The Effect of Long-Term Memory Knowledge on Rehearsal and Refreshing in Working Memory

Gérôme Mora¹, Valérie Camos²

¹ University of Bourgogne
² University of Fribourg
Influence of long-term knowledge in short-term memory

Evidences from …

**Frequency effect**: high frequency words benefit from a facilitated access to long-term representations (*Hulme et al.*, 1991, 1999).

**Lexicality effect**: words benefit from association to long-term knowledge compared to non-words (*Hulme et al.*, 1997).

Effects mediated by more than one mechanism (*Thorn, Frankish, & Gathercole*, 2009).

Two mechanisms operate at separate stages of the memory process.

1. Activation levels at storage
2. Redintegration at retrieval
Long-term knowledge and maintenance mechanisms in WM

Do LTM effects occur during maintenance in working memory?

Subvocal Rehearsal
(Baddeley, 1986)

Attentional Refreshing
(Baddeley, 2000; Camos et al., 2009; Engle et al., 1999)

If LTM effects occur at maintenance they should interact with variation of maintenance mechanisms.
Aim: Investigate interaction of LTM effects with maintenance mechanisms in young adults.

Exp 1:
Interaction of frequency with refreshing
Location judgment task
(Barrouillet et al, 2007)

Exp 2:
Interaction of lexicality with refreshing & rehearsal
Location judgment task
Articulatory suppression task
(Baddeley, 1986)
Exp. 1: Frequency × Refreshing

Complex span paradigm

Lists of 6 words
- High Frequency > 70
- Low Frequency < 1

Within-subject design
Exp. 1: Frequency × Refreshing

**Frequency effect**
\[ F(1,18) = 40.54, \quad p < .001 \]

**Pace effect**
\[ F(1,18) = 34.72, \quad p < .001 \]

**Frequency x Pace**
\[ F<1 \]
Exp. 1: Frequency × Refreshing

Frequency effect is not mediated by attentional refreshing at maintenance.

However, rehearsal could account for persistence of the frequency effect.

Exp. 2
Rehearsal and refreshing were orthogonally manipulated.
Exp. 2: Lexicality × Refreshing × Rehearsal

Rehearsal ✔
Refreshed ✔

Complex span paradigm

6 items to remember

item1
item2
Exp. 2: Lexicality × Refreshing × Rehearsal

<table>
<thead>
<tr>
<th></th>
<th>Rehearsal</th>
<th>Refreshing</th>
</tr>
</thead>
<tbody>
<tr>
<td>w1</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>w2</td>
<td>✗</td>
<td>✔</td>
</tr>
</tbody>
</table>

6 items to remember

Complex span paradigm

outil oui...

item1

item2
Exp. 2: Lexicality × Refreshing × Rehearsal

<table>
<thead>
<tr>
<th></th>
<th>Rehearsal</th>
<th>Refreshing</th>
</tr>
</thead>
<tbody>
<tr>
<td>'w1'</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>'w2'</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>'w1 up w2 down'</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6 items to remember

Complex span paradigm

- item1
- item2

up down
Exp. 2: Lexicality × Refreshing × Rehearsal

| Rehearsal | ✔ | ✗ | ✔ | ✗ |
| Refreshing | ✔ | ✔ | ✗ | ✗ |

6 items to remember

Complex span paradigm

oui oui...
Exp. 2: Lexicality × Refreshing × Rehearsal

| Rehearsal | ✔ | ✗ | ✔ | ✗ |
| Refreshing | ✔ | ✔ | ✗ | ✗ |

6 items to remember

Words
3 phonemes nouns
- chef
- cube

Non-Words
Differed from words on 1 phoneme
- chif
- cude

Within-subject design
Exp. 2: Lexicality × Refreshing × Rehearsal

Lexicality
\( F(1,22) = 120.93, p < .001 \)

Refreshed
\( F(1,22) = 18.50, p < .001 \)

Rehearsal
\( F(1,22) = 84.76, p < .001 \)

Lexicality × Refreshing
\( F<1 \)

Lexicality × Rehearsal
\( F(1,22) = 1.23, p = .279, \eta^2_p = .05 \)

Lexicality × Refreshing × Rehearsal
\( F(1,22) = 1.89, p = .183, \eta^2_p = .08 \)

★ p < .001
**General Conclusion**

- Frequency and lexicality effects seem to be mediated by other processes than those occurring at maintenance.
  - Building of representations or Activation level at encoding or redintegration at recall (Thorn et al., 2009).

**Exp. 1:** Frequency affected recall whatever the pace of the concurrent processing.
  - Frequency effect is not mediated by attentional refreshing.

**Exp. 2:** Lexicality affected recall whatever rehearsal and/or refreshing were impeded.
  - Lexicality effect is not mediated by:
    1. attentional refreshing
    2. subvocal rehearsal
Thank you for your attention