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?

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.

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 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.

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.