# A WEB-BASED HIGH VARIABILITY PHONETIC TRAINING APPLICATION FOR FRENCH VOWELS

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Over the past few decades, a large number of studies have demonstrated the effectiveness of High Variability Phonetic Training (HVPT) on the development of second language (L2) speech perception and production (for a review, see Barriuso & Hayes-Harb, 2018; Thomson, 2018). To date though, almost all studies have focused on L2 English and have been conducted in lab-settings, thus limiting the number of learners who can benefit from this pedagogical approach. In this paper, I report on the development of a free web-based HVPT application targeting the development of French vowels. *Ouïe* (French for "hearing"; https://ouie.org/) consists of two modes: 1) a "*familiarisation*" mode that familiarizes learners with International Phonetic Alphabet symbols (with audio examples) and basic phonetic explanations regarding place and manner of articulation, and 2) a training "*entraînement*" mode. In the training mode, tokens are (currently) produced by five voices and target the 10 oral vowels /i-e-ɛ-a-y-ø-œ-u-o-ɔ/ and the three nasal vowels /ɔ̃-ɑ̃-ɛ̃/ in a variety of phonetic contexts. Learners can choose sessions of 20 or 40 words, with each trial followed by immediate feedback.

## INTRODUCTION

High Variability Phonetic Training (HVPT) is a type of perceptual training in which the stimuli are produced by multiple talkers in varied phonetic contexts (Barriuso & Hayes-Harb, 2018; Thomson, 2018). The theory behind HVPT is that introducing variability in the input leads to greater and more generalizable improvements in L2 speech perception (Lively, Logan, & Pisoni, 1993; Logan, Lively, & Pisoni, 1991). Over the past three decades, the benefits of HVPT has been demonstrated for the learning of consonants (Hardison, 2003; Iverson, Hazan, & Bannister, 2005), vowels (Lambacher, Martens, Kakehi, Marasinghe, & Molholt, 2005), tones (Wang, Jongman, & Sereno, 2003), and syllable structure (Huensch & Tremblay, 2015). In addition, a large number of lab-based studies have shown that HVPT enables learners to establish more robust mental representations of L2 sounds and contributes to pronunciation development. A meta-analysis of 25 years of perception training research conducted by Sakai and Moorman (2018) showed that training experiments that are strictly controlled led to medium-sized improvements in perception ($d = 0.92$, $SD = 0.96$) and small improvements in production ($d = 0.54$, $SD = 0.45$). The meta-analysis also reported that the average number of hours spent on training was 4.79 hours over an average of 7.7 sessions and 19.54 days.

For instance, Lambacher et al. (2005) investigated the effects of six sessions of HVPT on the perception and production of the American English mid and low vowels by Japanese speakers.

Their results revealed that the trainees (but not the control group) significantly improved in the perceptual identification task, and that this positive effect was transferred to production. At posttest, the training group was also found to be more intelligible and found to have vowel categories with less spectral overlap than participants in the control group.

Almost all HVPT studies have been conducted in laboratory settings, which has the benefit of being a controlled environment but which also comes with constraints regarding ecological validity and access to perceptual training (Martin & Inceoglu, 2022). In comparison, very little work has been done on the effect of HVPT outside the lab. This is primarily due to the lack of HVPT tools available to learners outside the lab. Two notable exceptions are English Accent Coach (www.EnglishAccentCoach.com) developed by Ron Thomson (2012) and Linguatorium Auris (https://www.linguatorium.com/). English Accent Coach is a free web-based resource which promotes the learning of English vowels and consonants using the same HVPT approach used in lab-settings, i.e., learners are presented with a word, identify the targeted phoneme by selecting one of the options presented on a screen, and receive corrective feedback. Because it is web-based, English Accent Coach can be used by a large number of learners of English all over the world, with results similar to those expected in lab-settings. For instance, in a recent study by Iino and Thomson (2018), Japanese EFL learners received three sessions of training on the /r-l-w/ over a period of ten weeks, leading to large improvement on the perception of the three consonants and small improvements on the production of these sounds. Linguatorium Auris, also based on L2 pronunciation research (see Qian, Chukharev-Hudilainen, & Levis, 2018), is an adaptive HVPT system which diagnoses learners' individual pronunciation problems through a pretest and creates a personalized program that trains learners to distinguish sounds that are challenging to them.

In brief, the ever-increasing access to technology and the Internet allows us to expand perceptual training to a much greater number of language learners. This is particularly useful as web-based perceptual training enable the offering of personalized learner-centred learning opportunities. The ease of access to resources allows for flexible practice, which may in turn lead to an increase in students' learning autonomy and improvements in L2 speech perception and production.

**L2 French Vowels Perception and Production**

To date, English Accent Coach and Linguatorium Auris are the only web-based tools using HVPT methods and no such app has been developed for other languages. Yet, the potential for a HVPT tool for French sounds is high for several reasons. First, French is the fifth largest world language, spoken by 321 million native speakers and studied by 50 million second language learners (Organisation Internationale de la Francophonie, 2022). Second, the French vocalic system is often challenging for non-native speakers and is, therefore, an important focus of French pronunciation instruction (Inceoglu, 2019a; Kennedy, Blanchet, & Trofimovich, 2014; Sturm, 2019).

Of particular perceptual challenge to L2 learners of French is the front rounded /y/, which is assimilated as /u/ by Anglophones (Levy, 2009; Rochet, 1995) and /i/ by Brazilian Portuguese native speakers. This difficult contrast has also been reported in production studies (Inceoglu & Gnevsheva, 2020; Kocjančič Antolík, Pillot-loiseau, & Kamiyama, 2019; Ruellot, 2011). Other problematic contrasts include the pairs /ø-œ/, /e-ɛ/, and /y-ø/ as demonstrated in studies with a wide range of native speakers, including English (Gottfried, 1984), Arabic (Nawafleh & Alrabadi, 2017) and Japanese (Kamiyama & Vaissière, 2009). There is also strong evidence that the perception and production of nasal vowels is challenging for learners from a range of L1s, including American English (Inceoglu, 2016; Montagu, 2002), Australian English (Inceoglu,

2019b), Brazilian Portuguese (Berri & Pagel, 2003), Japanese and Spanish (Racine, Detey, Schwab, & Zay, 2010), Spanish (Bustamante et al., 2018) and Cantonese (Li, Yin, & Pu, 2019). Yet, the only training study so far, Inceoglu (2016), showed that six sessions of audiovisual or auditory perception training led to statistically significant improvements in both the perception and production of the three nasal vowels, compared to a control group which did not receive training.

**Ouïe: Web-Based HVPT for French**

I started developing Ouïe (https://ouie.org) —meaning *sense of hearing* in French— in 2019 with a small grant from the College of Arts and Social Sciences at the Australian National University. Ouïe is free and available to learners all over the world, and to my knowledge, it is the only (web-based) HVPT tool that focuses on French vowels. At the time of writing, Ouïe comprises the voices of six French native speakers; however, audio stimuli from additional speakers will be added over time, with the goal of reaching about 20 speakers. Ouïe can be used by learners of all proficiency level, including learners with limited knowledge of the IPA. On the homepage, users are invited to select one of two modes: familiarization or training (Figure 1).

**Figure 1**

*Ouïe's homepage directing users to choose the familiarization or training "entraînement" mode.*



Les voyelles du français sont souvent difficiles pour les apprenants. S'entrainer à bien les reconnaitre est important et les recherches en linguistique montrent que bien percevoir ces voyelles améliore la prononciation.

Le mode de familiarisation présente les voyelles du français et l'alphabet phonétique international qui est utilisé dans les dictionnaires. Ecoute les voyelles et associe-les aux symboles phonétiques aussi longtemps que nécessaire. Après la phase de familiarisation, entraine-toi à reconnaitre les voyelles en sélectionnant la voyelle que tu entends.

> Familiarisation

> Entraînement

**Familiarisation mode**

The purpose of the familiarization mode is a) to provide basic information about the International Phonetic Alphabet (IPA) and French phonetics and b) to allow users to click on IPA symbols and hear common words associated with these vowels.

By clicking on the lightbulb (see Figure 2), users access a short overview of the French vocalic system. They are taught that French vowels differ in terms of 1) frontness/backness, 2) height, 3) lip rounding, and 4) nasality:

1. French vowels can be fronted "antérieures", i.e., produced with the tongue at the front of the mouth, or back "postérieures", i.e., produced with the tongue at the back of the mouth.

2. The degree of mouth aperture varies among vowels. The closed ("fermées") vowels /i/, /y/, /u/ are produced with a small opening of the mouth and the tongue is raised. Mid-closed vowels /e/, /ø/, /o/ are produced with an opening of the mouth that is a bit bigger. The vowels /ɛ/, / ɛ̃/, /œ/, /ɔ/, /ɔ̃/ are mid-open and the mouth opens even more. Finally, the two vowels /a/ and /ɑ̃/ are open ("ouvertes") and the tongue is in a low position.
3. Lips can be unrounded, like with the vowels /i/, /e/, /ɛ/, / ɛ̃/, /a/ or rounded, like with /y/, /ø/, /œ/, /u/, /o/, /ɔ/, /ɔ̃/, /ɑ̃/. Users are also informed that there are many rounded vowels in French and learners often do not round their lips enough.
4. Vowels can be oral or nasal (the air escapes through the mouth and the nose). The three French nasal vowels are /ɔ̃/ (hyperrounded), /ɑ̃/ (rounded), and /ɛ̃/ (unrounded). Users are also informed about the fourth nasal vowel /œ̃/ only present in certain Francophone regions.

The audio stimuli used in the familiarization mode include highly frequent words that should be familiar to beginner learners of French, with three exemplar words per vowel (see list in Table 1). Both the familiarization mode and training mode focus on the ten oral and three nasal vowels present in Standard Parisian French. Excluded from the inventory are the schwa, and both the open back /ɑ/ and the fourth nasal vowel /œ̃/ which have been progressively replaced by /a/ and /ɛ̃/, respectively, in Standard French and Parisian French (Hansen, 1998; Léon & Léon, 2007).
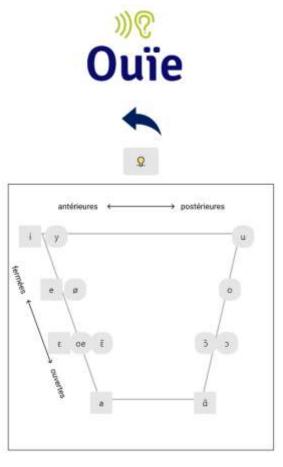
**Table 1**

*Word List Used for the Familiarization Mode*

| [i] | vite | dix | lire |
|---|---|---|---|
| [e] | nez | pré | clé |
| [ɛ] | même | être | père |
| [a] | chat | mal | froid |
| [y] | vue | mur | russe |
| [ø] | deux | peut | yeux |
| [œ] | neuf | peur | jeune |
| [u] | tout | jour | doute |
| [o] | beau | chose | gauche |
| [ɔ] | homme | pomme | forte |
| [ɔ̃] | long | donc | montre |
| [ɑ̃] | temps | ventre | grande |
| [ɛ̃] | faim | cinq | train |

**Figure 2**

*Screenshot of the familiarization mode, with oral stimuli "nez" [ne] (nose). The lightbulb at the top of the screen directs users to phonetic information about the sounds of French.*



nez

## Training mode

The training mode is currently set up to train the whole vocalic system. Enabling users to choose the vowels they want to work on is a possibility for future versions of the tool, but training the whole inventory is not deemed problematic. On the contrary, Nishi and Kewley-Port's (2007) study revealed that training 9 American English monophthongs can be more beneficial than training a sub-set of three difficult vowels.
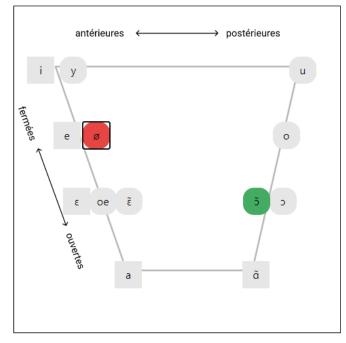
The stimuli for the training mode consist in 181 CVC, CCV, CVCC, or CCVC real words where the initial consonant is one of the following: /b-p-t-d-k-g-s-z-f-v-ʃ-ʒ-l-ʁ-m-n/. For instance, "pour" *(for)* /puʁ/, "blé" *(wheat)* /ble/, "tigre" *(tiger)* /tigʁ/, "drôle" *(funny)* /dʁol/.

In the training mode, users can currently choose to be presented with 20 or 40 items, and I plan to increase that number in future versions of the application. Users can also indicate their email addresses, but this functionality is only relevant for me as I assign homework activities to my students. At a later stage, I would like to be able to add a tracking function so users can monitor their progress and/or email their progress to their language instructor. Upon starting the training

mode, users are presented with the first audio stimuli. Again, just like in the familiarization mode, learners click on the IPA symbol of the vowel they believe they heard. If their choice is correct, the next audio stimuli is presented without any feedback. If they select the wrong IPA symbol, users receive corrective feedback. Figure 3 shows when a user incorrectly selects the vowel /ø/ instead of the nasal /ɔ̃/; the incorrect vowel is highlighted in red and the correct one appears in green. Users can also check how many remaining stimuli the session has; in Figure 3, there are 19 "tours restants" *(remaining rounds).*

**Figure 3**

*Screenshot of the training mode where a participant has selected an incorrect answer.*



Tours restants: 19.

**Pedagogical recommendations**

In line with previous HVPT research (Thomson, 2018), it is recommended that learners take part in regular short sessions over several weeks rather than one or two long sessions. Since Ouïe is currently programmed to present 20 or 40 stimuli, learners are encouraged to practice at least 40 stimuli and complement their session with either another round of 40 stimuli or a shorter round of 20. Ideally, learners should complete two or three sessions per week over a couple of weeks.

Although Ouïe was primarily designed to be used autonomously by learners of French, there is also potential to use the tool in language classrooms. Teachers can use the shorter 20-stimuli sessions to supplement their teaching of the IPA. Teaching phonetics and the IPA in the French classroom is indeed recommended and has been shown to be attractive to students (Miller, 2012).

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