The Effects of Self-Directed Perception Training on Japanese Noun Accent by American Learners of Japanese

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This study investigated how self-directed perception training on Japanese nouns affected L1 American learners of Japanese (*N* = 48) focusing on (a) listening; (b) accent pronunciation; (c) the perceived naturalness; and (d) the correlations of perception and production. The experimental group engaged in pitch-accent listening tasks with accent-lined vocabulary lists. Both the experimental- and control groups were asked to detect the accent patterns and to pronounce 13 words with 2, 3, and 4 morae. The results showed improvement in the posttest on listening and pronunciation. A significant difference was found only for the experimental group with pronunciation of the no-line condition. Perception and production were positively correlated with each other. Further analysis suggested that pretest listening might be associated with posttest speaking but not vice-versa. Thus, integrating accent listening activities is strongly suggested.

本研究は英語が母語のアメリカ人の日本語学習者48人を対象に、各自がクラス外で行う聴覚練習が名詞のアクセント習得にどう影響するか調査した。特にa)リスニング、b)アクセントの発音、c)発音の自然さ、d)リスニングと発音の関係に焦点を置いた。実験群にはアクセントライン付きの単語リストを与え、ピッチアクセントの聞き取り練習を課した。テストでは2，3，4モーラの混じった13語のアクセントの発音とリスニングを行い、その結果、ポストテストのリスニングとアクセント発音に改善が見られた。特に実験群がアクセントラインなしで発音をした場合に有意差が見られた。本研究により聴覚力と発音の関連性が認められた。又、プリテストの聴覚力は、ポストテストの発音に影響する可能性があるが、発音の聴覚力への影響は認められなかった。この結果から、アクセントの改善に積極的にリスニング活動を取り込むことが推奨される。

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Prosodic features play a crucial role in communication; however, teaching prosody is often neglected in foreign language instruction (e.g., Abe et al., 2013; Baker, 2011; Derwing & Munro, 2005; Odisho, 2016; Tsurutani, 2011). Acquiring a proper accent is one of the key factors in carrying out successful communication, especially in the Japanese language in which the accent has lexically contrastive pitch patterns (Beckman & Pierrehumbert, 1986; Shport, 2016). However, pitch accent is a challenge for non-native speakers with the irregularities of noun accent patterns (Matsuzaki & Kawano, 2003). When accents are indicated in Japanese textbooks, Tokyo accents or standard accents are often presented by marking where a pitch fall occurs for accented words and marking high-pitched morae for unaccented words (hereafter, accent lines). Even so, effective ways of utilizing the device are not well-incorporated in lessons, and acquiring the accents is left up to the learners (Minematsu et al., 2017).

Prior literature has addressed that difficulty in L2 production (pronunciation) is embedded in perception (listening) and has reported that training in perception improved production (Derwing & Munro, 2005; Wang & Sereno, 2003). Nevertheless, auditory practice is not conducted enough in current classrooms (Odaisho, 2016). Although many positive effects of systematic prosody instruction were reported, the majority of research was in laboratory settings, and the research findings were not reflected in teaching (Derwing & Munro, 2005). Because not very many studies have been done in classroom environments, this study was conducted in real classroom settings without formal accent training, aiming to examine if listening assignments with the visual aid of accent line would improve pitch accents of American learners of Japanese. The result of this study may suggest whether incorporating accent lines and listening practice outside class could enhance learning Japanese pitch accents. The main focus of the study was to investigate whether the self-directed perception training would help learners acquire proper pitch accents of Japanese nouns; whether it would affect the learners' perception and production; and the subsequent evaluation of the naturalness of pitch accents by native speakers of Japanese. Correlations among perception, production, and naturalness were also examined.

Literature Review

Japanese Pitch Accent

Japanese pitch accent differs from English accent in phonetic alignment and function. The prominent difference is that Japanese pitch accent is lexically linked, while English accent is not (Beckman & Pierrehumbert, 1986; Shport, 2016). Japanese words consist of mora, and each mora bears either a low (L) or high (H) pitch. A sudden pitch fall from high to low makes words "accented" and no pitch fall makes words "unaccented (or flat)" (Kubozono, 2007). Distinguishing pitch accent contrasts plays an important role in communication (Nakagawa, 2002), especially on homophonic nouns such as *ka.MI* (LH) 'paper' and *KA.mi* (HL) 'god' (Note: a [.] separates each mora, and uppercase letters indicate the high pitch). The correct lexical accent makes a significant impact on the natural pitch contour of Japanese (Tanaka & Kubozono, 1999; Tsurutani, 2011). Acquiring pitch accents, however, is a challenge as Japanese noun accents are mostly arbitrarily determined (Matsuzaki & Kawano, 2004) and pitch accents inflect with compound nouns and may change within different Japanese dialects. The irregularities of the noun accent patterns make pitch accents more complex to acquire and may discourage both teachers and learners from tackling them.

Causes of Difficulties in Learning Accent

Mastering tone and pitch accent is arduous if a learner's L1 is non-tonal or not associated with pitch (Shen & Froud, 2016; Yang, 2015). L1 American-English learners of Japanese often show strong first language interference (L1 transfer) from the characteristics of English stress which is determined at a phrase level and relates to duration, intensity, or vowel quality (Beckman & Pierrehumbert, 1986). Japanese pitch accent is prominent with an abrupt decrease in F0 while the English stress accent is marked by an increase in the degree of force, which can be perceived as similar to the Japanese pitch peak by L1 English learners (Nishinuma et al., 1996). It is reported that American learners rely on F0 peak location but not F0 fall, thus unaccented patterns could be difficult (Shport, 2016). L1 English speakers tend to stress at the pitch peak of unaccented words but fail to keep the flat pitch, resulting in the unaccented nouns being pronounced as accented (e.g., *wa.TA.SHI* 'I'[LHH] vs. *wa.TA.shi* 'I' [LHL]). Also, English accent rules are applied to stress the penultimate or antepenultimate syllable in a four-mora Japanese word (as cited in Taylor, 2012, p.79). The causes of mispronunciation on morae

can be categorized into three types: (a) lack of knowledge about the target language, or L1 does not have the patterns of the L2; (b) lack in perception, that is, one has the knowledge, but, the sound cannot be recognized and thus cannot be produced; or, (c) lack in production where one is able to distinguish the sound but cannot produce (Toda, 2003, p. 71), which may account for the causes of mis-articulation of accent.

Perception and Production in Second Language

Concerning the learning process, previous theoretical and empirical studies attested that perception of the L2 surpasses production in general and that the acquisition of perception is essential for L2 learners to develop production skills (e.g., Carlet & de Souza, 2018; Isbell, 2016; Lee et al., 2020; Saito & van Poeteren, 2018). In phonetic studies, Flege's (1995) speech learning model has generally been applied to account for the connection between perception and production. In this theoretical model, a new or similar phonetic category is created when the L2 sound is different enough from the L1 phonological system, and the process of perceiving the new L2 sound enables the production to occur. Applying the model, it is assumed that L2 learners first notice new accent patterns in L2 and develop a new prosodic system, which can be encouraged by explicit, form-focused instruction and by a substantial amount of listening. Accordingly, speaking domain is activated which leads to L2 production.

Considerable numbers of perception-production studies have reported that gained knowledge through perception learning was transferred to the production (e.g., Bladlow et al., 1997; Sakai & Moorman, 2018). Saito and van Poeteren (2018) studied English /r/ in Japanese learners of English and found that perception was correlated with accuracy and intelligibility of production in both controlled and spontaneous settings. Perception-based training with explicit instruction was reported to be more effective than production-based instruction, among four different instruction modes of perception-based versus production-based training with syllabic-focused and phonemic-focused, indicating significant large gains for both segmental and suprasegmental features (Lee et al., 2020). Wang and Sereno (2003) reported perception training effects were transferred to production on tone contrasts with American learners of Mandarin, improving by 18% compared to the pretest. The training effects were generalized to new stimuli and were retained six months after training. Some studies, however, found contrasting results indicating production exceeded perception (Yang, 2012, as cited in Yang, 2015) or reported no correlation found between perception and

production (Kartushina et al., 2015). Perception training research reported improvement in perception by 10-20%, although the positive results were partially transferred or not transferred at all to production for vowels (Carlet & de Souza, 2018) and tone constrasts (Perrachoine et al., 2011). Production training alone has shown positive results on L2 production Kartushina, et al., 2015; Yang, 2015); however, production training effects were only found on production but not on perception (Cooper & Wang, 2013). More recent studies state that perception and production positively interact with each other (Nagle, 2018, as cited in Saito & Plonsky, 2019, p. 663), thus strengthening perception may simultaneously activate both perception and production domains and enhance proficiency.

Knowledge and Accent Acquisition in L2 Speech Development

As Japanese pitch accent is a lexical property, it is suggested that a phonological form, or an accent pattern, is entailed in processing and storing the mental lexicon (Beckman & Pierrehumbert, 1986). Regarding lexical accent perception, Goth and Tamaoka (2019) state that lexical-linked prosody is promoted by long-term knowledge of L2 phonological structure. According to their theory, short-term storage is stimulated by perception that requires phonological-based judgments on lexical accent: first evaluating accent correctness, then categorizing sounds according to visual representations of pitch contours. L2 lexical knowledge contributes to an understanding of the phonological patterns. Thus, it can be assumed that accuracy on form-based judgments can be the representation of acquiring an accent pattern that was drawn from long-term memory.

Based on this premise, knowledge of L2 regularities positively affects perception; accordingly distinguishing the accent patterns may enhance L2 production ability. Previous research generally supported that explicit L2 instruction had a positive effect by raising learners' awareness on specific features of L2 (Carlet & de Souza, 2018; Kennedy, et al., 2014). Instruction-awareness links have been successfully reported in L2 listening with a metacognitive approach to L2, such as monitoring comprehension and evaluating understanding. With the complexity of pitch accent, the question is whether explicit instruction can lead to improving learners' accents. Japanese accent training often involves pitch accent lines or signs indicating the location of a pitch fall (see Ayusawa, 2003; Nakagawa & Nakamura, 2010). Isomura (1996) confirmed the relationship between knowledge and perception ability by conducting a set of two tests; one examined acquired knowledge by having the participants indicate a pitch

fall without listening and the other with listening to test their perception ability. A positive correlation was found between these two tests indicating that the perception proficiency was high when the patterns were acquired. Other studies on perception and production reported that knowledge of the pitch fall could improve listening, but knowledge alone would not guarantee accurate accent pronunciation (Ayusawa, 2003; Matsuzaki & Kawano, 2003). Prior studies lead us to assume that explicit instruction of accent patterns can promote perception by making a new set of accent categories; however, further studies are necessary to examine to what extent it enhances perception and pronunciation proficiency.

Current Accent Instruction in the Classroom

Pronunciation instruction tends not to be systematically organized in language curriculum due to time constraints and/or a lack of teacher's knowledge, and teaching materials do not provide sufficient information on methodologies for prosody (Abe et al., 2013; Derwing & Munro, 2005; Ogawara & Kawano, 2002; Tsurutani, 2011). Supportive devices such as variations of visualized prosody have been reported as effective tools. Prior studies found that audio-visual feedback with a visualized intonation line was more effective than mere auditory feedback (e.g., de Bot, 1983). Learners with high production proficiency performed well only with auditory feedback, while average learners utilized auditory, visual, or sensory supports (Nakagawa & Nakamura, 2010). Thus, incorporating a multisensory (auditory, visual, tactile-kinesthetic) and multicognitive (think, associate, analyze, synthesize, etc.) approach in teaching pronunciation is suggested for maximum effectiveness in acquiring L2 pronunciation (Odisho, 2016).

To help in learning pitch accent, some Japanese language textbooks provide vocabulary lists with an accent line; however, the explanation is brief and prosody instruction is not systematically incorporated into the lessons. Other researchers are against marking accents claiming that it confuses learners, especially beginners, unless it provides a detailed explanation (Hasegawa, 1995).

The Present Study

Despite many studies investigating the patterns of inaccurate accent, the majority of studies were in laboratory settings (Derwing & Munro, 2005) or through systematic in-class instructions. Furthermore, very few studies

focused on the effects of accent teaching materials (Matsuzaki & Kawano, 2004). With these conditions taken into account, the goal of the study was to examine whether the self-directed perception training (a series of accent listening assignments) with visual material (the accented-lined vocabulary list) would help learners acquire proper pitch accents of Japanese nouns. Due to the setting of this study, only words that the participants knew the lexical meanings were tested. The focus of this study was the correctness of pitch accent but not the pitch patterns, therefore each accent pattern was not mainly discussed.

This study investigated (a) whether the training would have positive effects on perception (listening) and production (accent pronunciation or speaking) of learned vocabulary; (b) whether the evaluation of naturalness of the experimental group would improve after the treatment; (c) whether there would be any relationship between perception and production of accent. Each hypothesis is stated below.

> Hypothesis 1: The experimental group's improvement on all the posttest scores (listening tests, speaking tests, evaluation of the naturalness) from the pretest scores will be larger than the control group's improvement.
>
> Hypothesis 2: The scores of the listening tests will be correlated with those of the speaking tests.

Research Method

Participants

All students (N = 58) in Japanese language courses at a university in the South of the United States were recruited. Ten students whose first language was not English were excluded from the data analysis. The final sample of 48 native speakers of American English (30 males, and 18 females) participated in this study. Among this sample, 25 students were in the first-year course, 13 students were in the second-year course, eight students were in the third-year course, and two students were in the fourth-year course. The majority of them are between 18 and 22 years old. The student's proficiency levels varied from novice for the first-year students to intermediate for the fourth-year students. Participants had very little opportunity to listen or speak Japanese in real communication due to the small Japanese population at the location.

Procedure

With Institutional Review Board (IRB) approval, pilot studies were conducted with a different group of participants before the main study, and, as a result, some words were replaced in the main study due to the difficulty of distinguishing pitch fall (see the Measures section for more detail). The participants in each course were divided into the experimental group and the control group by alphabetical order on the class rolls. The students with odd numbers on the roll were assigned to the experimental group (n = 26) and the students with even numbers were in the control group (n = 22). The number of each group became uneven due to the exclusion of non-native English speakers. The detail of the experiment of each group is explained later in this section. To avoid any influence, the purpose of the study was hidden from the participants, and the breakdown of the groups was known only to the researcher and was kept secret from the other instructor. No accent-focused instruction was provided in class during the period of the study. The tested words were incorporated into conversation practice and were indicated by images or photos rather than written words on a PowerPoint. When errors in accents were noticed, the instructor provided corrective feedback with a correct pitch accent.

Prior to the pretest, all participants received a 30-minute explanatory session by the researcher, which introduced the pitch accent along with practices on listening and drawing accent lines. They were asked to write a straight line on the unaccented (flat) mora and a symbol ˩ for the pitch fall (e.g., ka.˩ga.ku.wa). The participants were instructed by the researcher not to share any materials with members of another group during the study. They were informed that all the materials would be shared after the research, and extra points would be given for participating in the study as compensation for work done outside of class. Pretests for listening and accent pronunciation were given to both groups one month into the semester after the participants had learned the vocabulary in the lesson. The listening tests were conducted during the class; section one was conducted first followed by section two. On a different day, the data on accent pronunciation was collected individually outside class time; the no-line condition was followed by the with-line condition. Posttests were conducted at the end of the semester in the same manner. A questionnaire was also administered after the posttests to obtain information about accent learning.

Experimental Group

The experimental group engaged in pitch-accent listening homework assignments prepared by the researcher. There were four lessons covered during the experiment, and each lesson contained an average of 22 nouns including pronouns except the last lesson which had 14 nouns. During the first week of each lesson, the experimental group was asked to write the accent pitch of all the nouns in the lesson by listening to an accompanying CD with no support materials about accent. In the second week, they received a vocabulary list with accent lines and were asked to read aloud the nouns with the accent lines and practice the accent outside the classroom. For the third week's homework, they were asked to write two words in the current or previous lessons that contained the same accent pitch as a sample word. The homework consisted of six sample words with four different accent patterns. The experimental group repeated the routines for four lessons for twelve weeks.

Control Group

The control group received neither the accent-lined vocabulary list nor did self-directed training on accent during the period of the study, apart from the explanatory session before the pretest. In place of accent assignments of the counter-part group, they received meaning-oriented vocabulary homework in which they were asked to write the meaning of nouns in each lesson.

The homework was created to provide an opportunity for them to learn the meaning of words without focusing on the accent.

Measures

Modifying a Tokyo Accent Perception Test

The listening test was created based on a Tokyo accent perception test developed by Nishinuma (1994) which consists of three listening sections, each composed of 24 words of three, four, and five morae with different accent patterns to identify pitch fall for accented nouns. Based on the first part of the Tokyo accent perception test (test on a single word accent), three tests were developed for this study: (a) a listening test that contained two sections, (b) an accent pronunciation test with two conditions: a no-line condition and with-line condition, and (c) a naturalness evaluation by native speakers of Japanese. The tests were written in Romanized Japanese and/or English to ensure the participants' understanding. At the end of the study, a questionnaire was administered to all the participants to identify how students valued accent learning.

The Tokyo accent perception test included a knowledge test to measure the learner's acquisition of accents, having them write pitch patterns without listening. Instead of the written knowledge test, this study included an accent pronunciation test with a no-line condition to evaluate if a participant could pronounce a correct accent from their implicit knowledge, or through a newly developed Japanese accent system. A total of 13 nouns including two-, three-, and four-mora nouns with four different accent patterns were selected from the first five lessons in the textbook and used for both the listening and accent pronunciation (speaking) tests. The words were presented with a subject/topic particle *wa* (e.g., *se.n.sei.wa* 'teacher,' *to.mo.da.chi.wa* 'friend,' *ku.tsu.wa* 'shoes'; see Table 1 for the tested words). The first six nouns were used for both the pretest and posttest. The other seven words were replaced at the posttest to avoid practice effects from the pretest. The measure contained more *nakadaka* (mid-high) accented words and unaccented (flat) words than other pitch patterns for two reasons (a) the complexity of acquiring these two patterns was reported in previous studies; (b) the skewed distribution of Japanese accent pitch. According to Kubozono's (2008) database, the distribution of Japanese accent is heavily skewed to the unaccented and antepenultimate; 71% of native Japanese nouns (N = 2,220) and 51% of Sino-Japanese (SJ) nouns (N = 4,939) are unaccented, and, among accented words, 59% of native Japanese nouns and 95% of SJ words are antepenultimate.

Listening Test: Section-1 and Section-2

In section one of the listening test, each stimulus was pronounced by a native speaker of Tokyo accent Japanese and recorded with a natural speed, and the participants listened to each word twice and marked the pitch fall or wrote straight lines for unaccented words. Written lines were analyzed and designated as correct or incorrect by the researcher. Correctness was determined by the locations of the pitch fall as well as distinguishing unaccented words. Section two was developed to test whether the participants could distinguish correct accents from incorrect ones. Previous studies reported that words with an accent at the first mora were easy for American learners (Ayusawa, 2003; Isomura, 1996; Nishinuma et al., 1996). For two mora words, it was assumed that the first mora accented nouns (*I.ma.wa*, *U.mi.wa*) would be scored high, whereas the unaccented word (*ko.RE.WA*.) and Odaka accent two-mora nouns (*ku.TSU.wa*) would be scored low. The incorrect accents were made to evaluate if American learners were able to identify unaccented (flat) accents when they were

Table 1
Nouns Used in the Pretests and the Posttests

No. of mora/ Accent patterns	2 morae	3 morae	4 or more morae
heiban 'flat'	***ko.re.wa*** LHH	***wa.ta.shi.wa*** LHHH	*to.m.da.chi.wa* LHHHH
(unaccented)	'this'	'I'	'friend'
		re.ki.shi.wa LHHH 'history'	
Atamadaka	*i.ma.wa* HLL	***go.ze.n.wa*** HLLL	
(head-high)	'now'	'a.m.'	
		ka.ga.ku.wa HLLL 'science'	
nakadaka		***ni.ho.n.wa*** LHLL	***se.n.sei.wa*** LHHLL
(mid-high)		'Japan'	'teacher'
			be.n.go.shi.wa LHHLL
			'lawyer'
			*da.i.ga.ku.sei.w*a LHHLLLL
			'college student'
odaka	***ku.tsu.wa*** LHL 'shoes'		*i.mō.to.wa* LHHHL
(tail-high)			'sister'

Note. wa is a nominative particle.
In the posttests, the above not bolded words were replaced with the following nouns:
2 morae: u.mi.wa HLL, 'sea' (atamadaka), he.ya.wa LHL 'room' (odaka),
3 morae: ki.nō.wa LHLL 'yesterday' (nakadaka); go.ha.n.wa HLLL 'meal' (atamadaka), ko.do.mo.wa LHHH, 'child'(heiban/unaccented), 4 morae: shu.ku.da.i.wa LHHHH 'homework' (heiban/unaccented), ta.be.mo.no.wa LHHLL 'food' (nakadaka).

pronounced incorrectly with the first mora as high pitch (*KO.re.wa* and *KU.tsu.wa)*. Some of the longer mora words were also pronounced with high-pitch on the first mora (e.g., *DA.i.ga.ku.sei.wa, SE.n.sei.wa*, *SHU.ku.da.i.wa*). Regarding unaccented nouns, it is reported that American learners rely on F0 peak location but not F0 fall, thus unaccented patterns can be difficult (Shport, 2016). Considering the tendency, the second mora (F0 peak) was pronounced with high pitch in the words below (*wa.TA.shi.wa, ko.DO.mo.wa*, *to.MO.da.chi wa*) instead of the correct unaccented pattern (e.g., *wa.TA.SHI. WA*). The listening section two was conducted after section one. The same 13 nouns were pronounced with a correct accent and an incorrect accent, repeated twice. The participants chose which version they perceived as the correct one. Therefore the score ranges from 0 to 13 for both tests.

Accent Pronunciation (Speaking) Test: No-line Condition and With-line Condition

The speaking test was conducted individually on a different day from the listening test. The participants were given two cards with the same set of 13 words in two conditions: the no-line condition and the with-line condition. First, they were asked to pronounce the words with the no-line; then, they pronounced the same set of words with accent lines. For both conditions, participants' utterances were recorded and evaluated by three native speakers of Japanese who were trained to be Japanese language instructors. Two of them were from Tokyo, and one was from another region but spent a couple of years in Tokyo before coming to the U.S. Each word was judged for the correctness of the accent. When the judges disagreed, though rare, tended to occur with Nakadaka accent, they listened to the recordings to reevaluate the correctness by distinguishing the placement of pitch fall.

Evaluation of the Naturalness

Three native Japanese speakers, based on their Tokyo accent, assessed the naturalness of the accents. After listening to each recording, they gave scores on the naturalness of accents on a Likert scale from 1 (very unnatural) to 5 (very natural). They were instructed to focus on the speaker's accent, not pronunciation, loudness, or length of the sounds. An intra-class correlation (ICC) coefficient was computed on naturalness evaluation between three raters separately for each condition. ICC showed a high degree of reliability; ICC = .92 for the pretest no-line condition, ICC = .92 for the pretest with-line condition, ICC = .91 for the posttest no-line condition, and ICC = .96 for the posttest with-line condition.

Results

Descriptive Statistics

Table 2 shows the averages of correct answers by each word for the listening tests and accent pronunciation (speaking) tests. This highlights that the test includes a variety of words from easy to difficult words.

Table 2

Averages of Correct Answers by Each Word at the Posttest: Listening Tests and Speaking Tests

	Listening Section-1		Listening Section-2		Speaking No line		Speaking With line	
	Exp	Cont	Exp	Cont	Exp	Cont	Exp	Cont
Words	Percentage		Percentage		Percentage		Percentage	
kore wa	96	100	96	91	73	59	69	64
watashi wa	100	91	92	82	54	64	65	64
gozen wa	46	36	100	91	65	77	85	91
sensei wa	54	41	73	91	58	36	58	59
nihon wa	42	36	77	59	46	50	62	82
kutsu wa	15	27	58	68	8	0	15	14
kodomo wa	85	82	92	96	54	46	62	59
shukudai wa	65	59	89	82	39	23	54	55
gohan wa	19	27	92	82	58	77	89	77
umi wa	31	36	89	91	65	82	89	77
kinō wa	85	73	65	86	54	59	58	64
tabemono wa	31	55	81	82	58	82	89	91
heya wa	15	23	42	64	8	23	4	23

Note. Exp=experimental group; Cont= control group.

A chi-square test was performed with Bonferroni correction on the percentage of the correct answers of the listening and speaking tests on each word between the experimental and the control conditions. None of the words showed significant difference. For the difficulty of each word, it

revealed that two-mora Odaka accent words (e.g. *ku.TSU.wa, he.YA.wa*) were challenging for American learners of Japanese, which corresponds to the previous studies reporting that the first mora in two-mora nouns tends to be pronounced with high-pitch (Isomura, 1996; Ayusawa, 2003). However, the level of word difficulty did not affect the results of the experimental manipulation. Therefore, the following analyses were performed on the mean scores of all words.

Listening Test Section-1: Writing Accent Lines

The first hypothesis was to see whether the experimental group would improve more than the control group at the posttest on all the tests. A 2 (group: experimental group vs. control group) X 2 (time: pretest vs. posttest) mixed-model ANOVA was performed to detect the pitch patterns. Descriptive statistics of the listening test are shown in Table 3. As expected, there was a significant improvement from the pretest to the posttest, $F(1, 47) = 4.06$, $p = .050$, $\eta^2 = .080$ (for the pretest, $M = 6.41$, $SD = 1.96$; for the posttest, $M = 6.98$, $SD = 2.26$). However, no difference was found between groups, $F(1, 47) = 0.03$, $p = .875$, $\eta^2 = .001$. The interaction was also not significant, $F(1, 47) = 0.02$, $p = .902$, $\eta^2 = .000$. This indicates that posttest scores improved equally in both groups; therefore, the first hypothesis was not supported.

Table 3

Descriptive Statistics for Listening Pretest and Posttest for Section 1 and Section 2

	Group 1		Group 2	
	Section 1	Section 2	Section 1	Section 2
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Pretest	6.38 (1.92)	10.65 (1.72)	6.43 (2.04)	10.61 (1.99)
Posttest	6.92 (1.99)	10.46 (1.39)	7.04 (2.60)	10.52 (1.70)

Note. Group 1 = experimental group; Group 2 = control group.
Section 1 = writing accent lines; Section 2 = choosing correct accents.

Listening Test Section-2: Choosing Correct Accents

To examine whether the experimental group performed differently from the control group in choosing correct accents, a 2 (group: experimental group vs. control group) X 2 (time: pretest vs. posttest) mixed-model ANOVA

was conducted. Against the predictions, no main effects and interaction were significant, *ps* > .616 (see Table 3). Thus, hypothesis 1 was not supported for the listening test section 2 as well.

Accent Pronunciation (Speaking) Test: With-line Condition and No-line Condition

To examine the effects of the accent line, a 2 (group: experimental vs. control) X 2 (time: pretest vs. posttest) X 2 (line type: no-line vs. with-line) mixed model ANOVA was performed on the speaking test score, as judged by native speakers. Even though it was trending towards significance, the main effect of time was not significant showing the posttest score (M = 7.40 , SD = 1.79) was slightly higher than the pretest score (M = 6.97, SD = 1.74), $F(1,47) = 3.00$, $p = .088$, $\eta^2 = .062$. More importantly, a significant main effect of the line type was found $F(1,47) = 69.44$, $p < .001$, $\eta^2 = .602$. The score was higher with the accent line (M = 8.06 , SD = 1.90) than without the line (M = 6.31 , SD = 1.51). The main effect of the group was not significant, $F(1,47) = 1.30$, $p = .260$, $\eta^2 = .028$. The main effects of time and line type were qualified by a two-way interaction of time and line, $F(1,47) = 6.88$, $p = .012$, $\eta^2 = .130$ (see Table 4 for descriptive statistics). Post-hoc tests with the Sidak correction showed that the no-line condition improved tremendously from the pretest to the posttest, $p = .001$ while the with-line condition did not show an improvement, $p = .772$.

Table 4

Descriptive Statistics for Speaking Pretest and Posttest for No-line and With-line Condition

	Group 1		Group 2	
	No-line	With-line	No-line	With-line
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Pretest	5.35 (1.6)	7.85 (2.36)	6.41 (1.99)	8.41 (2.04)
Posttest	6.65 (1.62)	7.96 (2.29)	6.95 (1.76)	8.09 (2.31)

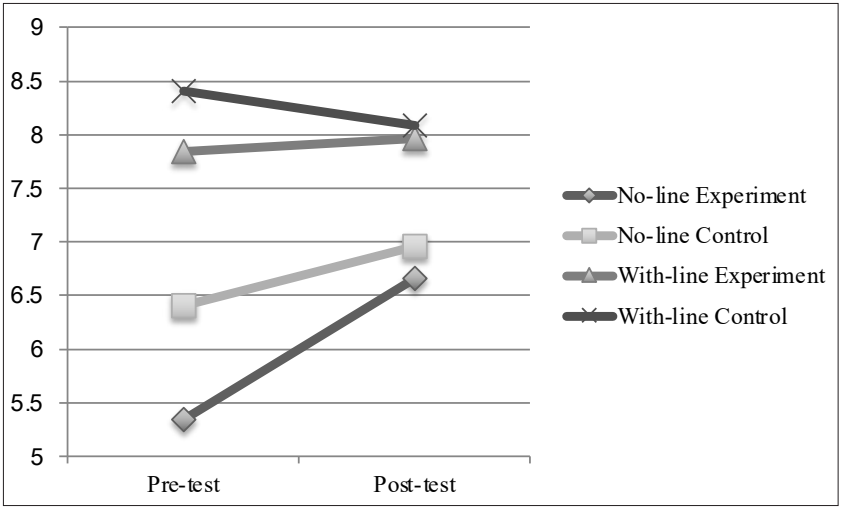
Note. Group1=experimental group; Group 2=control group.
No-line=the no-line condition; With-line=the with-line condition.

The means of the experimental group in the no-line condition displayed a large difference between the pretest and the posttest, compared to that of

the control group. One of the aims of the study was to examine a difference between the experimental and control conditions, and thus a post-hoc analysis was done for each condition although a three-way interaction did not show a significant difference (see Figure 1).

Figure 1

Scores of Accent Pronunciation (Speaking) Tests of Each Group



As shown in the graph, the experimental group in the no-line condition showed a sizeable improvement from the pretest to the posttest, with a significant difference only for the experimental group, $p = .001$, but not for the control group, $p = .162$. It shows that the first hypothesis regarding the accent pronunciation was supported for the no-line condition.

Evaluation of the Naturalness

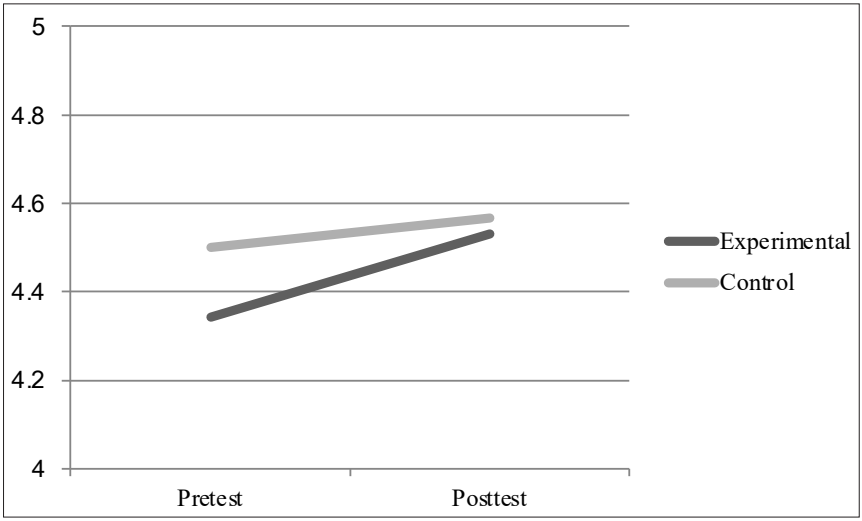
In determining how native speakers of Japanese judged the accents produced by the participants, a 2 (group: experimental vs. control) X 2 (time: pretest vs. posttest) X 2 (line type: no-line vs. with-line) mixed-model ANOVA was performed on the naturalness of the accent. The result showed that all the main effects and interactions were significant, although the means were higher for the control group on both the pretest and the posttest. The main

effect of time was significant at $F(1,46) = 33.77$, $p < .001$, $\eta^2 = .423$ ($M_{pretest} = 4.55$, $SD_{pretest} = 0.14$; $M_{postest} = 4.41$, $SD_{posttest} = 0.23$). The line's effect (no-line vs. with-line) was also significant at $F(1,46) = 59.44$, $p < .001$, $\eta^2 = .564$ ($M_{no\text{-}line} = 4.42$, $SD_{no\text{-}line} = 0.17$; $M_{with\text{-}line} = 4.54$, $SD_{with\text{-}line} = 0.19$). A significant difference was also found between groups $F(1,46) = 4.11$, $p = .048$, $\eta^2 = .082$ ($M_{experimental} = 4.44$, $SD_{experimental} = 0.18$; $M_{control} = 4.53$, $SD_{control} = 0.14$).

The results indicate that a two-way interaction of group and time was also significant at $F(1,46) = 8.05$, $p = .007$, $\eta^2 = .149$. To assess in further detail, a post-hoc test with the Sidak correction was performed, and each group had significant differences between the pretest and the posttest: the experimental group, $p < .001$, and the control group, $p = .049$. The mean difference of the experimental group was larger between the pretest and the posttest (M difference = 0.19) than the control group (M difference = 0.07) (see Figure 2), thus, the first hypothesis was supported for the evaluation of naturalness. It may suggest that the training contributed to greater improvement in the experimental group.

Figure 2

Means of Naturalness of Pretest and Posttest



Correlations: Relationship between Listening and Accent Pronunciation

Hypothesis two was made to investigate whether perception, or distinguishing the pitch patterns, would be related to production, or proper accent pronunciation. To test how perception affected production, Pearson correlation coefficients were computed to assess the relationship between listening tests and accent pronunciation tests. Positive correlations were found on the pretest and the posttest, except on the pretest accent pronunciation and the posttest listening (see Table 5 and Table 6).

Table 5

Descriptive Statistics of Speaking and Naturalness

	Pretest				Posttest			
	Group1		Group2		Group1		Group2	
	No-Line	With-Line	No-Line	With-Line	No-Line	With-Line	No-Line	With-Line
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
Speaking	5.35 (1.6)	7.85 (2.36)	6.41 (1.99)	8.41 (2.04)	6.65 (1.62)	7.96 (2.29)	6.95 (1.76)	8.09 (2.31)
Naturalness	4.28 (0.25)	4.41 (0.27)	4.43 (0.19)	4.57 (0.18)	4.47 (0.13)	4.59 (0.18)	4.52 (0.14)	4.62 (0.18)

Note. Group1=experimental group; Group 2=control group.
No-line=the no-line condition; With-line=the with-line condition.

Table 6

Correlation: Listening, Accent Pronunciation, and Naturalness for Both Groups

	2	3	4	5	6
1. Listening Pretest	.59**	.32*	.50**	.35*	.49**
2. Listening Posttest	–	.21	.48**	.12	.45**
3. Speaking Pretest		–	.57**	.86**	.61**
4. Speaking Posttest			–	.64**	.97**
5. Naturalness Pretest				–	.70**
6. Naturalness Posttest					–

Note. Listening tests include both sections 1 and 2.
Accent pronunciation (speaking) and naturalness include both no-line condition and with-line condition.
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

These results showed the listening pretest correlated positively with all variables; *rs* > *.32* , *ps* < .028., which confirmed the second hypothesis. The speaking pretest correlated positively with the speaking posttest; $r = .57$, $p < .001$. However, no correlation was found between the speaking pretest and the listening posttest; $r = .21$, $p = .147$. The results suggested the listening pretest might relate to accent pronunciation but the speaking pretest might have no relation to listening. The results implied that listening ability on accents might lead to high scores on both perception and production while speaking ability might not aid perception.

Discussion

Perceptual Training, Accent Pronunciation, and the Naturalness

The main purpose of this study was to examine whether the self-directed perception training with accent-lined vocabulary lists would improve perception and production of pitch accents. Although both groups improved their perception overall, the treatment effect was not found in the listening sections. Looking at each section, both groups outperformed at the posttest in section one (writing accent lines; $M = 6.98$), but no significant improvement was found for section two (choosing correct accents; $M = 10.49$). The result suggests that the participants were able to distinguish what was correct or incorrect; however, detecting an exact location of pitch fall was a much more intricate task. Non-significant results of section two could be due to a ceiling effect because the mean score was 10.49 out of 13.

In general, however, the accent pronunciation test showed that the accent line was a useful device to produce more accurate pronunciation as both groups outperformed in the with-line conditions. In the no-line condition, a significant difference was found only for the experimental group, which can be interpreted to mean that this group learned pitch patterns through the treatment, leading them to acquire and produce more accurate pitch accents. In contrast, the with-line condition did not improve much in the posttest, which might be just a matter of course that participants could produce accurate accents at both tests if they knew how to read the visualized pitch accents with lines. From the result, it can be inferred that the accent line itself will guide learners to produce more accurate accent without training, but adding perception training will strengthen their proper accent pronunciation.

As for naturalness, the results showed that both groups scored higher on the posttest, but the mean difference of the experimental group was larger, which indicates that the experimental group improved their accent considerably. Furthermore, speaking at the pre- and posttest showed strong correlations with naturalness, which indicated the accuracy of the pitch attributes to the naturalness of accent, confirming previous studies (e.g., Tsurutani, 2011) that implied inaccurate accent could cause unnaturalness in their production. It can be more theoretically explained by Saito and Plonsky (2019) that specific suprasegmental instructions can improve global L2 pronunciation proficiency. It was reported that the phonological qualities attributed to human ratings of the global L2 pronunciation proficiency (i.e., comprehensibility, accentedness, perceived fluency). Improvement in naturalness might be the result of improving one or more qualities of L2 pronunciation proficiency.

Relationship Between Perception and Production of Accent

The listening pretest indicated a strong correlation with production and naturalness at the posttests. The result of the correlation leads us to assume that a word will be pronounced properly if one can listen to the accent. Interestingly, positive correlations were not found between the speaking pretest and the listening posttest. In other words, the ability to pronounce accent does not guarantee high listening ability later, whereas the listening ability could be related to the ability to pronounce accurately in a future task. Accordingly, prioritizing listening training in instruction is indeed effective in enhancing L2 pronunciation proficiency.

Did learners improve their pitch accent because of the perception training or from a different factor? A possible cause is the positive effects of accent research itself where the participants might become more attentive to their accents by being involved in accent research. Kennedy et al. (2014) note that learners' reflection and pronunciation awareness have a strong link, which enables learners to evaluate what affects their understanding of pronunciation and their production (p. 92). It calls for additional work to investigate learners' awareness of pitch accent as well as their motivation to improve prosody.

Pedagogical Implications

Incorporating perception and production training with explicit instruction can be effective and constructive, as both perception and production may correlate with relate each other (Lee et al., 2020). Recasting or speaking practices provide opportunities for learners to test their knowledge and to produce sounds, which may enhance procedural knowledge and lead to automatization. As Saito and Plonsky (2019) noted, "what is crucial for teachers and learners and what instructed SLA research is mainly concerned with—the extent to which L2 learners have automatized controlled knowledge resulting from instruction" (p. 667).

Although corrective feedback generally improves L2 learning, Saito and Wu's study (2014) suggested that form-focused instruction, without corrective feedback, might be a sufficient initial prompt to stimulate learners' attention from meaning to sound learning and may generate access to a new sound category in L2 (p. 674). Due to the limited time in class, L2 speech development can be promoted with a combination of explicit instruction in class, with consciousness-raising activities and autonomous activities outside the classroom. Carlet and de Souza (2018) suggested

that these outside activities could include L1-L2 comparison tasks and a phonological self-awareness questionnaire to increase learners' awareness about phonology which would be effective in motivating L2 pronunciation learning.

It was reported that pronunciation strategies affected comprehensibility while language aptitude correlated to pronunciation accuracy (Smemoe & Haslam, 2013); thus, a combination of strategies and consciousness-raising activities, which enhance accuracy, may magnify learning effects. A self-monitoring strategy for acquiring pronunciation creates positive effects such as building a standard of accurate pronunciation, monitoring one's own output, and practicing independently (Ogawara, 1997). Intonation instruction raises both learners' awareness and confidence, leading them to tackle further training; learners would perceive the necessary effort as valuable and worthwhile (Ramirez Verdugo, 2006, as cited in Kennedy et al., 2014).

Creating systematic instruction is essential to equip teachers to tackle accents with confidence (Hirano, 2014). Various methods and devices of accent learning have been introduced, such as phrasing by Nakagawa and Nakamura (2010) and shadowing technique by Toda et al. (2012). Recent widespread technology also enables us to use advanced digital resources. A computer-assisted language learning has shown pedagogical effectiveness; it can provide feedback based on an automatic analysis of the learner's utterance (e.g., Short et al., 2013). A Japanese accent database, On-line Japanese Accent Dictionary, provides various useful tools and functions: visual aids for accent patterns (high/low) for nouns, adjectives and verbs; intonation patterns of sentences, and speech synthesis; and text-to-speech technologies which generate spoken sounds and sentences from written texts (Minematsu et al., 2017). These technology-based tools are beneficial for both language educators and learners but, most importantly, help learners to be autonomous and self-directed. Considering individual variables such as language aptitude, learning goals, and preferred learning styles, various instructional methods should be introduced so that each learner can optimize their learning, and, important to this study, to improve accent pronunciation.

Limitations and Future Directions

Although careful instructions were given before and during the study, because of the classroom-based nature of this study, some conditions were not fully controlled. Future studies should thus control the usage of

accented-line vocabulary lists and listening homework, and interaction between two groups. Second, the number of tested items was fairly small, and the selection of the tested words might not be representative. The choices of words were limited due to the data collection involving beginner-level participants, and under constrain, voiceless vowels and special mora were included. The averages of these words were relatively low; however, there are no significant differences between the experimental group and the control group. Thus, it can be assumed that the word did not affect the data analysis. Another issue was the number of mora, which was not equal in the pretest and the posttest. The posttest of this study includes more 2 and 3 mora words than the pretest. Although the results do not show the effects of the different numbers of mora words, the same number of different mora words should be included in each accent pattern. Future studies should contain more items with a careful selection of words to enhance the validity and to research the acquisition of pitch patterns further. Third, the results would be more reliable if each section of the listening test was conducted on a different day to avoid a possible practice effect. However, the test sequence equally affected both experimental and control groups, thus the test sequence might not have influenced the interpretation of the experimental effect. Fourth, the study was only conducted with specific and controlled tasks at the single-word level. As Saito and Plonsky (2019) pointed out, more varieties, such as both specific and global constructs and controlled and spontaneous tasks in different speaking contexts, should be incorporated to evaluate the effectiveness of instruction. The assessment for future studies should be conducted with multiple measures including both subjective and objective measures, or acoustic. Lastly, although this study only tested learned words because the focus was on acquiring correct accents of lexically known words, future studies should include novel items to evaluate if the positive effects will be transferred to new stimuli. Additionally, a delayed posttest should be performed in future studies so that the result can be generalized as a possible long-term effect.

Conclusion

This study provides evidence for the positive effects of perception training. Furthermore, the results indicated that the perception training and the presence of accent lines or visual devices were indeed effective. Thus, these are suggested to be incorporated in prosody instructions from the start. Incorporating prosody instruction from the beginner courses may optimize L2 learning as the perception-production link is relatively stronger than in

the later phrase (Saito & Van Poeteren, 2018). Further studies are necessary to improve the usage of visual devices and the implementation of perception training to reap its benefits. The timing as well as the quality and quantity of accent instruction should be taken into consideration when applying it to classroom instruction.

Notes

1. One female participant in the control group participated only in the listening test due to illness, thus the data of the accent pronunciation test did not include this participant.

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