**Hypotheses**

**Fixed Strategy Hypothesis:** Domain Language completely determines perception strategies. 

- Past support for this hypothesis in previous work. 
- Cutler et al. (1992) found use of L1 perception in L2, even in highly balanced French - English bilinguals. 
- Other studies show variation in bilingual flexibility in phoneme contrast perception (Pallier et al., 1997) and stress awareness (Dupoux et al., 2010).

**Variable Strategy Hypothesis:** There is some inherent flexibility in an individual’s perception strategies. 

- Cutler et al. (1992) compared French and English, which are closely related. 
- Could more extreme differences lead to more pressure for bilinguals to adopt L2 strategies?

**English and Mandarin**

**English**

- Stress-based segmentation strategy in previous results. 
- Complex syllable structure (clusters of up to 3 consonants at the beginning and end of syllables, 10,000+ syllable types). 
- Writing system: written characters represent approximately phonemes.

**Mandarin**

- Highly restricted syllable structure (no consonant clusters, only /n/ and /ŋ/ as possible codas, ~400 syllable types, or ~1200 counting tone). 
- Writing system: character represents a monosyllabic morpheme. 
- Evidence for a syllable-based production strategy (O’Sheaghdha et al., 2010).

**Experiment**

- Fragment detection task. 
  - Participants monitor for a target sequence (CV or CVC) while listening to a series of words and press a button when a word begins with the sequence is heard. 
  - Initial syllable of target word may have either CV or CVC structure; faster response time when target sequence matches this structure viewed as evidence of syllable-based segmentation strategy.

- Four English conditions with different syllable/ morpheme structure, one Mandarin condition (examples of each condition in Table 1, one condition taken from Cutler et al., 1986). 
- For each condition, seven pairs of words with same initial phonemes, but different syllable structure; each word presented once with CV target and once with CVC target (see Table 1 for examples).

- Non-dominant language first; dominant language second (different day). 
- Participants: L1 Mandarin (L2 English) (Current US graduate students, lived in Mandarin speaking country through college age) (n = 20)
- Mandarin Heritage Speakers (Born in US or moved to US before age 10, Mandarin speaking parents) (n = 20)
- L1 English (L2 Mandarin) (Born in US, English speaking parents, studied Mandarin in High School or College) (n = 11)
- English Monolinguals (No experience with a language other than English for more than four hours per week before age 10) (n = 20).

**Background and Introduction**

**Speech Segmentation**

- Speech is a continuous stream of sound without reliable boundaries between words. 
- Listeners utilize many sources of information in determining word boundaries, including rhythmic characteristics of the language.

- Past work suggests cross-linguistic variability in rhythm-based speech segmentation strategies.


- Given this variability, what happens when a bilingual’s two languages encourage different strategies?

**Results**

**L1 Mandarin (L2 English)**

- English Stimuli
- Mandarin Stimuli

**Mandarin Heritage Speakers**

- English Stimuli
- Mandarin Stimuli

**L1 English (L2 Mandarin)**

- English Stimuli
- Mandarin Stimuli

**English Monolinguals**

- English Stimuli
- Mandarin Stimuli

**Results (Continued)**

- Analysis: Linear mixed-effects models with maximal random effects structure, significance determined through model comparison.

- No significant target by context interaction for any group in the English conditions (including those not pictured).

- In Mandarin condition, significant target by context interactions for all groups except English monolinguals, who showed a marginal interaction.

- In Mandarin, L1 Mandarin group shows effect of matching target and context for CV words only (e.g., xi- is detected more quickly than xin- in “xin’na2”, but xin- and xi- are detected with equal speed in “xin’shen1”), while Heritage Speakers and L1 English group show this effect for both CV and CVC words. 

**Discussion**

- Results support the Variable Strategy Hypothesis.
  - L1 groups show evidence of syllable-based segmentation in English.
  - L1 English group shows evidence of syllable-based segmentation in Mandarin, despite relatively little Mandarin experience.

- Marginal syllable effect in English monolinguals for Mandarin stimuli indicates acoustic cues to syllable boundaries may be present, but experience is needed to fully utilize them.

- Why don’t L1 Mandarin listeners show a syllable effect in Mandarin cvc words?

- Open syllables more common than closed syllables in Mandarin (Teng, 2005), so segmenting after vowels may be an efficient strategy.

- However, heritage speakers show syllable effect in both cv and cwc words, indicating this asymmetry is not found in all early learners of Mandarin.

- Work is a larger project, which includes data on production strategies for the same participants.

- Production data also show support for Variable Strategy Hypothesis.

**References**


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**Table 1: Example Stimuli from Each Condition**

<table>
<thead>
<tr>
<th>Condition (pictured above)</th>
<th>CV target</th>
<th>CVC target</th>
<th>CV word</th>
<th>CVC word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bimorphemic nasal (English)</td>
<td>su-</td>
<td>sun-</td>
<td>sunny</td>
<td>Sunday</td>
</tr>
<tr>
<td>Bimorphemic nasal (Mandarin)</td>
<td>xi-</td>
<td>xin-</td>
<td>xin’an2</td>
<td>xin’shen1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional conditions (not pictured)</th>
<th>CV target</th>
<th>CVC target</th>
<th>CV word</th>
<th>CVC word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monomorphic fricative</td>
<td>mi-</td>
<td>mis-</td>
<td>missile</td>
<td>mist</td>
</tr>
<tr>
<td>Liquid</td>
<td>ba-</td>
<td>bal-</td>
<td>balance</td>
<td>balcony</td>
</tr>
<tr>
<td>Monomorphic nasal</td>
<td>pe-</td>
<td>pen-</td>
<td>penny</td>
<td>pencil</td>
</tr>
</tbody>
</table>