Indian Institute of Science
Centre for BioSystems Science and Engineering

BSSE Annual Work Presentation

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A compositional code for reading

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ABSTRACT

Reading is a recent cultural invention that exploits the intrinsic recognition capacities of our visual system. But does reading consist only of learning letter-sound mappings, or does it also fundamentally alter letter representations? This question has been difficult to address because (1) illiterates and literates everywhere differ along socioeconomic and cognitive dimensions that confound all comparisons and (2) in the Western world, nearly all languages use nearly the same Latin letters.

In my first study, we addressed this question by exploiting the orthographic diversity of Indian languages. Specifically, we identified two distinct groups of students (both English-literate) but with one group fluent in reading the Telugu script but not the Malayalam script, and the other group fluent with reading Malayalam but not Telugu. To probe letter representations without reading, we used oddball visual search as a natural index of similarity between shapes. Our results show that reading alters letter representations by making single letters more discriminable and by weakening interactions between letters. More broadly, orthographic complexity of words can be understood as a linear sum of letter relations.

In my second study, we investigated the common observation that reading speed for jumbled words is not severely impeded if we preserve its end letters. This effect is popularly known as "Cambridge University Effect". Various letter coding schemes fail to explain this effect. Here, we propose that the visual properties of our brain are sufficient to explain why we read jumbled words so efficiently. We begin by alleviating the problem of reading jumbled words into a visual search task. Next, we develop three models of varying complexity to understand how letters combine to form strings and tested them on two lexical tasks. 1) Scrambled word task. 2) Lexical decision task. Interestingly, the model can predict the time taken to solve scrambled words, and lexical decision time for nonwords. It can also predict difficulty in reading jumbled WRODS and 7EX7 W17H NUM83R5.

Taken together, these studies show that our remarkable abilities at reading words is driven by intrinsic recognition abilities of our visual system.