figure 2: Average Formant Values, F2

5.1   Intralingual Results

The within-German intralingual vowel groupings /o:/, /e:/ and /ø:/, as well as /u:/, /i:/ and /y:/ were normalized using the Bark difference metric described in Section 4 above (cf. Figures 3-6 below). Both males and females were included in the procedure for normalization to provide an overview of differences based on their respective language level. Figures 3 and 4 suggest that while the /ø:/ category had significant overlaps with back vowels in the A group, the vowel was more distinct in the more proficient B group albeit with only a few utterances approaching /e/, which is the norm in native German speech (Delattre, 1964). The B group also showed F1 and F2 differences in the production of /ø:/ relative to the other vowels. The vowel space in the B group occupied by /y:/,

however, appears to have been produced with higher F2[9] Values than in the A group. This resulted in a slightly merged vowel space with /u:/ in the A group, with the B group's /y:/ vowel space merging with /i:/ (Figures 5 and 6).
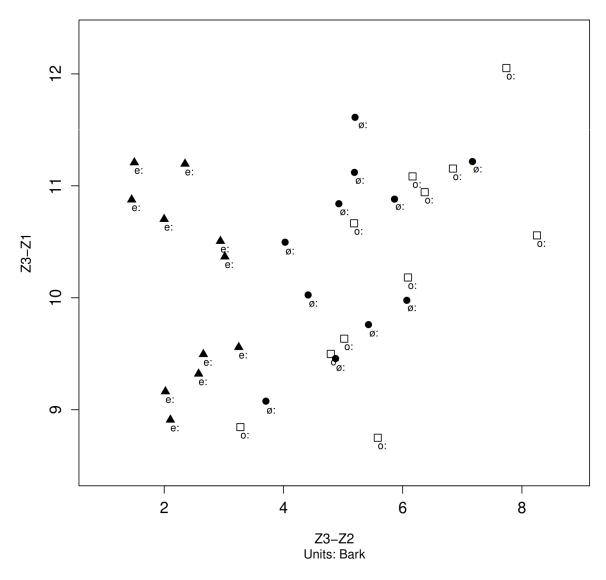

Figure 3: Group A Intralingual Vowel Production - /e:/, /o:/, /ø:/

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[9] While the figures use Bark units, the x-axis and y-axis may still be understood to reflect the relative positions of the vowels, with the x-axis representing F2 and the y-axis F1. The origin is at the top right corner of the graph.

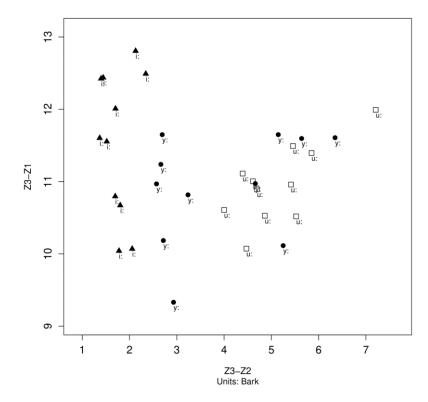Figure 4: Group B Intralingual Vowel Production - /e:/, /o:/, /ø:/

Figure 5: Group A Intralingual Vowel Production - /i:/, /u:/, /y:/
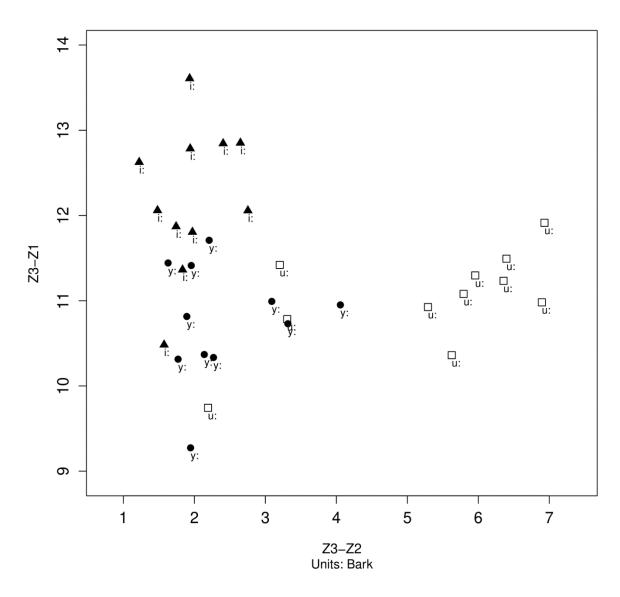
Figure 6: Group B Intralingual Vowel Production - /i:/, /u:/, /y:/

5.2   Interlingual Results

5.2.1 L2-L3 Interlingual Results

The results for the English and German interlingual comparisons, where the primary cardinal vowels in English are compared to the German target vowels, mirror the trends in the intralingual analysis, as shown in the figures below. The A group, however, demonstrated a more distinct overlap of /ø:/ with the English /o/ vowel (Figure 7), while the B group maintained a mostly coherent phonetic space for the /ø:/ sound and produced noticeable fronting closer to the English

/e/ (Figure 8). The /y:/ results for the A group corroborate the findings for German described above by tending towards low F2 values (Figure 9), with the B group fronting /y:/ and producing higher F1 values (Figure 10). However, in contrast to what was observed in the intralingual results, the distance of /ø:/ to /e:/ production in the English data is less prominent.
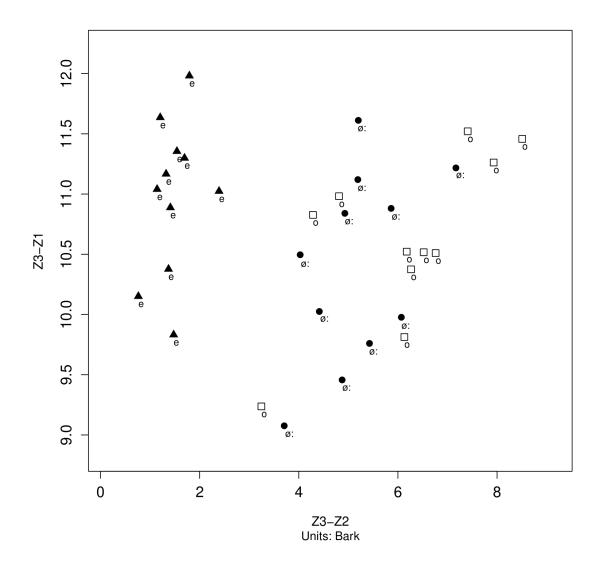

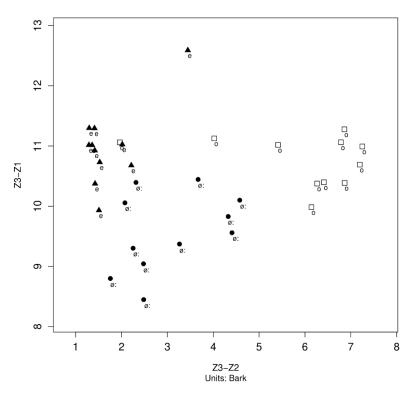Figure 7: Group A Interlingual Vowel Production (English) - /e/, /o/, /ø:/

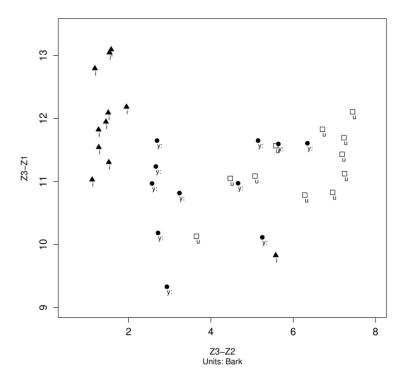Figure 8: Group B Interlingual Vowel Production (English) - /e/, /o/, /ø:/

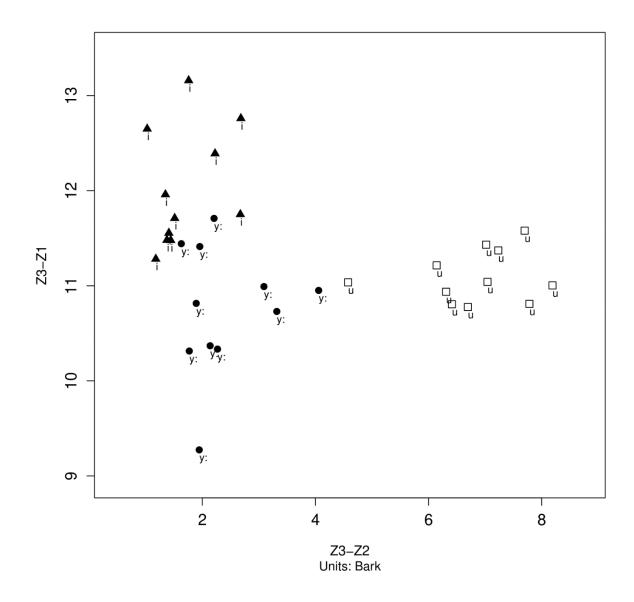Figure 9: Group A Interlingual Vowel Production (English) - /i/, /u/, /y:/

Figure 10: Group B Interlingual Vowel Production (English) - /i/, /u/, /y:/

5.2.2 L1-L3 Interlingual Results

As F1and F2 measures can be represented as points on a plane, distances between vowels are Euclidian and may be calculated using the following formula:

$$d(p, q) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2}$$

The averages of Filipino vowel positions on a plane thus demonstrate the shortest Euclidian distances of the known vowels from the target L3 vowels (cf. Appendix 4). The target vowels /y:/ and /ø:/ thus appeared closer in phonetic space to their Filipino counterparts /i/, /u/, /e/, and /o/, respectively.

The /ø:/ values in the A group tend to have lower F1 values than the Filipino /o/, resulting in a little less than half of the measured formants being found outside the vowel space of the Filipino vowels /o/ and /e/ (Figure 11). On the other hand, the B group's F1 values for all three vowels demonstrate relatively less skewness. F2 values in the B group for /ø:/ reflect a distinct space between /e/ and /u/ (Figure 12), with the results for the /y:/ target vowel revealing the tendency in the A group to make distinctions in F2 (the x-axis), with some /y:/ utterances appearing to be more fronted, and some found nearer to /u/ (Figure 13). The B group demonstrated more fronting in /y:/ and some F1 changes in the target vowel relative to /i/ (Figure 14).
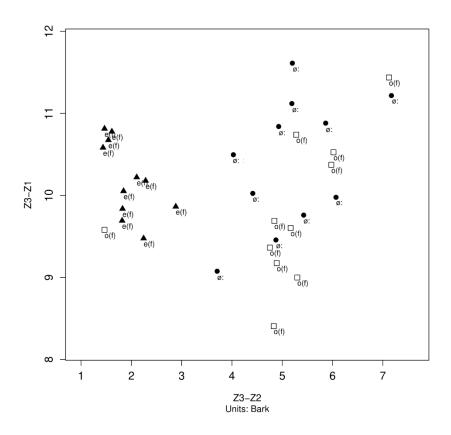

Figure 11: Group A Interlingual Vowel Production (Filipino) - /e/, /o/, /ø:/
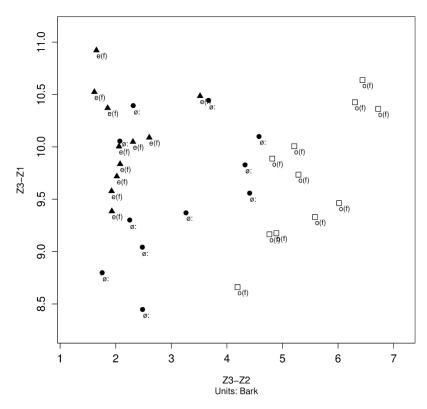
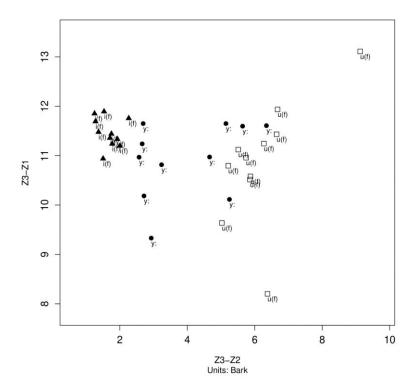Figure 12: Group B Interlingual Vowel Production (Filipino) - /e/, /o/, /ø:/

Figure 13: Group A Interlingual Vowel Production (Filipino) - /i/, /u/, /y:/

Figure 14: Group B Interlingual Vowel Production (Filipino) - /i/, /u/, /y:/

6.   Discussion

In general, the results suggest that proficient learners who had more intensive phonetic training were able to create distinct vowel spaces for the German vowels /y:/ and /ø:/. New space was created primarily through F2 changes, although some F1 variance can be seen in the results. However, there are key differences in the B group vis-à-vis the A group in terms of /y:/ and /ø:/ production, as the A group results indicated more accuracy in production of /y:/ than in the B group, perhaps due to the influence of French and Mandarin. This finding contrasted starkly with the

results of /e/ and /ø:/. While /ø:/ occupies a relatively autonomous phonetic category in the advanced group, the values were not as close to /e/ as expected. What exactly *caused* the deviations remains mostly unclear, although there are indications from the normalized vowel data and Euclidian distance calculations that the sounds are generally recognized to be different in nature (cf. Appendix 2, 3, and 4). At the same time, it is interesting to note that while target vowels were kept relatively separate from their closest counterparts in German and English vowel space, the differences were primarily found in F2. Calculations for Euclidian distance for English formant averages and their relationship to the formant values of German (cf. Appendix 3) show that there was less skewness between English vowels and the target L3 vowels as opposed to vowels from the other languages. Although this could suggest that relatively stable English vowel spaces were used to estimate the new phonetic categories, more studies need to be carried out to determine the validity of this hypothesis.

Secondly, it appears that the target vowels were more closely linked to Filipino values in terms of Euclidian distance (cf. Appendix 4). This finding suggests that while there was an effort to maintain distinctions between vowel groups within German at the intralingual level and between English vowels and the target L3 vowels (as was demonstrated by the lower degree of interlingual overlap in the B group), the new vowel space created for /y:/ and /ø:/ tended to encroach on an already existing vowel space created for Filipino. This finding could have several implications. It could mean that the respondents perceived that the target vowels mirrored L1 sounds, and produced them accordingly, or that in their attempt to maintain phonetic distance between the target vowels, they had approached a space that was occupied by L1 values due to the relative degree of flexibility of L1 sounds as a result of the limited number of vowels (compared to the L2 and L3), meaning that variance in F1 or F2 may not necessarily be considered as phonemic in L1.

There are certain limitations to the scope of this study, which is exploratory in nature and focuses on a small group of learners under specific learning circumstances. For future studies, a larger cohort and more repetitions of the target words are necessary to minimize the effect of both external circumstances and variability in the individual disposition as well as the gender of the learners while performing the task. Phonetic analyses of the outcomes of phonetic repetition exercises (listening to and repeating words) and the spontaneous speech of multilingual learners in FL contexts can also contribute to the extant literature on phonetic acquisition.

While it is not within the scope of this study to compare native speaker phonemes to the vowels produced by the learners, the study attempts to show that proficiency and training were associated with the creation of independent, if not slightly overlapping, vowel spaces outside of the known vowel spaces from the L1, L2, and L3. Even if these phonetic productions were to manifest in places that are not phonemic for the L3, i.e., deviating from the norms of native speech, yet not being in the same category as /u:/, /i:/, /e:/ or /o:/, their very existence demonstrates that there were indeed attempts at producing a new phonetic category for the phonemes. While these neither-here-nor-there sounds may not be easily recognized by a 'native' speaker, they are nevertheless internally valid considering the vowel space known to the learner.

In terms of the changes through time and proficiency, there is partial evidence to show that learners in the A group, as predicted by Flege (1995, 2007), have difficulty distinguishing 'new' vowels from those already existing in their vowel inventory. This is true in the production of /ø:/, but holds only partially true for /y:/, which can be seen in a space between the German /u:/ and /i:/ and the English equivalents /u/ and /i/ even at the A1 level, which may be due to the knowledge of French or Mandarin, as mentioned above. In the case of A-group production of /ø:/, the vowel is treated as a single category (Best, 1995), often coinciding with /o:/ values. In the B group, however, there are more overlaps between /y:/ and /i/ or /i:/ than in A group productions.

Evidently, learners were able to form distinct phonetic categories for "new" vowels through explicit phonetic training and increased proficiency, even while being in an environment where the target language is not a lingua franca. Nevertheless, the results can be likened to Flege's (1995, 2007) hypotheses about the changes in phonetic categories of new sounds over time. The cross-sectional approach employed here, however, ought to be regarded only as an approximation of time-based factors, which can be explored in detail through longitudinal studies. It is also plausible that the task type influenced the results of this study, as vowel production was recorded in 'laboratory' settings rather than as spontaneous speech.

An additional question that may emerge from previous L2<->L3 transfer research is if the L2 appeared to be suppressed over time in favor of the L1. Studies such as Wrembel (2010) and Hammarberg (2001) have utilized native speaker evaluations that make assumptions about what the first language of non-native speakers could be, using cues from both segmental and suprasegmental features. In the absence of such an evaluation in this study, it can be observed that target vowels produced by the B group had a shorter Euclidian distance (cf. Appendix 4) to Filipino

vowels than to German or English vowels. It is thus plausible that L1 vowel space was used to facilitate the production of the 'new' L3 vowels, albeit without disturbing the intralingual vowel relations (i.e., distinctions between 'new' and known vowels in German), as stated above.

7.   Conclusion

This conclusion shall draw on the implications of this study for phonetics and present directions for possible didactic interventions. The results show the complex nature of L1, L2, and L3 interactions, suggesting that the creation of distinct phonetic categories is plausible in terms of intralingual and interlingual relationships between vowels. This finding could mean that the vowel space created encroaches upon already existing phonetic categories in other languages, particularly the L1. Nonetheless, there is evidence to show that both L2 and L3 demonstrate similar vowel differentiation results and that the 'new' vowel spaces are distinct from the spaces of known vowels in the L2 and L3, despite having some overlaps with sounds in the L1. It is plausible that learning an L2 or the process of learning an L2 may help in making L3 distinctions between known vowels and 'new' vowels, as some participants in the beginner's group were already able to place the target vowels in new spaces between known vowels in English and German. The role of other L2s besides English, however, cannot be concretely established in this study.

Furthermore, explicit phonetic training had been introduced in the language classes of all participants, albeit in different degrees for both groups. It is unclear if this was the critical factor in the production of vowels, but in Lipinska's 2015 study, where vowel space for the German vowel /œ/ completely overlapped with known vowels in a cohort of Polish learners of German, the insufficiency of formal phonetic training in foreign languages was heavily emphasized (p. 88). The limitations of the present study include the study of potential influences from other L2s, mainly French and Mandarin, which both have a /y/ sound, and the need to examine more contexts of speech production – i.e., by embedding words in sentences, increasing the number of repetitions and by oral repetition tasks, for instance.

The didactic lessons that can be drawn from the results of the tests above are reflected in the observations of Marx and Mehlhorn (2010) on phonetics, as well as those mentioned in Kärchner-Ober (2009) on developing learning strategies at young ages. In the former, the authors emphasize that explanations of varying grapheme-phoneme correspondences, teacher feedback on pronunciation, and explicit L1/L2/L3 comparisons are necessary to facilitate L3 learning (p.13).

On the other hand, Kärchner-Ober (2009) suggests that introducing varied exercises and learning strategies in the L2 can significantly help in increasing awareness of linguistic differences in language learning.

There is thus a need for early intervention in the distinction of sounds, and the inclusion of as much exposure, comparative exercises between the L1, L2 and L3, and meta-cognitive activities or lectures as possible when teaching foreign languages that are not spoken in the place of learning. At the same time, this study has consciously focused on whether the sounds of the target vowels are clear enough to be distinguished from known vowels with some shared distinctive features, rather than insist on rigidly imitating native speaker norms that may not be tenable to achieve after a certain age, or easily achievable when access to native speakers is limited.

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Appendix 1: Target Word List

Kehle /e:/

Kiel /i:/

Kohler* /o:/

Köhler /ø:/

Kuhle /u:/

Kühle /y:/

k**a**le /eɪ/

k**ee**l /i/

c**oa**l /o/

c**oo**l /u/

Kerida /e/

k**i**lig /i/

Kolget* /o/

k**u**lang /u/

*Surnames or proper nouns

Appendix 2. Euclidian Distances between German primary cardinal vowels and the target vowels

Vowels	N.S. (f)	A (f)	B (f)	N.S. (m)	A (m)	B (m)
/u:/ - /y:/	619.052	220.176	678.164	458.747	296.798	298.298
/i:/ - /y:/	649.130	770.501	770.476	481.416	823.786	626.147
/o:/ - /ø:/	693.012	35.302	181.631	508.915	202.918	416.110
/e:/-/ø:/	24.331	745.303	827.547	785.000	754.492	748.454

*N.S.- Native Speaker formant values for cardinal vowels were taken from Pätzold and Simpson (1997) and calculated for distance from the target vowels (/y:/, /ø:/) in the same data set.

Appendix 3. Euclidian Distances between English primary cardinal vowels and the target vowels

Vowels	A (f)	B (f)	A (m)	B (m)
/u/ - /y:/	582.765	859.46	234.261	894.387
/i/ - /y:/	1029.4	647.699	657.045	609.929
/o/ - /ø:/	200.346	647.452	75.161	172.481
/e/-/ø:/	1151.98	868.127	940.231	757.161

Appendix 4. Euclidian Distances between Filipino primary cardinal vowels and the target vowels

Vowels	A (f)	B (f)	A (m)	B (m)
/u/ - /y:/	475.305	580.065	435.501	211.748
/i/ - /y:/	833.563	673.547	728.214	397.423
/o/ - /ø:/	340.540	399.478	145.734	328.021
/e/-/ø:/	982.887	587.636	662.122	398.641

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