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Number symbols represent more than numbers

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A central question in numerical cognition is, whether the processing of number symbols (e.g., digits) is grounded in non-symbolic representations of numbers. In the present work, we investigated neural activation patterns of numerical (symbolic and non-symbolic) and non-numerical (symbolic and non-symbolic) stimuli to systematically test this assumption.

We collected brain imaging (fMRI) data from 24 adults (13 females), who were asked to evaluate whether numerals, dots, letters and lines were arranged in a correct (e.g., 1 2 3; A B C; • • • • •) or incorrect numerical/non-numerical ordinal position (e.g., 3 1 2; C A B, • • • • •).

In agreement with the above assumption, we observed greater neural similarity within the category of numbers (numerals and dots) compared to the semantically unrelated conditions (letters and lines). However, the results also showed greater similarity between numerals and letters compared to numerals and dots. This result is in sharp contrast to the semantic grounding idea of numbers. It demonstrates that number symbols share greater processing similarities with other symbols than with their semantic counterpart (i.e., dots).

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