

Writing-Mind-Machines



Entropology

The world began without man and will end without him. The institutions, morals and customs that I shall have spent my life noting down and trying to understand are the transient efflorescence of a creation in relation to which they have no meaning, except perhaps that of allowing mankind to play its part in creation. But far from this part according man an independent position, or his endeavors—even if doomed to failure—being opposed to universal decline, he himself appears as perhaps the most effective agent working towards the disintegration of the original order of things and hurrying on powerfully organized matter towards ever greater inertia, an inertia which one day will be final. From the time when he first began to breathe and eat, up to the invention of atomic and thermonuclear devices, by way of the discovery of fire—and except when he has been engaged in self-reproduction—what else has man done except blithely break down billions of structures and reduce them to a state in which they are no longer capable of integration? No doubt he has built towns and cultivated the land; yet, on reflection, urbanization and agriculture are themselves instruments intended to create inertia, at a rate and in a proportion infinitely higher than the amount of organization they involve. As for the creations of the human mind, their significance only exists in relation to it, and they will merge into the general chaos as soon as the human mind has disappeared. Thus it is that civilization, taken as a whole, can be described as an extraordinarily complex mechanism, which we might be tempted to see as offering an opportunity of survival for the human world, if its function were not to produce what physicists call entropy, that is inertia. Every verbal exchange, every line printed, establishes communication between people, thus creating an evenness of level, where before there was an information gap and consequently a greater degree of organization. Anthropology could with advantage be changed into ‘entropology’, as the name of the discipline concerned with the study of the highest manifestations of this process of disintegration.

Claude Lévi-Strauss, *Tristes Tropiques*, pp. 413-414.

Information

Communication

Entropy



Writing, Memory, Community

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Let's move on. I have a more subtle point to make. Please hear me out.

As you may know, I hold that a philosopher arrives, eventually and with great effort, at a direct intuition of the Good through dialectic/dialogue: a public and real-time exchange of language with other people. The opposite of this kind of exchange is the written word: a record of a living conversation in a dead letter. I made an argument against writing in my *Phaedrus*. Writing induces forgetfulness, since people don't have to remember anymore once something is written down. Through alien, external marks on paper they can go through a process of recalling internal thoughts: the opposite of true memory.



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Now let me try to apply what I've just said about writing to your work, Will.

Writing disrupts traditional culture and social relationships. The memory of a traditional culture is oral. It is shared, public and communal, based in ritualized speech that everyone knows. Writing allows an individual to divorce himself from society. My teacher Socrates chose death rather than exile: divorce from his community. To him life without the shared public intimacy of a face-to-face culture was unthinkable.

Socrates' work itself would have been impossible to conduct in writing. True discourse, the kind of reasoned conversation that leads to understanding, is inscribed in the human soul, and it is delivered through speech.

From Cybernetics to Cognitive Science

From 1948-1980s

- Information a dimensionless quantity
- Mind—disembodied information capable of being located in different substrates
- Central Planner model of mind
- Symbolic manipulation based on language

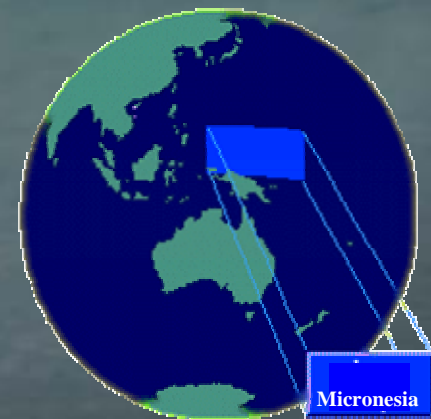
From 1990s-Present

- Information is physical
- Distributed Cognition
- Embedded Cognition
- Autonomous Agents
- Coupling of sensors and actuators with the world
- Natural objects are computational systems

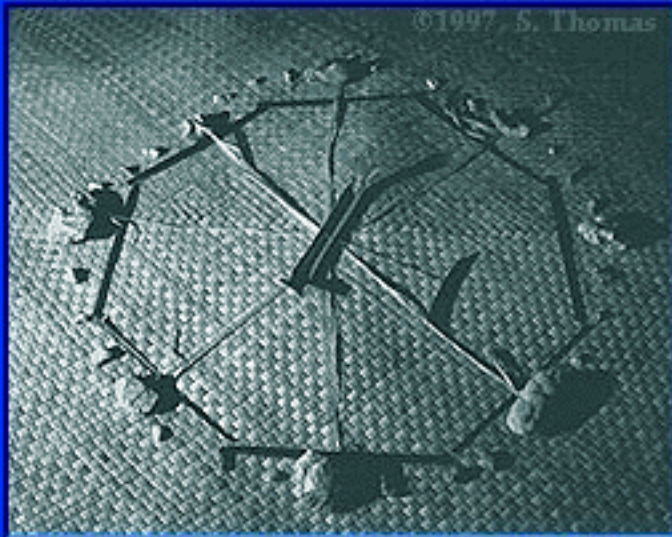
Navigators of Micronesia

Traditional navigators of the Central Caroline Islands provide a case in point. The Carolinian art of navigation includes a sizable body of knowledge developed to meet the needs of ocean voyaging for distances of up to several hundred miles among the tiny islands and atolls of Micronesia.

Lacking writing, local navigators have had to commit to memory their knowledge of the stars, sailing directions, seamarks, and how to read the waves and clouds to determine currents and predict weather.



Cognition in the Wild



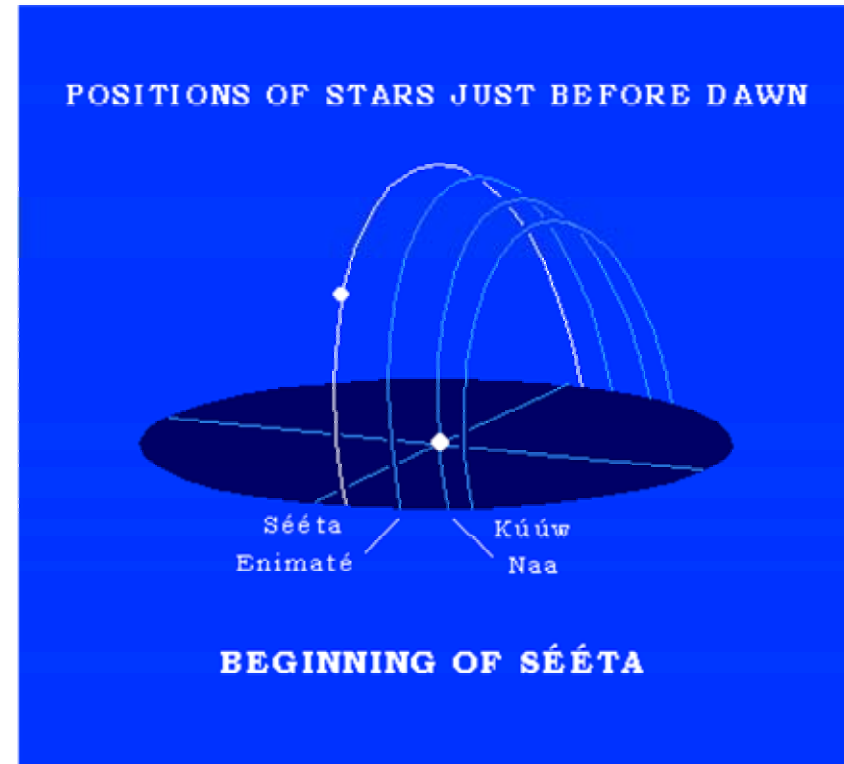
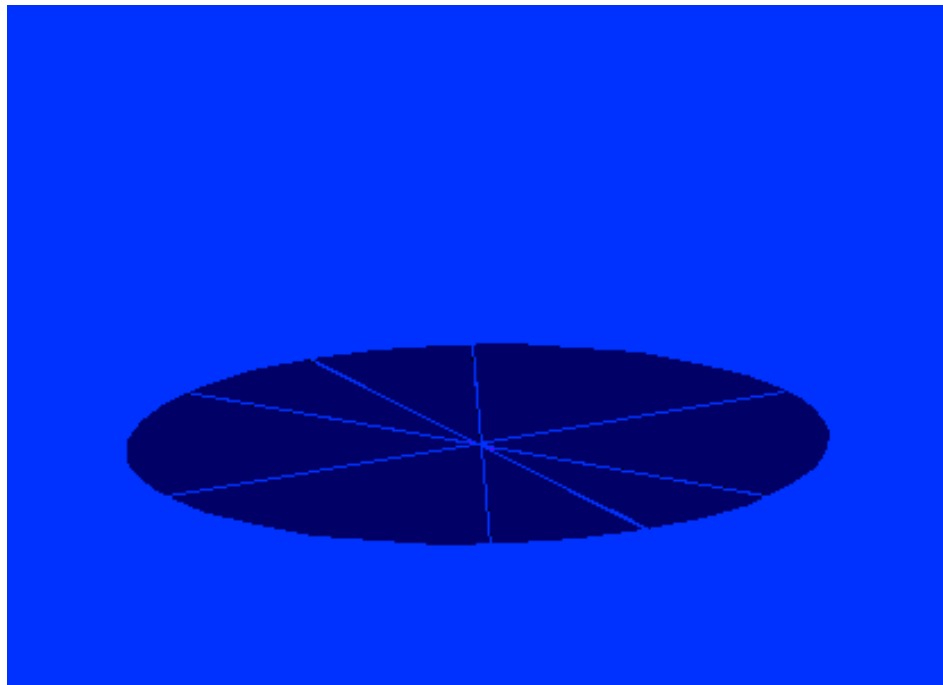
Representation of "star structure"
(sidereal compass) and canoe
for teaching purposes.



Canoe angling across swell.



Steering with foot on steering war.
Navigator is smoking.



The "star structure" divides the great circle of the horizon into **32 points** where the stars (other than Polaris) for which the points are named are observed to rise and set. These 32 points form a sidereal (star) compass that provides the system of reference for organizing all directional information about winds, currents, ocean swells, and the relative positions of islands, shoals, reefs, and other seamarks. The diametrically opposite points of this compass are seen as connecting in straight lines through a central point. A navigator thinks of himself or of any place from which he is determining directions as at this central point. Thus, whatever compass point he faces, there is a reciprocal point at his back.

Leaning on the Environment

All sailing directions are kept in relation to the sidereal compass, as are the relative locations of all places of interest, including such numerous seamarks as reefs, shoals, and marine life. To memorize this large body of information the Carolinians have developed various exercises.

How could a Micronesian navigator come to have this knowledge acquired by many generations—a compilation of the experiences of many navigators?

Today the knowledge of a Micronesian navigator exceeds what could be acquired by direct observation, but it does not exceed what could be remembered by one individual.





All navigation computations make use of frames of reference. The most prominent aspect of the Micronesian conception is the apparent motion of the *etak* island against the fixed backdrop of the star points defined by the sidereal compass.

The islands move for the Micronesian navigator because it is computationally less expensive to update their positions with respect to the frame defined by the navigator and the star points than it is to update the positions of both the navigator and the star points with respect to the positions of the islands.

In watching the ant, we learn more about the beach than about what is inside the ant.

Herbert Simon

The environments of human thinking are not “natural environments”. They are artificial through and through. Humans create their cognitive powers by creating the environments in which they exercise those powers.

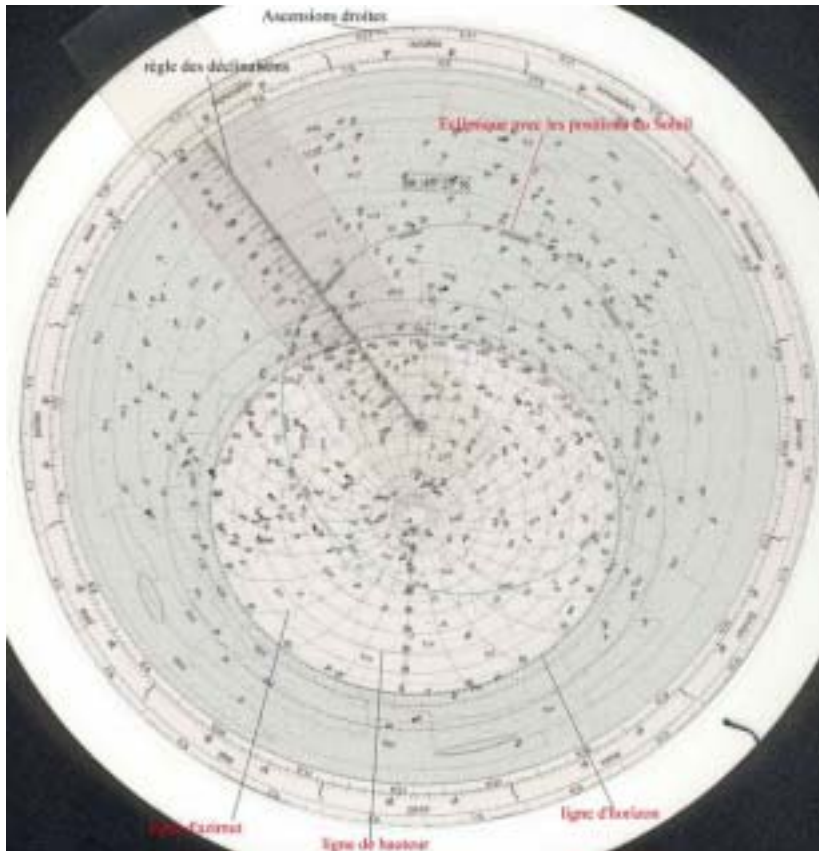
We are all cognitive bricoleurs—opportunistic assemblers of functional systems composed of internal and external structures. For the Micronesian navigators, the stars are not artifacts, yet they do have a structure, which in interaction with the right kinds of internal artifacts (strategies for “seeing”). Becomes one of the most important structured representational medic of the Micronesian system.

Centers of Calculation



A way of thinking comes with these techniques and tools. The advances that were made in navigation were always parts of a surrounding culture. They appeared in other fields as well, so they came to permeate our culture.

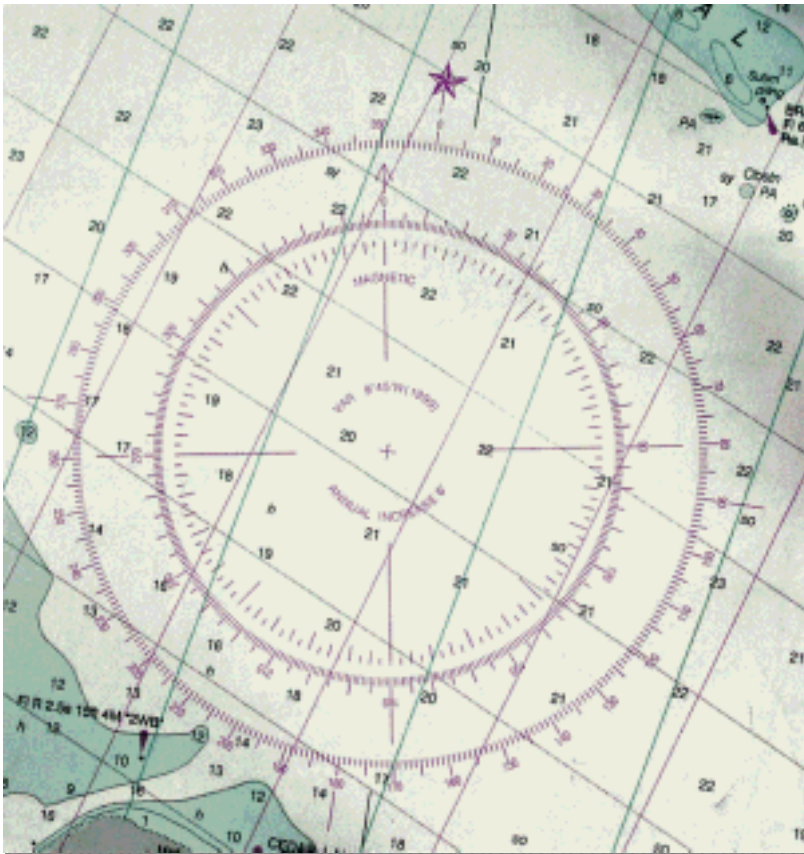
Cognitive Ecologies



It is important to consider the whole suite of instruments that are used together in doing the task. The tools of navigation share with one another a rich network of mutual computational and representational dependencies. Each plays a role in the computational environments of the others, providing the raw materials of computation or consuming the products of it. In the ecology of tools, based on the flow of computational products, each tool creates the environment for the others.

Every argument showing why a particular tool is easy to use is also an argument showing why both internal and external tools are part of the very same cognitive ecology.

Western Navigators



The chart, by virtue of its interpretation as a model of an expanse of actual space, encourages a conception of a voyage as a sequence of locations on the chart.

As a physical analog of space, the chart provides an interface to a computational system in which the user's understanding of the form of the symbolic expressions (lines of position) is structurally similar to the user's understanding of the meanings of the expressions (relations among locations in the world)

Robosapiens—Cog and Kismet



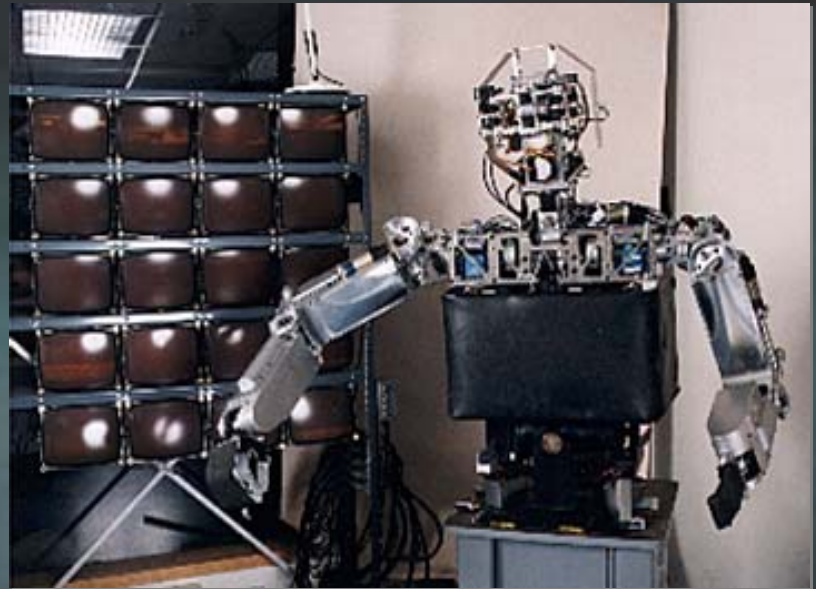
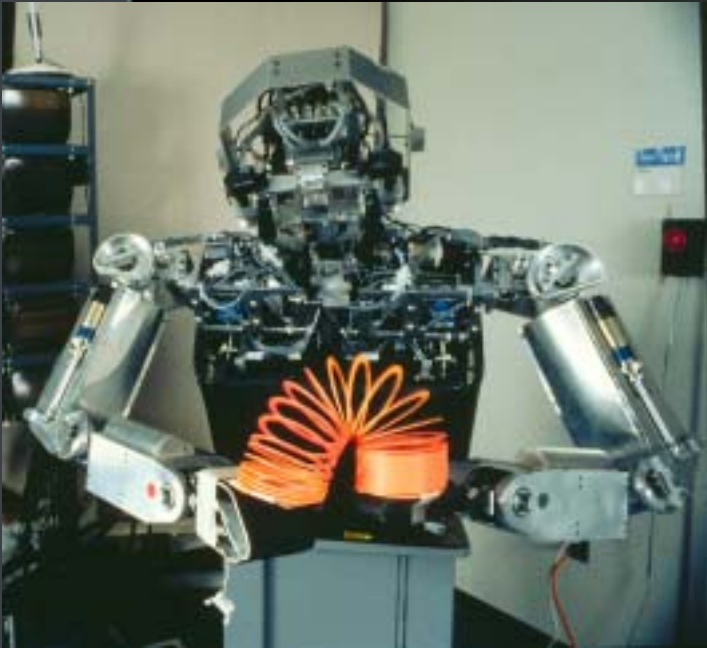
Brooks—Out of Control



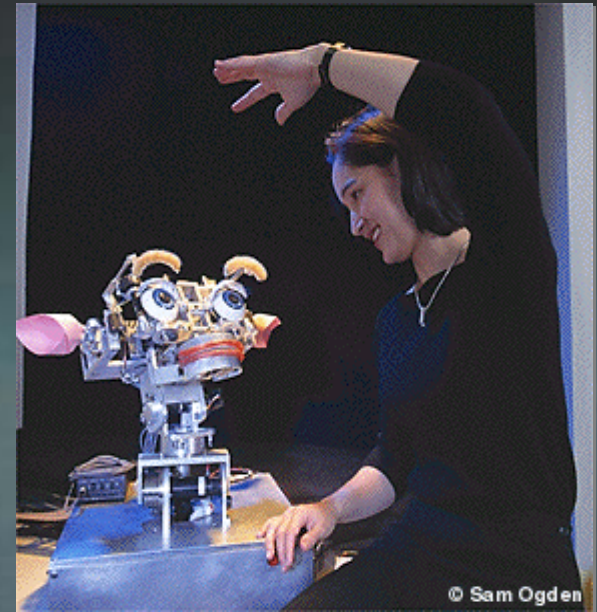
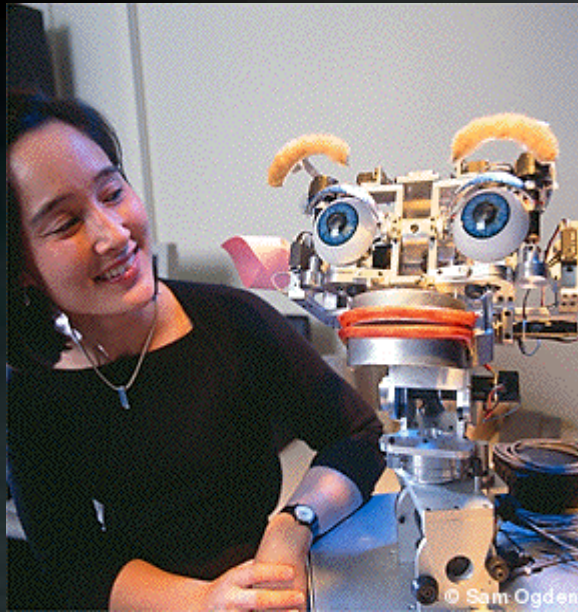
Subsumption Architectures



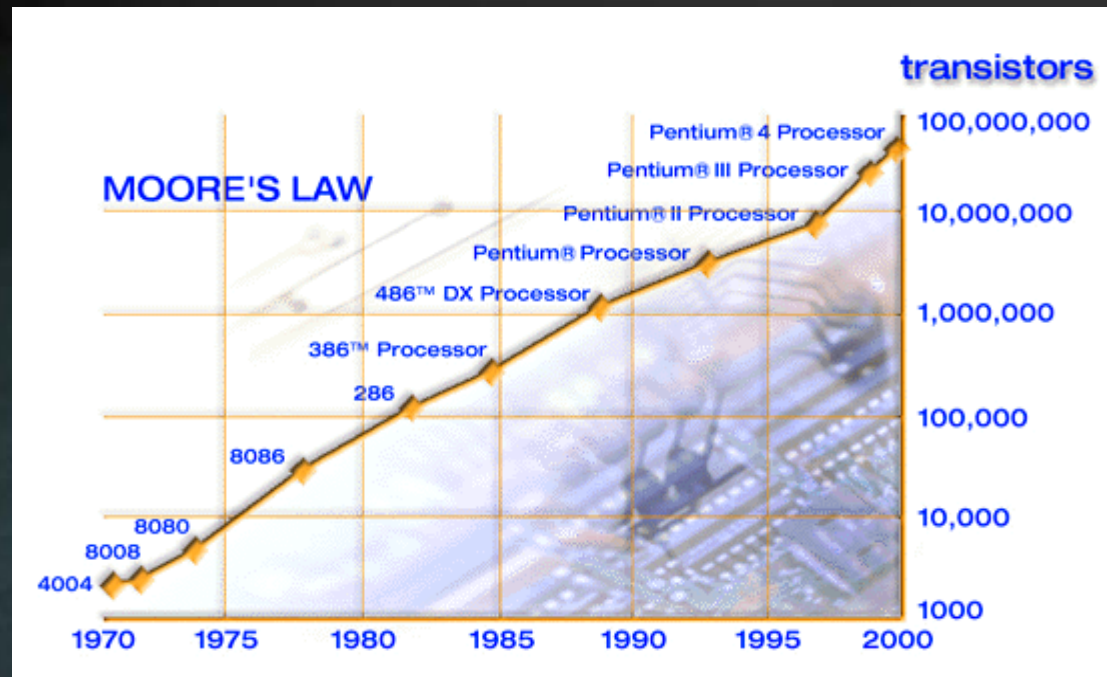
Cog



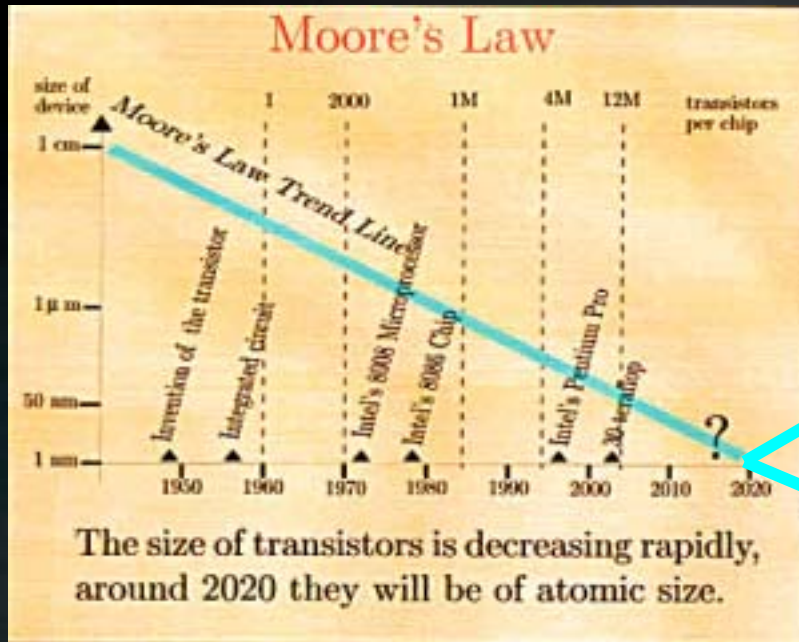
Kismet



Making Things Think



From Boxcars to Motes



David Deutsch

Quantum
Computing

Neural networks
Genetic
Programming



Things That Think

If the present work of TTT (Things That Think) succeeds, implants are the natural next step, equally intriguing and frightening. Even more so is what could come after that, editing the genome so that you grow the right parts. ...What's so privileged about our current eye design? We now know a lot more about optics, and chemistry, and could design eyes that have a broader spectral response...There are no longer serious ontological debates about the design of the eye as proof of the existence of a God, but we haven't taken seriously the converse that if the design of the eye does not represent divine intervention, and we don't intend to replace one deity with another by deifying evolution, then the eye is open to mortal improvement. And who says we just have to upgrade our existing senses. Growing up I was disappointed when I realized that it appeared that I didn't have ESP, but I do know how to use a cell phone to talk around the world. How about adding radios to brains?

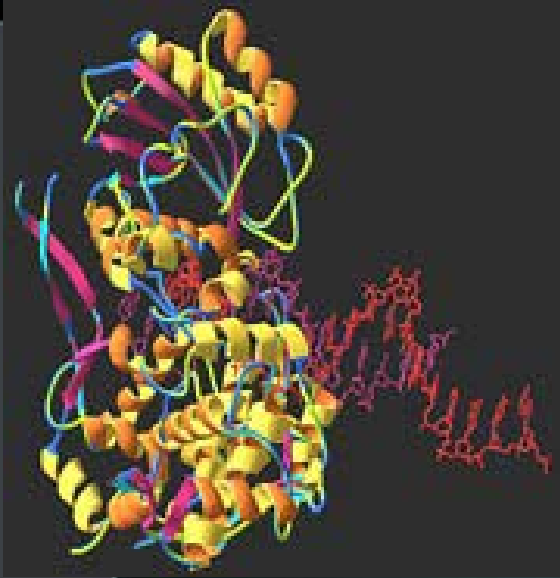
Neil Gershenfeld, *When Things Start to Think*, p. 212

Aftermarket Additions to the Genome

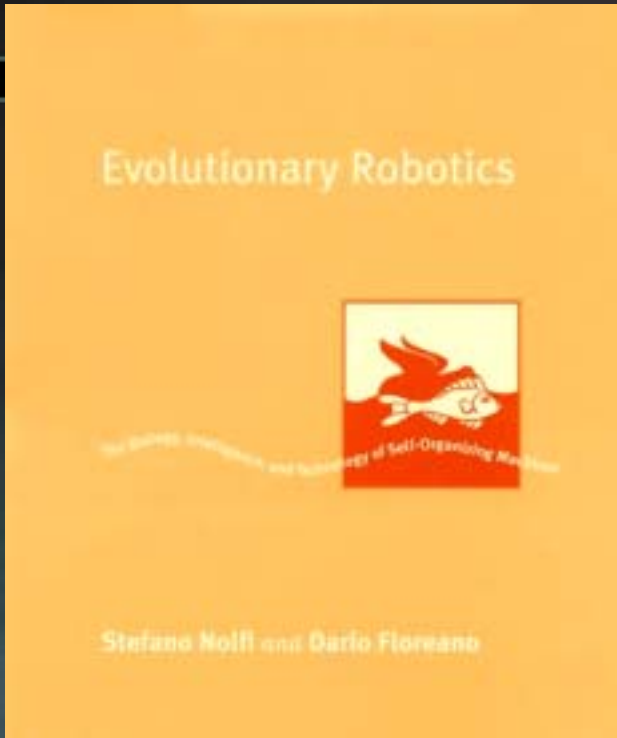
The attendant ethical, social, and scientific challenges are staggering, but the point stands that our current construction represents one evolved and evolving solution and that it is open to improvement. Evolution is a consequence of interaction, and information technology is profoundly changing how we interact; therefore, it's not crazy to think about an impact on evolution. If I'm far from being ready to let someone implant a chip, I certainly nowhere near being willing even to entertain seriously a discussion of aftermarket additions to the genome, but I have to admit that that is the logical destination of current trends. I fear, and hope, that we eventually reach that point. You'll be able to tell we're getting close when the Media Lab starts hiring molecular biologists.



Neil Gershenfeld, *When Things Start to Think*, p. 212.



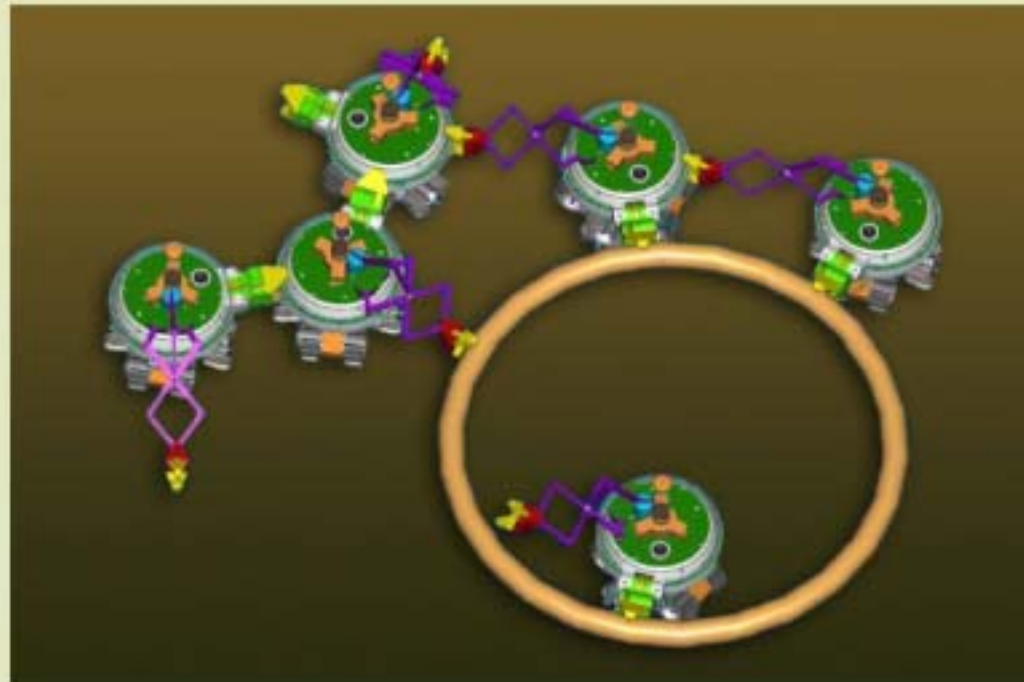
DNA computing



Evolving neural networks
Genetic Programming
Evolvable hardware

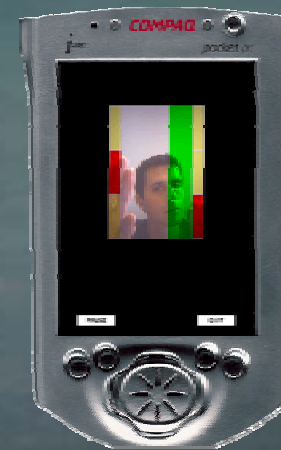
Welcome to the Swarm-bots web site

Swarm-bots is a project sponsored by the [Future and Emerging Technologies](#) program of the [European Community](#) (IST-2000-31010), aimed to study new approaches to the **design** and **implementation** of **self-organizing** and **self-assembling** artifacts.



Project coordinator: Professor [Marco Dorigo](#)

Principle: Humans and robots have different visual, tactile and auditory perceptions. To successfully transmit information, they must build a shared understanding of a vocabulary to designate the same events. This is achieved by reducing the number of features of the shared perceptual space; building, thus, a robust learning system that can handle various situations and noisy data.





unspoiled savages/picturesque humans

So, to my great disappointment, the Tibagy Indians were neither completely 'true Indians', nor, what was more important, 'savages'. But, by removing the poetry from my naïve vision of what experiences lay ahead, they taught me, as a beginner in anthropology, a lesson in prudence and objectivity. Although I found them to be less unspoiled than I had hoped, I was to discover that they were more mysterious than their external appearance might lead one to believe. They were a perfect illustration of that sociological situation which tends to be the only one available to the observer in the second half of the twentieth century; they were 'primitives' who had had civilization brutally thrust upon them, but once the danger they were supposed to represent had been overcome no further interest had been taken in them. Their culture was an individual mixture, made up on the one hand of ancient traditions which had withstood the influence of the whites (such as the practice, still frequent among them, of filing and incrusting the teeth) and on the other of borrowings from modern civilization, and its study, however deficient in the element of the picturesque, was to prove no less instructive than that of the pure Indians whom I was subsequently to encounter.

Claude Lévi-Strauss, *Tristes Tropiques*, pp. 154-155.



EVOLUTION OF A NEW SPECIES

Robo *sapiens*

Technohumanities

Can our critical tools meet
the challenges?