CORRESPONDENCE

LIMITED COMPETITION

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In my article (Good, 1967, p. 90), I said "The more the program is based on the methods used by humans the more light it will shed on the nature of thought processes. But for the sake of a clear-cut objective I should like to write a program that wins games."

I still believe what I said then, although I have left the hard work of programming to others. But the power of "brute force" has somewhat undermined the goal of the first sentence. To serve that goal, it would be useful to introduce a new kind of competition between programs in which, for any given move, the machine is not allowed to examine more than say 100 or 1000 positions. I am not saying that such competitions should replace the current ones, but that they should be held in addition. If the machines stated the reasons for their moves, these competitions would be of great value to cognitive psychology, to AI, and to chess-players.

Reference

Good, I.J. (1967). A five-year plan for automatic chess. *Machine Intelligence II* (eds. E. Dale and D. Michie), pp. 89-118. Oliver and Boyd, Edinburgh.

LIMITED COMPUTATION I

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It was reported in the March 1993 *ICCA Journal*, p. 49, that Monroe Newborn predicted that "200 years from now, computers may be powerful enough to solve the game of chess". This statement should not be taken too seriously, in part because of the time span involved (predicting next year's advance is tricky enough) but more importantly, because of certain theoretical barriers to solving the game of chess.

For instance, using arguments based on quantum mechanics, H.J. Bremermann has conjectured that no computer, either living or artificial, can process more than 2×10^{47} bits of information per gram of its mass per second. [Bremermann, H.J. "Optimization through Evolution and Recombination" in *Self-organizing Systems* (eds. M.C. Yovits *et al.*), pp. 93-106, Spartan Books, Washington D.C., 1962].

If this is true, a computer the size of the earth (6×10^{27} g) operating continuously for a period equal to the estimated age of the earth (10^{10} years) could process fewer than 10^{93} bits. This number is considerably less than the number of possible sequences of moves in chess games of 40 moves by both sides, which has been estimated at 10^{120} [first suggested by C.E. Shannon in "Programming a Computer for Playing Chess", *Philosophical Magazine*, Vol. 41, No. 7, pp. 256-275, 1950].