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An engineer is conditioned to assume that the observable behavior of any system is a consequence of activity of mechanisms within the system. It is easy to construct systems, however, which are capable of manifesting behavior not deducible from a complete description of the system; for instance, it is well known that any system sufficiently elaborate to subsume the rules of arithmetic has this property. The human central nervous system, obeying a large (but presumably finite and denumerable) set of rules and functioning as a data manipulating and processing system in addition to computing the illusion of self awareness, evidently meets the requirements of being sufficiently complex to manifest behavior not explicable on the basis of even its total description.

Even though it is impossible to give a complete list of all the possible activity in a complex nervous system, we can expect that any specific action that actually occurs is a consequence of some specific internal function. Arms move and thoughts occur only when neurons fire; only a mystic would assert that the system generates some external or internal operation without its having been carefully computed by actual, finite, physically delineated neural circuitry firing according to (at least statistically) precise patterns. Therefore, laying aside all Gödelian inspired forebodings about the Decision Problem, our group has viewed the understanding of the human central nervous system pragmatically—given this finite lump of hardware and its myriad externally and introspectively observable behavior patterns, is there some mathematical discipline which can (even if in a crude and preliminary way) explain (by exhibiting isomorphic behavior) a meaningful subset of brain functions? We require that our models of brain function utilize computation techniques that could reasonably be supported by the central nervous system as known today and at the same time be interpretable in terms of interesting and observable human behavior.

To this date we have submitted the human eye-brain and ear-brain sensory systems to this sort of mathematical modeling. The brain portions of these models include both primary sensory and associative cortex. The models are successful in that they fit known anatomical, physiological, and psychological data concerning

*Due to time limitations, Dr. Kabrisky was unable to include a complete manuscript in this special issue. The editor has therefore substituted Dr. Kabrisky's original proposal, which formed the basis for his presentation at the colloquium. A bibliography has also been included for further references.

the human central nervous system and have been shown to be testable in parallel with human subjects in a variety of perception tasks. These tasks include perception/recognition tests ranging from the simple judgment of the name of a symbol to aesthetic considerations of similarity and difference in a set of arbitrary complex forms. The mathematical models which we have erected behave well within the norm of human behavior on identical tasks and, most important, have predicted human behavior on certain eye-brain system tasks not heretofore known.

Our tendency at this point is to assume that our models actually indicate the true internal function of the human central nervous system in those portions of the system concerned with visual and auditory perception.

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