once mastered, deteriorates when an attempt is made to apply explicit rules consciously.

In an important sense, then, Chomsky is one of our mythical explorers. Unable to inspect the insides of the found objects, human minds, and ignorant of whatever engineering principles may be relevant, e.g., the neurophysiology of the living brain, he sets out to infer the found object's laws from the evidence of its linguistic behavior.[1]

As far-reaching as the research aims of Chomsky's school are, they are modest compared to those of the leading scientists working in that branch of computer science called "artificial intelligence" (AI). Herbert A. Simon and Allen Newell, for example, together leaders of one of the most productive teams of AI researchers at Carnegie-Mellon University, Pittsburgh, claimed as early as 1958 that, in their own words;

> "There are now in the world machines that think, that learn and that create. Moreover, their ability to do these things is going to increase rapidly until—in the visible future—the range of problems they can handle will be coextensive with the range to which the human mind has been applied."[2]

They thus proclaimed the research aim of the new science, AI, to be nothing less than to build a machine whose linguistic behavior, to say the least, is to be equivalent to that of humans. Should AI realize this aim, it will have achieved the second, and very high indeed, level of understanding of human functions that we discussed for our explorers' understanding of the functions of the machines they encountered. In that context we fantasized that the explorers had succeeded in building a machine whose input-output behavior was, under any test whatever, indistinguishable from that of the machines they found, although the components of the two machine types need not have been the same.

In fact, the research goals of AI are much more ambitious than were those of our explorers, who intended only to understand how the machine they found generated its textual responses to the textual inputs it was given, whereas the goal of AI is to understand how an organism handles "a range of problems . . . coextensive with

the range to which the human mind has been applied." Since the human mind has applied itself to, for example, problems of aesthetics involving touch, taste, vision, and hearing, AI will have to build machines that can feel, taste, see, and hear. Since the future in which machine thinking will range as widely as Simon and Newell claim it will is, at this writing, merely "visible" but not yet here, it is perhaps too early to speculate what sort of equipment machines will have to have in order to think about such human concerns as, say, disappointment in adolescent love. But there are machines today, principally at M.I.T., at Stanford University, and at the Stanford Research Institute, that have arms and hands whose movements are observed and coordinated by computer-controlled television eyes. Their hands have fingers which are equipped with pressure-sensitive pads to give them a sense of touch. And there are hundreds of machines that do routine (and even not so routine) chemical analyses, and that may therefore be said to have senses of taste. Machine production of fairly high-quality humanlike speech has been achieved, principally at M.I.T. and at the Bell Telephone Laboratories. The U.S. Department of Defense and the National Science Foundation are currently supporting considerable efforts toward the realization of machines that can understand human speech. Clearly, Simon's and Newell's ambition is taken seriously both by powerful U.S. government agencies and by a significant sector of the scientific community.

Given that individuals differ in their visual acuity, it is not to be expected that everyone even now can see the same future that was already visible to Simon and Newell in 1958. Nor is it necessary for psychologists to recognize the power of computer models of human functions in order to share Simon's and Newell's grandiose vision. Much humbler signs point the way, and even more directly.

Whatever else man is, and he is very much else, he is also a behaving organism. If man's understanding of himself is to be at least in part scientific, then science must be allowed to assume that at least some aspects of man's behavior obey laws that science can discover and formalize within some scientific conceptual framework. However naive and informal or, on the other hand, sophisticated and formal a notion of "information" one has in mind, it must be granted that man acts on (that is, responds to) information that im-