Machines Cannot Think

Although modern computers calculate with lightning speed they cannot match man's ability to conceptualize and reason—By Patricia McBroom

➤ NO MACHINE in existence can think like humans and the chances that one will soon emerge are slim, according to a new and impressive summation of the status of artificial intelligence.

Headlined claims of intelligent computers have blossomed out of all proportion to the truth, wrote Dr. Hubert L. Dreyfus, professor of philosophy at the Massachusetts Institute of Technology in his analysis, "Alchemy and Artificial Intelligence," written while he was a consultant to the Rand Corporation in Santa Monica, Calif.

Computer enthusiasts, said Dr. Dreyfus, are much like the man who inches up a tree believing he will reach the moon. All evidence indicates that there is just such a chasm between the "brute force" thinking of even the most complex digital computers and the "elegant" thinking humans engage in as a matter of course.

However, early successes with checker-playing machines have "hypnotized" computer experts into the assumption that humans think like digital computers, but on a more complex level. Like alchemists who vainly worked to turn lead into gold, these intelligent scientists are persisting in the face of widespread setbacks.

For instance, noted Dr. Dreyfus, the most successful chess-playing program was allegedly able to counter the moves of a master player up to some point in the middle of the game. Actually, he said, it plays a rather "stupid" game, and in its last official bout was beaten by a 10-year-old novice in 35 moves.

The chess problem points up one of the many differences between human and machine thinking.

Checkers, simple as it is, can be calculated far enough ahead to select a winning move. Chess cannot. The number of alternatives open to a chess player is so great that a branching "tree" of impossible proportions would have to be investigated by the computer. Therefore, in order to prune the tree, experts introduced what is called "heuristics." The machine supposedly only considers those moves that are most promising—a sort of "educated hunch-playing" that has been compared to human playing.

But no way has yet been found to prune the tree so that the machine scans only the most promising moves. Even if a way were found, said Dr. Dreyfus, the game would probably not be any closer to human processes.

Humans do not count through hundreds of moves before arriving at a few good alternatives, said Dr. Dreyfus. Somehow the player manages to zero in on his opponent's weak area. He is marginally aware of the total board, but does not explicitly consider most of it, as the machine must. Through this "fringe of consciousness" thinking the player arrives at a focus and then starts to "count"—"if I move there, he will do that," and so on.

This explicit logical counting out—the only type of thinking of which machines are now capable—is, by all observation, more laborious and less economical than any other thought process. Humans use it in solving some problems, but they have available to them three other processes that no machine has yet duplicated:

The first is the "fringe of consciousness" or "global awareness," process, as in scanning a crowd for a familiar face.

The second is the ability to grasp essentials—in other words, insight. Without applying elaborate rules, humans are able to see similarities between various problems and objects. They move directly to the essence, ignoring the nonessential.

The third type of thinking Dr. Dreyfus called "ambiguity tolerance." Before understanding language, for instance, humans do not have to reduce it to absolutely precise, unambiguous rules. But the machine does.

Reasonable people interpret reasonable sentences unequivocally most of the time. A computer cannot reliably interpret sentences at all, in part because it cannot work with ambiguity. Early, elementary successes with machine translators have fizzled into stalemates, Dr. Dreyfus said.

Signs of stagnation are now evident in game playing, in machine translation, in the use of computers to prove mathematical theorems, and in a complex field—pattern recognition. All depend on human thought processes far beyond a machine's present capability.

Dr. Dreyfus believes the limits on artificial intelligence are near. "Before we invest more time and money," he said, "we should ask whether . . . computer language is appropriate for analyzing human behavior." Can human intelligence be approximated on a digital computer? "The answer to both these questions seems to be 'no.' "

• *Science News, 90:6 July 2, 1966*