Poznań Studies in Contemporary Linguistics 47(1), 2011, pp. 146–158

doi: 10.2478/psicl-2011-0012

VARIABILITY AND SYSTEMATICITY IN INDIVIDUAL LEARNERS' JAPANESE LEXICAL ACCENT

BECKY TAYLOR
Nagoya University
rebecca.taylor@e.mbox.nagoya-u.ac.jp

ABSTRACT

This paper presents novel experimental production data to establish generalisations about the accent patterns produced by individual English learners of Japanese. 21 British English learners read aloud tokens varying in word type (two- and three-mora nouns and verbs) and speech environment (in isolation and preceding a function word) and native speakers identified the accent types produced. The results show both considerable between-learner variability and within-learner systematicity. The accent types produced are seen to vary with word type and speech environment, but both how they vary and which accent types are produced are shown to be individual to the learner. It is suggested that this combination of between-learner variability and within-learner systematicity may be the result of a difficulty in phonologically encoding Japanese lexical accent.

KEYWORDS: Lexical accent; production; British English learners; between-learner variability; within-learner systematicity.

1. Introduction

Japanese has lexical accent which is realised as a pitch fall; words have at most one accent and can be unaccented. In this paper, the presence or absence of an accent and its position will be referred to as the "accent type" of a word.

Research into the production of Japanese accent patterns by English learners of Japanese has shown that the learners tend to produce words unaccented, or to place an accent either two or three mora from the end of a word (Horiguchi 1973; Toki 1980; Yoshimitsu 1981; Yamada 1994; Kuno 1998). These are all common accent types in Standard Japanese (Sugito and Tahara 1989). However,

examples of learners producing words with accent types that differ from Standard Japanese (SJ) have been widely reported in the literature. These include accenting words that are unaccented in SJ, producing words with no accent when they are accented in SJ, and differences in accent position.

Heavy syllables in both English and Japanese tend to be accented[1] (Kubozono 2006), and there is some evidence for a relationship between syllable structure and accent placement in the speech of English learners of Japanese (Horiguchi 1973). However, some learners have, in contrast, been reported to be more likely to produce words with no accent when they include a heavy syllable (Kuno 1998). This is not the only variation between learners reported in the literature: Kuno (1998) also shows that the most frequently produced accent type varies between learners, and Yoshimitsu (1981), in analysing three learners' errors, reports that two learners accent unaccented SJ words and one learner deaccents accented SJ words.

Other than a probable influence of syllable structure, it is not known which types of words are produced with which accent types. Accent types have been reported to vary when repeated in read speech (Toki 1980) and natural speech (Yamada 1994). Toki (1980) attributes this to the effect of speech environment, but no study has been carried out to determine which types of speech environment induce which types of accent. Similarly, although specific instances of differences between the learners' productions and SJ accent type have been reported, no study has been carried out to determine what is and isn't acquired from SJ.

In SJ, for a noun with n syllables, there are n+1 possibilities for accent location: it may be accented on any of the mora or it may be unaccented (Kindaichi and Akinaga 2001: Appendix, p.10). Final accent is not realised in isolation, but is realised when a function word (such as a particle or copula) follows the finally-accented word. Initially-accented, medially-accented and unaccented words remain so when followed by a function word.[2] In contrast to nouns, verbs in SJ are, as a rule, either accented two mora from the end of the word or unaccented (Kindaichi and Akinaga, 2001: Appendix, p.49). When followed by a function word, accented verbs remain accented, while unaccented verbs either remain unaccented or take an accent on the final mora, depending on the spe-

[1] At least for nouns in the case of Japanese; Kubozono (2006) only analyses nouns and a relation between accent placement and syllable weight does not seem to have been reported elsewhere.

[2] There are some function words that change the accent type of the noun they follow but they are exceptions to the general rule and will not be dealt with in this paper. For examples, see Kindaichi and Akinaga (2001: Appendix, pp.72–73).

cific function word (Kindaichi and Akinaga 2001: Appendix, pp.74–75). In this way, the accent type of a word tells us whether and where it will be accented in production, both in isolation and followed by a function word.

The aim of the current study is to determine, for individual English learners of Japanese, which accent types two and three mora nouns and verbs are produced with in two speech environments: in isolation and preceding a function word. The analysis focuses on the following points: how much and in what way do the learners differ? How does word type (part of speech, number of mora) and speech environment (the presence/absence of a function word) affect accent type? What do the learners acquire from SJ? Only words with light syllables are included in order to avoid the effect of heavy syllables on accent placement.

2. Procedure

21 British English (BE) learners of Japanese took part in a production study. Two groups of learners were studied, 13 learners with *less Japanese experience* (less than 450 hours of classroom time and between zero and three months in Japan), and eight learners with *more Japanese experience* (at least 650 hours of classroom time and at least ten months in Japan). All are self-reported speakers of Standard Southern British English. The BE learners of Japanese read aloud, in pseudo-randomized order, tokens of eight different *stimulus types*. The stimulus types differed in word type – number of mora of the target word (two or three) and part of speech (noun or verb) – and also in speech environment (target word in isolation or preceding a function word).

The eight stimulus types are shown in Table 1, with examples, approximate English translations, and SJ accent types. For nouns, the function word used is the copula *da*. For verbs, the function words used are the particles *hodo* 'as far as' and *node* 'because'. Two different function words are used with verbs since whether an unaccented verb is produced unaccented or with final accent depends on the type of function word it precedes; unaccented verbs are unaccented before *hodo* and accented on the final mora before *node*.

The examples of each stimulus type in Table 1 are arranged in columns according to SJ accent type, as shown at the top of the table. This is the accent type *as realised in production* according to SJ. Since final accent is not realised in isolation, it is categorised as "SJ unaccented". Similarly, since the accent type of an unaccented verb depends on the function word it precedes, unaccented verbs followed by *hodo* are categorised as "SJ unaccented" but unaccented words followed by *node* are categorised as "SJ final". In the examples given,

Table 1. The eight stimulus types with examples, English translations and SJ accent types.

Stimulus type	SJ initial	SJ medial	SJ final	SJ unaccented
[2N] (2 mora isolated nouns)	CHIzu 'map'			hako 'box' heYA* 'room'
[3N] (3 mora isolated nouns)	DEguchi 'exit'	aNAta 'you'		hidari 'left' hiruMA* 'daytime'
[2N+f.w.] (2 mora nouns before function word)	CHIzu+da 'It's a map'		heYA+da 'It's a room'	hako+da 'It's a box'
[3N+f.w.] (3 mora nouns before function word)	DEguchi+da 'It's an exit'	aNAta+da 'It's you'	hiruMA+da 'It's daytime'	hidari+da 'It's left'
[2V] (2 mora isolated verbs)	MIru 'look'			iku 'go'
[3V] (3 mora isolated verbs)		aRUku 'walk'		asobu 'play'
[2V+f.w.] (2 mora verbs before function word)	MIru+node 'Because I see' MIru+hodo 'As far as I see'		iKU+node 'Because I go'	iku+hodo 'As far as I go'
[3V+f.w.] (3 mora verbs before function word)		aRUku+node 'Because I walk' aRUku+hodo 'As far as I walk'	asoBU+node 'Because I play'	asobu+hodo 'As far as I play'

* Final accent not realised in isolation

accented syllables are capitalised. Unaccented tokens are shown all in lowercase; however, the capitalisation of the final mora of finally-accented tokens, which is not realised in isolation, has been retained for clarity.

In order to avoid the influence of syllable structure, the stimuli are chosen not only to contain no heavy syllables, but also to contain no high vowels between voiceless consonants, as these have a tendency to be devoiced in Japanese and may therefore be perceived by the learners as a consonant cluster. Twelve

tokens of each combination of stimulus type and SJ accent type are used, giving a total of 312 tokens. Wherever possible, the stimuli are chosen from the beginners textbook *Minna No Nihongo* (3A Corporation 1998).

The words were displayed to the learners in *kanji* (Chinese characters), with the phonetic reading displayed in the *hiragana* script. An English translation of the target word (not the following function word) was provided. The learners were encouraged to repeat a word if they were hesitant or if they misread the script. In the very few cases where errors remained to the extent that the word was not recognisable (e.g. different number of syllables, more than one segmental error) the productions were discarded, but productions with minor errors (e.g. voicing, non-Japanese liquids) were included in the analysis. The accent types with which the target words were produced were identified by three phonetically-trained native Japanese speakers. Where their responses differed, the majority response (two out of three) was used. If all three responses differed, the data was not used in the analysis.

3. Results

3.1. Variability: An overview

Table 2 summarises the accent types produced by each learner. All accent types produced with a frequency of at least 10% are included in the table. Where 50% or more of the tokens are produced with the same accent type, the percentage of this dominant accent type is displayed.

It can be seen from Table 2 that there is considerable between-learner variation in the accent types produced. At one extreme, one less experienced learner (LM_MT) and one more experienced learner (MM_TG) produce almost all tokens with no accent. At the other extreme, three less experienced learners (LF_EP, LF_JW, LM_MD) and one more experienced learner (MF_NT) produce almost all tokens accented.[3] Of these, two produce dominant initial accent with some medial accent, and two produce a mixture of accent on the initial mora, the medial mora and the mora before the function word.

The remainder of the learners produce a combination of accented and unaccented tokens. Of these, some show a dominant accent type, with three less experienced learners (LF_AG, LF_LC and LM_JR) producing a majority of tokens

[3] Table 2 only shows those accent types produced with a frequency of 10% or over, but of the total items produced, LF_EP produces 6% with no accent, LF_JW produces 2% and LM_MD and MF_NT both 3%.

Table 2: The accent types produced by each learner.

Less experienced learners	
LF_AG	61% no accent; also initial and medial
LF_EP	Mix of initial, medial and before f.w.
LF_GC	61% initial; also medial and no accent
LF_JW	73% initial; also medial
LF_LC	56% no accent; also initial and medial
LF_LD	63% initial; also medial and no accent
LF_MB	Mix of initial, medial and no accent
LM_JE	50% initial; also medial and no accent
LM_JO	Mix of initial, medial and no accent
LM_JR	61% no accent; also initial and medial
LM_MD	Mix of initial, medial and before f.w.
LM_MT	98% no accent
LM_NB	Mix of initial, medial and no accent
More experienced learners	
MF_KW	56% initial; also medial and no accent
MF_NT	72% initial; also medial
MF_PH	Mix of initial, medial, before f.w. and no accent
MM_DM	62% initial; also medial and no accent
MM_DT	56% initial; also medial and no accent
MM_JB	Mix of initial, medial and no accent
MM_LH	53% initial; also medial and no accent
MM_TG	81% no accent

with no accent, and a total of three less experienced learners (LF_GC, LF_LD and LM_JE) and four more experienced learners (MF_KW, MM_DM, MM_DT and MM_LH) producing a majority of tokens with initial accent. Lastly, five learners (LF_MB, LM_JO, LM_NB, MF_PH and MM_JB) produce a mixture of accented and unaccented tokens with no one dominant accent type; all of these learners produce initial, medial and no accent, but one also produces some tokens with an accent before the function word.

In this way, we see much variety, ranging from dominant "no accent", through a mixture of accent types, to dominant initial accent, with no obvious relation to the relative Japanese experience of the learners.

3.2. Systematicity: three case studies

In this section, the accent types produced by three learners will be examined: LM_JR (a less experienced learner who has dominant "no accent"), MF_KW (a

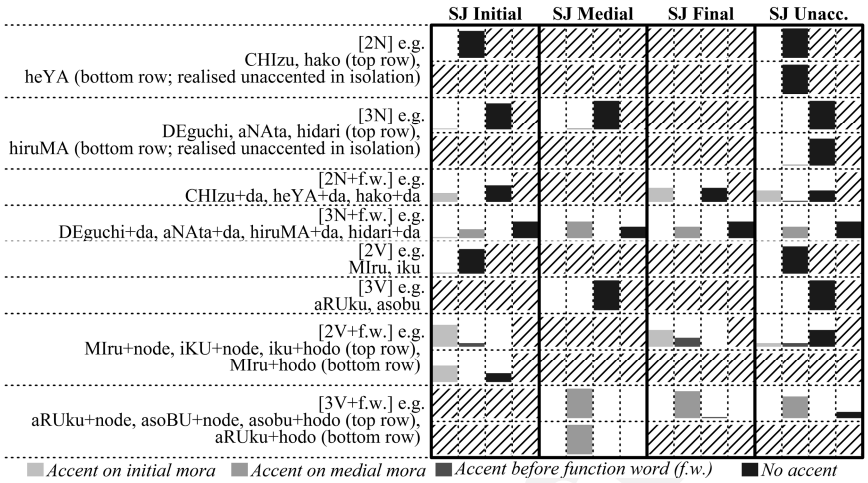

Figure 1. The accent types produced by learner LM_JR.

more experienced learner with dominant initial accent) and LF_EP (a less experienced learner who does not have a dominant accent type).

The accent types produced by the first learner, LM_JR, are shown in Figure 1. The stimulus types are shown on the left of the figure, where "2/3" is the number of mora, "N/V" is the part of speech and "f.w." is function word. The SJ accent types are shown across the top of the figure. For each combination of stimulus type and SJ accent type there are up to 12 tokens that the learner has produced, since some may have been discarded as described above. The accent types produced by the learner for these tokens are shown as pale grey for initial accent (on the far left for each combination of stimulus type and SJ accent type), mid-grey for medial accent (on the second from left for each three mora combination of stimulus type and SJ accent type), dark-grey for final accent (on the second from right for each combination of stimulus type and SJ accent type containing a function word) and black for no accent (on the far right for each combination of stimulus type and SJ accent type). (The striped boxes should be ignored, since these are combinations of stimulus type, SJ accent type and produced accent type that do not exist due to the number of mora of the tokens.)

From Figure 1, it can be seen that although LM_JR has dominant "no accent", various accent types are produced, and they are not distributed evenly. For some combinations of stimulus type and SJ accent type – for example 2-mora nouns ([2N]) with SJ initial accent – all 12 tokens are produced with only

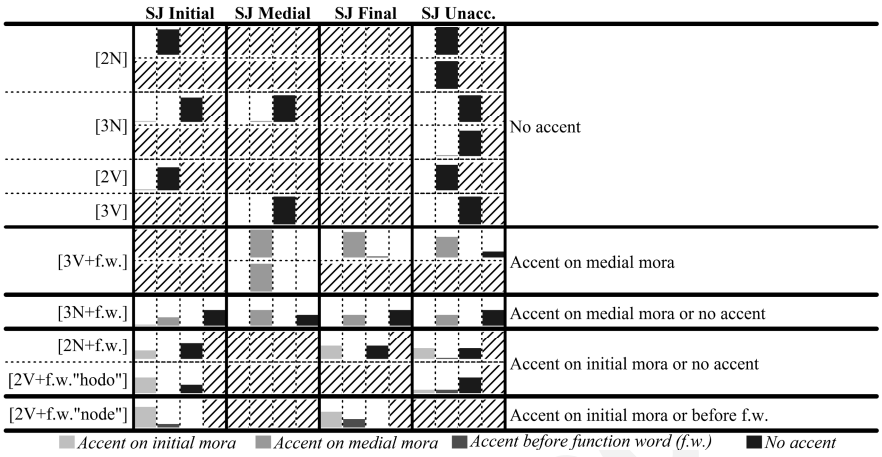

Figure 2. The accent types produced by LM_JR
rearranged to show the similarities and differences between stimulus types.

one accent type. For others – for example 2-mora nouns before a function word ([2N+f.w.]) with SJ initial accent – there are a mixture of accent types. In addition, the accent type (or accent types) produced depends on the stimulus type. This can be seen more clearly by rearranging the order of the stimulus types, grouping together those stimulus types that are produced with similar accent types, as in Figure 2.

On the right of Figure 2 is a description of the accent types produced for each group of stimulus types. It can be seen this figure that LM_JR's production of accent type is highly systematic. From the group of stimulus types at the top of the figure, we can see that isolated words are produced with no accent, almost without exception. In contrast, words preceding a function word show a mixture of accent types, with three-mora words showing a different distribution of accent types for verbs and nouns, and two-mora verbs showing different accent types depending on the type of function word. There are only very minor exceptions to these generalisations; the most notable of which is a Standard Japanese-like initial accent unaccented contrast in two-mora verbs preceding the function word *hodo*.

The accent types produced by the second learner, MF_KW are shown in Figure 3. Again, the stimulus types are arranged so that those stimuli that are produced with similar accent types are grouped together. The accent types of learner MF_KW also vary with stimulus type in a highly systematic way. The

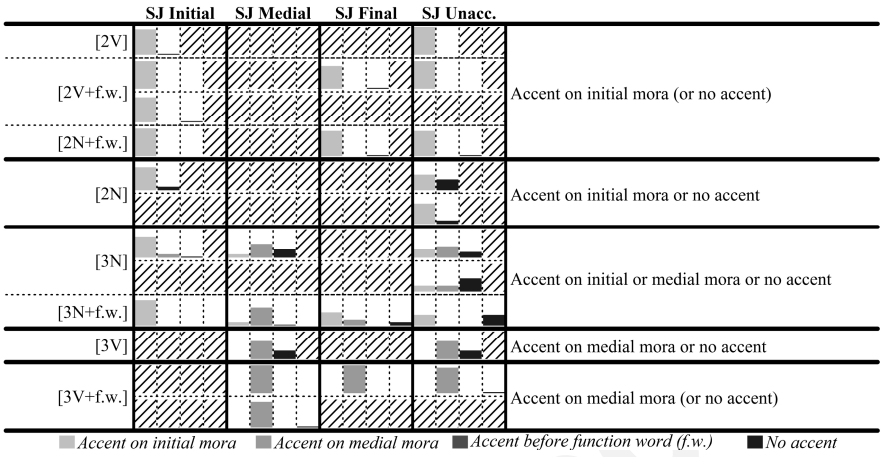

Figure 3. The accent types produced by MF_KW
arranged to show the similarities and differences between stimulus types.

top two groups are the two-mora words. These are produced almost exclusively with initial accent; unaccented tokens only appear in two-mora isolated nouns. From the bottom two groups, we can see that three-mora verbs are produced almost entirely with medial accent, but, again, in isolation there are some unaccented tokens. In contrast, three-mora nouns show a mixture of accent types, with some SJ-like accenting, especially before a function word. It is important to note that the order of stimulus types in Figures 2 and 3 are not the same: which combinations of stimulus types are produced with similar accent types depends on the learner.

Figure 4 shows the accent types produced by the final learner, LF_EP. Once again, the accent types produced can be seen to vary with stimulus type in a highly systematic way that is specific to this learner. However, LF_EP differs from the previous two learners in that, within each group of similarly-accented stimuli, there is more widespread SJ-like accenting.

3.3. Variability and systematicity: summary of individual learners productions

Table 3 summarises the results of the remaining 18 learners, arranged according to their dominant accent type: no accent, initial accent, and no dominant type. Within each section, the less experienced learners (prefixed LF or LM) are

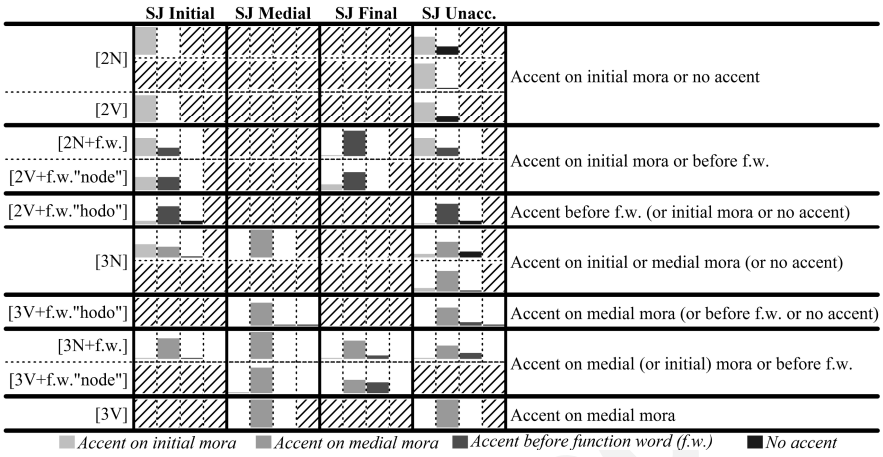

Figure 4. The accent types produced by LF_EP
arranged to show the similarities and differences between stimuli.

shown above the more experienced learners (prefixed MF or MM). Infrequently occuring accent types are shown in brackets.

Table 3. The accent types produced by the other 18 learners.

Learners with dominant "no accent"	
LF_AG	[2N] No accent; [3N] [2N+f.w.] [2V] [3V] [2V+f.w. *hodo*] Initial or no accent; [2V+f.w. *node*] Initial, before f.w. or no accent; [3N+f.w.] Initial, medial or no accent; [3V+f.w.] Medial or no accent
LF_LC	[2N] [2V] Initial or no accent; [2N+f.w.] [2V+f.w.] Initial, no accent (or before f.w.); [3N] [3N+f.w.] [3V] Initial, medial or no accent; [3V+f.w.] No accent (or medial accent)
LM_MT	[2N] [3N] [2N+f.w.] [3N+f.w.] [2V] [3V] [2V+f.w.] [3V+f.w.] No accent
MM_TG	[2N] [2V] No accent (or initial); [2N+f.w.] [2V+f.w.] No accent (initial or before f.w.); [3V] No accent (medial); [3N] [3N+f.w.] No accent (initial or medial); [3V+f.w.] No accent (medial or before f.w.)
Learners with dominant initial accent	
LF_GC	[2N] Initial or no accent; [2N+f.w.] [2V] [2V+f.w.] Initial; [3N] [3N+f.w.] [3V] [3V+f.w.] Initial or medial
LF_JW	[2N] [2N+f.w.] [2V] [2V+f.w.] Initial; [3N] [3N+f.w.] [3V] [3V+f.w.] Initial or medial

LF_LD	[2N] [2N+f.w.] [2V] [2V+f.w.] Initial (or no accent); [3N] [3V] Initial, medial or no accent; [3N+f.w.] Initial, medial, before f.w. or no accent; [3V+f.w. *hodo*] Medial or no accent; [3V+f.w. *node*] Medial
LM_JE	[2N] [2V] Initial (or no accent); [2N+f.w.] [2V+f.w.] Initial, final or no accent; [3V+3N] Initial, medial or no accent; [3N+f.w.] Medial (initial, before f.w. or no accent); [3V+f.w.] Medial, before f.w. or no accent
MF_NT	[2N] [2N+f.w.] [2V] [2V+f.w.] Initial; [3N] Initial (medial or no accent); [3V] [3N+f.w.] Initial or medial; [3V+f.w.] Medial (or initial)
MM_DM	[2V+f.w.] Initial; [2N] [2V] Initial (or no accent); [2N+f.w.] Initial (or before f.w. or no accent); [3N] [3N+f.w.] Initial, medial or no accent; [3V] Initial or medial; [3V+f.w.] Medial (or initial)
MM_DT	[2N+f.w.] [2V+f.w. *node*] Initial; [2N] [2V] [2V+f.w. *hodo*] Initial or no accent; [3N] Initial, medial or no accent; [3V+f.w. *hodo*] Medial or no accent; [3N+f.w.] Initial or medial; [3V] [3V+f.w. *node*] Medial (or initial)
MM_LH	[2N] [2V] Initial or no accent; [2N+f.w.] [2V+f.w.] Initial (before f.w. or no accent); [3N] [3V] Initial, medial or no accent; [3N+f.w.] Initial, Medial (before f.w or no accent); [3V+f.w.] Medial, before f.w. or no accent
Learners with no dominant accent	
LF_MB	[2N] [2V] [2V+f.w. *hodo*] Initial or no accent; [2N+f.w.] [2V+f.w. *node*] Initial, before f.w. or no accent; [3N] Initial, medial or no accent; [3N+f.w.] Initial, medial, before f.w. or no accent; [3V+f.w. *node*] Medial, before f.w. or no accent; [3V] [3V+f.w. *hodo*] Medial or no accent
LM_JO	[2N] [2V] Initial or no accent; [2N+f.w.] [2V+f.w.] Initial, no accent (or before f.w.); [3N] [3V] Initial, medial or no acccent; [3N+f.w.] Initial, medial, before f.w. or no accent; [3V+f.w.] Medial, before f.w. or no accent
LM_MD	[2N] [2V] Initial (or no accent); [2N+f.w.] [2V+f.w.] Initial or before f.w.; [3N] [3V] Medial (or initial) mora; [3N+f.w.] Medial, before f.w. (or initial); [3V+f.w.] Medial (or before f.w.)
LM_NB	[2N] [2V] Initial or no accent; [2N+f.w.] [2V+f.w.] Initial (before f.w. or no accent); [3N] [3V] Initial, medial or no accent; [3N+f.w.] [3V+f.w.] Medial (initial or before f.w.)
MF_PH	[2N+f.w.] [2V+f.w.] Initial or no accent; [2N+f.w.] [2V+f.w. *hodo*] Initial, before f.w. or no accent; [2V+f.w. *node*] Initial or before f.w.; [3V+f.w. *node*] Medial (or before f.w.); [3V] Medial or no accent; [3V+f.w. *hodo*] Medial, before f.w. or no accent; [3N] Initial, medial or no accent; [3N+f.w.] Initial, medial (or before f.w.)
MM_JB	[2N] [2V] [2V+f.w. *hodo*] Initial or no accent; [2N+f.w.] [2V+f.w. *node*] Initial (before f.w. or no accent); [3N] Initial, medial or no accent; [3N+f.w.] Medial (initial, before f.w. or no accent); [3V] [3V+f.w.] Medial or no accent

It can be seen from Table 3 that for each learner, the accent types produced vary with stimulus type. The accent types of these learners are not all as markedly systematic as the three learners shown above. However, Table 3 shows us that there is between-learner variation in both the groupings of stimulus types that are produced with similar accent types and the accent types produced. It is clear that not only *which* accent types are produced but also *how* the accent types vary with stimulus type are individual to the learner.

4. Discussion

This paper shows that there is no one accent type that can be considered to be representative of BE learners: initial, medial, final, unaccented and all combinations of these are observed, and which accent types are produced is seen to depend on the learner. Moreover, the accent types are seen to vary according to word type (part of speech, number of mora) and speech environment (the presence/absence of a function word), although *how* they vary is again learner dependent. However, in contrast to the marked variability *between* learners, examination of the individual accent patterns produced by three learners shows considerable *systematicity*. For these learners, accent type depends on word type and speech environment in a highly systematic – and learner specific – way.

Summarising research on the acquisition of English stress patterns by Thai, Korean and Spanish learners of English, Wayland et al. (2006) state that "Late learners of English may rely more heavily on word-by-word learning of stress patterns and are less likely to abstract generalities about stress placement by syllabic structure and lexical class". The results of the current study seem to suggest the opposite conclusion for BE learners of Japanese: the learners appear to be making generalisations about accent type according to number of mora, part of speech and presence or absence of a function word.

It is less clear why the generalisations made about accent should vary so extensively from learner to learner. One possibility is that the learners might have difficulty encoding Japanese lexical accent in their phonological representations. This would be similar to, for example, French learners of Spanish, where a series of *perception* studies have shown that monolingual French speakers (Dupoux et al. 1997, 2001) and French learners of Spanish (Dupoux et al. 2007) have difficulty phonologically encoding lexical stress. Whether this could lead to the type of learner-specific generalisation over word type and speech environment seen here in this *production* study is a question for further research.

REFERENCES

3A Corporation. 1998. *Minna no Nihongo skokyu I, II*.
Dupoux, E., C. Pallier, N. Sebastian and J. Mehler. 1997. "A destressing 'deafness' in French?" *Journal of Memory and Language* 36. 406–421.
Dupoux, E., S. Peperkamp and N. Sebastian-Galles. 2001. "A robust method to study stress 'deafness'". *Journal of the Acoustical Society of America* 110(3). 1606–1608.
Dupoux, E., N. Sebastian-Galles, E. Navarrete and S. Peperkamp. 2007. "Persistent stress 'deafness': The case of French learners of Spanish". *Cognition* 106. 682–706.
Horiguchi, J. 1973. "Eigokokumin ni yoru nihongo no yon-onsetsu meishi no akusento no yosoku to sono jissai" [Predicted and actual accents types of 4-mora nouns produced by English speakers]. *Nihongo Kyouiku* 19. 97–112.
Kindaichi, H. and K. Akinaga. 2001 . *Shinmeikai Nihongo Akusento Jiten* [Shinmeikai Japanese accent dictionary]. Tokyo: Sanseido.
Kubozono, H. 2006. "Where does loanword prosody come from? A case study of Japanese loanword accent". *Lingua* 116. 1140–1170.
Kuno, S. 1998. "Bei-eigowasha ni okeru nihongo akusento no seisei" [The production of Japanese accent by American English speakers]. *On-in Kenkyuu* 1. 83–90.
Sugito, M. and H. Tahara. 1989. "Toukeiteki kanten kara mita Oosaka akusento: Toukyou tono hikaku wo chuushin ni" [A statistical analysis of Osaka accent compared to Tokyo accent]. *Onsei Kenkyuu* 3. 143–165.
Toki. T. 1980. "Eigo wo bogo to suru gakushuusha ni okeru akusento no keikou" [Accent trends in learners with English as a first language]. *Amerika, Kanada Juuichi Rengou Nihon Kenkyuu Sentaa Kiyou* 3. 78–96.
Yamada, N. 1994. "Nihongo akusento shuutoku no ichidankai: Gaikokujin gakushuusha no baai" [A stage in acquiring Japanese accent: The case of foreign learners]. *Nihongo Kyouiku* 83. 108–120.
Yoshimitsu, K. 1981. "Gaikokujin gakushuusha no akusento" [Foreign learners' accent]. *Nihongo Kyouiku* 45. 63–75.
Wayland, R., S.G. Guion, D. Landfair and B. Li. 2006. "Native Thai speakers' acquisition of English word stress patterns". *Journal of Psycholinguistic Research* 35. 285–304.

Corresponding author:
Becky Taylor
Graduate School of Languages and Cultures
Nagoya University
Furo-cho, Chikusa-ku
Nagoya, 464-8601
Japan
rebecca.taylor@e.mbox.nagoya-u.ac.jp