

GLIDE INSERTION IN FRENCH HIATUS FOR ARABIC LEARNERS OF FRENCH AS A FOREIGN LANGUAGE

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Arabic learners of French as a second language have been known to produce French hiatus sequences with an epenthetic glide between the two vowels such as in [pejaʒ] for “péage” and [nejɔ̃] for “neon”. This study attempts to investigate and document this phenomenon by looking at phonetic transcriptions of French words containing V-V sequences within and across word boundaries. The first part of this exploratory study required Arabic learners to transcribe a series of isolated words using IPA to see if they would insert glides. In the second part, learners were invited to record short sentences containing V-V sequences within and across word boundaries to confirm their presence acoustically. Results show a clear tendency for most learners to insert a glide in the phonetic transcription of V1V2 sequences; [j] is inserted if V1 is front and [w] is added if V2 is back. Those glides are also present in recorded sentences as demonstrated in the brief acoustical analysis performed on complete sentences. The final section discusses the possibility that these epenthetic segments may be due to differences between the syllable structures of L1 (Arabic) and French.

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INTRODUCTION

Instructors of French as a foreign language in Morocco have often remarked that hiatus sequences (two adjacent vowels belonging to different syllables) in French, either across word boundaries or within words, constitute a challenge for Arabic native speakers. They have also noticed that learners often modify the V1V2 sequences of a hiatus by inserting a glide in between the two vowels. These epenthetic glides are quite noticeable to native speakers and can arguably contribute to the perception of a foreign accent. The scientific literature does not confirm the presence of such glides, nor does it provide a comprehensive account of the challenges that Arabic learners of French face in their acquisition process. The goal of this study is twofold: firstly, document the presence of those epenthetic segments and, secondly, explore the idea whether the syllable structures of Arabic is the source of these epenthesis in the learners’ interlanguage productions in French.

Several theoretical models are available in the scientific literature to predict or explain the difficulties that learners encounter while learning new sounds. Some of the more recent and dominant models are the Speech Language Model (SLM) proposed by Flege (1995, 2003, 2007) and the Perceptual Assimilation Model (PAM) offered in Best (1995) and in Best and Tyler (2007). These models all focus on the acquisition of new phonemic oppositions or sounds and how these can be affected by their similarities with already-existing, L1 sounds. According to the SLM, for instance, learners retain the capability to learn new sounds throughout their lives; however, the production accuracy depends on how L2 sounds are perceived and how they are categorized through L1 sound patterns. Similarly, the PAM proposes that learners assimilate new L2 sounds

according to different patterns also based on already-existing L1 categories: two categories, category goodness or single category contrasts. Both models are relying on the perception of the individual sounds, at the phonetic level, and include the existence of their variants. Even though these models include some allophonic variation, they do not directly address the acquisition of these L2 sounds into any greater structural unit such as the syllable, nor do they consider the effect that suprasegmental properties may have on the accurate production of the target language sounds such as reduction in unaccented syllables, intonation rises, etc.

Previous research has found however that L1's phonotactic properties in general, and the syllabic structure more specifically, do carry over in the acquisition of another language (for instance see Onishi et al. 2002, Trammel 1993, Sato 1984, Delattre 1965). In a study that involved English learners of Spanish, Vokic (2008) found that distributional differences between the L2 and L1 phonemes contributed to explaining how successful learners were in producing phonemes in the target language. In a production task, learners were more successful when the distributional properties of the L2 phonemes overlapped those of the L1's phonemes. In addition to this, studies by Tarone (1987), Chela-Flores (1996), and Cebrian (2009) have shown that the Lax Vowel Constraint that restricts the production of lax vowels in closed syllables in English constitutes an additional challenge for Catalan learners of English. In a series of two experiments, the study shows that Catalan learners of English show a greater tendency to mispronounce /l/ as [i] in CVCVC than in CVC contexts. This result, according to the researcher, can be explained by the lesser knowledge of the English lax vowel constraint by the Catalan learners, which leads them to syllabify words according to Catalan syllabic rules rather than the coda syllabification done by native speakers of English. Once the CVCVC words are syllabified into CV.CVC, a smaller number of words were pronounced with a lax vowel [ɪ] than a tense [i]. This supports the importance of phonotactic constraints and their interference in interlanguage.

Another relevant study that underlined the importance of phonotactics in the acquisition of another language is Cheng and Zhang (2015). This publication reports the results involving the production and perception of monosyllabic English words by Mandarin-speaking college students to assess the accentedness of consonants in initial and in final position. The speech data involved in this experiment were monosyllabic words with consonants that involve all major categories of English consonants: voicing, place and manner of articulation in initial and final position of CVC words. The differences between the syllabic structure of Mandarin and English led the researchers to predict that native Mandarin speakers would experience more difficulty in perceiving and producing contrasts in final position than native English speakers. Also, they expected a strong correlation between L2 perception and production at the onset of the syllables and a weaker correlation in the coda position. Their results confirmed the asymmetry phenomenon as Mandarin speakers performed better in syllable-initial than final syllable-positions at both tasks, namely in producing and perceiving English consonants.

These two experiments provide empirical evidence that confirms the complexity of the acquisition of new sounds and, more specifically, that support the importance of considering syllable structure as a unit in the acquisition of new sound patterns. These notions will be examined in the context of Arabic learners of French as a foreign language in Morocco.

Current Experiment

The syllable, generally accepted as a psychological unit of organization in natural languages, can be defined as a “unit of pronunciation typically larger than a single sound and smaller than a word” (Crystal 2009). In French, syllable structures can vary widely, going from a simple /V/ syllable as in “a” [a] (“Il a chaud.”) to a more complex /CCCVC/ for instance as in “strate” [strat] (“cette strate est très épaisse”) or /CVCCCC/ in “dextre” [dɛkstr] (“Ce coquillage est dextre.”) and with many other combinations in between. Wioland (1991) provided a list of 12 different syllable structures in French, to which we added three more (13 to 15):

1. CV mes [me], sous [su], banc [bã]
2. CCV prix [pri], cuit [kɥi]
3. CVC sourd [sur], tisse [tis]
4. V et [e], à [a], an [ã]
5. CCVC brique [brik], place [plas]
6. CVCC fourche [furf], chèvre [ʃɛvr]
7. VC âme [am], onde [ɔ̃d]
8. CCCV croit [krwa], droit [drwa]
9. CCVCC prêtre [prɛtr], trouble [trubl]
10. CCCVC froisse [frwas], fresque [frɛsk]
11. VCC oncle [ɔ̃kl], ouvre [uvr]
12. CCCVCC stricte [strikt], truisme [trɥizm]
13. VCCC arbre [arbr], astre [astr]
14. CVCCC marbre [marbr], tordre [tɔrdr]
15. CVCCCC dextre [dekstr]

This wide variety of syllable types can often create a hiatus if a syllable without a coda is immediately followed by another syllable starting with an empty onset, as in examples 1 and 2 below for instances of hiatus within and across words respectively.

1. Within a word: /CV.V/ “truand” [try.ã]
2. Across words: /CV.V.V/ “tu as eu” [ty.a.y]

Contrary to French, where syllable structures can be quite diversified, Arabic only has only two basic syllable structures: open and closed syllables, with a nucleus that can either be short or long. Consequently, the following four structures are possible: /CV/, /CV:/, /CVC/ et /CV:C/. One can see in these structures that in onsets in Arabic are always present and that they always consist in a single element.

The structure of Arabic syllables has been recognized and clearly explained by Ibn Jinni who was one of the grammarians of the school of Basra. In his book, he states that onsets are always present since vowels preceding a consonant are not allowed: [famuh̄a:lun ʔan taku:na lħarakatu fil

martabati qabla lharfi]. He then adds that hiatus are not allowed in Arabic because a single consonant cannot support two identical or different vowels: [walharfu lw:ahidu la: jatahammalu harakatajni, la: muttafiqatajni wa la: muxtalifatajni].

It is this obligation to have an onset in Arabic that blocks the possibility of having a hiatus. Anecdotal evidence suggests that, when faced with two such consecutive vowels, French learners with Arabic as their L1 tend to compensate for this new structure with one of three alternatives: they either (a) insert a glide as in [VGV] between the two vowels, (b) replace the initial vowel with a glide to produce [GV] or, (c) replace the final vowel with a glide to produce [VG]. This additional glide will be either [j] or [w] and the evidence suggests that it agrees with the frontness of the first vowel of the hiatus.

Therefore, this study investigates the following research questions:

- 1) Can Arabic learners of French as an additional language produce hiatus V1.V2 sequences within words or across word boundaries?
- 2) If so, are some sequences more difficult than others?
- 3) If not, what strategy do they use to produce the hiatus sequences?

Based on anecdotal evidence and the relevant scientific literature listed above on the influence on the syllable structure in the acquisition of an additional language, it is expected that a glide will be inserted between V1 and V2. Also, the nature of the glide will agree in frontness with V1.

METHODOLOGY

Data Collection

An experiment was designed to examine if Arabic learners succeed in producing V1-V2 sequences within and across syllables in French and, if not, what the replacement sequences will be. The first step of the experiment required participants to transcribe phonetically a list of target words containing V1V2 sequences. A follow-up analysis was also devised to verify acoustically the presence of glides before or after vowels in the target syllables.

Participants

Participants who were students at the Université Cadi Ayyad in Marrakech were sought out to provide speech material in a short experiment. In this first exploratory study, few criteria were used to select our participants. However, they did have to be enrolled in the third year of their program at the Department of French of the Cadi Ayyad University (to have sufficient knowledge of the IPA to complete the tasks), have either Arabic or Tamazight as their first language, and be willing to do the experiment without compensation. A total of 10 speakers volunteered for this first experiment, aged 20 to 42 years old. All participants were considered as intermediate learners of French.

Experimental Tasks

The first task consisted in a transcription of a list of 101 French words using the International Phonetics Alphabet, which participants have learned in their Introduction to Linguistics course in

their program. Words to be transcribed were chosen based on the presence of a V-V sequence and, in order to minimize the number of words that had to be transcribed while maximizing the data collected during this phase of the study, some of those words may have been unfamiliar to some of the participants.

Some of the participants agreed to record the same words and sentences in a reading task. During the session, they were instructed to read a list of 27 sentences presented to them on a sheet of paper, one sentence at a time, at a normal pace. These sentences were constructed to include all target words of this study while minimizing the number of sentences participants had to record; therefore, each sentence contained between one and four target words. Recording sessions took no more than 15 minutes. The prosodic context in which these words were located was not controlled, except for the sentence-final position that was excluded as a possible position to facilitate acoustical analyses. Recordings were done on the participants' phone and sent to the main experimenter.

Stimuli

The target words chosen for this initial experiment vary in length, going from a single vowel to polysyllabic words. Because anecdotal evidence has suggested that the transitional glide would agree in frontness with the first vowel of the hiatus (front if V1 is front, and back if V1 is back), all stimuli have been classified in two groups. The list of all stimuli in Appendix 1 lists approximately two thirds of the stimuli expected to have [j] as a glide and one third expected to have an epenthetic [w] with 77 and 24 words in both categories respectively.

As mentioned above, sentences read by participants contained several target words that could be either nouns, verbs or adjectives, as in examples 3 and 4 below.

3. Ce néon est ideal pour ce véhicule océanographique nouveau.
4. Les géôles sont réouvertes, les portes réusiniées et les oléoducs réhabilités par ce géomètre zélé.

Data Analysis

In the first task, participants were asked to provide IPA transcriptions of all target words. These transcriptions were examined by both researchers to determine if participants inserted glides between vowels and, if so, in what linguistic context. The objective of the second task was to verify acoustically the presence of those glides in the target words using PRAAT. To this end, a small number of target words in the recorded sentences were examined. At this point, no systematic analysis of the glides' acoustic properties was performed since the main objective of this initial study was to document their presence, their nature ([j] or [w]) and in what context they were appearing.

RESULTS

Patterns for [j]

This section presents the analysis of the IPA transcriptions of the stimuli provided by all participants. Table 1 and Figure 1 show the raw numbers and percentages of [j] glides transcribed in the stimuli due to the presence of V1 being a front vowel. Three main observations can be made

for this group. Firstly, the target sequence VV of the hiatus present in the corpus is only reached on average at 22.9% overall and by all speakers. Therefore, it appears and confirms that this sequence represents a problem for learners since more than three quarters of target words underwent a modification of their expected syllable structure. In an effort to provide more empirical data to support and document the existence of these glides between vowels, a short acoustical analysis was performed on several sentences. As expected, Figures 2, 3 and 4 show discontinuity in the acoustical signal that confirms the presence of a glide between the vowels under study. In these figures, it is easy to notice the decrease of energy in the oscillogram and the formant variation in the spectrogram, both associated to the presence of the glide [j].

Secondly, the most frequent substitution is to insert a [j] glide in between V1 and V2; it happens on average about 50% of the time. Without learners 6, 7, 8 and 12, the average goes up to 66%, which shows that some learners are clearly more capable of hitting the target. Thirdly, L8 and to a lesser extend L9 are interesting because not only did they frequently inserted [j] between the two vowels but they also dropped V1, rendering this sequence simpler and easier to produce. In this sense, dropping V1 makes the structure of the syllable, namely GV2, match the native Arabic structure.

Table 1

Numbers and percentages in italics of all phonetic realizations for words with an expected [j] for all learners.

	L1	L3	L5	L6	L7	L8	L9	L10	L12	L14	Totals
[j]											
VG	49 <i>67.1</i>	48 <i>65.8</i>	39 <i>60.0</i>	31 <i>41.3</i>	7 <i>9.2</i>	33 <i>44.0</i>	47 <i>63.5</i>	54 <i>72.0</i>	10 <i>13.2</i>	51 <i>68.0</i>	50.4
VG	0 <i>0</i>	3 <i>4.1</i>	4 <i>6.2</i>	2 <i>2.7</i>	8 <i>10.5</i>	1 <i>1.3</i>	0 <i>0</i>	0 <i>0</i>	1 <i>1.3</i>	14 <i>18.7</i>	4.5
VV	8 <i>11.0</i>	2 <i>2.7</i>	13 <i>20.0</i>	36 <i>48.0</i>	50 <i>65.8</i>	0 <i>0</i>	4 <i>5.4</i>	3 <i>4.0</i>	53 <i>69.7</i>	2 <i>2.7</i>	22.9
GV	13 <i>17.8</i>	20 <i>27.4</i>	3 <i>4.6</i>	6 <i>8.0</i>	3 <i>4.0</i>	36 <i>48.0</i>	20 <i>27.0</i>	13 <i>17.3</i>	6 <i>7.9</i>	5 <i>6.7</i>	16.9
V	3 <i>4.1</i>	0 <i>0</i>	6 <i>9.2</i>	0 <i>0</i>	8 <i>10.5</i>	4 <i>5.3</i>	2 <i>2.7</i>	5 <i>6.7</i>	6 <i>7.9</i>	3 <i>4.0</i>	5.1
Total:	73	73	65	75	76	75	74	75	76	75	

Figure 1

Proportion in percentages of all phonetic realizations for words with an expected [j] for all learners.

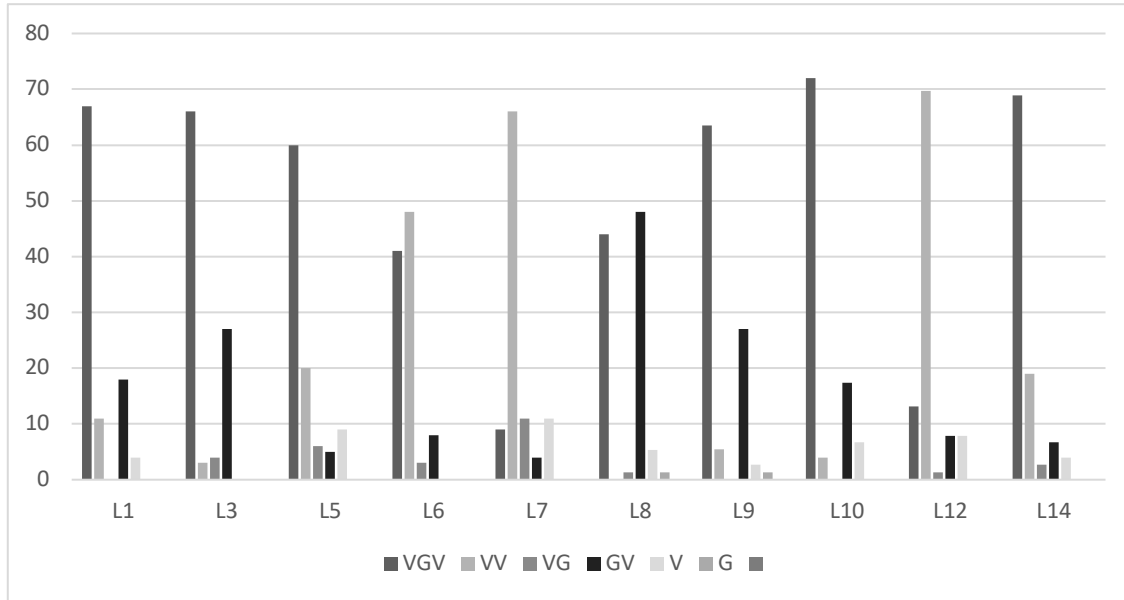


Figure 2

Spectrogram of the word 'péage' from the sentence 'L'idéal est de passer au péage de l'oasis avant d'atteindre l'aéroport surchargé.'

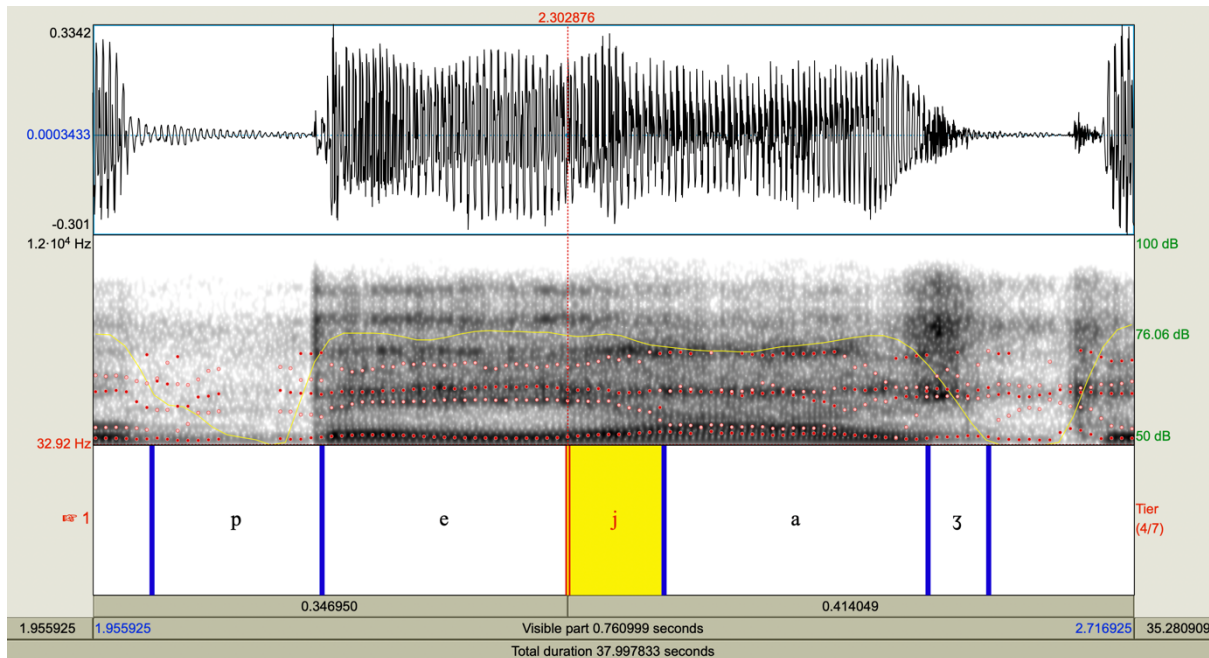


Figure 3

Spectrogram of the word 'aérée' from the sentence 'Il a avoué que c'est agréable d'être dehors dans cette oasis aérée et réhabilitée depuis peu.'

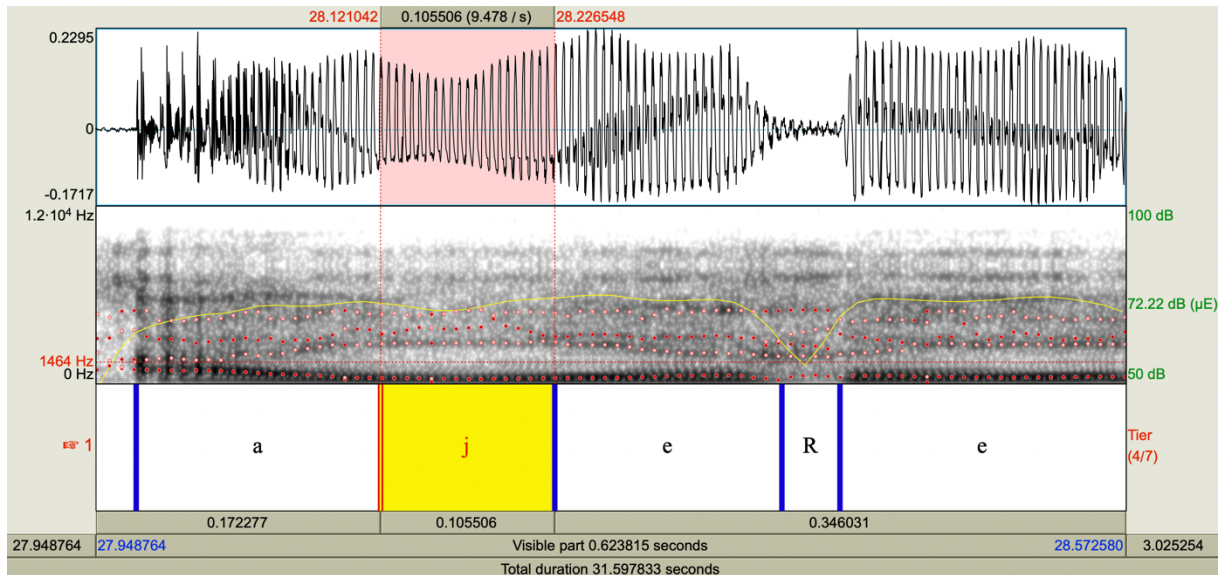
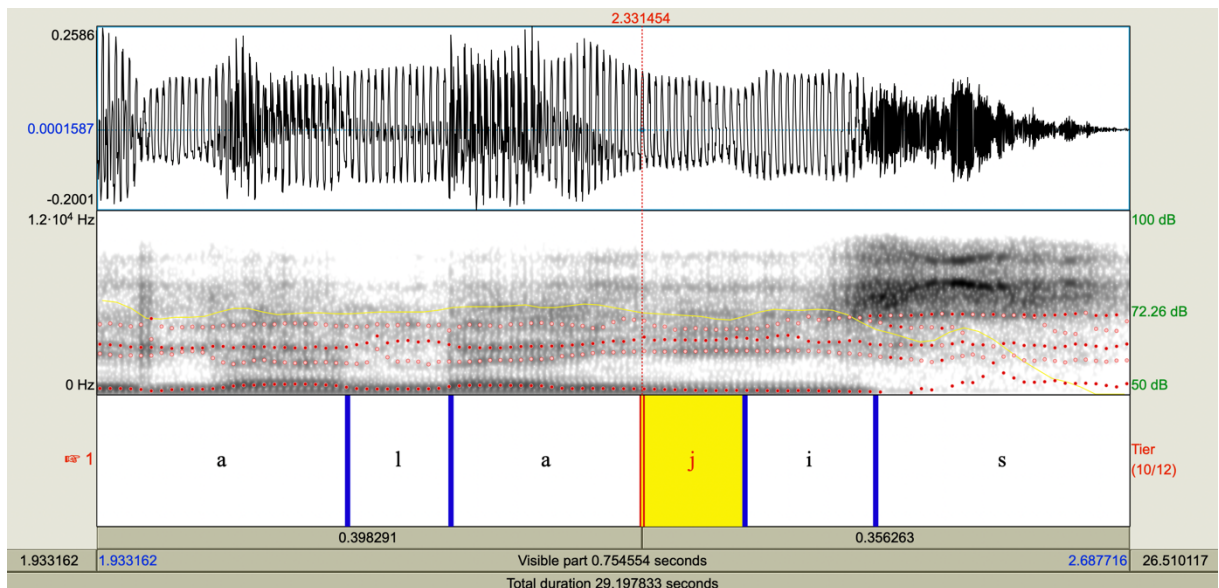


Figure 4

Spectrogram of the words 'la laïcité' from the sentence 'Haïr la théologie et la laïcité est une attitude déontologiquement chaotique, naïve voire répréhensible moralement.'



5.2 Patterns for [w]

Table 2 and Figure 5 illustrate the various sequences that have been found in the expected sequences of V1V2 for the [w]. Results for this group of words are somewhat less clear than the

previous one as tendencies are harder to identify. However, we notice three main results. Firstly, none of the learners display a rate of more than 40% for the target sequence V1V2. The one exception to this is S7 who produced the greatest number of expected V1V2 sequences with 41.7%. The overall average for this target sequence is extremely low at 13.7%.

Secondly, all speakers felt the need to either replace V1 with a glide or insert a glide between the two vowels. When combined, these two sequences represent most of all hiatus sequences by learners with rates between 63% for S6 and 95% for S8. As one would expect since the target sequence rate is so high, S7 stands out again with a combined GV2 and V1GV2 rate of 41.6%. The oscillogram and spectrogram presented in Figure 6 illustrate the presence of the glide [w].

It is difficult to identify any other single pattern in the exploratory data presented here, partially due to the sample size being too small to exhibit any robust tendency. There is, however, one observation that must be made. If we were to group the two most common sequences of sounds produced by these speakers, namely VGV and GV, it becomes obvious that all speakers, without exception, felt compelled to produce the [w] glide before the second vowel, with or without V1. Rates become on average 78.8% of VGV sequences, with the lowest rate of 63% and the highest being 95%.

Table 2

Numbers and percentages in italics of all phonetic realizations for words with an expected [w] for all learners.

	L1	L3	L5	L6	L7	L8	L9	L10	L12	L14	Totals
[w]											
VGV	20 <i>2.0</i>	10 <i>44.5</i>	4 <i>22.2</i>	10 <i>45.5</i>	2 <i>8.3</i>	10 <i>43.5</i>	4 <i>17.4</i>	8 <i>33.3</i>	10 <i>45.5</i>	20 <i>86.9</i>	35.8
VG	2 <i>10</i>	0 <i>0</i>	0 <i>0</i>	1 <i>4.6</i>	2 <i>8.3</i>	0 <i>0</i>	3 <i>13.0</i>	0 <i>0</i>	0 <i>0</i>	1 <i>4.4</i>	4.0
VV	1 <i>5</i>	0 <i>0</i>	2 <i>11.1</i>	6 <i>27.3</i>	10 <i>41.7</i>	0 <i>0</i>	1 <i>4.3</i>	6 <i>25</i>	5 <i>22.7</i>	0 <i>0</i>	13.7
GV	14 <i>70</i>	11 <i>50</i>	12 <i>66.7</i>	4 <i>18.2</i>	8 <i>33.3</i>	12 <i>52.2</i>	15 <i>65.2</i>	10 <i>41.7</i>	7 <i>31.8</i>	1 <i>4.4</i>	43.3
V	1 <i>54</i>	1 <i>4.6</i>	0 <i>0</i>	1 <i>4.6</i>	1 <i>4.2</i>	1 <i>4.4</i>	0 <i>0</i>	0 <i>0</i>	0 <i>0</i>	1 <i>4.4</i>	2.7
G	0 <i>0</i>	0 <i>0</i>	0 <i>0</i>	0 <i>0</i>	1 <i>4.2</i>	0 <i>0</i>	0 <i>0</i>	0 <i>0</i>	0 <i>0</i>	0 <i>0</i>	0.4
Total:	20	22	18	22	24	23	23	24	22	23	

Figure 5

Proportion in percentages of all phonetic realizations for words with an expected [j] for all learners.

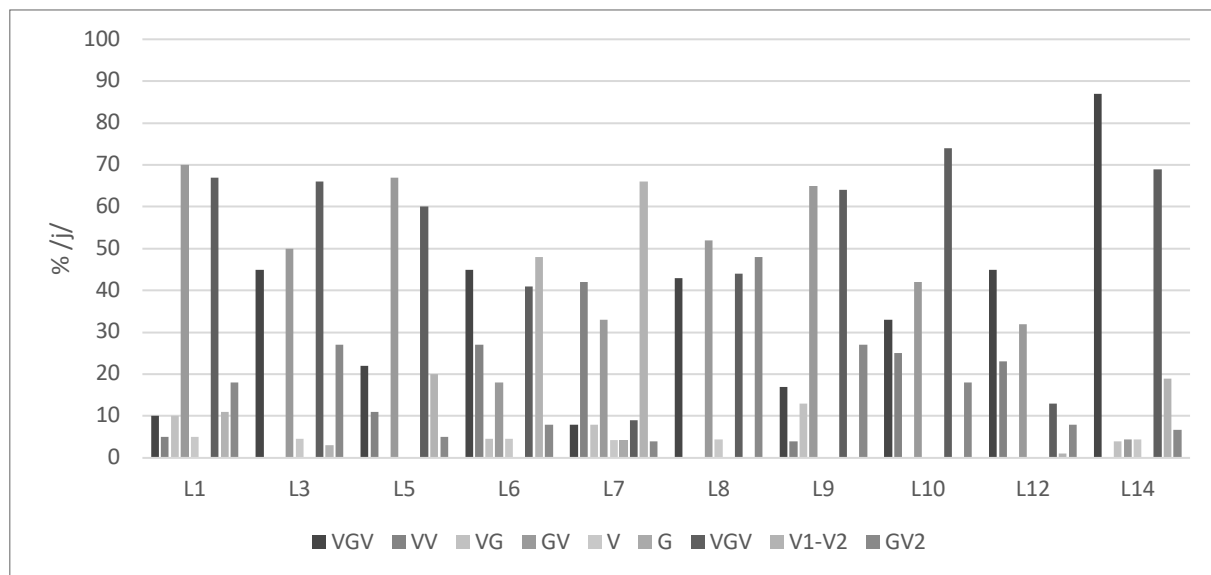
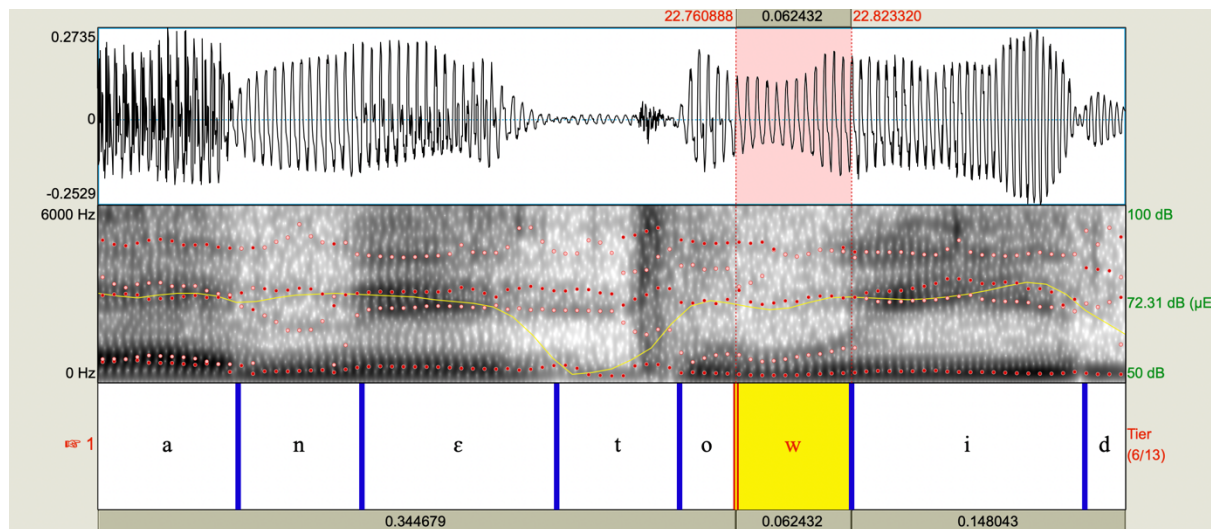


Figure 6

Spectrogram of the end of the word 'planétoïde' from the sentence 'Les astéroïdes et les planétoïdes sont observés la nuit.'



DISCUSSION AND CONCLUSION

Despite being the result of a preliminary analysis, the data presented in this exploratory study show some interesting trends which are best presented through the experimental questions posed at the beginning of this paper. The first question asked if Arabic learners of French as an additional language can produce hiatus V1.V2 sequences within words or across word boundaries? Results of their IPA transcription show a very low rate of target sequences in French hiatus V1V2 as presented in Table 1. This strongly suggests that these syllable structures are challenging to many Arabic learners of French. In many cases, learners preferred to either replace V1 with a glide or keep V1 and insert a glide before V2. However, some of the learners' productions did contain a French hiatus V1V2, as would have produced native speakers. Consequently, the answer to this first experimental question must be affirmative, albeit only partially because of the low rate of successful target sequences by learners.

The most likely explanation for the substitutions produced may lie in the phonotactic rules of learners' L1, namely Arabic. In this language, empty syllable onsets and hiatus are not allowed, which causes a problem for the newly acquired French V1-V2 sequences within and across words. Therefore, learners seek a syllable structure that is closer to their native language's structures, which always include an onset either in a CV or CVC syllable. The most frequent alternative produced by learners, namely V1GV2, respects the native speakers' phonotactic rules since glides usually have the same status as consonants.

The second experimental question examined the possibility that some sequences would be more difficult to produce by learners than other sequences. Although this experiment was not specifically designed to identify easier or more difficult V1V2 sequences, it did provide different results for the group of words that contained the glide [j] and the ones that included the glide [w]. Overall, learners were noticeably more successful in producing the hiatus for the group of words with an expected [j] than for the group of words with an expected [w]. At this point, the explanation for this result is not clear. It could be related to the frequency of the words used for the study, or perhaps because the insertion of [j] is more frequent in general and, therefore, more likely to be produced for all learners. Once more, additional data will be needed to properly answer this question.

Finally, the third experimental question was an attempt to identify which sequence of segments was the most frequent as a replacement for the target sequence. The data clearly shows that the VGV sequence for the group of [j] words, and the VGV and the GV sequences for the [w] groups, were the preferred ones by many learners. A follow-up experiment with a greater variety of stimuli may provide further insight as to why these sequences were the preferred one.

It must be noted that the small corpus gathered in this experiment also suggests that the glide must agree in frontness with preceding vowel. Therefore, in the case of a hiatus in French, all front vowels would be followed by the [j] whereas the back ones would be followed by the [w]. Again, such a small corpus does not offer convincing evidence and further empirical studies are necessary to confirm or refute this initial result.

Further investigation of this phenomenon will need to provide more data to confirm the epenthesis that has been briefly documented with this exploratory study. More speakers, at different stages of their acquisition process, would also offer better view of the changes regarding this phenomenon

according to their proficiency. It may also be possible to determine if sociolinguistic factors or individual differences such as age of acquisition, exposure to French, use of the target language may be correlated with a greater production of the target sequence. As well, it will be paramount to investigate the reason why learners perceive glide in French hiatus sequences as evidenced by their transcriptions. In addition, it would be interesting to determine the exact effect of these glide insertions on the learners' intelligibility, comprehensibility and overall perceived foreign accent by native speakers.

Finally, these results provide data that confirm the complexity of the acquisition of new sounds and, more specifically, that support the importance of considering syllable structure in the acquisition of new sound patterns. Additional research on this topic, and on the effect of suprasegmental and prosodic factors in the acquisition of a foreign language will greatly contribute to better understand, predict, and improve the acquisition of new phonemic systems. Such data will naturally lend themselves to the design of better pedagogical approaches that will provide learners with better strategies to reduce their foreign accent.

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