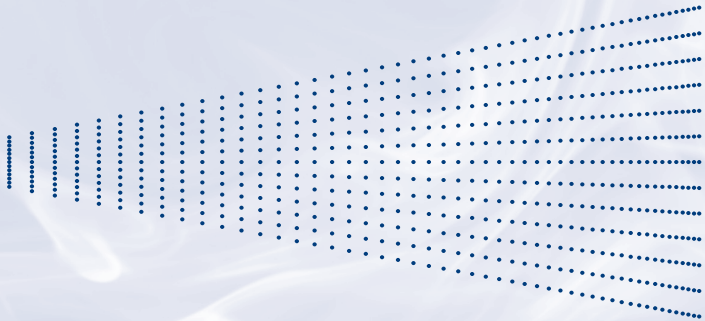
21 January 2005

An optical illusion

Here are a bunch of dots. On the left, we can't resist perceiving them as vertical lines; and on the right, as horizontal.



You couldn't ask for an illusion more elementary, more easily explained. Yet isn't it a prototype of so much of our world? Our notions of this and that are *right*, and we couldn't do without them. But alter a few parameters smoothly to other values, and those notions may suddenly and quite rightly jump. Remember this illusion next time you think about the nature of reality, or next time you disagree with a friend.

12 January 1988

Evaporation and the brain drain

Evaporation of a liquid works like this: the molecules are bouncing around at random with various speeds, and some of the faster ones have enough energy to escape the liquid entirely. So they fly away, leaving the remaining molecules a little less energetic on average. In other words, the liquid becomes cooler.

Brain drains work the same way. The intellectually or economically livelier particles in America's inner cities, in the north of England, or in parts of Asia and Africa tend to fly away from those surroundings that have too little to hold them. As a result, a simple matter of statistics, the culture they leave behind becomes intellectually or economically cooler.

16 July 2003

An analogy should be imperfect

To be useful, an analogy should be good but not perfect. If A is *exactly* like B, then they are the same and there is no point in comparing them. Comparisons become fruitful when A is 90% like B. Then the analogy serves as a magnifying glass, revealing details of that interesting 10%.

This reminds me of musical instruments. We think of a guitar string or a flute as a resonator with a set of eigenvalues, that is, natural frequencies. Strictly speaking, however, such an analysis imagines that the instrument is a closed system — and if that were so, we couldn't hear it! A useful musical instrument must be a good resonator, but not perfect.

Of course, musical instruments aren't *exactly* like analogies.

28 June 1986

Bad logic in a good cause I

**Women's lib is founded on two facts,
Serene and stately:**

**That women are the same as men,
And that they differ greatly.**

16 August 2004

Do needles inject drugs?

According to doctors, tens of thousands of drug users in the US have become infected with HIV because they were unable to obtain clean needles. Our conservative government has a policy of not providing free needles, on the theory that having needles at hand encourages drug use.

Notice how perfectly this view contradicts that other conservative dictum: "Guns don't kill people, people kill people."

26 July 1991

Can an adult sin?

One of my mother's favourite stories from my childhood goes like this. One day we were discussing sin. To my surprise I discovered that this was something grownups worried about too. "But what sins can *grownups* have?" I asked.

Of course the joke is that grownups' sins are giant-sized compared with children's. Yet in a deeper sense, I was right. The essence of sin is action that contradicts principles laid down by a higher authority. For children, the higher authority is their parents. For grownups, what is it? Three conventional answers are (1) God, (2) some sort of absolute moral truths, and (3) society (or, perhaps, our genetic blueprint). The awkward thing is, the first two of these candidates do not actually exist, and most people consider the third insufficient to give morals their zip. So the question of whether grownups can sin is not so silly after all.

12 January 2002

Responsibility decays with distance

We care more about poverty here than in Afghanistan (per capita), more about a murder here than in Burundi. Many people feel that this unevenness in our attentions is unjust. They say, is an Englishman more human than an Afghan? They tend to feel guilty about their own unevenly spread sympathies or actions, or disparaging of others'.

I think that feelings naturally decay with distance, whether physical or psychological, and that although one should strive for the decay function to be not too rapid, one should not feel guilty that it is there at all. Here's a thought experiment. Suppose the world were unbounded, populated by infinitely many people living in lands receding infinitely into the distance. Should we care equally about all of them? Of course not, for this would mean caring zero about each one. But now, surely our view of the world cannot depend on the fact that 6 billion is less than infinity.

The principle generalizes. It is natural, and not reprehensible, that we care less about chimpanzees than humans and less about squirrels than chimpanzees. And it is natural that we care less about ourselves ten years from now than ourselves tomorrow. Feelings decline with temporal distance as well as spatial, and that, as I've argued elsewhere, is the proper resolution of Pascal's wager.

18 August 2002

Wickedness and destruction

It is an old idea that man's wickedness will bring destruction upon him. As the scenarios of doom have multiplied in the last century, this prophecy has taken new forms. Capitalist greed will destroy the environment and we will be poisoned, or starved. Our hubristic playing at God in the test tube will unbalance the human gene pool. Licentious enjoyment of sex and drugs will unleash superdiseases that bring civilization crashing down. Or the military men in their obscene lust for power will trigger a nuclear war. Take your pick.

These apocalypses may be plausible technically, but they are inflated morally. Man in his arrogance is determined to believe that if a big destruction comes, it must be the result of a big wickedness. I don't think so. Our wickedness hasn't changed much since Biblical times. If we destroy ourselves, it will not be because our souls have become ever darker, but because our technology has become ever stronger. Our death, like most deaths, will not be retribution; it will be meaningless.

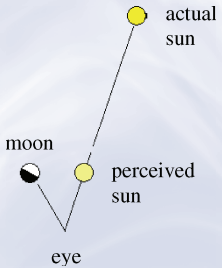
13 October 2003

The other moon illusion

The famous optical illusion associated with the moon concerns its size on the horizon and up in the sky. Lately I've noticed another illusion concerning its shape, and this one is powerful too.

Look up one day when both the moon and the sun are in the sky. The moon will be shaped like a C or a D, with the circle of its edge on one side and the straighter shadow line on the other. Now look at the sun again and try to understand why that shadow line is where it is. *It's completely wrong!* Your eye tells you, *the moon should look fuller!*

Like the more famous moon illusion, I think this one is caused by confusion about distances. You, the moon and the sun form a triangle in which the sun is effectively infinitely further away than the moon. However, your eye cannot perceive this. It interprets the moon and the sun as bodies at comparable distances. This makes the trigonometry all wrong and the position of that shadow inexplicable.



2 August 1985

Ten billion

Roughly, the brain contains 10^{10} neurons and the genetic code contains 10^{10} nucleotides.

As a rule of thumb, perhaps 10^{10} components is the level of complexity at which a system may go so far beyond the behaviour of its individual pieces as to exhibit a life of its own.

The earth has around 10^{10} human inhabitants. Perhaps the truest understanding of them comes from ignoring the individual particles and viewing humanity instead as a single organism, occupying, and manipulating, the whole surface of the earth.

19 March 1997

One way to put together 10^{44} pieces

Life on Earth consists of 10^7 species, each consisting of 10^{10} individuals, each consisting of 10^{13} cells, each consisting of 10^{14} molecules.

28 July 1985

Death as ecological disaster

From the point of view of an individual cell in my body, the universe consists of itself and many similar fellows, closely packed together, and bathed in the nutrients needed for survival. The environment is benign, well adjusted to support life.

When I die, it will seem to this cell that the life-giving ingredients of the oceans and atmosphere have been inexplicably replaced by poisons. The cell will die, victim of an ecological disaster.

13 March 1997

Solving the problem of consciousness

Eventually mankind will solve the problem of consciousness by deciding that we are not conscious after all, nor ever were.

26 April 1997

Computer codes and genetic codes

Computer codes are better written than genetic ones, since there's a programmer in the loop, but as they get bigger, this distinction is fading.

18 June 1998

A trivia question you'll never be asked

Q: Along with the usual hydrogen, carbon, nitrogen, and oxygen, there is a fifth atomic element that appears in two of the twenty amino acids from which all life on earth is made. What is this element?

A: Sulfur.

This little question epitomizes the gap between the two cultures. If you play Trivial Pursuit or watch Jeopardy for a few years, you may be asked about Michael Jordan's middle name, or the most popular movie of the 1930s, or the author of *Treasure Island*. But I promise you, you will never need to know that sulfur is the fifth element in amino acids.

18 February 2001

Ancient Trefethen DNA

Two curiously related events happened this week.

One was that Celera (in *Science*) and the Human Genome Project (in *Nature*) published their articles announcing the sequencing of the human genome. And there's a surprise: a human has only 30,000–40,000 genes.

Another was that I got an email message from a certain Grace Griffin in Haverhill, Massachusetts telling me that my great-great-great-great-grandfather Henry Trefethen and her great-great-great-great-great-great-grandfather John Trefethen were brothers.

This set me thinking. How much Trefethen DNA have Ms. Griffin and I inherited in common? I believe 1/64 of my DNA comes from Henry, and 1/256 of hers comes from John. Since Tom and Henry had half their DNA in common, this implies that she and I share about $2^{-15} = 1/32768$ of our DNA.

So my new-found cousin and I have about one Trefethen gene in common.

29 January 2004

Brownian motion by a team of ants

I looked at the pavement and saw the most remarkable thing: a piece of cracker, maybe two centimeters across, moving steadily towards the wall. I looked closer and saw a few dozen ants all around it, pushing it along with their collective strength. Amazing! I'd never seen ants collaborate like this on a big engineering project.

Then the piece of cracker changed direction and moved another way entirely. And then again, yet another direction. And I realized that it wasn't going anywhere purposeful. The ants weren't collaborating at all, just munching away and moving the cracker by accident. Its motion was random, the net result at each moment of the arbitrary forces exerted by a hundred little hind legs. A formic rugby scrum.

Once I saw what was going on it was wonderful to step back, blur my eyes, and watch the cracker swim about. This was Brownian motion, except with forces supplied not by molecular collisions but by earnest little ants.