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Acquisition in a multilingual context: English Mid and Low vowel contrasts by native speakers of Tashlhit*

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1. Introduction

Many African contexts are well known for their prevalent multilingualism where speakers have at their disposal rich multilingual repertoires that feed complex but common day-to-day linguistic interactions. The switch from one language to another in these contexts is both smooth and unconscious but also, dictated by the context. How language acquisition works in these situations is less well understood although studies of third language acquisition have been conducted and provide the closest approximation of what we might expect in a multilingual context.

There are a number of factors that make investigating the acquisition of further languages beyond the L1 and L2 interesting, dynamic, complex and challenging at the same time. It involves more variables than L2 acquisition presents and magnifies the way the number of previously acquired languages affect the various possible interactions in the learner's linguistic knowledge. Researchers are also interested in whether the order of acquisition affects the acquisition configurations. In case of speakers of Arabic and French acquiring English, does it matter if French is L1 and Arabic is L2 or vice versa? Moreover, the typological distance between the known languages and the target raises more questions for investigation. Other factors like fluency, L2 status or other language status in the acquisition of additional languages, and frequency of use have all been shown to play a role in acquisition (De Angelis, 2007; Falk & Bardel, 2010, 2011; Rothman & Cabrelli Amaro, 2010). Although the development of this area of research has been flourishing, acquisition of the phonology of additional languages remains an understudied area.

It has been argued that while L2 and L3 language learners might attain a native-like mastery in areas of grammar such as syntax and morphology, they almost never master target language pronunciation satisfactorily (Littlewood, 1994). Thus, L2/L3 learners must construct their own phonological representations to attain the desirable pronunciation. Ard (1990) finds that the interlanguage representation is not necessarily the same as that of the native speaker of the target language. Louriz (2004) shows how the correct (and incorrect) placement of primary stress of Moroccan Arabic natives learning English as L3 is the result of a representation that is different from that of English. L3 learners rerank the constraints available to them in their L1 and L2 to construct a new representation for English.[1]

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[1] Louriz (2004) couches her work within Optimality Theory and argues that highly ranked constraints in L1 and L2 are demoted in L3 grammar. For example, the constraint which requires the foot bearing primary stress to be aligned to the right edge of the prosodic word, is demoted below Align-L (Ft′, PwD), which is undominated in the learners' L1 and L2 to produce primary stress in English earlier in the word than it is in the languages they speak (Moroccan Arabic and French).

L2 phonology literature argues that sounds which undergo perceptual assimilation are those in close proximity in acoustic space. For instance, studies show that i/e and u/o are deemed non-assimilable in L2 vowel acquisition (Gordon, 2007; Ingram & Park, 1997) because they are at a far enough distance in acoustic space to not cause any interference. We investigate these same vowel pairings, in addition to others, with respect to Tashlhit learners of English.

This paper will investigate the production and perception of English [e ɔ æ ʌ] by L1 Tashlhit learners of English as an additional language in a multilingual context.[2] We will particularly examine the influence of L1 Tashlhit, as well as other languages in the linguistic repertoires of speakers, which in this case specifically includes Moroccan Arabic (MA), Standard Arabic (MSA) and French, on their acquisition of English mid and low vowel contrasts. We thus aim to trace the emergence of a vowel system in a multilingual learning environment.

The paper proceeds as follows. §2 provides an overview of relevant studies in L2 acquisition and so called L3 acquisition; §3 discusses the multilingual linguistic context in which Tashlhit is spoken, examining the different languages used; §4 introduces the study and presents the perception and production experiments and the results; §5 provides a discussion of the findings, seeking explanations and also considering broader implications for language teaching and future work; and §6 provides some final conclusions.

2. Studies of L2 and L3 Phonology

De Angelis (2007) proposes that "third or additional language acquisition refers to all languages beyond the L2 without giving preference to any particular language" (p.11). An L3 is thus a special case of the wider category of L2, and not necessarily language number three in order of acquisition (Hammarberg, 2001).[3]

Archibald (2021) compiles an overview in L2 phonology research pointing to the major findings in the field throughout its development. He summarizes the factors that have been explored in L2 phonology literature to explain acquisition as well as variation in production. These are L1 transfer (Trofimovich and Baker, 2006), amount of experience (Bohn & Flege, 1992), amount of L2 use (Guion et al., 2000), age of learning (Abrahamsson and Hyltenstam, 2009), orthography (Escudero & Wanrooi, 2010; Bassetti et al., 2015), frequency (Davidson, 2006), attention (Guion & Pederson, 2007), training (Wang et al., 2003) as well as cross-language speech production (Flege, 1995) and cross-language speech perception (Best & Tyler, 2007), which are reported to affect acoustic and articulatory aspects of acquisition.

Other researchers relate the success in the acquisition of L2 to markedness (Parker, 2012); marked structures are more difficult to acquire than unmarked ones. The seminal work of Eckman (1985) proposes that markedness differential is crucial rather than markedness continuum *per se*. An L2 structure that is marked and does not exist in the L1 would be difficult to acquire, whereas an unmarked structure that is absent in the L1 would be easier to acquire. Since unmarked structures are frequent in most of the world's languages, Archibald (2021)

[2] We will use the term "additional language acquisition" to refer to the acquisition of languages beyond a second language and specifically acquisition in multilingual contexts. IPA is used for phonetic transcription/representation of vowels.

[3] What the term L3 continues to espouse though is the strict ordering of language acquisition and the assumed distinct grammars of these languages. We would like to explore more flexibility in the designation and roles of languages in multilingual contexts to capture more accurately the ease of transfer of use between the different languages that may not restrict these to totally distinct categories. In this sense "additional language" is evoking a different categorization and conceptualisation of languages than L3 does, even when it refers to the acquisition of more than 3 languages.

raises the issue of how and when to relate structures that are easy to acquire to frequency or markedness. Various approaches to frequency have been introduced. A usage-based approach in Wulff and Ellis (2018) relates frequency to usage, whereas Wilson and Davidson (2009) relate it to frequency of input. As far as production is concerned, markedness has been reported to be more explanatory than frequency. On the other hand, it has also been reported that the most frequent structure is the most marked (Cardoso, 2007).

Second and third language acquisition are now treated as distinct areas of research in the literature. While L2 learners have only one language to transfer from, L3 learners have more. This latter scenario of language learning involves more complexity in that it involves transfer from L1/L2 to L3 and vice versa. There are a few studies that have investigated phonetic or phonological transfer in L3. These have shown that having a wider range of phonetic and phonological knowledge, L3 learners possess a larger inventory of articulatory and perceptual awareness, which is supposed to make L3 learning easier. Tremblay (2010), for example, shows that multilingual learners do better in discriminating new sound contrasts. However, other studies contrast with this. Werker (1986) claims that early bilinguals and monolinguals are similar in perceiving new L3 contrasts, implying that at least early bilinguals show no advantage over monolinguals. Gallardo del Puerto (2007) observed Basque/Spanish bilinguals acquiring L3 English and found that bilingual proficiency is not predictive of L3 perceptual ability. There are thus mixed views on whether multiple languages offer advantage when acquiring additional languages.

Apart from general ease or difficulty of learning of an L3, a number of studies identify a range of factors that may affect L3 acquisition. These include: the actual or perceived typological distance between L2 and L3 (e.g. Rothman & Cabrelli Amaro, 2010; Rothman, 2010; Rothman, 2011); L1/L2 status (e.g. Bardel & Falk, 2007; Falk & Bardel, 2011; Hammarberg 2001); recency of acquisition and proficiency in L2 (e.g. Barkley, 2010; Ringbom, 2002; Williams & Hammarberg, 1998); and psycho-affective factors (e.g. De Angelis & Selinker, 2001). In the below discussion we consider studies particularly related to transfer in an L3 context.

2.1 Role of L1 and L2 Transfer in L3 acquisition

There is lack of consensus regarding the role the L1 plays in L3 acquisition. Some researchers argue that L1 has more influence than L2 in the process of acquiring L3. Listeri & Poch-Olivé (1987) conduct an acoustic analysis of L3 vowels produced by native speakers of Catalan and L2-Spanish. The results reveal that in that case L1 exclusively affects L3 production. In a study of L3 intonation, Ringbom (1987) finds that L2 transfer is rare especially since advanced L3 learners maintain their L1-based accent. Wrembel (2013) conducts a study where the participants' mother tongue was the dominant source of transfer. He found no trace of influence from L2. By contrast, Gut (2010) asserts that L1 plays no role in learning English rhythm and vowel reduction in L3 learners' production.

With respect to the role of L2, numerous studies suggest that it is mainly the L2 that frequently serves as a predominant source of transfer in L3 acquisition. Some research finds that it involves positive transfer in L3 acquisition, whereas others argue that it has a negative effect. Some studies (e.g. Williams & Hammarberg, 1998) relate the degree of L2 transfer to psychotypology, recency of acquisition and degree of proficiency.

Kamiyama (2007) finds that L2 orthography has a negative influence in both perception and production of L3 French vowels by L1 Japanese/L2 English speakers. Tremblay (2007) underlines positive L2 influence in voice onset time (VOT) of L1 English/L2 French learners

of L3 Japanese. Llama et. al., (2010) confirm these findings in another study of VOT of L1 English/ L2 French learners of L3 Spanish.

Several explanations have been suggested for L2 transfer. Wrembel (2010) suggests that at the initial state of third language speech production, L2 mechanisms are frequently reactivated blocking transfer from one's mother tongue (the L1). This is motivated by the resemblance in processes involved in non-native acquisition that L3 learners have already experienced. This might explain why Rivers (1979) shows L2 influence from a language that had nearly been forgotten. This is in line with the account made by Hammarberg and Hammarberg (1993, 2005) who relate the strong role of L2 at the initial state of L3 acquisition to the leaners' cognitive mode, which deactivates L1 transfer and relies on L2 to deal with foreign phonetic forms. They suggest that the role of L2 decreases at later stages of L3 acquisition. Supporting this, Wrembel (2010) found evidence for an increased L1 influence among L3 learners at advanced stages of acquisition.

Other studies relate L2 influence on L3 acquisition to psycho affective factors (Edmondson, 2001; Hammarberg & Hammarberg, 2005). According to De Angelis (2005) non-native languages are usually classified as "foreign language" category in learners' minds thus simply creating a cognitive association between them. As one's L1 does not sound "foreign" it is usually excluded and blocked from this association. De Angelis (2005) calls this process an "association of foreignness" (p. 42). It usually favours non-native transfer, giving L2 a privileged status. This phenomenon was observed quite early by Meisel (1983), who named it a foreign language effect.

2.2 Combined transfer

Apart from transfer in L3 acquisition being either strictly from the L1 or the L2, Louriz (2004) introduces the term "dual transfer" to refer to cases where both L1 and L2 influence L3 in relation to the acquisition of stress. Similarly, De Angelis (2007) refers to combined transfer to express the same effect. A few later studies make similar observations. Amaro (2012) states that "the influence from multiple languages and universals is not seen in a single segment, but rather across production, whether simultaneously (e.g. Barkley, 2010) or successively over the course of acquisition (e.g. Hammarberg & Hammarberg, 2005)."

Benrabah (1991) studies the segmental acquisition of Algerian Arabic/French bilinguals acquiring L3 English and found that learners transfer the more complex system of each (i.e., Algerian Arabic consonants and French vowels) into L3 English. This implies that the system that provides a wider segmental choice/range is the learner's reference in acquisition. Wrembel (2011) analysed the VOT in the L3-French speech of L1-Polish and L2-English users showing that there was a combined cross-linguistic influence of both L1-Polish and L2-English on the participants' L3 production in the study.

Also supporting combined transfer, Hammarberg (2001) introduces the Role Function Model to explain the combined influence L1 and L2 have in the course of L3 acquisition. On the one hand, L1's fixed neuro-motor system controls the learner's articulation during L3 acquisition. On the other hand, given L2-L3 foreign relatedness, L2 acts as a coping strategy that overrides L1 influence at the onset of acquisition. As L3 proficiency improves, there is less phonetic transfer from L2 and the influence of L1 comes to the surface. Hammarberg and Hammarberg (2005) support this proposal in their longitudinal L3 phonology study and find that while L3 learners start by transferring from L2, they transfer from both L1 and L2 as acquisition develops.

3. The multilingual context: Tashlhit speakers' linguistic repertoires

The central purpose of this paper is to understand acquisition of an additional language in a multilingual context and shed light on whether we can identify what influences the phonological acquisition process in this context. Specifically, to find out and explain the role that the languages involved play in the acquisition process. Our subjects are Tashlhit native speakers learning English in a context where they speak or interact with at least four other languages. We consider the linguistic landscape in Morocco and the context of acquisition of our learners, noting also that this is further enriched by varieties of the languages involved, particularly Moroccan Arabic and Amazigh varieties other than Tashlhit that we do not consider in this study. The multilingual language situation in Morocco affects all aspects of life in formal and informal sectors.

In this section we discuss the language background of the learners involved in this study and contextualise the status and usages of languages in Morocco, in general, and in the Amazigh speaking area, specifically. The Tashlhit native speakers in this study who are learning English, speak and are also exposed to Moroccan Arabic (MA), Modern Standard Arabic (MSA) and French. The role and uses of these languages in their linguistic repertoires are provided below.

3.1 Tashlhit (L1)

Tashlhit is a variety of the Amazigh language, which is a 5000-year-old Afro-asiatic (Hamito-Semitic) language (Sadiqi, 2001). It has been used by Imazighen who were the first inhabitants of Morocco for many centuries. This language has survived throughout the successive civilisations and languages that arrived in Morocco (e.g. Latin, Phoenician, Arabic). Despite the lack of an exact census, most sources report that at least 60 percent of Moroccans are ethnically Imazighen and acquire Amazigh as a native language (p. 65). Tifinagh-IRCAM is the widely used script adopted in the early 2000s.

There are three dominant varieties of Amazigh spoken in Morocco. Tarifit is used in the Rif Mountains and the neighbouring valleys, situated in the north of Morocco. Tamazight and Tashlhit are spoken in the High Atlas Mountains with Tamazight also spoken in the Middle Atlas and Tashlhit also spoken in the Anti-Atlas.

Like most Amazigh languages, Tashlhit has three vowel phonemes {a, i, u} which may be raised and retracted when tautosyllabic with an emphatic consonant resulting in the allophones {ɑ, e, o}. Given the basic inventory of the vowel system, the three vowels have a wide range in the vowel space from [a] to [æ]; [i] to [e], and [u] to [o] (Kossmann & Stroomer, 1997). As far as schwa is concerned, its status is somewhat unclear and disputed with e.g. Ridouane, (2008, 2011) arguing for consonant syllabicity rather than epenthesis, while Bensoukas, (2006, 2012) and Bensoukas & Boudlal (2012) adopt the view that schwa occurs in prosodic morphology. This differs from other Amazigh varieties - Tamazight and Tarifit – which have schwa (Dell & Elmedlaoui, 1988; Coleman, 1999; among others).[4] The absence/status of schwa in Tashlhit has no direct bearing on the current study which is focused on full vowel contrasts.

[4] Syllable structure and schwa syllabification in Tashlhit are part of ongoing interesting debate that has produced different competing perspectives. See Ridouane (2016) for an excellent overview of Tashlhit phonology.

3.2 Moroccan Arabic (MA)

Moroccan Arabic is the product of a contact situation between Amazigh and Eastern varieties of Arabic. While the former is the native language of the land, the latter was introduced with the islamisation of Morocco in the 8th century and, later on, with several waves of immigration from Eastern populations. It refers to the variety of Arabic used as lingua franca by most Amazigh Arab natives in Morocco. It is important to note that MA is not one homogenous language but is composed of a number of dialects; Heath (2002) suggests at least 15 dialects.

In this respect, MA speakers can be divided into two categories. There are 'old speakers', who base their language practice on their local dialectal variety, and 'new speakers' lacking this background, either due to an Amazigh home language or growing up in one of the urban "melting pots" without a particular dialectal profile (Maas, 2012). This distinction is important in our study, because our learners are considered new speakers of MA who mainly only speak MA outside their homes. Most such speakers are anecdotally said to speak MA with their native Amazigh intonation.

As far as the sound system is concerned, Amazigh phonology is believed to have a strong influence on MA (Sadiqi, 2001). This is most noticeable in the vowel system and the syllable structure that makes Moroccan Arabic syllables more complex than other Arabic dialects. The rural MA varieties naturally contain fewer Amazigh elements than the urban varieties, although some borrowed vocabulary is present in their lexicon.

It is generally accepted that MA consists of three vowel phonemes {i, a, u} in addition to the central epenthetic vowel {ə}. However, there is a debate on quantity. Arabists tend to retain the difference between long and short vowels of Old Arabic, maintained in Modern Standard Arabic (a second language to literate MA natives), treating the central vowel [ə] as a short vowel in MA. Some scholars consider it to be epenthetic since it splits non-admissible consonant sequences (Benhallam, 1990; Boudlal, 2001; Maas, 2011; Lahrouchi, 2018). In addition, its phonetic description is also fuzzy; it is seen as schwa (Harris, 1942; Benhallam, 1980, 1990; Keegan, 1986; Heath, 1987; Boudlal, 2001) or as a vocoid (Dell & El Medlaoui, 2002) or even that its phonetic signal is to be interpreted as a mere audible consonantal release as shown by its phonetic signal (Gafos et. al., 2002).

3.3 Modern Standard Arabic (MSA)

Standard Arabic is generally used in education, media and administration as well as in political and scientific discourse. It has the prestige of a written language in the sense that it is codified and standardized. However, it is not the mother tongue of any speaker. It is related to the Arabization policy in Morocco, whose objective, among others, is to develop and modernise it. The major function of MSA is to express the aspects of modern culture, which had been expressed only in French previously, and which now have the role of introducing the occidental culture into the country. For this reason, MSA has concentrated on lexical innovation and translation of French terms (Ennaji, 2001; Gago Gomez, 2019 and references therein).

Unlike Classical Arabic, MSA is characterised by a new enriched lexicon and by borrowings from French, as well as English and Spanish. It is also distinguished by syntactic and stylistic changes and a phonology that is highly influenced by dialectal Arabic. Despite this, it counts as part of the linguistic knowledge of our learners that our participants would have learnt as part of schooling. MSA, like Tashlhit and MA, has three phonemic vowels {a, i, u} and their

long counterparts {a:, i:, u:}. For our Tashilhit learners of English this offers no additional contrast in height apart from high and low. Like MA and Tashlhit, the six vowels are lowered and retracted in emphatic environments.

3.4 French

French has been strongly present in Morocco since the 1912 treaty which made French the official language of Morocco. It was imposed as 'the only language of civilization and advancement' (Bourhis, 1982). It has since become the main language of education; with its position strongly strengthened by the school system, taught from primary school (p. 14).

French is used in government, business and media alongside Arabic varieties. However, Moroccan speakers' fluency in French varies according to learners' level of education. As far as our study is concerned, French introduces to our learners a wider range of vowels than MA and MSA would have previously done. French has twelve oral vowels and four nasal vowels (Armstrong, 2021) as shown below.

(1) French vowel system

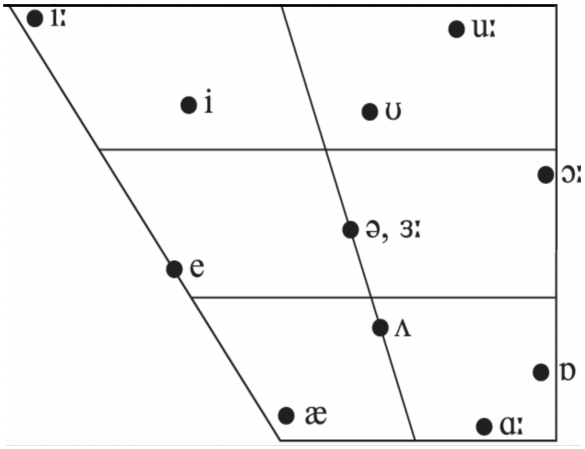
i	y		u		
e	œ		o	œ̃	ɔ̃
ɛ	ɶ	ə	ɔ	ɛ̃	ɑ̃
a			ɑ		

Thus, our learners have through French, four vowel heights contrasting the front and back distinctions as well as the dimension on rounded front vowels, in addition to a central vowel - schwa. There is further complexity in the system with also four phonemic nasal vowels, at least three of which are mid vowels.

3.5 English

In a globalized world, English is a popular language among the young generation with one of the most popular courses at university being English studies. English is taught in Morocco, although French is the national language. In state schools, students are introduced to English from the last year of secondary school (rather than of high school, in the last decade). We observe though that the day-to-day use of English is still limited in the wider community with most interactions in English mainly in the context of learning the language. At least for the context of this study, learners were broadly mainly learning Southern Standard British English (SSBE) as the target taught in schools and university although they are also exposed to other dialects, particularly American English from the movie industry. Below is a vowel chart for SSBE based on Weckworth (2021) which is derived from Jones (1917).

(2) Southern Standard British English Vowels (Weckworth, 2021)



Our study will specifically focus on the acquisition of the mid-vowel contrasts {e, ɔ} and the low vowels {ʌ, æ} for which it has been argued, as noted above, that previous studies show no merger between i/e and u/ɔ.[5] In the multilingual context of acquisition we investigate there are competing systems between MA and MSA, on the one hand, and French, on the other, that can have some interesting interaction with acquisition that we will explore in more detail below.

4. The Study: Hypotheses and predictions

The goal of the study is to investigate the acquisition of the English mid vowels – front and back {e, ɔ} and the low vowels {ʌ, æ}. Given the number of vowels in the range of languages spoken by the participants, these vowels should be reasonably easy to acquire based on the following hypotheses.

(i) There will be little interference from the three-vowel systems in Tashlhit, MA and MSA because three vowels are in the corners of the vowel space and far enough apart to not result in interference with the English mid vowels, particularly {e and ɔ}.

(ii) On the basis of French vowels, we expect learners to learn the English vowels easily, but perhaps have some interference from French and for the English vowels to be close to the French vowels in acoustic space, because the French vowels are exemplars of mid vowels in the learners' vowel space.

(iii) The positions of the English vowels for the Tashlhit learners of English will be different from those of native speakers because of the multilingual repertoires they hold.

Below are the vowels relevant to the study and indications of which of these are present in the languages that the participants use.[6] The target language English is the last one in the list.

[5] Using standard vowel references as used in most phonetic and socio-phonetic work we are interested in the DRESS and LOT vowels for the mid-vowels and the STRUT and the TRAP vowels. In most varieties of SSBE the STRUT vowel is a raised form of the START vowel and the distinction between these varies for different speakers (see Lindsey, 2012 for detailed discussion). We treat the STRUT vowel as low although it is higher than the START vowel.

[6] A tick indicates the presence of a vowel category/type in a language while a cross indicates its absence. A tick in parenthesis shows that there is some allophonic variation for these vowels so that they are contextually present,

Table 1: *Vowels in the multilingual context of Tashlhit learners of English compared to English*

	i:/i FLEECE	ɪ KIT	e DRESS	ɑ:/ɑ START	a	æ TRAP	ʌ STRUT	o:/o NORTH	ɔ LOT	u/u: FOOT
Tashlhit	✓	x	(✓)	x	✓	(✓)	x	(✓)	x	✓
MA	✓	x	(✓)	x	✓	(✓)	x	(✓)	x	✓
MSA	✓	x	(✓)	x	✓	(✓)	x	(✓)	x	✓
French	✓	x	✓	✓	✓	x	x	✓	✓	✓
English	✓	✓	✓	✓	x	✓	✓	✓	✓	✓

Much work in L2 acquisition has shown that accurate perception precedes and entails accurate production (Flege, 1995, among others). Based on hypothesis (ii) we predict that Tashlhit learners of English will have no difficulty in the perception and production of the target English vowels because of their experience with peripheral-mid vowel contrasts in French. We therefore conducted perception and production experiments to test the hypotheses given above. The details of the study and findings are given below.

4.1 Participants

The participants of the study were all students at the department of English language and literature at the University of Ibn Zohr in Agadir. They consisted of 20 native speakers of Tashlhit equally divided between males and females. Their age range was between 19 to 23 years (mean 21). They all originate from the Southern Tashlhit speaking region of Morocco, namely Agadir, Chtouka Ait Baha, Tata and Tiznit. At the time of testing, they were living in Agadir, and none reported any hearing deficits.

All participants had started learning English in the final year of secondary school and were still learning English at university. They grew up with Tashlhit as their only mother tongue spoken at home. At the age of 6 to 7 years old, they started learning MA. This is about school age, when they might have teachers and/or peers who are not Tashlhit speakers. They speak MA very fluently, like natives. Around the same age they were exposed to Modern Standard Arabic in the classroom. Two years later, they started learning French in primary school. They are advanced speakers of French and are able to use the language with ease although we did not test their level. The information regarding when they started learning/using a language are based on self-reporting, but they also follow patterns which are consistent with the introduction of these languages in school. At the time of testing, they had been learning English for about four to five years (with an average of 4 hours a week in the first three years). Based on the duration of learning and their proficiency we consider their English to be at about lower intermediate level. We conducted both perception and production tasks which lasted about 15 minutes each. Participants were compensated with a small token financial incentive.

primarily as a result of vowel lowering in the context of emphatics. Please note that while the English vowel categorisation and descriptive labelling is used in the top row, we do not mean to suggest that where vowels are present in two languages, e.g. [i] in MA and English, that these are phonetically identical, hence our use of vowel "category/type" here. This hurdle is overcome in the detailed discussion to follow when the experimental results are considered. For [i:] and [o:] these are short where they occur in Tashlhit, MA and MSA.

4.2 Perceptual Experiments

Two experiments were conducted to test whether Tashlhit natives also speaking MA, MSA and French, can perceive selected mid and low vowel contrasts in English. The experiments consisted of discrimination and identification tasks.

The discrimination task consisted of an AX experiment that had 200 tokens with the five target vowel pairs given in a word {i/e, u/ɔ, e/æ, ɪ/æ, ʌ/æ}. A native British English female speaker was recorded producing the items. Two repetitions of each item were retained as experimental stimuli. Instructions were given orally in Moroccan Arabic as to what each task entailed. Participants were tested individually in a quiet room. They received the speech stimuli through professional quality covering headphones. On each AX trial, participants were presented with two stimuli and had to indicate whether they were the same (AA) or different (AB). They indicated this by writing their response (S or D) on an answer sheet. The inter-stimulus interval was set to 3 seconds, and the inter-trial was 8 seconds.

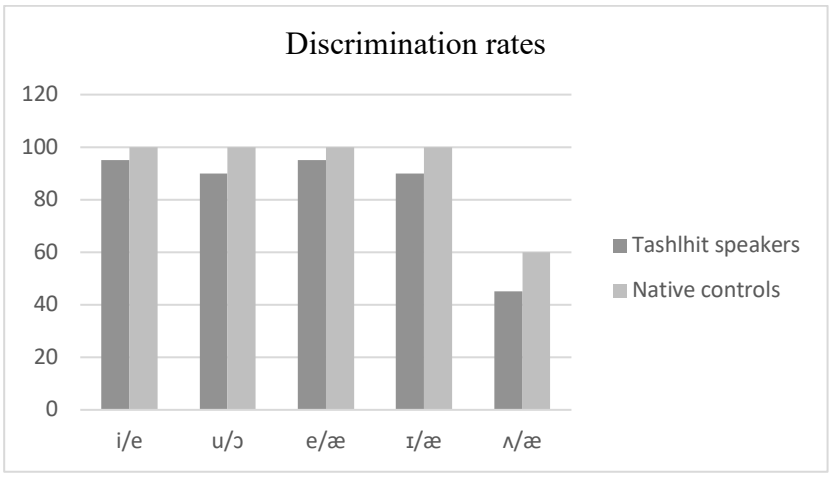
For the identification task, informants were required to fill in blanks in C_C contexts, e.g., p_t and t_k based on their perception of nonce word CVC stimuli. Since there are fewer vowel symbols than there are vowel sounds, participants were asked to complement their response in the identification with an example of a word that contained the same vowel as they had identified, i.e., that rhymed. This was also a way of ensuring that they paid particular attention to the vowel. The vowels identified by the participants were transcribed. There were 6 target vowels in total with 2 repetitions. 240 tokens were collected. Reaction times were not measured in both tasks, but participants did not spend longer than 20 seconds on any one item. Participants were allowed to ask for any clarification if they needed it. This was taken up in very few cases.

4.3 Results

Results are displayed in Figures (1) and (2). The striking observation is that subjects performed better in the discrimination task than in the identification task.

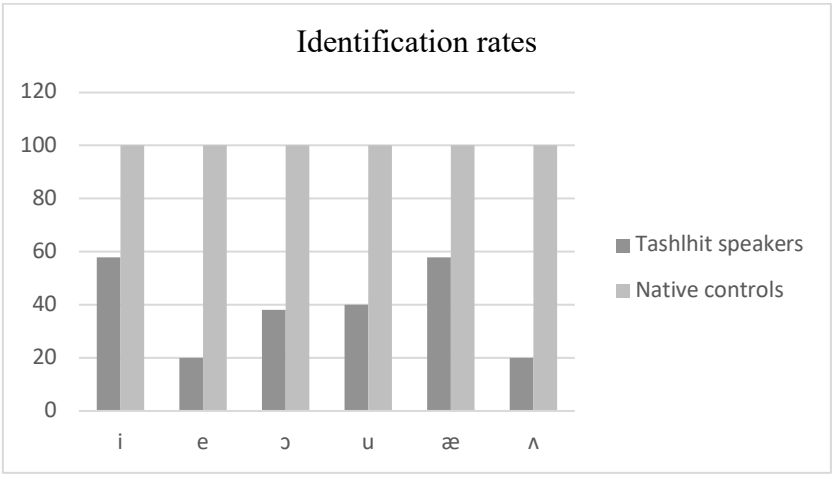
Figure (1) shows the overall discrimination accuracy for the five pairs of vowels. The learners performed well in discriminating between the vowel pairs {i/ɛ, u/ɔ, ɛ/æ, ɪ/æ, ʌ/æ}. Their correctness rate was near ceiling (95%) approaching that of native controls. However, they encountered difficulty discriminating between ʌ/æ (48%). The two groups of vowels are distinct in one major characteristic. The first four pairs differ in F1 only; whereas the last one differs in both F1 and F2. This suggests that the learners are more capable of discriminating vowels differing in F1 value only but have more difficulty with those where both the F1 and F2 values change. This results in the specific difficulty of discriminating between /ʌ/ and /æ/. However, note that native controls also performed less well in the last pair of vowels (60%). Both groups had a decrease of 40% correctness rate in this pair which has been argued to be a particularly subtle contrast even for native speakers as the data show (see Lindsey 2012 discussion).

Figure: 1 *Correct discrimination rates per vowel pair*



As far as the identification task is concerned, Figure (2) demonstrates the percentages of correct identification per stimulus vowel. All native controls reached the 100% ceiling of correctness. Tashlhit English learners were dramatically unsuccessful in identifying all vowels; their most correct performance was just above chance level. The immediate observation is that learners performed better in what they perceive as the corner vowels, i.e., in {i, u, æ} than in mid vowels and [ʌ], although the performance in [ɔ] is better than [e]. Within the first group, they performed the best in identifying /i/ and /æ/ (front vowels) with 58% accuracy than in /u/ (back vowel) where they had only 40% accuracy rate. In contrast, as far as mid vowels are concerned, subjects identified [ɔ] with less difficulty (40%) than [e] and [ʌ] (20%). Despite the overall poor performance, results reveal that Tashlhit English learners performed better in identifying the three corner vowels than mid or other low vowels.

Figure: 2 *Correct identification rates per stimulus vowel*



We conclude that the Tashlhit English learners perceive the target contrasts (discrimination test) but their perception did not allow them to accurately identify the vowels in the contrast (identification test). We summarize these results in the following confusion matrix, which

demonstrates the rate or percentage of confusion in both tasks between any pair of vowels of the six target vowels.

Table 1: *Confusion matrix*

	i	**e**	**ɔ**	**u**	**æ**	**ʌ**
i	58	33	0	3	3	0
e	32	15	7	3	28	13
ɔ	0	0	40	38	8	8
u	0	0	30	43	5	3
æ	0	8	5	0	58	23
ʌ	10	0	15	5	45	20

The matrix shows poor identification of {e, ɔ, ʌ} (light grey cells) for which an error analysis shows that they are assimilated to {i, u, æ}, which are identified more correctly overall. Recall that {e, o, a} are allophones in both MA and MSA occurring in the vicinity of tautosyllabic emphatic consonants, whereas they are phonemes in French (Armstrong, 2021). When the Tashlhit learners misidentify mid vowels and low [ʌ], this is an indication that they confuse them with other vowels implying that Tashlhit learners perceive vowels like /i/ and /e/ as exemplars of the same category. Our findings are in this sense in line with results in previous works such as Pineda Mora et al. (2019) but contrast with, for example, Ingram & Park (1997) who show i/e as being non-assimilable in Korean and Japanese learners of English.

We consider the production experiments below. Given the perception results above, where learners face difficulty, we can expect that production will also not be optimal with {e, ɔ, ʌ} not likely to be significantly different from {i, u, æ} in the Tashlhit English learners' productions.

4.4 Production Experiments

Production experiments were composed of three tasks consisting of target mid and low vowels. The first one was production of target words in a list presented in a carrier phrase produced at their own pace. Subjects were asked to produce the 6 target vowels in C_C nonce words in a carrier phrase. Two bilabial stops are used in the onset position {b, p} and three consonants at different manners in the coda position: {m, t, s}. None of these are close to emphatics that have a lowering effect. Thus b_m, p_t and b_s created non-words totaling 260 tokens. In the second task, subjects were presented with a print-out of the experimental stimuli consisting of an extract from the 'rainbow passage' (Fairbanks, 1960). Participants read the passage out loud at their own pace. The last task was a CVC word-chain game, where participants had to create a string of words by adding a word progressing from one participant to the next. We report results from the first two tasks.[7] The experiments were recorded using zoom H4 with a sampling rate of 44Hz.

Data were phonetically analyzed using Praat (Boersma & Weenink, 1992-2022) looking at the formant values of the vowels produced and also using Praat to plot the vowel ranges. Measurements of the first and second formant frequencies (F1 and F2) were extracted at vowel midpoint using an automated procedure in Praat. To reduce individual differences, the Bark

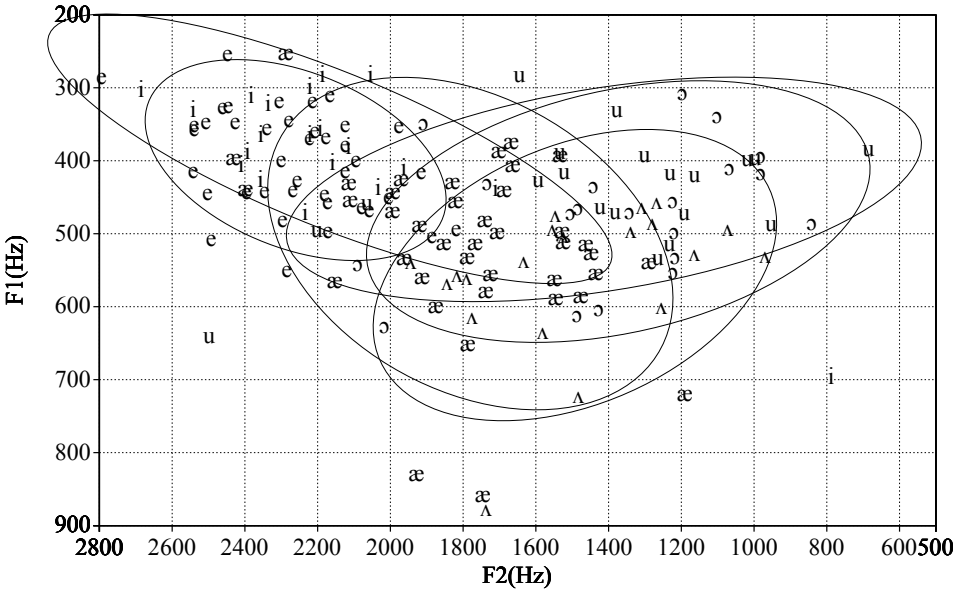
[7] We do not analyse the data from this final task, which was intended to provide freer non-scripted productions as there were a number of pauses with participants also mainly unable to recall the preceding words. The task, however, worked very well as an ice breaker before the two production tasks that we report on here.

Difference Metric normalization was applied to F1 and F2 and was used in the figures presenting the vowel productions.

4.4.1 Results

Figure 3 shows the position of the English vowels {i, e, u, ɔ, ʌ, æ} as produced by multilingual Tashlhit learners of English. Results show a merger between {i/e} and {u/ɔ} although the standard deviation of the mid vowels {e, ɔ} are slightly less than and contained within those of {i, u}, respectively. Contra to expectation, [æ] and [ʌ] emerge as distinct.

Figure 3: *Production of English vowels by Tashlhit natives*



Recall, as is well established, that the lower the F1 value, the closer the tongue is to the roof of the mouth, i.e., the higher the vowel, and the higher the F2, the more fronted the vowel. This is proportional to the frontness/backness of the highest part of the tongue. Examining the production range of [i] and [e], Figure 4 demonstrates that the production space of [e] overlaps with that of [i]; i.e., it is a subset of the latter. Moreover, the fact that F2 ranges from 1900Hz to 2300Hz and F1 is between 250Hz to 500Hz indicates not only confusion, but also variation in production. Despite the variation, we can still see a clear pattern, and the merger of {i, e} in the vowel space is unquestionable. We see this in the separated picture in Figure 4 below. There is similarly merger also between {u, ɔ} with [ɔ] contained within [u]. We discuss these results further in the extracted picture in Figure 5.

Figure (4): *i -e production range*

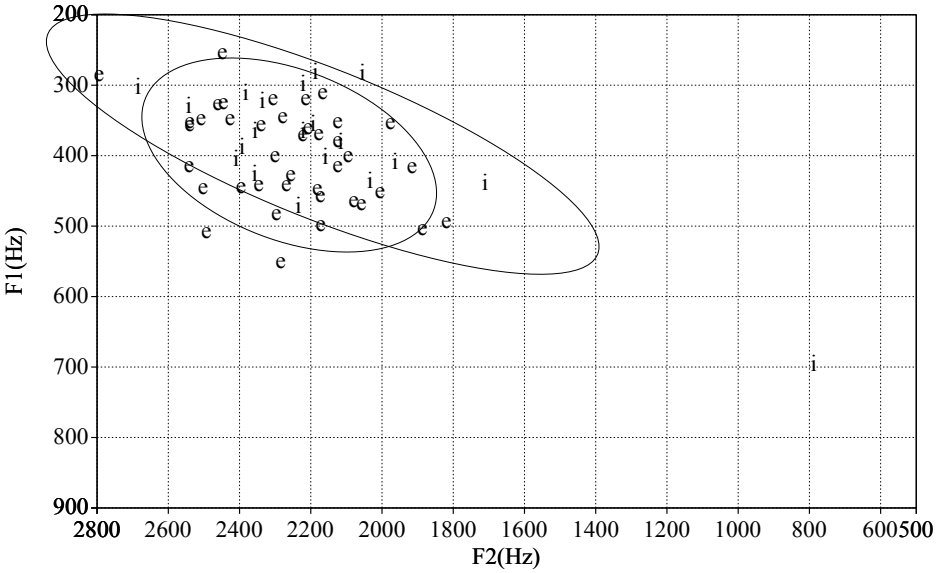
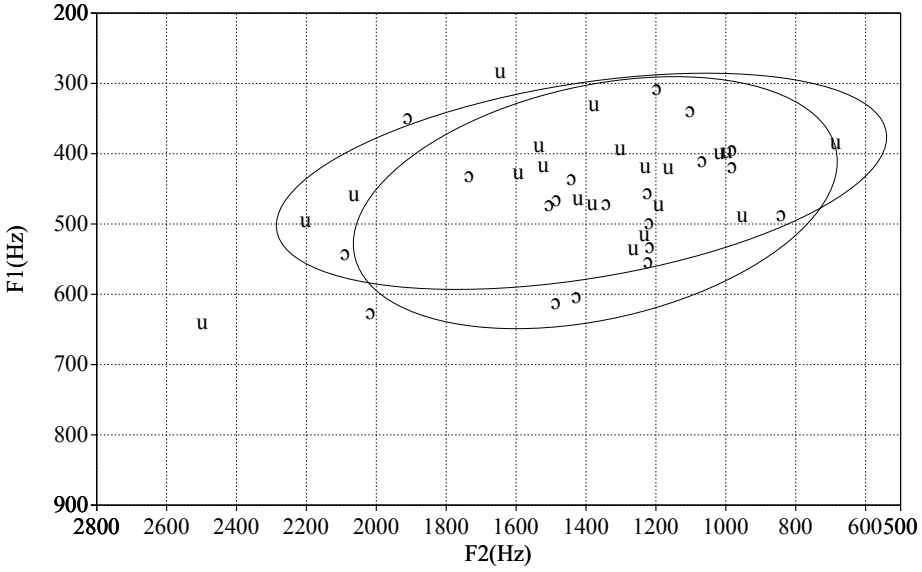


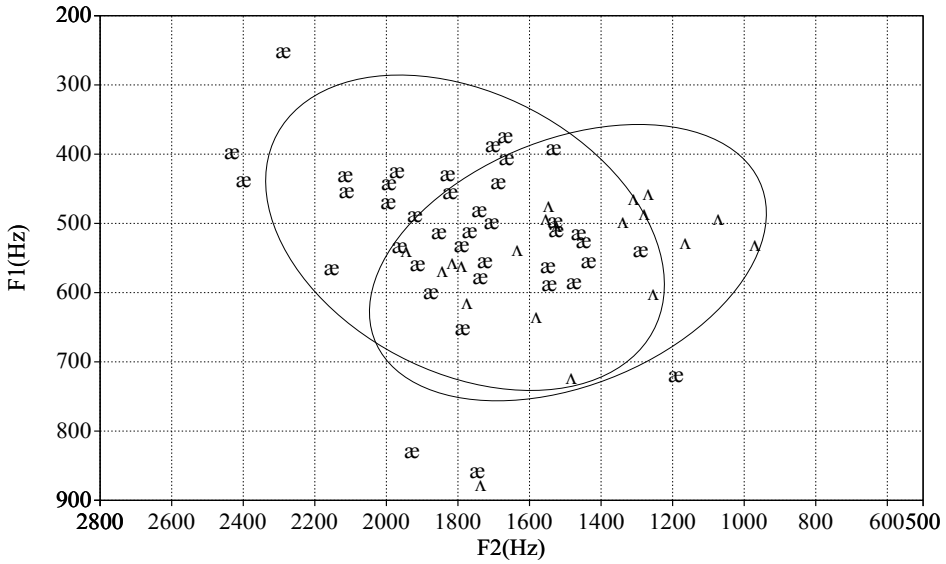
Figure 5 demonstrates that {u, ɔ} merge, i.e., their production ranges overlap to a great extent implying confusion on the part of Tashlhit speakers. What is striking in contrast to i/e is that the range of u/ɔ is significantly larger with F2 ranging from 550Hz to 2300Hz and F1 from 300Hz to 610Hz. This indicates wide variation and range of vowels in production, although note that the concentration is mainly bewteen 1000Hz and 1600Hz on F2.

Figure (5): u/ɔ production range



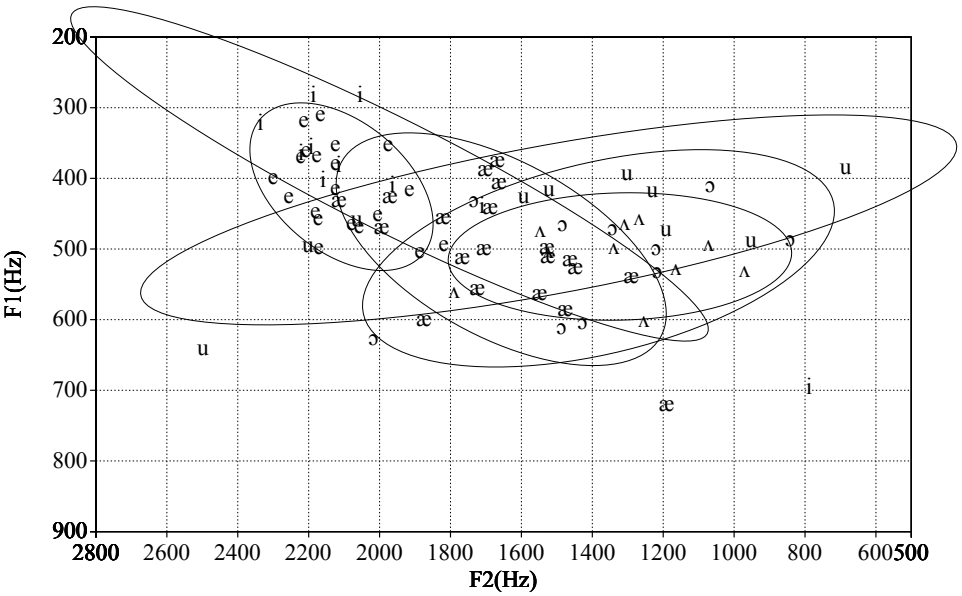
For the ʌ/æ pair, Figure 6 makes it evident that these vowels are mainly treated as distinct although there is an area of partial overlap. Their F2 ranges between 950Hz and 2250Hz with an overlap between 1400Hz and 2000Hz, and F1 from 300Hz to 700Hz with an overlap between 650Hz and 450Hz. This shows that production varies and merger is only partial.

Figure (6): ʌ/æ production range



In order to further analyse and better understand the observed variation, we divided the production data further into male and female speakers, which reveals contrasting patterns of performance as shown in Figures 7 and 8.

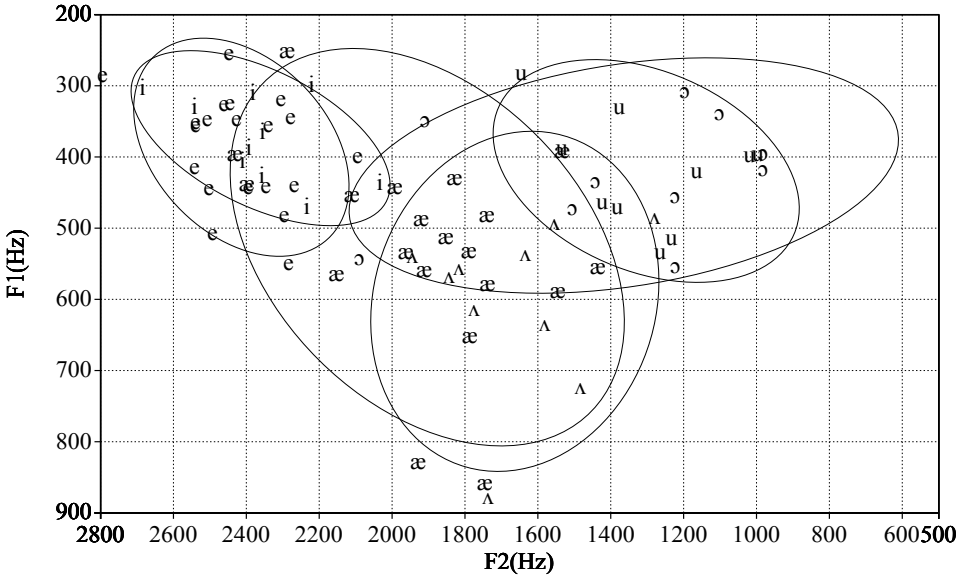
Figure (7): *Male Tashlhit English vowels*



Firstly, male production occupies a wider F2 (and with a less degree F1) range in contrast to female speakers. Secondly, the production range of peripheral and mid vowels in males is lowered and retracted compared to female production. And finally, unlike in female production, almost all vowels are partly or totally merged in male pronunciation, i.e., while there is vowel overlap for both males and females, there is less distinction between the vowels in male compared to female speakers.

The production range of [i] in female speech is much narrower (higer and fronter) than in male pronunciation. The F2 value in females varies from 2100Hz to 2250Hz and F1 from 370Hz to 320Hz, whereas in males it is between 1700Hz and 2500Hz for F2, and 600Hz to 180Hz for F1. [e] production space seems to be totally different in male and female productions. This vowel is much lower and retracted in male speech. [u] in the female production range is also much smaller in terms of F2. By contrast, male production of [u] is spread across the vowel space (while there is not much difference in F1).

Figure (8): *Female Tashlhit English vowels*



Female production range of [æ] is more concentrated (shorter F2) than in males. Thus overall, although there is an expected lower pitch in male than in female speakers, the difference in range is unexpected. Thus, at least in this sample of learners, female speakers do much better than males in moving towards distinguishing the vowels in the vowel space, although even in this case we see a merger beetween u/ɔ and i/e in female speakers but less so for æ/ʌ. There are no doubt important sociolinguistic factors that may have led to this division but which we do not pursue in the present paper.

5. Discussion

5.1 Role of L1 Transfer and other languages

In order to examine any influence of Tashlhit learners' mother tongue on their perception and production of English vowels, it is necessary to shed light on the acoustic values of the formant frequencies for L1 Tashlhit vowels (Ridouane, 2014) and compare them to the mean value of their production of English vowels (Figure 10). Compare Figures 9 and 10 below.[8]

[8] These vowel plots are produced using Praat (Boersma and Weenink 1992-2022).

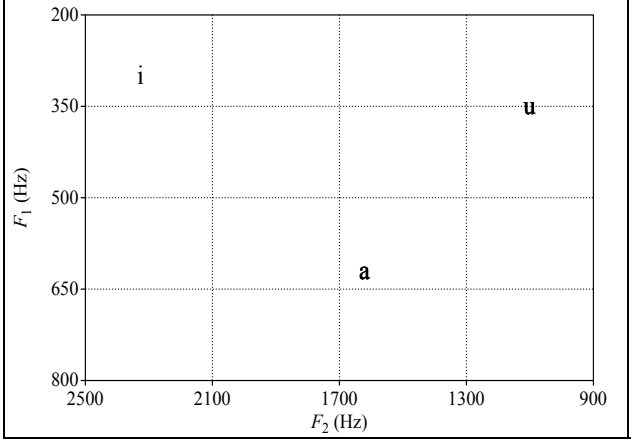
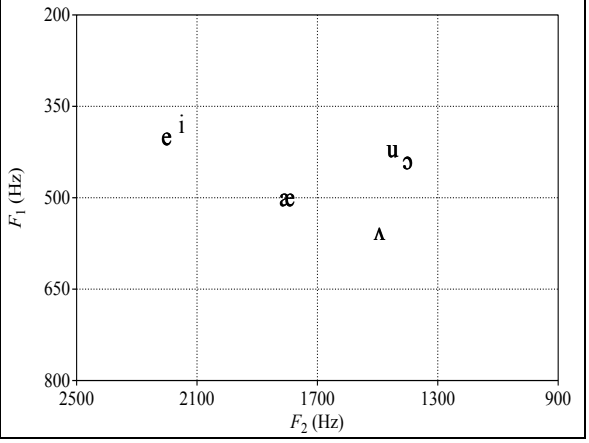
Figure (9): *L1 Tashlhit vowels*	Figure (10): *Tashlhit English vowels*
	

Figure 9 shows that L1 vowel positions for Tashlhit are spaced low on F1 and wide apart on F2 for i/u and with high F1 for the low vowel /a/. Figure 10 shows the position of the English vowels as produced by Tashlhit speakers, here showing the mid and low vowel targets as well as {i, u}. The comparison shows that Tashlhit speakers' English vowels [u] and [ɔ] are fronter and lower than the L1 [u] and the productions of [i] and [e] are lower and less front than the L1 [i]. [æ] is less low than L1 [a] but [ʌ] is distinct from [æ]. What would be 6 distinct vowels of English emerge as four vowels, in a pattern similar to the L1 but creating a smaller triangle of the merged L2 vowels plus [æ] that is contained within that of the L1 in acoustic space.

This demonstrates that the target mid vowels are misidentified with the target English vowels acoustically assimilated into composite vowels that differ both from the L1 /i/ and /u/, on the one hand, and from English i/e and u/ɔ, on the other. Unexpectedly, French, one of the languages spoken by the participants, does not seem to figure at all in these productions in that it does not appear to aid productions to be closer to the target. Although it is tempting to view this as evidence of the supremacy of the L1, we would like to relate it to the multilingual context of acquisition. In this case, out of all the languages spoken and used, three of these – Tashlhit, MA and MSA – have three-vowel systems where mid vowels only occur as allophones. This has two effects. Firstly, the recurrence and dominance of three-vowel systems in the linguistic repertoires of these learners establishes these systems in a more compounded way that has a cumulatively stronger effect on the acquisition of further languages. Secondly, since mid-vowels in these languages only occur as a result of a phonological context (presence of emphatics) which does not occur in English, and was therefore not present in the stimuli, the strong cues for mid vowel production are absent, and therefore perception is skewed towards merger as the data show.

Comparing F1 and F2 in Figures 9 and 10, we observe that the greatest shift both from Tashlhit and English is seen in the F2 values. This is detailed in Table (2) below.

Table 2: *Comparison of F1/F2 between L1 Tashlhit and English productions*

	F1/F2	Tashlhit L1	English	Tashlhit English
a	F1	620	667	513 (=æ)
	F2	1620	1565	1780
i	F1	300	296	390 (=e)
	F2	2325	2241	2186
u	F1	350	386	454 (=ɔ)
	F2	1100	1587	1392

The F2 for [æ] in the learners' English productions is greater than in both the L1 and the target language, although not very different from the L1. It is not clear at all why the learners make any change here since maintaining the L1 would be closer or indeed at the target but recall that there are more language formant values that speakers are exploiting and which must feed into their English productions. This means that looking at only the L1 does not provide the best insight and these findings thus support combined transfer (Louriz 2004, De Angelis (2007). In addition, there is also likely a foreigness effect where learners cognitively assume they need to make some change in the production of the newly being learnt language. But overall, in the absence of a detailed statistical analysis, learners are in a good range towards [æ]. For both productions of English [i] and [ɔ], the movements to a more intermediate position suggest some perception of the English F2 or more likely are the result of adjustments triggered by a fuller vowel space in the multilingual context.[9]

On the other hand, the over increase in F1 for English [i, ɔ] results in vowels that are closer to mid vowels. We assume this is influenced by the assumption of a smaller vowel system but also fed by perception and the expectation of new foreign vowels. This however, as the data show, does not affect F1 and F2 equally. Learners can manipulate or make changes to F2 with less difficulty/effort than to F1, although this is directly related to the fact that at least based on the L1 there is less change needed in the F1 category. Within the multilingual context, however, we expect that there is much more competition in the vowel space that results in shifts in vowels where we would predict them to just be based on the L1. This is what we consider to be the motivation for the shift fed by perception as reported.

This is possibly further supported by the orthographic links between French and English – they are both written with roman script; and they share several cognates that are spelt with similar graphemes, although given the non-commutability between spelling/grapheme and phonetic outputs, where e.g., <a> can have multiple phonetic outputs in English (e.g., æ, ʌ, eɪ, ɑ, ə), this is likely to result in mis-mappings. In this case the lack of orthographic distinction between [æ] and [ʌ] may block the learners' production and may have affected the identification task results. This sort of metalinguistic knowledge has been shown to affect L2 acquisition (Bassetti et al., 2015; Hamann, 2018).

While the overall results could be argued to be in line with studies that show that the L1 has the greatest influence on additional language acquisition as Wrembel (2013) argues, two factors have to be considered in this context. Firstly, the L1 is not unique in this multilingual context which is replete with three-vowel languages, and secondly, the results are also likely influenced

[9] Unfortunately, we did not measure these speakers own French productions to allow us to gauge how these relate to the English productions but make a comparison to native French productions based on formant values in the literature, see discussion in section 5.2.

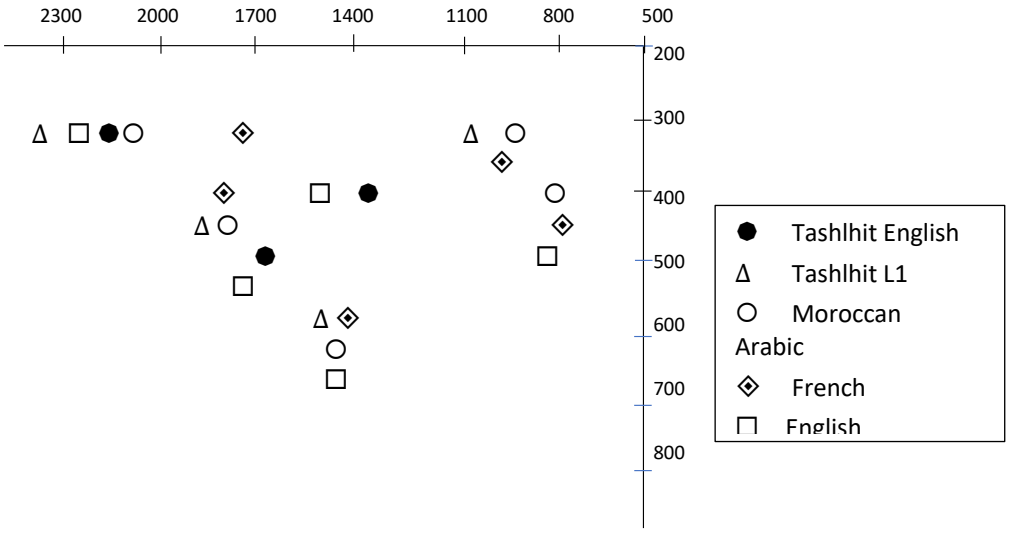
by the acquisition stage of learners at the intermediate level. As previously noted, Hammarberg and Hammarberg (2005) suggest that speakers initially rely on the L2 (or other non-first languages) in the initial stages of learning but then begin to shift back to the L1 in later stages of development. What these results do not show is the observation made in Benrabah (1991) where learners transfer the more complex to the less complex system as was argued for Algerian Arabic speakers learners of L3 English who contrasted transfer patterns between consonants (from Algerian Arabic) and vowels (from French).

5.2 Comparing across systems in multilingual learning

We end the data discussion by comparing across the vowel systems in the multilingual space of the learners. A caveat on this is that this is a simulated scenario as while we map the actual merged vowel productions of the Tashlhit subjects, we rely on the literature for the positions of MA, English and French vowels. In this sense this is a comparison of the learners' English productions against the assumed targets of the other languages as standardly produced by native speakers. An important piece that we leave to future work is a representation of the learners' actual vowel space with their productions of the relevant vowels to provide the actual multilingual space. We nevertheless think what we represent here is an important yardstick for this future work which will allow us to also understand how the other languages may have shifted from native speaker productions.

The mapped vowels in Figure 11 below show English [ɪ e æ u ɔ] (Deterding, 1997), French [a e i ɔ u] (Ouni & Laprie, 2003), Moroccan Arabic [a i u] + [e o] allophones (Kenstowicz & Louriz, 2009), Tashlhit [a i u] + [e] allophone and the merged English productions of Tashlhit learners. The key to the vowel productions is given below.

Figure 11: *A comparison of vowels in a simulated multilingual space*



Each filled circle point represnts two vowels for merged English i/e and u/ɔ and the single /æ/ for Tashlhit learners of English. At least compared to the position of native vowels, this illustrates that the vowels produced for English by the Tashlhit speakers are quite distant from the French vowels indicated by the diamond. This suggests that contrary to expectation based on a foreigness effect, French does not in fact influence the Tashlhit English vowels very much. Although the French vowels are close to at least one of the English vowels in each case, it is distant from another, therefore failing to make a contrast. In particular, the large change in F2

implies that the back vowel contrast is very poorly distinguished. Apart from u/a the acquired or emerging English vowels are close to MA and Tashlhit vowels to the extent that it seems that, at least for these vowel contrasts, a three vowel system is what emerges. However, u/ɔ using the mean value of tokens produced is much more central and not as back as all the other back vowels in all the other langauges in the multlingual space. The data for English show significant /u/-fronting as widely attested in most recent work.

Models of L2 perception give supremacy to the L1 as the language through which the L2 is perceived (e.g. Boersma & Hamann, 2009), and this then leads to mapping onto the relevant phonological forms. In the multilingual situation at hand, it is not so straightforward to decide which of the grammars in the linguistic repertoire are used for perception. If we consider that particular formant structures relate to particular vowels, and that these are the structures that the learner borrows from one or more of the languages in their repertoire, we end up with a quite complex picture for Tashlhit learners of English. In this case, rather than complete F1/F2 pairs from one language being mapped to the English vowel output, the data seems to suggest perceptual assimilation of the composite vowels to different parts of vowels of different languages, i.e., formant signatures for a single vowel are potentially made up of formants from different vowels as depicted in Table 3 below.

Table 3: *Mixed formant signatures of Tashlhit learners of English*

Vowel	F1	F2
e	= French, English	= MA
ɔ	= MA, French, English	= NONE
æ	= English	= MA, English

These (developmental stage) results suggest at least that the Tashlhit speakers' perception was influenced by the multiple languages within their repertoire and not just the L1. In some cases it's not even possible to uniquely identify which language the F1 or F2 formant is assimilated to and indeed it may be that there are multiple sources. For F2 and in particular for the back mid vowel /ɔ/ we see that this is an area of innovation where learners do not pattern with any of the languages in the repertoire.

5.3 Implications for language teaching and future work

The findings of this study have some implications or point to some considerations that can be made in English language teaching. Approaches to language teaching in non-native English-speaking contexts and in many parts of multilingual Africa, usually adopt an approach to language teaching where the English language classroom does not permit the use of other languages. Languages used outside of class are deemed to be inappropriate for the English classroom. This creates an artificial learning context in contrast to the way that language is used in the day-to-day lives of learners, with learners having to supress the other languages in their repertoire when in class. More recent approaches to language learning (Erling et al., 2017; 2021; McKinney 2020) challenge this approach and instead argue for multilingual language learning pedagogies where all the languages that learners have in their linguistic repertoire are treated as resources that enhance the learning of additional languages (Costley, et al., to appear; Reilly et al., 2022; to appear). In the results we have seen, it is surprising that despite the fact that the learners have French in their linguistic repertoire and French has at least two of the vowel contrasts they were trying to learn in English, with even a tense/lax distinction with {e, o, ɛ, ɔ}, speakers still had difficulty with mid-vowels. Even though these vowels of French are not at

the precise formant values for English, they would provide a better foundation and starting point for the learning of English rather than the L1 which seems to have the biggest impact on English vowel production and perception with little distinction between i/e and u/o.

A key finding in the present study is that the main cause of Tashlhit English learners' vowel merger in production is perceptual. Language teaching could therefore provide training to help learners identify non-native contrasts since more accurate perception leads to more accurate comprehension and word recognition. The fact that the Tashlhit learners of English in this study did better in discrimination than in identification tasks shows that while they can distinguish minimal pairs, they cannot identify the vowels accurately and are therefore less able to use the correct vowels for their own productions, also as the results show. An important factor that also affects learners is variation in the input since they also listen to different varieties of English. Rather than be strict about variation in the input, we see this as a resource that teachers could use to teach pronunciation in class. As multilingual speakers, Tahsilhit learners are adept at navigating different languages and teachers using these skills that learners have as well as their ability to contrast different languages, would allow learners to tap into their wider vowel inventory of French for the purpose of learning English. Although perfect native-like pronunciation is not the target and is indeed not expected in a multilingual context, teaching aspects of English pronunciation is useful to improve intelligibility particularly due to the non-transparent orthography of English, which can lead to mispronunciations as a result of analogies learners make based on orthography (e.g., the last syllable of the word 'determine' is pronounced in analogy with 'mine'). It would therefore be recommended that, in addition to teaching writing and reading, English pronunciation and sound structure are also included in both classrooms and in teacher training.

To further support the proposed multilingual approach to learning and teaching and to have a wider understanding of the linguistic competencies of the learners in their different languages future research in the following areas would be particularly beneficial. (i) A study where the production and perception of French vowels is investigated in this context would be significantly important as this would provide us with an understanding of whether the multilingual speakers have the resources available (here the knowledge of mid-vowels at least) that they could then easily exploit in the learning of an additional language. Impressionistically, at least at the production level, the learners use of French exhibited a level of fluency that would support an advanced and stable representation of this language in their cognitive systems. (ii) To further test and verify the findings of this study, future work could replicate the study in this paper with L1 Moroccan Arabic speakers who are learners of English to consider whether another language with the same vowel system would yield the same results. Since Moroccan Arabic speakers are also usually speakers of French, any proposals on multilingual learning pedagogies would also be applicable in this context and beyond in the Maghreb. (iii) Future work could also importantly look at the role of allophones in the language learning context. As Table 1 shows, Tashlhit has variants of /e/ and /o/ that occur in restricted contexts, but these vowels are not phonologically contrastive in the language. Building on the early work of Eckman et. al. (2003), this work could shed more light on the role of contractiveness and allophony in phonological acquisition, and the implication this has on the cognitive representation of allophones and also the acquisition of the phonological rules associated with such allophonic alternations in additional language acquisition. And finally (iv) while our findings provide the basis for further testable hypotheses in multilingual acquisition, either a

longitudinal study or a staggered study of the early, intermediate and advanced stages of acquisition of English by multilingual Tashlhit speakers would provide further insight on the role that the different languages in the linguistic repertoires of speakers plays in the acquisition process and would allow us to better understand how learners navigate the different languages and evaluate what role each language takes at the different stages of acquisition.

6. Conclusion

We presented a case of acquisition of English in a multilingual language context of Tashlhit speakers who also speak Moroccan Arabic, Modern Standard Arabic and French. We tested three hypotheses:

(i) There will be little interference from the three-vowel systems in Tashlhit, MA and MSA because the three vowels are in the corners of the vowel space and far enough apart to not result in interference with the English mid vowels, particularly {e and ɔ}.

(ii) On the basis of French vowels, we expect learners to learn the English vowels easily, but perhaps have some interference from French and for the English vowels to be close to the French vowels in acoustic space, because the French vowels are exemplars of mid vowels in their vowel space.

(iii) The positions of the English vowels for the Tashlhit learners of English will be different from those of native speakers because of the multilingual repertoires they hold.

With hypothesis (i) we expected that there was likely to be little interference from the three-vowel systems in Tashlhit, MA and MSA because the position of the three vowels in the vowel space could be deemed to be far enough away from the target vowels to result in any interference. To the contrary, we found that the Tashlhit speakers English mid vowels, particularly for {e, ɔ}, merged these vowels with {i, u}, respectively. Based on hypothesis (ii) we expected that the learners could learn English vowels easily if they relied on French vowels, but at this intermediate stage of English acquisition the learners did not draw any benefits from French although their formant structures of the vowels produced do suggest some influence of French. In fact, supporting hypothesis (iii) it was shown that learners produced vowels that are influenced by all languages in their linguistic repertoire and their positions of their English vowels were different from those of native speakers because of the multilingual repertoires they hold. We think that our findings are unique to the multilingual learning context and that this provides support for a combined transfer approach to additional language acquisition where, because of the interaction between the different vowels used by the speakers, all the languages in the repertoire have an effect on the production and perception of any new language learnt.

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