A picture is worth two thousand words: Visual complexity in morphographic word recognition

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Aims and background

Background

- Although studies on morphographic word processing usually control for character stroke counts (e.g., 鯨 'whale' has 19 strokes), we do not know much about the visual complexity.

Research questions

- Are stroke counts enough to capture visual complexity of Japanese *kanji* words? Doesn't JPEG size work better?
- What is the nature of the stroke effect? Linear or non-linear?
- It is possible to obtain an visual essence of kanji words (i.e., a prototypical kanji word) through an averaging technique?

Summary of the findings

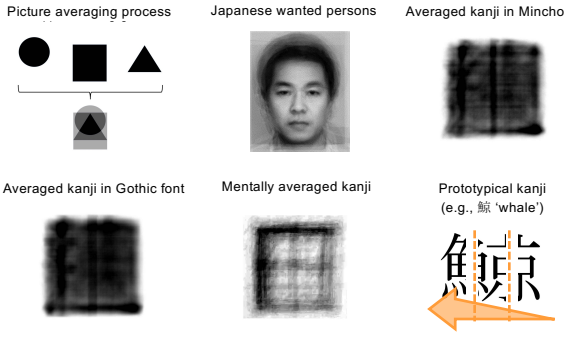
- *Strokes* was a better predictor than *JPEG size,* but it was not enough to fully account for visual complexity of *kanji* words.
- The effects of *Strokes* are not always linear.
- For Japanese *kanji* words, the left and middle parts of the character region are more likely to contain visual information.
- The average-based prototypicality affects word recognition.

Experiment 1 (Picture averaging)

- It is known that "visual essence" of faces can be obtained through averaging (Galton, 1878; Jenkins & Burton, 2008).

Method

- We applied this technique to 1945 Japanese *kanji* words. We also asked 111 native speakers of Japanese to guess what the averaged *kanji* would look like, which were then averaged.



Results

- The "visual essence" hints tripartite (but not bipartite) decomposition, with more information on the left (i.e., *Prototypicality*), which also account for the left-side bias in recognition of logographic words (Hsiao & Cottrell, 2009).
- Native speakers could not correctly guess the visual essence.
- The following visual complexity variables were studied:

(1) *Strokes*, (2) *Prototypicality*, (3) *JPEG Size*, (4) *Orthographic Levenshtein Distance*, (5) *Distance from the Averaged Image*, (6) *Number of Character Constituents*

Experiment 2 (Complexity rating)

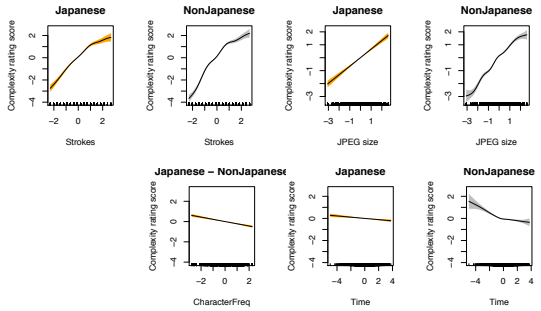
Method

- 20 native and 21 non-native speakers of Japanese rated visual complexity of 300 randomly selected *kanji* words, using a 9-point scale. Rating scores were analyzed.

Results

- Only native speakers rated *Prototypical* words less complex.
- *JPEG Size* could replace *Strokes*, but *Strokes* was better.

(1) *Strokes*, (2) *Prototypicality*, (3) *JPEG Size*, (4) *Orthographic Levenshtein Distance*, (5) *Distance from the Averaged Image*, (6) *Number of Character Constituents*



Experiment 3 (Progressive demasking)

Method

- 20 native speakers of Japanese identified, as quickly as possible, 300 kanji words that were progressively unmasked RTs were analyzed

Results

- *Strokes* had a linear effect, and it could not be replaced with *JPEG Size*.

(1) *Strokes*, (2) ~~*Prototypicality,*~~ (3) ~~*JPEG Size,*~~ (4) *Orthographic Levenshtein Distance*, (5) *Distance from the Averaged Image*, (6) ~~Number of Character Constituents~~

Experiment 4 (Eye-tracking lexical decision)

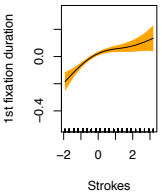
Method

- Data analyzed in Miwa et al. (2014) were reanalyzed.
- 21 Japanese made lexicality judgment with 708 two-character words and 708 nonwords, during which their eye movements were recorded. 1st subgaze durations were analyzed.

Results

- *Strokes* was a better predictor than *JPEG Size*.
- *Prototypical* words received longer fixations.

(1) *Strokes*, (2) *Prototypicality*, (3) *JPEG Size*, (4) ~~*Orthographic Levenshtein Distance*~~, (5) ~~*Distance from the Averaged Image*~~, (6) *Number of Character Constituents*



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