

Departmental Seminar

***Chinese character recognition—
Studies of complexity effect on recognition efficiency,
spatial frequency characteristics and crowding***

Date: August 26, 2013 (Monday)
Time: 11:30 a.m. – 12:30 p.m.
Venue: Room 813, 8/F, The Jockey Club Tower, Centennial Campus, HKU
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Chinese characters are used by around one-fifth of world population. Each character is composed of majorly three writing levels including single stroke, component and whole character. The visual spatial layout of Chinese characters is very special in the sense that each character occupies a square area regardless of the number of strokes it has. This special property makes Chinese characters have great variation of spatial complexity levels. While past research studies focused on the importance of different writing levels on Chinese character recognition, as the amount of feature information in a character is proportional to its spatial complexity level, the effect of character complexity on Chinese character recognition will be examined instead in the studies reported here in order to investigate how readers process or use the feature information to recognize Chinese characters in both central and peripheral vision.

The findings from several studies will be reported. Firstly, the efficiency of detecting and recognizing Chinese characters with different complexity levels was studied. The results suggested that generally recognizing a complex character was less efficient than a simpler one. The relationship between efficiency and complexity resulted in a loglog slope with exponent around 1, implying that the basic features of recognizing a single Chinese character might be less complex than a stroke. By analyzing the detection and recognition efficiency, Chinese character recognition might follow a two-stage processing model—feature detection and feature integration. The feature integration process was adversely influenced by internal crowding in peripheral vision. Secondly, the spatial frequency characteristics of recognizing Chinese characters of different complexity levels were examined. The results showed that the peak tuning frequency for recognizing a more complex Chinese character was higher and the bandwidth was narrower. In addition, it demonstrated different levels of size dependency in different complexity conditions. By comparing human data with data from a CSF-limited ideal observer, it implied that the processing mechanism of recognizing simple and complex characters was different. Thirdly, the importance of utilizing spatial frequency of different directions (i.e., horizontal and vertical) in Chinese character recognition was compared. The results showed that it was more efficient for native Chinese readers to use vertical stroke information to recognize Chinese characters whereas non Chinese readers used both vertical and horizontal stroke information similarly. Furthermore, the importance of vertical stroke information has also been demonstrated in peripheral vision. Fourthly, the complexity combination effect on crowded Chinese character recognition in peripheral vision has been examined. The results suggested that the behavior of feature integration process in peripheral vision might be consistent with summation theory, which stresses the relationship between the processing capacity of neurons and the processing demand of stimuli. Further insights on excessive feature integration theory in crowding were suggested as well.

The processing mechanism between recognizing simple and complex characters in central and peripheral vision will be discussed. In addition, combined the results from the studies above, how Chinese characters are recognized in low visual level processing aspects will be discussed as well.