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INVITED TALK

INVESTIGATING THE PHONOLOGICAL CONTENT OF LEARNERS' "FUZZY" LEXICAL REPRESENTATION FOR NEW L2 WORDS

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Adult learners are known to experience difficulty using novel second language (L2) phonological contrasts to distinguish words. Indeed, even the ability to perceive and produce a novel contrast with relative accuracy does not guarantee an ability to implement the contrast to distinguish words in tasks requiring lexical access. These observations lead to questions regarding the phonological content of learners' lexical representations of difficult L2 contrasts. In the present study we use an artificial lexicon design involving naïve L2 learners to examine the lexical encoding and retrieval of words containing novel L2 phonological contrasts. In each of two experiments, native English speakers were taught a set of six Japanese-like auditory minimal pairs along with pictured meanings. The members of each pair were differentiated by either consonant length (e.g., [teki] vs. [tekki]) or vowel length (e.g., [teki] vs. [teeki]), which are contrastive in Japanese but not in English. Participants were then tested on their ability to match the pictures to auditory words. These test items were matched (e.g., see picture of 'teki', hear [teki]) or mismatched (e.g., see 'teki', hear [teeki] for segment length). The results are compared to the predictions of several possible scenarios with respect to the ways in which participants might encode and retrieve words varying in segment length.

INTRODUCTION

It is well known that second language (L2) learners exhibit difficulty learning and processing L2 words' phonological forms, in particular when the words involve 'new' phonemes (e.g., Amengual, 2016; Broersma, 2012; Escudero, Hayes-Harb, & Mitterer, 2008; Hayes-Harb & Masuda, 2008; Pallier, Colome, & Sebastian-Galles, 2001; Sebastián-Gallés, Echeverría, & Bosch, 2005; Weber & Cutler, 2004). Several studies have suggested that this difficulty may arise due to the activation of inappropriate lexical items when listening to L2 speech, resulting in slow and/or inaccurate word recognition (e.g., Barrios, Jiang, & Idsardi, 2016; Broersma & Cutler, 2008, 2011; Cutler, Weber, & Otake, 2006; Darcy, Daidone, & Kojima, 2013; Ota, Hartsuiker, & Haywood, 2009; Pallier et al., 2001; Sebastián-Gallés et al., 2005; Sebastian-Gallés, Rodríguez-Fornells, De Diego-Balaguer, & Díaz, 2006). For example, Pallier et al. (2001) demonstrated that highly-proficient Spanish-dominant bilinguals exhibit repetition priming for Catalan minimal pairs differing in a vowel contrast that occurs in Catalan but not in Spanish (e.g., /sol/ 'sun' – /sɔl/ 'ground'), while Catalan-dominant bilinguals do not. Sebastián-Gallés et al. (2005) and Sebastian-Gallés et al. (2006) similarly showed that Spanish dominant bilinguals have difficulty rejecting nonwords that differ from real Catalan words in Catalan-specific vowel contrasts in a lexical decision task, and Sebastian-Gallés et al. (2006) further demonstrated that these erroneous lexical decisions do not elicit error-related negativity as detected by ERP.

The activation of inappropriate lexical competitors during auditory word processing has been interpreted as evidence that learners have non-target-like perceptual and/or lexical representations for difficult novel contrasts. In the case of non-target-like perceptual representations, learners may perceptually neutralize a difficult auditory contrast in favor of the member of the contrast that is most similar to the native category. This perceptual difficulty could play out in at least two different ways, depending on the status of the contrast in the lexicon. First, a neutralized perceptual representation will equally access neutralized lexical representations (i.e., minimal pairs are encoded as homophones; Escudero et al., 2008; Llompart & Reinisch, 2017). Alternatively, a neutralized perceptual representation might cause learners to access the word containing the native ('old') category in cases where the contrast is encoded lexically. Evidence for this latter possibility has been provided by eye-tracking studies demonstrating that learners initially activate words containing the 'old' category even when auditory inputs contain the 'new' category *but not the reverse* (Cutler et al., 2006; Weber & Cutler, 2004), and appears to arise when learners have access to evidence for the contrast in the form of written (Escudero et al., 2008) or articulatory information (Cutler et al., 2006; Escudero et al., 2008; Llompart & Reinisch, 2017; Weber & Cutler, 2004).

On the other hand, learners may have distinct perceptual representations but neutralized or phonologically ambiguous lexical representations for novel contrasts. Non-target-like L2 lexical encoding is in focus in the present study; in particular cases where learners experience lexical confusion due to lexical representations that are contrastive but "fuzzy" (e.g., Cook & Gor, 2015; Darcy et al., 2013; Hayes-Harb & Masuda, 2008).

Non-native-like lexical encoding and fuzzy L2 lexical representations

Among the challenges L2 learners face is navigating the perceptual and lexical-phonological consequences of novel contrasts. In some cases, learners appear to be able to perceptually distinguish novel contrasts but nonetheless experience difficulty in auditory word recognition tasks. Evidence for such cases has come from studies revealing asymmetric response patterns in lexical tasks (e.g., Barrios et al., 2016; Cutler et al., 2006; Darcy et al., 2013; Hayes-Harb & Masuda, 2008; Llompart & Reinisch, 2017, 2018; Sebastián-Gallés et al., 2005; Sebastian-Gallés et al., 2006; Weber & Cutler, 2004).

In one such study, Hayes-Harb and Masuda (2008) investigated native English speakers' memory for Japanese-like words contrasted by singleton and geminate medial consonants. Japanese contrasts singleton and geminate consonants (e.g., /haken/ *dispatch* vs. /hakken/ *discovery*) and short and long vowels (e.g., /kado/ *corner* vs. /kaado/ *card*). These length contrasts are often cited as a source of difficulty for native speakers of English, for whom consonant length is not phonemic (though long consonants can occur across word boundaries, as in *topic* vs. *top pick*), and for whom vowel duration covaries with vowel quality (e.g., /ɛ/ vs. /eɪ/) and vowel lengthening occurs allophonically (i.e., preceding voiced consonants as in *bad* vs. *bat*). Indeed, it has been demonstrated that Japanese length contrasts are difficult for native English speakers to produce (e.g., Han, 1992; Hardison & Saigo, 2010; Hayes-Harb & Masuda, 2008). On the other hand, Japanese consonant and vowel length contrasts may be relatively easy for native English speakers to perceive (see, e.g., Darcy et al., 2013; Tajima, Kato, Rothwell, Akahane-Yamada, & Munhall, 2008; Tajima, Kato, Rothwell, & Munhall, 2003; Tsukada, Cox, Hajek, & Hirata, 2018).

Hayes-Harb and Masuda (2008) taught native English speakers who had no prior Japanese language study, native English learners with one year of Japanese language study, and native Japanese speakers a set of four singleton-geminate minimal pairs (e.g., [pete] and [pette]; the target words) plus four filler words by pairing pictured meanings with auditory forms. They then examined the participants' memory for the words' phonological forms via an auditory word – picture matching task and a picture naming task. In the listening task, detectability (dprime) of the difference between matched (e.g., picture of 'pete' paired with auditory [pete]) and mismatched (e.g., 'pete' – [pette]) items was 1.01 for the participants with no Japanese language experience, 2.11 for the learners of Japanese, and 2.73 for the native Japanese speakers. A new analysis of this data reveals that the dprimes for all three participant groups are significantly greater than zero ($t(11)<.005$ for all). However, on the picture naming task, participants with no Japanese experience produced target geminate consonants only 17% of the time (in contrast to 99% and 58% geminate production by the native Japanese and the learners of Japanese, respectively). Hayes-Harb and Masuda (2008) interpreted the discrepancy between performance on the listening and production tasks by the participants with no Japanese language experience as evidence for partial encoding of the phonological contrast in their memory for the words. They hypothesized this pattern of performance could be accounted for by encoding 'old' phonemes accurately (e.g., [t] as /t/ in /pete/) but the 'new' phonemes as differing from the 'old' phonemes in a phonologically ambiguous, or fuzzy, way (e.g., [tt] as /t*/ in /pette/). Listening task accuracy thus would require only that participants detect whether the input contained /t/ or /t*/, while production accuracy would require a phonologically specific representation, i.e., one that identified length as the distinguishing feature.

Darcy et al. (2013) investigated the lexical encoding of Japanese consonant length contrasts by native Japanese speakers and native English speakers at intermediate and advanced levels of Japanese language proficiency. Darcy et al. (2013) used a lexical decision task involving real Japanese words containing singleton "old" and geminate "new" consonants, and nonwords created by changing a medial consonant from singleton to geminate and vice-versa. They hypothesized that if participants perceived consonant length in the auditory input but their lexical representations for words containing geminate consonants were fuzzy, they should exhibit the following ordinal accuracy (from highest to lowest): (1) Real singleton words (e.g., [akeru] 'to open') should be easy to accept because the input matches the lexical representation. (2) Real geminate words (e.g., [kippu] 'ticket') should also be easy to accept because while they do not exactly match the fuzzy underlying representation, they do not mismatch, either. (3) Geminate nonwords created from real singleton words (e.g., *[akkeru]) should be relatively easy to reject because they contain the new category but are compared to a lexical representation that contains the old category. (4) Singleton nonwords (e.g., *[kipu]) should be difficult to reject because they must be compared to fuzzy lexical representations. They found exactly this pattern in the results for the two learner groups, and concluded that learners experience difficulty with Japanese consonant length contrasts at the lexical level, proposing the convention "?" for indicating fuzziness (an alternative to the '*' proposed by Hayes-Harb & Masuda, 2008).

The Hayes-Harb and Masuda (2008) and Darcy et al. (2013) studies thus provide two different types of evidence for a phonologically ambiguous, or fuzzy, lexical representation of Japanese consonant length by native English speakers: in the former, the discrepancy between performance on an auditory word-picture matching task and a picture naming task, and in the latter, asymmetries in lexical decision performance. A question that emerges, then, is *What does it mean for a lexical representation to be fuzzy?* Thus far "fuzzy" has been taken to mean that a new phonological element is an imperfect match to a native (old) element. In the case of phonological length encoding by native English speakers, one possibility is that fuzziness is associated with a single segment, where, e.g., singleton /t/ and geminate /tt/ are represented by learners as /t/ and /t*/, respectively. However, a number of other scenarios are possible; these are laid out in detail below.

METHODS

This study involved a series of two experiments employing the artificial lexicon paradigm, examining the acquisition of Japanese-like length contrasts by native speakers of English. The studies discussed above investigated the acquisition of consonant length; in the present research we consider the acquisition of both consonant and vowel length in order to determine whether learners perform similarly on both types of phonological length. The first experiment focused on native English speakers' ability to learn and process Japanese-like words contrasted by consonant length; the second examined their ability to learn and process words contrasted by vowel length. Each experiment is presented in turn.

Consonant length experiment

Participants. Twenty-three native speakers of English (13 female, 10 male, ages 18-44, mean age of 22) were recruited from the University of Utah community. Participants did not report any hearing, speech, or language disorders, and none reported taking medications that may affect their cognitive or motor functions. Three reported also speaking Spanish as a native language and one Greek. They reported having studied Spanish (n=13), French (n=3), and ASL (n=1), Portuguese (n=1), and Mandarin (n=1), but had not studied Japanese or any other language with vowel and/or consonant length contrasts (e.g., Arabic, Hindi, or Italian).

Materials. A phonetically-trained female native speaker of Japanese produced six CVCV minimal pairs exemplifying the singleton-geminate contrast in medial position. Most but not all of the words are nonwords in Japanese. Each word was randomly assigned a meaning represented by a line drawing. Minimal pairs were included to increase the likelihood that participants would notice and lexically encode the length contrasts.

Table 1

The six short-long consonant minimal pairs and pictured meanings

Singleton		Geminate	
[teki]	*basket*	[tekki]	*book*
[hako]	*car*	[hakko]	*corn*
[hosa]	*flower*	[hossa]	*shirt*
[meso]	*violin*	[messo]	*grapes*
[kite]	*foot*	[kitte]	*house*
[keto]	*spider*	[ketto]	*stove*

Procedure. The experiment involved three phases. In the first, the word learning phase, participants were exposed to the auditory words and their pictured meanings. Each auditory word-picture pair presented once per block, and the block was presented eight times, in a new random order each time. No response was required of participants, who were told only to "learn the words and their meanings as well as possible". The criterion test phase immediately followed word learning. It involved a two-way forced-choice auditory word-picture matching task where each of the twelve words was presented twice, once in each of two conditions: matched and mismatched. In matched trials, the correspondence between the auditory word and the picture were in accordance with the word learning phase, and in mismatched trials, the auditory word was paired with a picture that corresponded to a different word during word learning (see Table 2). As the purpose of the criterion test phase was to ensure that participants had generally learned the words before moving on to the final test, items tested only participants' ability to discriminate among very different words, not the minimal pairs (which were in focus in the final test phase). Participants repeated the word learning and criterion test phases until they reached 90% accuracy on the criterion test.

Table 2

Example criterion test items

Condition	**See**	**Hear**	**Correct Response**
Match	 /teki/	[teki]	Yes (matched)
Mismatch		[hako]	No (mismatched)

The final test phase also involved an auditory word-picture matching task. Each picture was presented three times, once in each of three conditions (see Table 3). In the matched condition, the auditory word correctly matched the picture. In the mismatched consonant condition, the auditory word was the geminate counterpart of the correct (singleton) word. In the mismatched vowel condition, the auditory word had the correct consonant length, but the vowel in the first syllable was lengthened. In this way, there was a total of 36 final test trials.

Table 3

Example final test items

Condition	See	Hear	Correct Response
Match		[teki]	Yes (matched)
Mismatch C Length		[tekki]	No (mismatched)
Mismatch V Length	/teki/	[teeki]	No (mismatched)
Match		[tekki]	Yes (matched)
Mismatch C Length		[teki]	No (mismatched)
Mismatch V Length	/tekki/	[teekki]	No (mismatched)

Results. Before presenting the experimental results, we will lay out the predictions of several possible scenarios with respect to the lexical encoding and processing of Japanese consonant length contrasts by native English speakers. The first is the target-like scenario (see Table 4), where participants perceive and encode the novel length contrasts in a target-like way. This should result in high accuracy in all item conditions.

Table 4

Accuracy predictions for the target-like scenario

	Lexical Rep.	Match	Mismatch C	Mismatch V
Short C [old]	/teki/	[teki] Easy to accept	[tekki] Easy to reject	[teeki] Easy to reject
Long C [new]	/tekki/	[tekki] Easy to accept	[teki] Easy to reject	[teekki] Easy to reject

It is worth noting that we predict the same pattern of performance if participants simply annotate each lexical entry with the number of moras (see Table 5); for this reason, a finding of high accuracy in all conditions would require follow-up experiments with additional foil conditions in order to determine the appropriate interpretation.

Table 5

Accuracy predictions for the mora-counting scenario

	Lexical Rep.	Match	Mismatch C	Mismatch V
Short C [old]	/teki$_{2\text{MORAS}}$/	[teki] (2 moras) Easy to accept	[tekki] (3 moras) Easy to reject	[teeki] (3 moras) Easy to reject
Long C [new]	/teki$_{3\text{MORAS}}$/	[tekki] (3 moras) Easy to accept	[teki] (2 moras) Easy to reject	[teekki] (4 moras) Easy to reject

In the fuzzy segment scenario (see Table 6), participants have correctly associated the contrast with the target segment, but the representation of that segment is fuzzy. This is the scenario reported by Darcy et al. (2013) and Hayes-Harb and Masuda (2008). In this case, participants have encoded /teki/ and /tek?i/. As a result, [teki] for /tek?i/ should be difficult to reject because the auditory input does not mismatch the fuzzy representation of the segment. By contrast, [teeki] and [teekki] for /teki/ and /tek?i/, respectively, should be easy to reject because the long vowel is not accommodated by the lexical representations.

Table 6

Accuracy predictions for the fuzzy segment scenario

	Lexical Rep.	**Match**	**Mismatch C**	**Mismatch V**
Short C [old]	/teki/	[teki] Easy to accept	[tekki] Easy to reject	[teeki] Easy to reject
Long C [new]	/tek?i/	[tekki] Easy to accept	[teki] Difficult to reject	[teekki] Easy to reject

In the word length scenario (see Table 7), participants have correctly identified length as differentiating lexical items, but have not associated length with a particular segment. In this scenario, [tekki] for /$teki_{LONG}$/ should be easy to accept because of it contains a long segment, and [teki] for /$teki_{LONG}$/ should be easy to reject because nothing is long. However, [teekki] for /$teki_{LONG}$/ should be difficult to reject because it has at least one long segment.

Table 7

Accuracy predictions for the word length scenario

	Lex. Rep.	**Match**	**Mismatch C**	**Mismatch V**
Short C [old]	/teki/	[teki] Easy to accept	[tekki] Easy to reject	[teeki] Easy to reject
Long C [new]	/$teki_{LONG}$/	[tekki] Easy to accept	[teki] Easy to reject	[teekki] Difficult to reject

Finally, in the fuzzy word scenario (see Table 8), participants have encoded only an indication that the word departs from English in some way. In this scenario, for /(teki)?/ participants should accept all auditory forms because the entire representation is fuzzy.

Table 8

Accuracy predictions for the fuzzy word scenario

	Lexical Rep.	Match	Mismatch C	Mismatch V
Short C [old]	/teki/	[teki] Easy to accept	[tekki] Easy to reject	[teeki] Easy to reject
Long C [new]	/(teki)?/	[tekki] Easy to accept	[teki] Difficult to reject	[teekki] Difficult to reject

Other scenarios are possible, including ones where participants only reject auditory forms that were not presented during the exposure phase (Word Familiarity Scenario), or where they only reject auditory forms that contain new phones (English Bias Scenario). These scenarios are presented in the Appendix.

Table 9 presents the mean proportion correct and mean dprimes, and Figure 1 presents a graph of the dprime data. The consonant length experiment results were submitted to an ANOVA with dprime as the dependent variable and word condition (2 levels: Long Consonant [new], Short Consonant [old]) and mismatch condition (Mismatch Consonant, Mismatch Vowel) as between-subjects variables. Word condition was not significant ($F(1,22)=.680$, $p=.418$, partial eta squared =.030), mismatch condition was not significant ($F(1,22)=.050$, $p=.825$, partial eta squared =.002), but the interaction of the two was significant ($F(1,22)=7.745$, $p=.011$, partial eta squared =.260). Planned comparisons between performance on words containing the 'old' and 'new' phones indicate that in the Mismatch C condition, performance was more accurate on words containing the old phone (Short C; $F(1,22)=4.861$, $p=.038$, partial eta squared =.181) but in the Mismatch V condition, performance was significantly more accurate on the words containing the new phone (Long C) ($F(1,22)=5.039$, $p=.035$, partial eta squared =.186).

Table 9

Mean proportion correct and mean dprime by word condition and mismatch condition

n=23	Mean proportion correct (stdev)			Mean dprime (stdev)	
	Matched	Mismatch C	Mismatch V	Mismatch C	Mismatch V
Short C [old]	.891 (.119)	.457 (.373)	.319 (.359)	1.013 (1.031)	.674 (.992)
Long C [new]	.804 (.199)	.399 (.354)	.558 (.375)	.732 (.969)	1.130 (1.037)

Looking first at the Mismatch C results, we see the asymmetry in responses predicted by the fuzzy segment scenario and the fuzzy word scenario, with significantly lower dprimes for Long C [new] words than for Short C [old] words. In addition, the significant difference reported in the Mismatch V results is the *opposite* of that predicted by the fuzzy word scenario. The results of this experiment are thus consistent with participants having encoded the old Short C words using the native category, and the 'new' Long C words in a phonologically ambiguous, or fuzzy, way. The pattern of results further suggests that participants may have correctly associated the fuzziness with the medial consonant, or at least that they do not incorrectly associate the fuzziness with the preceding vowel. Since Japanese has both vowel and consonant length contrasts, a second experiment involving the representation of vowel length allows us to see whether the pattern observed here is also found for words containing vowel, as opposed to consonant, length.

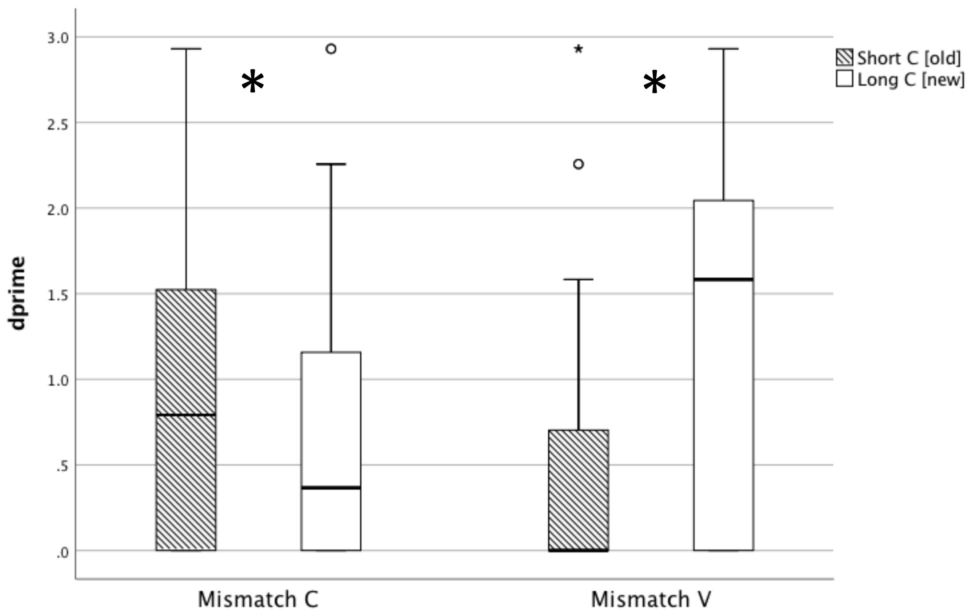

Figure 1. Boxplot of consonant experiment dprimes by pictured word length (Long C [new], Short C [old]) and mismatch condition (Mismatch C, Mismatch V).

Vowel length experiment

Twenty-three new native speakers of English (16 female, 7 male, ages 18-48, mean=22) participated in the vowel length experiment; all met the same criteria as participants in the consonant length experiment. One reported also speaking Spanish as a native language and one Portuguese. They reported having studied Spanish (n=11), French (n=10), ASL (n=1), Cambodian (n=1), Portuguese (n=1), and Chinese (n=1). The materials were six CVCV minimal pairs exemplifying the Japanese short-long vowel contrast in the first syllable: [teki]-[teeki], [hako]-[haako], [hosa]-[hoosa], [meso]-[meeso], [kite]-[kiite], and [keto]-[keeto] and were assigned meanings represented by line drawing pictures. The procedure for the vowel length experiment was identical to that of the consonant length experiment.

Results. Mean proportion correct was converted to dprime (see Table 10).

Table 10

Mean proportion correct and mean dprime by word condition and mismatch condition in the vowel length experiment

n=23	Mean proportion correct (stdev)			Mean dprime (stdev)	
	Matched	Mismatch C	Mismatch V	Mismatch C	Mismatch V
Short Vowel [old]	.855 (.176)	.299 (.265)	.319 (.313)	.547 (.651)	.626 (.796)
Long Vowel [new]	.891 (.139)	.667 (.289)	.312 (.360)	1.538 (.951)	.695 (.848)

The vowel length experiment results were submitted to an ANOVA with dprime as the dependent variable and word condition (2 levels: Long Vowel [new], Short Vowel [old]) and mismatch condition (Mismatch Consonant, Mismatch Vowel) as between-subjects variables. Word condition was significant (F(1,22)=9.933, p=.005, partial eta squared =.311), mismatch type was not significant (F(1,22)=3.349, p=.081, partial eta squared =.132), and the interaction of the two was significant (F(1,22)=13.131, p=.002, partial eta squared =.374). Planned comparisons between performance on words containing the 'old' and 'new' phones indicate that performance was significantly more accurate on words containing the new phone (long vowel) in the consonant mismatch condition (F(1,22)=15.453, p=.001, partial eta squared =.413) but there was no difference between the two word types in the vowel mismatch condition (F(1,22)=.186, p=.671, partial eta squared =.008).

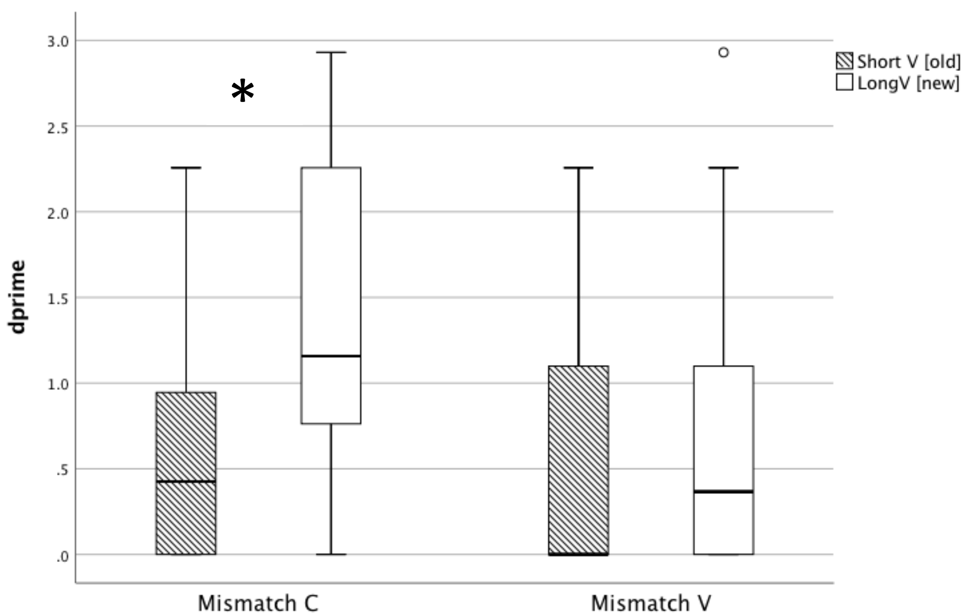

Figure 2. Vowel experiment dprimes by pictured word length (Long Vowel [new], Short Vowel [old]) and mismatch condition (Mismatch Consonant, Mismatch Vowel).

We did not see an asymmetry in responses to the Mismatch V items, and thus do not find evidence in support of either the fuzzy segment scenario or the fuzzy word scenario; indeed, this pattern of results suggests that participants have not encoded short- and long-vowel words contrastively in their lexical representations. Consistent with the consonant experiment, we do observe significantly higher accuracy in the Mismatch C – Long V condition. In both experiments, participants are able to reject the four-mora [teekki] items, suggesting that these items saliently mismatch the word forms learned during training, possibly due to their extra-long duration.

DISCUSSION

In the experiments reported here we sought to investigate the so-called "fuzziness" of L2 lexical representations. We presented a number of possible scenarios with respect to native English speakers' performance on an auditory word – picture matching task in effort to characterize the locality of information that is associated with the L2 fuzzy representation of consonant and vowel length. In the consonant length experiment, where participants learned Japanese-like singleton-geminate minimal pairs, we found evidence for the fuzzy representation of consonant length, evidenced by asymmetric detection of consonant length mismatches associated with words containing short (old) and long (new) consonants. We further found they had not incorrectly associated phonological length with vowels in the word, in fact exhibiting an asymmetry in responses for vowel-mismatched items that was in the opposite direction than would be predicted if they had done so. It is important to note, however, that the relevant dprimes were quite small (<1), indicating that even when participants appeared to have established contrastive lexical representations to some extent, their resulting performance was not highly accurate.

In the vowel experiment, we did not find evidence for the contrastive encoding of vowel length—participants performed similarly on vowel-mismatched items for both long vowel and short vowel words. The discrepancy between the results for consonant length, where we found evidence of fuzziness associated with the representation of long consonants, and vowel length, where we did not find any evidence of differential representation of short and long vowels in participants' lexical representations, suggests unsurprisingly that novel L2 contrasts can differ in the difficulty they pose for learners. In this case, under identical exposure conditions, the native English-speaking participants were better able to lexically encode consonant than vowel length, perhaps due to a differential perceptibility of the two contrast types.

The experiments reported here have provided some insight into the locality of fuzziness, indicating minimally that the fuzzy representation of L2 consonant length is not incorrectly associated with a neighboring vowel. However, there is much more to be investigated with respect to the phonological nature of fuzziness: For segmental contrasts, is fuzziness associated with individual features or with a segment as a whole? What role does "category goodness" (Best, 1995) play in determining learners' assessment of auditory input relative to fuzzy segmental representations? How does the phonological nature of fuzziness evolve over time in learners, and how does fuzziness as conceived here relate to findings elsewhere in the literature concerning "phonolexical robustness" (see, e.g., Llompart & Reinisch, 2018)? The present research, in laying out a number of hypotheses with respect to L2 lexical encoding scenarios, represents a starting point in the investigation of the phonetic/phonological properties of fuzzy lexical representations.

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APPENDIX

In the English bias scenario, participants do not compare auditory forms heard during the test to lexical representations, but rather only reject auditory forms that are not English-like.

Accuracy predictions for the English bias scenario

	Lexical Rep.	**Match**	**Mismatch C**	**Mismatch V**
Short C [old]	n.a.	[teki] Easy to accept	[tekki] Easy to reject	[teeki] Easy to reject
Long C [new]	n.a.	[tekki] Difficult to accept	[teki] Difficult to reject	[teekki] Easy to reject

In the word familiarity scenario, participants do not compare auditory forms heard during the test to lexical representations, but rather only reject auditory forms that were not presented to them during the word learning phase.

Accuracy predictions for the word familiarity scenario

	Lexical Rep.	**Match**	**Mismatch C**	**Mismatch V**
Short C [old]	n.a.	[teki] Easy to accept	[tekki] Difficult to reject	[teeki] Easy to reject
Long C [new]	n.a.	[tekki] Easy to accept	[teki] Difficult to reject	[teekki] Easy to reject