3.10^{15} cells, the participants of this meeting comprise more cells than all unicellular organisms on this globe, and with 10^{25} cells in "human coalitions" mankind represents probably more cells than the rest of all living organisms.

Up to this point I have only discussed the necessity for information flow in autonomous, decision making systems. I hope that I have made sufficiently plausible that a system composed of communicating automata provides each automaton with a higher payoff function—*e.g.*, survival value—than would be possible in a mere set of automata, and also that a system of automata closely linked to each other by active communication channels—a coalition—can again be considered as a single automaton of higher complexity. However, I have not mentioned with a single word that which is communicated amongst these automata or amongst their elementary components. Indeed, what are they talking about?

It is impossible to answer this question if an automaton is considered to be an isolated entity. In order that this question makes any sense at all, we have to immerse the automaton into an environment with many possible states, or—to be more poetic—where the wind blows, the sun shines, rocks tumble, water splashes; in other words, where something is going on. In addition, we may allow this environment to contain other automata, either of the same kind or of different make-up. In order that these automata show some stability in this "hostile" environment, it is clear that they have to discover some order in this environment. In an absolute chaos their survival is questionable. When I use the word "order" I simply mean that in this environment not everything happens that could happen. In our environment, for instance, we find that most things maintain their shapes, fall downwards and do not move in zig-zag motions through space, *etc.* In other words, the transition probabilities for certain state sequences are very close to unity, while others are vanishingly small. This is just another way of saying that there are "Laws of Nature" and our textbooks of physics, chemistry, astronomy and so, are nothing else but a codification of these laws.

After these preliminaries on the structure of the environment it is now obvious that in order for our automata to survive, they have to crack the code of their environment's intrinsic order. This they have accomplished if they can find a solution for an internal representation of the order of their surrounding universe. Although it is to a certain degree irrelevant in which code this representation is accomplished—sequences of electric pulses, sound frequencies, black marks on a white background, wiggly grooves on a black disk, changing magnetic patterns on a flexible tape, *etc.*—it is of great importance that this code is shared by many elements comprising the automaton, because—as we have seen earlier—it is the joint knowledge of the elements of the system which makes the system wiser than the sum of the wisdom of its parts. This answers the question as to what is communicated: it is information about the structure of the environment of the automaton.

With these remarks I could conclude my discussion on communication among automata. However, it may be profitable to illustrate the principles presented herein with a brief allegory. In Figure 1 we have

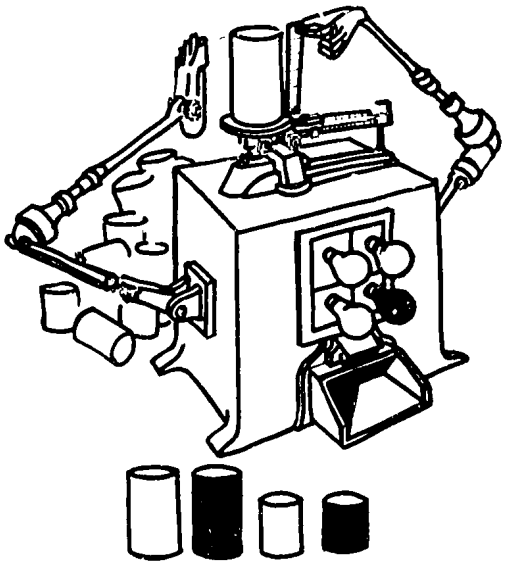

FIGURE 1

an automaton which lives on gasoline which he consumes when it is fed to him in small cans. These he can measure and