Science & Technology

Social science

What boys and girls are made of

Mar 6th 1997

From *The Economist* print edition

SUGAR and spice motivated many an explorer, and the voyages of discovery that resulted from European demand for these products were the basis for building powerful empires. Today, the same resources are still stimulating the development of new trading societies--but now those societies are growing inside computers, rather than overseas. And in watching these artificial societies grow, their inventors are starting their own voyage of discovery--one they hope will provide insights into real societies that have thus far been denied to conventional social science.

Two of these inventors are Robert Axtell and Joshua Ep stein, who work at the Brookings Institution in Washington, DC. They have created an artificial world they call “Sugar scape”. In it, software “agents” of their devising live out their lives.

The agents devised by Dr Axtell and Dr Epstein appear on a computer screen as little red dots which move over a 50 by 50 grid. Each is actually a piece of software running inside the computer. But, like people in a real society, the Sugarscape agents are not identical. They have different visual abilities and different demands for sugar.

The computer landscape has two mountains of a re source, called “sugar”, which the agents require. All of them follow the same rules: look around, go to the unoccupied spot with the largest amount of sugar, and then eat the sugar. The sugar, when consumed, grows back at a pre-determined rate.

When only sugar is present, the agents' behaviour is boringly predictable. Most of them cluster in the sugar mountains. Only a few of the extremely short-sighted are left out in the cold. But, having proved their model worked, Dr Axtell and Dr Epstein went on to add complexity to it in the form of a second resource--“spice”. In this version, the agents require both sugar and spice, but they do not necessarily have to gather their needs directly. Instead, they may trade with one another. Each time a trade happens, the computer registers the price of one good in terms of the other.

In the most simple sugar and spice models, the market settles on one price for each commodity. It does so with no central planning--a happy story for orthodox economics. However, as Dr Axtell and Dr Epstein added further complexity to their model the story

became messier. The simple model had agents who never died and whose preferences never changed. But if old agents are allowed to pass away and be replaced by new ones, and if agents' preferences for sugar and spice evolve as they interact, the cyber-market never settles on a single price (just like real life).

Sugarscape is not the only agent-based model that has started to explore the pattern of trade. The agents in a model devised by Deborah Duong (who works at George Mason University, in Fairfax, Virginia), can produce a variety of goods (she calls them “oats”, “peas”, “beans” and “barley”). They, too, can trade. But they can also vary the amount of each good they produce. In Ms Duong's model, each agent quickly learns to tell which other agents sell the produce needed to complement its own diet. It then adjusts its behaviour accordingly.

When she ran her model, Ms Duong found that it vindicated Adam Smith. It ended up with a division of labour--although each agent can “grow” the full range of goods if it chooses to, it generally decides that it is more efficient to produce just one and trade it for the others. Ms Duong's agents, then, spontaneously organise themselves into a barter economy. Indeed, they sometimes go further, with one of the goods taking on a money-like quality and being used as a standard of trade.

The next step is to build models that can be tested against the real world. In one such test Dr Axtell and Dr Epstein have collaborated with George Gumerman, an ar chaeologist from the Santa Fe Institute in New Mexico, to model the Anasazi society. This was a culture that flourished in the American Southwest for hundreds of years, built astonishing cliff dwellings, and then vanished. But the simulation has not yet found the reason why it did so. Rather than disappearing, computer-based versions of Anasazi society sometimes go on. . . . And on, and on, and on, and on

Back to top »

- Printable page
- E-mail this