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BRAIN MODELING - FROM ELECTRICAL AND ELECTRONIC CIRCUITS AND MODULES TO OBJECTS AND THREADS: APPLICATION TO TOURETTE´S SYNDROME

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From the time of the discovery of electricity, scientists have actively borrowed ideas from technology to help understand brain function. The earliest ´models´ depicted connexions between various parts of the nervous system as if they were electrical circuits. With the development of valve and transistor technology, excitatory, inhibitory circuits (and the actions of receptors and ligands) and neural loops came into fashion. Integrated Circuit (IC) hardware technology and modular software design (e.g. in languages such as C and FORTRAN) no doubt ushered in the move towards ´modularity´. A review of the literature has revealed that multithreading, a key feature of modern software design has not been applied to modeling movement disorders. We aimed to model the clinical phenomena in Tourette´s Syndrome (TS) using multithreading. Using the programming language Java 6, we modelled motor and verbal tics as running on different threads. Tics were reproduced by impulsive generation of motivational threads for motor or verbal actions which were subject to voluntary control. Voluntary suppression was implemented using a ´psychic threshold score´ which if exceeded allowed the motivational thread to initiate a motor thread which is turn was under some voluntary control. We find that from an internal representation standpoint (´software´) for the brain, motor and verbal tics are identical phenomena: only the peripheral manifestations are different. Various clinical phenomena such as tic suggestibility, suppression, release, etc can be demonstrated. Our experience of modeling TS leads us to recommend threads as the means to model other movement disorders and neuropsychiatric conditions.

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