a computer thinks a million times faster than our neurons do.

I remember showing my girlfriend how a Lisp machine could calculate the factorial of 1000 in a matter of seconds and display the answer over several screens. She was aghast. She had never seen such analytic power before. I remember the same sense of wonder and even fear at seeing Macsyma, the mathematical assistant program, functioning for the first time before I knew how it was done and, hence, before the magic was taken away.

Another impact on the general public will come from household and commercial robots. These devices will be mobile, providing a range of different services to the public. While they are stupid and docile, we need not fear them; however, the steady increase in their intelligence year by year, as next year's model promises to be more emotionally aware than this year's, will sow doubts about where all this fabulous technology will end up. In 20 years time, it will be commonplace to say that the twenty-first century will be dominated by the machine if humanity so chooses—and maybe even if not.

The general public, the politicians, and, certainly, the intelligentsia will be discussing the fate of the artifice and the fate of humanity to a far greater extent than is the case today. In fact, I am rather annoyed by the current ostrichlike attitude of many intelligentsia with regard to the social implications of their work. I label such intelligentsia “the mice” because they have the horizons of mice.

It is only a matter of time before enough people see the writing on the wall and start to seriously question just how far these artifices should be allowed to develop. Today, this questioning is somewhat academic because we are still some time away from such realities, but it will be real and pressing in a generation or two and will constitute the dominant issue of the age.

One can expect that people will take sides and that considerable energy and passion will be devoted to pleading the various options, so it is now appropriate to discuss just what the various options are.

Options

Basically, I see two major options: We let the artifices freely evolve, or we don't.

If we let them freely evolve, we take a risk because these machines might choose to modify themselves in random ways, similar to the chance mutations of biological evolution. Limits exist on the level of control one can place in machines. One can build in metalevel strategies to control the strategies, one can build metalevels to control the metalevels, but ultimately at the top level, certain strategies simply have to be built in. To change these top-level strategies and choose between good changes and bad changes, the only resource left is survival. Our artifices might choose to become subject to the same Darwinian forces as biological creatures and for the same reasons.

However, because ethical attitudes are in the limit merely a particular configuration of molecules, we could never be sure that the artifices would treat human beings with the same level of respect as we would like. After all, when we kill mosquitoes or even cows, we think little of it because we believe mosquitoes and cows are such inferior creatures that we feel justified in exercising the power of life or death over them. We could not rule out a similar attitude on the part of the artifices toward human beings.

However, a lot of people will start seeing humanity as a stepping-stone toward a higher form of evolution and will claim it is humanity's destiny to help the artifices get off the planet and into their true environment—namely, the cosmos—perhaps in search of other hyperintelligences.

Some human beings might want to modify their own bodies and brains to become artifices themselves. This is a third possibility. There might be others.

What is almost certain is that a great debate on the artifice issue will dominate the climate of global politics in the twenty-first century. It is quite likely that preliminary versions of this great debate will occur among academic circles this century. It is the task of intellectuals to look into the