



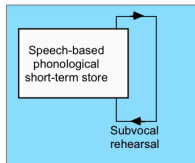

Short-term memory for ASL fingerspelling and print

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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



Baddeley (1986)

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:

Similar words	Dissimilar words	
blue	king	
hard? chew	farm	easy?
due	tax	
jew	bug	

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)

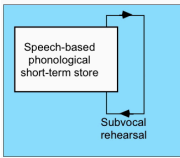
The phonological similarity effect for ASL signs

Similar handshapes		Dissimilar handshapes	
 BOOK	 BROOM	 EARTH	 EGG
 SOAP	 BREAD	 KEY	 SOCKS
hard?		easy?	

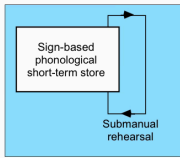
Poizner et al. (1981), Wilson & Emmorey (1997)

The Sign-based Phonological Loop

- ASL signs are stored in a form based representation



Baddeley (1986)

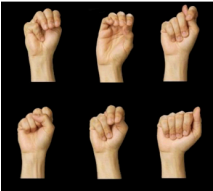
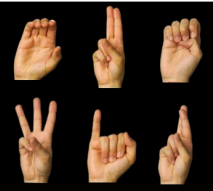


Wilson & Emmorey (1997)

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?

Manual similarity in ASL fingerspelling

Manually similar	Manually dissimilar
	
harder?	easier?

Hanson, Liberman & Shankweiler (1984)

Our questions

Print to a phonological code?

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

<u>Phono similar words</u>	<u>Phono dissimilar words</u>
blue	king
chew	farm
due	tax
jew	bug
hard?	easy?

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?

<u>Manually similar words</u>	<u>Manually dissimilar words</u>
e-a-s-t	b-o-x
n-o-s-e	c-a-p
m-a-t	d-e-s-k
n-o-t	l-i-e
hard?	easy?

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?

Manually similar words Manually dissimilar words

east	king
nose	farm
mat	tax
not	bug
hard?	easy?

FS to a phonological code?

- Do deaf signers recode FS into a phonological code? Dual-coding?
- A phonological similarity effect for FS words?

Phono similar words Phono dissimilar words

b-l-u-e	k-i-n-g
c-h-e-w	f-a-r-m
d-u-e	t-a-x
j-e-w	b-u-g
hard?	easy?

Hypotheses

- If deaf readers recode 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

Design and stimuli

	Phonological condition:		Manual condition:	
	similar	dissimilar	similar	dissimilar
Printed words (deaf & hearing)	blue chew due jew shoe two who you	king farm tax bug some with cry that	east nose mat not meat same son ten	box cap desk lie race love sick new
FS words (deaf only)	b-l-u-e c-h-e-w d-u-e j-e-w s-h-o-e t-w-o w-h-o y-o-u	k-i-n-g f-a-r-m t-a-x b-u-g s-o-m-e w-i-t-h c-r-y t-h-a-t	e-a-s-t n-o-s-e m-a-t n-o-t m-e-a-t s-a-m-e s-o-n t-e-n	b-o-x c-a-p d-e-s-k l-i-e r-a-c-e l-o-v-e s-i-c-k n-e-w

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

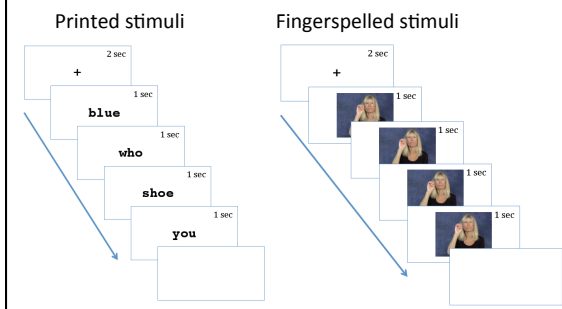
	deaf	hearing
Print	21 (M age = 31.1, SD = 10.6)	21 (M age = 22.7, SD = 5.2)
FS	20 (M age = 32.8, SD = 9.2)	--

- 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: $t(40) = 0.89, p > .05$
- phono awareness (composite score): deaf M = .62, SD = .15; hearing M = .91, SD = .07; $t(28) = 8.2, p < .001^*$

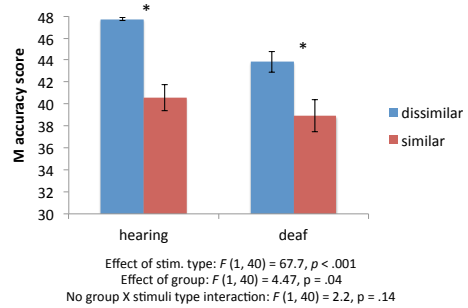
Procedure

- 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)

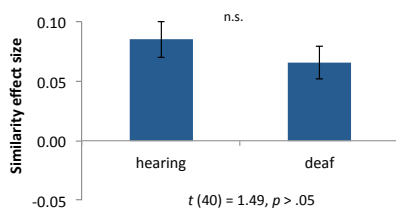
Stimuli presentation



Phonological similarity effect in printed word recall

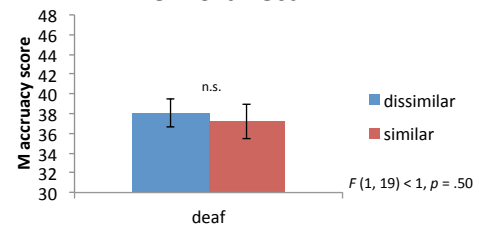


Phonological similarity effect in printed word recall

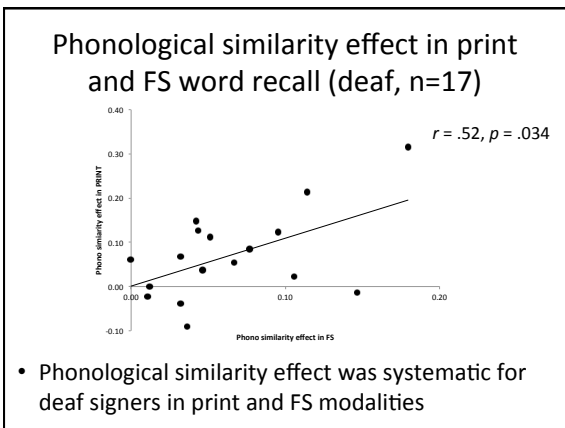
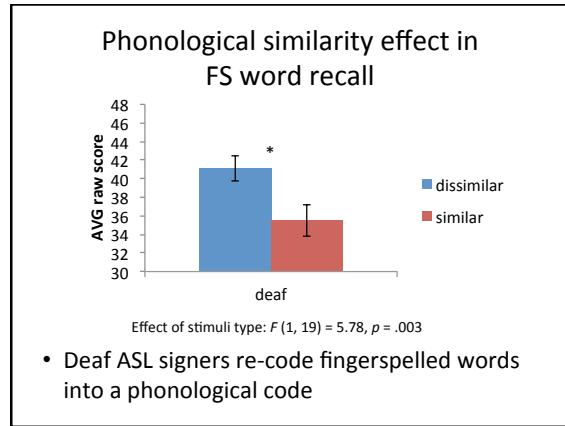
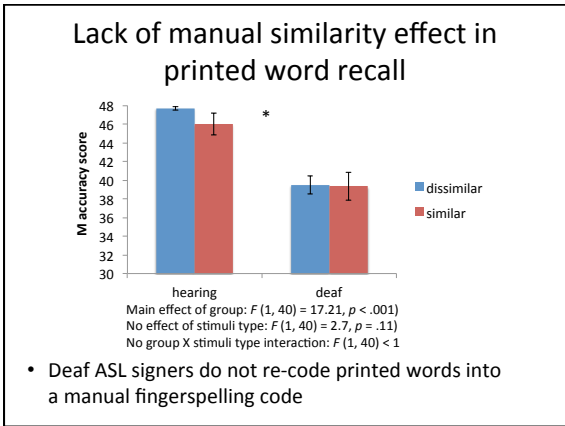


- Deaf ASL signers re-code printed words into a phonological code, similarly to hearing non-signers

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?



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?

<p><u>Similar words</u></p> <p>n-o-s-e e-a-s-t m-a-t n-o-t s-a-m-e s-o-n t-e-n m-e-a-t</p> <p>Similar enough?</p>	<p><u>Dissimilar words</u></p> <p>b-o-x c-a-p d-e-s-k l-i-e l-o-v-e n-e-w r-a-c-e s-i-c-k</p> <p>Dissimilar enough?</p>
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The manual similarity effect for FS

- New manual similarity metrics developed using an articulator model by Diane Brentari and Jonathan Keane <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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