Nonsense-Syllable Sound Discrimination Ability Correlates With Second Language (L2) Proficiency

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ABSTRACT

Sound discrimination helps babies acquire the vocabulary, morphology and syntax of their first language. Researchers have also shown a relationship between sound discrimination ability and second language (L2) experience. In this research, we investigated the correlation between the sound discrimination ability of low-intermediate level, adult Japanese learners of English and various measures of their L2 proficiency, including the TOEIC (IP) test, grammar and vocabulary tests, and a motivation measure. Firstly, our results showed a strong correlation between nonsense-syllable consonant sound discrimination ability and the listening comprehension results of the TOEIC test. Secondly, a moderate correlation was found between overall sound discrimination and such L2 proficiency measures as vocabulary, grammar, and reading ability. Finally, we found that vowels were more difficult to discriminate than consonants; in particular, the vowel in a VC syllable was the most difficult to discriminate, whereas the consonant in a CV syllable was the easiest to discriminate. We interpret our results to mean that, for low-intermediate level L2 learners, a simple 10-minute sound discrimination test can serve as a reasonably reliable tool for placement of students into different class levels, especially listening and reading classes.

Keywords: sound discrimination, L2 proficiency, listening, TOEIC, English

1. INTRODUCTION

In the past, a number of studies have investigated the link between sound discrimination ability and the ability to acquire language. For example, it has been shown that the sound discrimination ability of 6-month-olds is correlated with their first language (L1) development (vocabulary, morphology, and syntax) at two years of age [10]. The ability of babies to discriminate sounds in the language around them helps them to acquire more vocabulary and to understand the subtleties of morphological affixes and grammatical rules. If this sound discrimination ability helps babies to acquire their first language, it is natural to think that it would help adult learners acquire a second language (L2).

In fact, researchers have shown that there is indeed a relationship between sound discrimination ability and L2 experience. Previous research [2, 4] has shown that longer exposure to L2 (via earlier age of acquisition and also total number of years) correlates with better L2 sound discrimination ability. Research [12] has also shown that longer exposure to L2 correlates with worse L1 sound discrimination ability in noise. In [5], although English /r/ - /l/ perception ability by Japanese was tied to L2 proficiency, the subjects were only divided into two categories: inexperienced and experienced. However, no study has investigated the correlation between L2 sound discrimination ability and L2 proficiency as measured on a continuous scale. The present study does exactly that.

L2 proficiency can be measured in a myriad of ways, including passive (receptive) and active (productive) vocabulary knowledge, syntax, listening comprehension, pronunciation, reading comprehension, writing ability, etc. There exist many standardized tests of L2 proficiency, such as the TOEFL, TOEIC, IELTS, etc. the scores from which provide recognizable benchmarks. In the present study, we examine the correlation between L2 sound discrimination ability and various L2 proficiency measures, including reading/listening TOEIC scores.

General L2 listening comprehension (not sound discrimination ability) has been studied in detail, and correlations have been found between it and other aspects of L2 proficiency. For example, receptive vocabulary knowledge significantly correlates with listening comprehension [9, 6], but grammatical knowledge does not [6]. In a state-of-the-art article on L2 listening comprehension

research, Vandergrift [11] states that sound discrimination ability needs to be investigated as a possible factor affecting L2 listening. In this study, we administer a sound discrimination test and a number of L2 proficiency tests, along with a motivation assessment, and we report the correlations between the various scores. We test the claim that a simple sound discrimination test would suffice for streaming low-intermediate level students into different proficiency levels.

2. METHOD

2.1. Subjects

Although the various tests were administered to over 300 undergraduate students, the group was eventually reduced down to 90 for a number of reasons. First, any students who were in their second year or above were eliminated so that all students had a relatively consistent degree of past exposure to English. Second, listwise deletion was employed, meaning that any student who had even one test score missing was eliminated from consideration. All 90 subjects were Japanese first-year undergraduate students (mean age = 19) at the University of Aizu, a computer science university in Japan. All subjects had undergone 6 years of English-as-a-Foreign-Language (EFL) education in the Japanese school system and were enrolled in four different sections of the same freshman Listening and Reading course. None of the subjects were enrolled in a class with the professor whose voice was used for the sound discrimination test. The mean TOEIC (IP) score for students was 345, indicating approximately a low-intermediate level of English.

2.2. Procedure

All subjects in this study took a number of tests from February 2010 to January 2011. A summary of the tests can be seen in Table 1. They are described in chronological order below.

The university-internal entrance exam that students took in order to be accepted into university was a 2-hour 100-question exam that focused on vocabulary, grammar, and reading comprehension, but did not have a listening comprehension section.

The TOEIC IP Test (TOEIC = Test of English for International Communication; IP = Institutional Program) is a standardized 2-hour test consisting of 100 Listening questions and 100 Reading questions. A score from 5 to 495 is available for each of the two sections. Pan [8: pp.81–82] describes the TOEIC as such: "The listening tasks consist of four parts: (1) choosing the best description that matches the photograph, (2) responding to one short question or statement, (3) choosing the best response to the question from a conversation, and (4) choosing the best response to the question from a short talk. The reading section includes three parts in the forms of (1) incomplete sentences, (2) error recognition or text completion, and (3) reading comprehension."

Table 1: Tests administered and mean scores

Date	Test	Perfect score	Mean (s.d.)
Feb. 2010	Entrance Exam	200	145 (16.4)
May 2010	TOEIC (IP) – total	990	345 (86.2)
May 2010	TOEIC (IP) – listening	495	195 (50.8)
May 2010	TOEIC (IP) – reading	495	150 (44.6)
Jan. 2011	Sound discrimination – total	69	44 (9.2)
Jan. 2011	Sound discrimination – vowels	26	15 (3.8)
Jan. 2011	Sound discrimination – consonants	43	29 (6.2)
Jan. 2011	Course grammar test	50	31 (5.5)
Jan. 2011	Course vocabulary test	150	106 (10.9)
Jan. 2011	Motivation test	240	158 (27.8)

The sound discrimination test consisted of 69 questions, 43 of which were about consonants (22 pre-vocalic and 21 post-vocalic), and 26 of which were about vowels (13 pre-consonantal and 13 post-consonantal). It was administered using the multiple-choice quiz format in Moodle, an open-source course management system [7]. Students used noise-cancelling headphones to listen to each item, and they were free to adjust the volume to a comfortable level. Test instructions were written in Japanese and students were given sufficient time to read them and ask questions before starting. Students were asked to listen to each item only once and random remote monitoring of students confirmed that this rule was consistently followed. A time limit of 10 minutes (for the 69 questions) was set so that students felt some pressure to continue to make progress (and not to listen to an item more than once). Each item was a nonsense

syllable – either CV or VC, with the target sound naturally occurring in English. For consistency, if a consonant (C) was the focus, the vowel used was always [a]. If a vowel (V) was the focus, the consonant used was always [p]. The 69 nonsense syllables can be seen in Table 2. All tokens were pre-recorded by the first author in a quiet environment. After listening to an item, the subject had to choose one of four answers – the one that contained the sound s/he heard. Both question order and the order of the four answer choices were randomized for every subject.

Table 2: Sixty-nine nonsense syllables used in the sound discrimination test

Type of syllable	Nonsense syllables used
Pre-[a] consonants (22)	[pa, ba, ta, da, ka, ga, tʃa, dʒa, ma, na, fa, va, θa, ða, sa, za, ʃa, ha, ɹa, ja, wa, la]
Post-[a] consonants (21)	[ap, ab, at, ad, ak, ag, atʃ, adʒ, am, an, aŋ, af, av, aθ, að, as, az, aʃ, aʒ, aɹ, al]
Pre-[p] vowels (13)	[ip, ep, ɪp, ɛp, æp, up, ʊp, op, ʌp, ɑp, aɪp, aʊp, ɔɪp]
Post-[p] vowels (13)	[pi, pe, pɪ, pɛ, pæ, pu, pʊ, po, pʌ, pɑ, paɪ, paʊ, pɔɪ]

The answers were given in the form of very common English words, with one sound underlined (see Table 3). For example, in the case of the syllable [pa] where students were instructed (in Japanese) to choose the word that contained the same consonant sound, the answer choices were "pin", "been", "fit", and "voice". Distracter answer choices were chosen to have the most frequent perceptual confusions as target sounds.

Table 3: All words that appeared as answer choices in the sound discrimination test

Question type	Answer choice words used
Pre-[a] consonant	pin, been, toss, done, kiss, guess, check, juice, miss, nice, fit, voice, thin, those, sit, zoo, shop, hit, rice, yes, wet, like
Post-[a] consonant	zip, web, sit, need, sick, log, peach, judge, him, seen, sing, wife, live, tooth, father, nice, cause, wish, pleasure, four, kill
Pre-[p] vowel	meet, take, kick, set, cat, food, took, coat, luck, hot, nice, house, coin
Post-[p] vowel	meet, take, kick, set, cat, food, took, coat, luck, hot, nice, house, coin

The course grammar and vocabulary tests were in-house multiple choice tests based on material that students had studied during one Listening and Reading course.

Finally, the motivation test was created based on Gardner's Attitude/Motivation Test Battery, or AMTB [3]. From the 104 items of the AMTB, 60 were extracted, modified to suit the Global English context, and then translated into Japanese. Subjects answered on a 4-point Likert scale from "Strongly agree" to "Strongly disagree." The reliability of this test (Cronbach alpha) was .955.

Two-tailed Pearson product-moment correlation coefficients were calculated for the sound discrimination results versus each other test. In addition, univariate ANOVA were calculated to compare consonant and vowel results, as well as syllable-type results. SPSS software was used for all statistical analyses.

3. RESULTS

Two-tailed Pearson product-moment correlation coefficients can be seen in Table 4. Using Cohen's [1] guidelines for reporting behavioural science effect sizes (small effect size, r = 0.1 – 0.23; medium, r = 0.24 – 0.36; large, r = 0.37 or larger), we can see that although we have many medium effects, the only large effect is the correlation between consonant sound discrimination and TOEIC (IP) listening. The correlation between overall sound discrimination and the total TOEIC score is almost a large effect at r = .356. Note that there was only a small correlation between subjects' motivation and their overall sound discrimination scores.

Table 4: Two-tailed Pearson product-moment correlation coefficients

Test	Overall sound discrim.	Vowel sound discrim.	Consonant sound discrim.
Entrance Exam	r = .357 **	r = .320 **	r = .337 **
TOEIC (IP) – total	r = .356 **	r = .266 *	r = .368 **
TOEIC (IP) – listening	r = .361 **	r = .271 **	r = .372 **
TOEIC (IP) – reading	r = .278 **	r = .206	r = .287 **
Course grammar test	r = .293 **	r = .330 **	r = .236 *
Course vocabulary test	r = .282 **	r = .236 *	r = .276 **
Motivation test	r = .226 *	r = .261 *	r = .177

** = significant at p<0.01; * = significant at p<0.05

Using sound discrimination scores from 314 students (not only the 90 students included in the correlation statistics), it was found that a group effect existed for vowels versus consonants (vowels were more difficult to discriminate than consonants), and that there was an interaction effect for position in the syllable. Thus, the most difficult sound to discriminate was the vowel in a VC syllable. The easiest was the consonant in a CV syllable. The other two (post-vocalic consonant and post-consonantal vowel) were equally difficult, but significantly different ($p<0.05$) from the first two.

4. DISCUSSION

Even though our correlation results do not necessarily show a causal relationship, we believe that our results have implications for the teaching of L2 listening comprehension. Since sound discrimination ability is fairly strongly correlated with L2 listening proficiency, then some emphasis on the sound segment level seems justified and indeed recommended for learners at a lower level, such as those in the present study. Of course, it is also possible that proficient L2 English students became proficient by exposing themselves to English more often (through television, radio, teaching materials, etc.) and that this extra exposure to the second language caused their sound discrimination ability to increase.

Given that vowels are significantly more poorly discriminated than consonants (57.7% correct versus 68.4% correct, from Table 1) by Japanese listeners, it is not surprising that many teachers in Japan tend to focus on vowels.

It is very interesting that we found even a moderate correlation between overall sound discrimination ability and reading proficiency. It is possible that at this lower level of proficiency, some learners are sounding out words when they read and knowledge of phonemes helps them to do so.

5. CONCLUSIONS AND FUTURE WORK

This study has shown that for low-intermediate level second language learners, there is a moderately strong correlation between their L2 sound discrimination ability and their L2 proficiency as measured by the TOEIC test. For such L2 learners, a simple 10-minute sound discrimination test can serve as a reasonably reliable tool for placement of students into different class levels (especially listening and reading classes).

One limitation of this study is that all the tests were not conducted at the same time. There is a difference of almost 1 year from the time of the entrance exam to the time of the sound discrimination test. Even the TOEIC test and the sound discrimination test were separated by 8 months. In those 8 months, each student would have been affected in a different way by the language instruction being conducted in class. In a follow-up study presently being conducted, we are administering all tests at the same time (the beginning of the first semester of university) so that our correlation statistics will have an even stronger meaning.

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