

Mathematical operations as manifestations of cognitive functions

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Short abstract:

We suggest that some of the well-known mathematical operations may be manifestations of certain cognitive functions of the brain. We investigate the examples of Fourier transformation and orthogonalization of vectors and argue that the brain possesses an orthonormal basis as an integral part of its memory storage strategy, which enables it to virtually perform Fourier transformation. Besides, the brain also possesses the capability to construct orthonormal bases in order to discriminate between the incoming information and the stored information. While the first one, which may be a part of the brain's hardware, is essential for its memory system to be robust against trauma, the latter ones are generated specifically for, and by the incoming information for them to be classified and categorized.

We show that Fourier transformation could be the manifestation of two of the brain's capabilities related with memory: (i) it may integrate the information arriving from different sense organs; and (ii) having formed the memories like this it may be employed in consolidating them into the long-term memory areas. The operation (i) may happen in the hippocampus whereas (ii) may be operated in the areas between the hippocampus and the cerebral cortex. The Fourier transformation can spread the memories in the long-term memory areas in such a way that each synapse contains the entire information of a memory being stored.

Orthogonalization could be the manifestation of the brain's capability to compare two memories to identify their similarities and differences. We argue that the brain may be storing these similarities and differences, i.e. the orthogonalized information, rather than

the full information. Orthogonalization has another significant feature — it enables storage of the similarities and differences following an economy principle. Economy is believed to be inevitable in any cognitive action.