



Effect of complexity of inflectional paradigm on word production

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Background

- When **novel words** enter a language, they adapt to the language's **inflectional system** (e.g. the Finnish word *brändi* 'brand')
- Finnish has different inflectional types suitable for integration of novel words like *brändi*
- Some of these inflectional types are irregular and are not typically used to inflect novel words

Two theories for how language users inflect words (e.g., *sneak*)

Dual-route model	Single-route model
While inflecting an irregular word, we retrieve the whole inflected word form from an associative lexical memory (<i>snuck</i>)	We use the same cognitive mechanism, namely a single associative process, for irregular (<i>snuck</i>) and for regular (<i>sneaked</i>) word forms
While inflecting a regular word, we apply a rule (e.g., add a default suffix <i>-ed</i> : <i>sneaked</i>)	
Predictions: Speakers will use the regular paradigm as a default for inflecting novel words, but may use an irregular paradigm if the novel word resembles a real word that has irregular inflection.	Predictions: Speakers are likely to rely on phonological similarity of the novel words to real words in their mental lexicon to choose the inflectional paradigm.
The dual-route model also predicts that people who have less intact functions in hippocampal regions (e.g., people with dementia) would show difficulties in processing and retrieval of irregular word forms.	Thus, pseudo-words that resemble real words with regular inflection will have regular inflection, and pseudo-words that resemble real words with irregular inflection will be inflected in the same way.

Research questions

- Do speakers inflect novel words based on their phonological resemblance to a certain inflectional type of words?
- Do participants with dementia avoid morphophonological changes by adding a default suffix regardless of a word's phonological resemblance to any type, as the dual-route model predicts?
- Is there an effect of education on people with dementia?

Materials

We built 99 pseudo-words based on three Finnish noun types that differ in their regularity and inflectional complexity.

The inflectional type *lasi* is productive and regular.

The inflectional types *savi* and *vesi* are both irregular in Finnish.

The *vesi* inflectional type has a more complex inflectional paradigm than the *savi* inflectional type.

lexical entry: <i>lasi</i> 'glass'		
	singular	plural
nominative	lasi	lasi-t
genitive	lasi-n	lasi-en
partitive	lasi-a	lase-ja
essive	lasi-na	lase-i-na
translative	lasi-ksi	lase-i-ksi
inessive	lasi-ssa	lase-i-ssa
elative	lasi-sta	lase-i-sta
illative	lasi-in	lase-i-hin
adessive	lasi-lla	lase-i-lla
ablative	lasi-lta	lase-i-lta
allative	lasi-lle	lase-i-lle
abessive	lasi-tta	lase-i-tta
comitative		lase-i-ne-(POSS)
instructive		lase-i-n

lexical entry: <i>savi</i> 'clay'		
	singular	plural
nominative	savi	save-t
genitive	save-n	savi-en
partitive	save-a	savi-a
essive	save-na	savi-na
translative	save-ksi	savi-ksi
inessive	save-ssa	savi-ssa
elative	save-sta	savi-sta
illative	save-en	savi-in
adessive	save-lla	savi-lla
ablative	save-lta	savi-lta
allative	save-lle	savi-lle
abessive	save-tta	savi-tta
comitative		savi-ne-(POSS)
instructive		savi-n

lexical entry: <i>vesi</i> 'water'		
	singular	plural
nominative	vesi	vede-t
genitive	vede-n	vesi-en
partitive	vet-tä	vesi-ä
essive	vete-nä	vesi-nä
translative	vede-ksi	vesi-ksi
inessive	vede-ssä	vesi-ssä
elative	vede-stä	vesi-stä
illative	vete-en	vesi-in
adessive	vede-llä	vesi-llä
ablative	vede-ltä	vesi-ltä
allative	vede-lle	vesi-lle
abessive	vede-ttä	vesi-ttä
comitative		vesi-ne-(POSS)
instructive		vesi-n

Methods

Speech elicitation task: Speaker orally completes a sentence containing a target word, which they must inflect at the end.
Niklakselle sälmi on tärkeää, mutta hän ei saanut yhtään ...
"For Nicholas a sälmi is important, but he hasn't got any ..."
This sentence would elicit a singular partitive form of the target word.

Participants:

17 cognitively healthy controls (HC, age 55-79, mean 65.8)
22 individuals with Alzheimer's disease (AD, age 56-83, mean 72.7)
24 individuals with mild cognitive impairment (MCI, age 58-81, mean 72.4)

Data analysis of inflected pseudo-words using a mixed-effects model (Bates et al., 2015)

Dependent variable: Type of inflection produced (1 for *lasi*-like inflection, 2 for *savi*-like inflection, and 3 for *vesi*-like inflection)

Explanatory variables:

- **Phonological overlap:** the minimal Levenshtein distance (Levenshtein 1966) between each pseudo-word and each word from types *lasi*, *savi*, and *vesi*. Levenshtein distance was computed by counting the number of insertions, deletions and substitutions necessary to turn one string into another. Lower numbers indicate more similarity.
- **Dementia severity:** A global measure of cognitive assessment based on the Sum of Boxes score from the Clinical Dementia Rating Scale (CDR-SOB, Hughes et al., 1982), assessed to all participants.
- **Years of education**

Results

Distribution of inflectional types

- Participants used the regular inflectional type for most responses.

type	HC	MCI	AD
lasi	84.5 %	89.5 %	81.8 %
savi	7.7 %	5.6 %	8.6 %
vesi	7.9 %	4.9 %	9.6 %

Results of mixed-effects analysis

Elderly controls:

- **phonological overlap with *vesi*-type** ($b = -.155, t = -3.67, p < .001$)
- **phonological overlap with *savi*-type** ($b = .108, t = 2.9, p = .005$)
- phonological overlap with *lasi*-type (*not significant*)
- CDR-SOB (*not significant*)
- **Years of education** ($b = .024, t = 2.1, p = 0.053$)

Individuals with mild cognitive impairment:

- **phonological overlap with *vesi*-type** ($b = -.109, t = -3.25, p < .001$)
- phonological overlap with *savi*-type (*not significant*)
- phonological overlap with *lasi*-type (*not significant*)
- CDR-SOB (*not significant*)
- Years of education (*not significant*)

Individuals with Alzheimer's disease:

- **phonological overlap with *vesi*-type** ($b = -.383, t = -7.55, p < .001$)
- phonological overlap with *savi*-type (*not significant*)
- phonological overlap with *lasi*-type (*not significant*)
- **CDR-SOB** ($b = -.118, t = -5.24, p < .001$)
- Years of education (*not significant*)

Discussion

- Results support predictions of the dual-route model: phonological overlap of a novel word with a real word was a significant predictor but only for words from irregular inflectional types.
- Participants with more severe AD tended to avoid complex morphophonological changes to pseudo-words, even when they resembled *vesi*-type words. Thus, they chose a strategy of minimal effort (add a default suffix with no changes to the stem), which may be a compensation mechanism that they use in order to perform the task successfully.
- The opposite strategy, apply more morphophonological changes if possible, seems to be present in people with more years of education, but only in the healthy control group.

References

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