Short-term memory for ASL fingerspelling and print

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The Phonological Loop
• The phonological loop is used to temporarily store and rehearse information in WM (Baddeley, 1986; Gathercole & Baddeley, 1993)
• Words are stored in form (speech) based representation

Evidence for a phonological similarity effect in serial recall
• Words are repeated from a small set to reduce reliance on long-term memory (N = 8)
• Poorer recall of phonologically related words:

<table>
<thead>
<tr>
<th>Similar words</th>
<th>Dissimilar words</th>
</tr>
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<tbody>
<tr>
<td>blue</td>
<td>king</td>
</tr>
<tr>
<td>hard?</td>
<td>farm</td>
</tr>
<tr>
<td>chew</td>
<td>tax</td>
</tr>
<tr>
<td>due</td>
<td>easy?</td>
</tr>
<tr>
<td>jew</td>
<td>bug</td>
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The phonological similarity effect
• Printed words are re-coded into a phonological code in short-term memory (STM)
• Evidence for phonological (speech-based) coding for deaf readers has been mixed but appears with more skilled readers (Conrad, 1979, Chincotta & Chincotta 1996)
• Do all deaf signers use a phonological code?
• Manual coding (Shand 1982, Moulton & Beasley 1975, Hanson, Liberman & Shankweiler, 1984)
• Deaf signers have an English-based code and an ASL-based code available to them (Campbell & Wright, 1989; Dodd, Hobson, Brasher, & Campbell, 1983; Hanson, 1982, 1990)

The phonological similarity effect for ASL signs
• ASL signs are stored in a form based representation

The Sign-based Phonological Loop
• ASL signs are stored in a form based representation

Fingerspelling (FS) to a manual code?
- Do deaf ASL signers represent FS words in a manual code?
- Is there a manual similarity effect for FS?

<table>
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<th>Manually similar words</th>
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<tr>
<td>e-a-s-t</td>
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Manual similarity in ASL fingerspelling
- Fingerspelling (FS) provides a manual system for representing English orthography
- FS as an additional or alternative manual coding strategy?
- A manual similarity effect in fingerspelled word recall?

Print to a phonological code?
- Do deaf ASL signers re-code printed words into a phonological code?
- A phonological similarity effect for print?

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Example: manually similar words

READY
Example: manually dissimilar words

Print to a manual code?
- Do deaf ASL signers re-code printed words into a manual (FS) code?
- A manual similarity effect for printed words?

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</tr>
<tr>
<td>nose</td>
<td>farm</td>
</tr>
<tr>
<td>mat</td>
<td>tax</td>
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<tr>
<td>not</td>
<td>bug</td>
</tr>
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FS to a phonological code?
- Do deaf signers re-code FS into a phonological code? Dual-coding?
- A phonological similarity effect for FS words?

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<td>f-a-r-m</td>
</tr>
<tr>
<td>d-u-e</td>
<td>t-a-x</td>
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Hypotheses
- If deaf readers re-code printed words into a phonological code, they will show a phonological similarity effect.
- If deaf readers store/rehearse FS words in a manual code, they will show a manual similarity effect.
- If they re-code print into FS, we will see a manual similarity effect for printed words.
- If they re-code FS words into a phonological code, we will see a phonological similarity effect for FS words

Rating of stimuli
- Phonological similarity ratings:
  “Please rate how similar each pair of words sounds to you”
  (1 don’t sound similar at all – 5 sound very similar)

- Visual similarity ratings
  “Please rate how similar each pair of words looks to you”
  (1 don’t look similar at all – 5 look almost exactly the same)

- Manual similarity ratings
  “Please rate how similar each pair of words feels to you when you fingerspell them”
  (1 don’t feel similar at all – 5 feel very similar)
**Participants**

<table>
<thead>
<tr>
<th></th>
<th>deaf</th>
<th>hearing</th>
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<tbody>
<tr>
<td>Print</td>
<td>21 (M age = 31.1, SD = 10.6)</td>
<td>21 (M age = 22.7, SD = 5.2)</td>
</tr>
<tr>
<td>FS</td>
<td>20 (M age = 32.8, SD = 9.2)</td>
<td>--</td>
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- reading grade: deaf = 12 (PIAT 83); hearing = college (PIAT 84); t(40) = 0.89, p > .05
- reading fluency score: t(30) = 0.47, p > .05
- print exposure score: t(40) = 0.86, p > .05
- KBIT score: t(40) = 0.89, p > .05
- phonological awareness (composite score): deaf M = .62, SD = .15; hearing M = .91, SD = .07; t(28) = 8.2, p < .001*

**Procedure**

- 8 target words, 8 control words
- 24 four-word lists: 12 similar, 12 dissimilar lists (+ 8 practice lists)
- order presentation was counterbalanced
- participants recalled printed words in print, fingerspelled words in fingerspelling (FS was video recorded)

**Stimuli presentation**

**Phonological similarity effect in printed word recall**

![Graph showing phonological similarity effect in printed word recall]

- Effect of stim. type: F(1, 40) = 67.7, p < .001
- Effect of group: F(1, 40) = 4.47, p = .04
- No group X stimuli type interaction: F(1, 40) = 2.2, p = .14

**Lack of manual similarity effect in FS word recall**

- Deaf signers do not represent FS in a manual code
- Relatively low accuracy for both dissimilar and similar FS items – a good measure of similarity of FS?

- Deaf ASL signers re-code printed words into a phonological code, similarly to hearing non-signers
Lack of manual similarity effect in printed word recall

- Deaf ASL signers do not re-code printed words into a manual fingerspelling code

Phonological similarity effect in FS word recall

- Deaf ASL signers re-code fingerspelled words into a phonological code

Phonological similarity effect in print and FS word recall (deaf, n=17)

- Phonological similarity effect was systematic for deaf signers in print and FS modalities

Phonological coding and reading proficiency

- The use of phonological coding in STM task did not correlate with phonological awareness performance task or reading scores
- Is there a relationship between the use of speech-based coding in STM and reading proficiency?

The manual similarity effect for fingerspelled words?

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<td>s-a-m-e</td>
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- New manual similarity metrics developed using an articulator model by Diane Brentari and Jonathan Keane [https://github.com/jonkeane/amohs](https://github.com/jonkeane/amohs)
- Similarity metrics:
  - pairwise similarity for pairs of words
  - e.g. box-dog is similarity(b vs. d)+similarity(o vs. o)+similarity(x vs. g)
- Contour metrics:
  - comparison of all handshapes within a single word
  - e.g. box is similarity(b vs. o)+similarity(o vs. x)
The manual similarity effect for FS

• A manual similarity effect with our new stimuli will confirm that deaf signers use a manual code to represent FS in WM

• If we don’t see a manual similarity effect, and we continue to find a phonological similarity effect, it will support an argument that FS is mainly re-coded into a speech-based code

Summary and conclusions

• a phonological similarity effect contributed to poorer recall of printed words in deaf and hearing groups (replicating Hanson 1982)

• deaf readers maintain and rehearse printed words in STM using a phonological (speech-based) code

Summary and conclusions

• we did not find evidence for a manual (fingerspelling-based) coding of fingerspelled or printed words – this requires further work

• it remains unclear if fingerspelling is maintained in STM using a manual code

Summary and conclusions

• phonological similarity also affected recall of fingerspelled words in deaf readers

• fingerspelling is re-coded into a phonological (speech-based) code for short-term recall / rehearsal

Summary and conclusions

• speech-based code may be better suited for rehearsal of temporal order information in short-term memory than a manual code

• the ability to use a speech-based code for short-term rehearsal may not be a predictor of reading achievement; it is unclear if access to phonology could be used to support skilled reading (this warrants further research)

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References


References cont.


