

Production of English sounds by EFL learners: The case of /i/ and /ɪ/

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ABSTRACT

The present study examined the production of English /i/ and /ɪ/ by 135 native speakers (NSs) of Spanish and Catalan with different starting ages of foreign language (FL) learning and degree of exposure to the FL. Subjects (Ss) were foreign language (FL) learners in a formal learning context within the first language (L1) community. Seven English-speaking listeners were asked to identify the vowels /i/ and /ɪ/ that the Ss and a control group of 13 NSs of English produced in the words *tea* and *it*. Results showed that learners' /i/s were identified at higher frequency rates than their /ɪ/s. As in [5], learners' /ɪ/s differed significantly from NSs' /ɪ/ identification scores, and were often misidentified as /i/. Differences among age groups' rate of correct identification for /i/ and /ɪ/ did not reach significance. Nor did the effect of experience. However, an improvement in FL learners' production /ɪ/ was observed along with an increase in exposure to the FL. Overall, the findings agree with previous research on the production of English /i/ and /ɪ/ as an L2 by Spanish and Catalan NSs and extend them to a FL learning context.

1. INTRODUCTION

In L2 acquisition research, a number of studies have examined nonnatives' perception and production of English segments within the framework of the Speech Learning Model (SLM) [2,4]. This model proposes an account of the differences observed in perception and production of L2 sounds by early and late learners.

According to the SLM, age of onset of L2 learning will determine the nativeness of perception and production of target language (TL) sounds. Thus, the earlier learners start acquiring an L2, the more chance they will have to master L2 sounds in a native-like fashion. This model also predicts that varying degrees of success in nonnatives' perception and production of L2 sounds will depend upon whether learners identify L2 sounds as similar to a category in their L1 inventory or new [2,4].

The SLM further hypothesizes that as learners' experience in the L2 increases, they may be able to discern phonetic differences between L1 and new L2 sounds, whereby a phonetic category for a new L2 sound may be established. The formation of an additional phonetic category, in turn, may lead to a more native-like perception and production of L2 segments. For instance, [5] reported that experienced Spanish native speakers' productions of English /ɪ/ were identified at higher rates

than /ɪ/s produced by inexperienced Spanish subjects.

Findings of studies carried out within the SLM apply mainly to subjects who learned the L2 largely in L2 settings. Research on foreign language (FL) learners in formal learning contexts within the L1 community is more limited. Thus, little is known about what happens to learners' perception and production of FL sounds with different starting ages of FL learning and with various degrees of exposure (or experience).

The present study looked at learners of English as a FL (EFL), who had been exclusively exposed to the TL in a formal language learning context (i.e., school setting). Therefore, FL learners' production of English sounds was assessed in an attempt to determine whether the same effects of onset age of L2 learning and experience in the L2 (as characterized by the SLM) would prevail in a situation where subjects are not immersed in the L2-speaking community. More precisely, the study examined Spanish and Catalan native speakers' (NSs) production of one difficult English vowel contrast, namely /i/-/ɪ/.

Native Spanish speakers' difficulty in perceiving and producing correctly the distinction between English tense vs. lax vowels (non-existent in the Spanish vowel inventory) is well known. Thus, a great deal of research (again in L2 immersion contexts) has focused on that type of distinction, and, in particular, on the English vowel contrast /i/-/ɪ/ [3,5]. Results indicated that Spanish speakers can perceive and produce English /i/ at near-native or native-like frequency rates. However, they often fail to perceive and produce /ɪ/ in a native-like way. Mostly, subjects were found to misperceive and mispronounce /ɪ/ as its tense counterpart: /i/. Like Spanish, the vowel inventory of Catalan lacks the tense/lax vowel distinction. Research on Catalan speakers' perception and production of /i/-/ɪ/ [1] agrees with the findings for Spanish NSs.

2. METHOD

2.1. Subjects

Subjects in this study are part of a larger L2 acquisition study currently ongoing at the Department of English Philology at the University of Barcelona. In this case, a total of 135 Ss (56 male, 79 female), NSs of Spanish and/or Catalan, participated in the study. They were distributed in 8 learner groups that differed in terms of onset age of FL learning – 8, 11, 14, and 18+ years (groups A, B, C, and D, respectively) – and amount of formal exposure to the TL – 2.5, 4.5, and 7.5 years on average (exposure 1, 2, and 3, respectively). Unlike many

studies in L2 phonological research, participants were exclusively exposed to English in a formal language learning context (i.e., school setting). That is, they had not taken English courses outside school. Nor had they spent time in any English-speaking country.

As for subjects' L1, they were classified into three language groups: dominant Spanish speakers, dominant Catalan speakers, and Spanish/Catalan balanced bilinguals. It should be noted that since all Ss lived in Catalonia, they had been exposed to both Spanish and Catalan, and so they were familiar with the phonology of both languages. However, in this study, Catalan and Spanish L1 Ss were pooled into a single group, based on the observation that neither language has an /i /-i/ distinction.

Group	<i>n</i>	AOL ^a	Exp ^b	L1 ^c	Age ^d	Gender ^e
A1	17	8	2.5	C 40 S 20 B 40	10.97	6m, 11f
A2	28	8	4.5	C 21.4 S 14.3 B 64.3	12.93	14m, 14f
A3	13	8	7.5	C 23.1 S 30.8 B 46.2	16.61	6m, 7f
B1	13	11	2.5	C 8.3 S 58.3 B 33.3	13.09	8m, 5f
B2	14	11	4.5	C 7.1 S 35.7 B 57.1	14.92	6m, 8f
B3	14	11	7.5	C 28.6 S 28.6 B 42.9	18.01	5m, 9f
C1	13	14	2.5	C 33.3 S 16.7 B 50	16.14	6m, 7f
D1	23	18+	2.5	C 22.7 S 27.3 B 50	28.47	5m, 18f
NE	13				11.61	5m, 6f

Table 1. Characteristics of groups in the study.

^aOnset age of FL learning (in years); ^bExposure to FL (in years); ^cCatalan, Spanish, Both Catalan/Spanish (in %); ^dChronological age at testing (in years); ^emale, female

A control group of 13 NSs of General British English (NE) was also examined in the study. There were 5 male and 8 female speakers, with an average age of 11.61 years (range: 6 - 58 years). The characteristics of all participant groups are summarized in Table 1 above.

2.2. Speech materials

Subjects performed a series of oral tasks. For this study, only the imitation task was analyzed. The imitation or production task consisted of repeating a list of 34 English words as presented by a female NS of British English via tape recorder. Ss were asked to repeat a word immediately after hearing it. There was a three-second interval between the presentation of one word and the following one. Ss were told to proceed with the task in the event that they did not produce a word. No training was provided beforehand and they performed the task only once. The words in the production task contained English segments that are difficult for Spanish and/or Catalan speakers.

Subjects' productions were tape-recorded on school

premises. Unfortunately, this resulted in somewhat noisy recordings. To have a more homogeneous set of data, S/N was measured on all the recordings with the program Signalyze. Only those recordings with a S/N higher than 10.00 dB were included in this study (one of the reasons for unequal-size groups). Native English speakers' speech samples were also recorded under similar conditions to those of learner groups.

Out of the 34 words that every subject produced, 11 words were selected for further analysis. The words were chosen on the basis of containing the following English vowel sounds: /i, ɪ, ε, æ, ɒ, u, ʌ/. A total of 1,628 words (148 Ss x 11 words) was digitized with CoolEdit at 22.05 kHz and 16-bit resolution, and then normalized for peak amplitude.

2.3. Listeners

Seven female NSs of General Canadian English participated in the study as paid listeners. They were 26.14 years old on average (range: 21-40) and reported normal hearing. Listeners, or judges, were either undergraduate or graduate students in Linguistics at the University of Ottawa. All had taken courses in phonetics and communication disorders. The 7 judges had studied French and had lived in a community in which French is often used, although only one judge used French on a daily basis. One judge also knew Italian and American Sign Language, and another listener reported some knowledge of Japanese. As for Spanish and Catalan, none of the judges was fluent in either of the two languages. All of the 7 judges had taken Spanish courses at some point (between 2 months and 2 years). And only one judge had spent time in a Latin American Spanish-speaking country (2 months).

2.4. Procedure

The 11 words that contained English /i, ɪ, ε, æ, ɒ, u, ʌ/ were presented twice, each in different random blocks, to each judge through headphones via computer. The first presentation of words, done in 11 sessions (one session per word), involved assigning a foreign accent (FA) rating to each vowel sound on a 9-point scale of FA. The remaining 11 sessions consisted of identifying the vowels that the subjects had produced in the same words (all tokens of a single word were presented in each session). In this case, listeners had to choose among 15 possible options presented on the computer screen. In all cases, judges had to give a FA rating on the specific segments and identify the vowel that best characterized each subject's production of the sound in question. The inter-stimulus interval was 1.5 seconds, although judges could listen to an item as many times as needed.

In both parts of the task, judges were given specific instructions as well as 5 or 10 practice items (for the FA rating and vowel identification tasks, respectively) at the beginning of each session. All listeners completed a total of 22 sessions each. They did a maximum of 4 sessions per day. Each session was separated by at least a 10-minute break. Sessions belonging to different parts of the experiment never occurred on the same day. Unknown to the listeners, a random 25% of the total subjects'

productions was added once the 148 imitations had been presented. In those cases where a vowel sound was studied in two words, only one word (session) presented the extra 25% repeated productions. Thus, 14 sessions/blocks (7 for FA rating and 7 for vowel identification) contained 184 stimuli, and 8 blocks had 148 stimuli each (4 for FA rating and 4 for vowel identification). Some 26,320 FA ratings and identifications were obtained during a one-month period.

For the present study, only the vowel identifications obtained for /ɪ/ and /i/ in the words *it* and *tea* were examined. Therefore, there were 1,036 identifications for /ɪ/ (148 stimuli x 7 judges) and another 1,036 for /i/ (148 stimuli x 7 judges).

The possible response options for /i/ were “[ij] good”, “[ij] slightly distorted”, and “[ij] very distorted”, which referred to English /i/ and its diphthongization nature, as well as “[i]” (tense vowel, but not diphthongized – much more like Spanish [i]-quality vowel), “[e]”, “[eʰ]”, “[ɪ]”, “[ɛ]”, “[æ]”, “[ɑ]”, “[ɒ]”, “[ʌ]”, “[ʊ]”, “[u]”, and “[ɜ] or [ə]”. For /ɪ/, judges could choose among “[ɪ] good”, “[ɪ] slightly distorted”, and “[ɪ] very distorted”, in addition to “[i]”, “[ij]”, “[ɛ]”, “[e]”, “[eʰ]”, “[æ]”, “[ɑ]”, “[ɒ]”, “[ʌ]”, “[ʊ]”, “[u]”, and “[ɜ] or [ə]”. Good, slightly distorted, and very distorted realizations of “[ij]” and “[ɪ]” were considered correct identifications (and thus they were grouped into one response for subsequent statistical analyses), for they involved recognition of the target sound [ij] (or /i/) (tense and diphthongized) and [ɪ], in spite of its degree of distortion. The remaining vowel responses were considered misidentifications. Judges’ identifications for /ɪ/ and /i/ were analyzed by means of the statistical package SPSS 11.0 for Windows.

3. RESULTS

Mean inter-rater correlations were first calculated among the 7 judges’ vowel identifications for /i/ and those for /ɪ/. In both cases, the inter-rater agreement reached was not satisfactory enough ($r = .63$ and $r = .64$ for /i/ and /ɪ/ respectively) to justify having a single percent identification score averaged over the 7 listeners.

3.1. Production of /i/

All judges identified the control group’s /i/s in 100% of instances¹. Percent correct identifications for /i/ were often high among nonnative speaker (NNS) groups (range: 58.24% - 100%). The only exception to this finding was judge 1, who tended to identify learner groups’ /i/s at lower frequency rates (range: 30.8% - 61.5%) than the remaining judges (see Figure 1).

A Kruskal-Wallis analysis with onset age of FL learning as a factor yielded significant differences between all NNSs’ /i/ identifications and those of NSs for judges 1, 6, and 7 ($p < .05$). Among NNSs, three between-group

comparisons reached significance for judge 7, according to Mann-Whitney *U* tests: A1 – C1, A1 – D1, and B1 – D1 ($p < .05$), where late learners obtained significantly higher correct identification scores than younger starters.

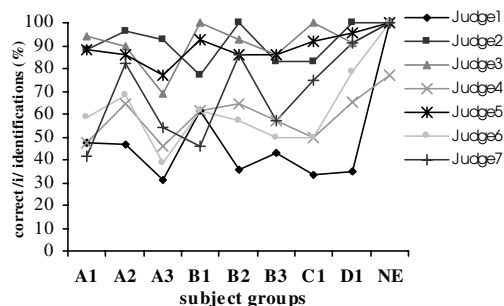


Figure 1. Percent correct identifications for /i/.

In general terms, an increase in formal instruction in the TL did not result in significant differences in correct /i/ identification scores (only the A1-A2 comparison reached significance for judge 7 ($p < .05$)).

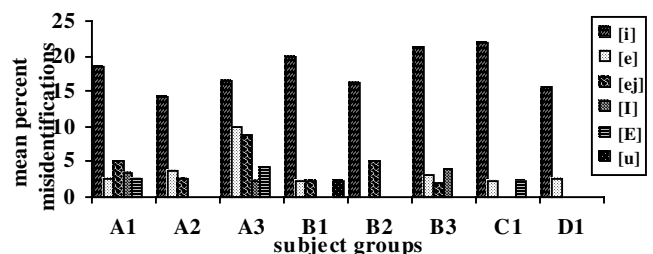


Figure 2. Misidentification patterns for /i/.

Misidentification patterns² for /i/ were calculated. By far, [i] – i.e., the pure tense vowel – was found to be the most frequent misidentification for /i/ (the English tense and diphthongized vowel). To a lesser extent, other substitutes were [eʰ], [e], and [ɛ] (see Figure 2 above).

3.2. Production of /ɪ/

Percent /ɪ/ correct identification scores were computed for the 9 subject groups. All judges identified English NSs’ /ɪ/s as intended in nearly 100% of instances, whereas NNSs’ /ɪ/s were identified as intended at lower correct identification rates (range: 38.46% - 60.20%). However, the extent to which learner groups correctly produced /ɪ/ varied greatly among the 7 listeners, as seen in Figure 3. The differences observed between all learner groups and the NE group were significant for all judges, but for judge 7, according to Kruskal-Wallis analyses with onset age of FL learning as a factor ($p < .05$). Mann-Whitney *U* tests revealed that 8- and 11-year-old starters obtained significantly lower correct identification scores than English NSs, according to judges 1, 3, 4, and 6 ($p < .05$). For judge 5, the differences were located between A2 and NE, only.

¹ Judge 4 identified three English NSs’ /i/s as /e/. As /e/ is an accepted British pronunciation in the word *tea*, judge 4’s performance was not considered problematic.

² As in [5], only misidentifications with a frequency higher than 2% are included in Figures 2 and 4. Misidentification scores are also averaged over the 7 listeners, due to space limitations.

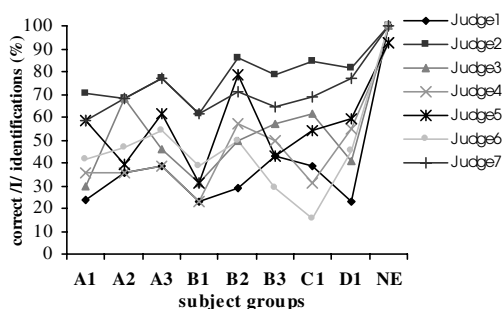


Figure 3. Percent correct identifications scores for /ɪ/.

In addition, late learners with 2.5 years of formal exposure to English (C1 and D1) were also found to produce /ɪ/ at significantly lower rates than English NSs, according to the same judges, as well as judge 4. Among learner groups' /ɪ/ productions, age of FL learning did not yield significant differences, although judges tended to rate C1's and D1 /ɪ/s at higher correct frequency rates than A1 and B1. As far as experience was concerned, NNS groups' /ɪ/ productions were identified as intended at higher rates, as Ss' experience in the FL increased. Correct identification scores were noticeably higher in Ss with 4.5 years of instruction in English (A2 and B2) than in those with 2.5 and 7.5 years of formal exposure (the latter produced /ɪ/ correctly at higher rates than Ss with 2.5 yrs of instruction). In spite of this, very few comparisons reached significance: A1 and A2 for judge 3 ($p = .029$), and B1 and B2 for judge 5 ($p = .038$).

Misidentification patterns for /ɪ/ were also obtained. As displayed in Figure 4, the most frequent substitutes for /ɪ/ were [i] and [i], and to a lesser extent [ɛ], [e], and [e].

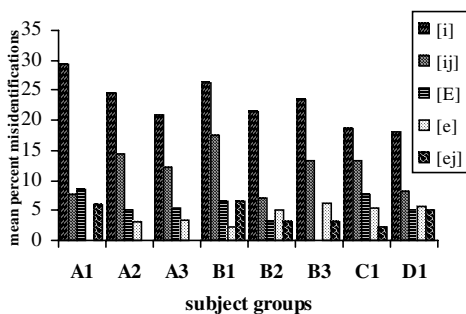


Figure 4. Misidentification patterns for /ɪ/.

4. DISCUSSION

The results obtained for Spanish and Catalan NSs' production of English /i/ and /ɪ/ showed that /i/s were identified as intended at higher frequency rates than /ɪ/s. This agrees with previous findings on Spanish L2 learners' production of the English tense-lax vowel contrast [5]. However, an unexpected result was obtained. Contrary to [3,5], NNSs' /i/ identification scores differed significantly from NSs'. Although this result could be taken as meaning that neither onset age or experience in a FL learning context had an effect, another reason might account for NNSs' somewhat lower /i/ identification scores. In the vowel identification task of this study, a specific

distinction was made between English /i/ which shows more formant movement (i.e., it is diphthongized), and the pure tense vowel [i], as would be Spanish /i/; whereas in [3,5] no such difference was examined. So, if both intended /i/ and pure tense [i] responses had been considered correct productions, /i/ identification scores would have been higher than 70% (range: 70% - 100%) in all cases. Based on this, results would then corroborate previous findings.

As in [3,5], /ɪ/ identification scores were significantly lower than /ɪ/s produced by English NSs. Likewise, NNSs mispronounced /ɪ/ as [i] and /i/.

As for onset age of FL learning, there was no clear advantage of any age group in the production of the English /i/-/ɪ/ contrast. Despite this fact, judges tended to identify older learners' /i/s and /ɪ/s (C1 and D1) at higher correct rates than younger learners (A1 and B1).

Experience was not a significant factor, either. However, an improvement in FL learners' production of /ɪ/ was observed along with an increase in exposure to the FL. This finding agrees with the prediction of the SLM that learners might be able to discern differences between L1 and L2 sounds, as experience in the TL increases.

Finally, the degree of inter-listener variability found in this study should be commented on. All judges identified NSs' /i/s and /ɪ/s. And they agreed in that no subject group produced /ɪ/ within the NS range.

To sum up, results on the production of the English /i/-/ɪ/ distinction by Spanish and Catalan learners of English as a FL agree with previous research on the production of English /i/ and /ɪ/ as an L2 by Spanish and Catalan speakers, and extend them to a FL learning context.

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