Pairwise Comparisons and their Contribution to Understanding Consciousness

Thomas L. Saaty
Distinguished University Professor
University of Pittsburgh
Pittsburgh, Pennsylvania, USA
E-mail: saaty@katz.pitt.edu

Making comparisons of elements with respect to criteria is an ability we are born with as are all conscious living things. We derive priorities using informed judgment from comparisons of elements in regard to influence: dominance of the importance, preference or likelihood with respect to a property they share. Priorities represent a rank order of the things that are compared. They also represent proportionality of the numbers that represent that order.

The priorities are derived from pairwise comparison matrices which lead to the consideration of eigenvalues, in particular the principal eigenvalue, of a positive and occasionally nonnegative matrix. This eigenvalue becomes a useful tool in the measurement of inconsistency of judgments. When we use a hierarchic structure to make a decision we must synthesize these different priorities through multiplication followed by addition in an appropriate manner.

With network structures, we use the idea of a supermatrix. In the supermatrix, the entries are block matrices whose columns are eigenvectors derived from paired comparison matrices. The columns of the supermatrix must be stochastic in order for it to converge. This is accomplished by weighting each column of block matrices so the columns of eignenvectors in the blocks sum to one and we can raise the weighted supermatrix to powers to obtain the limiting priorities that represent the answer we seek.

With a neural structure, we need eigenfuntions to represent the priorities. The firing of each neuron can be represented by an eigenfunction, an exponentially damped periodic function of period one. There are four fundamental kinds of eigenfunctions that belong to the four division algebras: real, complex, quaternionic and octonionic. Each kind is suitable for certain kinds of sensations and thoughts. An article that investigates the interpretation of how these eigenfunctions can be used to describe consciousness in the neural domain will appear in the *Journal of Neural Networks*. Beyond that are other hypercomplex numbers that in addition to non-commutativity as with quaternions and octonions and non-associativity as with octonions are inadequate to characterize them. For example, sedonions which are non-commutative and non-associative have the peculiar property that the product of two non-zero elements can be zero as can happen with multiplying matrices.

ISSN 1936-6744
http://dx.doi.org/10.13033/ijahp.v8i1.381

A useful contribution of the ANP in applications is that it opens a new vista into nonlinear thinking that involves feedback for which language alone is unable to cope, by expressing in words and sentences, the consequences of all the influences that work together to shape the future. Logical thinking is linear and language itself is linear and moves from assumptions to conclusions linearly. The decision framework of benefits, opportunities, costs and risks has such complexity in it that logic and language alone cannot cope. Kurt Gödel’s incompleteness theorem about undecidable proofs may also be questioned in using the comprehensive but incomplete network structures in complex decision making. This is because a built in assumption is that the system they represent is always open to adding new factors that influence the outcome.

ISSN 1936-6744
http://dx.doi.org/10.13033/ijahp.v8i1.381