# Japanese Listeners Are More Likely to Perceive Illusory Vowels in Predictable Contexts

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## Does Predictability Influence Perception Accuracy?

Studies examining the role of predictability on linguistic behaviour show that speakers typically produce speech less robustly in predictable contexts (see e.g. Hall et al., 2018; Jaeger & Buz, 2016; Shaw & Kawahara, 2017).

We propose a perceptual corollary to this behaviour: listeners are less attentive to incoming acoustic signals when they are more predictable.

This proposal is tested in a series of AXB discrimination tests that examine the discriminability of epenthetic vowels in real and nonce word tokens that vary in length.

## Stimuli

Stimuli consisted of either real or nonce word pairs where one item in each pair consisted of an elided vowel in a position where vowels are typically devoiced or deleted in spoken Japanese.

These stimuli were designed to test participants' ability to perceive the presence vs absence of this elided vowel in real and nonce conditions, and in words of varying length in terms of mora count.

Stimuli were recorded in a recording studio located at the University of Melbourne and produced by an Australian English speaking phonetician. 5 repetitions of each token was recorded; only tokens 2, 3 and 4 were used in the following experiments. Tokens were organised into AXB triads by way of a Latin square.

## Participants

20 L1 Japanese speakers (17 female) aged 19-26 ($M = 22$, $SD = 1.7$) residing in Melbourne, Australia were recruited for this study.

Participants were recruited by word of mouth.

Participants had not resided in Australia for greater than 3 months and had not spent more than a month in a country other than Japan or Australia.

| Real Word AXB Contrasts | Vowel | Gloss | Mora | Mean Acc. | St. Dev. |
|---|---|---|---|---|---|
| /tabesugimafita/-/tabesugimafta/ | /i/ | "over ate" | 7 | 80% | 10% |
| /tabemafita/-/tabemafta/ | /i/ | "ate" | 5 | 81% | 11% |
| /mafita/-/mafta/ | /i/ | "directly under" | 3 | 83% | 9% |
| /fita/-/fta/ | /i/ | "under" | 2 | 93% | 7% |
| /daisuki/-/daiski/ | /u/ | "really like" | 4 | 88% | 7% |
| /suki/-/ski/ | /u/ | "like" | 2 | 98% | 3% |

**Table 1.** Real word contrast discrimination accuracy.

| Nonce Word AXB Contrasts Pairs | Vowel | Mora | Mean Acc. | St. Dev. |
|---|---|---|---|---|
| /padezukinafipa/-/padezukinafpa/ | /i/ | 7 | 80% | 14% |
| /padenafipa/-/padenafpa/ | /i/ | 5 | 77% | 15% |
| /nafipa/-/nafpa/ | /i/ | 3 | 87% | 8% |
| /fipa/-/fpa/ | /i/ | 2 | 88% | 7% |
| /gaisupi/-/gaispi/ | /u/ | 4 | 96% | 5% |
| /supi/-/spi/ | /u/ | 2 | 98% | 3% |

**Table 2.** Nonce word contrast discrimination accuracy.

## Procedure

The experiment was conducted in a quiet room located at the University of Melbourne. Participants were exposed to trials through a Macbook Pro running Psyscope X. Responses were recorded by keystroke.

Triads were presented to participants in 3 blocks (1 /u/ epenthesis block and 2 /i/ epenthesis blocks) from which they were drawn at random. Each block consisted of 192 trials for a total of 578 trials (48 per contrast pair).

Tokens were spaced with a 1000 ms inter-stimulus interval and trials were spaced with a 1500 ms inter-trial interval. If participants did not respond within 2000 ms, triads were returned to the pool an replayed at a later time.
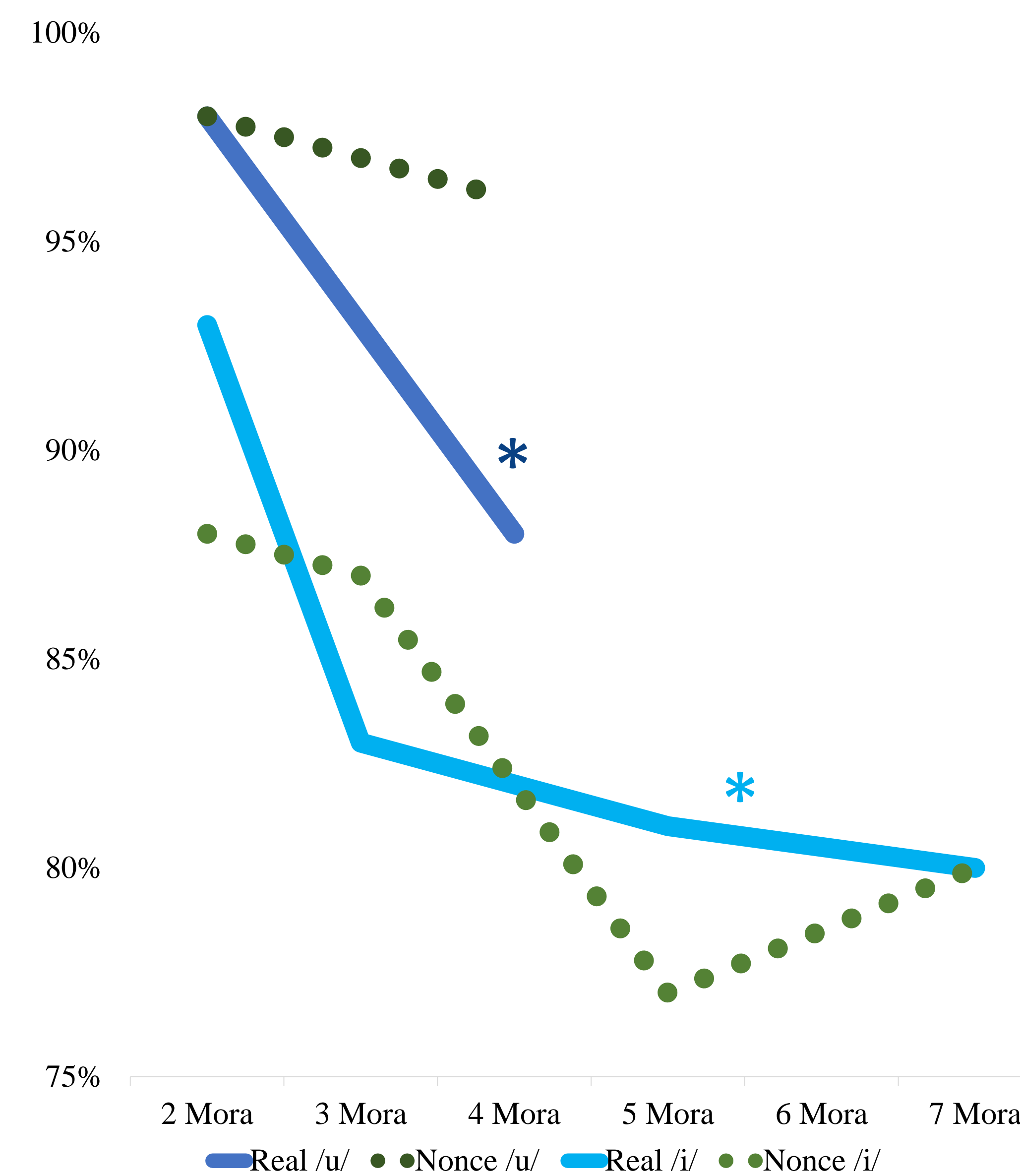


**Figure 1.** Line graph detailing the relationship between word length and discrimination accuracy. Asterisks relect a significant difference between longest/shortest contrasts.

## Results

The results show an influence of word length on discrimination accuracy (i.e., the longer, the less accurate, especially within tokens that share the same epenthetic vowel), and that this influence differs between real and nonce word tokens.

An ANOVA calculated on /i/ epenthesis tests revealed a significant effect of test on accuracy $F(7,159) = 4.4$, $p < 0.001$. A post hoc comparison with Bonferroni correction revealed a significant difference between 2 mora tokens and 7 mora tokens in real words ($p = 0.01$) but not in nonce words ($p = .635$).

An second ANOVA calculated on /u/ epenthesis tests revealed a significant effect of test on accuracy $F(3,79) = 21$, $p < 0.001$. A post hoc comparison with Bonferroni correction revealed a significant difference between 2 mora tokens and 4 mora tokens in real words ($p < 0.001$) but not in nonce words ($p = .609$).

## Increased Length Correlates with Decreasing Accuracy

The results show that the token length effect is greater with trials that contain real words rather than nonce words, particularly with words that contain around 3-4 mora.

Unlike nonce words, when real words get longer, the identity of the incoming signal becomes more predictable due to top down knowledge.

This increase in predictability results in listeners assigning less attentional resources to the incoming acoustic information so that illicit sequences are more likely to be assimilated to their most transitionally probable match.

Possible confound: longer tokens place a greater demand on cognitive resources, making listeners more error prone. This explanation however predicts the same pattern between accuracy and word length.

In line with a recent extension of the Perceptual Assimilation model (Kilpatrick et al., in press), this assimilation reduces or eliminates the perceptual distance between the contrast pairs, resulting in reduced discrimination accuracy.

## Acknowledgements

## Bibliography

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