Introduction

Visual word recognition studies with a case-mixing manipulation have consistently revealed shorter response times (RTs) for consistent lowercase than for mixed-case words, known as the case-mixing effect. Lien, Allen, and Crawford (2012) provided electrophysiological evidence for an early locus of case mixing (i.e., structural encoding), as indexed by the N170 effect. Recently, Perea, Vergara-Martinez, and Gomez (2015) claimed a late locus of case mixing using a masking priming paradigm. In their study, participants performed a lexical-decision task on an uppercase target, which was preceded by an identity or unrelated prime (e.g., “plane” or “music” followed by “PLANE”, respectively). The prime was presented in lowercase or mixed case. They found similar priming effects on RT (unrelated RT = identity RT) for lowercase and mixed-case primes, suggesting that case mixing does not impede the early lexical access.

The Present Study

Perea et al. (2015) used only uppercase targets, which potentially promoted the visual word recognition system to encode targets and primes using the letter-level channel (an analytic channel). As a result, a similar priming effect was observed for both lowercase and mixed case primes. The present study examined this possibility.

We adopted Perea et al.’s (2015) masking priming design but included both uppercase targets and lowercase targets (blocked within participants). As in Perea et al., the prime word was presented in lowercase or mixed case, which was the same identity (regardless of case type) or unrelated to the target.

We measured the priming effect on RT and proportion of error (PE) for uppercase targets and lowercase targets.

**Priming Effect = Unrelated Prime – Identity Prime**

Predictions

If case mixing does not hinder the initial access to abstract lexical representations during visual word recognition as claimed by Perea et al. (2015), then similar priming effects for lowercase and mixed-case primes should be observed for both uppercase targets and lowercase targets.

If case mixing has an early locus (e.g., an early encoding level), then one would expect larger priming effects for lowercase than mixed-case primes at least for the lowercase target where word recognition is achieved primarily using whole word shape as the basic encoding unit (holistic processing; e.g., Healy & Cunningham, 1992).

Experiment 1

**Task**: A lexical-decision task - determining whether a letter string formed a word or nonword (the “x” key for words and the “n” key for nonwords).

**Stimuli**: A total of 160 words and 160 nonwords were used to form 8 different lists, with the list being counterbalanced between participants. A practice block of 16 trials and 4 regular blocks of 40 trials for each target case type.

**Design**: A 2 (prime type: identity vs. unrelated) x 2 (prime case type: lowercase vs. mixed) x 2 (target case type: lowercase vs. mixed) x 2 (target lexicality: word vs. nonword) within-subject design. All variables except target case type were intermixed within blocks.

**Event Sequence**: An example of the unrelated condition below.

![Event Sequence Diagram](image)

**Results (N=120)**

For both target words and nonwords, the 3-way interaction between target case type, prime case type, and prime type was significant on RT, F(1,112)=8.11, p=0.0149. Similar priming effects on RT for lowercase and mixed-case primes were observed for uppercase target, replicating Perea et al.’s (2015) findings. For lowercase target, however, the priming effect was significantly larger for lowercase primes than mixed-case primes. For target nonwords, the 3-way interaction was not significant on RT. F(1,112)=2.39, p=0.1209. No effects were observed in PE. F(1,112)=1.81, p=1.81. These findings suggest an early locus of case mixing, when holistic processing can be used, as in lowercase targets.

Experiment 2

**Experiment 2** examined whether the priming effect observed in Experiment 1 was caused by lexical access.

We used a non-lexical, font discrimination task. The stimuli were similar to Experiment 1, except that the target was printed in Arial for Courier font (the “x” key for Arial font and the “n” key for Courier font). Again, 8 different lists were generated between participants.

**Results (N=112)**

For both target words and nonwords, the 3-way interaction between target case type, prime case type, and prime type was not significant on RT and PE, F(1,104)=1.81, p=1.181. The priming effect was negligible, indicating that priming effects were caused primarily by lexical access.

Conclusions

The present study examined whether Perea et al.’s (2016) findings were due to the use of uppercase targets, which potentially promoted the visual word recognition system to encode targets and primes using the letter-level channel (an analytic channel).

Experiment 1 used both uppercase and lowercase targets. While the uppercase target replicated Perea et al. (2015), the priming effects for the lowercase target were larger for lowercase than mixed-case primes.

Experiment 2 examined whether the priming effect was caused by lexical access, or not, by using a non-lexical, font discrimination task. The priming effect was negligible for lowercase and mixed-case primes in both target words and target nonwords.

These results suggest an earlier lexical locus of the case-mixing effect, as well as holistic priming.

References


