

# The time-course of lexical activation in Japanese two-character word recognition

## An eye-tracking lexical decision study

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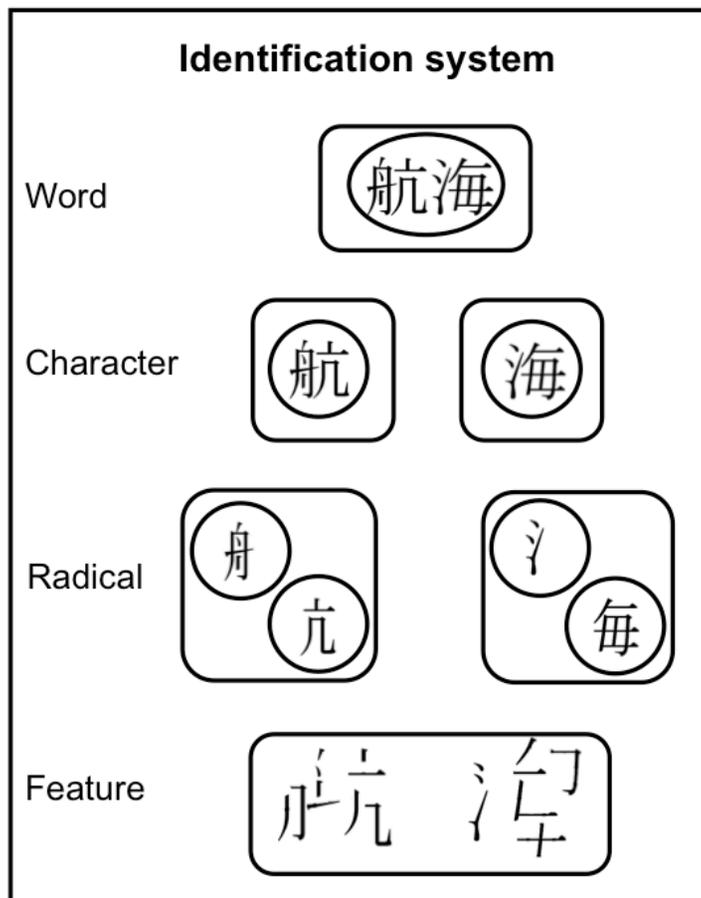
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ICPEAL 2012 (Nagoya, Japan)

October 27, 2012

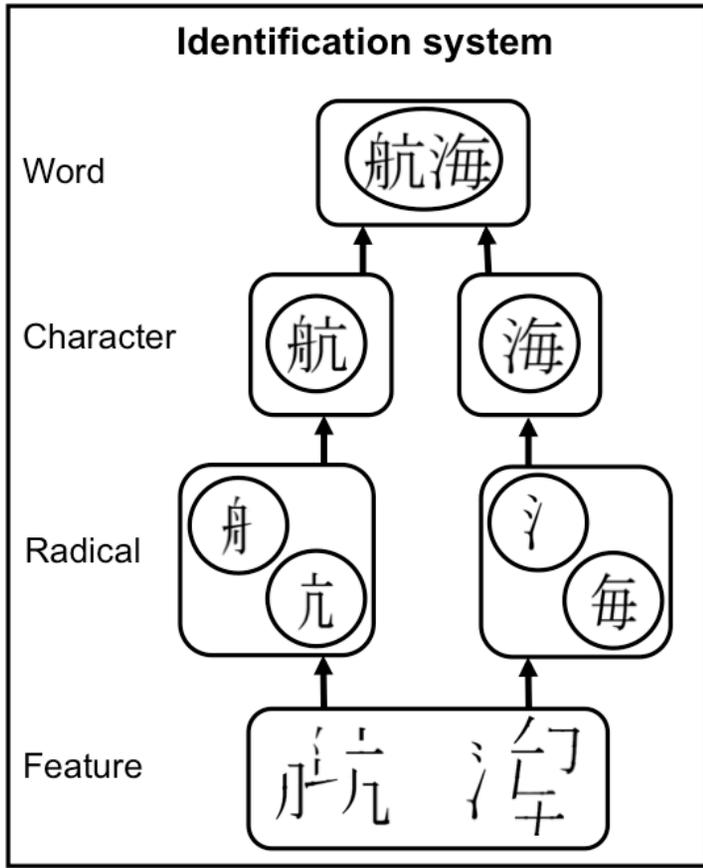
# Morphological Processes



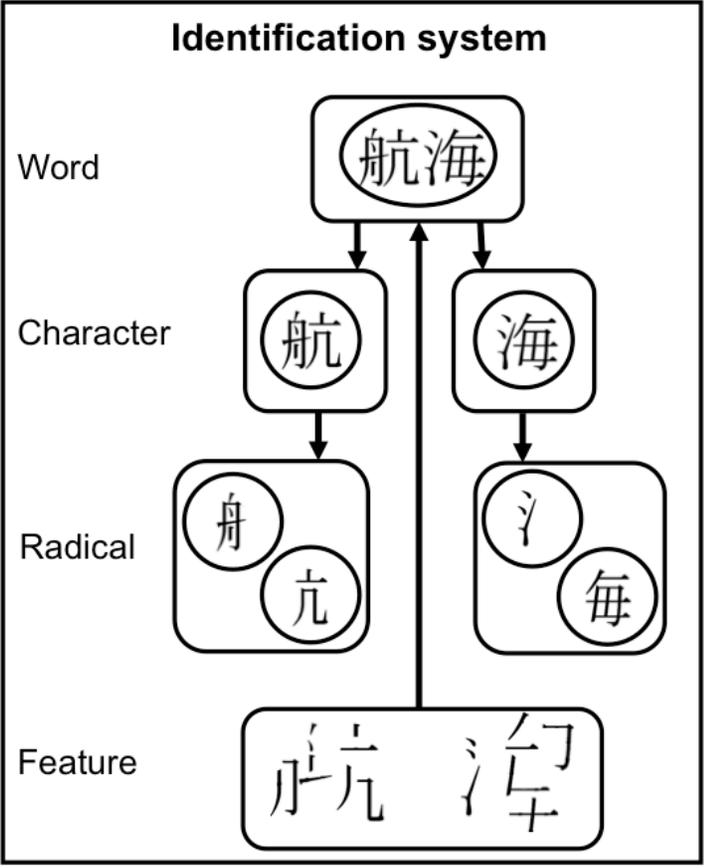
- How do the whole and its parts contribute to our recognition of a complex entity as a coherent meaningful unit ?
- Japanese and Chinese logographic (morphographic) two-character words have a multiple layer of morphological complexity.
- How are two-character words (= most common word type) recognized ?

# Morphological Processes

### Sub-lexical Model (Radical-driven Decomposition)



### Supra-lexical Model



# Research Questions

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- 1. What is the order of activating the constituents and the whole word representations ?**
- 2. What is the relative importance of the left and the right constituents in complex word processing ?**
- 3. What is the role of attention ? (what do eye fixations reflect?)**
  - We conducted lexical decision with eye-tracking experiments (see Kuperman et al., 2009 for Dutch lexical decision with eye-tracking)
  - We tested relevant lexical predictors in mixed-effects regression modeling (Baayen, Davidson, & Bates, 2008).

# Lexical Decision with Eye-tracking

- **Participants**

21 Japanese speakers in Canada

- **Materials**

708 two-character words

708 nonwords

(non-existing combination of characters)

- **Procedure**

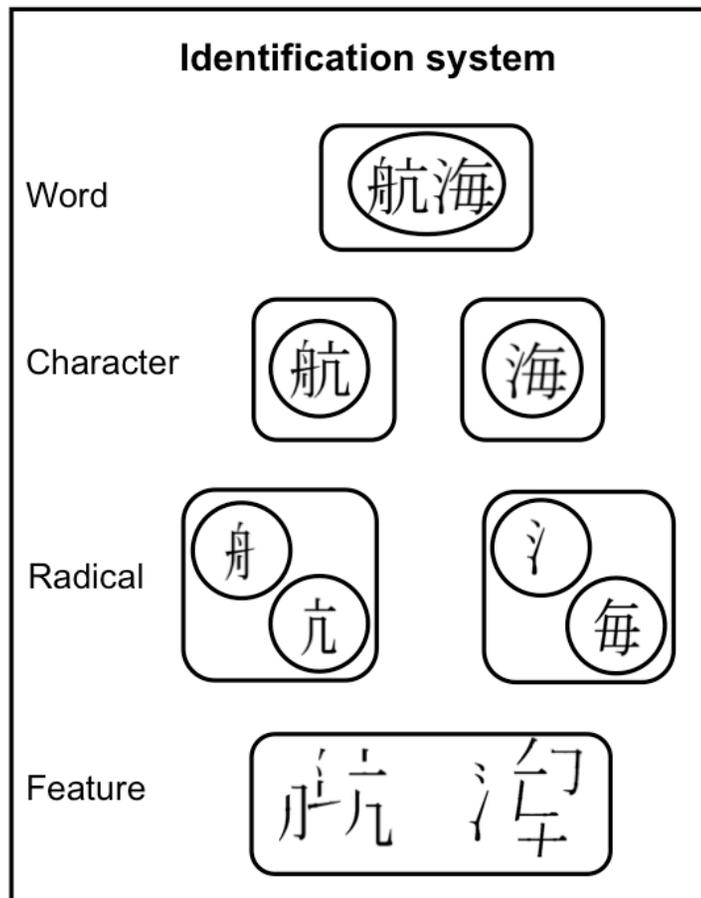
472 words in one session \* 3 sessions

Fixation point manipulation

(Left, Central, Right)



# Lexical Predictors



## Whole Word

Whole Word Frequency,  
Google Doc Frequency (residualized)

## Character

Left *Kanji* Frequency  
Right *Kanji* Frequency

## Radical

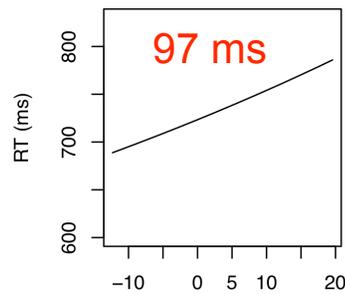
Left Kanji Radical Frequency  
Right Kanji Radical Frequency

## Feature

Whole Word Strokes  
Left *Kanji* Strokes (residualized)  
Right *Kanji* Strokes (residualized)

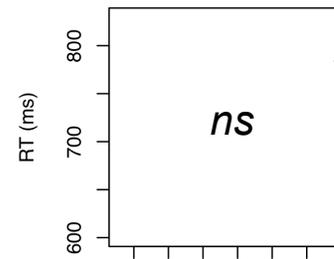
# Response Time Analysis

### Feature



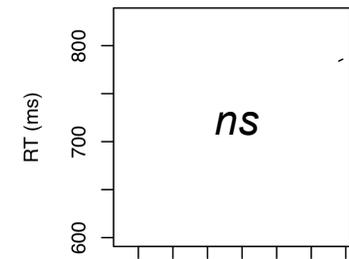
Whole Word Strokes

### Radical



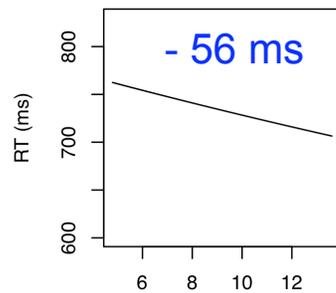
Left Kanji Radical Freq

### Radical



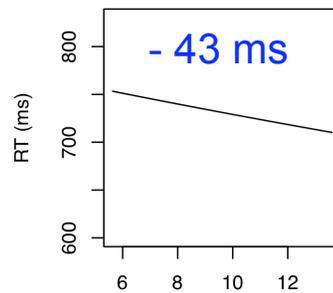
Right Kanji Radical Freq

### Character



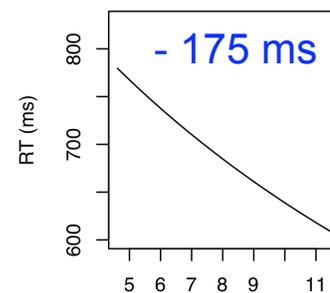
Left Kanji Freq

### Character



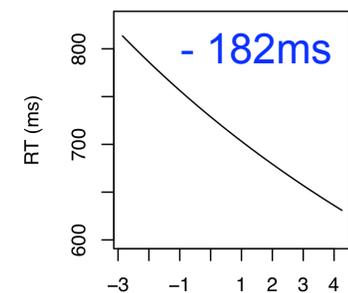
Right Kanji Freq

### Whole Word



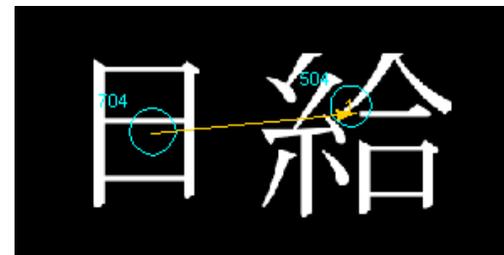
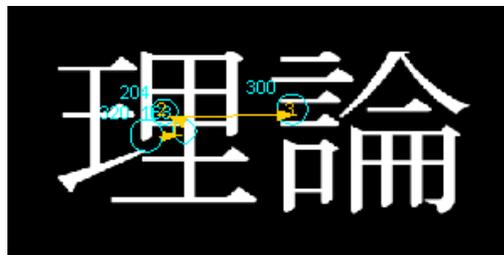
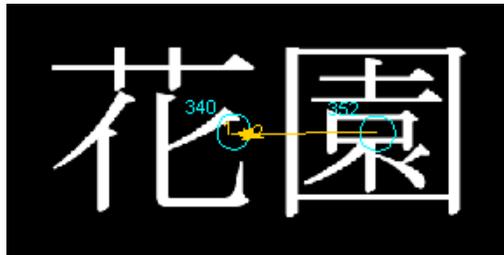
Whole Word Freq

### Whole Word



Google Doc Freq

# Observed Eye Movements

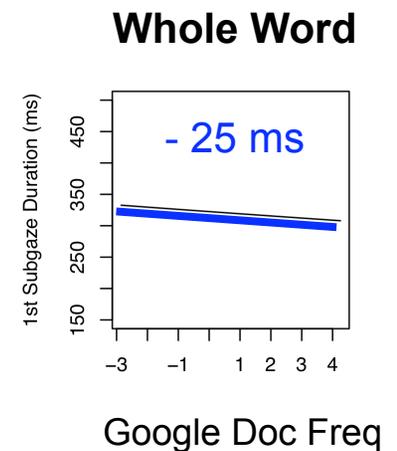
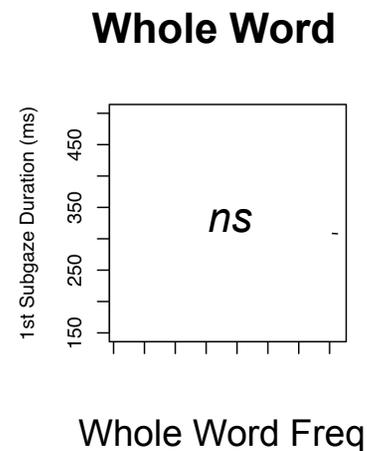
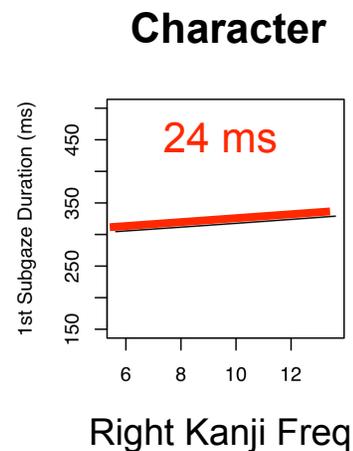
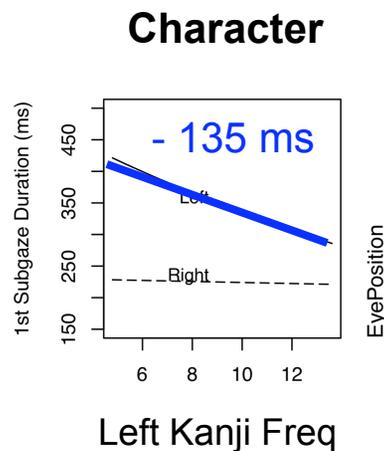
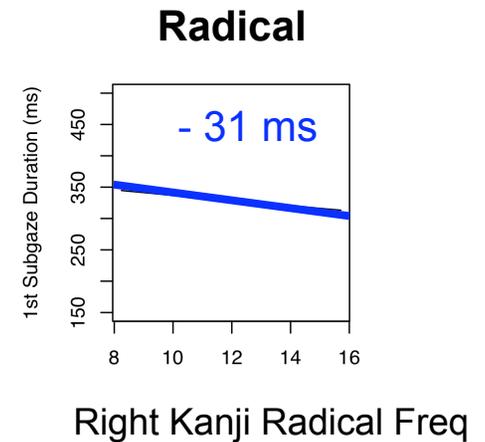
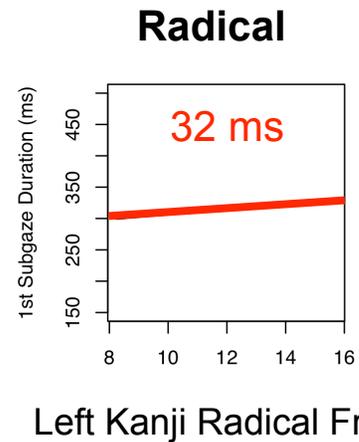
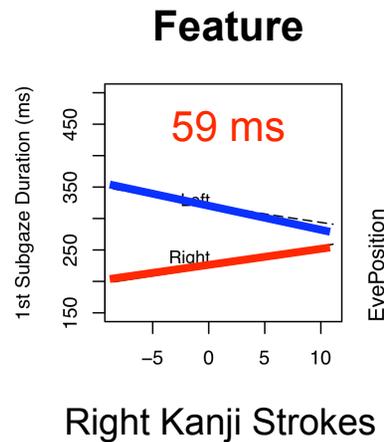
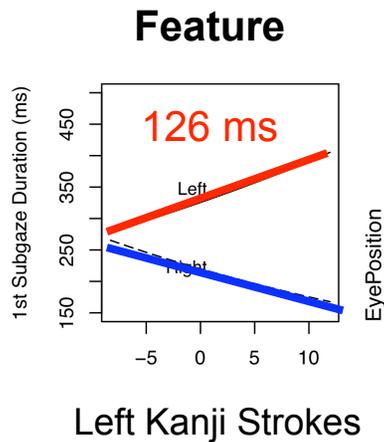


- When readers were motivated to read from right to left, more fixations were needed (effect size = 0.1 subgazes)
- Eye movements were mostly character-based.

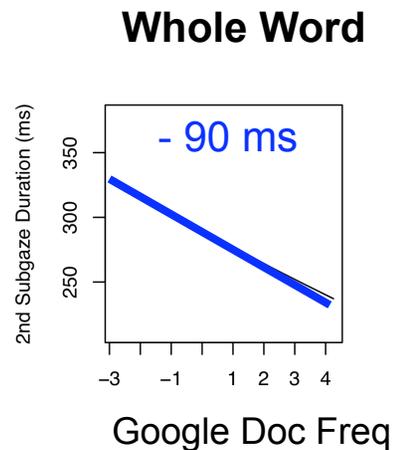
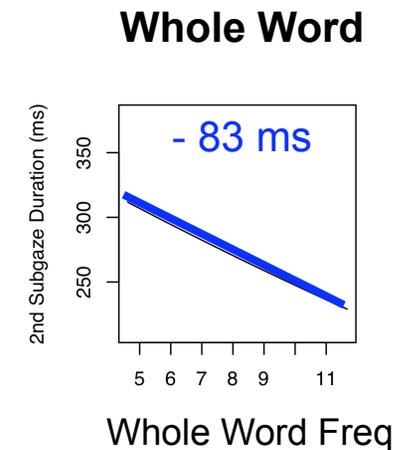
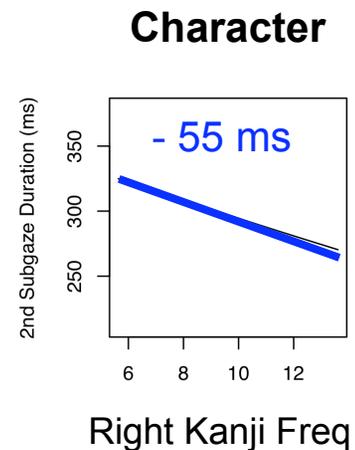
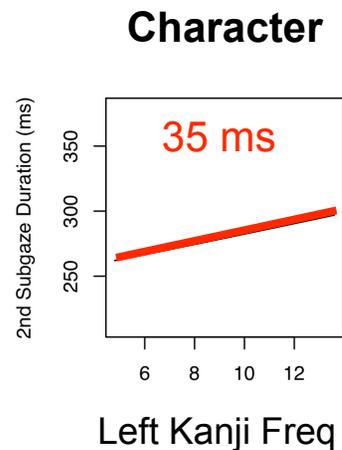
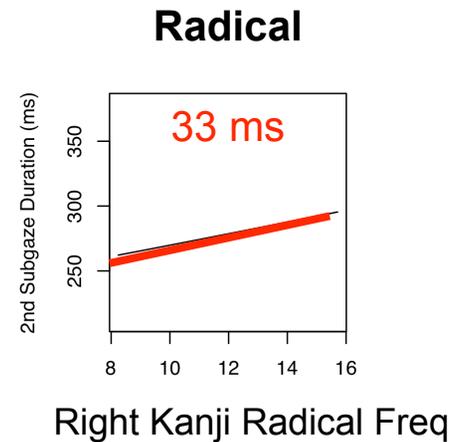
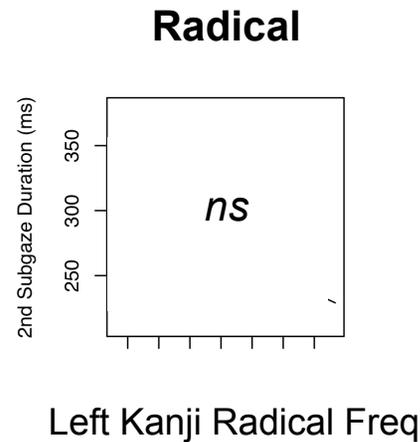
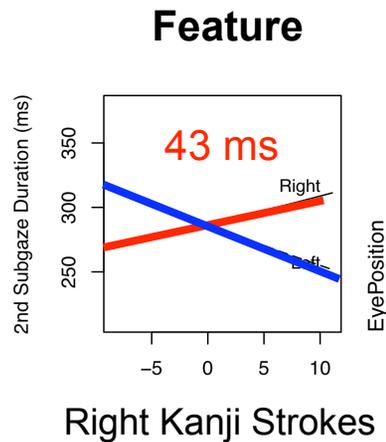
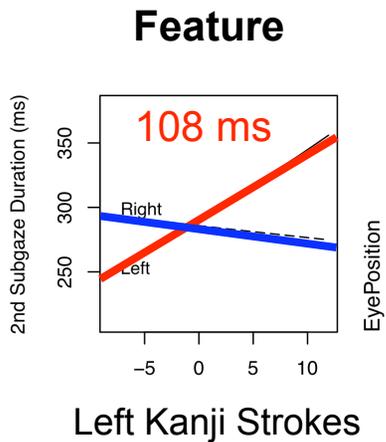
# Sub-lexical Radical-based Model's Prediction for 1<sup>st</sup> Subgaze Duration



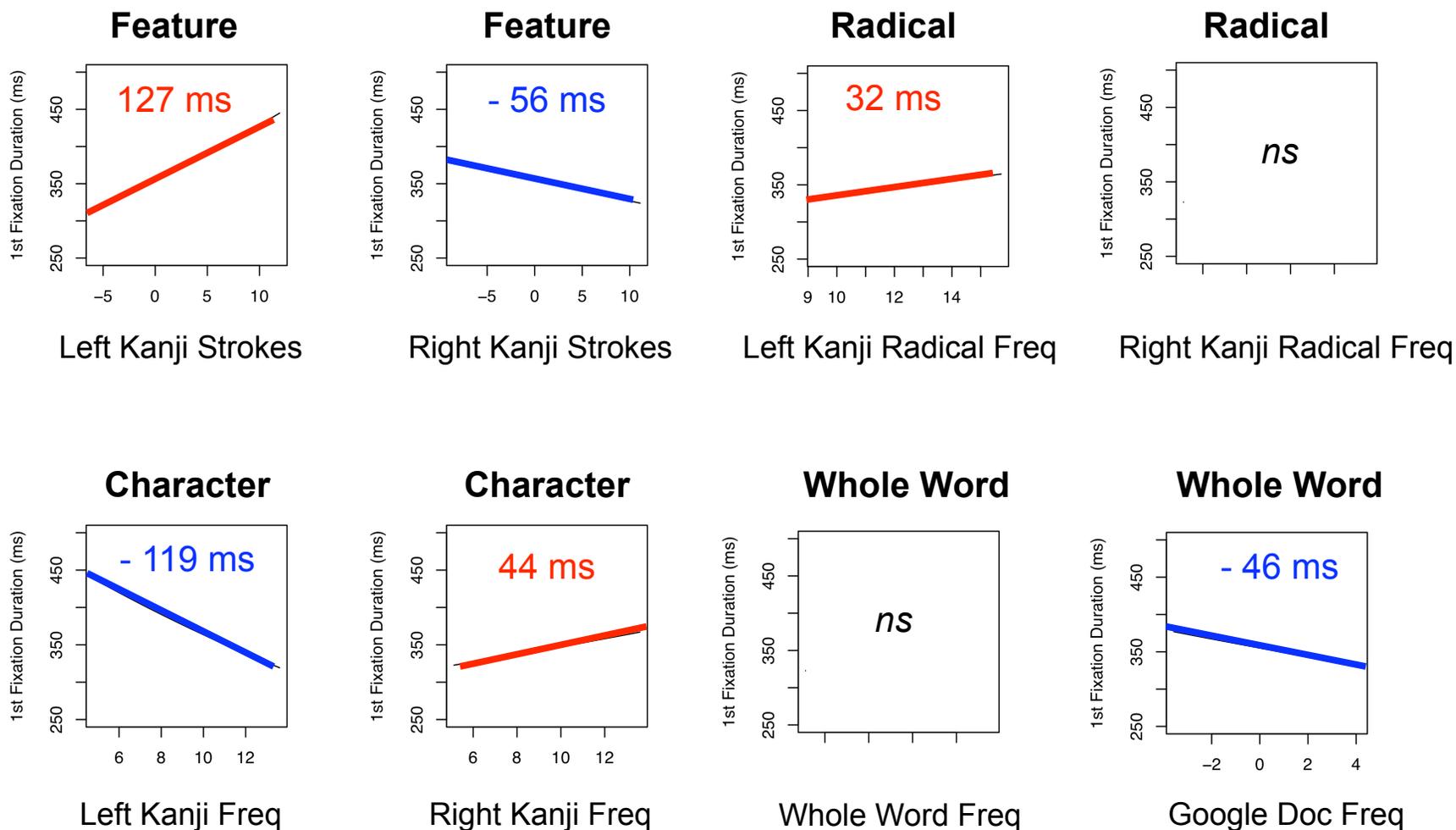
# 1<sup>st</sup> Subgaze Duration Analysis



# 2<sup>nd</sup> Subgaze Duration Analysis

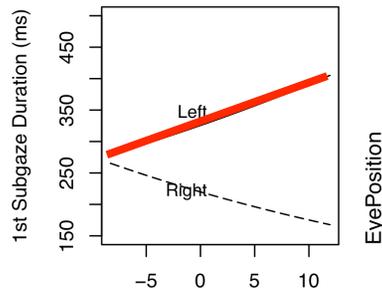


# Smaller Font, Different Nonwords, Left Fixation & Analysis of 1<sup>st</sup> Fixation Durations: Basic Results were replicated!



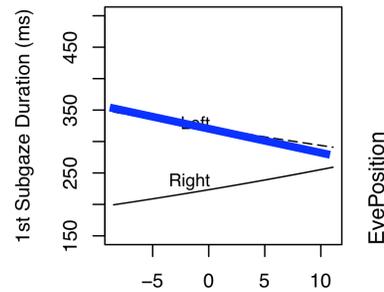
# 1<sup>st</sup> Subgaze Duration Analysis

## Feature



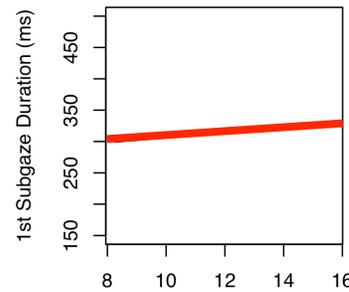
Left Kanji Strokes

## Feature



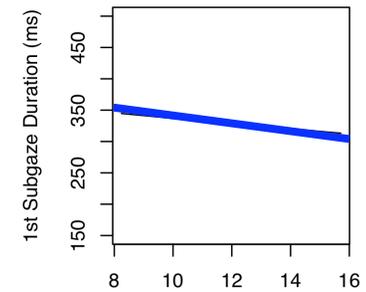
Right Kanji Strokes

## Radical



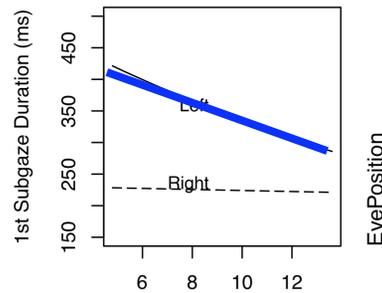
Left Kanji Radical Freq

## Radical



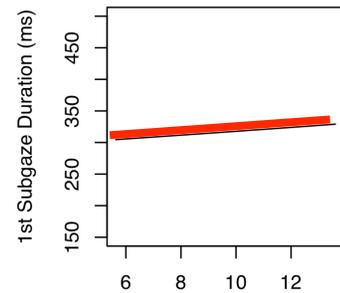
Right Kanji Radical Freq

## Character



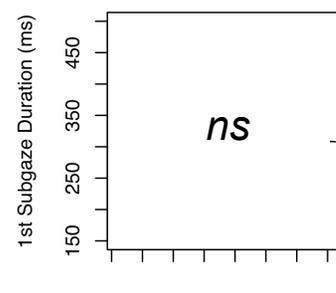
Left Kanji Freq

## Character



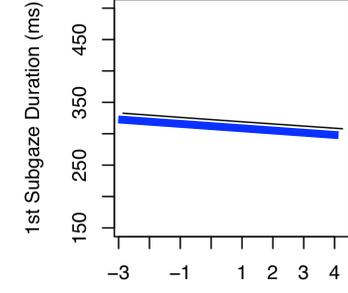
Right Kanji Freq

## Whole Word



Whole Word Freq

## Whole Word



Google Doc Freq

# Summary

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## **1. What is the order of activating the constituents and the whole word representations ?**

→ Effects of the characters were facilitatory, large, and more robust than effects of the whole word and the radicals during the earliest time frame (radical effects were small and inhibitory)

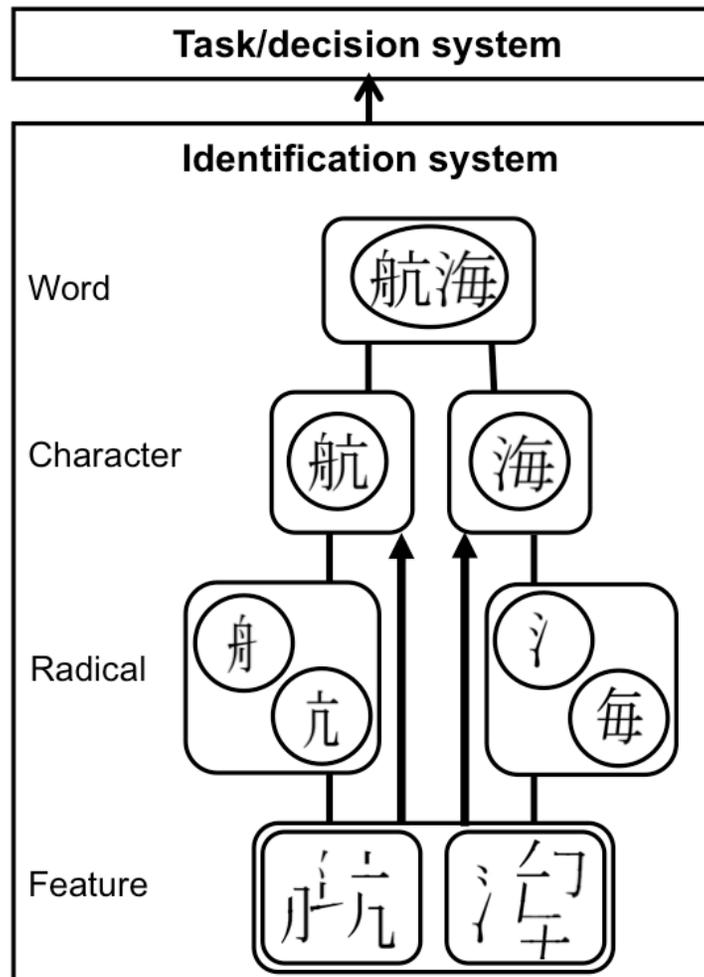
## **2. What is the relative importance of the left and the right constituents in complex word processing ?**

→ It is not an either-or issue. They contribute at different points in time.

## **3. What is the role of attention ?**

→ Attention modulates lexical processes.

# Our Proposal: Character-driven Processing Model



- Effects of the characters were facilitatory, large, and more robust than effects of the whole word and the radicals during the earliest time frame (radical effects were small and inhibitory)
- Given this, we propose a character-driven processing model with a level-skipping assumption.
- Character-driven processing pattern was found regardless of the font size and nonword types.