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DARWINISM IN THE STOCK MARKET

I was listening to public radio in the car one afternoon and heard a program that I found especially interesting. Though it is hard to believe at first, I think the concepts may be useful in how we think about common stocks.

The title of the program was *Digital Darwinism*. It was a documentary produced by an organization called Soundprint. After the broadcast, when I got home, I was able to pull up the entire script of the program on the Internet. The part of the documentary that caught my fancy went this way:

It seems that there is a fellow by the name of Tom Ray who is an evolutionary biologist who has worked in the tropical rain forests for about twenty years, studying ecological evolution and the natural history of butterflies, beetles, and plants.

In a rain forest, watching evolution happen can get rather frustrating. Adaptations and changes in species can take thousands of years to see. The notion of watching it faster inside a computer came to Ray around 1980, while he was a graduate student at Harvard. He got into a conversation with another graduate student from MIT's "artificial intelligence" lab who asked if he knew that it was possible to write a "self-replicating" program?

Ray says that, at that moment, he imagined in his head that, if you had a self-replicating program, and you added "mutation," you could get "evolution" and whole new forms of life could evolve in your computer. Unfortunately, however, Ray had no idea how to do it because he was a biology student and did not know anything about computers.

Ray says he fantasized about the possibilities of evolution's operating in a completely different medium than that with which we are familiar and about new life forms evolving and becoming more complex and forming new ecological communities in the computer.

DIGITAL "DNA"

The notion percolated in Ray's mind for about a decade until he finally started tinkering with computers to try to make his notion a reality. Experts told him it was not possible to write such a program that would simulate evolution because computers are too literal. They rely on very specific programs that are not tolerant of mistakes. Add a few random mutations intentionally, and your computer will crash.

Ray reasoned that you could make the same argument about biology. If you randomly alter the "DNA" program—the genetic map—in a living organism, most of the time it will cause damage. What Ray had to do was design a computer with "evolvability" as a design criteria, which had never been done before. So Ray designed such a computer and wrote a program for it. The program was a simple one with just eighty commands that would merely recopy itself in memory, and that was all that it did.

The copies made copies, and memory started getting pretty crowded with hundreds of little programs reproducing like rabbits—or actually more like one-celled amoebas. (I understand that this is one of the ways computer viruses now do their thing.)

Some of these programs were given mutations—one of the eighty commands would be made to change randomly, or disappear altogether. Most mutations caused the programs to fail, but a few occasionally performed better with their altered commands.

Then some most unusual things began to happen. In the primordial digital memory soup, a new, tiny program appeared. It was not big enough to reproduce on its own. Instead, it attached itself to one of the bigger programs, and used commands in the host to reproduce itself. It was a "digital parasite."

Parasites appeared very quickly, and Ray began to see population cycles where the population of parasites would grow and the population of hosts would decline. There were too many parasites—just like we see in nature, with predator-pray cycles and parasite-host cycles.

In the days that followed, Ray saw other new programs evolve in ways that also smacked of life. He saw lying, cheating, and stealing. He saw things like a carnivorous flower, where an insect comes along and thinks it is going to get a nectar meal and gets eaten by the flower instead. He saw all kinds of other social behavior.

By accident, Ray even discovered "sex" in the evolution of his programs. He wanted to stop evolution to do ecological experiments where he did not want new species appearing, and so he turned off the mutations. Since that had been the source of genetic change, he reasoned, without mutation, you could not have evolution. But the programs continued to evolve anyway. Eventually he found out that his programs were having sex. They were producing programs that contained genetic material from more than one parent and that was enough for them to evolve at seemingly the same rate, even <u>without</u> mutations.

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In a sense, each daughter program had genetic code from both mother and father programs. But instead of passing along "DNA," each parent passed along pieces of computer program.

"PUNCTUATED EQUILIBRIUM"

At this point an MIT professor by the name of Danny Hillis enters the scene. Hillis says, "the great thing about computer life is that we now have a second example of something like life. Before, our only hope of doing that was discovering alien life on some other planet."

With this second example of life, Hillis points out, we can begin to understand some generalities about what evolving systems can do, must do, and will do. And that, he says, gives us some hope of guessing what we might do next.

Hillis has grown his own varieties of reproducing computer programs, and so also has watched evolution unfold before his eyes. He has discovered some additional characteristics of digital evolution that have puzzled biologists about natural evolution for decades.

In particular, if you watch how things evolve in these simulated evolutionary systems, they really do not evolve steadily and uniformly. Actually, nothing much happens for tens of thousands of generations and, then, suddenly, in a few hundred generations—a blink of time, everything changes. That is a phenomenon that biologists call "punctuated equilibrium." If you look at fossil records, that is exactly what happens. Over a period of tens of thousands of years, for example, clams are a certain size, and, then, all of a sudden, they change to a very different size. They do not change gradually to get bigger and bigger. They seem to change all at once. So it appears that whatever natural law is causing this phenomenon in real biology may also be what is causing it in the simulated computer environment.

What has also been found in the computer is that, during the quiet periods, a lot was going on in the DNA, even though nothing much was going on in the body shapes of the organisms. And that is suggestive of what might be happening in biology.

SO WHAT?

Maybe this is also suggestive of what goes on in the stock market, in sectors of the market, and in the evolution of the price of a common stock.

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It is said of the stock market, of growth stocks in particular, and of individual companies most assuredly, that their prices move in "spurts." We seem to sit around in frustration about eighty percent of the time while our common stock or portfolio of stocks languishes; then, after we have come to wonder if it may be headed for extinction, it **suddenly** moves briskly upward again—dramatically maybe, but probably for only a short period of time.

I had always assumed that it was just the fickle nature of the investing public's tastes that caused the price of a common stock to grow in such an unpredictable manner. After hearing this documentary, however, I now suspect that there may, instead, be some immutable mathematical law of nature that is responsible for the phenomenon. Whatever causes both the species of the planet and the replicating programs in a computer to evolve in such erratic fashions, may also be the cause of the erratic nature by which the prices of common stocks evolve. This must be the stock market's "punctuated equilibrium."

It appears to me as though the price of a common stock at a point in time is comparable to the physical characteristics of a species at some point in its evolutionary history. The fundamentals that underlie the price of that stock—the levels and trends of the company's sales, profit margins, and earnings, etc.—are the company's DNA.

If, then, we are to conjecture about the course of the evolution of the price of a common stock, we had probably better focus, not on the stock's current price behavior, but rather on the company's genetic map. By studying its "corporate DNA," we may be able to discern what is likely eventually to happen to the price of a stock; but, because of this fickle and mysterious evolutionary law of nature, mathematics, and the stock market called "punctuated equilibrium," we seem destined forever to be kept in the dark as to exactly when whatever we predict should happen might, indeed, actually happen.

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CONCLUSION

If, then, the next time you ask your stockbroker about a stock's prospects, he responds, "I will look at what is going on in the company's DNA to see if there are any mutations likely to evolve into a point of punctuated equilibrium," you will know exactly what he is talking about.

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1998