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Transposed Letter Effects in Korean

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Abstract

Typographical errors caused by switching the order of two letters in a word (e.g., *jugde* for *judge*) are often misperceived as the word. This phenomenon, known as the transposed letter (TL) effect, has been used widely in studying letter position coding in reading. Previous research by Lee and Taft (2009) found no TL effects in Korean, a nonlinear script, causing those authors to argue that the processing of letter position information varies as a function of the orthographic structure of a language. Therefore, given the nature of Korean, no TL effects should exist in Korean because TL nonwords do not activate their base words. The purpose of the present research was to evaluate this claim using the masked priming, lexical decision task (LDT), a more conventional method for evaluating automatic processing than the simple, unprimed LDT used by Lee and Taft. TL primes were generated by transposing letters between syllables. Mirroring the manipulations used by Lee and Taft, there were three types of TL primes: onset1-onset2 (O-O) transpositions, coda1-coda2 (C-C) transpositions, and coda1-onset2(C-O) transpositions. Control primes involved replacing the second of the transposed letters in TL primes. As Lee and Taft predicted, no facilitation effects emerged, however, there were significant inhibition effects following TL primes, effects that Lee and Taft's analysis cannot explain.

Introduction

Transposed Letter (TL) Effects

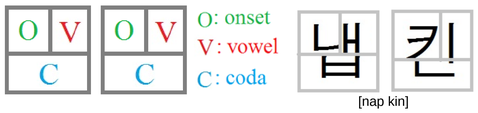
- Readers are more likely to misperceive a nonword as a word if the nonword is formed by switching positions of two letters of the base word than if it is formed by replacing those same letters
  - E.g. nakpin vs. nahbin
- Observed in languages with linear scripts, e.g., English (Lupker, Perea & Davis, 2008), Spanish (Perea & Lupker, 2004), Japanese Kana (Perea & Perez, 2009)
- No TL effects observed in two language systems:
  1. Semitic languages: Hebrew and Arabic (Velan & Frost, 2007; Perea, abu Mallouh & Carreiras, 2010)
  2. Korean (Lee & Taft, 2009)
     - A nonlinear alphabetic script
     - Letters associated with set physical positions – immune to TL effect

Korean Alphabets *Hangul*:

- 24 letters: 14 consonants and 10 vowels
- A nonlinear alphabetic script
- **Syllabic -** Each character is a syllable, consisting of 1 vowel and 1-2 consonants
- Syllables always start with consonants and end with either vowels or consonants
- Letters are associated with set physical positions, which could make Korean immune to TL effects

한글

[han gul]



Introduction (continued)

Two main methodologies for investigating TL effects:

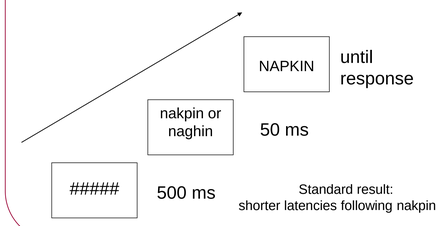
Lexical Decision Task – Simple Presentation - Nonword data (Lee & Taft 2009)

NAPKIN "yes"
or
NAKPIN "no"
or
NAGHIN "no"

until response

Standard result:
"NO" latencies longer for nakpin than naghin

Masked Priming & LDT (Present study)



Standard result:
shorter latencies following nakpin

Why choose Masked Priming?

- Largely eliminates contribution of the frontal lobes to priming (Forster, 1998)
- Better able to tap into automatic processing than simple lexical decision
- More standard technique

Purpose:

a. To investigate importance of letter position information in word recognition process in Korean

b. To evaluate the claims of Lee & Taft (2009)

Research Question:

- Can TL effects be observed in Korean when the masked priming, lexical decision methodology is used?
  - If TL effects are observed:
    - Onset-coda physical position cues, if they are used, become relevant later than letter recognition
    - Likely that Lee and Taft's task was not a good one for investigating TL effects in Korean
  - If TL effects are not observed:
    - Onset-coda physical cues may become relevant early on and play a crucial role in word recognition in Korean
    - Lee and Taft's analysis may be correct

Methods

Participants:

- Undergraduates from UWO and volunteers from different Korean communities in London, ON (n = 24)
- Native Korean speakers
- Normal or corrected-to-normal vision

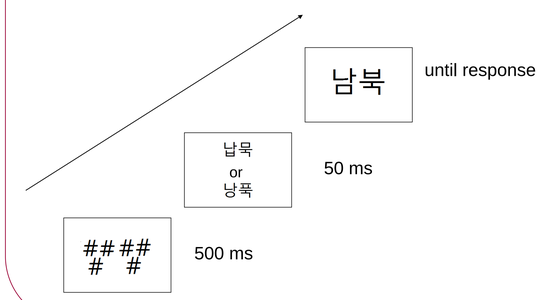
Materials:

- Six lists, each with:
  - 10 practice items
  - 180 targets (50:50 word:nonword ratio)
    - Counterbalanced - each target appear once in each list, but each time in a different priming condition (15 words and 15 nonwords in each priming condition for each participant)
- Primes - Six conditions (paralleling Lee & Taft, 2009):

1. TL O-O	밤눅 – 남북	4. RL O-O	탐훅 – 남북
2. TL C-C	낙붐 – 남북	5. RL C-C	낟붓 – 남북
3. TL C-O	납묵 – 남북	6. RL C-O	낭푹 – 남북

Procedure:

Masked Priming & LDT



Results

Median lexical decision times (in ms) and percentage of errors for word targets

	Type of Prime		
	TL (ER %)	RL (ER %)	TL Priming
Onset1-Onset2 (O-O)	753 (8.9)	735 (4.9)	-19 (-4.0)
Coda1-Coda2 (C-C)	731 (7.6)	700 (6.4)	-31 (-1.2)
Coda1-Onset2 (C-O)	715 (7.0)	729 (6.3)	14 (-0.7)

Note: TL = Transposed-Letter prime, RL = Replacement-Letter prime, ER = error rate. Negative numbers in the TL Priming column indicate inhibition effects.

Results (continued)

- Significant interaction between relatedness and prime type in both the subject (F_1) and item analyses (F_2)
  - $F_1(2, 34) = 5.13$, $p < .05$
  - $F_2(2, 152) = 4.06$, $p < .05$
- Main effect of prime type was significant in subject analysis
  - $F_1(2, 34) = 4.01$, $p < .05$
- Post-hoc tests indicated the inhibitory effect of O-O transpositions and the inhibitory effect of C-C transpositions were significant in one, but not both, analyses
  - O-O: $F_1(1, 17) = 7.17$, $p < .05$
  - C-C: $F_2(1, 77) = 4.21$, $p < .05$
- The facilitory effect of C-O transpositions was not significant in either analysis
  - C-O: $F_1(1, 17) = 1.65$, $p > .10$, $F_2(1, 77) = 2.74$, $p > .10$

Conclusions

- Lee and Taft's basic argument was that TL nonwords do not activate their base words due to the nature of Korean. Hence there should be no inhibition in their task and no facilitation in a masked priming task.
- There is some potential evidence of TL facilitation in the C-O condition (e.g., nakpin-NAPKIN) but there is no good evidence that effect is real at this point. Hence, Lee and Taft's general point about Korean may be correct, TL primes do not activate their base words.
- The novel finding of inhibitory effects of O-O and C-C TL primes in Korean requires further research/explanation.
- It is possible that the lexical system of Korean readers is based of syllables themselves and that those syllables act like word units do for readers of other languages.
  - Syllables as basic unit for lexical discrimination
  - Previous literature (e.g., Davis & Lupker, 2006) reported inhibitory priming effects when target words were primed with orthographically related words (e.g., attitude-APTITUDE), due to "lexical competition".
  - When a transposition of letters across syllables occurs in Korean, two syllables are produced that are similar to the syllables in the base word. Those syllables may inhibit the processing of the correct syllables in the base word slowing processing overall ("syllabic competition")
  - The nonsignificant facilitation for C-O transpositions may actually reflect a real facilitation effect that is muted by this inhibition process. It is the one transposition used here that is most similar to the transpositions that produce the most reliable effects in English (e.g., nakpin-NAPKIN).

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