The Role of Working Memory and Language for Bilingual Chinese in Complex Mental Multiplication

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Introduction

Different working memory systems are involved in mentally solving complex multiplication problems. This involvement depends on presentation format for Chinese (Imbo & LeFevre, 2010):

![Working memory model of Baddeley & Hitch (1974) and Baddeley (2000).]

- **Purpose:**
  - Examine whether different working memory (WM) systems are recruited depending on presentation format and language of response.

- **Hypotheses:**
  1. Regardless of language of response, participants are more likely to rely on phonological WM for horizontal problems, and visual WM for vertical problems.
  2. Additional phonological WM resource is required from L1 to L2 due to the language translation process.

Method (N = 26; Mean age = 24 years)

- **Primary task:**
  - Two-digit x One-digit multiplication problems in 2 language (L1, L2) blocks
    - Problem complexity: easy; hard
    - Presentation format: horizontal; vertical

- **Secondary task:**
  - 3 conditions per language block
    - No load (control)
    - Phonological load
    - Visual load

Results: Secondary task (accuracy)

<table>
<thead>
<tr>
<th>Primary task</th>
<th>Easy problems</th>
<th>Hard problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological task</td>
<td>L1 &gt; L2</td>
<td>No consistent relations with the working memory variables because participants found the problems too difficult.</td>
</tr>
<tr>
<td>Visual task</td>
<td>L1 = L2</td>
<td>No consistent relations with the working memory variables because participants found the problems too difficult.</td>
</tr>
</tbody>
</table>

Primary task (Easy problems):

- **Horizontal:** L2 was always slower than L1; phonological load effect was greater than the visual load effect.
- **Vertical:** Although L2 was slower than L1, the visual load effect was much larger than the phonological load effect.

Conclusion

The results are consistent with Imbo and LeFevre’s findings (2010). Further, mental multiplication in L2 requires additional phonological load, specifically on translation of numbers from L2 to L1.