Discrepancies between APL-TOE (≠\) and other theories

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Some hypotheses of APL-TOE [LanA] disagree with generally-admitted postulates of neural-circuit or molecular-computing theories, so that, as a complement to the papers submitted to APL94, a few points, which needed clarification, are reviewed here.

(Quotations are italicised and embedded between "…")

"Neurons ARE continuous dynamical systems, and neuron models must be able to describe smooth, continuous quantities such as graded transmitter release and time-averaged pulse intensity " [Hopf] p. 626.

Neurons are made of molecules in which interacting entities are electrons; an average, between an electron and a "no electron", has no physical meaning. Never forget that, even in classical mechanics, averaging two opposite forces which are not applied to the same point, would lead to ignore the rotating action of a couple (or the effect of a dipole in magnetism); moreover, it is dangerous to postulate, especially for "micro-forces" which correspond to "micro-actions", that two opposite actions are necessarily simultaneous.

"The input currents of all synaptic channels are simply additive" [Hopf] p. 627.

They cannot be additive, as individual-electron sequences, except modulo 2, and with timing : successive applications of ≠ within an information processor, e.g. a chain of alternate single and double chemical bonds, which would perform a "≠\ like" algorithm, again, cannot be simultaneous; hence the general disagreement :

"We refer to the dynamics as "classical" because we are ignoring propagation time delays and the quantal nature of quantum potentials, in analogy to classical mechanics. " [Hopf] p. 633, in ref.12.

"Energy functions, for minimization, appropriate to each problem, have to be constructed " (a general postulate).

Minimization, seen in modulo 2 integer algebra, simplifies : because of the property of either 0 or 1, raised to any positive power p, to be... idempotent, non-linearities disappear; then, a least-square method becomes a least-any-power method, which will not depend on the choice of any exponent p (such as 2) : the ≠\ algorithm, when its iterates are seen as a whole, tries to equalize parity-neighboring; it is, *per se*, an ideal, then general, optimizer. One should bear in mind that the modulo 2 integer matrix product, expressed in APL as ≠.∧ can also be written ≠.˜ because α×ω in Z/2Z is also α˜ω. The cognitive transform of any binary signal B which is defined as the catenation of the successive iterates of ¯1†B„≠\B can also be obtained as a matrix product (convolution) of B by a Sierpinski conforming matrix (a mirrored geniton); due to the fact that the Sierpinski matrix is the most perfect self-similar fractal one can imagine, with a sparsity* (the ratio of 0-terms) which drastically increases as a function of its size, the ˜ component of the matrix product always selects the minimum item between a sparse row or column of the fractal matrix, and the corresponding item of sequence B. Cognitive- or helix-transforming rearranges information, optimizes it, and compresses it when it is periodical.

All this is a consequence of ≠\ being the Law electrons like to play with, as explained in one of the papers [LanE].

"[In switching devices], *switches recognize minimal patterns of ones and zeros, like the patterns recognized by the familiar AND, OR and NOR gates (called "logic gates" because they conform to mathematical logic operations). "[Conr]p.56*

If AND, OR and NOR gates are "familiar", they are also able to pollute information. With the NAND gate (also discussed in some essential papers, by Forrest L. Carter, on cellular automata and "Molecular Device Computers") and the ones expressed in APL by symbols < < > > , these Boolean gates (14 out of 16 possible ones altogether) are not necessary in biological models which have to exhibit "self-organization" : Boolean gates, with the exception of ≠ known as XOR outside APL, and of its opposite NXOR (alias EQUAL =), are all, at least partly, Gödelian, i.e. undecidable : they may add entropy (noise) to information they process, because it is impossible, in the general case, to reconstruct the original information from information having being submitted to such gates; the less familiar XOR and the "unknown-outside-APL" XOR_SCAN are not-polluting.

*Note of the redactor: the author means to say scarcity.

Idiom ≠\ self-encrypts any information into itself as a key, is reversible, (its in-verse is simply the Gray-code function, in fact a useless function, because of the rules of periodicity that govern ≠\ when iterated as a multi-soliton wave, for finite information sequences, even a whole human genome). ≠\ is "isentropic", compatible with the way entities with self-organization capabilities may "live", with NO production of entropy. As an algorithm, ≠\ is the "optimum optimorum" one can imagine for a perfect reversible computer, performing serial-to-parallel conversions of information and conversely, producing the equivalent of a FFT and its inverse as well, solving breathtaking puzzles, the solution of which would require the exact inversion of huge matrices (such problems lead, with conventional arithmetic, to intractable large systems of high-order differential equations that our present-time computers could NOT solve, because of the obliged truncations of floating-point processors, the best entropy-producing tools that were - unfortunately - invented and used by Man during the second half of the 20th century).

About reversibility, see [Fred] and especially Baker [Baker] who reinforces the properties of ≠\ (though he seems to ignore APL and the idiom); this author starts from ideal considerations on Newton's method for square-root finding, and about data sorting (“ and ““ are indeed connected to ≠\ ), and proposes a "reversible programming language" (Y -LISP).

"The world of computing is divided into two radically different domains. The classical world achieves programmability at the expense of evolutionary adaptability and computational efficiency. The biomolecular world is not programmable..." etc... [Conr] p. 57.

Algorithmic compression, as well as theoretical derivations have first led to emit a conjecture (1989), then to prove, that ≠\ must be the nucleus of all algorithms; so, the subtle but arbitrary distinction between programmable devices and not-programmable ones will vanish : any man-written computer program which uses, as a scalar function, anything else than ≠ (XOR gates) is not an optimal version of the algorithm : algorithmic compression has not been completed yet; conversely, biomolecular structures SHALL use (they have no choice) the main property of electrons, which indeed corresponds to a ≠\ model, at the quantum level.

A subtle distinction between binary computing on one hand, and tactile recognition of the shape of a molecule by another molecule like a key in a lock, on the other hand, also collapses, once useful binary computing has been proved to be reducible to the use of ≠ and ≠\ alone : the role that is played by shapes was investigated [Lans] especially to show that ≠\ can produce shapes that one indeed observes in Nature (even if the model remains bi-dimensional); then, the study of "tactile recognition" in connection with learning and vision, was paradoxically undertaken, thanks to the universality and the efficiency of the Braille alphabet for the blind [LanB]:

Tactile recognition (first learning how to read with fingertips, then reading just for pleasure or, recursively, with an education goal, of learning Latin, music, mathematics or... the Morse alphabet) is performed by blind people on very simple binary matrices, scanned in parallel along three rows. When one looks at blind people's fingers running on the lines of their Braille books, one SEES ≠\ at work, directly.

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