[For my December 2007 diary, go here.]

Diary - January 2008

John Baez

January 1, 2008

Let's start the year with some feel-good stories about cats and mice.

The LA police department is hiring feral cats to protect police stations... from rodents! Feral cats don't make great pets, so when they're caught they're usually killed. But, they're great at hanging around and scaring away rats. And, they work for room and board.

A feral cat slinks through the parking lot of the LAPD's Southeast Division.
Picture by Bob Chamberlin / LA Times.

> **LAPD enlists feral cats for rat patrol**
>
> Carla Hall, Los Angeles Times Staff Writer
> December 29, 2007
>
> They are the homeless of the domestic animal world — colonies of feral cats that roam residential neighborhoods and lurk around office buildings and commercial garages, scavenging for food.
>
> Unlike other strays that might rub up against a leg hoping for a crumb or a head rub, these felines are so unaccustomed to human contact that they dart away when people approach. Feral cats cannot be turned into house pets. When they end up in municipal shelters, they have little hope of coming out alive.
>
> But one animal welfare group has figured out a way to save their lives and put them to work in Los Angeles. The Working Cats program of Voice for the Animals, a Los Angeles-based animal advocacy and rescue group, has placed feral cats in a handful of police stations with rodent problems, just as the group placed cats in the rat-plagued downtown flower district several years ago -- to great effect.
>
> Six feral cats were recently installed as ratters in the parking lot of the Los Angeles Police Department's Southeast Division, and another group will be housed at the Central Division early in the new year.
>
> Their reputation as furtive and successful exterminators grew after feral cats were introduced to the parking lot of the Wilshire Division nearly six years ago. Rats had been burrowing into the equipment bags that bicycle officers stored in outside cages; inside the facility, mice were sometimes scurrying across people's desks.

> "Once we got the cats, problem solved," said Cmdr. Kirk Albanese, a captain at the Wilshire station at the time. "I was almost an immediate believer."
>
> After Albanese moved to the Foothill Division in the northern San Fernando Valley, he introduced feral cats to the building's mice-infested basement in 2004.
>
> "I think it's a very humane way to deal with a very stubborn problem," said Albanese, now assistant to the director in the office of operations at Parker Center, which has its own rat problem.
>
> The cats don't generally solve the rodent problem by killing rats and mice — although the cats are game for doing so if they catch them. Rather, the cats simply leave their scent. Once rodents get a whiff of feline presence, like gangsters under a gang injunction, they move on.
>
> [...]

It takes work getting a feral cat acclimatized to a new location. You have to keep them caged up, since at first they'll do whatever they can to get back to their old place. After about 30 days, they'll settle in.

On the other side of the eternal cat-mouse battle, the big new development is genetically engineered "marathon mice" that can run much longer than an ordinary mouse and doesn't need to exercise to stay physically fit!

There seem to be a couple of different strains of marathon mice. The first was developed by Ronald Evans of the Salk Institute in 2004, and involved getting a gene to create more PPARδ, a regulator that affects metabolism in fatty cells. Somehow this resulted in a dramatic increase of "slow twitch" muscle fibers, the kind that don't get tired.

- Ira Flatow and Alex Chadwick, Genetically Altered 'Marathon Mice' Created in Lab, *Day to Day*, National Public Radio, August 26, 2004.
- Gene targeting turns mice into long-distance runners, *Public Library of Science Biology* **2** (August 24, 2004).

However, last November researchers at Case Western Reserve developed an even more amazing strain, based on a different principle: increased production of the enzyme phosphoenolpyruvate carboxykinase. While a normal mouse typically runs 200 meters on a treadmill, this mouse can run 6 kilometers! It eats 60 percent more than a normal mouse, but it weighs only half as much and has just 10% as much body fat. It lives longer, and at the elderly age of two and a half years it can run twice as fast as normal mice that are only six months to a year old!

- Genetically Engineered 'Mighty Mouse' Can Run 6 Kilometers Without Stopping, *ScienceDaily*, November 2, 2007.
- P. Hakimi *et al*, Overexpression of the cytosolic form of phosphoenolpyruvate carboxykinase (GTP) in skeletal muscle repatterns energy metabolism in the mouse, *The Journal of Biological Chemistry* **282** (November 9, 2007), 32844-32855.

You can see a mighty mouse in action here.

Of course, the serious side of the marathon mouse is what it will mean for genetic engineering of *people*.

January 4, 2008

One of our gates was ripped off its hinges during the last big windstorm. Now they say we're in for a lot of rain: up to a foot in places (not here), and maybe *ten feet* of snow in the Sierras. This could really ease the drought in a serious way. In the burnt hills, people are preparing for mud slides.

The rain is supposed to hit this evening — and before it, more high winds. I'd better take the trash bins in, so we don't have garbage blowing everywhere. It's a good day to clean out the gutters, too!

January 7, 2008

It didn't help: the gutters in front of the house fell down. More repairs.

But, it snowed a lot in the mountains, and the hills are turning green, making for some pretty views. Lisa and I took a hike in Box Springs Park, pretty close to our house, starting from the Two Trees entrance. Lisa took these photos:

Trails

Resting hummingbird

View of San Gorgonio Mountains

January 18, 2008

I've been knuckling down and working hard. Besides working on my classical mechanics course and the Geometric Representation Theory Seminar, I'm trying to get a lot of papers done. I've been miserably burdened trying to finish off papers for conference proceedings, papers with coauthors, and the like, but I think I'm beginning to see my way clear.

Here's the story: the struggles of a mathematician who's juggling too many balls at once.

I've been working on a paper with Danny Stevenson, The Classifying Space of a Topological 2-Group, leading up to the construction of characteristic classes for certain 2-bundles. I'd also been committed to finish a paper for the Abel Symposium conference proceeedings by this month or the next. In December I cleverly realized I could kill two birds with one stone by making these the same paper, instead of writing a separate expository paper for the Abel Symposium, as I'd been planning. By now this paper with Danny is almost done, but there are some niggling technical details left to straighten out. I'm way too busy to sit and think about these with the attention they deserve, but Danny seems to be figuring them out very nicely — when he gets ahold of a tough technical problem, he doesn't let it go until it's solved! I hope to get at least a first version on the arXiv in a week or less.

So, that'll be two papers off my list, using some clever bookkeeping.

I've also been working on a paper with Aaron Lauda, called A Prehistory of *n*-Categorical Physics. This had been slated to appear in the proceedings of a conference Peter May and I ran at the IMA in the summer of 2004: *n*-Categories: Foundations and Applications. This proceedings has been coming to fruition very slowly. It's partially my fault, but luckily I can blame André Joyal, since he's writing a huge introduction to quasicategories, the centerpiece of the whole volume, which has taken forever to finish. I also have another paper in this conference proceedings, thankfully finished: Lectures on *n*-Categories and Cohomology, with Mike Schulman. I suddenly realized that I don't need *two* papers in this

proceedings — and that it might even look bad to have more than one papers in a volume I'm editing. So, I got Peter and Aaron's permission to pull out the Prehistory and place it in the proceedings for Deep Beauty: Mathematical Innovation and the Search for an Underlying Intelligibility of the Quantum World, a conference that Han Halvorson ran this fall. I sort of *had* to write a paper for that, since I was the "keynote speaker". I checked with Halvorson, and he said he liked the Prehistory. Indeed, it fits the theme of his conference better than it fits the IMA proceedings. I'm almost done with it, but now I have more time to finish it — it's due in the fall.

So, one more paper off my list, and one almost done, to be finished by autumn.

I'm also working on a paper with Mike Stay: Physics, Topology, Logic and Computation: A Rosetta Stone. This is due by mid-February for a volume Bob Coecke is compiling on "new structures in physics". I'm finally in a position to work hard on this, and it should go quick. I should be working on it right now! But, I'll burn out if I work all the time.

When that one is done, I'll have a bit of a breather.

There's a paper I'm writing with Laurent Freidel, Aristide Baratin and Derek Wise, Representations of 2-Groups. Luckily, my coauthors all seem quite distracted, so I don't feel under much pressure just now.

There's also a paper I need to finish for a volume on mathematics and narrative, Why Mathematics is Boring. I'm probably behind on this, but they haven't been pestering me.

I hope I can finish one of these two by September, along with the Prehistory, because then I'm giving a series of three lectures in Glasgow — the Robert Rankin Lectures. The Glasgow Mathematical Journal Trust will provide someone to transcribe these, and then I'll be stuck with the job of turning those transcripts into nice papers. That's always harder than it seems, since a good talk should contain much less information than a good paper. But, it's a good opportunity to try something fun, so I've decided to speak on My Favorite Numbers. The three lectures will be titled simply 5, 8 and 24. They'll cover a lot of curious special properties of these numbers. Someday I'd like to write a book on these theme, with each chapter covering a number: 0, 1, 2, 3, 4, 5, 6, 7,... eventually skipping some of the less interesting ones. However, I have more ideas for projects than time to do them, so this book may never get written.

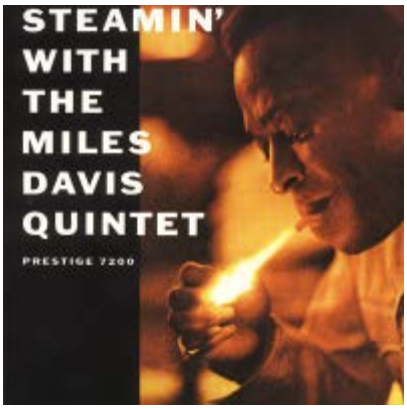
There are also some papers I'm writing with grad students — but I don't feel nearly as worried about these, because it's *they* who must finish these papers or pay the price.  These days I meet with all my students for a mammoth session every Wednesday. We spend most of that time talking math, but as they get further along, the balance is shifting towards work on papers. Alex Hoffnung is close to finishing one called Chen Spaces: A Convenient Category for Differential Geometry (or something like that). He also has a followup in the works, on connections and smooth anafunctors. And, he and Chris Rogers have made a lot of progress on a paper about categorifying classical mechanics. John Huerta will eventually start working on a paper about the algebraic structure of grand unified theories — we've got the ideas worked out; he just needs to start writing. And, later, Christopher Walker should write something about the categorified q-deformed harmonic oscillator (a topic of this quarter's seminar).

I also have another paper on the back burner: Higher-Dimensional Algebra VII: Groupoidification. But, I want to give this one enough time to cook nicely.

So — lots of stuff! I felt it as a crushing burden this fall, but now I'm chipping away at it nicely. The math, of course, is delightful. It's just the feeling of "deadlines" and "duties" that I have trouble with.

January 19, 2008

I've been getting into jazz more lately. I've always liked *some* jazz, but now I'm getting a bit more serious about it. For example: I have *Workin'*, *Cookin'* and *Relaxin'* by Miles Davis' first quintet, but now I feel the need to get *Steamin'* — the last of this marvelous series of albums, all made on *two days*: May 11 and October 26, 1956. They feature an almost unbeatable lineup: Miles Davis on trumpet, John Coltrane on tenor sax, Red Garland on piano, Paul Chambers on bass, and Philly Joe Jones on drums.



It's amazing how they cranked out so much good music in such a short time, but this is what a group of stellar musicians can do after playing together for years!

In fact, I've been getting pretty obsessed by Miles Davis, up to somewhere around *Bitches Brew* — everyone seems to lose interest in him past *some* point, and that's probably it for me. (I find Bitches Brew fascinating but not actually much fun to listen to; later he seemed to go flaccid, perhaps from too much cocaine.) His first quintet is great, but his second quintet really blows my mind. Those melodies by Wayne Shorter are so elliptical, evocative, mysterious....

I'm also getting into Coltrane. He's one of those names you hear mentioned with a strange awe, as if he's more respected than enjoyed. I'm finally overcoming the strange distaste this caused in me, and listening to his stuff. Naturally, it's great. Besides his work with Davis, I've been enjoying *Lush Life* and *Blue Train*.

Today I got *A Love Supreme* — again, one of those things I'd heard about so often that I was somehow unwilling to try it. Also the 8th edition of the Penguin Guide to Jazz Recordings. I like jazz now with almost the same passion I had for rock as a kid... but jazz is music for grownups: more sophisticated harmonically and rhythmically, just as adventurous at its best, always pushing the limits, but with a subtler, gentler spirit.

Mind you, I still like rock! It's not about growing out of old things; it's about growing into new ones.

January 24, 2008

Yay! Danny and I finished our paper The Classifying Space of a Topological 2-Group. It's good to be working myself out of the paper jam I'd gotten into. Now I'm turning to the Rosetta Stone paper with Mike Stay. Time to think about logic.

On a wholly different note — this rings so true:

> **A National Near-Death Experience**

We're getting closer to the light — the one at the end of the George Bush tunnel.

Patt Morrison, LA Times.
January 24, 2008

One year from this very moment, someone other than George Bush will be sliding behind that antique desk in the Oval Office. In embassies and outposts that fly the Stars and Stripes, photographs of a face other than Bush's will be going up on the walls.

At long, long last. It is seven years since Bush plopped down behind that desk, seven years when hope and honor and good faith and goodwill died a little for me, for many other heartsick Americans who love this country, and for millions around the world who looked up to this country.

I say "died," and I mean that. The psychiatrist Elisabeth Kubler-Ross laid out the basic stages of grief and coming to terms with loss. And Kubler-Ross' five stages track almost perfectly the arc of how we've grappled and grieved over the sickening power crusade of the Bush administration against the nation for these last seven years.

Denial: It can't be happening. Who could expect that the man who had to win election in court, not at the polls, would instantly, arrogantly go on the attack — wiping out environmental protections unmatched since Teddy Roosevelt, throwing out scores of health and safety and accountability and privacy rules and protections that made life better for typical Americans, and making "caveat emptor" the only motto of U.S. business? There must be some mistake, doctor.

Anger: It's not fair. How dare they? How can they practice retrograde isolationism abroad and rapacious cronyism at home? How can they dishonor 9/11 by exploiting the nation's fears to justify upending the Constitution and creating a metastasized secret government? Threatening librarians with prosecution? Arresting people wearing anti-Bush T-shirts, thus conflating protest with sedition? Sneaking and peeking on us without warrants — at the same time they're wrapping the White House in impenetrable secrecy in the name of national security? I went to bed at night raging against the outrages — Abu Ghraib, Guantanamo, Katrina, Blackwater, Terri Schiavo — and woke to fresh ones with the morning's news.

Bargaining: If they stop now, I'll make my peace. OK, they have the Supreme Court, and the war they lied to get — maybe that's enough. Maybe it's enough that the war will bankrupt our children, just please don't let it bankrupt our grandchildren too. He went to war with terrorism, so if he goes to war against global warming and failing levees the way he did against terrorism, I live with a "Clear Skies" initiative that pollutes the air and a "Healthy Forests" initiative that whacks more trees. Promise me it won't happen again, and I'll let it go.

Depression: I can't even lift my head to pay attention. Saddam Hussein had WMD? Sure, fine, yeah. Dick Cheney doesn't want to submit to a mandatory archive inspection, so he claims he's not part of the executive branch? Naturally. The administration decides what it wants to do, then makes up its own facts to justify it. Reality, like history, is written by the victors. Take the science out of NASA and the Interior Department, and the Earth is suddenly in great shape; species are no longer endangered. Declare "mission accomplished" with 150 dead American soldiers, and five years later, when the numbers are more than 20 times that, observe offhandedly that the U.S. could "easily" be in Iraq another 10 years. Whatever. I've pulled the shades.

Acceptance: Ready for whatever comes. Game over, peace out. I thought I was at the acceptance stage, but not yet.

I can't forget that, in the nation's name, these men have abused power to defeat the constitutional remedies for abuse of power. They've turned every government agency into a hit squad for Bush-Cheney Inc. They've despoiled this exquisite, singular planet just to stuff a few more millions into billionaires' pockets.

> Can I hold out for one more year? Can the nation? Will another election save us? Are we suckers to believe, still, in the ultimate curative power of that brilliantly conceived human instrument, the Constitution? What other choice do we have? I'm ready for a last-minute miracle cure.
>
> Bring it on.

The latest outrage continues: the head of the so-called "Environmental Protection Agency", Stephen Johnson, is trying to cover up the procedure (or lack of it) that led him to forbid 15 states the ability to cut automobile exhaust emissions:

January 25, 2008

The last speaker of the Alaskan language Eyak died yesterday: Udachkuqax*a'a'ch, born in 1918. In English she was known as Marie Smith Jones.

January 26, 2008

A feral cat at your local police station is nothing compared to *this:*

Picture by Matthew Dickie

This was taken by Matthew Dickie, an engineer at the famous Jet Propulsion Laboratory in the hills near Pasadena, as he walked to work in the morning. Joe Mozingo wrote about it in today's LA Times:

> On its east side, the Arroyo Seco — a stream that goes from dry to torrent depending on the weather — courses out of the mountains onto a sandy flood basin behind the Devil's Gate dam.
>
> Because mountain lions and other wildlife routinely follow streams, the Arroyo Seco is a natural corridor, funneling a 32-square-mile watershed down to a narrow cut — where Dickie spotted the cougar last week.
>
> Until last year, when the upper JPL property was fenced, large deer herds roamed the facility's open areas.
>
> "Whenever you have a lot of deer, you are asking for lions," said Lt. Martin Wall of the California Department of Fish and Game. Two years ago, JPL employees found a partially eaten deer carcass under a trailer. "That was an eye-opener for them," Wall said.
>
> JPL spokeswoman Veronica McGregor said all sorts of animals — bears, foxes, coyotes — roam onto the property. Generally, when security officers are notified of a mountain lion sighting, officials make an announcement over the public address system and post an advisory on JPL's internal website. McGregor said this has happened three times since 2004.
>
> Joe Edmiston, director of the Santa Monica Mountains Conservancy, said such sightings should be celebrated. "I think it's the most wonderful thing in the world that we still live in a place that's not tamed, not domesticated," he said. "We should venerate the idea that this mountain lion is staring up at the engineers in their pocket protectors."
>
> Fish and Game biologists estimate that there are 4,000 to 6,000 mountain lions in the state, from the redwoods to the Laguna Mountains on the Mexican border. One was killed by a vehicle on Angeles Forest Highway near Acton earlier this month.

A nice book on Coltrane's music, with a nice dose of music theory, but nothing too heavy:

- Ben Ratliff, *Coltrane: the Story of a Sound*, Farrar, Straus and Giroux, 2007.

John Coltrane's loquacious soloing was in strong contrast to Miles Davis' laconic style, which led to some conflict during the golden years when Coltrane was in Davis' first quintet. From Ratliff's book:

> This was the period when Coltrane occaisioned two of jazz's most famous punch lines. They both amount to

the same thing. One came from Cannonball Adderly: "Once in a while, Miles might say, 'Why did you play so long, man?' and John would say 'I took that long to get it all in.'" The other seems to have no definite source. Coltrane says to Davis that he can't figure out a way to stop his solos. Davis retorts: "Why don't you try taking the horn out of your mouth?"

January 27, 2008

More rain down here — so, snow up in the mountains! Lisa and I went on a hike in Box Springs park:

January 28, 2008

If you care about the Earth, please don't vote for Romney. According to today's Los Angeles Times, Mitt Romney recently "chided McCain for cosponsoring legislation aimed at fighting global warming, saying it would cost jobs and raise gasoline and electricity prices. *'Don't you understand, they don't call it American warming, they call it global warming,'* he shouted. *'We don't need to have America have additional costs that the rest of the world doesn't bear.'*"

It's also not called "Chinese warming", "Indian warming", etc. So, by Romney's logic, I guess nobody should do anything about it. We should all wait for someone else.

January 30, 2008

Just a note to myself: someday I want to buy a bamboo saxophone, since they're a lot easier to play than the regular kind! With only a few minutes practice I could make a sound on one in a market in Greenwich last summer. Here's a place that sells them:

- Chameleon Instruments.

and here's the website of the guy that makes them:

- Xaphoon.

For my February 2008 diary, go here.

The water is rising. You try to rappel.
A rousing cheer for the boy in the well. - REM

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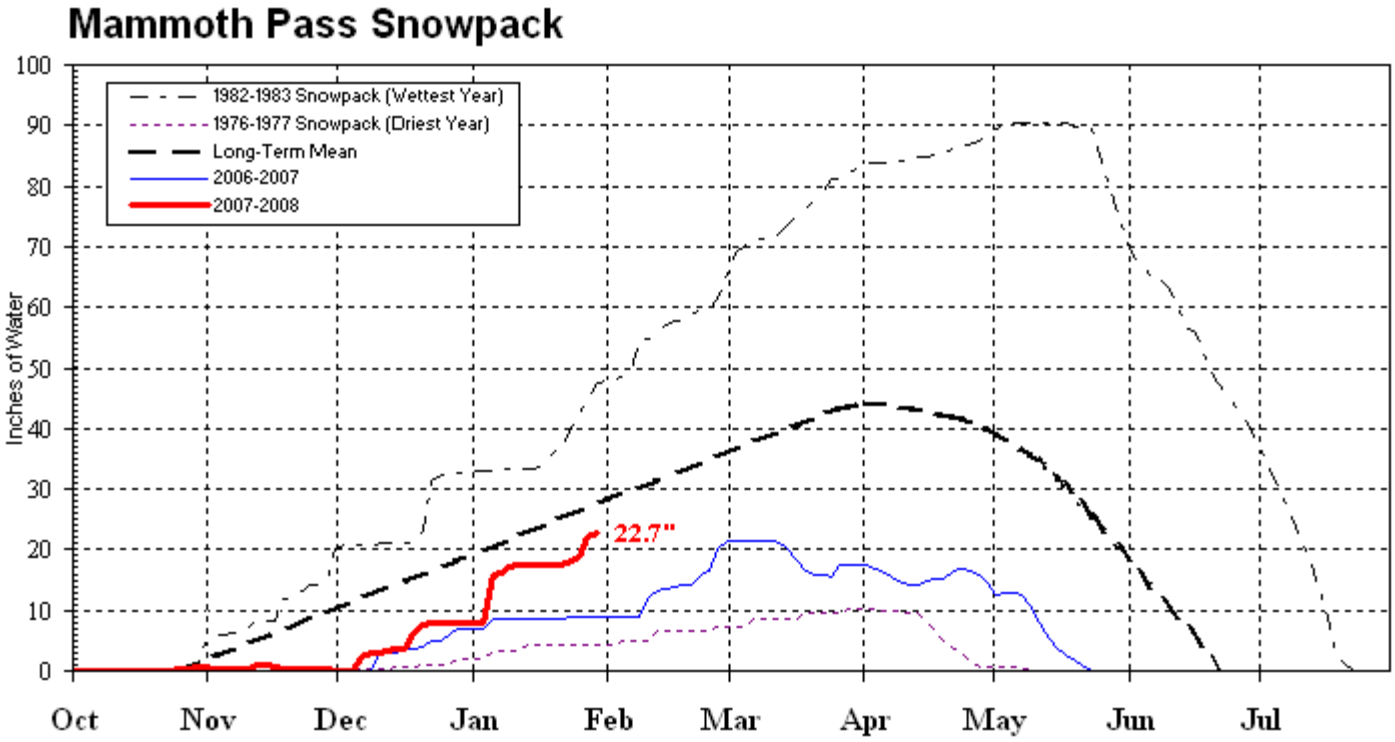
For my January 2008 diary, go here.

Diary - February 2008

John Baez

February 3, 2008

Another rainy day. Gutters and gate fixed by Kevin Otjen — they're holding up well. But it's not a wild windy storm like the ones we had last month: it's a gentle steady drizzle. The snow pack in the eastern Sierras is doing much better than last year:



On Sunday mornings, Lisa and I lie in bed reading the paper and listening to the radio. Here's a nice radio essay on one of my all-time favorite pieces — *Music for 18 Musicians* by Steve Reich — and its award-winning new performance by an ensemble from Michigan:

- Music for 18 (Cornfed) Musicians, *Weekend Edition Sunday*, National Public Radio, February 3, 2008.

It's fun hearing just two xylophone performers from the Grand Valley State University New Music Ensemble play their parts from one passage, letting the notes fall in place one at a time, starting from a simple phrase, growing to something rich and strange. When this piece is fully underway, it's like the music of the spheres, or the whir of virtual particles endlessly tracing out Feynman diagrams in the aether. It's excellent for doing mathematics.

If you like mysteries, this story has its own spooky charm:

- For 50 Years, Nuclear Bomb Lost in Watery Grave, *Weekend Edition Sunday*, National Public Radio, February 3, 2008.

A few other items. First, one from the Technology Review. You have to register to read this, but it's free, and they don't send you spam:

- David Rotman, The Price of Biofuels, *Technology Review*, January/February 2008.

Bottom line, as already mentioned here on October 2: the corn-produced ethanol, so popular here in the US, is very problematic. Right now 20% of US corn is being converted to ethanol. This has driven the price of corn to record levels, but it's not nearly enough to make a serious dent in gasoline consumption. Apparently there's no way it ever will: "even proponents of corn ethanol say that its production levels cannot go much higher than around 15 billion gallons a year", while we now use 142 billion gallons of gasoline. Worse, it takes a lot of energy to *make* ethanol: the whole production cycle only produces 25% more energy than it uses.

Cellulosic ethanol could be better. Cellulose from many sources can be converted to ethanol, and this doesn't require using edible crops like corn: you could use waste wood chips from lumber, grasses that grow quickly just about anywhere, and so on. However, the production methods are still experimental: not very efficient, not ready to be scaled up:

> Many researchers believe that the most promising way to make cellulosic biofuels economically competitive involves the creation — or the discovery — of "superbugs," microörganisms that can break down cellulose to sugars and then ferment those sugars into ethanol. The idea is to take what is now a multistep process requiring the addition of costly enzymes and turn it into a simple, one-step process, referred to in the industry as consolidated bioprocessing. According to Lee Lynd, a professor of engineering at Dartmouth College and cofounder of Mascoma, a company based in Cambridge, MA, that is commercializing a version of the technology, the consolidated approach could eventually produce ethanol at 70 cents a gallon. "It would be a transformational breakthrough," he says. "There's no doubt it would be attractive."
>
> But finding superbugs has proved difficult. For decades, scientists have known of bacteria that can degrade cellulose and also produce some ethanol. Yet none can do the job quickly and efficiently enough to be useful for large-scale manufacturing.
>
> [...]
>
> Susan Leschine, a microbiologist at the University of Massachusetts, Amherst, believes she just might have stumbled on a bug that will do the job. She found it in a soil sample collected more than a decade ago from the woods surrounding the Quabbin Reservoir, about 15 miles from her lab. The Quabbin sample was just one of many from around the world that Leschine was studying, so it was several years before she finished analyzing it. But when she did, she realized that one of its bacteria, *Clostridium phytofermentans*, had extraordinary properties. "It decomposes nearly all the components of the plant, and it forms ethanol as the main product," she says. "It produces prodigious amounts of ethanol."
>
> Leschine founded a company in Amherst, SunEthanol, that will attempt to scale up ethanol production using the bacterium. There's "a long way to go," she acknowledges, but she adds that "what we have is very different, and that gives us a leg up. We already have a microbe and have demonstrated it on real feedstocks." Leschine says that other useful microbes are probably waiting to be discovered: a single soil sample, after all, contains hundred of thousands of varieties. "In this zoo of microbes," she says, "we can think that there are others with similar properties out there."

A more futuristic but perhaps ultimately better option: get bugs to convert cellulose and other stuff to *hydrocarbons*.

Second: there are lots of people here at UCR I'd enjoy meeting — but I'm so darn busy, I don't tend to go around knocking on doors. I just read about these folks in a UCR magazine:

- Cheryl Hayashi recently won a MacArthur for her work on the evolution leading up to spider silk — 1/10 the diameter of the human hair, lighter than cotton, 5 times stronger than steel.
- Allen Mills just created molecular positronium: that is, "molecules" where each "atom" is an electron-positron pair. Now he's trying to make a Bose-Einstein condensate of positronium.

- Timothy Lyons and others have detected traces of oxygen in the Earth's atmosphere about 100 million years before the "Great Oxidation Event" 2.4 billion years ago.

Luckily Tim Lyons is my next-door neighbor! I'll ask him about the Great Oxidation Event next Saturday if he comes to our Lunar New Year party.

Third: some Arabic music websites I keep meaning to check out:

- Radio Casablanca - a blend of traditional and contemporary Arabic music.
- Radio Méderranée Internationale - out of Tangiers, in French. Look under "musique".
- Radio Cairo - extensive music archive.
- National Radio of Tunis: a broad introduction to the modal *malouf* music of Tunis.

February 8, 2008

The bad word about corn-based ethanol is getting around, and — thank god — a policy debate is starting before we've completely plunged from the frying pan into the fire:

- Richard Harris, Study: Ethanol Worse for Climate Than Gasoline, *Weekend Edition Sunday*, National Public Radio, February 7, 2008.
- Environmentalists Debate the Promise of Biofuels, *Talk of the Nation*, National Public Radio, February 8, 2007.

Unfortunately, it's not just corn-based ethanol (darling of the government-subsidized farmers here in the US). According to this paper, it seems *all* biofuels are potentially dangerous sources of extra CO_2 if we rip up existing vegetation to plant them:

- Timothy Searchinger, Ralph Heimlich, R. A. Houghton, Fengxia Dong, Amani Elobeid, Jacinto Fabiosa, Simla Tokgoz, Dermot Hayes, and Tun-Hsiang Yu, Use of U.S. croplands for biofuels increases greenhouse gases through emissions from land use change, *Science*, January 28, 2008.

The abstract:

> Most prior studies have found that substituting biofuels for gasoline will reduce greenhouse gases because biofuels sequester carbon through the growth of the feedstock. These analyses have failed to count the carbon emissions that occur as farmers worldwide respond to higher prices and convert forest and grassland to new cropland to replace the grain (or cropland) diverted to biofuels. Using a worldwide agricultural model to estimate emissions from land use change, we found that corn-based ethanol, instead of producing a 20% savings, nearly doubles greenhouse emissions over 30 years and increases greenhouse gases for 167 years. Biofuels from switchgrass, if grown on U.S. corn lands, increase emissions by 50%. This result raises concerns about large biofuel mandates and highlights the value of using waste products.

Alex Farrell of Berkeley says the biofuels industry needs a rapid switch of direction away from *growing* fuel towards using various forms *waste*: "We could replace all of the ethanol that we consume in California just using waste that goes to the landfill today, and turning that into ethanol."

Other suggest growing grass on lands that aren't suitable for crops. This sounds like a great way to destroy what's left of our wilderness.

February 9, 2008

I've been hard at work on my Rosetta Stone paper with Mike Stay. But today is different - it's our Lunar New Year party. We've invited 53 of our closest friends and will get a bunch of them to work making jiaozi:

Unfortunately both Lisa and I have been under the weather with colds. We'll try to shake 'em off tonight.

February 10, 2008

Great party! And, we're healthy now.

February 16, 2008

More people are beginning to realize that we're entering a new geological epoch: the Anthropocene:

- Welcome to the Anthropocene Epoch, *All Things Considered*, National Public Radio, February 16, 2008.

It looks like this epoch will be tough on the world's oceans:

- Map reveals extensive damage to world's oceans, *Talk of the Nation*, National Public Radio, February 15, 2008.

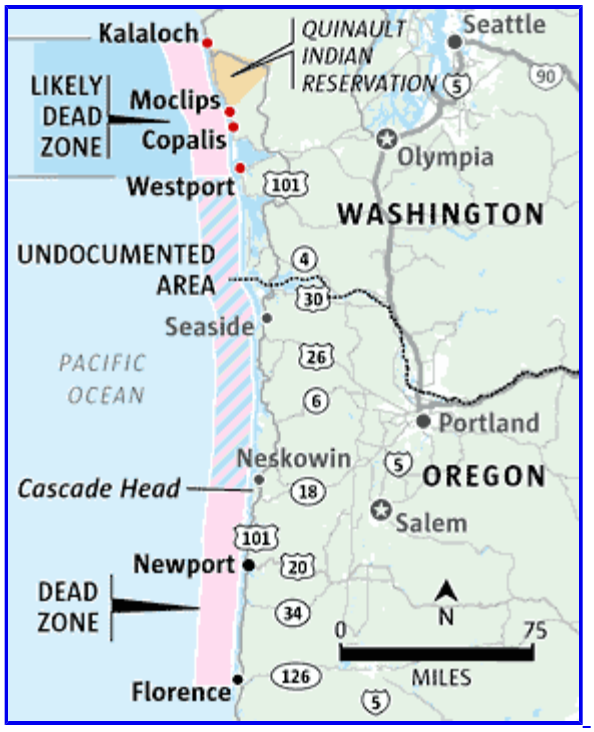
Global warming and the acidification of the ocean due to increased CO_2 are killing off coral reefs. Global warming and polluted runoff are causing the rapid spread of dead zones — patches of the ocean where the lack of oxygen kills all higher life forms.

Dead crabs washed ashore in Oregon after oxygen levels dropped too low.
Photo by Elizabeth Gates, *LA Times*

- Kenneth R. Weiss, Dead zones off Oregon and Washington likely tied to global warming, study says, *Los Angeles Times*, February 15, 2008.

A quote:

> Peering into the murky depths, Jane Lubchenco searched for sea life, but all she saw were signs of death.
>
> Video images scanned from the seafloor revealed a boneyard of crab skeletons, dead fish and other marine life smothered under a white mat of bacteria. At times, the camera's unblinking eye revealed nothing at all — a barren undersea desert in waters renowned for their bounty of Dungeness crabs and fat rockfish.
>
> "We couldn't believe our eyes," Lubchenco said, recalling her initial impression of the carnage brought about by oxygen-starved waters. "It was so overwhelming and depressing. It appeared that everything that couldn't swim or scuttle away had died."
>
> Upon further study, Lubchenco and other marine ecologists at Oregon State University concluded that that the undersea plague appears to be a symptom of global warming. In a study released today in the journal *Science*, the researchers note how these low-oxygen waters have expanded north into Washington and crept south as far as the California state line. And, they appear to be as regular as the tides, a lethal cycle that has repeated itself every summer and fall since 2002.
>
> "We seem to have crossed a tipping point," Lubchenco said. "Low-oxygen zones off the Northwest coast appear to be the new normal."



Dead zones as of June 2006

- Kenneth R. Weiss, Dead zones off Oregon and Washington likely tied to global warming, study says, *Los Angeles Times*, February 15, 2008.

Yet another deadly blow to the oceans comes from overfishing. Many species of large fish are headed for extinction. For example, bluefin tuna in the Atlantic are down 97% since the start of long-line fishing in the 1980s. White marlin are down 94%. And so on.

What can *you* do? First: vote for politicians who seriously care about the Earth, not just the smaller problems that distract us so. Second: only buy seafood from sustainable sources! Find out what's good and what's bad. The sustainable seafood movement is already having an effect.

The seafood you should *never* eat:

- Atlantic bluefin tuna
- Chilean sea bass
- Grouper
- Orange roughy
- Atlantic cod (especially US and Canada)
- Atlantic halibut
- Oreo
- Caviar (wild-caught, North America or Caspian sea)
- Atlantic salmon (farmed)
- Snapper
- Shark

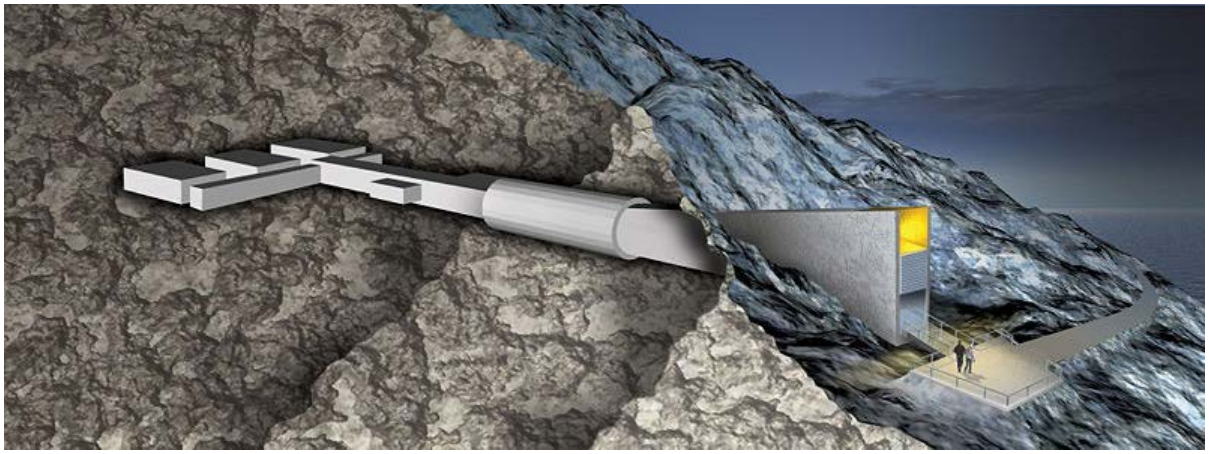
These may seem like meager responses to a massive problem, and indeed they are — but very small things can make the difference between *low population levels*, which can eventually bounce back, and *extinction*, which is forever. Don't forget the Lazarus taxa!

February 27, 2008

Speaking of Lazarus taxa rising from the dead, the Svalbard Global Seed Vault on the icy Norwegian isle of Spitsbergen

has hit the news in a big way! It's an impressive structure, in a grand location, designed for a noble task:

photo by Dean C. K. Cox for the International Herald Tribune



Global Diversity Trust

Near Arctic, Seed Vault Is a Fort Knox of Food

Elisabeth Rosenthal
New York Times, February 29, 2008

Longyearbyen, Norway - With plant species disappearing at an alarming rate, scientists and governments are creating a global network of plant banks to store seeds and sprouts, precious genetic resources that may be needed for man to adapt the world.s food supply to climate change.

This week, the flagship of that effort, the Global Seed Vault near here, received its first seeds, millions of them. Bored into the middle of a frozen Arctic mountain topped with snow, the vault.s goal is to store and protect samples of every type of seed from every seed collection in the world.

As of Thursday, thousands of neatly stacked and labeled gray boxes of seeds — peas from Nigeria, corn from Mexico — reside in this glazed cavelike structure, forming a sort of backup hard drive, in case natural

disasters or human errors erase the seeds from the outside world.

Descending almost 500 feet under the permafrost, the entrance tunnel to the seed vault is designed to withstand bomb blasts and earthquakes. An automated digital monitoring system controls temperature and provides security akin to a missile silo or Fort Knox. No one person has all the codes for entrance.

The Global Vault is part of a broader effort to gather and systematize information about plants and their genes, which climate change experts say may indeed prove more valuable than gold. In Leuven, Belgium, scientists are scouring the world for banana samples and preserving their shoots in liquid nitrogen before they become extinct. A similar effort is under way in France on coffee plants. A number of plants, most from the tropics, do not produce seeds that can be stored.

For years, a hodgepodge network of seed banks has been amassing seed and shoot collections in a haphazard manner. Labs in Mexico banked corn species. Those in Nigeria banked cassava. Now these scattershot efforts are being urgently consolidated and systematized, in part because of better technology to preserve plant genes and in part because of the rising alarm about climate change and its impact on world food production.

"We started thinking about this post-9/11 and on the heels of Hurricane Katrina," said Cary Fowler, president of the Global Crop Diversity Trust, a nonprofit group that runs the vault. "Everyone was saying, why didn't anyone prepare for a hurricane before? We knew it was going to happen."

"Well, we are losing biodiversity every day — it's a kind of drip, drip, drip. It's also inevitable. We need to do something about it."

This week the urgency of the problem was underscored as wheat prices rose to record highs and wheat stores dropped to the lowest level in 35 years. A series of droughts and new diseases cut wheat production in many parts of the world. "The erosion of plants' genetic resources is really going fast," said Dr. Rony Swennen, head of the division of crop biotechnology at the Catholic University of Leuven in Belgium, who has preserved half of the world's 1,200 banana types. "We're at a critical moment and if we don't act fast, we're going to lose a lot of plants that we may need."

The United Nations International Treaty on Plant Genetic Resources, ratified in 2004, created a formal global network for banking and sharing seeds, as well as for studying their genetic traits. Last year, its database received thousands of new seeds.

A system of plant banks could be crucial in responding to climate crises since it could identify genetic material and plant strains better able to cope with a changed environment.

Here at the Global Vault, hundreds of gray boxes containing seeds from places ranging from Syria to Mexico were moved this week into a freezing vault to be placed in suspended animation. They harbor a vast range of qualities, like the ability to withstand drier, warmer climate.

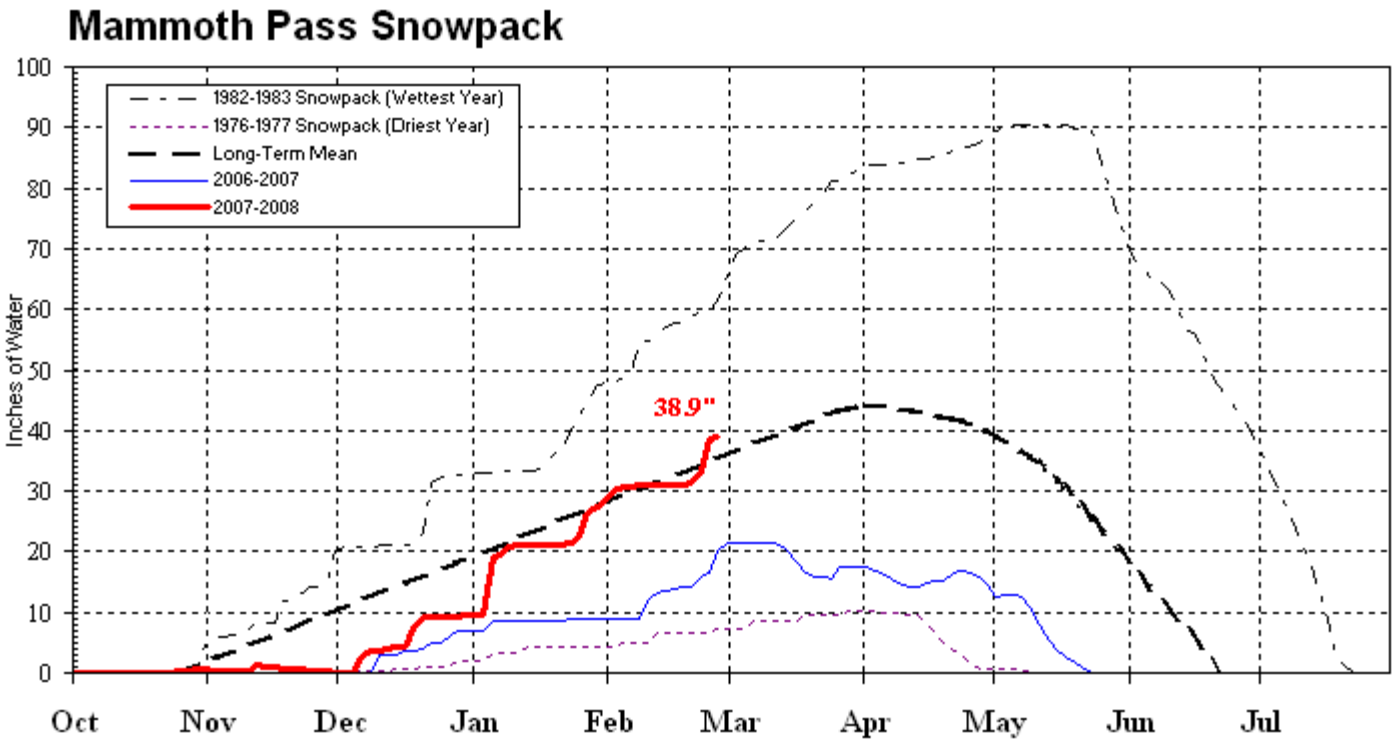
Climate change is expected to bring new weather stresses, as well as new plant pests into agricultural regions. Heat-trapping carbon dioxide emissions will produce not just global warming but an increase in extreme weather events, like floods and droughts, the Intergovernmental Panel on Climate Change concluded.

Already three-quarters of biodiversity in crops has been lost in the last century, according to the United Nations Food and Agriculture Organization. Eighty percent of maize types that existed in the 1930s are gone, for example. In the United States, 94 percent of peas are no longer grown.

photo by Mari Tefre, Global Diversity Trust

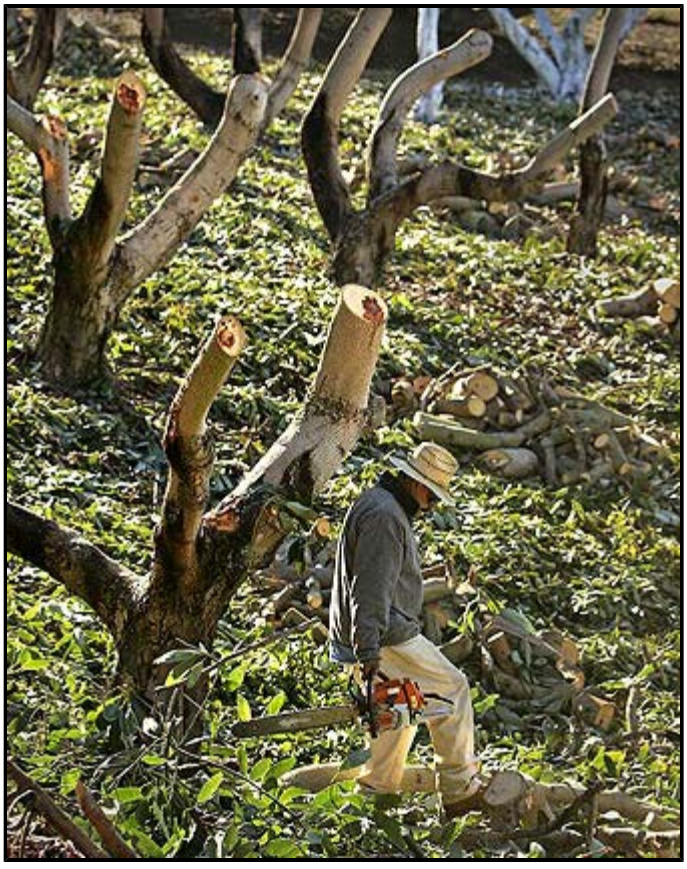
February 29, 2008

It's been raining a lot this month! It's nice to see how the snowpack in the Sierras is doing - especially compared to last year:



But on January 1st, a mandatory 30% water reduction hit many California farmers who had signed up for a program that gave them discounted water in exchange for being first in line when cutbacks were necessary. So, avocado growers in southern California are 'stumping' hundreds of trees to save water:

- Deborah Schoch, Water cuts slicing into avocado groves, *Los Angeles Times*, February 26, 2008.



Juan Flores walks among idled trees at the

Bejoca Co. avocado farm.
Photo by Mark Boster, *LA Times*

I think this 'stumping' doesn't kill the trees, but only renders them dormant... but I'm not sure: it looks pretty brutal. While the gardener in me hates to see this happen to any tree, water-intensive agriculture is really not the right way to use land in southern California. We need to face reality: too many people, not enough water — and a growing chance of drought thanks to global warming, while the population grows.

Some water facts from the Environmental Protection Agency:

- The average American uses about 160 gallons of water a day, at a cost of 27 cents.
- Lawn watering accounts for at least 50% of an average household's water usage.
- 40% of the water used indoors is flushed down the toilet, at an average of 4-6 gallons a flush.
- The average American uses 2 gallons of water a day to brush their teeth.

These facts suggest some strategies. For one: use reclaimed water for irrigation and toilets! The Irvine Ranch Water District here in southern California is a leader in this field. 80% of business and community landscaping is irrigated with reclaimed water! This water is delivered through a separate distribution system with more than 245 miles of pipeline, eight reservoirs and 12 pump stations. Even cooler, reclaimed water is used in toilets in some buildings. This takes a dual plumbing system, which must be expensive... I wonder how long it takes to pay for itself.

Another idea is to recycle greywater: the somewhat dirty water produced by washing dishes, laundry and bathing. In principle this is an idea that could be adopted one household at a time, using systems like the one marketed by Ecoplay. Again, I don't understand the economics.

The real trick would be to make this subject seem as fascinating to young scientists as biotech or computer science.

For my March 2008 diary, go here.

If society wishes to avoid catastrophic disruption of our lives, the time for action is now. - Jane Lubchenko

baez@math.removethis.ucr.andthis.edu

home

For my February 2008 diary, go here.

Diary - March 2008

John Baez

March 1, 2008

It was a misty, moist day. Lisa and I drove down to Carlsbad, a town on the Pacific coast north of San Diego. We looked at a house for sale down there — a house with an ocean view, for sale "cheap" because the owner committed suicide. Not really all that cheap! Property prices have dropped about 10% since last year; it may be a good time to buy something, or it may be still too early. Anyway, the main problem with the house was that it overlooked Highway 5 and a bunch of shopping malls. It had an ocean view — and more importantly, a 15-minute walk to the beach — but the noise from the highway was pretty unpleasant. So, we'll keep looking.

I haven't been spending much time on this diary lately: I've been too busy writing papers! I guess the truly great diarists had lots of spare time... or else they took it as their true profession. The most I get is a relaxed evening now and then: let me use this one to say what I've been up to lately... and what I'll do next.

Since January 24th I've been working with Mike Stay on a paper called Physics, Topology, Logic and Computation: a Rosetta Stone. It's an attempt to help people from different disciplines talk to each other by explaining how category theory provides a *general language for systems and processes*.

The section on logic, and even more the section on computation, has pushed up against the limits of my competence. I'm learning a lot, but I feel pressured by the deadline — even though Bob Coecke gave me an extension to March 10th. Lisa is going to Brown University next weekend, so I can do nothing but work on this Rosetta Stone paper. That'll be sort of fun. It'll be really nice to be done, and have more time to think about things in a somewhat more relaxed way.

Winter quarter classes finish on March 14th. During the spring break, Lisa and I are flying to the National University of Singapore on the 21st — arriving on the 23rd, and coming back on the 27th. I'll give a talk to the math and physics departments, while she'll speak at the philosophy department.

Spring quarter is a "non-teaching quarter" for Lisa and me. We don't have to teach, since we compressed our courses into the previous two quarters. But, we have to be on campus for all but a month. Lisa plans to spend a month at Fudan University in Shanghai, starting around April 10th. For part of this time — maybe 3 weeks — I plan to visit the CAS-MPG Partner Institute for Computational Biology in Shanghai, invited by Andreas Dress.

Later, around May 6th-13th, I'll visit my pal Bill Schmitt at the math department at George Washington University, and also visit my parents. Later, on May 20th, Alan Weinstein has invited me up to Berkeley to talk about groupoids.

My grad students are making good progress on various projects, enough so they want to spend the spring quarter talking about *their* work in my seminar, instead of listening to me mouth off. So, both while I'm here and while I'm travelling, the spring seminar will cover these topics:

- John Huerta - representation theory in the Standard Model and grand unified theories
- Christopher Walker - Hopf algebras and quantum groups
- Alex Hoffnung - smooth spaces, sheaves and topos theory
- Chris Rogers - categorified classical mechanics and Lie n-algebras

Alex has almost finished a paper with me on smooth spaces, so it's about my turn to jump in and polish it off. Alex and Chris are working with me on a paper on categorified classical mechanics and Lie 2-algebras. I want them to finish it soon, but I also want some time to recover from these other papers before tackling that!

There's another paper that's been hanging over my head for a long time: Representations of 2-Groups with Laurent Freidel, Aristide Baratin and Derek Wise. Now Derek has sent it back to me... I need to look and see where it stands now.

At times, writing all these papers feels like a rat race. What's the point of churning out so much stuff? More and more I think my real goal in mathematics is not to solve as many problems as possible, or even come up with as many theories as possible. What I really want is to promote a certain spirit, or attitude: clarity, simplicity, a sense of humor. I like to write things that make people happy. But I can't do this well when I'm feeling overworked and stressed-out!

So, I want to slow down. But when I have ideas, it's hard to resist writing about them. And, writing about them always takes a lot of time.

I can't help thinking about this annoying quote by Bertrand Russell:

> Abstract work, if one wishes to do it well, must be allowed to destroy one's humanity; one raises a monument which is at the same time a tomb, in which, voluntarily, one slowly inters oneself.

I really don't want this to be true.

I enjoy writing — it's one of my favorite activities. (Hey, I'm doing it now!) So, I don't want to stop, or even write less. I just want to do it without feeling *pressured* by deadlines or collaborators.

Maybe the best thing would be to work only with Jim Dolan, and write all the papers myself, at whatever rate I feel like.

March 2, 2008

For some unknown reason, noctilucent clouds are becoming more widespread — clouds made of ice crystals in the mesopause, 85 kilometers up. They can often be seen glowing at night, hence their name. Once they were rare, and seen only near the poles. Now they're more common — and at lower latitudes, too!

Nobody knows why. But, here's one theory. It takes extreme cold for ice crystals to form this high up - that's why noctilucent clouds form mainly near the poles. But, as greenhouse gases keep more heat in the lower atmosphere, less gets out to the upper atmosphere. So, more noctilucent clouds — and at lower latitudes.

In fact, it seems noctilucent clouds were never seen before the Industrial Revolution. Can we be sure of that? If so, it's a big piece of evidence.

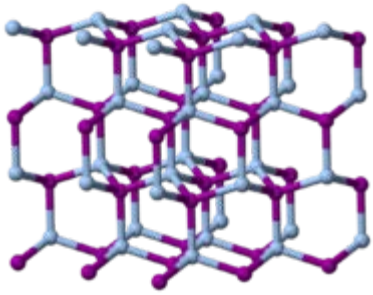
On August 4, 2006 I showed you a photo of a noctilucent cloud taken by Lee Montgomerie:

It seems nobody knows what causes noctilucent clouds. Water vapor vastly prefers to condense or form a crystal where there's a pre-existing speck of stuff to cling onto — a "seed" or "nucleator". I've heard it stated quite firmly that most high-altitude ice crystals are seeded by dust from meteors. But I don't know if anyone has actually checked! A quick search actually turns up a paper with a contrary slant:

- Narayan R. Gokhale and James Goold Jr., Ice-nucleating properties of dust collected above 80 kilometers, *Journal of Geophysical Research* **74** (1969), 5374-5378.

  Abstract: A specially constructed apparatus was used to compare the ice-nucleating properties of dust particles collected above 80 km with those of soil and AgI particles. The dust particles were found to be relatively inactive in ice nucleation when compared with AgI and soil particles of terrestrial origin.

You've got to admire someone who actually takes the trouble to collect dust from 80 kilometers up instead of sitting around theorizing. Of course this result doesn't *disprove* the claim I've heard, since AgI (silver iodide) is supposed to be especially *good* at nucleating ice crystals — apparently because its crystal structure is similar:



Anyway, the new story is that most snowlflakes are seeded by *bacteria!*

- Christner, B.C., C.E. Morris, C.M. Foreman, R. Cai, and D.C. Sands, Ubiquity of biological ice nucleators in snowfall, *Science* **319** (February 29, 2008).

From the *LA Times*:

> "Bacteria are by far the most active ice nuclei in nature," said Brent C. Christner, an assistant professor of

> biological sciences at Louisiana State University.
>
> Christner and colleagues sampled snow from Antarctica, France, Montana and Canada's Yukon and found that as much as 85% of the nuclei were bacteria, he said. The bacteria finding was most common in France, followed by Montana and the Yukon, and was even present in Antarctica.
>
> The most common bacteria found were *Pseudomonas syringae*, which can cause disease in several types of plants including tomatoes and beans.
>
> In the past, scientists have tried to eliminate *Pseudomonas*, Christner said, but now that it turns out to be a major factor in encouraging snow and rain, he wonders if that is a good idea. Eliminating the bacteria might result in less rain or snow, or it might be replaced by other nuclei such as soot and dust.

I would be very interested to learn whether bacteria survive the process of serving as an ice crystal nucleus. If they do, maybe this is part of their life cycle — it could be a good way to get around! The losers go to Antarctica, but the winners could get a free ticket to almost anywhere.

On another note, here's an interesting article on corn:

- Jerry Hirsch, Corn is king — and therefore a growing problem, *Los Angeles Times*, March 2, 2007.

In a nutshell: the growing US reliance on corn for ethanol could mean that the next drought across the Midwest causes prices to shoot up, not just for food, but also for gasoline. Food supplies and fuel are now linked in a new way.

Back in 2002, according to the National Corn Growers Association, 58% of corn went for animal feed, and 10% went to make ethanol. In 2007 just 46% went for feed and 25% went to make ethanol. (Other uses include food, exports, seed and various industrial uses.)

March 3, 2008

These are some continents I want to learn more about — some hypothetical — and their very approximate dates:

- Gondwana - 600 to 30 million years ago
- Laurasia - 300 to 60 million years ago
- Pangaea - 300 to 180 million years ago
- Euramerica, also known as Laurussia or (most charmingly) the Old Red Sandstone Continent - 300 million years ago
- Pannotia - 600 to 540 million years ago
- Proto-Laurasia - 540 million years ago
- Proto-Gondwana - 540 million years ago
- Rodinia - 1100 to 750 million years ago
- Columbia, also called Nuna - 1800 to 1500 million years ago
- Nena - 1800 million years ago
- Baltica - 1800 million years ago
- Kenorland - 2700 to 2100 million years ago
- Ur - about 3000 million years ago
- Vaalbara - about 3600 million years ago

The information on Wikipedia is hard to follow and even contradictory. Part of the problem is that there are conflicting theories, especially for the really old stuff.

March 4, 2008

Yay! Darwinian reasoning triumphs again!

On March 2nd I guessed that some bacteria are good nucleators for ice crystals "on purpose", because it helps them spreads around. It turns out the biologist Brent Christner, — whose work I was discussing — agrees. In fact, some bacteria have a protein coat that *mimics the structure of ice crystals!*

- Christopher Joyce, Snow flurries, bacteria likely, *All Things Considered*, National Public Radio, March 4, 2008.

March 5, 2008

In response to the above, my student Mike Stay's brother, Douglas Summerstay, wrote:

> This is just the beginning. Soon they will discover that airborne amoebas can actually steer their snowflakes by shifting their weight, consuming bacteria in an invisible ecosystem. Later, chemical communication systems discovered between bacteria will lead to the realization that clouds are, in a sense, conscious, and able to subtly alter wind currents by taking advantage of the "butterfly effect." These meta-organisms can become malevolent, and seeking feeding material with a unquenchable appetite, spawn tornadoes. (Seeking high concentrations of bacteria and refined sugar products, they are naturally drawn to trailer parks.)
>
> The entire atmosphere will be reinterpreted as an ephemeral biomass. Thunder will be reinterpreted as a kind of mating call.
>
> And just wait until they discover the truth about volcanoes...

And — noctilucent clouds will turn out to be the way bacteria travel between planets!

Shades of Hoyle's panspermia theory! This is a theory I don't believe, but would like to be true:

- Brig Klyce, Hoyle and Wickramasinghe's analysis of interstellar dust.

A quote:

> These two scientists did not originally set out to prove that life comes from space. They were astronomers, not biologists. They were trying to identify the contents of interstellar dust by finding something that would match its infrared signature, or extinction spectrum. When they began working on this problem in the early 1960s, the standard theory was that the spectrum could be adequately explained by graphite grains. But an imperfect match between the theoretical and actual spectra, and an implausible account of the formation of the grains pushed Hoyle and Wickramasinghe to search elsewhere. In their work and others', molecules that are more closely related to biology began to enter the picture.
>
> In 1968, polycyclic aromatic molecules were detected in interstellar dust. In 1972, convincing evidence that the dust contained porphyrins was obtained. Then in 1974 Wickramasinghe demonstrated that there are complex organic polymers, specifically molecules of "polyformaldehyde" in space. These molecules are closely related to cellulose, which is very abundant in biology. By 1975, Hoyle and Wickramasinghe were convinced that organic polymers were a substantial fraction of the dust. This line of thought was considered wildly speculative at that time. Now however, the idea that organic polymers in space are abundant and may be necessary for life is well accepted. Today we often see stories about things like vinegar among the stars, or "buckyballs" from space as "the seeds of life". To that extent the scientific paradigm for the origin of life on Earth has already shifted.

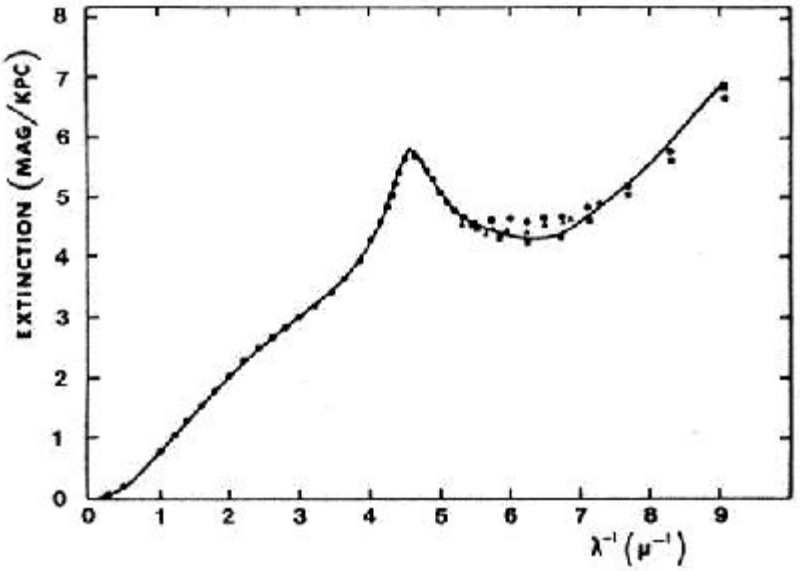


Fig. 1. Wavelength dependence of interstellar extinction normalised to 1.8 mag/kpc at $\lambda^{-1} = 1.8\ \mu m^{-1}$. Points are astronomical observations; solid curve is for the grain model proposed here. (● average extinction data compiled from many sources by Sapar and Kuusik (1979). ▲ ESA data from Jamar *et al.* (1976). ■ OAO II data from Bless and Savage (1972).

Graph of extinction spectrum of interstellar dust

But Hoyle and Wickramasinghe were not satisfied. In the middle 1970s, they turned their attention to an apparent anomaly in the spectrum. It had a low, broad "knee" centered at about 2.3 wavelengths per micrometer (the slight convexity on the slope at the left side of the graph). This spectral feature could be explained if the grains of dust were of a certain size, and hollow. After trying almost everything else first, in 1979, they looked at the spectrum for bacteria. Dried bacteria refract light as irregular hollow spheres, and their size range is appropriate. The match between the spectrum for dried bacteria (solid line) and the ones from the interstellar grains (dots, triangles and squares) was nearly perfect. Thinking without prejudice, Hoyle and Wickramasinghe concluded the grains probably were dried, frozen bacteria.

> *When [Wickramasinghe] first made this calculation... he was dumbfounded. After almost twenty years in which he had tried in vain to obtain a theoretical extinction curve closely matching the observations, using theories that permitted a considerable measure of parameter fitting, he now had a theory with no adjustable parameter, a theory which yet gave... excellent results... .*

This finding was ridiculed at the time, is still ridiculed today, and is definitely not accepted by mainstream science. It has become common to wonder if Fred Hoyle has "gone off the deep end" as several other British scientists have done in their latter years. But in fact, Hoyle spent ten productive years studying the implications of this finding. And Chandra Wickramasinghe is still working on the evidence for life from space. While exploring the vast new scientific territory they found, they have taken some wrong turns and have changed their opinions on some questions. Certain other scientists have roundly criticised them for such "inconststencies" and for sometimes having less than complete corroboration for their findings. Criticism so bitter discourages all pioneering scientific enquiry. Perhaps their work will be honored eventually.

March 10, 2008

Yay! Mike Stay and I finished our paper Physics, topology, logic and computation: a Rosetta Stone! It's an introduction to category theory for physicists designed to help them make contact with other fields that use categories in analogous ways. It should appear in Bob Coecke's book *New Structures of Physics*.

It was sort of nerve-racking work, since there was a deadline that I really wanted to meet, and it turned out I needed to learn a lot more about logic and computation to do a decent job. So, it's a real relief to be done. I'm gonna goof off for little bit, especially since classes are almost over and I'm making decent progress on finishing lots of papers. But, I want to keep working on categories and computation with Mike Stay and also with Alex Hoffnung... trying to explain things clearly made it clear there's a lot to be done, especially when it comes to categorifying the lambda calculus and its quantum version.

March 12, 2008

This morning I was interviewed by Ben Wallace-Wells, who was commissioned by the *New Yorker* magazine to write a piece on Garrett Lisi. He asked me lots of questions about the exceptional group E8, physics, Lisi's theory, and so on. He said he'd just seen Garrett give a talk at the U.C. Davis seminar run by my former student Derek Wise.

March 15, 2008

Classes are over! It's been a relaxing Saturday so far. Last night and this morning I polished up my course notes on classical mechanics. Then Lisa and I worked on the yard, pulling up weeds, transplanting succulents, and planting a new rose and a cute grey-green plant whose name I don't know. We also played around with Jeepers.

Jeepers! In the last month this black cat has befriended us:

He belongs to our next-door neighbor, but he comes by almost every day. He was shy at first, but now comes running when we call, and rolls playfully on his back as we pet him, pawing at us with claws sheathed. We give him milk but often he's not very hungry. What he really wants is *fun and friendship*. He's made us happier.

My summer plans are gradually solidifying. From June 16th to 20th I'll go to a workshop on Categorical Groups in Barcelona, organized by Pilar Carrasco. This is part of a big year-long program on homotopy theory and higher categories. I'll also be in Barcelona from June 30th to July 5th to attend the main conference run by this program. In between, say from June 21st to 29th, I'll visit Pilar Carrasco in Granada.

I'll spend most of July and part of August in Paris talking to Paul-André Melliès about categories and computation, with

a small side-trip to Portugal. It should be lots of fun, especially since I'll see a bunch of folks I know at Algebraic Topological Methods in Computer Sciences from July 7th to 11th. I hope I can stay in the same apartment near the Jardin du Luxembourg! I should try to arrange that, posthaste.

I asked Carlo Rovelli if he'll be in Paris this summer. He said no — but he gave me an enticing summary of recent developments in loop quantum gravity:

> July and August is a rather unlikely period for me to be in Paris. But I would very much like to have the chance of talking with you, physics and else. Here is a telegraphic report of the latest spinfoam beautiful developments that you are missing and will one day regret:
>
> - First, we have found a modification of Barrett-Crane that matches exactly with loop quantum gravity in 4d, including the area spectrum, and including in the Lorentzian. It basically corrects an obvious "quantization mistake" in deriving Barrett-Crane. So, finally the covariant and canonical approach talk directly to one another.
> - Second, I believe the arguments are piling up pointing to the fact that the "many small chunks" intuition is *not* the right one for approximating processes near flat space: the large-spin limit is the right approximation. These arguments come from uncertainty relations, from cosmology, from the ADM energy operator, and else.
>
> End of the report.

If things work out as well as he says, especially regarding the all-important second point, I won't regret having stepped aside from this subject... but I may want to jump back in! It was hard quitting quantum gravity. I'm glad I did, so I'll never regret that. But, I won't feel the need to *stay* out if I get interested in it again.

March 21, 2008

Lisa and I took off for Singapore at 9 pm today, Friday...

March 23, 2008

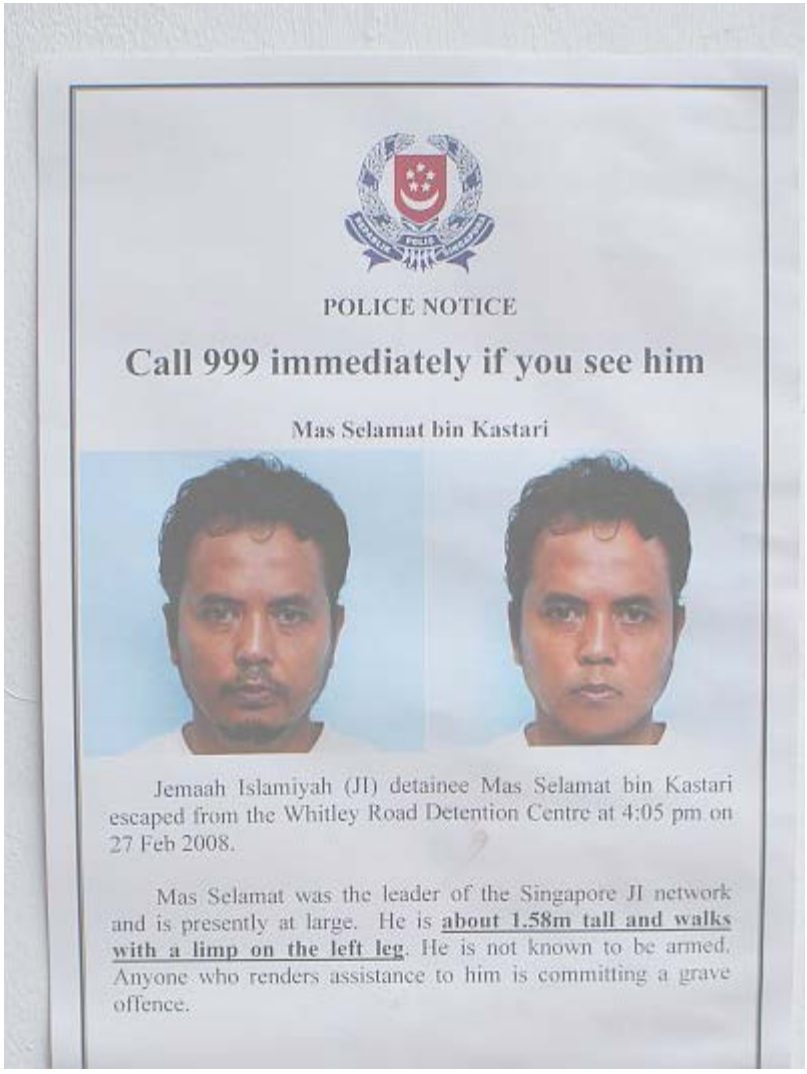
... and we arrived today, Sunday, at 6 am! A 17-hour flight, a late-night departure, and the International Date Line conspired to make us arrive two calendar days after we left.

The airport in Singapore was shiny and high-tech, a marked contrast to the dilapidated dirty old airport in Los Angeles. I got an EZ-Link card for the subway system — Lisa already had one. Like the Octopus card in Hong Kong, this lets you pay for the subway by just slapping your wallet or purse on a machine as you enter and leave — no need to take it out! You can also use it to buy all sorts of stuff. Furthermore, all cars in Singapore are equipped with an In-vehicle Unit on the lower right corner of the front windshield. This automatically bills you for driving in congested areas, parking in parking lots, and so on. Needless to say, the government can use all these transactions to track your movements. It doesn't bother me much; I just notice these things.

We took a train to the Park Hotel Orchard on Orchard Road, the main shopping street in Singapore. After a brief nap we explored Arab Street.

Masjid Sultan
(Sultan Mosque)
Muscat Street and North Bridge Road, Singapore

Throughout the train station and everywhere in the streets we saw posters for Mas Selamat bin Kastari, alleged leader of the Singapore branch of Jemaah Islamiah, who had been suspected of planning to bomb the airport, and detained without charges in 2006 under the Internal Security Act:



POLICE NOTICE

Call 999 immediately if you see him

Mas Selamat bin Kastari

Jemaah Islamiyah (JI) detainee Mas Selamat bin Kastari escaped from the Whitley Road Detention Centre at 4:05 pm on 27 Feb 2008.

Mas Selamat was the leader of the Singapore JI network and is presently at large. He is **about 1.58m tall and walks with a limp on the left leg**. He is not known to be armed. Anyone who renders assistance to him is committing a grave offence.

This February 27th, Mas Selamat escaped from a detention center while his family was visiting him. He was being led to a room to meet them when he asked to go to the toilet... and then he mysteriously *disappeared!*

Needless to say, this was a major loss of face for the Singapore government, which has mounted an energetic but so far utterly fruitless campaign to recapture him. He might be in Malaysia or Indonesia by now. I later heard a summary of rumors surrounding this incident, most notably: 1) it was an inside job and 2) he had been treated so badly during captivity that the government found it necessary to have him disappear. My informant said: "One thing is sure: *we'll never know*."

It's steamy and hot; beautiful tropical trees line the streets, some covered with epiphytes. Orchard Street is packed with high-end shopping malls, expensive boutiques and fancy hotels.

Lisa and I bought guidebooks at Kinokuniya, a wonderfully large bookstore — part of a chain I'd earlier enjoyed in Sydney. Lisa bought a general guide and I bought a guide to the local cuisine, which is incredibly diverse, including various forms of Chinese, Indian, Malay, Indonesian and Peranakan cuisine, also known as Nonya cuisine. The Perankans are descendants of Chinese who settled around the Strait of Malacca and intermarried with the local Malays.

Later this book came in handy: we had ayam buah keluak for dinner at a nearby Perankan restaurant, which however took a while to find. "Ayam" means chicken, and "buah keluak" means it's cooked with the very distinctive nuts of the kepayang tree, to make a rich brown sauce. Yum!

March 24, 2008

I gave a talk today — a joint math/physics talk on higher gauge theory at the National University of Singapore. Heavy rain in the afternoon. Apparently the rainy season is lasting longer than usual this year.

March 25, 2008

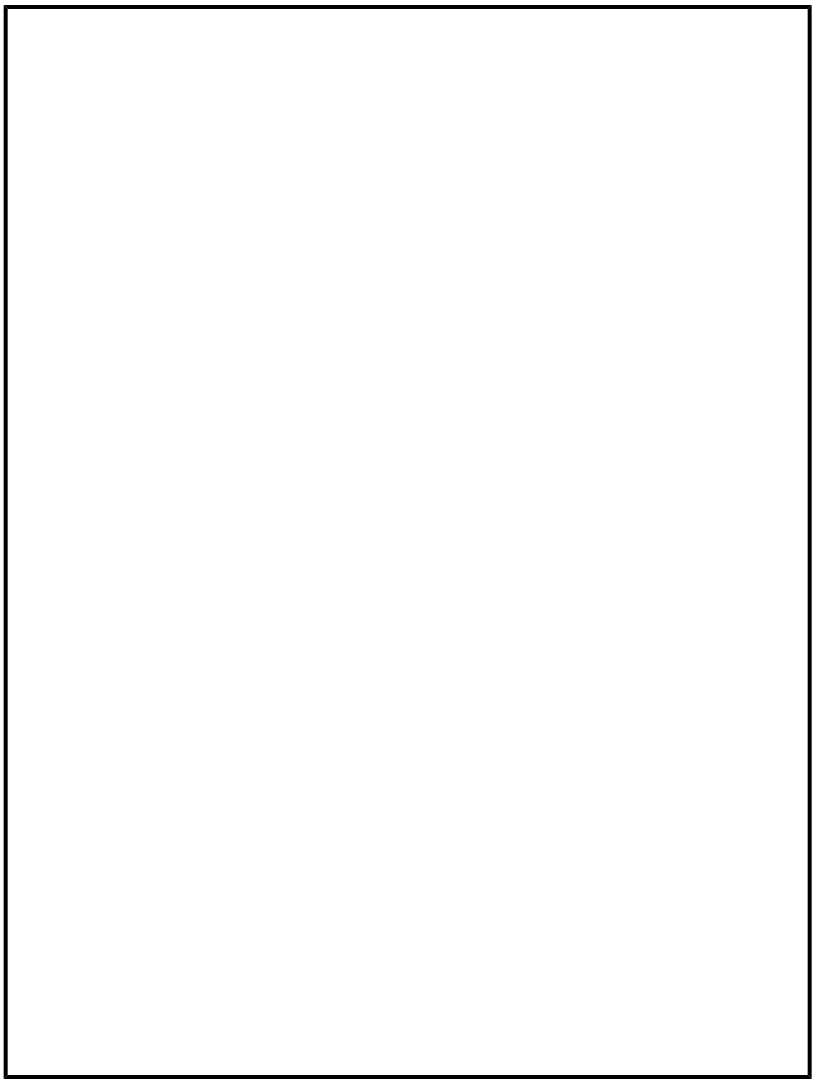
I got an introduction to the Nanoscience and Nanotechnology Initiative at NUS. It's got a lot of people involved all over campus doing lots of fascinating things, but it's headquartered in a lab in the basement of the physics department. They noted it was a very small office and I, perhaps tactlessly, joked that it was good they're doing nanotechnology.

They've got a 10 million dollar (Singapore dollar) grant to work on graphene semiconductors, which have the potential to run much faster than conventional silicon semiconductors. They're also trying to develop new materials for water filtration. Amazingly, despite the rainy climate, Singapore suffers from water shortages! This city-state is so densely packed that there's not enough room for reservoirs. So, they buy water from Malaysia, filter it, sell a bunch back and keep some for themselves.

Lisa gave a talk at the philosophy department of NUS today. Afterwards we went to dinner with some friends of hers. One asked how I liked Singapore. I said it was very easy to navigate compared to Hong Kong and (still more) Shanghai — most everyone speaks English, it's very clean and orderly, etcetera. He agreed and said some people call Singapore "Asia Lite".

March 26, 2008

Today Lisa and I mainly hiked around town today — we took the subway to Little India and poked around a bit:



Statue of Ganesha

Lots of small shops selling saris and other clothing, Indian CD and DVDs, groceries, incense, flower necklaces, and the like. Lisa bought a DVD of a couple of movies by the director of *Bombay*. The woman selling it was probably Tamil. We peeked into an Indian classical music store and saw a guy sitting on the floor repairing a harmonium. Lisa asked if the son of her pal David Kelly had taken tabla lessons there. Yes!

We had lunch in a hawker center: a large open floor at the bottom of a building, packed with booths selling diverse foods and drinks. Hawker centers were originally discouraged by the government of Singapore, being rather dirty places at the time, but then they came to their sense, regulated them, and cleaned them up a bit. They're practically the beating heart of Singapore cuisine — not fine dining, just great eating.

We had an order of satay for lunch, with appam for dessert: a kind of pancake made from fermented rice flour flavored with coconut milk. The fellow who sold it to us asked where we were from. I cautiously said "California", thinking this might deflect a little anti-American sentiment. He smiled, shook my hand, and said how he loved Americans, felt terrible about 9-11, and so on. He said Singapore was a great place. "Do you know the circus — with all the animals lined up, and the ringmaster in the middle?" According to him the different ethnicities in Singapore are kept under control by Lee Kuan Yew.

The shocking pink milk-rosewater drink called bandung was available, along with the complex dessert drink called chendol. However, I was feeling hot and tired, jet lag kicking in, so I had a Coke to chill myself and jolt myself awake with caffeine and sugar. What a waste of an opportunity! I never got around to trying either chendol or bandung, despite their omnipresence.

At 5 pm I had a meeting with Artur Ekert, head of the Centre for Quantum Technologies, which has been set up by the Singapore government as a "centre of excellence" loosely affiliated with NUS. He'd just gotten back from Oxford, where he spends three months a year. He was bursting with enthusiasm, the perfect guy to head a new institute like this. He knew I'd been hanging out at the Perimeter Institute, talking to quantum information people there, and working on n-categories.

I've summarized some of the technical aspects of our conversation in week262 of This Week's Finds, but we also talked a bit more broadly about the culture of Singapore. He said was that Singapore was a fascinating meeting of East and West: the Greek tradition of argumentation and the more hierarchical Confucian tradition of meritocracy. I think this is a lovely thought, much more appealing than mere "Asia Lite". He said he was fascinated by the time period around 400 BC, simultaneously the heyday of classical Greek and Chinese philosophy... he said if he could go back in time, it would be to that time. I cracked up and told him my wife Lisa works precisely on comparing classical Greek and Chinese philosophy from that time period.

March 27, 2008

Back from Singapore!

March 31, 2008

I talked to James Dolan about modular forms and his (possibly crazy, possibly great) idea that the modularity theorem is deeply analogous to quadratic reciprocity. Actually this analogy can be found in the introduction to Diamond and Shurman's *A First Course in Modular Forms*, but Jim is taking it more seriously and trying to develop it it further, and I'm trying to help out.

For those of you who don't know about this stuff, the modularity theorem is the big, hard, conceptually beautiful result that has Fermat's Last Theorem as a minor corollary. Before it was proved it was called the Taniyama-Shimura-Weil conjecture. Andrew Wiles proved just enough of it to get Fermat's Last Theorem. Other people polished it off.

Jim also pointed out an amazing video of an elephant painting. You've *got* to watch it!

At night, I hear owl hooting, over and over, for the first time in a long while.

For my April 2008 diary, go here.

I rejoice that there are owls. Let them do the idiotic and maniacal hooting for men. It is a sound admirably suited to swamps and twilight woods which no day illustrates, suggesting a vast and underdeveloped nature which men have not recognized. They represent the stark twilight and unsatisfied thoughts which all have. - Henry David Thoreau

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home

[For my March 2008 diary, go here.]

Diary - April 2008

John Baez

April 1, 2008

This is an aerial photograph of Owens Lake by David Maisel, part of this travelling exhibit:

- Imaging a Shattering Earth: Contemporary Photography and the Environmental Debate.

Quoting from the online catalog:

> Owens (Dry) Lake in California is a beautiful place to be. The red dust swirling all around gives off a rich, vibrant sheen of color as the wind kicks up the dust. What one doesn't realize when one sees this dust is that

it is highly toxic. Yet this wasn't always the case.

In the past, Owens Lake would overflow frequently to the south. It had done so like clockwork for about 800,000 years. During the late 1800s and early 1900s, the lake varied in depth between five and seven meters, depending on the day's conditions. However, as American settlement of the West increased, water began being diverted from the lake. Beginning in 1913, Owens Lake was diverted to Los Angeles for irrigation purposes, and by 1926 the lake was dry.

Nothing remained of the lake but brine and hardy organisms that were able to survive in such saline conditions. As a result, all of the groundwater and land became contaminated. In order to regulate somewhat this contamination, the EPA has set a maximum contamination level of 0.005 milligrams per liter of water. Regardless, the contamination levels have climbed to 23 times greater than the federal health standard allows.

The contaminated soils contain high amounts of PCE, or tetrachloroethylene. This chemical was found at the site in 1995. It is regularly used as a solvent in cleaning operations. Exposure to PCE can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Other side effects of this chemical are liver problems and increased risk of cancer.

To combat the problem, the Environmental Protection Agency has declared the region unfit for habitation and began reclamation efforts. The land is being tested regularly and scientists believe that the land will again be livable in as little as 70 years.

Everywhere I've ever been, natural landscapes make me feel happy — even the most desolate deserts. Humans have a unique ability to create environments I find depressing. Some are melancholy, unloved, like a dimly lit highway overpass at night covered with graffiti, or this building I saw this month in Shanghai:

Others are almost magnificent in their devastation — ruined on a vastly extravagant scale, like Lake Owen.

More and more I've come to believe people create around them external landscapes that match the internal landscape of their soul. Perhaps because I do more gardening these days, I look at people's yards as I walk to work, and I read — or imagine reading — their personalities from their gardening. Some people don't give a damn. Some actually go out the way to make their yard ugly, filling it with trash. Others are a bit prim, going for rigid hedgerows. Some are well-balanced and happy, in a wide variety of different way.

April 2, 2008

Maya Lin, the artist who created the haunting memorial for Vietnam veterans in Washington DC, is now tackling something even bigger.

> **Maya Lin's earthly concerns**
>
> April 1, 2008
> Anne-Marie O'Connor, LA Times
>
> San Diego - Maya Lin has always had a deep feeling for the land. As a child, she roamed the leafy woods of the Appalachian foothills in southern Ohio, listening to the mating calls of the songbirds that filled the forest. Now Lin perceives a growing stillness, as the number of songbirds across America are decimated by habitat destruction. The growing degradation of the natural world haunts Lin — celebrated as the creator of the Vietnam Veterans Memorial and the reinventor of the American memorial genre —as she pulls together the plans for what she says will be her "last memorial."
>
> The title of this work-in-progress, like many of the details, is evolving: Perhaps "What is Missing," perhaps simply "Missing." But the theme is clear: Lin's finale will grieve for the animals, birds and plants driven into extinction — and warn of the urgency of acting now to halt the devastation.
>
> Lin envisions it as a multisite chronicle, including photography and video, at places around the world and with a commemorative list of names — this time the names of extinct species. It is to be launched with a memorial table on Earth Day in April 2009 commissioned by the California Academy of Sciences in San Francisco, which chose her design to include inits new building in Golden Gate Park, an academy spokeswoman said.
>
> "Do the math, guys. Where do we want to be in 50 years? That's the question," she said at the Museum of Contemporary Art San Diego as she installed her latest exhibit in a cathedral-like gallery lighted by the afternoon sun.

There's more in the article. What it shows of the memorial leaves me underwhelmed, but the *idea* is good.

I think it would be better to make replicas of 100,000,000 stuffed passenger pigeons. Lovingly mounted on individual stands in a 10,000 × 10,000 square grid, they'd make a good reminder of what we've killed so far:

Except we actually killed *between 10 and 50 times as many*.

From the Chipper Woods Bird Observatory site:

> Their flocks, a mile wide and up to 300 miles long, were so dense that they darkened the sky for hours and days as the flock passed overhead. Population estimates from the 19th century ranged from 1 billion to close to 4 billion individuals. Total populations may have reached 5 billion individuals and comprised up to 40% of the total number of birds in North America (Schorger 1995). This may be the only species for which the exact time of extinction is known.

Namely: 1:00 pm on September 1, 1914.

April 3, 2008

The battle rages on:

In the UK, the mayor of London is imposing a heavy fee on gas-guzzling vehicles in the city center, but a German car company is suing. In the US, the Environmental Prevention Agency is dragging its heels on reducing CO_2 emissions, but 18 states are suing.

April 4, 2008

On Monday evening, Lisa and I are going to Shanghai. Burning carbon, adding to the problem... I'm going to buy carbon offsets after doing some more research on what are the best ways to do this:

- EcoBusinessLinks, Price study of offsetting emissions of carbon.

Prices for offsetting a metric ton of carbon dioxide seem to range from $4 to $99 (where the lowest price only applies when you buy 25 tons). Flying 3200 kilometers (2000 miles) in an airplane creates about one ton of CO_2. So, I can offset my CO_2 emissions quite affordably if I make sure I'm really doing something useful, not getting scammed.

I'm almost done reading this SF novel:

- Kim Stanley Robinson, *Sixty Days and Counting*, Bantam, 2007. See reviews by Greg L. Johnson and Rick Kleffel.

This is the third and best of a trilogy which envisions a near future in which the chickens seriously come to roost: global warming leading to global environmental collapse, and our last-ditch efforts of stave it off. It's suspensful. What's really special about it, though, is the day-to-day lives of the characters and their thoughtful reflections, which ground the whole thing and make it real.

There's a lot about China, which makes me think of where I'll be going in 3 days. And there's a lot about California, which makes me think of life here. A long hike in the Sierras:

> The stars were popping out overhead, swiftly surpassing in number and brilliance any starscapes they ever saw at home. The Milky Way was like a moraine of stars. Sound of distant water clucking through the a patch of meadow, the wind in the pines; black spiky horizons all around, the smooth airy gap of the pass behind. It was a blessing to feel so tired in such a place. They had made the effort it took to regather, and here they were again, in a place so sublime no one could truly remember what it was like when they were away, so that every return had a sense of surprise, as if re-entering a miracle. Every time it felt this way. It was the California that could never be taken away.

Except it could.

Charlie had, of course, read about the ongoing drought that had afflicted the Sierra for the last few years, and he was also familiar with the climate models which suggested that the Sierra would be one of those places most affected by the global rise in temperature. California's wetmonths had been November through April, with the rest of the year as dry as any desert. A classic Mediterranean climate. Even during the Hyperniño this pattern had tended to endure, although in El Niño conditions more rain fell in the southern half of the state and less in the northern half, with the Sierras therefore getting a bit of both. In the past, however, whatever the amount of precipitation, it has fallen on the Sierra in the form of snow; this had created a thick winter snowpack, which then took most of the summers to melt. That meant that the reservoirs in the foothills got fed a stream of melting snow at a rate that could then be dispersed out to the cities and farms. In effect the Sierra snowpack itself had been the ultimate reservoir, far bigger than what the artificial ones behind dams in the foothills could hold.

Now, however, with global temperatures higher, more of the winter precipitation came down as rain, and thus ran off immediately. The annual reservoir of snow was smaller, even in good years and in droughts it hardly formed at all.

California was in an uproar about this. New dams were being built, including the Auburn dam, located right on an earthquake fault; and the movement to remove the Hetch Hetchy dam had been defeated, despite the fact that the next reservoir down the Tuolomne had the capacity to hold all Hetch Hetchy's water. State officials were also begging to Oregon and Washington to allow a pipeline to be built to convey water south from the Columbia River. The Columbia dumped a huge amount of water into the Pacific, one hundred times the maximum flow of the Colorado River, and all of it *unused*. It was immoral, some said. But naturally the citizens of Oregon and Washington had refused to agree to the pipeline, happy at a chance to stick it to California. Only the possibility that many Californians would then move north, bringing their obese equities with them, was causing any of them to reconsider their stance. But of course clear cost-benefit analysis was not the national strong suit, so on the battle would go for the forseeable future.

In any case, no matter what political and hydrological adjustments were made in the lowlands, the high Sierra meadows were dying.

This was a shock to witness. It had changed in the three years since Charlie had last been up. He hiked down the trail on their second morning with a sinking feeling in his stomach, able to cinch the waistbelt of his pack tighter and tighter.

They were walking down the side of a big glacial gorge to the John Muir Trail. When they reached it, they headed north on it for a short distance, going genly uphill as the trail followed the south fork of the Kings River up toward Upper Basin and Mather Pass. As they hiked, it beame obvious that the high basin meadows were much too dry for early August. They were desiccated. Ponds were often pans of cracked dirt. Grass was brown. Plants were dead: trees, bushes, ground cover, grasses. Even mosses. There were no marmots to be seen, and few birds. Only the lichen seemed okay — although as Vince pointed out, it was hard to tell. "If lichen dies does it lose its color?" No one knew.

I'm pleased to report that *this* spring it rained enough for a profusion of flowers in the granite hills above our house. But, this scenario reminds me very much of last year.

Anyway, as you can see, this novel is slow and meditative at times. I like that. But, it builds to quite a climax. If you read it, I suggest reading *Forty Signs of Rain* and *Fifty Degrees Below* first, so you know the characters and understand their situation — it's all one big novel. But this last part is the best.

April 13, 2008

Not much on my diary the last few days — as usual, the more that's going on, the less shows up here!

Lisa and I showed up in Shanghai on Wednesday the 9th, and on Thursday she gave her first lecture. She's giving 8 lectures on classical Chinese and Greek culture at the University of Fudan: two on Homer, two on strategy, two on medicine and two on divination. She has a nice office with her Chinese name in big letters on the door:

Actually her Chinese name is Rue Li, but apparently they preferred Li Sa.

I'll visit the CAS-MPG Partner Institute for Computational Biology, but so far I've just been working on my own. She'll stay for over a month; I'll just stay until the 26th.

We're residing in the Fudan University Dong Yuan Expert Building — academics from other countries are traditionally called "foreign experts" here. We stayed here for a few days in the summer of 2006 before moving into an ordinary apartment.

At first being here was a bit dreamlike, thanks to daze of jet lag and the strange sensation of returning to this Shanghai neighborhood, originally so strange to me in every respect, now familiar, yet half-forgotten. The fact that we're now living in a different place, and most of the streets have names beginning with Guo or Zheng, adds to this sensation: in the old days I turned off Guoquan Ho Lu and walked down Zhengsu to the market, but now I turn off Guofu Lu and walk down Zhengxiu — or something like that. Plus, every morning there's a wild storm of bird songs, since old men gather on our street with their caged songbirds:

It's cool and cloudy now instead of miserably hot and humid. It's a real blessing to be able to walk down the street and not be dripping in sweat after one block.

Our place was sadly lacking in kitchen supplies, so that was the first order of business. Luckily Lisa has some very good friends from earlier visits living right next door! So, we could borrow some cups and plates and recover the trusty rice cooker from our previous visit. We picked up some basics at local shops: soap, rice, soy sauce. We bought some bok

choy and ginger on the street. Country women sitting in a row on the sidewalk selling vegetables. How do they survive?

We took a bus downtown for other sundries. Things change fast here. Stores we once knew are already gone; new stores take their place. They're building a new subway line to the university, so the mess of construction is even worse than before. The old city downtown continues its radical transformation, slums dating back to the Ming being torn down and replaced *en masse* by fancy apartment buildings, the original inhabitants given a bit of money and kicked out.

We bought some wooden bowls, a knife, and a teapot from a restaurant supply store on Renmin Road. Lisa had her favorite tailor start making her a bathrobe; we'll pick it up next week.

Then we took a long hike to the nearest subway station. China is rising, building itself up: everyone in Shanghai is busy making things, selling things.

But hiking through traffic along Huaihai Road, I got tired. The traffic etiquette in Chinese cities is strictly Darwinian. Cars dodge trucks, motor scooters dodge cars and trucks, bicycles dodge motor scooters, cars and trucks, and pedestrians like me have to dodge everything. Well, there are some rules: cars and strucks stop for stop lights, nobody else does.

Huaihai Road was all torn up with construction, like so much of the city. I became quite depressed, thinking of all these people slaving away in such ugliness, cogs in a machine they can't control, struggling to survive while enriching the already rich and powerful.

And I wondered: who among us is free to do what we really want: what we've decided is best after considered

judgement? Not necessarily the "titans of industry" who seem to profit from all our labor. Not necessarily the politicians, bound by the rigid rules of power. Maybe me. Maybe Lisa's tailor, an artist at his trade. Did he *always want* to be a tailor, or was he thrust into this job and have to make the best of it? I couldn't ask him. I bet it's largely a matter of attitude: another person in the same job could see it as a tiring chore, but he brings a sense of style to his work, he makes it an art, so he enjoys it — and makes everyone around enjoy it, too.

Yesterday we looked for our favorite CD and DVD store: *Artbook Rockmusic Artmovie*.

When we discovered it in 2006 it was a small place, with a tiny cramped back room full of arcane movies: Bunuel's *L'Age D'Or*, Orson Welles' *Mr. Arkadin*. When Lisa visited last fall it had moved to a slightly larger place a bit down the street. This time we couldn't find it. We wandered all over: a guy in a guitar store said it had moved around the corner to Handan Road, so we walked down there. Lots of small shops selling women's clothing, a place called *Strangers Bar*, but no *Artbook Rockmusic Artmovie*. Finally Lisa asked for help at a camping goods store. She had a card with the phone number of the place, and one of the staff phoned the place, found out where it was, and walked us down the street, aiming us in the right direction. Back to the original street... hey, just where we were looking before! The reason we didn't find it: now it has an even hipper name: "2046".

In case you're interested, it's on 300-8 Guoding Road.

I bought three CDs for a total of 75 yuan: Suzanne Vega's *Beauty and Crime*, Future Sound of London's *Teachings from the Electronic Brain*, and Rabih Abou-Khalil's *Songs for Sad Women*. The exchange rate is 7 yuan to the dollar, so experiments like these are affordable.

Today was perhaps our first "typical" day. We got up at 6 am and Lisa went to do taiji. Despite the lure of a warm bed I tagged along, thinking to get a little exercise. We walked past the old men with their bird cages, past the wet market and the xiaolong bao shop, which still thankfully survives, down another street, past a little stand that was selling ma chou — yum, sesame balls! — and over to the university gymnasium. I walked briskly around the track while Lisa waited for her taiji group to show up. They were late: Master Ma has a new grandchild, so he doesn't show up every day, and discipline seems to slacken a bit when he's not around.

It was fun walking around the track, thinking about local cartesian closedness for categories of concrete sheaves, watching the crowd of mostly older men and women jogging or walking around, some walking backwards, some doing a bit of qi gong, with occasional people on the sidelines doing pushups, skipping rope, and the like. Lisa's taiji group

showed up, and so did some other groups, including an impressive one dressed all in black doing the Chen style. The morning is a nice time here: the air is fresh, and people like to exercise in public spaces, and talk with their friends.

Afterwards, walking back, we bought two sesame balls for 0.7 yuan — just a dime! Then we picked up some dou jiang and jian bing to take home for breakfast. Dou jiang is a very popular soy milk drink, often served warm — people also like a bowl of it with a "you tiao" crumbled in — that's a fried dough stick. Jian bing is a marvelous kind of crepes-like breakfast dish from northern China that people make on a big flat hotplates, usually on the side of the road. It's pretty complicated, but they make it really quick — I explained how in my July 7, 2006 diary entry. Alas, the place where we bought it today doesn't include peanuts. We'll try a different place next time.

Then breakfast at home, watching the English version of Chinese TV news. They say the Dalai clique is inciting violence, making up lies about 40 Tibetans being killed in the March riots — and to add insult to injury, Westerners are siding with them, ignoring all the deaths caused by rioters and looters, and using the business as an excuse to ruin the Olympics!

(At home we get very different — and I hope more accurate — news. But it's worth imagining what would happen if, back in 1893, Europe had threatened to boycott the Chicago World's Fair unless the US returned several western states to the indigenous peoples whom we had slaughtered and confined to reservations. No way! We'd have been outraged!)

Then writing this diary.

April 15, 2008

My gloomy reflections above may not be shared by the Shanghainese themselves, or at least not most. Like Americans from the late 1800s until a few decades ago, they have a can-do, optimistic spirit! At least that's what this person thinks:

- Anne-Marie Slaughter, Expatriate in Shanghai inspired by Asian optimism, *All Things Considered*, National Public Radio, April 14, 2008.

I think she's probably right: where I see a city torn apart by construction and people working their butts off, they see an economic boom lasting several decades that's lifted millions from poverty to a standard of living they could never have imagined!

It's interesting that Slaughter says America has lost this spirit of optimism. I think that's true too, but I don't think most Americans are quite ready to admit it yet. For example, consider the recent uproar when Barack Obama was caught saying that many small-town Americans have become "bitter" and turned for refuge to "God and guns".

Today was my third "typical day" in Shanghai — except today I didn't go to the track: it was raining. Lisa still did taiji, somewhere sheltered from the rain. But, not the sword form; nobody wants a rusty sword. She found a stand that does jian bing with peanuts, and brought some back for breakfast!

I've been working hard with my student Alex Hoffnung on a paper called Smooth Spaces: Convenient Categories for Differential Geometry. We're fine-tuning it, it's starting to hum — it's at this stage in writing a paper that I can write all day, touching up this detail and that, improving the wording, reorganizing proofs, feeling energized and happy.

But now I need to switch gears and put some time into another paper, Representations of 2-Groups on Higher Hilbert Spaces. Some of my coauthors are getting antsy; they want it done now. Sounds good to me! I'm eager to dig out of the pile of half-written papers I've buried myself under. But this paper is at a less happy stage of its embryonic development: in some sense it's close to done, but we still need to fight our way through some technical issues involving measure theory. We're not enjoying it now; we just need to do it. It takes me a bit of time to build up momentum for struggles like this.

Still, it'll be good to to help bring categorification into the heartlands of analysis.

Trent Reznor has some cool instrumental stuff on his new album, *Ghosts I - IV*:

- Tom Moon, Nine Inch Nails: "ghosts" of songs, *All Things Considered*, National Public Radio, April 14, 2008.

April 16, 2008

We took the 139 bus from Fudan University to Lu Xun Park, a nice big park not too far from here. The cherry trees and plum trees were blooming, so, having read plenty of Chinese and Japanese literature, I finally got to see what all the fuss is about. Here's a photo Lisa took:

Seeing this makes me want to learn xiangqi, also known as Chinese chess.

Then we visited Lu Xun's house. Lu Xun is the most famous Chinese writer of the 20th century. If you're like me, you've never heard of him, or maybe know him as the author of *Diary of a Madman*.

His house was a townhouse in a cute little alley. We went up to the window of the house nearby to buy a ticket from a woman sitting at a desk. A tall man in civilian clothes and some sort of military officer came out the door, and the former asked us: "Meiguo ren? American?" Fighting back panic, I said "Yes". Then they took us on a guided tour.

His home, three stories, was suprisingly opulent — but as a popular writer in his day, he was quite well-off. His books were still there, and Lisa spent a lot of time looking at them.

April 17, 2008

Yesterday we had dinner after 9 pm, so we did takeout at one of the that stays open late on the pedestrian street near Fudan University (one of our main hangouts, lined with restaurants). It's a Szechuan place, so we had spicy lamb, eggplant with peppers (but sweet, a concession to Shanghai taste), frog, and rice. Yes, frog!

But, we didn't order the *dog*. This was actually the first time I'd seen dog on a menu, so I started pondering whether I would ever eat it, why wasn't I vegetarian, how much something had to be like me before I'd refused to make a meal of it, etcetera. Lisa abruptly cut short these increasingly abstruse reflections by saying that in any case dog was probably out of season. I was surprised that dogs became edible only in a certain *season*, but Lisa explained that old folks like to eat dog in the winter, since it's supposed to strengthen their yang.

We also had roast frog with pepper as part of a late lunch today at the snack shop on Siping Road. It's good! I don't like how amphibians are going extinct, but I bet these frogs must be farmed.

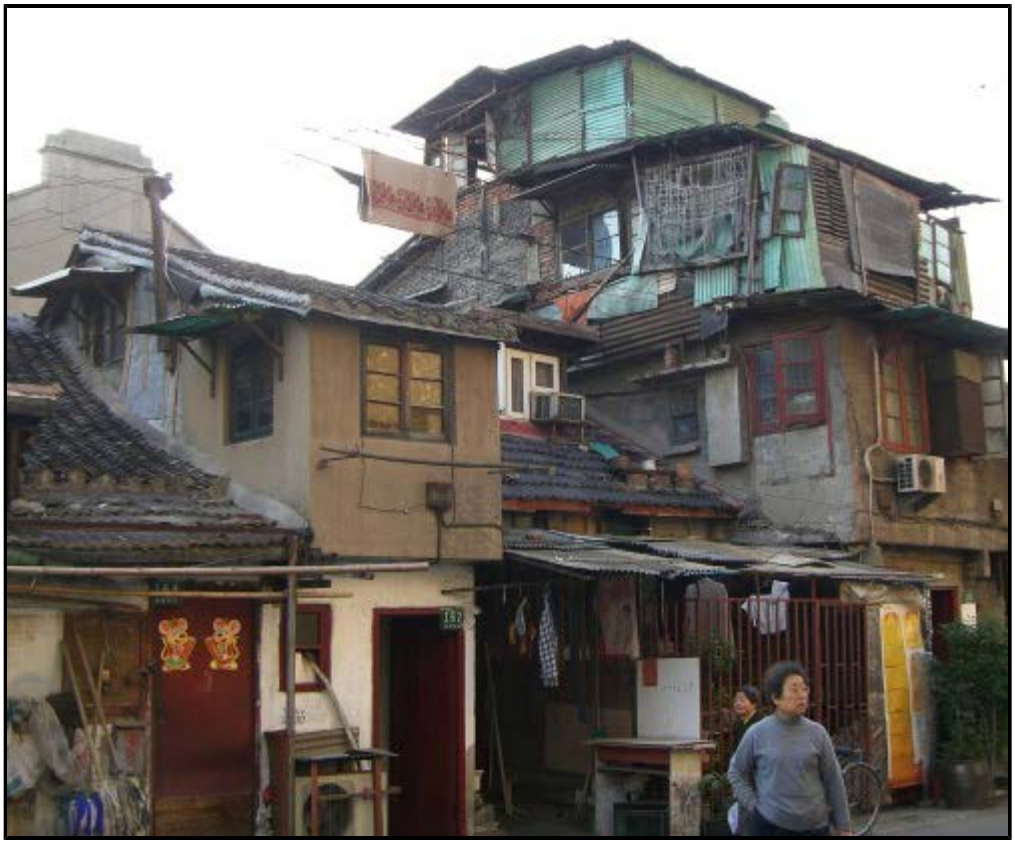
April 18, 2008

Lisa and I went downtown to pick up the bathrobe made by her tailor — I took a picture of this and stuck it back near the end of my April 13th entry. Then we explored the old city. It was a great day, invigoratingly cool — and sunny, for the first time since I've been here. A perfect spring day. So, I took a lot of photos.

Walking down Sipailou Road in the old city, you get a sense of the bustling vitality of a traditional urban Chinese market — a thousand people doing a thousand things, a thousand things to buy, not constrained by zoning laws, not yet flattened into blandness by big corporations. All these photos were taken in a single 20-meter stretch:


皇中皇大饼
乡村小吃 都市名点
3元/个

Of course, one downside is that lots of people are living right behind these storefronts, in conditions that most Americans (at least) would find pitifully squalid. See that ramshackle house in the back of the above picture? Here's a picture of the other side, taken by Lisa — I bet a lot of people live here:



Here's a picture of a shoemaker on Sipailou Road, also taken by Lisa:

April 20, 2008

We went down to the French Quarter today. We had tea in Fuxing Park, a popular location for families and old folks:

If you see a bunch of guys doing this in China:

you can bet someone's playing cards.

Guys also gather to watch guys playing Chinese chess:

And these people are not sneaking tippy-toe across the park; they're doing taiji, strangely late in the day, around 3 pm:

Then we visited Sun-Yat Sen's house nearby at 7 Xiangshan Road, and the museum they've built there. I found it moving, both for the hopes that Sun Yat-Sen had, and for how they went awry (as usual with revolutions).

As the father (in some sense) of both the Kuomintang and the Chinese Communist Party, Sun Yat-Sen is revered both in Taiwan and the People's Republic of China. Born in 1866, he was trained as a physician — like Lu Xun. In 1894 he wrote a long letter to the governor-general of the province of Zhili, who was a reformer, but he was rebuffed... and thenceforth he became a revolutionary.

While ceaselessly planning and raising funds for his revolutionary activities, often in exile, he also read and wrote

voraciously. The museum displayed copies of books by Russell and Schopenhauer that he had reviewed, as well as a book on nutrition. Also the books he wrote. Later: the French curves he used to plan railroad lines, the edict where he introduced the use of the solar calendar, and a pigtail or "queue" shorn from someone's head as a result his order banning this hairstyle, which had been imposed in 1644 by the Manchus. Busy guy!

But, as usual with revolutions, all his idealism was caught in the undertow real-world politics and subverted. He reached his height of power in 1912, as the first provisional President of the Republic of China. He allied himself with military leader Yuan Shikai, who helped the Kuomintang force out the Empress Dowager Longyu, and then became Provisional President himself, but then cracked down on the KMT. Sun Yat-Sen led a revolt against Yuan Shikai, which failed, so he fled to Japan. Yuan Shikai named himself emperor; a complicated set of fights involving local warlords then ensued. Sun Yat-Sen returned to southern China in 1921 and was elected president and generalissimo. He allied himself with the communists in the attempt to retake the north... but died of liver cancer in 1925.

It makes me want to read more about this period of Chinese history: the late Qing dynasty, its fall, and the revolutions and warfare that followed.

April 24, 2008

It's Wednesday, and I'm leaving on Saturday. Soon, all too soon! I'll miss this place.

Following Lisa's example, on Monday I bought an MP3 player at a local electronics store. Not an Ipod — a Teclast TL-C260. It supposedly has 2 gigabytes of memory, and it's nice and cheap: 330 yuan, or about $47. Right now I'm trying to get it to work, so far without success. A near-featureless flat interface and a manual in Chinese make this a bit tricky — sort of like an alien artifact in a science fiction story. But Lisa got hers to work (an earlier, less cryptic model) and loves it. And, the salespeople in that store are actually quite reliable — though I naturally lean towards skepticism, if I can't get it to work soon, I bet they'll show me how (or admit it's busted and give me a new one).

Looking for a manual in English on the web, it seemed the only way to get one was to join a forum called MP4 Users; the company is Chinese so I think it was these enthusiasts who translated the manual. And while looking around, I found a bit about Chinese MP4 players...

Yes: I said I bought an MP3 player, but I did that just to sound comprehensible to Americans. Here in China MP4 players, which also play videos, are all the rage — and that's what I got. Wikipedia has an amusingly derogatory article on them. It begins:

> MP4 players are portable media players developed in the People's Republic of China and surrounding regions which support the MPEG-4 video format.
>
> A majority of these players are actually incompatible with the format, and are limited to low-grade proprietary formats[1] that are considered to be cheaper alternatives for these players.

It then describes some of these formats, for example AMV:

> The image compression algorithm of this format [4] inadequate by modern standards (about 4 pixels per byte, compared with over 10 pixels per byte for MPEG-22 / DVD video), with a typical resolution of 128 × 96 pixels and a framerate of 12 fps. A 30-minute video will be compressed into just 80 MB with a very lossy bitrate.[5]

You don't need to know what all this means to pick up on the scornful tone. More relevant to my own problem is the section on instruction manuals:

> Manuals that are bundled with these players are considered to be inconsistent and are generally difficult for users to comprehend due to its poor translation.[6] Manuals may also refer to features that the particular player model may not possess. And due to the nature of the product, there is usually no contact or website

information.

Wikipedia is now urging that articles include authoritative sources, so you can click on the footnote and read Amazon reviews of a "1GB Pastel Pink Mp4-Mp3 Player" that say things like:

> I bought this MP3/4 player for my little sister for Christmas, and so far I am very pleased. The sound quality is great and visually it is very attractive, however it is a lot smaller than what I expected. Consequently the pictures when viewed are quite small and blurred. I am having trouble reading the instructions which have been changed directly from Chinese and make no sense!! Consequently I haven't been able to make use of all the player's features and I still cannot change and store videos on the player. Despite this, it is a great little player & great value for money!! I am very happy!!

The point is: these Chinese MP4 players are so cheap you *don't care* that they're not perfect and you can't read the instructions — or at least you shouldn't. Another reviewer writes: "I purchased this not knowing its size. It's tiny, the size of a matchbox." That reminds me of an incredibly small one I saw in the store here, about the size of my thumbtip. Maybe that was just an MP3 player, but still: how do you work something so small?

But the really informative website on these machines is this:

- Dr. Elwyin Jenkins, A Guide to the Southern Chinese MP4 Players, eBay.com.au.

I'm going to quote a lot of this, since it conveys quite movingly the incredible drive and can-do attitude of the hundreds of little Chinese companies who throw together technology like something out of William Gibson novel:

> ## How Apple Shaped the Southern Chinese Industry
>
> Long before Apple launched its iPod range of players, the Southern Chinese electronics industry was already buzzing with activity in building personal instruments that could play CDs, could records from FM radio stations and replay as many times as you want music from that source, and in building for western countries small players that could house a range of .mp3 format tunes. It was in 1998 that Eiger Labs in Europe created the first "non-mechanical" .mp3 player that could continue playing regardless of the external shock caused to the player. Interestingly, Apple Computer's iPod range started not from this "non-mechanical" concept but rather from the concept of housing a mini-disk drive.
>
> It was the popularity of the non-mechanical machines that began a stream of new products from around the world made by Eiger Labs, HanGo Electronics (Southern China), EmpegCar, and many others. Just about every manufacturer of consumer electronics had a version. Then came Apple iPod that from 2001 and onward manufactured a number of versions of its popular player all with its signature round sensor keypad. The important thing to note here is that while Apple is a worldwide company with its base strongly in the USA, Apple subcontracted the manufacture of its iPod range to a number of manufacturers all of whom were based or who had their primary base in Southern China.
>
> Basically because of the large numbers of iPods Apple was now selling, Apple controlled the price of "flash memory" the solid state memory used in the most popular iPods, and also now the most popular non-iPod machines that were made by a number of manufacturers to meet Apple on the non-mechanical turf. Apple also controlled a large portion of the Southern Chinese manufacturers due to the Apple Accessories it was producing and having produced by manufacturers under license.
>
> Hundreds of manufacturers in Southern China wanted to have a slice of the "Apple-pie" and were preparing themselves to compete for licenses in producing Apple iPods or accessories. Most manufacturers were not accepted for one reason or another. Having gained skills in manufacture to build iPod type machines, it was these manufacturers who began flooding the worldwide marketplace with a range of iPod look alikes, as well as many other designs of .mp3 players.

The MP4 Advantage

The bulk of manufacturers in Southern China having lost out in making iPods for Apple turned their expertise elsewhere — making Apple iPod look alikes. Chinese people have a very different view on art, the expression of art, and the way in which items are made, authored, or invented. If a very talented person painted the Mona Lisa, then it is the duty of an artist who comes after that famous painting and painter to perfect that art, or to change that piece of art with a new rendition. So it was with the arrival of the iPod. If there was an iPod there should be a way for me, as a manufacturer, to build a better iPod, an iPod with a different screen that would be useful to some other types of people using iPods.

However, a number of manufacturers saw that they could build a competitive advantage over an iPod. Apple iPod's at the time in 2001, only played MP3 music format. The Southern Chinese factories saw a competitive advantage that they could bring to the marketplace — manufacture an MP4 Player — which in their interpretation of file formats is the populist format for video and video-like format that encases the details necessary to reproduce a video picture along with music.

There are about 350 factories, assembly plants and marketing offices housed in the sprawling metropolis of Shenzhen. Some of them have good research and development facilities whilst others have purely a marketing interface to the world or have an assembly plant. Typically since 1998, any new producers/sellers of "iPod" look alikes, and MP4 players, buy a wholesale pack of gear necessary to build a "common mould" product; that is, a mould that is also sold to many other manufacturers. A new producer takes this common mould product and what is basically an inventory of parts needed to assemble a product that looks like any other producer's product. However, to be true to the Chinese manufacturing ethos, the new producer needs to do something quite different to the common mould product that improves the look, operation or whatever of the product. Therefore we have in the marketplace today, hundreds of MP4 machines that look very much the same, but have some distinctive change technically or otherwise.

The author goes on to describe various southern Chinese MP4 players and their features, emphasizing: "*there is no such thing as a perfect Mp4 player*. Every machine is lacking something, missing a promised capability, or in need of altering the way something works."

The reference to 350 factories, assembly plants and marketing offices in Shenzhen reminds me of my visit to Shenzhen in August 2005. It's quite a city. Not a tourist destination, except for shoppers from Hong Kong trying to save money. But, it could be the city of the future.

The future is already here – it's just not evenly distributed.
- William Gibson

April 25, 2008

My last full day here — my flight leaves tomorrow at 7:30 pm. I'll miss Shanghai, and miss Lisa too.

Lisa got up at 6:20 am to do her taiji with Lao Ma and the rest of the gang. The others leave around 7:45 but he stays longer to teach her extra stuff, and today he started teaching her the 42 — the only Yang style sword form she he hasn't learned yet. She'd been hoping for this, but not expecting it, since Ma is getting old and busy with grandchildren. Different forms are named after the number of movements; here's a video of the 42:

- 42 Tai Chi Sword Form.

Being a lazy bum, I woke up around 7:30 and went out to meet her. It's was a perfect sunny but crisp spring morning. The bird fanciers were out in force, and I wished I'd brought my camera.

We came back and en route we got jian bing for breakfast as usual; being almost my last day I thought I'd try something different for a change, so I had mine with a cruller inside instead of the usual crunchy cracker. Bad move! The crunch

turns out to be a key aspect of the jian bing's charm.

We also picked up a kind of scallion cake cooked in a tandoori-like oven at the usual sesame ball place, on the same "now or never" principle — and these turned out to be okay, though Lisa liked them more than I did.

Later we took a walk and I picked up Chinese editions of Griffiths and Harris' *Principles of Algebraic Geometry* and Marsden and Ratiu's *Introduction to Mechanics and Symmetry* for 78 and 72 yuan, respectively, at a book store near Fudan University. They have a lot of math and physics books! I've been trying to learn some algebraic geometry lately, so it'll be fun to tackle Griffiths and Harris again. When I tried it back in grad school I didn't get much past the basics of sheaves, deRham and Doubeault cohomology, and Hodge theory, but now the stuff on curves and abelian varieties looks mouth-watering.

Yesterday we took my Teclast MP4 player back to the store; it just didn't work at all! They replaced it with a good one, and took the trouble to switch the language from Chinese to English — *excuse me, that's not English, it's Russian!* — okay, English. And today Lisa and I figured out how to download some MP3s into, starting with what she had available: Dylan's *Desire*, Satie's *Gymnopedie*, Dao Lang's *2002 Nian De Di Yi Chang Xue* and Yo-Yo Ma's *Classic Yo-Yo*.

So, now I'm finally part of the MP3 generation! In a few weeks they'll probably move on to something else...

I don't know if you've been paying attention to the world food crisis. I tend not to mention news here if I feel everyone knows it already, but on the off chance you don't, listen to some of these stories:

- Soaring World Food Prices, National Public Radio.

Food prices are shooting up for a bunch of reasons, from rising oil prices (oil is used for obvious things like tractors and transportation but also to make fertilizer), droughts hitting rice production hard in Australia, and rising demand from China, to the sinking dollar, if that's your currency of choice. (Some claim China is getting rid of dollars and hoarding grain — any real evidence of that?)

Another much-ballyhooed factor is the way grain is going to make ethanol. That would be scary if true: have we already reached the point where rising energy prices suck major amounts of grain from starving poor countries into American SUVs? It's hard for me to tell. The columnist Roger Cohen says it's exaggerated. But I'd like to see more hard numbers.

National Public Radio has been talking about rising food prices for weeks, but now I see people up in arms about how Wal-Mart and Costco are limiting sales of rice. It seems that the Australian press is making an especially big deal about this, calling it "rationing".

Some climate news: according to Sarah Das of Woods Hole and Ian Joughin of the University of Washington, Greenland is not giving way to catastrophic melting. Meltwater is forming underground streams that lubricate the slide of glaciers, already *doubling* their rate of motion in some places. Das and Joughin just found that lakes on the surface can quickly cut through ice all the way down to the rock far below. They saw a lake of meltwater containing 45 million cubic meters of water drain completely in an hour and a half — a flow of 8,000 cubic meters per second, more than Niagara Falls. The water seems to have cut through over a kilometer of ice to the rock below! But, the rate of outflow of glaciers at the sea's edge is *not* drastically speeding up. Right now they're raising global sea levels at less than a quarter inch per century.

- Ira Flatow, Water power cracks ice sheet, *Science Friday*, April 18th, 2008.
- Woods Hole Oceanographic Institution press release, Lakes of meltwater can crack Greenland's ice and contribute to faster ice sheet flow.
- Sarah B. Das, Ian Joughin, *et al*, Fracture propagation to the base of the Greenland ice sheet during supraglacial lake drainage, *Science*, April 17, 2008.

Scientists walk along the edge of a large canyon formed by many years of meltwater stream flow across the surface of the Greenland ice sheet. The lines along the wall of the canyon show the stratigraphic layers of ice and snow laid down over the years.
(Photo by Sarah Das, Woods Hole Oceanographic Institution.)

We've been having a lot of trouble with bark beetles killing pines in the San Bernardino mountains near Riverside, causing bad fires — but it's nothing compared to this:

- John Nielsen, Beetle infestation compounds effects of warming, *Morning Edition*, National Public Radio, April 24, 2008.
- Susan Brown, Beetle tree kill releases more carbon than fires, *Nature*, April 23, 2008.
- W. A. Kurz *et al*, Mountain pine beetle and forest carbon feedback to climate change, *Nature* **452** (24 April 2008), 987-990.

Since 1997, pine beetles have killed 120,000 square kilometers of pines in Canada — that's the area of Pennsylvania, an order of magnitude bigger than any previous known infestation. Global warming seems to be aiding the rise of these beetles. The death of these forests will cause the release of about 270 megatons of CO_2 by 2020. By coincidence, this is exactly the amount of *reduction* of CO_2 emissions that Canada is seeking to accomplish by 2012.

So, we have a positive feedback loop: warmer climates mean more beetles mean more CO_2 mean warmer climates, at least until the pine forests all die.

Ready for some good news? I recently heard about an interesting negative feedback loop: the increased amount of CO_2 dissolved in seawater seems to be leading to a rise in little algae called coccolithophores that have calcium carbonate "shells". When these shells fall to the sea floor, it takes CO_2 out of circulation. This fits nicely with Le Chatelier's principle — but scientists had been expecting the opposite, since more CO_2 in the water makes it more acidic, which tends to *dissolve* sea shells and coral reefs and release more CO_2. So, this comes as a nice surprise, especially since there are a *lot* of these coccolithophores — apparently they play a big role in taking CO_2 out of the atmosphere:

- Christopher Joyce, As oceans grow more acidic, a tiny plant thrives, National Public Radio, *Morning Edition*, April 18, 2008.
- Debora Iglesias-Rodriguez *et al*, Phytoplankton calcification in a high-CO_2 world, *Science* **320** (April 18, 2008) 336-340.

April 28, 2008

Back home, jetlagged and slightly sick, busy trying to make a deadline on a grant proposal to get money for my students. On the shuttle ride back from the airport late Saturday night, I saw the hills of Sierra Madre on fire. We're having record heat here - 100 Fahrenheit in April is unusual! (That's 38° C.)

It's very strange having fires so early in the spring — not a good sign. On the TV show *60 Minutes* I hear that half the forests in America are likely to be gone in the next century, victim to fires, thanks in part to global warming.

April 29, 2008

If you've enjoyed my Shanghai diary, try this:

- Chengdu Diary, National Public Radio.

It's a lot of fun. I've had a fondness for Chengdu ever since my visit in August of 2005.

April 30, 2008

Jimmy Giuffre died last week. My dad had a great album by him... I need to get ahold of it:

- Steve Schwartz, Jazz clarinetist Jimmy Giuffre: a look back, WGBH, April 28, 2008.

They don't make 'em like they used to! The jazz age is gone now. We can't recreate it, and imitations fall flat, but you can still feel its spirit.

Here you can see Billie Holiday, Ben Webster, Lester Young, Coleman Hawkins and Gerry Mulligan all together. This is their December 8th, 1957 performance of Billie Holiday's song Fine and Mellow, from the CBS television special *The Sound of Jazz*.

You can see the sadness in Billie's eyes turn to a smile as she listens to Lester Young's solo. Long past his prime, he had to summon up his strength to stand up for this. He drank himself to death 15 months later. He was the one who named Billie "Lady Day". She called him "The Pres". They'd had a close artistic relationship for many years. I can't help but

wonder if they were in love, but Billie seemed to always be involved with abusive men.

(Her second husband, whom she married in 1952, was an enforcer for the Mafia. Like her other men, he beat her. But — all her biographers say at this point — *at least he tried to get her off drugs*. You see, she'd gotten into heroin in her later years, and had been busted a few times, put in prison for a year... and in 1947 she'd been banned from performing in all clubs in New York. "I can play Carnegie," she said, "but I can't play the crummiest gin joint in New York." Still, somehow she managed to sing regularly at Birdland.)

On the ride to Lester Young's funeral, Billie Holiday told the jazz critic Leonard Feather, "I'll be the next one to go". Sure enough, she died only 4 months later, from cirrhosis of the liver, under house arrest at the hospital for heroin possession. When her body was examined she was found to have $750 taped to her leg. She had only 70 cents in the bank. She was 44 years old. She is buried in St. Raymonds Cemetary in the Bronx.

Sad self-destructive behavior. But somehow all the foolish misery of their lives is transmuted to beauty in the alchemy of music.

This was her most devastating song of all:

From happier days:

Here's to Billie! I've been listening to her stuff a lot these days.

For my May 2008 diary, go here.

Through new uses of corporations, banks and securities, new machinery of industry, of labor and capital — all undreamed of by the Fathers — the whole structure of modern life was impressed into the service of economic royalists. It was natural and perhaps human that the privileged princes of these new economic dynasties, thirsting for power, reached out for control of government itself. They created a new despotism and wrapped it in the robes of legal sanction. - Franklin Roosevelt

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home

For my April 2008 diary, go here.

Diary - May 2008

John Baez

May 1, 2008

Todd Trimble pointed out an interesting movie of CO_2 emissions in the US. Later I saw a similar movie of air traffic, which starts out great but degenerates into goofy visual effects near the end. They're both worth watching.

If you're feeling depressed about mysteriously crashing populations of bats and bees, amphibians, and other species, let the ginkgo be a lesson: there's a big difference between being *almost* extinct and being extinct. So, it pays to work hard to save species even when it seems almost hopeless.

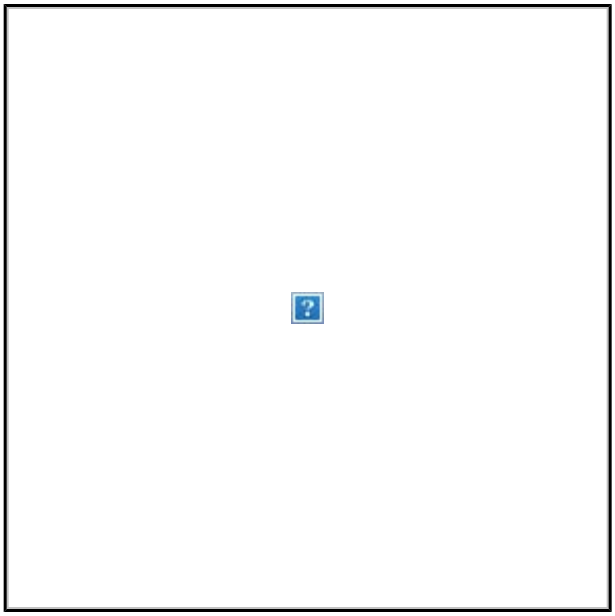
The modern ginkgo tree is a "living fossil", the only surviving member of the phylum Ginkgophyta, which had its heyday in the Cretaceous, about 145 million years ago. The Cretaceous was the last period when dinosaurs walked the earth. During the cataclysm that killed the dinosaurs, all but two species of the ginkgo family died out. Their range has been contracting almost ever since. It's possible they had evolved to have their seeds dispersed by dinosaurs, in which case they may have been pining away ever since.

(Excuse the pun.)

Ginkgos are marked by some special features: extreme longevity, slow reproduction rate, low population density, and strong "ecological conservatism": they only like light soils around rivers. Presumably all these factors contribute to make ancient ginkgos almost indistinguishable from ginkgos today.

By the time the ice ages began — the end of the Pliocene and the start of the Pleistocene, 1.8 million years ago — they only survived in a certain part of central China.

After the apes evolved into humans and some in Europe became scientists, these western scientists found fossil ginkgo leaves and decided this was an extinct species of plant:



But, they were wrong! The ginkgo had survived in China, mainly in monasteries in the mountains and in palace and temple gardens, where Buddhist monks cultivated the tree starting around 1100 AD. Only a few wild ginkgos are known

in China, especially around the southern slope of Jinfo Mountain near the border of Guizhou Province.

The Buddhists monks later took the ginkgo to Japan around 1190...

In 1691, a German physician and botanist named Engelbert Kämpfer, in Japan on a mission with the Dutch East-India Company, found ginkgos in Japan and brought back seeds to Holland. The trees from these first seeds survive today!

They were taken to America in 1784, and by the late 1800s it had become a popular tree for city streets on east coast urban areas. Now *Ginkgo biloba* is fashionable for its medical properties.

In short: its story continues! For more:

- Cor Kwant, The Ginkgo pages: history.

May 7, 2008

I gave a talk on the number 5 at George Washington University. I'm staying with my old pal Bill Schmitt, who teaches there.

Bill and I were math grad students at MIT, and he's one of the few people I've kept up with since then. It's strange how this sort of thing works — you can't guess ahead of time who you'll still be talking to twenty years later. Bill's interest in Hopf algebras and combinatorics seemed far from my work on quantum field theory when I was a student, but now they look awfully similar to me. We also just get along — and we've managed to see each other often enough to keep the connection alive.

First Bill had a job at the University of Southern California and lived in Venice, California, within range of Riverside. Then he got at the University of Tennesee, in Memphis, but was kind enough to invite me to give a talk there. Now he's teaching in DC, conveniently located near my parents. So, it's fun to visit him when I go to DC —

especially since visits carry a certain sadness, a certain darkness now that my dad is confined to a nursing home, and my mother lives alone, struggling with some tough decisions.

The last time I visited Bill, he lived right off Dupont Circle — a fashionable spot in the heart of DC. Now he's living out in Bethesda, to be near his daughter. But a lot remains constant: in both these places, and also in Memphis, he lived near the top of an apartment building, in a sparsely furnished set of rooms dominated by a grand piano and an incredibly good stereo system.

He's one of the few people who not only loves music as much as me, but loves it in a similar *way*, so we can enjoy listening to it together and talking about it. I tend to think of him as a "confirmed bachelor", who likes women but needs the freedom of living alone. So, I really enjoy doing bachelor things with him: eating out at restaurants where he's a favored "regular", staying up late, listening to music, talking math, and drinking. All the stuff I'd do if I lived alone — except I'd be absolutely miserable, since living alone is not my thing. So for me, visiting Bill is like an idealized temporary taste of the bachelor lifestyle backed by the comforting knowledge that it's not a permanent condition. The part-time presence of his 4-year-old daughter throws a monkey wrench into this pattern, but somehow less than you might think. The fact that she's basically delightful helps.

Best piece of music I've discovered on this visit: Thom Yorke's album *The Eraser*. The first song that really caught my attention was Skip Divided, because I'd already heard the flashy remix by the German group Modeselektor over at NPR. But, I've gotten to love almost all these songs — try Black Swan, It Rained All Night, Analyse and The Eraser. I suggest ignoring the videos: I'm just using YouTube as a way to let you hear cheap versions of these songs! In their full-fledged album versions, some of these songs are so high-tech and sonically thick that they come out like pure noise on my cheaper pair of headphones... but sound great on good speakers. They're also full of soul. I like this album better than *In Rainbows*.

> *If you get stuck in other people's impressions of what you do, it actually starts informing how you carry on — and then you know you're in trouble, because then you're part of this noise that actually was nothing to do with you in the first place.* - Thom Yorke

May 10, 2008

I'm visiting my mom, dad and sister — and my aunt came out from Pasadena to join us! Fun family reunion. The shadows of old age haunt us all, but we love each other, and rarely get to see each other all at once.

My aunt gave my dad a CD by Jimmy Giuffre, the jazz clarinetist I mentioned on April 30th. This CD is actually a double album containing *Tangents in Jazz*, the record my dad had that I loved so much as a kid! Wow! This stripped-down, slightly countrified jazz — dominated by clarinet, drum silent except when needed, completely lacking piano — was so far ahead of its time! It sounds like something Bill Frisell would do. It's gentle, but funky. It makes me happy.

From an online review of a larger collection:

> There is a kind of poetic imagination at work in the early solo recordings of Jimmy Giuffre. He knew what sound he was looking for; could hear it in all its breezy complexity; but had to experiment for a number of years before hitting upon it: a varied and rich tapestry that may be overlooked by mainstream jazz fans who are still goo-goo-eyed over all the '50s had to offer; but shouldn't be. Taken in part or as a whole, The Complete Capitol and Atlantic Recordings of Jimmy Giuffre, (six CDs-worth from the Four Brothers sessions), reveal truly original statements sung by a master of dynamic, harmonic, and timbral invention and counterpoint. Giuffre (and Dave Brubeck) studied counterpoint with French composer Darius Milhaud, and it shows. The music contained here is considered, even today, with its strange lineups and odd ghostly voicings, to be sometimes quirky or iconoclastic.
>
> The evidence, of course, is in the recordings themselves, beginning with 1953's *Four Brothers* session. Giuffre alternates on clarinet, baritone, and tenor, with side men that include pianist Russ Freeman, trumpeter Jack Sheldon, bassist Curtis Counce, and drum king Shelly Manne, on half the session, and altoist Bud Shank, Shorty Rogers on flugelhorn (and subbing Ralph Pena on bass), and vibist Bob Enevoldsen. On Four Brothers, one can hear Giuffre's discontent with the idea of the piano carrying the body of the harmonic groove and the skittering of the drums during the solos.
>
> The next step would be, of course, to jettison the piano for the scandalous (at that time) *Tangents in Jazz*. Featuring Giuffre and his army of horns with Sheldon, Pena, and drummer Artie Anton, *Tangents in Jazz* set the pens of critics to scrawling across the page. Here was a quartet set that decided the piano — even before Chet Baker — was dispensable, and that linear development and improvisation would be better served by accenting timbre and dynamic rather than an overabundance of harmonic considerations.
>
> Right or wrong, and despite the controversy, the album has proven to be a classic. The reason is simple: Giuffre's insistence on subtle shades and textures in melodic improvisation made his music — no matter how "odd" sounding — palatable. The muted tones and nuances of *Tangents in Jazz* are balanced by the sheer melodic invention of the soloing of all players as they develop along contrapuntal lines, showcasing timbral shifts that would normally go unnoticed as key elements in the linear — not horizontal — erection of a series of melodic ideas in a composition; all joined by improvisation that added a block that harmony may or may not be considered as a stepping stone to another rung. And hell yes, *Tangents in Jazz*, like *Four Brothers* before it, swung smooth; but it swung tough.

May 20, 2008

Another trip — now Lisa and I are in Berkeley, where I gave a talk on my work with Jim Dolan at the Groupoids in Analysis and Geometry Seminar run by Alan Weinstein. This was a real pleasure, since I've been hearing about Alan Weinstein's work on the math of classical mechanics ever since I studied the subject with Victor Guillemin (his east-coast rival) at MIT, and he's one of geometers who has most fully embraced categories — or at least groupoids, Lie algebroids, stacks and the like.

He told me he jokingly refers to categorification as "higher mathematics".

I also met Jenny Harrison, and was delighted to hear that she enjoys This Week's Finds. She said that when it shows up, she knows it'll be a fun day! That's what I'm always striving for... I'm glad it's working for some people.

Lisa and I had dinner with Alan, his wife, and a postdoc. Jenny was unable to make it.

May 22, 2008

Lisa and I are now visiting Stanford, where she gave a talk at the Center for East Asian Studies. This afternoon I visited my student Mike Stay at Google — that's where he works now.

They have lots of lectures on all subjects at Google, so I gave a talk there. To make it fun for people, I decided to give my talk about the number 5. Unfortunately, it turned out I was giving it at the same time Condoleeza Rice was giving a talk! I was pleased that some people still came.

Afterwards Mike and I discussed his thesis, which will be about the analogies between computation and physics (broadly speaking) and categorifying the lambda calculus (narrowly, at least to start with). Mike was excited about something called the blue calculus, which more closely models current object-oriented programming. I need to catch up on a lot of material before I can address this sort of thing intelligently, connecting the practice of computation with the elegance of abstract category theory. But, it would be fun.

The Google "campus", as they call it, is a sight to see. Swimming pools, a *Tyrannosaurus rex*, a replica of Space Ship One (a spaceplane that completely the first privately funded flight in space), a bunch of video screens mapping web traffic in real time, the obligatory whiteboards all over, free coffee bars, free juice bars, free cafeterias serving all sorts of tasty food... they've clearly put thought into keeping their employees happy. I could sense myself becoming jealous.

The place is also a bit like a dream school for bright overgrown kids: lots of primary colors, toys, and all your needs met as long as you do wonderful things. That made me feel a bit nervous. As a university teacher, I'm used to being the "grownup" amid kids.

Dinner with Lisa's colleagues, including Yiqun Zhou and Mark Lewis, whom I'd met before in Cambridge.

May 23, 2008

Back in Riverside, it's raining and chilly! That's a real shock, especially since it was about 40° C when we left. But it's nice.

We have an agave in our back yard that's revealed itself to be a century plant, sending up an enormous stalk and flowering magnificently before it dies. A couple weeks ago it looked like some sort of mega-asparagus:

Now it looks like this:

For my June 2008 diary, go here.

How charming is divine Philosophy!
Not harsh and crabbed, as dull fools suppose,
But musical as is Apollo's lute,
And a perpetual feast of nectar'd sweets,
Where no crude surfeit reign. - Milton, *Comus*

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Diary - June 2008

John Baez

June 1, 2008

My days especially quiet now that Lisa is visiting Taiwan, especially since I'm on a non-teaching quarter. I'm writing a lot, listening to music in my office at home: mainly jazz, Radiohead and Thom Yorke, and a bit of techno and other stuff.

Today it's Sunday; I went to a cafe called Panera at the Riverside Plaza and spent several hours polishing up a draft of a paper I'm writing with my students Chris Rogers and Alex Hoffnung, called Categorified Symplectic Geometry and Classical String Theory.

I need to finish off a number of papers and prepare a few talks before I go to Barcelona on the 14th. I can get nervous if I think about how much I'm committed to do. And I still haven't found a place to stay for our stay in Paris starting July 6th! But I'll muddle through.

I read an article about some charmingly persistent scientists seeking radio broadcasts from extraterrestrial life — especially Rick Forster, who is working on an array 42 new radio dishes devoted to this search up in Hat Creek, a valley near Mt. Shasta in northern California:

- John Johnson Jr., Aliens get a new switchboard: a SETI radio telescope in Northern California, *Los Angeles Times*, June 1, 2008.

A little quote of this fun story:

> Frank Drake made his first attempt to find Earth's sister planet in 1960, using an 85-foot-diameter antenna at the National Radio Astronomy Observatory in West Virginia. Radio waves have long been considered ideal for communication with alien civilizations because the waves are easy to produce and receive, which is why we use them on Earth to carry television and radio signals. They also penetrate the gas and dust between stars.
>
> Drake pointed the antenna at two nearby stars, Epsilon Eridani and Tau Ceti — virtually next-door neighbors in galactic terms at just over 10 light-years from Earth.
>
> In April 1960, Drake picked up a signal. His first thought, according to Seth Shostak, was: "Can it be this easy?"
>
> The second was, "Holy cow, what do I do now?"
>
> "It wasn't that easy," said Shostak, who is writing a book about the search for alien intelligence.
>
> Drake, now 78, had mistaken a passing aircraft for an alien broadcast. It was the first of many false alarms to haunt the field, presenting a problem that persists today: separating the man-made and natural radio signals from the electronic "Howdy, neighbor" of an alien civilization.
>
> Shostak calls it the "E.T. or AT&T?" problem.
>
> So how does one go about tuning in intergalactic radio? It's a lot more complicated than simply pointing your antenna at the right star, just as tuning in your favorite radio station on Earth requires more than being

within broadcast range. You have to spin the dial.

The radio spectrum ranges over frequencies of 3 kilohertz (3,000 hertz) to 300 gigahertz (300 billion hertz). The alien version of "I Love Lucy" could be hiding anywhere in between.

With the Hat Creek array, SETI will be able to scan a much broader range than ever before: everything from 0.5 gigahertz to 11 gigahertz, a range of 10 billion channels.

When researchers get a promising signal, the real work begins.

The key test, according to Tarter, is the bandwidth. Nothing in nature produces signals narrower than 300 hertz.

"Quasars, pulsars, things like that make signals much broader," Shostak said. "A narrow signal must have been produced by a transmitter."

But whose? Ours or theirs?

The next step after finding a signal is to watch it for a while. Does it change, or does it sit there on the dial giving off a continuous whine or beeping as regularly as a metronome? An alien signal would undergo subtle changes as Earth's orbital position changed relative to the other planet, whereas a man-made signal would be constant.

"Getting a signal is not such a big deal," Shostak said. "At Arecibo, we got one every six seconds."

With the Hat Creek array, he expects to get a promising signal every couple of hours. Every six months, he expects, researchers will get one that seems to pass all the tests. But that's just the beginning. After that, SETI will alert other observatories for confirmation.

Over nearly 40 years of searching, no signal has panned out to be anything more than a satellite transmission or some mundane natural pulse.

But the time period is deceptive. All the actual search time added together amounts to only 18 months of concerted effort, Shostak said — hardly enough to conclude that our galactic brethren either are not there or are not interested in communicating.

For the truly dedicated, patience is not only a virtue but a requirement. Just ask Jill Tarter.

She began her search in the late 1970s at NASA's Ames Research Center in the Bay Area, where scientists were interested in following up on Drake's work.

Tarter signed on. "I realized I was alive in the first generation of human beings who could answer the are-we-alone question rather than going around asking priests and philosophers," she said. "Good grief, why wouldn't I want to become involved in that?"

The NASA search was killed by Congress in 1993, but Tarter refused to give up.

Jill Tarter was the basis for the main character in Carl Sagan's novel *Contact*. She was played by Jodie Foster in the movie version of this story — one of my favorite science fiction movies, despite a few infuriating aspects. Jodie Foster did a good job. I can just imagine her saying line: "Good grief, why wouldn't I want to become involved in that?" There are so many obvious answers to that question, I can't help but smile... but at the same admire the spirit. The childlike, earnest naivete of the scientist who just won't quit!

Maybe science requires a certain quixoticism: you're trying to do amazing, wonderful things, and most attempts fail — but overall science *succeeds* in doing amazing, wonderful things.

On another note: I recently read somewhere that Arecibo-quality radio antennas on other solar systems could only pick up the carrier wave of TV broadcasts from Earth like the *I Love Lucy* show mentioned above — not the actual signal.

But the big question is: *is anyone out there?* I last talked about the so-called Fermi paradox in my December 14, 2006 diary entry. It's not really a paradox, more like a puzzle. Here's a new article on the subject:

- Nick Bostrom, Where Are They? — Why I Hope The Search for Extraterrestrial Life Finds Nothing, *Technology Review*, May-June 2008.

I'm not sure I agree with his logic, but here's the core of his argument:

> I hope that our Mars probes discover nothing. It would be good news if we find Mars to be sterile. Dead rocks and lifeless sands would lift my spirit.
>
> Conversely, if we discovered traces of some simple, extinct life-form — some bacteria, some algae — it would be bad news. If we found fossils of something more advanced, perhaps something that looked like the remnants of a trilobite or even the skeleton of a small mammal, it would be very bad news. The more complex the life-form we found, the more depressing the news would be. I would find it interesting, certainly — but a bad omen for the future of the human race.

He notes that with lots of stars and planets, and so far no signs of any life, there must be a "Great Filter" making it hard for intelligent life to sweep across the cosmos. This is the usual Fermi paradox argument. Then:

> So where is the Great Filter? Behind us, or not behind us?
>
> If the Great Filter is ahead of us, we have still to confront it. If it is true that almost all intelligent species go extinct before they master the technology for space colonization, then we must expect that our own species will, too, since we have no reason to think that we will be any luckier than other species. If the Great Filter is ahead of us, we must relinquish all hope of ever colonizing the galaxy, and we must fear that our adventure will end soon — or, at any rate, prematurely. Therefore, we had better hope that the Great Filter is behind us.
>
> What has all this got to do with finding life on Mars? Consider the implications of discovering that life had evolved independently on Mars (or some other planet in our solar system). That discovery would suggest that the emergence of life is not very improbable. If it happened independently twice here in our own backyard, it must surely have happened millions of times across the galaxy. This would mean that the Great Filter is less likely to be confronted during the early life of planets and therefore, for us, more likely still to come.
>
> If we discovered some very simple life-forms on Mars, in its soil or under the ice at the polar caps, it would show that the Great Filter must come somewhere after that period in evolution. This would be disturbing, but we might still hope that the Great Filter was located in our past. If we discovered a more advanced life-form, such as some kind of multicellular organism, that would eliminate a much larger set of evolutionary transitions from consideration as the Great Filter. The effect would be to shift the probability more strongly against the hypothesis that the Great Filter is behind us. And if we discovered the fossils of some very complex life-form, such as a vertebrate-like creature, we would have to conclude that this hypothesis is very improbable indeed. It would be by far the worst news ever printed.

I agree that finding evidence for a Great Filter *behind* us would be good news for us, while finding evidence that it's *ahead* would be bad news. But, I'm finding simple life forms on Mars might not necessarily be "disturbing" — wouldn't it suggest the Great Filter was *behind* us? Actually, I think the details matter immensely: we'd need to see how much the death of life on Mars said about our own situation.

For example, it would be really scary finding remnants of a dead civilization in the midst of an endless series of primary elections between two candidates in the same political party, either one of whom could have saved the day.

June 2, 2008

I finished a draft of the paper with Chris and Alex, and rewarded myself by buying Trent Reznor's new album, *Ghosts I-IV*. I'm listening to it now. It's good music, and a great idea: two CDs of music for only 10 bucks, or download it even cheaper — and it comes with a Creative Commons Attribution Non-Commercial Share Alike license that lets. you to reproduce it. This is partially to encourage you to make your own music videos of it and show them as a part of a "film festival" they're planning on YouTube.

I've been studying Pythagoreanism ever since giving the first trial runs of my talk on the number 5, which features the so-called Pythagorean pentagram. The idea behind that pentagram was almost completely without historical basis, just a nice mathematical "just so story". But, it can't hurt to learn the history.

And, despite a profusion of legends in the later Greek literature, it turns out almost nothing is known of Pythagoras himself — and very little about the Pythagoreans of the 5th century BC. Tim Silverman. recommended this book:

- Walter Burkert, *Lore and Science in Ancient Pythagoreanism*, Harvard U. Press, Cambridge, Massachusetts, 1972.

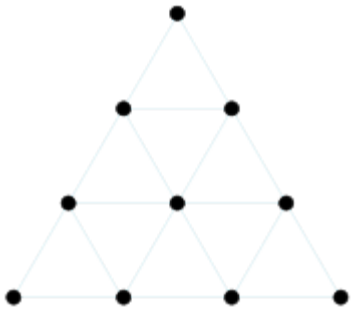
It's very scholarly and thorough... and it clearly shows the futility of trying to extract the "historical Pythagoras" from the dark cloud of myths surrounding him:

> No other branch of history offers such temptations to conjectural reconstruction as does the history of mathematics. In mathematics, every detail has its fixed and unalterable place in a nexus of relations, so that it is often possible, on the basis of a brief and casual remark, to reconstruct a complicated theory. It is not surprising, then, that gap in the history of mathematics that was opened up by a critical study of the evidence about Pythagoras has been filled by a whole succession of conjectural supplements.

It's much easier to learn about the Renaissance "neo-Pythagoreans". This book is a lot of fun, though too romantic to be truly scholarly:

- S. K. Heninger, Jr., *Touches of Sweet Harmony: Pythagorean Cosmology and Renaissance Poetics*, The Huntington Library, San Marino, California, 1974.

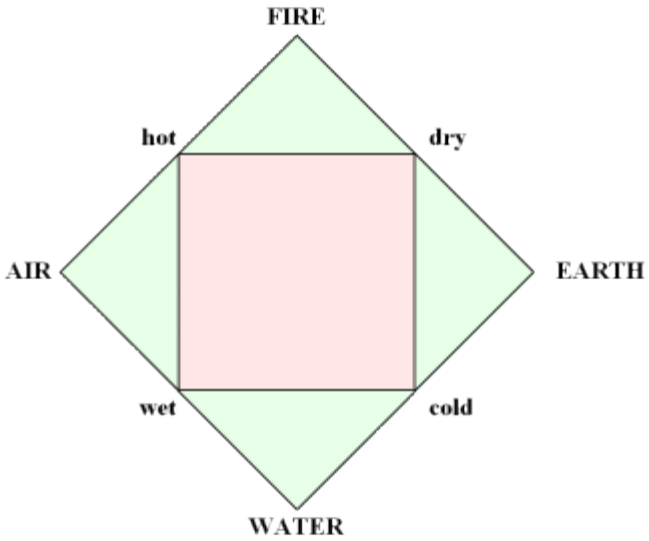
It seems clear that the Renaissance neo-Pythagoreans, and even the Greek Pythagoreans, and perhaps even old Pythagoras himself were much taken with the tetractys, a symbol that looks like this:



To get the importance of the tetractys, you have to temporarily throw out modern scientific thinking and get yourself in the mood of magical thinking, or correlative cosmology. To the Pythagoreans, the four rows of the tetractys represent the point, line, triangle and tetrahedron, respectively. The "fourness" of the tetractys also represents the four elements: earth, air, water and fire. I'm not sure if there are specific elements that correspond to the numbers 1, 2, 3, and 4, though. The Renaissance thinkers liked to organize the elements using the chain of analogies

fire : air :: air : water :: water : earth

(running from light to heavy), or in a pattern like this:



Fire is primarily hot and secondarily dry.
Air is primarily wet and secondarily hot.
Water is primarily cold and secondarily wet,
Earth is primarily dry and secondarily cold.

Hmm? Air is *primarily* wet, while water is only *secondarily* wet? This theory sounds all wet.

The tetractys also took the Pythagoreans in other strange directions. For example, who said this:

"What you suppose is four is really ten..."

A modern-day string theorist, talking to a loop quantum gravity theorist about the dimension of spacetime? No! Lucian attributes it to Pythagoras, referring to the tetratkys and the fact that 1 + 2 + 3 + 4 = 10. This somehow led the Pythagoreans to consider the number 10 as representing perfection.

Pythagorean music theory is a bit more comprehensible. The Greeks, and the Babylonians before them, knew that nice-sounding intervals in music correspond to nice rational numbers. For example, they knew that the octave corresponds to a ratio of 2:1. We'd now call this a ratio of *frequencies*; one can get into some interesting scholarly arguments about when and how well the Greeks knew that sound was a *vibration*, but never mind — read Burkert's book if you're interested in that question.

Whatever these ratios meant, they also knew that the fifth corresponded to a ratio of 3:2, and a fourth to 4:3.

They then figured out that the octave could be divided into a fourth and a fifth:

$2/1 = 4/3 \times 3/2$

and at some point they defined a whole tone to be the difference, or really ratio, between a fifth and a fourth:

$(3/2)/(4/3) = 9/8$

So, when you go up one whole tone in Pythagorean tuning, the higher note should vibrate 9/8 as fast as the lower one. If you try this on a modern keyboard, it looks like after going up 6 whole tones you've gone up an octave. But in fact if you buy the Pythagorean definition of whole tone, 6 whole tones equals

$(9/8)^6 = 531441 / 262144 \quad 2.027286530...$

which is, umm, not quite 2. Another way to put it is that if you go up 12 fifths, you've almost gone up 7 octaves, but not quite: the so-called circle of fifths doesn't quite close, since

$(3/2)^{12}/2^7 = 531441/524288 \quad 1.01264326...$

This annoying little discrepancy is called the Pythagorean comma.

Unfortunately, this sort of discrepancy is an unavoidable fact of mathematics. Our ear likes to hear frequency ratios that are nice simple rational numbers, and we'd also like a scale where the notes are evenly spaced, but we can't have both. Why? Because you can't divide an octave into equal parts that are *rational* ratios of frequencies: a nontrivial nth root of 2 can never be rational.

So, irrational numbers are lurking in any attempt to create an equally spaced (or as they say, "equal-tempered") tuning system. And you might imagine this pushed the Pythagoreans to confront irrational numbers. This case has been made by the classicist Tannery, but Burkert doesn't believe it: there's no written evidence suggesting it.

You could say the existence of irrational numbers is the root of all evil in music. Indeed, the diminished fifth in an equal tempered scale is called the diabolus in music, the "devil in music", and it has a frequency ratio of $\sqrt{2}$.

Or, you could say that this built-in conflict is the spice of life! It makes it impossible for harmony to be perfect and therefore dull.

Anyway, Pythagorean tuning is not equal-tempered: it's based on making lots of fifths equal to exactly 3/2. So, all the frequency ratios are fractions built from the numbers 2 and 3. But, some of them are nicer than others:

first = 1/1
second = 9/8
third = 81/64
fourth = 4/3
fifth = 3/2
sixth = 27/16
seventh = 243/128
octave = 2/1

As you can see, the third, sixth and seventh are not very nice: they're complicated fractions so they don't sound great. They're all a bit sharp compared to the following tuning system, which is a form of "just intonation":

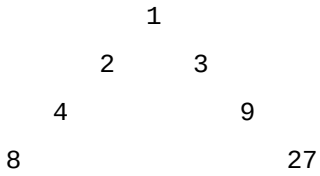
first = 1/1
second = 9/8
third = 5/4
fourth = 4/3
fifth = 3/2
sixth = 5/3
seventh = 15/8
octave = 2/1

A long and interesting tale could be told about this other system, but I won't tell it here. Instead, let's just study how the third, sixth and seventh differ:

- In just intonation the third is 5/4 = 1.25, but in Pythagorean tuning it's 81/64 = 1.265625.
- In just intonation the sixth is 5/3 = 1.6666.., but in Pythagorean tuning it's 81/64 = 1.6875.
- In just intonation the seventh is 15/8 = 1.875, but in Pythagorean tuning it's 243/128 = 1.8984375.

For more information on Pythagorean tuning, try the Wikipedia article. For now, I just want to say how it's related to other aspects of Pythagorean or Platonic numerology, especially the so-called "Platonic Λ".

The "Platonic Λ" is a certain way of labelling the edges of the tetractys by powers of 2 on one side, and powers of 3 on the other:



I can't help wanting to flesh it out like this, so going down and to the left is multiplication by 2, while going down and to the right is multiplication by 3 — or in musical terms, going up an octave and going up an octave and a fifth:

So, I was pleased when in Heninger's book I saw some of these numbers in a plate from a 1563 edition of the *De Natura Rerum*, a commentary on Plato's *Timaeus* written by the Venerable Bede sometime around 700 AD.

In this plate, the elements fire, air, water and earth are labelled by the numbers 8, 12, 18 and 27. This makes the aforementioned analogies:

fire : air :: air : water :: water : earth

into strict mathematical proportions:

8 : 12 :: 12 : 18 :: 18 : 27

In my effort to get to the bottom of this, I was soon led to a bizarre passage in Plato's *Timaeus* — a passage I'd never before come close to understanding! It describes the Platonic Λ and further ideas which seem closely related to Pythagorean tuning and perhaps the "music of the spheres".

Before I show you this passage, which is quite dense and bewildering, let me quote the introduction to the *Timaeus* written by Jowett, one of the main translators of Plato into English. First, some general stuff about the role of number in Greek thought:

> Number and figure were the greatest instruments of thought which were possessed by the Greek philosopher; having the same power over the mind which was exerted by abstract ideas, they were also capable of practical application. Many curious and, to the early thinker, mysterious properties of them came to light when they were compared with one another. They admitted of infinite multiplication and construction; in Pythagorean triangles or in proportions of 1:2:4:8 and 1:3:9:27, or compounds of them, the laws of the world seemed to be more than half revealed. They were also capable of infinite subdivision — a wonder and also a puzzle to the ancient thinker (*Republic*). They were not, like being or essence, mere vacant abstractions, but admitted of progress and growth, while at the same time they confirmed a higher sentiment of the mind, that there was order in the universe. And so there began to be a real sympathy between the world within and the world without. The numbers and figures which were present to the mind's eye became visible to the eye of sense; the truth of nature was mathematics; the other properties of objects seemed to reappear only in the light of number. Law and morality also found a natural expression in number and figure. Instruments of such power and elasticity could not fail to be 'a most gracious assistance' to the first efforts of human intelligence.

Second, a summary of the passage I'm about to clobber you with:

> The proportions in which the soul of the world as well as the human soul is divided answer to a series of numbers 1, 2, 3, 4, 9, 8, 27, composed of the two Pythagorean progressions 1, 2, 4, 8 and 1, 3, 9, 27, of which the number 1 represents a point, 2 and 3 lines, 4 and 8, 9 and 27 the squares and cubes respectively of 2 and 3. This series, of which the intervals are afterwards filled up, probably represents (1) the diatonic scale according to the Pythagoreans and Plato; (2) the order and distances of the heavenly bodies; and (3) may possibly contain an allusion to the music of the spheres, which is referred to in the myth at the end of the Republic.

Okay, now for the passage itself! Hang on to your seat! Including some explanatory text by Jowett, it reads:

> Now God did not make the soul after the body, although we are speaking of them in this order; for having brought them together he would never have allowed that the elder should be ruled by the younger; but this is a random manner of speaking which we have, because somehow we ourselves too are very much under the dominion of chance. Whereas he made the soul in origin and excellence prior to and older than the body, to be the ruler and mistress, of whom the body was to be the subject. And he made her out of the following elements and on this wise: Out of the indivisible and unchangeable, and also out of that which is divisible and has to do with material bodies, he compounded a third and intermediate kind of essence, partaking of the nature of the same and of the other, and this compound he placed accordingly in a mean between the indivisible, and the divisible and material. He took the three elements of the same, the other, and the essence, and mingled them into one form, compressing by force the reluctant and unsociable nature of the other into the same. When he had mingled them with the essence and out of three made one, he again divided this whole into as many portions as was fitting, each portion being a compound of the same, the other, and the essence. And he proceeded to divide after this manner:
>
> First of all, he took away one part of the whole (1), and then he separated a second part which was double the first (2), and then he took away a third part which was half as much again as the second and three times as much as the first (3), and then he took a fourth part which was twice as much as the second (4), and a fifth part which was three times the third (9), and a sixth part which was eight times the first (8), and a seventh part which was twenty-seven times the first (27). After this he filled up the double intervals (i.e. between 1, 2, 4, 8) and the triple (i.e. between 1, 3, 9, 27) cutting off yet other portions from the mixture and placing them in the intervals, so that in each interval there were two kinds of means, the one exceeding and exceeded by equal parts of its extremes (as for example 1, 4/3, 2, in which the mean 4/3 is one-third of 1 more than 1, and one-third of 2 less than 2), the other being that kind of mean which exceeds and is exceeded by an equal number, e.g:
>
> - over 1, 4/3, 3/2, - over 2, 8/3, 3, - over 4, 16/3, 6, - over 8: and
> - over 1, 3/2, 2, - over 3, 9/2, 6, - over 9, 27/2, 18, - over 27.
>
> Where there were intervals of 3/2 and of 4/3 and of 9/8, made by the connecting terms in the former intervals, he filled up all the intervals of 4/3 with the interval of 9/8, leaving a fraction over; and the interval which this fraction expressed was in the ratio of 256 to 243, e.g.
>
> 243:256::81/64:4/3::243/128:2::81/32:8/3::243/64:4::81/16:16/3::242/32:8.
>
> And thus the whole mixture out of which he cut these portions was all exhausted by him. This entire compound he divided lengthways into two parts, which he joined to one another at the centre like the letter X, and bent them into a circular form, connecting them with themselves and each other at the point opposite to their original meeting-point; and, comprehending them in a uniform revolution upon the same axis, he made the one the outer and the other the inner circle. Now the motion of the outer circle he called the motion of the same, and the motion of the inner circle the motion of the other or diverse. The motion of the same he carried round by the side (i.e. of the rectangular figure supposed to be inscribed in the circle of the Same) to the right, and the motion of the diverse diagonally (i.e. across the rectangular figure from corner to corner) to the left. And he gave dominion to the motion of the same and like, for that he left single and undivided; but the inner motion he divided in six places and made seven unequal circles having their

> intervals in ratios of two and three, three of each, and bade the orbits proceed in a direction opposite to one another; and three (Sun, Mercury, Venus) he made to move with equal swiftness, and the remaining four (Moon, Saturn, Mars, Jupiter) to move with unequal swiftness to the three and to one another, but in due proportion.

Whew! The last paragraph still has me completely befuddled, but Jowett says it sets up a correspondence between planets and numbers as follows:

Moon 1, Sun 2, Venus 3, Mercury 4, Mars 8, Jupiter 9, Saturn 27

These are, of course, the numbers in the Platonic Λ:

```
          1
       2     3
    4           9
  8                27
```

What does it all mean? I'm not sure. All I can say is that we're seeing a strange strand of numerological mysticism starting with the murky unnamed "Pythagoreans", flaring into visibility in Plato's *Timaeus*, and lasting for thousands of years, perhaps peaking in the work of Renaissance "neo-Pythagoreans".

June 3, 2008

I do math and physics of a rarefied, abstract sort. It's mindblowingly fun, but in a subtle way. It's a sublimated fulfillment of my love for intensity. When I was a kid, I would have preferred to build a 26-ton sphere of steel full of molten sodium and spin it around really fast! That's what Dan Lathrop does for a job. No wonder he's smiling.

Check out the video here, as well as the radio show:

- David Kestenbaum, Building a baby earth to test its magnetic field, June 2, 2008.

People who don't get jobs like that may want to spend time in a media immersion pod. Ever tried that? Not me. But lots of people have:

- Virginia Heffernan, In Tokyo, the new trend is 'media immersion pods', *New York Times*, May 14, 2006.

A little quote:

> [...] the Gran Cyber Cafés are enshrouded in the urgent, furtive atmosphere of a hot-sheet motel. Eyes averted, customers sign in, head to the library of entertainment options, and load up on fashion magazines, video games and DVD's of "24" as if stocking up on Jim Beam. Then they beetle-brow it to their solitary pods.
>
> What they do there is up to them. Some people channel-surf. Others trade stocks. You can download music, read novels, watch pornography, play video games, have sex, go to sleep.

> According to Mr. Isshow, Japan's "petit iede," or little runaways, come for downtime, free lattes and smoothies, and, at some branches, showers. They use the places as trial separations from home — staying a few hours, overnight or a few days, long enough to scare their parents. (A "night pack" allows use of the pod from 11 p.m. to 8 a.m. for about $10; some places sell toothbrushes and underwear too.) Periodically the management will remind a customer that the cafe is not a hotel, but above all they respect people's privacy.
>
> On a recent afternoon, at around 5:30, I visited the Gran Cyber Café in the Shinjuku neighborhood for the first time, to read e-mail and visit a news site or two. Checking in, I was assigned to pod 16-A.
>
> I loved 16-A the instant I saw it. I closed the door, slipped into a low-slung leatherette seat and surveyed the all-you-can-eat tech feast, which includes VHS and DVD players, satellite and regular television on a Toshiba set, PlayStation 2, Lineage II and a Compaq computer loaded with software, all the relevant downloads and hyperspeedy Internet. In the nearby library were thousands of comic books, magazines and novels. On the desk was a menu of oddball snacks, like boiled egg curry and hot sandwich tuna.
>
> The atmosphere is airless and hot, with a permanent cloud of cigarette smoke. Over all the effect is of a low-wattage, low-oxygen casino.
>
> When I spoke to Japanese cultural critics about the Gran Cyber Cafés, most gave high-flown theoretical accounts of their appeal. But Takami Yasuda, a professor at the School of Informatics and Sciences at Nagoya University who writes about virtual reality, shrugged. "I do not know exactly why people, young guys in particular, love to stay in such a dark place," he said.
>
> I don't know exactly why I stayed either. But 10 books, two DVD's, seven magazines, two newspapers and a video game later, I found that eight hours had elapsed.

I discovered this through a fun interview of Virginia Heffernan, part of a very interesting longer conversation about the spaces in which we consume media:

- Brooke Gladstone and Bob Garfield, Space odyssey, *On the Media*, National Public Radio, May 30, 2008.

June 4, 2008

A cool gray day — rare treat in June, here.

I've been enjoying watching baby birds practice flying, launching themselves off the palm tree in our front yard and awkwardly winging around while chirping in a cute, childish way.

The year before last, a nest of hawks occupied that tree, so we got to see baby hawks fly about and practice diving, sometimes pretending to attack their parents. Last year it was owls: at night we could hear hooting, and see vague white shapes doing strange things. This year I don't know what kind of baby bird I'm seeing. It's annoying. A mockingbird, maybe?

Mockingbirds are one of the dominant bird species here, energetic and intelligent, endlessly inventive in their song as they sit on a nice tree or rooftop. I love listening to them: they usually sing the same phrase three times in a row, then modify it and sing the new phrase three times, and so on, for hours. Usually you'll hear one nearby and another further away — presumably males battling it out, trying to impress the females with their talent. They're the most active in the morning, but in the spring they also sing starting right around midnight. I'm not sure why. But, it always makes me think of that old Elvis song:

We're gonna mock,
We're gonna mock,
We're gonna mock,

Around the clock tonight...

Hey, I hear the baby birds chirping now! I've got to go out and take a look.

June 6, 2008

It's late at night — midnight, in fact — and a mockingbird is singing away madly in front of my office. What is it trying to prove? Maybe that it's well-fed and energetic, with lots of time to kill.

My student Alex Hoffnung passed his oral today, and can now officially start work on his thesis. Yay!

I'm working on the talks I'll be giving in Europe. The first will be at 10 am the Monday after next, June 16th, at the workshop on Categorical Groups in Barcelona. I'll talk about my work with Danny Stevenson on classifying spaces for 2-groups. My former student Derek Wise, now a postdoc at U. C. Davis, will talk about representations of 2-groups on 2-Hilbert spaces. Bruce Bartlett, whom I feel a kind of avuncular academic relationship to, will be speaking on representations of 2-groups on finite-dimensional 2-Hilbert spaces. Eugenia Cheng will also be there. Derek has never met these other great pals of mine, so I'm looking forward to that.

Plus, I've never been to Barcelona. I've read that it's the coolest city on the planet! So, it should be fun. I wish I could spend months there and get to know it... but I'll only stay a week and then go to Granada, where I'll hook up with Lisa. I've got to remember to get tickets to the Alhambra. That'll be great.

But right now I've got to prepare talks. Actually, right *now* I've got to *sleep*.

June 9, 2008

Okay, I've got one talk done — Classifying Spaces for Topological 2-Groups, for the Categorical Groups conference in Barcelona. I also have my talk ready for the next conference in Barcelona, namely Homotopy Theory and Higher Categories. I'll do that one on a blackboard, so I don't need to make slides — and I've already given this talk once. But now I want to prepare my talk for Algebraic Topological Methods in Computer Sciences III, which will take place sometime during July 7th-11th In Paris.

It's a hectic nuisance now, but if I get all these talks ready now, I can enjoy myself when I'm actually visiting these wonderful places, meeting people and seeing old friends.

Here's an interesting article by a traveler who urges us not to destroy delicate ecosystems by engaging in so-called "ecotourism":

- Dan Neil, Please don't go, *Los Angeles Times*, June 1, 2008.

It's a great example of "do as I say, not as I do". But just because someone is a hypocrite (or had a sudden change of heart) doesn't mean they're wrong. You can read more and discuss this issue here:

- Sarah Handel, No reservations, *Blog of the Nation*, June 9, 2008.

Personally I need to find ways to travel less. I think I should become more fussy about what invitations I accept, and stay at a few places for a long time instead of jetting around madly.

June 13, 2008

I finished my talk on Computation and the Periodic Table, which I'll give in Paris on July 7th as part of a conference on Algebraic Topological Methods in Computer Science. Tomorrow I leave for Barcelona &mdash the official beginning of summer! I've been frantically busy, but now the fun starts.

June 15, 2008

I made it to Barcelona okay, though my departure from Heathrow was delayed an hour because President Bush decided to visit Britain just then. Now I'm in the hotel, which has good wireless. I met Tim Porter, a mathematician I met in Bangor, and we'll have dinner at 9 pm with anyone we can round up. The city of Barcelona is beautiful!

(We wound up having dinner with Chenchang Zhu and a friend of hers — they're here for another conference, on integrable systems. After dinner they walked over to the sea, but I went to bed. I met Adrian Ocneanu in the lobby — he's developing an interesting generalization of Lie algebras, and maybe of quantum groups, by generalizing the McKay correspondence from quantum SU(2) to other quantum SU(n)'s. One gets a more general notion of "Dynkin diagram"; I found pictures of SU(3) examples on page 18 of Jean-Bernard Zuber's review article.)

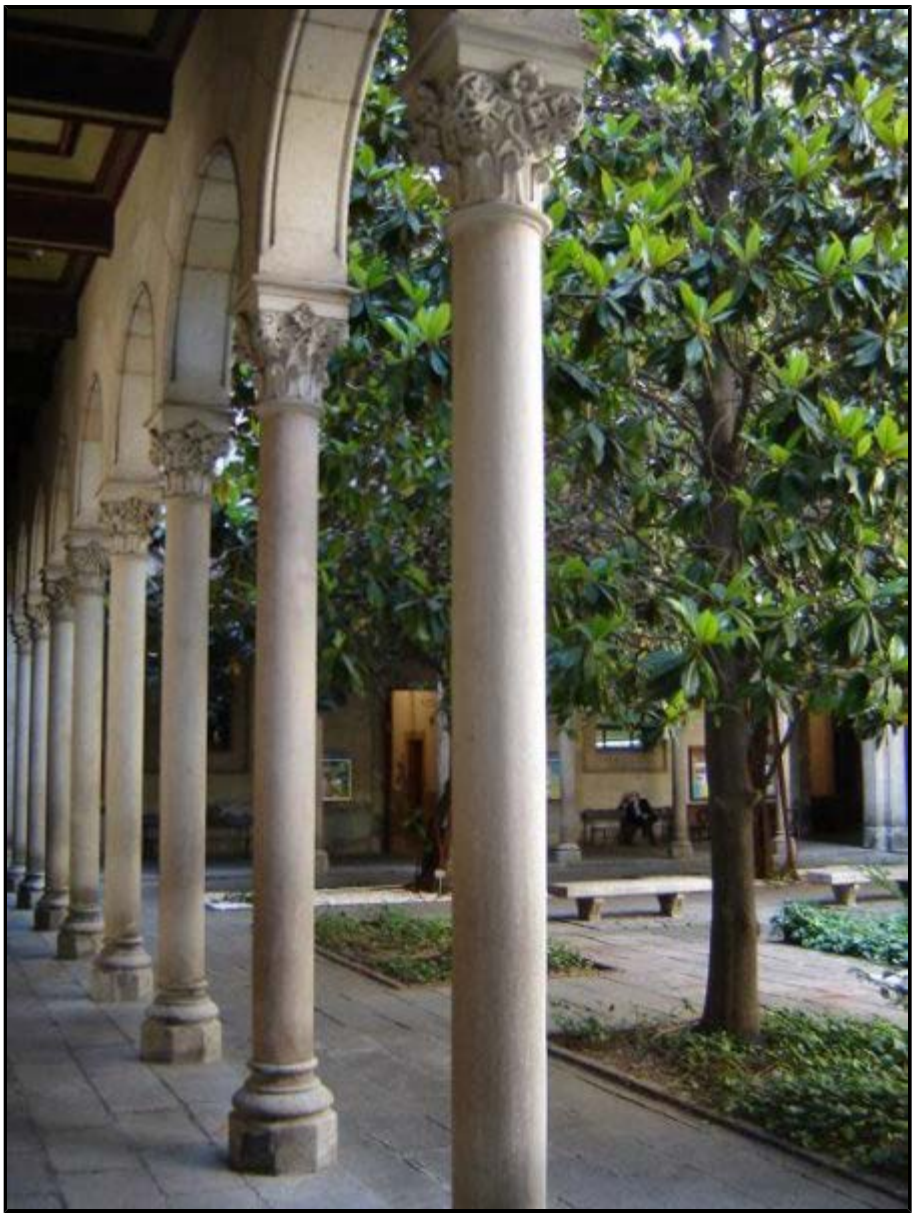
June 16, 2008

In rural Nepal they're starting to cook using charcoal briquettes made using an invasive forest-destroying weed instead of using wood. This means they're saving the forest instead of chopping it down, and the briquettes are smokeless so the home kitchens are healthier. Local women are making the briquettes and selling them. It sounds like a win-win situation:

- Sjoerd Nienhuys, The Beehive charcoal briquette stove in the Khumbu region, Bioenergy Lists: biomass cooking stoves.

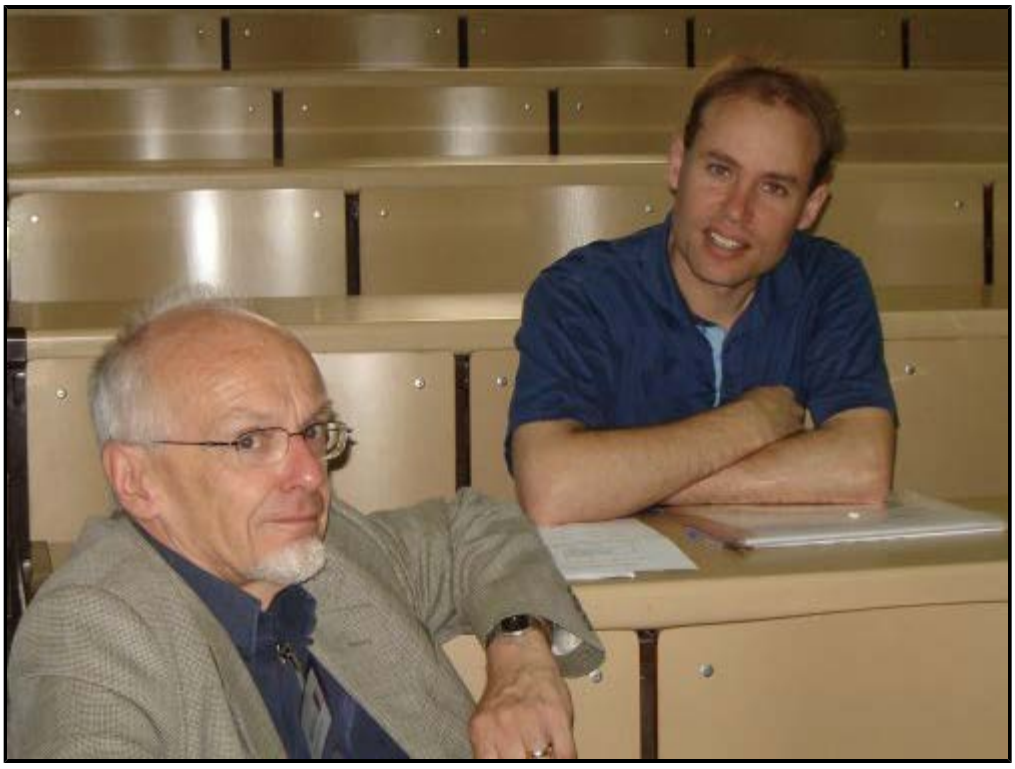
June 21, 2008

I wish my math department had a courtyard like the one here at the Universitat de Barcelona:



Still, it's great a place to visit, listen to talks about categorical groups, and speak with friends. I described some of the talks in week266. I had some really productive conversations with Derek Wise and Bruce Bartlett — we're starting to understand more deeply the beautiful geometry behind representations of 2-groups on higher Hilbert spaces. I'm tempted to include this new understanding in our paper, but it's taken forever to write already. Oh well.

Chenchang Zhu, with Carles Cascabuerta talking to student in background



Timothy Porter and Bruce Bartlett

Aurora del Río, Alain Rousseau, Pilar Carrasco and André Joyal
(photo by Tim Porter)

Derek Wise, John Baez and Bruce Bartlett at La Pedrada
(photo by Mathieu Anel)

June 18, 2008

Our math conference went on a field trip to La Pedrada, an apartment complex designed by Gaudi in the early 20th century. The exterior lines are curvy and "natural", like the rooftop decorations below, but the interiors are less far-out.

Overall I prefer the typical apartments of Barcelona.

Scene atop La Pedreda

Apartments in Barcelona

I'm staying in the Residència d'Investigadors southeast of the Plaça Catalunya. What language is this? *Català!* — or as I would usually say, Catalan. Yes, Barcelona is the thriving heart of Catalonia. I've been interested in Catalan and other lesser-known Romance languages ever since my visit to Nice, where I bumped into traces of the Occitan dialect called Nissart.

Near the Residència d'Investigadors there's a rest home for cats recovering from surgery... or so I've been assured, though one of my email correspondents remains dubious. All I actually *saw* was a fenced in yard full of listless cats next to the hospital:

If you know the full story, please contact me.

June 21, 2008

After the last talks, some of us met at 8 for dinner in a restaurant near the hotel. Afterwards Bruce Bartlett needed to pick up some cash at a cash machine; since he was a little nervous we started talking about crime, and a guy standing there said yeah, don't leave any valuables in your car: people will just smash the window and take them. They aren't locals; they're gangs that prey on tourists.

Then a few of us — Bruce Bartlett, Tim Porter, Alain Rousseau and a student of Bertrand Toen named Mathieu Anel — went to a bar. Mathieu took us to a bar famous from Hemingway's writings. Sadly, it was closed, so we walked on through increasingly seedy areas to find another. It was around 11 pm; some women who looked like prostitutes were displaying their wares, but many more people were standing or sitting on the sidewalks talking in small groups, shabby but not obviously disreputable. Guys were carrying around sixpacks of red cans, trying to sell what I inanely assumed was some sort of cola, but in fact beer. Not the sort of scene I'm used to. We found a bar with a soccer game on the TV in a back room but a reasonable place to talk in front. Tim Porter immediately went home, tired, but the rest of us talked politics and math until 1. On our way back we found the Hemingway bar was *open* and *packed*. We considered going in, but there was a bouncer in front regulating the inflow, and I was tired, so we decided not to.

June 22, 2008

I flew to Granada and took a bus to the center of town and then a taxi to the Carmen de la Victoria, a hotel for university guests at 9 Cuesta del Chapiz in the old city south of Albayzin.

It's a very beautiful old hotel, with trellises covered with wisteria and grapes, and fountains that burble away all day and even all night long. The rooms have heavy wood doors and cabinetry. But what makes it unique is its proximity to the Alhambra. Here's the view from my third-floor room on a clear cool morning before the sun roasts the city:

Lisa and I will tour the Alhambra on Wednesday. I've been waiting to do this for several years, after a near-visit that fell through. I've spent a lot of time reading Andalusian history, and I'm really psyched.

June 23, 2008

Lisa arrived at 1 am last night, her flight having been delayed 4 hours. I'm eager to tour Granada but she's catching up on sleep, so I'm writing my diary and watching swifts fly past the window. They're very common here; they swoop and dive solo or in packs with exuberant, seemingly unnecessary energy — as if motion was their natural state. Presumably they're catching insects, but it's hard to tell. They seem to like the big altitude gradients: the tall buildings on steep hills.

For me it's a joy to be in an urban environment dominated by some bird other than the pigeons and sparrows typical of American cities. I'm not a pigeon-hater: I commend their adaptability! I don't think they should be poisoned. But, they need some predators to keep their population under control.

Lately peregrine falcons have been moving into some urban environments, nesting on tall buildings and feeding on pigeons. Tim Porter, an avid bird-watcher, says there are six peregrine falcons in Barcelona. Each eats just one pigeon a day. That's not much! Will the falcon population increase until they make the pigeon population drop, or is there some other factor limiting the spread of falcons? Perhaps lack of suitable nesting spots?

June 23, 2008

I found my way to the Department of Algebra at the University of Granada and met my host, Pilar Carrasco. After a coffee with her and Antonio Garzón, I gave the first of two lectures on Lie 2-algebras. I started out with strict Lie 2-algebras, emphasizing their formal resemblance to strict 2-groups (also known as categorical groups). In the next lecture I'll switch to semistrict Lie 2-algebras, describe how they're classified using cohomology, give the string Lie 2-algebra as an example, and explain its relation to affine Lie algebras.

June 24, 2008

Together with Lisa's colleague Alicia and an artist named Paloma Fadón Salazar, we went first to a great tapas bar and then a truly delightful wine bar called La Bodequilla de al Lado. This place has room for only five or six people. It's run by a wonderful woman who will ask you what kind of wine you like, list choices and compare them intelligently and enthusiastically, writing the tab in chalk on the bar. Flamenco music is playing on an old record player.

The address of this place is Tendillas de Santa Paula 4, near the intersection with Calle de San Jeronimo, a few blocks from the Monasterio de Santa Paula. I hear the owner has a sister who runs a similar place called La Tana on Calle Rosario 9. Apparently they're both experts on flamenco and eager to talk about it (if you know Spanish).

June 25, 2008

Lisa and I went to the Alhambra: a magical, beautiful place. I've been waiting to see it for years. I took lots of pictures of tiles and someday I'll do a This Week's Finds about them. Here are a couple:

While touring the Alhambra, I became fascinated by the hydraulic technology so crucial to making this place what it is: a paradise of fountains, streams and gardens. Water was originally collected in cisterns and also carried up by hand... but the Alhambra bloomed only after Roman aqueduct technology was adapted to bring water from River Darro to water the gardens. The Arab name for an irrigation canal is "as-saqiya" in Spanish this became "acequia", and the dry regions of the New World once dominated by Spain still have elaborate acequia systems. At the Alhambra, construction of the Acequia Real was began sometime after Ibn Al-Nasr, founder of the last Muslim dynasty in Andalusia, worked out a a desperate deal with Ferdinand III of Castile, who had just invaded Cordoba: Ferdinand could also have Saville if Al-Nasr could keep control of Granada.

Like the Sierras in California, the snow pack in these Sierras is low this year, due to a drought. Pilar Carrasco says they resorted to artificial snow for the ski resorts near Granada this year. Meanwhile, in California, the snow pack started out promising but never got very big: it was a dry spring, and now wildfires are devastating northern California. Naturally I suspect global warming.

June 26, 2008

I gave my second talk on Lie 2-algebras, leading up to the string Lie 2-algebra associated to a simple Lie algebra. It went over well. This time I met Antonio Cegarra, one of the driving forces behind categorical groups and n-category theory at Granada. Cegarra and Carrasco are currently writing a paper on tricategories.

Lisa and I are getting into the habit of taking siestas after lunch, since it's really hot here during the day, with no air conditioning in most buildings. Then the Spanish habit of having dinner at 9 pm or later makes sense: the sun sets late, but then it cools down and becomes delightfully refreshing, as usual in dry climates.

While lying on the hotel bed in the afternoon, windows shuttered to keep out the blazing sun, sometimes I hear people practicing flamenco guitar or Arabic music. There's a renewed Arab presence in Granada due to immigrants from Morocco, who are very visible working at the falafel and kebab joints lining some streets in the touristy part of town. I hear there's ethnic tenion between them and the Spanish-speaking natives. I don't see much sign of that; the walls around here are covered with graffiti but I can't read most of it.

In the evening we hike along the steep narrow streets looking for good tapas bars, distracted by the views. Note the omnipresent swifts overhead:

In Andalusia, you often get a free tapas with every round of drinks; dinner comes as a gradual side-effect of a night on

the town. I've grown to like the roasted green peppers called pimientos del Padrón. Some people call these "Russian roulette" peppers. Most are mild, but supposedly one in ten is hot. However, I've only hit a single hot one in all my munching so far, and even that wasn't bad. Of course, I'm half Mexican and not easily impressed by hot foods.

Another great discovery was a drink called pacharan, which is made by soaking sloe berries, coffee beans and a vanilla pod in anisette. It's got a great flavor, and not terribly strong.

But when it's hot, there's nothing like cerveza con limón.

June 27, 2008

We had dinner with Pilar Carrasco and Lisa's colleague Alicia.

Earlier this week we picked up some CD's from a great little store. They're mostly put out by the obscure but magnificent Pneuma label. Lisa had already gotten ahold of one on her previous visit:

- Eduardo Paríagua and El Arabí Trio, *El Agua del Alhambra*, Pneuma.

It featured poems by Ibn al-Jatib (1313-1375), set to Andalusi music, with various different fountains in the Alhambra and the Generalife gardens gurgling or bubbling in various ways in the background of different pieces. Described this way, you may expect some goopy new age treacle, but the compositions are structurally cogent and the performers are rhythmically tight and serious about early music — especially, it seems, Eduardo Paríagua, who previously led an ensemble called Musica Antigua, and now manages the Pneuma label. He plays flute and percussion.

My favorite of the new crop is this one:

- Eduardo Paríagua, Waifr Sheik, Jamila Ghalmí and Luis Delgado, *Jardín de Al-Andalus*, Pneuma.

This is Arab-Andalusian music from Medieval Seville, consisting of maluf and moaxajas. Maluf is a style of Andalusian music now found in Tunisia — it made its way there as part of the massive Muslim exodus in the 13th century when the Christians conquered all of Spain except Granada. Moaxajas are a once popular style of Andalusian poem invented by Moadem ben Moafa of Cordova (840-920). Sung to music, they were carried by traders and travellers throughout the Muslim world: one practitioner of the art bragged that his moaxajas were sung in Baghdad just three months after he wrote them!

The album is peppy but gentle, mostly instrumental, dominated by lute but often backed by percussion. It features Wafir Sheik on lute, viola and other string instruments, Luis Delgado on percussion, and Eduardo Paríagua on flute, ney, flauta de caña and various still more obscure instruments, including percussion. The occasional singing is by Jamila Ghalmí.

June 29, 2008

Today Lisa and I flew from Granada back to Barcelona for a conference on Homotopy Theory and Higher Categories at the Centre de Recerca Matemàtica (CRM). We had arranged to come down to the front desk of the Carmen de la Victoria at 7:30 am and get a taxi to the airport, so we went to bed early... and woke at 1 am to the sound of a rock concert outside our window! A lousy group played set after set of songs by Queen, Buddy Holly, and the like, at maximum volume. After a few hours of this torture Lisa went down to complain; the man working the hotel desk was sympathetic but said the police never come when this happens. We read science fiction until 4:30, then fell asleep in a haze of noise.

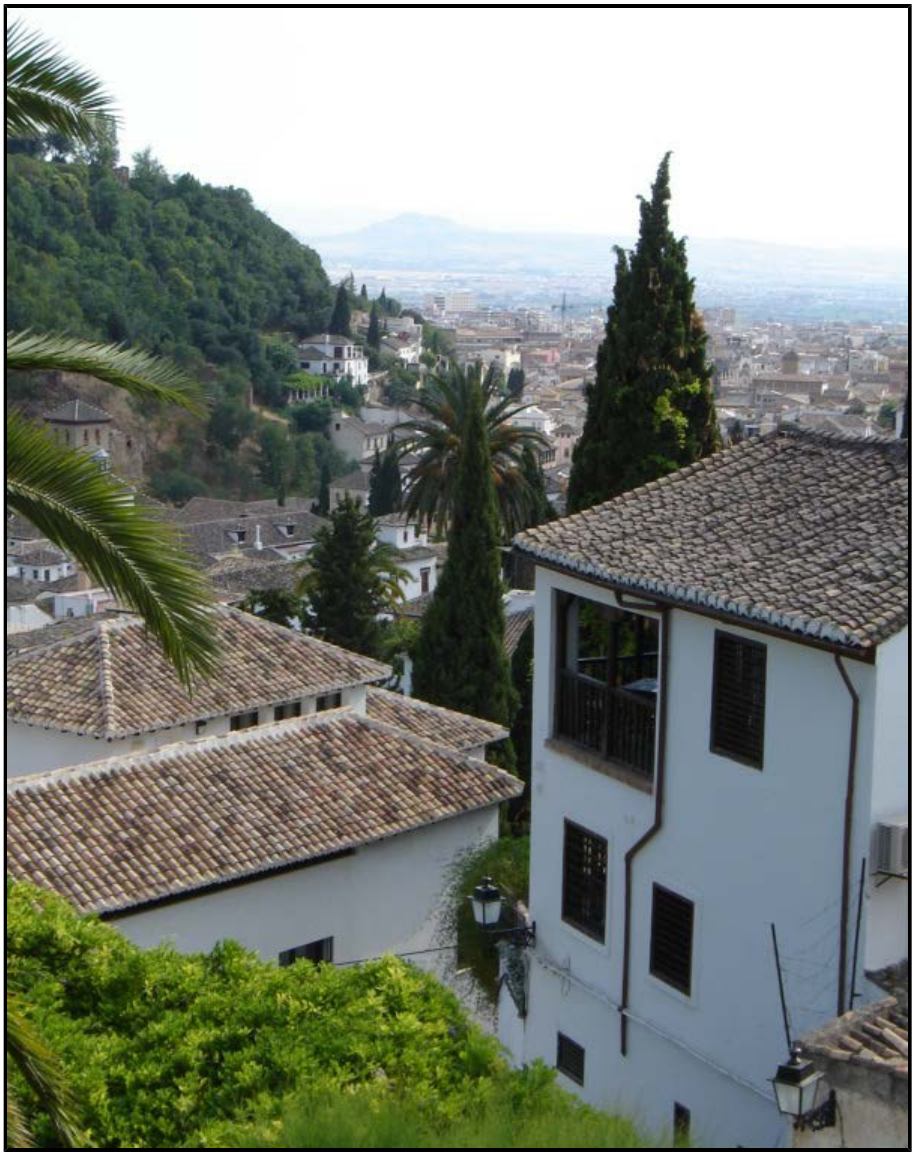
Now I know the band they'll hire to play in hell.

When the alarm rang, we groggily found our way to the SERHS Campus Hotel on the campus of the Universitat Autonoma de Barcelona (UAB) in Bellaterra, a suburb 18 kilometers north of Barcelona. The hotel refused to serve us lunch, even though there was a big buffet and lots of free tables: they said we needed to make reservations ahead of

time. They also refused to fix the broken wireless internet, saying it was the responsibility of the campus — and refused to give us a phone number for the campus, saying they'd contact the relevant officials themselves.

Later we discovered that this hotel is run by students at the hotel management school of the UAB.

Goodbye, Granada!



Granada: view from the Carmen de la Victoria

June 30, 2008

I bumped into Julie Bergner at breakfast and she helped me find CRM in the mammoth building that constitutes most of the campus here. I gave the first talk... a talk on groupoidification. Some people said they enjoyed it, but I was a bit intimidated by having André Joyal in the front row, since most of my *examples* of groupoidification were slight variants of his work on species. I felt I should have spent more time describing newer examples. But that's always how it goes: you have to decide how much you're going to educate and entertain the nonexperts, and how much you're going to impress the experts. Most mathematicians lean too far in the latter direction; I've made a committment to the former.

For my July 2008 diary, go here.

If white is the colour
of mourning in Andalusia,
it is a proper custom.

Look at me,
I dress myself in the white
of white hair
in mourning for youth. - Abu l-Hasan al-Husri (d. 1095)

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home

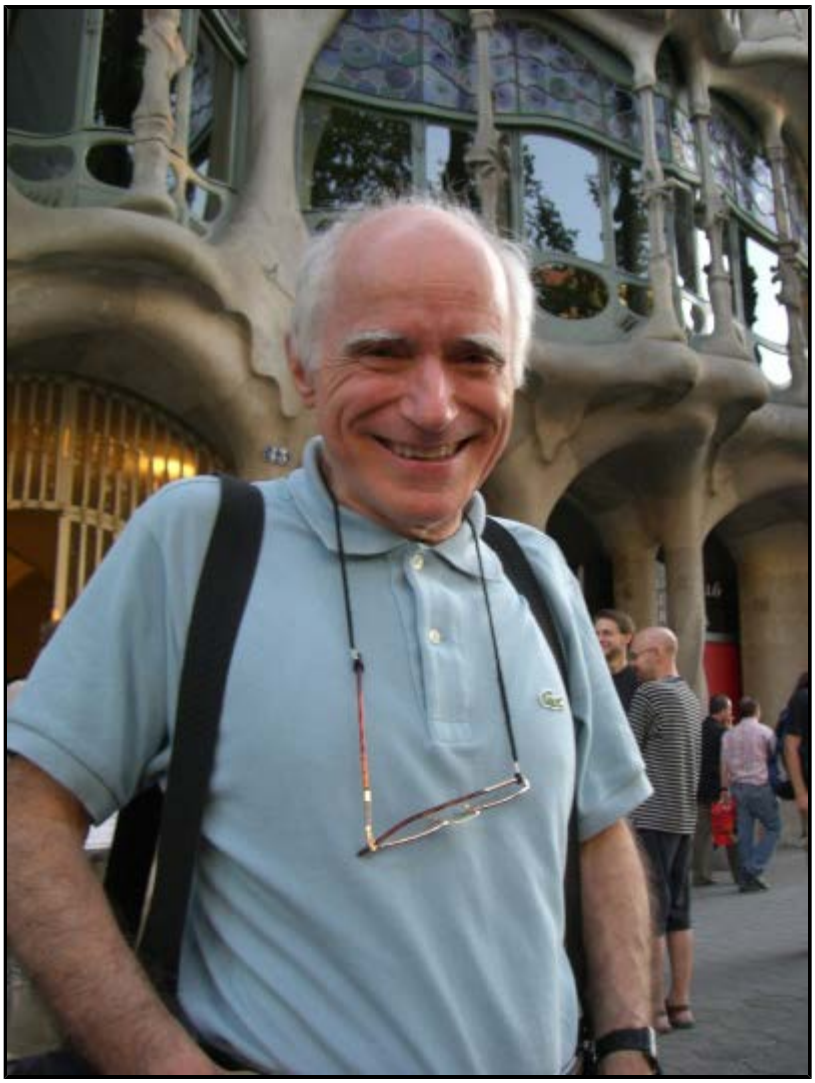
For my June 2008 diary, go here.

Diary - July 2008

John Baez

July 1, 2008

I'm at a conference on homotopy theory and higher categories in Barcelona. Here's my friend the category theorist Marco Grandis in front of a building designed by Gaudi:



Marco works on cubical n-categories and directed algebraic topology. Experts will recognize Mark Weber's impressive head in the background.

July 5, 2008

Having spent a little time wandering the old neighborhoods of Beijing, this book appeals to me:

- Michael Meyer, *The Last Days of Old Beijing: Life in the Vanishing Backstreets of a City Transformed*, Walker & Company, 2008.

I read a nice review of it in the *International Herald Tribune* today, flying from Barcelona to Paris.

July 6, 2008

Our apartment in Paris is magnificent, enormous. We're renting it from the same woman we rented from last year, but she sold that old place and got something far more grand, centrally located on Rue Soufflot. She's on vacation and needs someone to water the plants. If you lean out the balcony and look left, you see the Pantheon:

In the other direction, at street level, you can see the Jardin du Luxembourg, with the Eiffel Tower peeping above the trees:

The street itself is sometimes bustling with tourists, sometimes calm; there's an Italian ice cream store next to our front door. After a hotel room in Granada with a view of the Alhambra and this marvelous apartment in Paris, I can't help but feel it's all downhill from here. Did you ever get the feeling you're too lucky, and bound to pay for it later? The mortgage crisis, spiralling oil prices, and fires in California add to this sensation. I may look back on this as a charmed moment...

But no time for idle guilt today: I had to find the 89 bus to the monstrous towers of the Bibliothèque nationale de France and then an obscure location in Paris 7, where I gave a talk on Computation and the Periodic Table at a conference on Algebraic Topological Methods in Computer Science. I met my host at Paris 7, Paul-André Melliès. I also met Eugenia Cheng, Marco Grandis, Yves Lafont, Tim Porter and Mark Weber, all of whome had come from Barcelona. Sometimes I feel like part of a travelling circus troupe.

The conference was in a horrible concrete building that resembled a parking garage, with some walls painted orange. But, we made the best of it:

July 7, 2008

I enjoyed Rick Jardine's talk on path categories, and Paul-André's talk on a normalization theorem for the lambda calculus, which should have a nice interpretation in terms of 3-categories. I've *got* to get going with Mike Stay on categorification and the lambda calculus.

Later, Eugenia and I had a long talk on Steve Lack's paper on composing PROPs; you can see some of the results in a post at the *n*-Category Café.

July 13, 2008

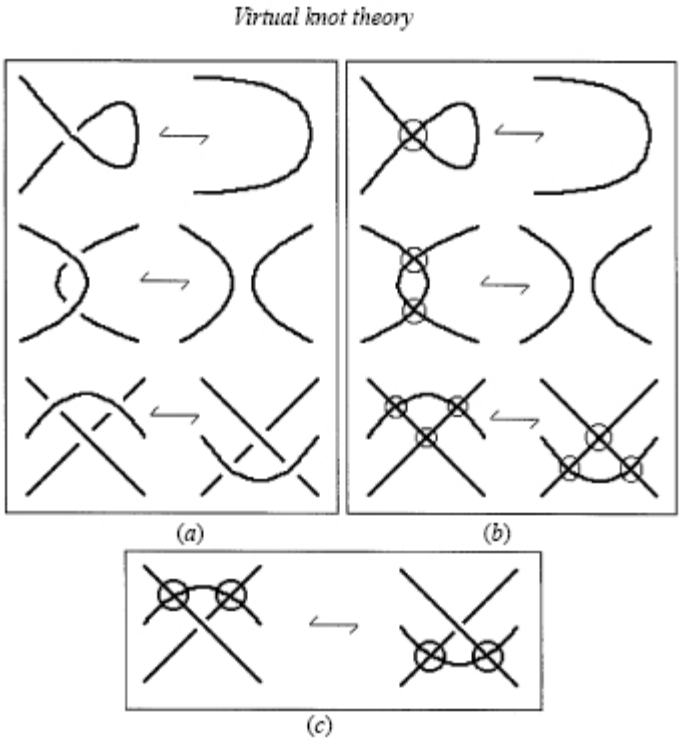
Today I flew to Lisbon for agregãço of Alexsandar Mikovic, who works on spin foam models of quantum gravity. An agregãço is a bit like what the Germans call a "habilitation": a further step after the doctorate. In Portugal you need to pass the agregãço to become a full professor.

I met Roger Picken and Louis Kauffman at my hotel just as I was checking in, and we went out to dinner. It reminded me a bit of the early 90's, when I went to Porto for Pickens' conferences on topological quantum field theory. I never met Kauffman at one of those, but we both often met Louis Crane and other mutual friends. Those were the heady early days of quantum topology, when higher categories first met physics.

July 14, 2008

In the morning Louis Kauffman gave a talk on virtual knot theory and I gave a talk on classifying spaces for topological 2-groups. In the afternoon we carried out the first phase of the agregãço, which required that Kauffman read Mikovic's resume and comment on it. Mikovic sat in a chair below while Kauffman and the other members of the jury sat on a raised stage behind a long table.

Kauffman and I had dinner and talked math. I'd like to understand the category theory underlying virtual knot theory. Abstractly, it seems to concern the free symmetric monoidal category on one object equipped X with a morphism R: X X → X X that satisfies the Yang-Baxter equation. This gives our category a braiding in addition to the original symmetry. We draw the new braiding as a crossing, and the original one as a "virtual crossing".

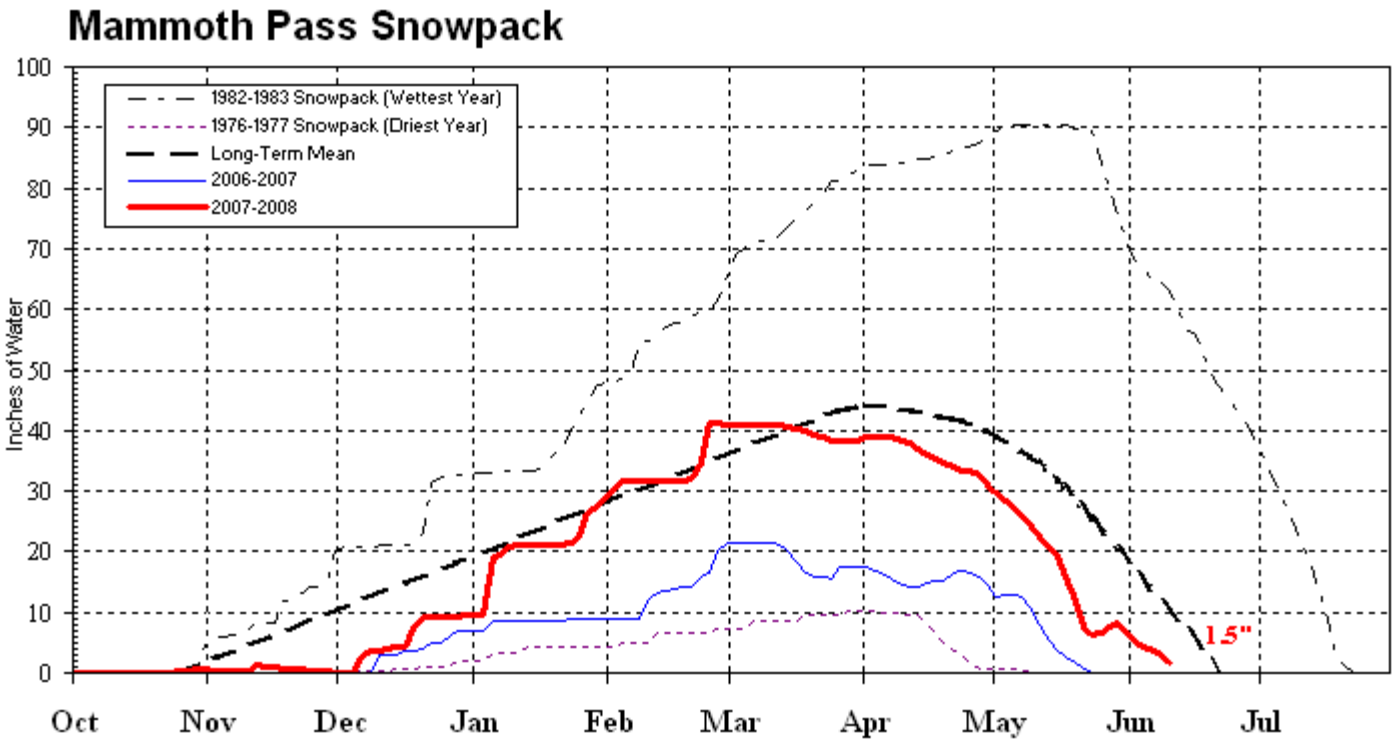


July 15, 2008

In the morning I had nice conversations with João Faria Martins and his wife Rachel Martins. I later wrote about João's work on week267, and I should learn about Rachel's work on double Fell bundles and write about that too.

In the afternoon we completed the agregãço, with Mikovic giving a talk on his research and me asking questions about it.

I should tell you about the weather in California! The snow pack in the Sierras started out promising this year, at least compared to last — and we had some nice rains down in Riverside. But overall, it fell short of the average:



This may have contributed to the fires this year. I haven't been saying much about these fires, because I'm in Europe and this year the fires are in the north, far from my home in Riverside. But, they've been enormous:

> **California Wildfires Set a Record**
>
> Mike Nizza, New York Times
> July 15, 2008
>
> Three weeks after lightning storms ignited an early start to California's wildfire season, a state official said history had been made this time around. From The Los Angeles Times:
>
> > "That has definitely surpassed any of our large fire events," said Daniel Berlant, a spokesman for the California Department of Forestry and Fire Protection.
>
> According to statistics from Mr. Berlant's agency, as many as 1,781 fires were burning at one point earlier in the battle; nearly 300 of them remain unquenched. In all, 861,385 acres were scorched by them, mostly in the northern part of the state. (A map shows where).
>
> Because this year's fires were mainly in sparsely populated rural areas, the biggest fire season has by no means been the most destructive, at least so far. Last year's wildfires in southern California prompted the "largest evacuation in California's history" and destroyed at least 1,800 homes.
>
> By contrast, this year's batch has mostly torn through forests, claiming only about 100 homes and prompting evacuation orders on a much smaller scale. Still, several populated areas did come under threat, including Big Sur, the mostly high-end tourist destination on the central coast. It was cleared in early July after a stubborn fire intensified.

July 17, 2008

From a speech by Al Gore:

Ladies and gentlemen:

There are times in the history of our nation when our very way of life depends upon dispelling illusions and awakening to the challenge of a present danger. In such moments, we are called upon to move quickly and boldly to shake off complacency, throw aside old habits and rise, clear-eyed and alert, to the necessity of big changes. Those who, for whatever reason, refuse to do their part must either be persuaded to join the effort or asked to step aside. This is such a moment. The survival of the United States of America as we know it is at risk. And even more — if more should be required — the future of human civilization is at stake.

I don't remember a time in our country when so many things seemed to be going so wrong simultaneously. Our economy is in terrible shape and getting worse, gasoline prices are increasing dramatically, and so are electricity rates. Jobs are being outsourced. Home mortgages are in trouble. Banks, automobile companies and other institutions we depend upon are under growing pressure. Distinguished senior business leaders are telling us that this is just the beginning unless we find the courage to make some major changes quickly.

The climate crisis, in particular, is getting a lot worse — much more quickly than predicted. Scientists with access to data from Navy submarines traversing underneath the North polar ice cap have warned that there is now a 75 percent chance that within five years the entire ice cap will completely disappear during the summer months. This will further increase the melting pressure on Greenland. According to experts, the Jakobshavn glacier, one of Greenland's largest, is moving at a faster rate than ever before, losing 20 million tons of ice every day, equivalent to the amount of water used every year by the residents of New York City.

Two major studies from military intelligence experts have warned our leaders about the dangerous national security implications of the climate crisis, including the possibility of hundreds of millions of climate refugees destabilizing nations around the world.

Just two days ago, 27 senior statesmen and retired military leaders warned of the national security threat from an "energy tsunami" that would be triggered by a loss of our access to foreign oil. Meanwhile, the war in Iraq continues, and now the war in Afghanistan appears to be getting worse.

And by the way, our weather sure is getting strange, isn't it? There seem to be more tornadoes than in living memory, longer droughts, bigger downpours and record floods. Unprecedented fires are burning in California and elsewhere in the American West. Higher temperatures lead to drier vegetation that makes kindling for mega-fires of the kind that have been raging in Canada, Greece, Russia, China, South America, Australia and Africa. Scientists in the Department of Geophysics and Planetary Science at Tel Aviv University tell us that for every one degree increase in temperature, lightning strikes will go up another 10 percent. And it is lightning, after all, that is principally responsible for igniting the conflagration in California today.

Like a lot of people, it seems to me that all these problems are bigger than any of the solutions that have thus far been proposed for them, and that's been worrying me...

Yet when we look at all three of these seemingly intractable challenges at the same time, we can see the common thread running through them, deeply ironic in its simplicity: our dangerous over-reliance on carbon-based fuels is at the core of all three of these challenges — the economic, environmental and national security crises.

We're borrowing money from China to buy oil from the Persian Gulf to burn it in ways that destroy the planet. Every bit of that's got to change...

But if we grab hold of that common thread and pull it hard, all of these complex problems begin to unravel and we will find that we're holding the answer to all of them right in our hand.

The answer is to end our reliance on carbon-based fuels.

Today Lisa and I went to the Musée du Cluny, which is very close by. A real gem! I enjoyed the special exhibit on Islamic art and its influence on Spain, borrowed from the Louvre, but the permanent collections were also great. The symbolism of the Lady and Unicorn tapestries was much more complex and interesting than I'd suspected. Almost like a Buddhist metaphor of transcending the senses.

I also didn't know they used dodecahedral dice in the Middle Ages. Lisa took this picture, which I may add to my talk on the dodecahedron someday:

July 18, 2008

I was quoted in this article about a very tricky subject, namely the vacuum:

- Tim Folger, Nothingness of space could illuminate the theory of everything, *Discover*, July 18, 2008.

To my great relief the quotes are sensible and throw cold water on some ideas that deserve a healthy splash. Science reporters often seek sensational stuff; I'm trying to learn the art of making quotable remarks that *deflate* overblown ideas.

I was also quoted in the same issue of *New Yorker* magazine that featured a controversial cartoon of Barack Obama and his wife on the front cover. This was for an article on Garrett Lisi and his much-hyped "theory of everything" based on the group E_8. My quote wasn't anything I actually said, but I'd failed to veto it forcefully enough at the fact-checking stage.

Lisa and I went shopping at the open-air market at the east end of Saint-Germain. It turns out they still eat horses in Paris, though the history of this practice is a bit obscure:

"Boucherie chevaline", or horse butcher, in the Latin Quarter of Paris

But, we didn't buy any horse meat. Instead we bought the makings for a particularly charming dinner of leek soup, frisée salad, sausage and chèvre, backed by a baguette.

Great ingredients make for great simple meals — that's the way of Provençal cooking. Another tradition, of fancy Parisian cuisine with lots of sauces, apparently arose as a way of dealing with food that was beginning to go bad.

July 23, 2008

Paul-André organized a little microconference at Paris 7 today:

- 10h – Mark Weber: A tutorial on monads with arities
- 11h – Nicolas Tabareau: Computing free models as Kan extensions
- 14h – John Baez: Groupoidification

- 15h – Dimitri Ara: Weak infinity-categories: Grothendieck versus Batanin
- 16h30 – Samuel Mimram: A tutorial on polygraphs and their applications to semantics
- 17h30 – Jonas Frey: a 2-dimensional adjunction between triposes and toposes

Alan Weinstein, Yvette Kosmann-Schwarzbach and Jamie Vicary came by to hear my talk. Jamie is spending the weekend here.

July 24, 2008

After espresso and a croissant at Escritoire — Lisa's favorite café in the courtyard of the Sorbonne — we stayed home and worked all day. Lisa worked on an entry about Taoism and Greek philosophy for the forthcoming *Oxford Companion to Taoist Philosophy*. I worked on two nearly-finished papers, on smooth spaces and categorified classical mechanics.

July 26, 2008

In the morning, Jamie Vicary and I had a nice conversation about commutative Frobenius algebras and how they link the classical and quantum worlds. I've long been interested in commutative Frobenius algebras, since they give rise to 2d TQFTs, but this is strangely *different* role for them. And, Jamie's ideas were especially interesting to me since Paul-André just explained to me some of Ross Street's results on "Frobenius pseudomonoids", which can be seen as categorified Frobenius algebras. For example, he shows a pseudomonoid is Frobenius iff it's *-autonomous. Since *-autonomous categories play a biggish role in logic, something interesting must emerge if we can sort out everything that's going on here.

To add to the stew, my former student (if I may call him that) Aaron Lauda has obtained Frobenius pseudomonoids from categorified ambidextrous adjunctions, and related both of these to 3d topology. I think I see a glimpse of some wonderful patterns, very tantalizing because I don't quite understand them.

July 27, 2008

We had Henry Crapo and a friend of his over for dinner. Henry is an expert on incidence geometry who has worked with my pal Bill Schmitt on using Hopf algebras to study matroids. He has a large house in Montpellier, and he's thinking of holding an informal conference next summer on Hopf algebras in quantum field theory... or something like that.

After dinner we walked over to the Île de Saint-Louis to get ice cream at our favorite place: Berthillon's. They've got some far-out-flavors: I had a scoop of the praline-and-coriander. Yum! Sounds weird, but it's great.

Île de Saint-Louis

The Île de Saint-Louis is one of two islands in the Seine right in the heart of Paris. On our way back home we took a bridge over to the other: the le de la Cité. This is the site of the Notre Dame cathedral, always packed with tourists. Henry led us down some steps to a plaque commemorating Jacques de Molay, the last Grand Master of the Knights Templar, who was burned at the stake on the Île de la Cité in 1314.

Here's one of those views every visitor to Paris sees:

Île de la Cité

July 30, 2008

As I get older, I'm more susceptible to the charm of nostalgia for old technology. Imagine the days when letters were sent using pigeons! They were the fastest method of sending a message from at least 2900 BC to the invention of the telegraph in 1844. From Wikipedia:

> Before the telegraph this method of communication had a considerable vogue amongst stockbrokers and financiers. The Dutch government established a civil and military system in Java and Sumatra early in the 19th century, the birds being obtained from Baghdad. In 1851, the German-born Paul Julius Reuter opened an office in the City of London which transmitted stock market quotations between London and Paris via the new Calais to Dover cable. Reuter had previously used pigeons to fly stock prices between Aachen and Brussels, a service that operated for a year until a gap in the telegraph link was closed.
>
> Details of the employment of pigeons during the siege of Paris in 1870-71 led to a revival in the training of pigeons for military purposes. Numerous societies were established for keeping pigeons of this class in all important European countries; and, in time, various governments established systems of communication for military purposes by pigeon post. After pigeon post between military fortresses had been thoroughly tested, attention was turned to its use for naval purposes, to send messages to ships in nearby waters. It was also used by news agencies and private individuals at various times. Governments in several countries established lofts of their own. Laws were passed making the destruction of such pigeons a serious offense; premiums to stimulate efficiency were offered to private societies, and rewards given for destruction of birds of prey. Before the advent of radio, pigeons were used by newspapers to report yacht races, and some yachts were actually fitted with lofts.
>
> During the establishment of formal pigeon post services, the registration of all birds was introduced. At the same time, in order to hinder the efficiency of the systems of foreign countries, difficulties were placed in the way of the importation of their birds for training, and in a few cases falcons were specially trained to interrupt the service war-time, the Germans having set the example by employing hawks against the Paris pigeons in 1870-71. No satisfactory method of protecting the weaker birds seems to have been developed, though the Chinese formerly provided their pigeons with whistles and bells to scare away birds of prey. However, as radio telegraphy and telephony were developed, the use of pigeons became limited to fortress warfare as early as in the 1910s. As an example, the British Admiralty discontinued its pigeon service in the early 20th century, although it had attained a remarkably high standard of efficiency. Nevertheless, large numbers of birds were still kept at the great inland fortresses of France, Germany and Russia at the outbreak of the First World War.

Here in Paris, let us take this moment to salute the brave pigeons that defended this city against the Germans and their hawks during the Franco-Prussian war!

> The pigeon post which was in operation while Paris was besieged during the Franco-Prussian War of 1870-1871 is probably the most famous. Barely six weeks after the outbreak of hostilities, the Emperor Napoleon III and the French Army of Chalons surrendered at Sedan on 2nd September 1870. There were two immediate consequences: the fall of the Second Empire and the swift Prussian advance on Paris. As had been expected, the normal channels of communication into and out of Paris were interrupted during the four-and-a-half months of the siege, and, indeed, it was not until the middle of February 1871 that the Prussians relaxed their control of the postal and telegraph services. With the encirclement of the city on 18th September, the last overhead telegraph wires were cut on the morning of 19th September, and the secret telegraph cable in the bed of the Seine was located and cut on 27th September. Although a number of postmen succeeded in passing through the Prussian lines in the earliest days of the siege, others were captured and shot, and there is no proof of any post, certainly after October, reaching Paris from the outside, apart from private letters carried by unofficial individuals. For an assured communication into Paris, the only successful method was by the time-honoured carrier-pigeon, and thousands of messages, official and private, were thus taken into the besieged city.

July 31, 2008

Alex, Chris and I came closer to finishing our paper on 2-plectic geometry. Later Paul-André came by and we continued dreaming of a grand scheme linking categorified Frobenius algebras to logic and topological quantum field theory. It's nice that our thoughts are converging...

Here's a poem by John Ashbery:

Some Trees

These are amazing: each
Joining a neighbor, as though speech
Were a still performance.
Arranging by chance

To meet as far this morning
From the world as agreeing
With it, you and I
Are suddenly what the trees try

To tell us we are:
That their merely being there
Means something; that soon
We may touch, love, explain.

And glad not to have invented
Some comeliness, we are surrounded:
A silence already filled with noises,
A canvas on which emerges

A chorus of smiles, a winter morning.
Place in a puzzling light, and moving,
Our days put on such reticence
These accents seem their own defense.

For my August 2008 diary, go here.

The hand holds no chalk
And each part of the whole falls off
And cannot know it knew, except
Here and there, in cold pockets
Of remembrance, whispers out of time. - John Ashbery

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home

For my July 2008 diary, go here.

Diary - August 2008

John Baez

Statue in Jardine du Luxembourg

August 2, 2008

Yay! Alex, Chris and I put our paper about categorified symplectic geometry on the arXiv! I hope this will be the beginning of a larger exploration of the interface between categorification and classical mechanics. Chris Rogers may work more on this.

Ken Caldeira thinks the most practical way to fight global warming is putting lots of sulfur dioxide into the upper atmosphere:

- Chris Mooney, Can a million tons of sulfur dioxide combat climate change?, *Wired*, June 23, 2008.

Lots of people don't like this idea, for some obvious reasons. Once we get into geoengineering, we'll have a whole new level of responsibility for not screwing up... and no real way to practice and get things right before trying things. But, in some sense we've already *gotten* into geoengineering by cutting down forests, killing large land mammals, overfishing

and burning vast amounts of buried carbon. As Thom Yorke said:

> To me, it's like spinning plates: I'm not sure how long we can keep this trick going.

An example: one-third of the more than 700 species of reef-building corals are threatened with extinction. A decade ago only 2% of corals species were endangered... but over the last 50 years, we've lost about a quarter of all reefs, and we can expect more to go.

- Bryan Walsh, Coral reefs face extinction, *Time*, July 11, 2008.

August 3, 2008

Our landlady is back from her travels. So, today we moved out of our magnificent apartment to a small studio around the corner, at 6 Rue Victor Cousin, right behind the Hotel de la Sorbonne. The building is very old, as witnessed by a wooden beam running across the room, but it's been broken up into small flats and modernized. Our place is mysteriously hot, and rather cramped, but Paul-André managed to make it seem quite romantic. His first words on entering were:

> Ah! A *love nest!*

This became a running joke between Lisa and me for the rest of our stay.

August 4, 2008

Now the truth can be revealed: together with my graduate students Alex Hoffnung, John Huerta, Chris Rogers and Christopher Walker, I applied for an received a grant from the Foundational Questions Institute, for a project on categorifying fundamental physics. This will allow these students to spend more time doing research for the next two years.

August 6, 2008

Paul-André and I have been meeting regularly at Café Rostand across from the Luxembourg Garden. He brings with him a Mac and an enormous artist's sketchpad on which he draws string diagrams. We're trying to understand computation and logic using higher categories, a project I've been working on with Mike Stay ever since the fall of 2006. To do this I want to understand such things as "the free cartesian closed 2-category on a lambda-theory", in which 2-morphisms are processes of computation. Paul-André instantly brought a higher level of sophistication to the project, since he's been working for quite a while on rewrite rules and game semantics in proof theory. So, we're now engaged in some fascinating explorations.

Today I took a break and wrote up some of what I've learned in "week268" of This Week's Finds. I'm particularly fascinated by the mysterious relation between propositional logic and 2d topological quantum field theories!

August 8, 2008

This evening we went to the Louvre with Paul-André and his daughter; they're open late on Fridays. We saw a lot of Greek, Etruscan and Egyptian art. It made me want to learn more history! I was especially struck by the sophistication of some Etruscan stautes dating back to the 8th century BC. They have a liveliness and informality that seemed so different from the formality of most, say, Egyptian or Babylonian art of the time. What were the Etruscans *like?*

But then I saw a cute little Egyptian statue of a cat playing with a kitten... so, clearly not all their art was the monumental serious religious stuff we're used to seeing.

August 11, 2008

We'd only been able to lease our studio apartment until the 11th, so today we moved to an even smaller place around the corner: a room at the Hotel des Trois Colleges on Rue Cujas. It's sort of sad moving to ever smaller places — it's like we're gradually leaving Paris, a bit at a time — but it has the advantage of making me eager to return home.

We've been walking around more on the right bank.

August 15, 2008

Back home in smoggy Southern California. Our garden is fine except for a dead jasmine plant and some ground cover and tomato plants that had mysteriously vanished — our gardener must have gotten rid of them. The century plant is doing great.

It's time to get a lot of work done!

August 19, 2008

If you're one of the people who is saddened by the decline of popular science magazines *Scientific American* and *The New Scientist*, I strongly urge you to subscribe to *American Scientist*. It's great! There's a wonderful article in the latest issue:

- David Sloan Wilson and Edward O. Wilson, Evolution for "the good of the group", *American Scientist*, September-October 2008, 380-389.

It re-evaluates the case for group selection, the idea that natural selection can lead organisms to evolve traits that are good for some group to which they belong, even if these traits come at their own personal expense. By the middle 1960s, this idea had gotten a bad rap. Evolutionary biologists tended to emphasize that evolution was all about the

replication of individuals — or in fact, individual genes. A gene "succeeds" if it manages to create lots of copies of itself; higher-level abstractions such as the success of a "group" don't count for anything. Altruism must be explained by phenonena such as kin selection: you'll risk death for your sister or brother since they have half your genes.

David Wilson has recently been pushing for a more nuanced view called multilevel selection. Groups of different sizes — cells made of organelles, organisms made of cells, families made of organisms, herds or tribes made of families, species made of herds or tribes — can succeed and propagate *as groups* thanks in part to altruistic behavior of their constituents. As the Wilsons (themselves a family group!) put it:

> These interacting layers of competition and evolution are like Russian matryoshka dolls nested one within another. At each level in the hierarchy, natural selection favors a different set of adaptations. Selectrion between individuals within groups favors cheating behaviors, even at the expense of the group as a whole. Selection between groups within the total population favors behaviors that increase the relative fitness of the whole group — although these behaviors, too, can have negative effects at a still-larger scale. We can extend the hierarchy downward to study selection between genes within a single organism, or upward to study selection betwen even higher-level organisms.

They present some fascinating evidence involving slime molds, termite colonies, biofilms formed by the bacterium *Pseudomonas fluorescens*, and so on. And, there are some downright scary experiments:

> William Muir of Purdue University compared two kinds of selection for egg productivity in hens. The hens were kept in cages, with several hens per cage. In the first experiment, the most productive hen within each cage was selected to breed the next generation (within-group selection). In the second experiment, all hens within the most productive cages were used to breed the next generation (between-group selection). In the first experiment, the most productive hen in each cage achieved her productivity largely by bullying the other hens. After six generations, a hyper-aggressive strain had been produced, with hens plucking each other's feathers in incessant attacks that were sometimes fatal. Egg productivity plummeted over the course of the experiment, even though the most productive hens had been chosen in every generation. In the second experiment, group-level selection resulted in a docile strain of hens, and egg productivity increased 160 percent in six generations.

(Why does the first experiment remind me of conservative talk radio shows in the US?)

I'm sure the arguments about the unit of selection are just starting; it's a very slippery subject. Someday I hope mathematicians will get interested in "games with ill-defined players": players that can themselves be loosely defined alliances of other players.

August 20, 2008

The Bush administration continues its criminal habits: now it seems that up to 225 days of White House email have been "lost". These emails have been sought for *months*, since they're important in a number of investigations. But, we won't be seeing them anytime soon:

> Washington (AP) - The White House is missing as many as 225 days of e-mail dating back to 2003, according to an internal draft document obtained by The Associated Press.
>
> The nine-page document invites companies to bid on a project to recover the missing messages. It outlines a process in which contractors would try to retrieve lost e-mail from 35,000 disaster recovery backup tapes dating back to October 2003. The period covers such events as growing violence in Iraq, the Abu Ghraib prison scandal and the probe into the disclosure of a CIA operative's identity.
>
> The project would apparently not include backup tapes going back to March 2003, even though an earlier White House assessment suggested e-mails were also missing from that period.

> The work would be carried out through April 19th, 2009, according to the request by the Office of Administration for contractors' proposals, which was dated June 20th.
>
> Last week, the White House declined to comment on the document.
>
> Earlier today, the White House said only that the information is "outdated and seriously inaccurate."

Also check out the Sierra Club's list of eco-heroes: civil servants trying to do their jobs and protect the environment, who were either forced to quite, or were fired by Bush and his cronies. A typical case:

> WHAT WENT WRONG: Asked by his superiors to assess a proposal to divert water from the Klamath River to downstream farmers, Mike Kelly argued that threats to endangered coho and chinook salmon and other protected species made the plan illegal. He was overruled by the "God Squad," a committee appointed by Vice President Dick Cheney to allow emergency exemptions to the Endangered Species Act. The irrigation plan went forward, resulting, in 2002, in a river choked with 70,000 dead salmon.
>
> THE HEAVY: Former Interior secretary Gale Norton and Cheney's "unseen hand."
>
> THE PRICE: Faced with political interference, Kelly resigned in 2004 and now works as a private environmental consultant.

Limulus polyphemus, the horseshoe crab

On a happier note: people are working to save the horseshoe crab on the Atlantic coast of the US, and it may be working!

- Jennifer Uscher, Jurassic Beach, *Nature Conservancy Magazine*, Summer 2008, 34-43.

The horseshoe crab goes back way before the dinosaurs: it's an arthropod but it's more closely related to spiders, ticks and scorpions than crabs. Spiders, ticks and scorpions — do I hear you say *yuck?* That's not fair They may look scary, but horseshoe crabs are harmless — in particular, their tail doesn't have a stinger. And, their immune system uses Limulus amebocyte lysate, a chemical that's now used in an important test for bacterial toxins. A horseshoe crab can be worth $2500 over its lifetime for periodic blood extractions!

There are lots of threats to horseshoe crabs. Fisherman chop them up and use them as bait — in fact they're sold for this purpose, for just $1 each. And every year, about 10% of horseshoe crabs die when surf flips them on their back and they can't succeed in righting themselves.

So: Just flip 'em! Not by the tail, though.

Another cool thing about horseshoe crabs is that their blood uses hemocyanin instead of hemoglobin. So: copper instead of iron! I'm not sure if that's true of *all* arthropods, or just some. Like all arthropods, they also have an open circulatory system: there's no distinction between blood and the interstitial fluid between cells.

August 21, 2008

The Weaire-Phelan structure is in the news:

Another interesting article:

- Vaclac Smil, Water news: bad, good, and virtual, *American Scientist*, September-October 2008, 399-407.

  A rational approach to food takes into consideration the water used from planting to production to harvest to animal husbandry to distribution to the table and to the garbage. In western countries, this process is remarkably inefficient for a variety of reasons. First, and perhaps foremost, the average U.S. citizen "consumes" 3,900 kilocalories per day, far more than the 1,500 to 2,900 kilocalories per day needed for good health. Of this, some 35 to 45 percent goes to waste — enough to supply 80 percent of the typical Bangladeshi's diet. Altogether, this amounts to about 5,000 liters of virtual water per day per person, distributed between water to grow plants that are in turn fed to animals, which are then fed to human beings, who deposit at least a third in the garbage. The author argues that simply by practicing *sensible carnivory* (reducing meat eating by 30 percent), U.S. and European Union residents could eliminate the need for about 250 cubic kilometers of virtual water per year.

Virtual water is perfectly real: it's just a name for the total amount of water used to accomplish something. It's a term invented in the 1990s by John Anthony Allan of the School of Oriental and African Studies at the University of London.

On another front, Infinera and Luxtera are coming out with integrated *optical* circuits — that is, roughly, chips based on photonics instead of electronics. So far these chips have at most 100 optical circuits each. But wait and see...

There's a new album by two of my favorite musicians: David Byrne and Brian Eno. It's called *Everything That Happens Will Happen Today*. And, it's free online!

In fact you can listen to it right *here:*

The world is so cool...

Some reviewers think the song "I Feel My Stuff" is too weird. I think it's great. It's got that chilly piano that Eno used on "Iced World" — but now mixed with a funky back beat and utterly insane lyrics sung with complete conviction by Byrne. Then comes the Brazilian samba-esque chorus of Eno singing "deh, deh-deh, deh-deh deh". Then an aggressive horn section joins in... and then we get a blistering guitar solo. What more could you want from a song? 

But, this song is actually very different from most on the album. Most of them have suspiciously simple, folky, uplifting harmonies — they call it "electronic gospel". The album is utterly, totally different from their last one, the world-shattering *My Life in the Bush of Ghosts*, so if you're looking for some sort of repeat of that, forget it.

If you can't stand listening to this new album, you may still have fun reading about it:

- John Pareles, Together again in different time zones, *New York Times*, August 15, 2008.
- John Doran, David Byrne and Brian Eno talk about new album, *The Quietus*, August 4, 2008.

August 24, 2008

We got our last Sunday edition of the *Los Angeles Times* today. We'd been subscribing for years, but today came the straw that broke the camel's back.

The *LA Times* used to be a great paper. It was a key part of our morning routine: I'd get up, make coffee and bring in the paper, and Lisa and I would read it while talking and listening to the NPR's morning news show.

But in 2000, the *LA Times* was bought by the same company that owns the *Chicago Tribune*, and they began rounds of cutbacks and layoffs in a misguided attempt to combat the effects of gradually declining subscriptions. John Carroll, former editor of the *Baltimore Sun*, was brought in to edit the paper. During his reign he eliminated more than 200 jobs — but that wasn't enough for the Tribune Company. The *LA Times* was making a profit — but not enough to make the Tribune Company happy. The *LA Times* was only making 20% profits, while the *Chicago Tribune* was making 30% profits.

John Carroll resigned in 2005 after refusing to make still more cutbacks, and he was replaced as editor by Dean Baquet. The *LA Times* was still great during this era: its investigative journalism won more Pulitzer prizes than any other paper than the *New York Times*. There were often more interesting articles than I had time to read.

But in November 2006, Baquet was himself ousted for not meeting the demands of the Tribune Group. He was replaced by James O'Shea.

Sometimes when you take a job, you deserve what you get. On January 20th of this year, James O'Shea was fired by publisher David Hiller after refusing to make $4 million more in cuts.

And then, on July 14th, while I was in Europe obliviously enjoying myself with my subscription to the *Times* on hold, David Hiller himself resigned. The editor of the Chicago Tribune, Ann Marie Lipinski, resigned on the same day. Why? Perhaps because the *Times* was slated for further cuts: 250 more positions gone, including 150 in the newsroom.

Now, for a long time, the book review section is the first thing Lisa reaches for on Sunday mornings — simultaneously with a cup of coffee. She continued doing this even as this section gradually shrank to a pale shadow of its former self. Earlier this year, it was ignominiously merged with the "opinion" section — a collection of editorials and political cartoons that once was a proud section of its own. The two were stuck back-to-back, each one upside-down with respect to the other, so you had to flip the darn thing midway while reading it. Still, that is what she read first.

I began to feel sorry for Lisa. There's a special kind of pity you feel for someone who respects a once noble institution after it's gone bad and ceases to return that respect. I suggested quitting our subscription, but Lisa convinced me that newspapers should still be supported. You can get your news off the internet, she said, but there still need to be reporters somewhere to get this news. I agreed: the *Los Angeles Times* was going through bad times, but it had good journalists, so there was always a chance that it could recover. We decided to wait and see.

There were lots of rumors that some rich Los Angeles moguls would get together, buy the *Times*, and restore it to its former glory. But on April 2nd, the Tribune Company sold the *LA Times*, *Chicago Tribune* and other "media assets" to Sam Zell, a billionaire with no ties to Los Angeles. Intitial hopes that he'd save the paper were quickly dashed, and he became the butt of many jokes.

On July 21st, while we were away, the *LA Times* completely canceled the Sunday book review. Four former editors of the section wrote a joint letter complaining about this:

> LOS ANGELES, Calif. — As former editors of the Los Angeles Times Book Review (1975 through 2005), we are dismayed and troubled at the decision by Sam Zell and his managers to cease publishing the paper's Sunday Book Review.
>
> This step signals the end of an era begun 33 years ago when Otis Chandler, then the paper's publisher and owner, announced the debut of the weekly section. Since then, the growth of the Los Angeles metropolitan region and the avidity of its numerous readers and writers has been palpable. For example, every year since its founding in 1996, the Los Angeles Times Festival of Books has attracted upwards of 140,000 people to the UCLA campus from all walks of life throughout Southern California. Four hundred writers from all over America typically participate. The written word is celebrated. It is the most significant civic event undertaken by the Los Angeles Times to deepen literacy and to strengthen the bond between its news coverage and its far-flung community of readers. But without the Book Review itself, the book festival will be a hollow joke.
>
> The dismantling of the Sunday Book Review section and the migration of a few surviving reviews to the Sunday Calendar section represents a historic retreat from the large ambitions which accompanied the birth of the section.
>
> To be sure, no section of any newspaper can remain hostage to past ways of covering the news of the day. We are convinced, however, that the way forward is to increase coverage of our literary culture — a culture that every day is more vibrant and diverse in the thriving megalopolis of Los Angeles.

> Angelenos in growing number are already choosing to cancel their subscriptions to the Sunday Times. The elimination of the Book Review, a philistine blunder that insults the cultural ambition of the city and the region, will only accelerate this process and further wound the long-term fiscal health of the newspaper.
>
> We urge readers and writers alike to join with us as we protest this sad and backward step.
>
> Sonja Bolle
> Digby Diehl
> Jack Miles
> Steve Wasserman

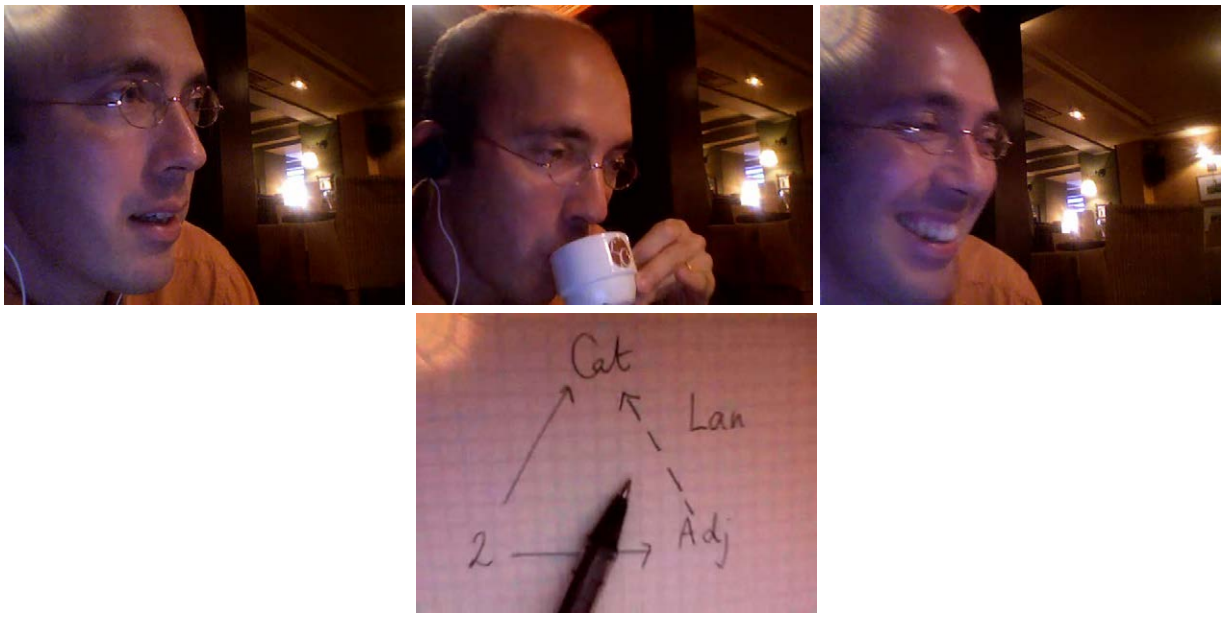
When we returned from our vacation, our subscription didn't automatically restart the way it was supposed to. It took a few tries to get it restarted. So, we didn't get the paper last Sunday.

Today is Sunday. I made coffee, brought in the paper and "deveined" it as usual, removing the clotted masses of advertising supplements and throwing them in the trash. I brought it into the bedroom. Lisa looked for the book review section and didn't find it. Sometimes I throw it out by mistake. So, I retrieved everyhting from the recycling bin and helped Lisa try to find the this section. We couldn't find it! Then I looked online and discovered the sad truth: it was gone.

Goodbye, *Los Angeles Times*.

August 29, 2008

I had my first Skype chat with Paul-André Melliès — me at home, him in a café.



I hope this becomes a regular thing, so we can keep our collaboration moving forwards. It's easy enough to finish up papers from afar, I've found — but not so easy to come up with ideas in the first place.

August 30, 2008

Very soon I've got to prepare some talks for the 2008 Rankin Lectures in Glasgow. I'm giving three talks on "My Favorite Numbers". The first, on the number 5, is basically ready. That one is supposed to be fun for a general audience, so it has lots of pretty pictures. I've given it twice already, but I'm not completely satisfied with the results — people weren't swooning in the aisles, so I need to tweak it a little. But mainly I need to prepare talks on the numbers 8 and 24.

I leave on September 13th, so I have about one week to prepare each talk.

I've been working hard with Aristide Baratin and Derek Wise on a paper about infinite-dimensional representations of 2-groups. It's coming together nicely.

Before switching to work on my talks, I felt the need to take a break — so yesterday I wrote an issue of This Week's Finds: "week269". I wound up spending most of my energy fitting the Weaire-Phelan structure into a bigger historical context. I only wanted to say a little about it, but history is like pulling on a loose thread: once you get started, it just keeps going!

Among other things, I ran into an interesting foreshadowing of current theories of global warming in the work of the great physicist Lord Kelvin. This is from an article in the *New Castle News* dated October 9, 1901:

> Lord Kelvin's conclusions were stated in a lecture recently delivered before the British association for the promotion of science. He has made a study of the subject for many years. He is now past middle age, and ranks as the foremost living physicist.
>
> The following is a summary of the important points of Kelvin's theory:
>
> 'The extravagant waste of oxygen by modern manufacturing processes may leave the inhabitants of the earth without air for breathing, and that within a short and calculable time. At the present rate of progress five centuries will exhaust the full supply of the world. This means the exhaustion of oxygen.
>
> 'The sum total of oxygen at our disposal is 1,020 millions of tons. Every ton of fuel used three tons of oxygen in combustion. Consequently the burning of 340,000,000 of tons of combustibles will destroy the world's air for breathing. The population of the earth is 1,500,000,000 persons. Each has to his credit 200,000 tons of combustibles. Burn this and we die, not from lack of fuel for keeping warm, but from lack of oxygen for breath. Considering the rate at which manufacturing and commerce are depleting the coal supply, less than 500 years may see the end of the human race.'
>
> Science has rarely offered so strange and so terrible a picture of the end of the world as Lord Kelvin's theory suggests. From various scientific authorities in New York (Hallock, Woodward, Hovey, Van Ingen, Burgess and others) interesting speculation as to the gradual approach of the final catastrophe has been gathered.
>
> With the decrease of oxygen in the air the heat of summer would become intense. This would not be the pitiless, parching heat of the desert. Moisture would hang heavy in the air. Steam would rise from the ground and the sun would be veiled in clouds of vapor.

August 31, 2008

Line of access shafts to a *dawoodi falaj* in Wadi al Batha, Oman. Photo by Sue Hutton.

Lots of people think tunnels, crypts and catacombs are cool, right? It's not just me, I hope! The appeal of *deep mysteries* may reach its most refined form in mathematics — or maybe archaeology, or certain forms of mysticism — but surely it's not just practitioners of such esoteric arts who enjoy thinking about "buried treasure", "secret passages" and the like.

It's even better when we've got *ancient underground water tunnels bringing life to the desert*, right? There's the added appeal of history, and the contrast between the parched surface of the landscape and the deep tunnels full of running water. How romantic can it get?

A *qanat* in Iran, from an article by Jona Lendering

I got interested in these irrigation systems when I read how they were being destroyed during the war in Iraq. I got more interested when I saw the canal system called an *acequia* at the Alhambra — see my June 25th diary entry. So, I've been poking around, trying to learn more about them.

In fact, underground irrigation systems are common throughout the Middle East, and they can be found all the way from the Gobi Desert to Spain. They have different names in different cultures: in Berber Arabic, they're called *foggara*; in Turkish, *qanat*; in Persian, *qarez*. You can read more about them here:

- Wikipedia, Qanat.
- Richard Covington, The art and science of water, *Saudi Aramco World*, May/June 2006.

- Sylvia Volk, Building a better *qanat*, in her website Pages of Asia.
- Nizwa.net, The traditional *aflaj* irrigation system.
- Anthony Smith, *Blind White Fish in Persia*, E. P. Dutton & Co., 1953.
  Owen Lattimore, *The Desert Road to Turkestan*, Little, Brown & Co., 1929. Republished by Kodansha Globe in 1996. (Contains a description of *qarez* in the Gobi desert).
- John and Susy Pint, The cave that became a qanat, The Desert Caves Project, 2005.

Anthony Smith's book looks like one of those classic adventurer's diaries. I was amazed to find it freely available online at the Universal Library. Owen Lattimore's *The Desert Road to Turkestan* is another of these — and I really should read it, because he used to live in the same neighborhood as my folks. Sylvia Volk's page is also fun to read, and part of a fascinating website. For example, she writes:

> All the Iranian qanats have fish in them. These fish are healthy, normal fish, neither blind nor white; the local people do not know where they come from, but they could get into the qanats in the spring, when rivers and springs overflow their banks and whole areas become flooded. In the nineteen-fifties, Iranian peasants believed that qanat fish lived forever, needing no nourishment but their own eggs; but then they also believed that the snails which lived in the qanats were actually fish eggs. They believed that hedgehogs live on sunlight, that crocodiles flourished in the desert, and that all porcupines were immortal; they also believed that a treasure lay at the source of every qanat, and upon one day every year, the largest fish in each individual qanat wore a golden crown borrowed from this treasure hoard.

What follows is part of an article on the *aflaj* of Oman — perhaps the best-preserved example of an underground irrigation system. (Five of these *aflaj* were chosen as World Heritage sites in 2006.) I've supplemented this article with photos taken by Sue Hutton, which can be seen together with commentary on a website she runs.

> **Oman's "Unfailing Springs"**
>
> Lynn Teo Simarski
> *Saudi Aramco World*, November/December 1992
>
> A pre-lslamic poet sang long ago of verdant Oman as "a goodly land, a land abounding in fields and groves, with pastures and unfailing springs." But in the region at the desert.s margin, where no natural rivers flow and where farming is impossible without irrigation, it is the splendidly-engineered *aflaj*, the system of underground and surface canals, that have watered the country's agriculture for millennia.
>
> Ancient *aflaj* (singular: *falaj*) still course like arteries beneath the hills and plains of Oman, twisting along precipitous cliffs and threading villages and date-palm groves, bringing to the parched land water and coolness and life itself.

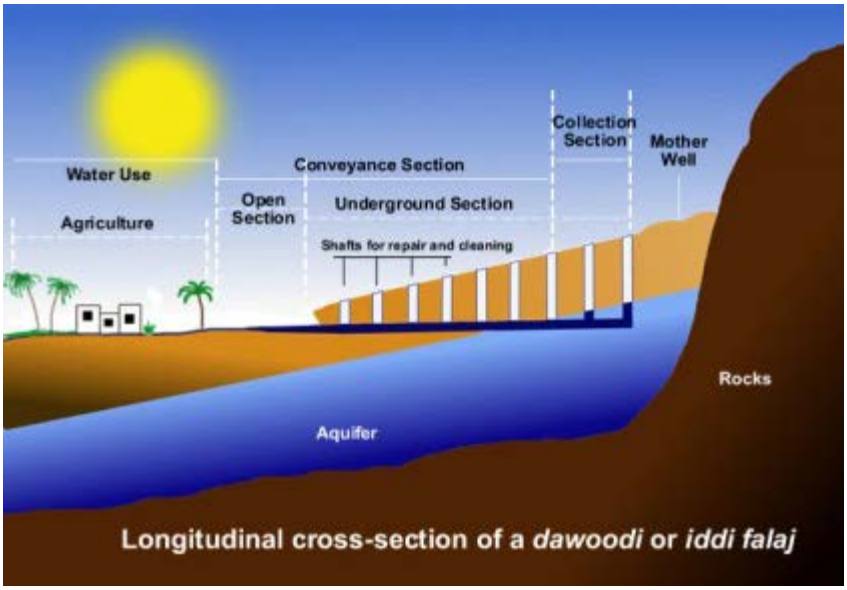
A *dawoodi falaj* watering a date plantation
in a village at northern edge of Wahiba Sands in Oman.
Photo by Sue Hutton.

The word *aflaj* itself denotes not only the water canals but also the irrigation network that relies on them and the social system that apportions water to the owners of water-shares. The *aflaj* have helped to shape the history and settlement patterns of Oman, and they continue even now to tie together each community that draws upon the *falaj*'s flow. As part of traditional greetings, an Omani will invariably ask about the condition of the *aflaj*, which evokes the reply, "*Insha'allah*, they are full." As concern expands over the best use of Oman's precious water resources, the state of the *aflaj* will undoubtedly continue to affect Omani life in the oil age and beyond.

"We have no rivers and our underground reservoirs are very limited," points out Kamal Abdurredha Sultan, a prominent Omani businessman and farm-owner concerned about the future of agriculture in Oman. "The rainfall on the whole, throughout the country, is unreliable. The past generations, perhaps realizing the circumstances, used the available water resources as efficiently as possible.... The wonderful and intricate *falaj* system was in complete harmony with the water circumstances and responded well to the wet and dry periods, each lasting several years, that were a feature of Oman's climate — and still are."

Different types of *aflaj* were built to suit the water sources available. Some 90 percent of precipitation falling on Jabal Akh-dar, northern Oman's mountainous core, percolates down to the underground water table. Those canals, known as *qanat aflaj*, collect water in the rock, sand, and gravel aquifers skirting the mountains' edge, and run beneath the land surface for kilometers to emerge at an oasis. The supposed length

of *aflaj* is, in fact, grist for fables: A camel stick, dropped by the Caliph of Baghdad into the Euphrates, is said to have surfaced in an Omani well called Ain Sariq.



Cross-section of a *qanat falaj*. In Oman, these are also called *dawoodi* or *iddi falaj*.
About 26% of *aflaj* in Oman are of this type, while 47% are *ghayl aflaj* and 27% are *ayni aflaj*.
Photo by Sue Hutton.

Other *aflaj* exploit shallow or surface waters. Most mountain *wadis*, or valleys, are lined with gravel and silt, which overlie consolidated rock in the valley floor. Water flows perennially through the surface layers of the *wadi* deposits, and this may be tapped by a *ghayl falaj*, which collects and conveys the water in an open channel to an oasis. Still other *aflaj* — *ayni aflaj* — simply conduct water above-ground from a spring, such as those channeling the hot springs welling up from diaphanous, calcite-encrusted pools near the towns of Nakhle and Rustaq.

The skills of *falaj* construction and repair are preserved today in Oman by the Awamir, a partly settled, partly nomadic tribe based near Izki, whose *falaj* specialists still travel throughout Oman, carrying out their trade. They have a respected reputation for water divining.

To begin a new *qanat falaj*, a diviner generally scrutinizes the topography, soils, and vegetation at a promising site for a mother well, or *umm al-falaj*, the vertical shaft down to the aquifer. Some Omani diviners are said to use less orthodox methods: A hydraulic engineer recently observed one enter a prolonged trance, during which he called upon Sulayman ibn Da'ud - Solomon, the son of David - and summoned a jinn from Africa to assist his search.

The mother well of the *falaj* on the Quriyat road.
Photo by Sue Hutton.

The shaft of a mother well averages 20 meters (66 feet) deep, but some mother wells descend as much as 60 meters (200 feet). At the bottom, the horizontal channel or gallery that is excavated downslope from the well is left unlined, so that the water can seep into it from surrounding porous layers.

After the collection gallery for the mother well is dug, the builders move down slope. Here they dig another vertical shaft and begin burrowing back almost horizontally toward the mother well. Crouching in the tunnel, they excavate with hammer and chisel. Successive vertical shafts extend the underground tunnel toward the point at which it surfaces kilometers away. The Awamir are particularly accomplished at excavating *aflaj* through hard rock - a daunting task, for a tunnel one kilometer (1100 yards) long and one-half meter (20 inches) in diameter requires removing between 3000 and 4000 tons of rock.

From the air, Oman's landscape, particularly the mountainous heartland, is dotted with holes that look like chains of bomb craters. These holes mark the successive vertical shafts sunk to excavate the horizontal tunnel of a *falaj*, and they indicate its course from source to the oasis. The original builders left the holes open after the underground canal was completed, so that their access shafts could be used for subsequent inspection and repair.

The hazards of *falaj* work are legion. In Iran, excavators baldly call the *qanat falaj* "the murderer" in Persian. An Oman Ministry of Agriculture engineer marvels at the skills of the original builders, who worked without air pumps or safety equipment. In an access shaft, a worker may be struck by falling stones,

while tunnels pose the danger of collapse. Added to this, the stifling heat and poor air circulation within a *falaj* may allow work for only 20 minutes at a time. The worker faces particular danger when, tunneling uphill, he nears the mother-well gallery where water has collected. Many have drowned in the onrush of water as the final rock gives way between the tunnel and the gallery.

Oman's rugged topography tested the ingenuity of ancient planners, who produced engineering solutions that are part of Oman's architectural heritage. Some *aflaj* run along the contour lines, tracing the curves of *wadis* or valleys, like the *falaj* near Tanouf in the Jabal Akhdar that hugs the cliff wall high above the *wadi* floor. Parallel abandoned channels, cut into the *wadi* wall some distance above the flowing *falaj*, probably testify to past changes in water level or flow.

Where a *falaj* crossed *wadis*, such as near Rustaq and Nakhle on the Jabal's coastward slopes, architects bridged the valleys with arched aqueducts often more graceful than the sturdy poured-concrete ones built today. Wherever the torrential flood of a *wadi* was strong enough to wash away an aqueduct, engineers built inverted siphons — closed U-shaped tunnels. In these, the horizontal *falaj* flow disappears down a vertical shaft on one side of the *wadi*, tunnels straight across beneath the *wadi* floor, and reemerges up a second vertical shaft on the other side. Because the lip of the second shaft is slightly lower than the siphon entrance, the head of water forces the flow through the structure.

For my September 2008 diary, go here.

You got warheads stacked in the kitchen
You treat distraction like it's a religion. - Beck, "Walls"

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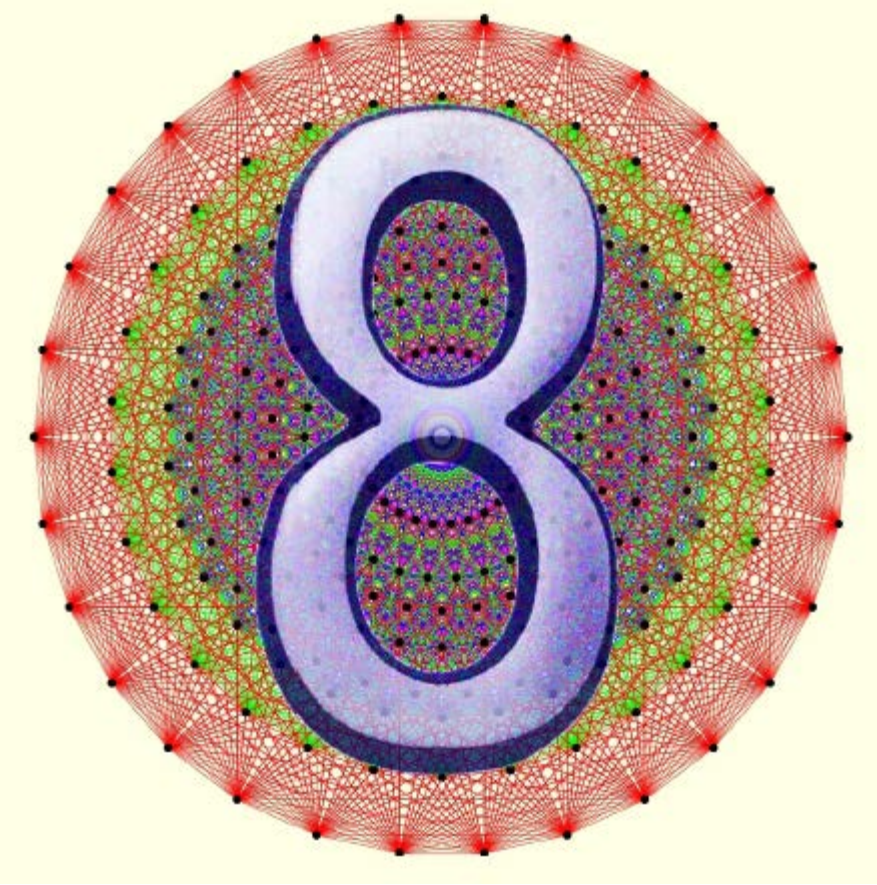
For my August 2008 diary, go here.

Diary - September 2008

John Baez

September 12, 2008



Lisa went to visit her folks on the 9th, and since then I've been hunkering down preparing three talks on My Favorite Numbers. It's been intense, exciting but lonely spending days trying to strip certain lovely ideas to their barest form, packing as much information as I can into pictures, hoping to blow away the audience with a kind of ascent from the simple to the elaborate without losing them in detail.

Luckily, when my airplane reaches its destination after a long journey I will be greeted (with any luck) by two of favorite folks: Tom Leinster from the University of Glasgow, who organized these talks, and Eugenia Cheng, now at Sheffield University. My pal Danny Stevenson, formerly a visiting assistant professor here at Riverside and now blessed with a permament position at Glasgow, will also be there. To top it off, Bruce Bartlett and Simon Willerton, both also from Sheffield, will also be there. Together, they constitute a substantial fraction of the British n-category revolution! But what makes it fun is that we're friends.

This afternoon I finally finished preparing the most elementary talk, on the number 5. As usual, it's a lot harder to design a good "elementary" talk than a good "advanced" one, since you can't make big assumptions about your audience: you have to avoid all the convenient professional jargon and get straight to the point. This requires a severe effort. Most of all, you have to remember what the point *actually is!* — why the subject was intriguing even *before* you became fatally enchanted by it.

These talk posters by Tom Leinster are great. They're like ads for a math rave.

Now I'm watching Hurricane Ike bear down on Galveston.

September 13, 2008

American political hysteria is rising as we approach the presidential election. I can't resist becoming absorbed in it, but to avoid contributing to it I will spare you my opinions. Let me just say this: ignore polls of the "popular vote", since what matters is the electoral vote. For constantly updated estimates of the electoral vote, keep looking at this:

- www.electoral-vote.com

The following is also interesting, but I haven't heard about it before and don't know if it's reliable:

- http://election-projection.net/

September 21, 2008

Back in Riverside. My talks went well, and it was a delightful week for me...

... except that the world financial system was crashing. The impact hasn't really hit yet; we'll see that in the months and years to come. Right now it's like titanomachy: little folks like us are watching gods and giants throw thunderbolts up in the clouds, but it will take a while for the fallout to filter down:

- Monday September 15 — Lehman Brothers goes bankrupt.
- Monday September 15 — The investment bank Merrill Lynch sells itself to Bank of America for $50 billion, half its value early last year.
- Tuesday September 16 — The US government bails out the crashing insurance giant AIG (American International Group), lending it $85 billion and taking an 80% share.
- Wednesday September 17 — Russia temporarily suspends stock trading.
- Thursday September 18 — The rapidly sinking bank HBOS (Halifax Bank of Scotland) is bought by Lloyds TSB for £12 billion.
- Friday September 19 — the American Security and Exchange Commission bans short-selling of many stocks, following Britain's lead.
- Friday September 19 — President Bush proposes a $700-billion bailout of banks, to be run by the Treasury Secretary *with no mechanism for oversight by Congress or the courts*.

- Sunday September 22 — Morgan Stanley and Goldman Sachs, the last two big investment banks left standing, decide to quit that status and become bank holding companies, which allows them to take deposits.

The problems underlying the crash are anything but news. The *Economist* magazine has been warning us for years of a dangerous bubble in the real estate market. For years, Warren Buffett has been calling complicated derivatives that conceal bad debt "instruments of mass financial destruction".

But now that it's happening, things are moving too quickly for adequate reflection. Just a few obvious thoughts:

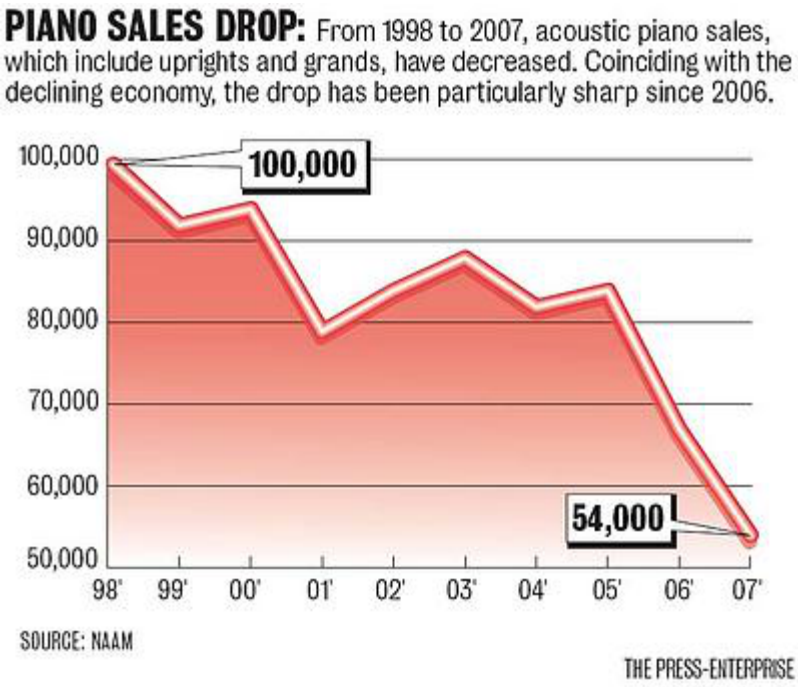
Depending on how it's handled, the proposed 700-billion-dollar bank bailout could be an enormous transfer of wealth from taxpayers to the banking sector. Note: nobody is proposing to bail out the people who can't pay their mortgages. Instead, we'll be bailing out the banks that vastly multiplied this debt by passing it on to each other in complicated ways that nobody fully understands.

As President Bush plans it, this bailout will also hand enormous power to Treasury Secretary Henry Paulson, or whoever becomes his successor in January. Paulson was CEO of Goldman Sachs, and we can expect his successor to be similarly entwined in the financial sector, since nobody else understands the technical aspects of this business. Congress needs to impose enough oversight to keep the game honest. And I hope enough people demand serious *reforms*.

In the longer term, we can expect that the US government will be saddled with *one extra Iraq War's worth* of debt. This debt will mainly be owed to China and other fast-growing economies. So, among other things, it represents another step in the decline of US power and the rise of China.

September 25, 2008

Piano sales have been dropping in the US, thanks first to the decline of the tradition of piano lessons, and more recently to the sagging economy. The *Riverside Press Enterprise* has an interesting article on this. Here's a graph from there:

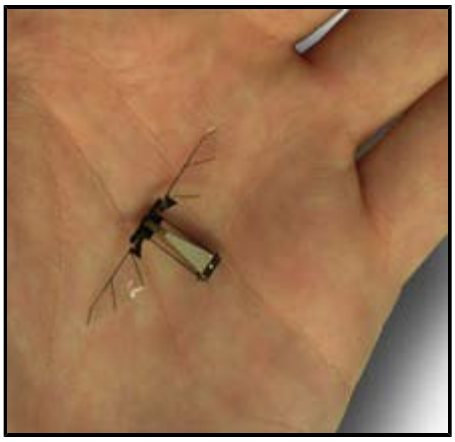


We can only imagine what will happen now.

September 26, 2008

A while back, Garrett Lisi pointed out a great video of someone flying over mountains in a wingsuit with jet engines. Now Yves Rossy has used such a contraption to fly across the English channel in less than ten minutes!

Speaking of flying things, check out this:



It's a robot fly! Great for spying on people. It was created by Robert Wood of Harvard. His research was paid for by the U. S. Defense Advanced Research Projects agency, who are developing stealth surveillance robots for battlefields and urban environments. Too bad he's not focusing more attention on positive uses for his cleverness.

- Rachel Ross, Robotic insect takes off, *Technology Review*, Thursday, July 19, 2007.

September 30, 2008

Some new books I'd like to read from the University of California Press:

- Richard Mackay, *The Atlas of Endangered Species*, revised edition, U.C. Press, 2008.
- Michael Lannoo, *Malformed Frogs: the Collapse of Aquatic Ecosystems*, U.C. Press, 2008.

  Maybe this will shed some light on the crisis of crashing amphibian populations.
- David Carle, *Introduction to Fire in California*, U.C. Press, 2008.
- Theodore W. Pietsch, *Oceanic Anglerfishes: Extraordinary Diversity in the Deep Sea*, U.C. Press, 2008.

  Anglerfish are fascinatingly ugly.

- Kevin Bales, *Ending Slavery: How We Free Today's Slaves*, U.C. Press, 2008.

  According to this book, thare about 27,000,000 slaves in the world today. How can we change this?

For my October 2008 diary, go here.

Try to relax and enjoy the crisis. - Ashley Brilliant

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For my September 2008 diary, go here.

Diary - October 2008

John Baez

October 13, 2008

Not much here lately. As usual, the amount I write in this diary is inversely proportional to the amount I'm doing.

Whoops - that's not true! As a mathematician, I should be more precise about these things. Here's the actual truth: if T is the number of hours I spend per day writing my diary, and t is the number of hours I spend doing other things, then:

$$T = 24 - t$$

This is the First Law of Blogging.

Anyway, today we've been hit by Santa Ana winds. They're no big deal here — at least not yet. But further west, north of Los Angeles, they've been spreading wildfires:

Residents evacuating their homes this morning.
Photo by Dan Steinberg/Associated Press

October 14, 2008

I remember being electrified by Laurie Anderson's song "O Superman" as a college student... and I've enjoyed her work ever since. I hardly ever go to concerts, but tonight Lisa and I went to a concert by her at UCR: part of her *Homeland* tour. The concert consisted mainly of dark reflections on American politics: even the few humorous songs like "Only an Expert" sank quickly into the grim spirit of political life here. The most cheerful moment came at the end, when her husband Lou Reed came out to join her, playing scalding electric guitar and singing along on "The Lost Art of Conversation". You can see a mellower version here — but unfortunately he doesn't sing on that. His voice is instantly recognizable to anyone schooled in rock, so it was great to hear him!

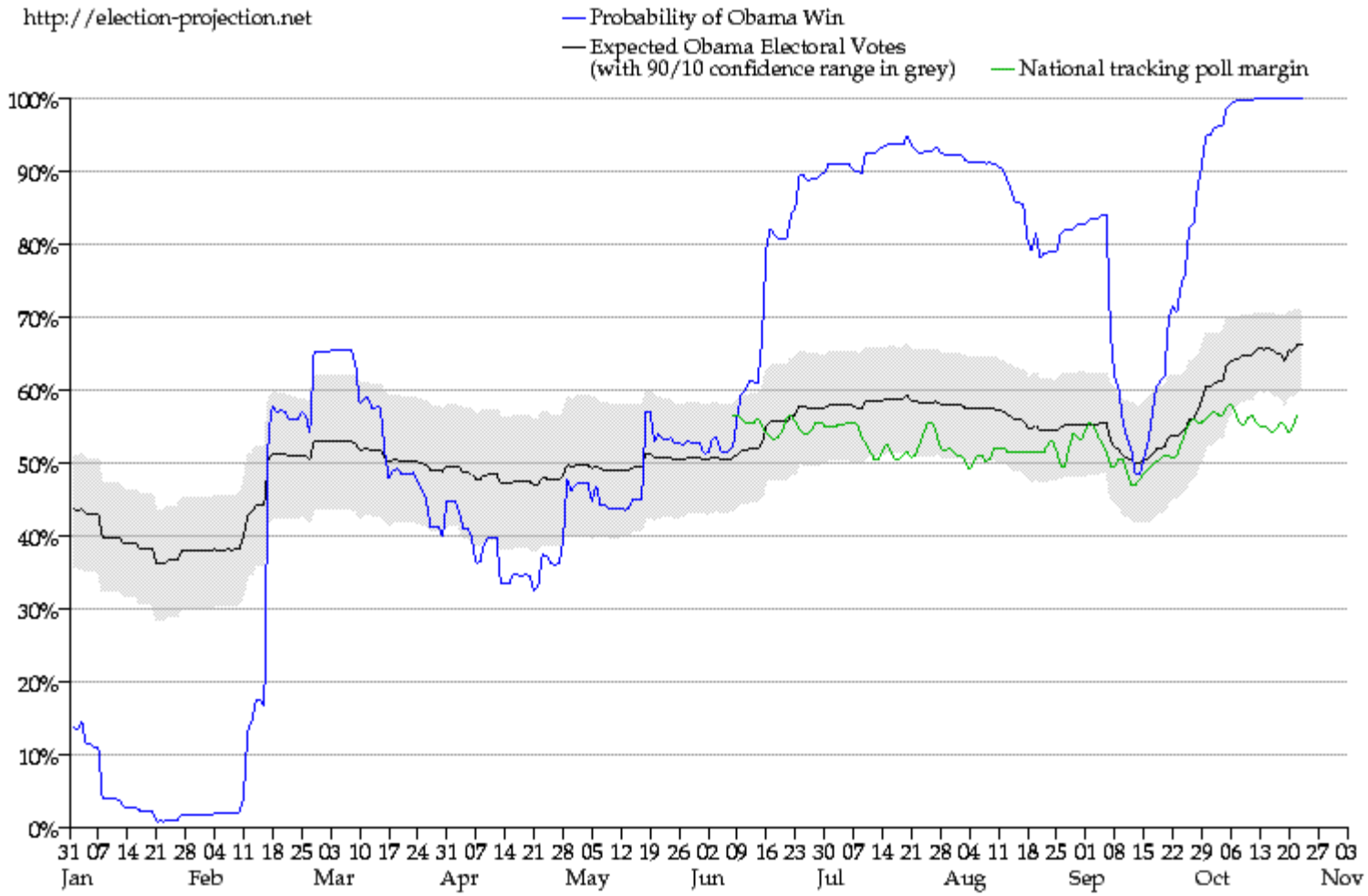
October 23, 2008

I'm visiting Matt Ando and Eugene Lerman at the University of Illinois at Urbana-Champaign. Today I gave two talks: a

math/physics seminar on classifying spaces for 2-groups, and a colloquium talk on the number 8.

Right now I'm lying in bed trying to keep from getting a cold, watching the news. (Only in hotels do I watch TV in bed.) The news is solidly about the presidential election 12 days from now: every tiny portent is carefully analyzed. The wind is blowing in Obama's favor, both in big ways and tiny ones.

Big ways: election projections based on state polls are down to giving McCain a 0.0% chance of winning! Last night it was 0.1%.



And tiny ways: the latest news blips involve outrage about Sarah Palin's $150,000 wardrobe paid for by the Republican National Committee, and McCain's article in the *Washington Times* lashing out against George Bush:

> "Spending, the conduct of the war in Iraq for years, growth in the size of government, larger than any time since the Great Society, laying a $10 trillion debt on future generations of America, owing $500 billion to China, obviously, failure to both enforce and modernize the [financial] regulatory agencies that were designed for the 1930s and certainly not for the 21st century, failure to address the issue of climate change seriously," Mr. McCain said in an interview with *The Washington Times* aboard his campaign plane en route from New Hampshire to Ohio.
>
> "Those are just some of them," he said with a laugh, chomping into a peanut butter sandwich as a few campaign aides in his midair office joined in the laughter.
>
> [...]
>
> He rejected Mr. Bush's use of issuing "signing statements" when he signs bills into law, in which the

president has suggested that he would ignore elements of the bills, labeling them potentially unconstitutional.

"I would veto the bills or say, 'Look, I don't like it but I'll obey the law that's passed by Congress and signed by the president.' I think the signing statements was not a correct implementation of the power of the executive. I think it was overstepping," he said.

And Mr. McCain emphatically rejected Mr. Bush's claims of executive privilege, often used to shield the White House from scrutiny.

"I don't agree with that either. I don't agree with Dick Cheney's allegation that he's part of both the legislative and the executive branch," he said.

Too bad he didn't say this earlier and more often. As this point, it comes across as desperate.

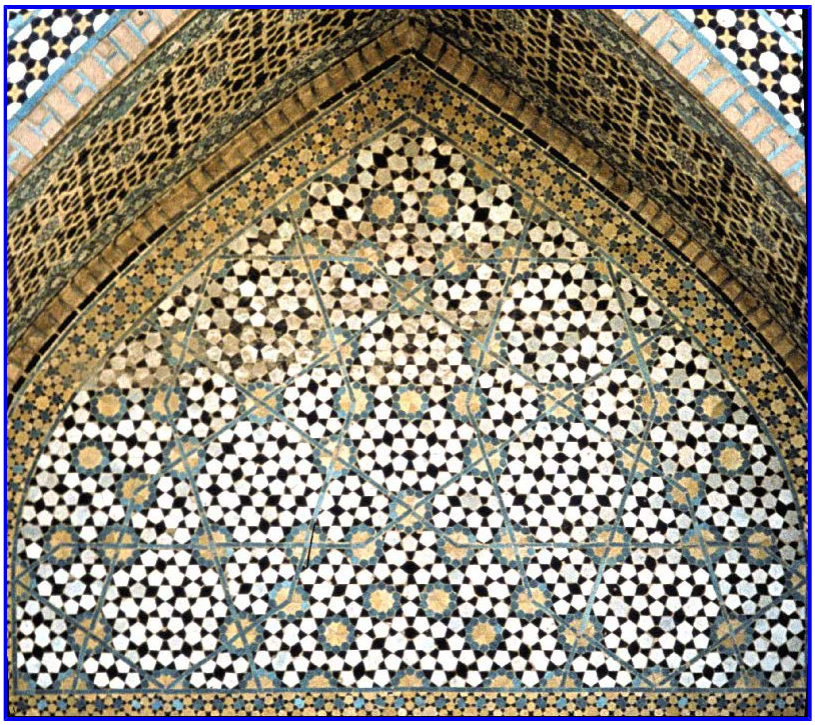
Since I don't want a Republican choosing the next two Supreme Court justices, pandering to the rich and the "religous Right", and trying to drill our way out of the energy crisis, I'm very happy. But since the Democrats have lost the last two elections against one of the worst candidates in history, I'm not counting my chickens until they've hatched.

October 30, 2008

Greg Egan is back from Iran! It was his first trip outside Australia. He'll probably have more to say about this himself, later. I'm sort of jealous — but I'm glad he let me show you some photos he took.

Here's a tiling with five-fold symmetry from the Friday Mosque in Isfahan:

Tilings of this general sort were discovered by the mathematician Penrose, but it turns out Penrose was beaten to the punch: you can see them in Islamic architecture from the 1600s! In week247 of This Week's Finds I showed some examples — like this, also from Isfahan:



From the Darb-i Imam shrine in Isfahan, Iran.

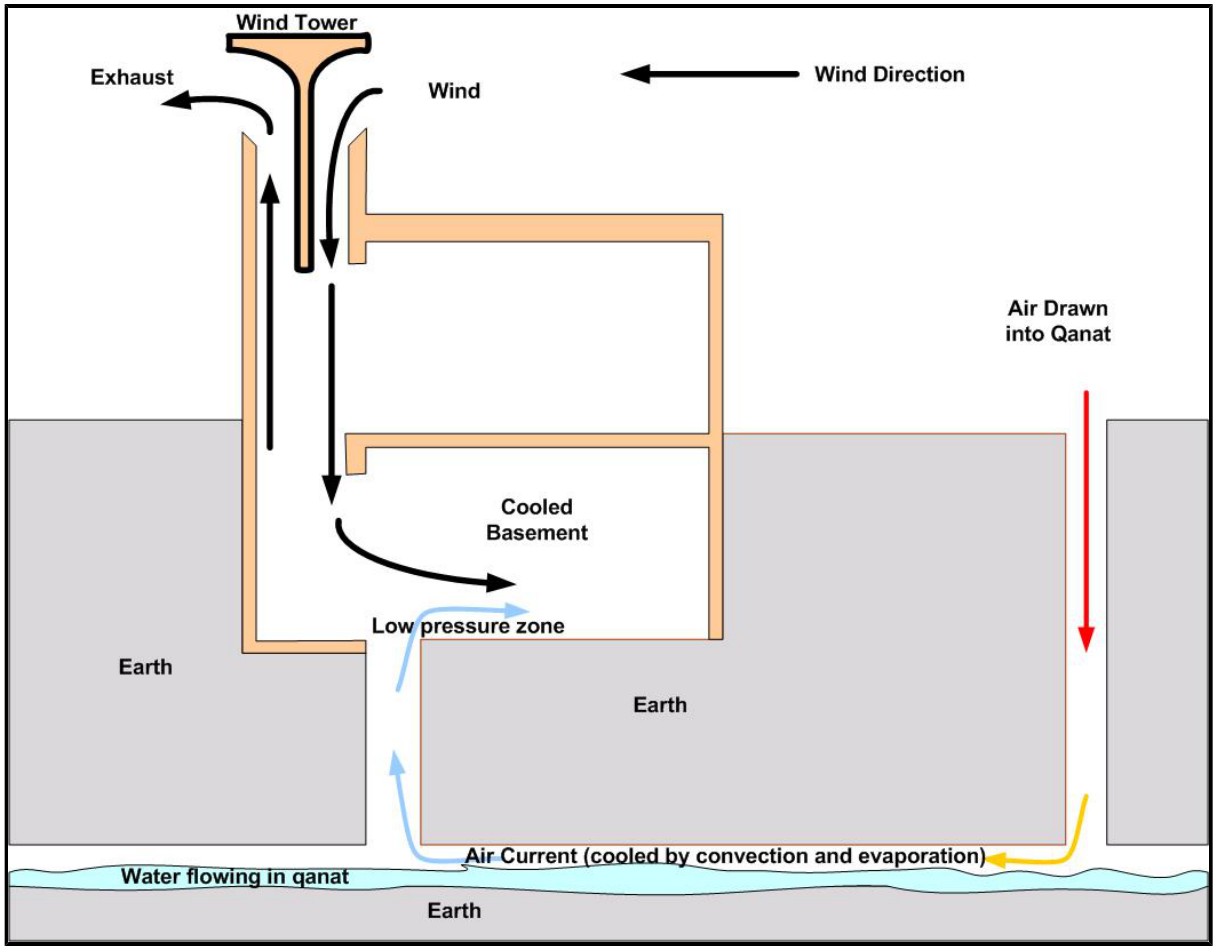
I found that photo here:

- Peter J. Lu and Paul J. Steinhardt, Decagonal and quasi-crystalline tilings in medieval Islamic architecture, *Science* 315 (2007), 1106-1110.

Lu and Steinhardt also discuss the mosque Egan visited!

Here are some photos he took in the marvelous ancient city of Yazd:

The second one shows a *bad gir*, or windcatcher — a natural cooling system based on the Bernoulli effect. They're especially effective in conjunction with a *qanat* — an underground water tunnel, commonly used for irrigation in the Middle East. I gave a detailed intro to *qanats* back on August 31. Here's how people combine a *qanat* and a windcatcher:



I love the idea of this sort of system, since it doesn't use any external power source — just the wind, water and the laws of physics. Green technology, centuries old!

Here's a picture of Yazd from an Iranian tourist website:

I wanna go there! I was a bit scared of the Islamic morality squads, but Egan says everyone he met was friendly: "Really, unless you felt compelled to wander the streets half-naked drinking alcohol and behaving lasciviously with your wife, I don't think you'd find anything the least bit arduous about visiting the place."

For my November 2008 diary, go here.

I am new enough on the national political screen that I serve as a blank screen on which people of vastly different political stripe project their own views. As such I am bound to disappoint some, if not all of them. Which perhaps indicates a second, more intimate theme to this book — namely how I or anybody else in public office, can avoid the pitfalls of fame, the hunger to please, the fear of loss, and thereby retain that kernel of truth, that singular voice within each of us that reminds us of our deepest commitments. - Barack Obama

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[For my October 2008 diary, go here.]

Diary - November 2008

John Baez

November 1, 2008

Lisa and I pulled up a big dried-up pride of Madeira plant from our back yard, and went to the local nursery to buy a dwarf citrus tree to put in its place. We already have a blood orange tree, a lime, a Meyer lemon and a kumquat. Also a kaffir lime, still in a pot, waiting to be planted.

In the parking lot we met a women who warned us that the election would be stolen from Barack Obama. She said:

- Oprah Winfrey used an electronic voting machine and had her vote dropped before her very eyes!

  (True, at least according to Oprah.)

- Diebold and Sequoia, prominent manufacturers of voting machines, are run by Republicans!

  (Indeed, Diebold's chief executive announced in 2003 that he'd been a fund-raiser for Bush and said he was "committed to helping Ohio deliver its electoral votes to the president next year". A top programmer at Diebold was convicted of 23 counts of felony for planting "back doors" in ATM software he designed in an earlier job.

Sequoia, whose voting machines are used here in California, has its own problems — but I don't see any links to Republicans.)

- Karl Rove has trained teams of operatives in the Justice Department to rig the vote!

  (I don't know.)

- It's all in Greg Palast's book, Armed Madhouse!

  (He indeed has a book, but I can't vouch for it.)

Not having heard about most of this stuff, I wasn't sure how paranoid she was being. I told her I still thought Obama would win. She said she hoped so, but...

There are clearly some very nervous people on both sides of this election, busy demonizing the opposition. There also seem to be plenty of *real* dirty tricks and legal wrangling going on — great fodder for conspiracy theories.

It's raining tonight! It hasn't rained for many months. A real treat!

November 2, 2008

We only got a little rain — but since it was the first rain since spring, it was very welcome. We're having a serious drought, not just here in the desert but more importantly up north, where we get lots of our water. I was taken aback when I first heard this, since the snowpack in the Sierras looked great on February 3rd; by July 18th it had fallen short, but it didn't seem disastrous.

> **California water shortages could lead to rationing, officials say**
>
> Bettina Boxall, LA Times
> October 31, 2008
>
> State water deliveries could be slashed next year if California continues its dry streak, a move that could lead to widespread rationing.
>
> California Department of Water Resources officials Thursday said water agencies could get as little as 15% of their State Water Project allocations, although that figure could go up if Sierra Nevada rain and snowfall return to normal in the coming months.
>
> "We're clearly making a major call for extra conservation, but also permanent conservation," said water resources director Lester Snow, who renewed the Schwarzenegger administration's call for the construction of new reservoirs.
>
> Officials at Southern California's major water supplier, the Metropolitan Water District of Southern California, say its board soon will discuss whether to initiate cutbacks.
>
> "We are preparing for the real possibility of water shortages and rationing," said Jeff Kightlinger, the MWD's general manager.
>
> Last spring was the driest since 1921 in the northern Sierra, depleting reservoirs in the State Water Project, which provides about a third of urban Southern California's water.
>
> A court ruling to protect delta smelt has reduced pumping from the Sacramento-San Joaquin Delta, the crossroads for sending water south to the San Joaquin Valley and the Southland.
>
> Snow said state reservoirs are starting the rainy season at their lowest levels since 1977, when California

was hit by a severe drought.

But state records show that if all the reservoirs that supply California, including major ones on the Colorado River, are taken into account, the picture is not so bleak.

The overall water storage is roughly 70% of the average for this time of year.

This year's flows into Lake Powell, which catches water from the upper Colorado River Basin, were above average, easing a long-term drought on the river.

Storms are expected statewide in the next few days and state meteorologist Elissa Lynn also said there is a potential for more precipitation this rainy season than last.

Water agencies rarely get their full allotment of deliveries from the State Water Project, which promises more water on paper than it usually has the ability to deliver.

Initial state project allocations, such as the 15% figure announced Thursday, also can change dramatically over the course of a year.

The lowest was in 1993, when the state anticipated that it would deliver only 10% of its customers' water requests. But conditions improved and contractors wound up getting 100%.

Two dry years in a row in the state, delta pumping cutbacks and an eight-year drought on the Colorado River led to scattered urban rationing this year and irrigation cutbacks in the San Joaquin Valley.

The MWD, which supplies water to agencies that serve 19 million people, mounted a voluntary conservation program that Kightlinger said has reduced water use by 8% to 10%.

But the MWD's Diamond Lake reservoir is nearly half empty and the agency's water reserves are down by a third.

November 4, 2008

Lisa and I had an election-watching party with some anthropologist friends of ours. It was my idea, but we held it at their house: their huge flat-screen TV, our home-made pizza.

There wasn't too much suspense, but still McCain's concession speech came as a tremendous relief. It was noble and gracious.

In Grant Park, Chicago, a crowd of 240,000 people went wild.

Then, together with those people and millions more across the world, we watched Obama's acceptance speech. It was moving in a way that you can only feel at the end of a year of suspense and worry.

I'm glad both Obama and McCain rose to the occasion tonight. It may help us stop squabbling, and begin the work we need to do. "The road ahead will be long. The climb will be steep."

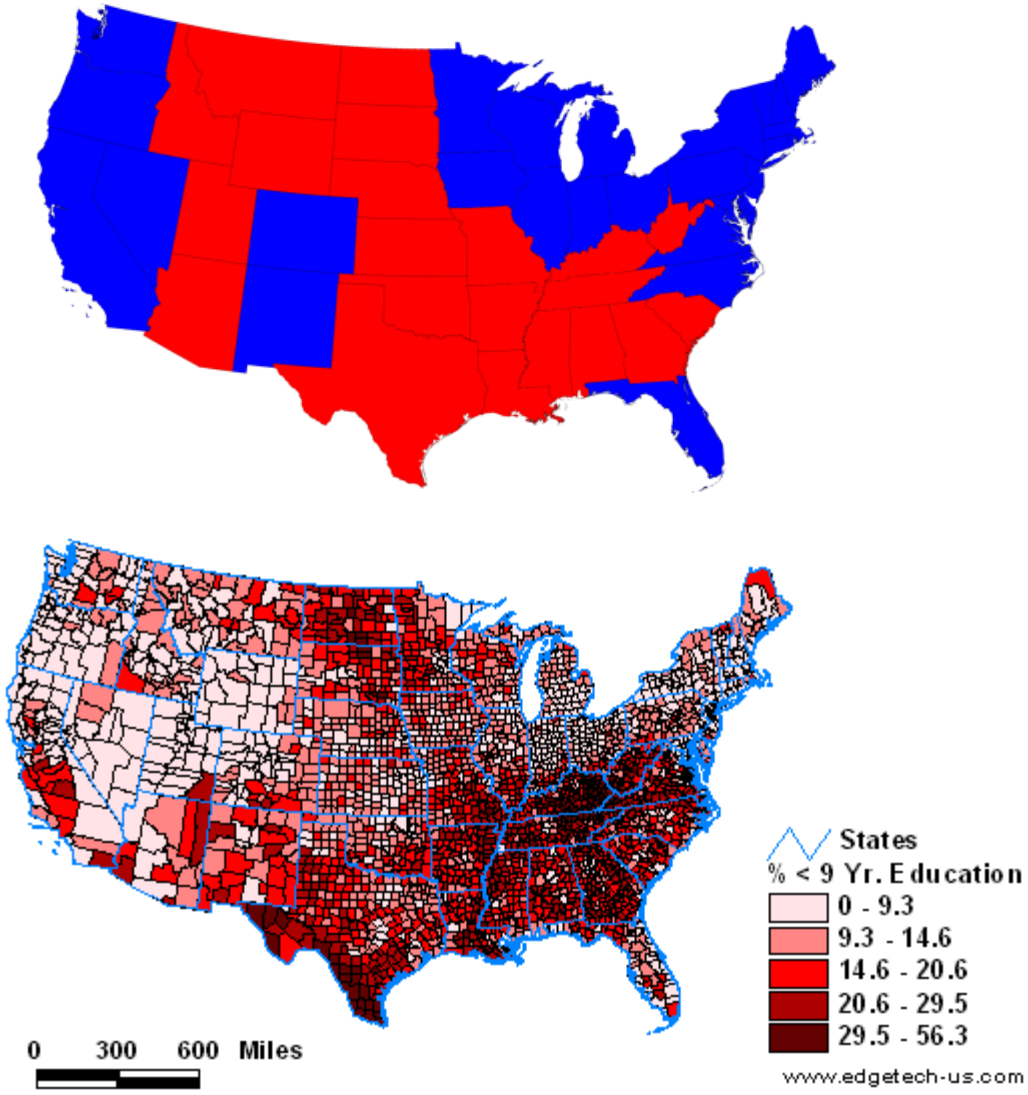
November 7, 2008

I like this headline:

- J. Freedom du Lac, Obama Win Gives Baez Something To Sing About, Washington Post, November 7, 2008

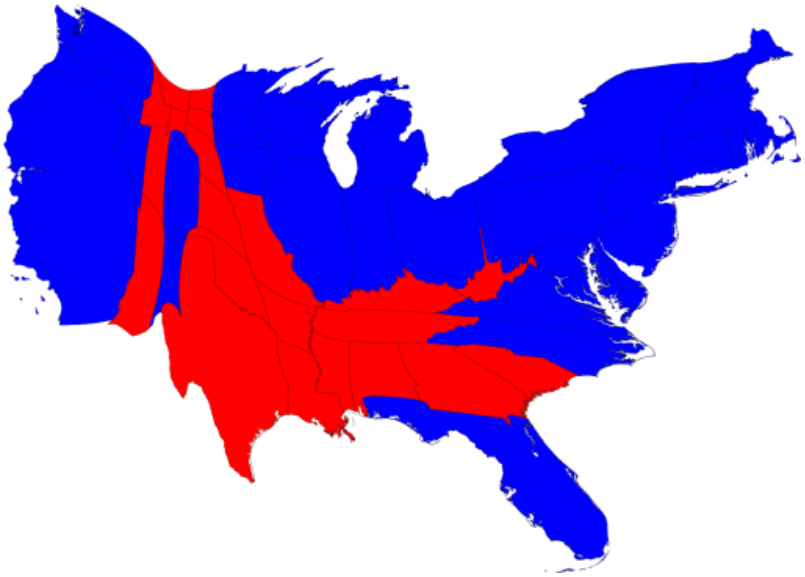
November 8, 2008

For what it's worth, here is a map showing states that voted for Obama (blue) or McCain (red), followed by a map showing the percentage of the population with less than 9 years of education:



This may explain why Republicans like to attack "elitists".

The red and blue map was brought to my attention by Toby Bartels. It was made by Mark Newman, who also has a much more interesting map showing the same results, but with each state given an area proportional to its population:



November 9, 2008

The Mission Inn in downtown Riverside is a baroque and whimsical building, built from 1902 to 1935 by an architect named Frank Miller. Miller worked on it obsessively, and he had a taste for the flamboyant. It has narrow passageways, exterior arcades, a medieval-style clock with moving figures — a monk, a bear, and so on — a five-story rotunda, a Chinese Room, a Japanese room, a simulated Spanish Mission, castle towers, minarets, flying buttresses, Mediterranean domes, a pedestrian skybridge, a garden containing 800 bells, and much more.

When I first moved to Riverside, the hotel had been closed for a long time. The city had a project to renovate it — but when the first Bush recession hit, the city ran out of money for this project. It even failed to pay contractors for work they'd done!

As you may or may not know, President Taft was extremely fat: he weighed over 300 pounds. He visited the Mission Inn, and they had a large and sturdy chair specially built for him. You can see it there now. One carpenter whom the city owed stole President Taft's chair from the inn and held it for ransom in an undisclosed location (a warehouse somewhere in town). The city eventually paid him.

Later, when the economy improved, work on the Mission Inn continued. I remember being able to walk right in and wander around the labyrinth of bizarre rooms. It was great fun. Now the Inn has reopened and only guests are allowed to nose around the place! (But, you can pretend to be a guest.)

But: I never knew the Mission Inn had *catacombs*.

- Elaine Yeung, The Mission Inn catacombs: what are they hiding?, *Highlander*, November 7, 2008.

Let me quote it:

> The expansive underground catacombs beneath the Mission Inn consist of numerous chambers and tunnels. They stretch from the bottom of the Mission Inn to as far as the old Riverside city hall, and out the back of the hotel to what used to be the servant's quarters across Sixth Street. The old city hall used to be across the street from Mission Inn Avenue.
>
> There are also rumors that the catacombs lead to Mount Rubidoux, but others claim that the catacombs only head in the direction of Mount Rubidoux.
>
> However, even though the catacombs underground extend outside of the Inn's property lines, they are still sealed to the Mission Inn underneath.

> The catacombs were created by the original architect, Frank Miller, in 1915. He filled the subterranean corridors with numerous artifacts he obtained near the end of San Francisco's 1915 Panama-Pacific International Exposition.
>
> Some of the most significant figures are the life-sized wax figures of Pope Pius X of the Papal Court and his 13 attendants. Miller also acquired 38 paintings of the 21 California missions done by a prominent artist, Henry Chapman Ford, in the 1960s and 1970s.
>
> Miller exhibited the paintings in the catacombs, and he named the location where the paintings were on display "El Camino Real," the Royal or King's Highway, after the road where the California missions are located. The underground museum drew many visitors during its opening period. Unfortunately mildew, dust, insects, and other aspects damaged many of the underground artifacts over the years.
>
> However, the catacboms were closed down to the public when the Mission Inn was re-opened in 1992 after a massive renovation project, safety issues being the main concern. In the event of a fire or earthquake, there are no easy escape routes.
>
> Closing of the catacombs stirred even more rumors among Riverside inhabitants. Some staff workers at the Mission Inn previously claimed that there was activity in the area of the foyer during the years following the Mission Inn's reopening.
>
> The Mission Inn's financial controller during the time of the hotel's re-opening even resigned after supposedly seeing someone in the area late one evening. So you probably don't want to find yourself alone there.
>
> Few people have been allowed to venture into the catacombs after their closure, but recently, the Mission Inn allowed people 10 chances to see them in late October. There were five tours of a maximum of 24 people on October 24th and 25th.

Darn! I missed them! But they were somewhat goofy Halloween-themed tours — you can see some photos.

November 10, 2008

Thomas Friedman is succeeding in publicizing some things we should all know:

- *Hot, Flat, and Crowded: Why We Need a Green Revolution — and How it Can Renew America*, Farrar, Straus and Giroux, New York, 2008.

From the Woodrow Wilson School:

> The book's title identifies three major trends of this century: Climate change is warming our planet; the rise of a global middle class is flattening the differences between rich and poor; and a rapidly expanding population is crowding the world. According to Friedman, these converging trends are driving "five global mega-trends" that will determine our future stability:
>
> - Energy and natural resource supply and demand: While some countries are taking steps to become more energy-efficient, the explosive growth of developing-country cities is outpacing these gains. Friedman asserts that there are not enough energy and natural resources for everyone to consume at Americans. current rates and that everyone, Americans included, must address energy supply and demand.
> - Petrodictatorship: We are "funding both sides of the war on terrorism," said Friedman: the U.S. military with tax dollars, and terrorist groups (and the states that sponsor them) with gas dollars.
> - Climate change: Friedman emphasized that the pace of climate change is exceeding many scientists' predictions, including those of the Intergovernmental Panel on Climate Change, and that we have

little time to act.
- Energy poverty: The lack of a consistent electricity supply not only cripples 1.6 billion people's ability to obtain high-quality health care and adapt to the effects of climate change, but also prevents them from accessing the myriad educational and economic opportunities provided by the Internet.
- Biodiversity loss: The Earth is losing species 1,000 times faster than normal, claimed Friedman. "We are the first generation of humans that is actually going to have to think like Noah," said Friedman, to save rapidly disappearing plants and animals.

Friedman thinks these trends are "a series of incredible opportunities masquerading as impossible and insoluble problems" because all five can be reversed by "abundant, cheap, clean, reliable electrons" and energy efficiency. The country that becomes the leader in new energy technology (ET) will have the most stable economy and garner the most respect on the international stage, said Friedman. If the United States does not take the lead in the ET revolution, others — China, India, Europe — will, but they won't do it as fast or as well as the United States, he says.

November 12, 2008

In the *Chicago Tribune*, Garrison Keiller writes:

Sitting on Top of the World

The city of Chicago is celebrating the rise of one of their own to the office of president of the United States.

Be happy, dear hearts, and allow yourselves a few more weeks of quiet exultation. It isn't gloating, it's satisfaction at a job well done. He was a superb candidate, serious, professorial but with a flashing grin and a buoyancy that comes from working out in the gym every morning. He spoke in a genuine voice, not senatorial at all. He relished campaigning. He accepted adulation gracefully. He brandished his sword against his opponents without mocking or belittling them. He was elegant, unaffected, utterly American, and now (Wow) suddenly America is cool. Chicago is cool. Chicago!!!

We threw the dice and we won the jackpot and elected a black guy with a Harvard degree, the middle name Hussein and a sense of humor - he said, "I've got relatives who look like Bernie Mac, and I've got relatives who look like Margaret Thatcher." The French junior minister for human rights said, "On this morning, we all want to be American so we can take a bite of this dream unfolding before our eyes." When was the last time you heard someone from France say they wanted to be American and take a bite of something of ours? Ponder that for a moment.

The world expects us to elect pompous yahoos, and instead we have us a 47-year-old prince from the prairie who cheerfully ran the race, and when his opponents threw sand at him, he just smiled back. He'll be the first president in history to look really good making a jump shot. He loves his classy wife and his sweet little daughters. At the same time, he knows pop music, American lit and constitutional law. I just can't imagine anybody cooler.

It feels good to be cool, and all of us can share in that, even sour old right-wingers and embittered blottoheads. Next time you fly to Heathrow and hand your passport to the man with the badge, he's going to see "United States of America " and look up and grin. Even if you worship in the church of Fox, everyone you meet overseas is going to ask you about Obama, and you may as well say you voted for him because, my friends, he is your line of credit over there. No need anymore to try to look Canadian.

And the coolest thing about him is the fact that back in the early '90s, given a book contract after the hoo-ha about his becoming the First Black Editor of The Harvard Law Review, instead of writing the basic exploitation book he could've written, he put his head down and worked hard for a few years and wrote a good book, an honest one, which, since his rise in politics, has earned the Obamas enough to buy a nice house and put money in the bank. A successful American entrepreneur.

> Our hero who galloped to victory has inherited a gigantic mess. The country is sunk in debt. The Treasury announced it must borrow $550 billion to get the government through the fourth quarter, more than the entire deficit for 2008, so he will have to raise taxes and not only on bankers and lumber barons. His promise never to raise the retirement age is not a good idea. Whatever he promised the Iowa farmers about subsidizing ethanol is best forgotten at this point. We may not be getting our National Health Service cards anytime soon. And so on and so on.
>
> So enjoy the afterglow of the election awhile longer. We all walk taller this fall. People in Copenhagen and Stockholm are sending congratulatory e-mails - imagine! We are being admired by Danes and Swedes! And Chicago becomes The First City. Step aside, San Francisco. Shut up, New York. The Midwest is cool now. The mind reels. Have a good day.

November 18, 2008

I now route my math department email through Google's "gmail" because it does a better job of filtering out spam. With gmail, there's always a little inconspicuous one-sentence advertisement on top, based on the words in your mail. So, I get lots of ads related to math and physics. But today, when I was scanning through my spam, I got this:

Spam Fajitas - Serves 8, add extra salsa if desired

November 19, 2008

The events move faster and it becomes hard to keep up with them. Record-breaking temperatures in Southern California have triggered another round of devastating wildfires, this time in Santa Barbara and Los Angeles. Again our town lucked out: no fire here.

Meanwhile, after years of huge profits from selling gas-guzzling monster cars, the American automobile industry is collapsing. This could be good thing. While the layoffs will hurt the American economy in the short term, in the long run we need to move away from the pernicious petroleum addiction this industry helps perpetuate. Influential people — not just starry-eyed visionaries like me — are starting to talk about the need for a green revolution. Shouldn't we take the opportunity to hasten it? The carbon-burning economy will eventually die; the big question is whether it will take us down with it.

This week the Big Three — Ford, General Motors and Chrysler — have been in Congress, begging for $50 billion of the taxpayer's money. Now it's the Republicans and Bush who are being sensible, not the Democrats: today they managed to derail this bailout. We'll see what happens.

When I was a kid, history seemed like a thing of the past. Now it's happening every day.

November 24, 2008

The October 15th *New Scientist* has a bunch of good articles about the need to end our quest for perpetual "economic growth" — at least as this term is defined now.

I think Gus Speth hits the nail on the head in his interview here:

- Liz Else, Interview: champion for green growth, *New Scientist*, October 15, 2008.

He says:

> My conclusion is that we're trying to do environmental policy and activism within a system that is simply too powerful. It's today's capitalism, with its overwhelming commitment to growth at all costs, its devolution of tremendous power into the corporate sector, and its blind faith in a market riddled with

externalities. And it is also our own pathetic capitulation to consumerism. Even as the environmental community swims more strongly against the current, the current gets ever stronger and more treacherous, so environmentalism slips under. The only solution is to get out of the water, take a hard look at what's going on and figure what needs to be done to change today's capitalism.

For more details on how tough a spot we've gotten ourselves into, try this:

- Tim Jackson, Why politicians dare not limit economic growth, *New Scientist*, October 15, 2008.

A quote:

> The Ehrlich equation, I = PAT, says simply that the impact (I) of human activity on the planet is the product of three factors: the size of the population (P), its level of affluence (A) expressed as income per person, and a technology factor (T), which is a measure of the impact on the planet associated with each dollar we spend.
>
> Take climate change, for example. The global population is just under 7 billion and the average level of affluence is around $8000 per person. The T factor is just over 0.5 tonnes of carbon dioxide per thousand dollars of GDP - in other words, every $1000 worth of goods and services produced using today's technology releases 0.5 tonnes of CO_2 into the atmosphere. So today's global CO_2 emissions work out at 7 billion × 8 × 0.5 = 28 billion tonnes per year.
>
> The Intergovernmental Panel on Climate Change (IPCC) has stated that to stabilise greenhouse gas levels in the atmosphere at a reasonably safe 450 parts per million, we need to reduce annual global CO_2 emissions to less than 5 billion tonnes by 2050. With a global population of 9 billion thought inevitable by the middle of this century, that works out at an average carbon footprint of less than 0.6 tonnes per person - considerably lower than in India today. The conventional view is that we will achieve this by increasing energy efficiency and developing green technology without economic growth taking a serious hit. Can this really work?
>
> With today's global income, achieving the necessary carbon footprint would mean getting the T factor for CO_2 down to 0.1 tonnes of CO_2 per thousand US dollars - a fivefold improvement. While that is no walk in the park, it is probably doable with state-of-the-art technology and a robust policy commitment. There is one big thing missing from this picture, however: economic growth. Factor it in, and the idea that technological ingenuity can save us from climate disaster looks an awful lot more challenging.
>
> First, let us suppose that the world economy carries on as usual. GDP per capita will grow at a steady 2 or 3 per cent per year in developed countries, while the rest of the world tries to catch up - China and India leaping ahead at 5 to 10 per cent per year, at least for a while, with Africa languishing in the doldrums for decades to come. In this (deeply inequitable) world, to meet the IPCC target we would have to push the carbon content of consumption down to less than 0.03 tonnes for every thousand US dollars spent - a daunting 11-fold reduction on the current western European average.
>
> Now, let's suppose we are serious about eradicating global poverty. Imagine a world whose 9 billion people can all aspire to a level of income compatible with a 2.5 per cent growth in European income between now and 2050. In this scenario, the carbon content of economic output must be reduced to just 2 per cent of the best currently achieved anywhere in the European Union.
>
> The potential for technological improvements, renewable energy, carbon sequestration and, ultimately perhaps, a hydrogen-based economy has not been exhausted. But what politicians will not admit is that we have no idea if such a radical transformation is even possible, or if so what it would look like. Where will the investment and resources come from? Where will the wastes and the emissions go? What might it feel like to live in a world with 10 times as much economic activity as we have today?

> Instead, they bombard us with adverts cajoling us to insulate our homes, turn down our thermostats, drive a little less, walk a little more. The one piece of advice you will not see on a government list is "buy less stuff". Buying an energy-efficient TV is to be applauded; not buying one at all is a crime against society. Agreeing reluctantly to advertising standards is the sign of a mature society; banning advertising altogether (even to children) is condemned as "culture jamming". Consuming less may be the single biggest thing you can do to save carbon emissions, and yet no one dares to mention it. Because if we did, it would threaten economic growth, the very thing that is causing the problem in the first place.

November 25, 2008

Kevin Kelly writes:

> John,
>
> This oddity is your kind of thing: The Ladder Stuck in Time
> http://www.geocities.com/Athens/Oracle/1631/ladder1.html
>
> -- KK

It's indeed my sort of thing: a mysterious and seemingly useless wooden ladder that has been perched below a window on the Church of the Holy Sepulchre at least since 1840:

Photograph by R. Malcolm Brown, 1999

James Lancaster tracks down the story of this ladder in the page cited above.

November 30, 2008

Lately I've become interested in the case of M. S. El Naschie, editor of *Chaos, Solitons & Fractals*, whose editorship is now due to end in January.

If you're into this sort of thing, you may be reminded of the Bogdanoff Affair. And you may wonder: whatever happened to the Bogdanoff brothers? Here's an interesting bit of news about them. It comes from a correspondent who may prefer to remain anonymous:

> I would like to bring to your attention some information about the Bogdanoff brothers (in the case you are not acquainted with it):
>
> 1. It seems that Igor and Grichka Bogdanoff hold the chair in theoretical physics at the "Megatrend University of Applied Sciences" in Belgrade, Serbia. This was reported in an article in the French newspaper *Le Figaro* on February 20th, 2008, which claims that the Bogdanoffs were hired already in November 2005 and taught theoretical physics and cosmology since December 2005. Apparently they are also heads of the General Cosmology Laboratory at the same university.
>
>   Amusingly, the information provided about this lab is identical to the description found on the homepage of the Mathematical Center of Riemannian Cosmology (which is mentioned in your article regarding the Bogdanoff affair).
>
> 2. At the end of 2006 the Bogdanoffs published also the Serbian version of their book *Avant le Big Bang*. Interestingly, this version is co-authored by the chancellor of the "Megatrend University", Mica Jovanovic, whose primary field of interest is business management (sic!).
>
>   Furthermore, the Bogdanoffs promote themselves as geniuses in cosmology comparable to Hawking

(e.g. in an interview for a students. newspaper/blog). Luckily, not everyone in Serbia is fooled by the twins, despite the traditional Serbian praise for Russians or Russian descendants.

For my December 2008 diary, go here.

Rosa Parks sat so Martin Luther could walk. Martin Luther King walked so Obama could run. Obama is running so our kids can fly. - Jay-Z

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For my November 2008 diary, go here.

Diary - December 2008

John Baez

December 1, 2008

On the East Coast of America, the oak trees aren't producing any acorns this year. Hickories aren't producing any nuts either! Nobody knows why: the weather has not been outlandish. No matter what the case, squirrels are in trouble this winter. Hawks and foxes eat squirrels, so they'll be in trouble too, come spring.

Interestingly, each oak tree undergoes a 2-4 year cycle: sometimes it produces lots of acorns, sometimes few. But I don't see any way for the cycles to synchronize in an area as large as the whole East Coast, and I don't believe this has been observed. So, something mysterious is happening. I don't like it. There are too many weird die-offs going on: bees, bats, frogs, and so on.

A flying squirrel retrieves food put out by the staff at Long Branch Nature Center in Arlington County.
Richard A. Lipski, *The Washington Post*

On a lighter note: Greg Egan reports a story about "Israeli spy pigeons":

> BTW, I don't know if you remember that I'd planned to visit the city of Kashan in Iran, but ended up dropping it from my itinerary because I lost two days due to a delayed flight. On the weekend, a friend told me that the Iranian authorities had "arrested Israeli spy pigeons" at the nuclear site near Kashan! I thought he must have got the story from The Onion, but it turned out to be true ... or at least it was published in an Iranian reformist newspaper, so maybe they actually had their tongue in their cheek as much as the editors of The Onion do:
>
> - Iran arrests 'spy pigeons' near uranium plant, *The Australian*, October 21, 2008.

I wrote about the long-lived reign of pigeon technology on July 30th. Pigeons were the fastest method of sending long-distance messages from 2900 BC to 1844 AD! They played a crucial role in the Franco-Prussian war. But I'd never heard of *spy pigeons* before.

Sheer ignorance on my part: pigeons were used to carry spy cameras over enemy lines in WWII. They looked pretty cute:

Spy pigeon, from the International Spy Museum.

Finally, here's a charming email I received in response to my October 30th entry about the Iranian city of Yazd:

> Hi,
> I was reading your book *Gauge Fields, Knots and Gravity* - J. Baez, J. Muniain. I said to myself, "Whose is this sweet pen opening the knots of this difficult subject? Let me find him on the Internet!" I have a djvu copy of your book torrented into my computer. When I got to your place, I saw some familiar pictures. I became gobsmacked. You also liked me: pictures from Iran and Yazd. I am originally from Yazd. You called that place, "cool!" Do you know why I like maths and quantum mechanics and other things? People of Yazd are very hard working. My father was a great lawyer, a legislator and a famous judge of highest rank in Iran. He also was a disciple of existentialism school of philosophy of Molla Sadra (1570-1648). Modern followers of this philosopher believe that he in his (existential) evolutional motion of essence attributed to the matter essentially has introduced the time dimension of Einstein's relativity. From that point they became very interested in studying the relativity theory. My father was also one of them. After being fifty years old he started reading Bertrand Russell's *ABC of Relativity* and such things. At the law school they were not taught any mathematics, and his familiarity was only of some basic maths and geometry. So he decided to learn all about differentials and integrals in a hope to understand tensors. One night he came with Gamov's book *One, Two, Three,... Infinity* and he talked about everything from that book including the worm in the apple and making a human inside-out, having all the universe inside him. At that time he was fifty eight and he died in 1960 when he was fifty nine years old. So it became my adventure to continue his road. Now, I am fifty-seven and have just got to understand your book. Let me tell you some stories about Yazdi people to let you know how much they liked green world and recycling. Their qanat system shows how much they were fighting with the lack of water sometimes they had qanat bringing water as far as 250 miles away. It is a joke that if around Yazd somebody in the empty remote desert sits to make himself lighter suddenly a shovel comes under him and a voice with the accent of the Yazdi people (it's like the Liverpool accent in Britain) tells him, "Don't waste it!" They have to keep the land fertile to fight back the moving dunes. It is believed that when Cyrus the Great was going from Shiraz to Bacteria to fight nomads attacking Iran he was passing Yazd and all the way his army riding in almond forests. But inner lakes receded and only small thickets and gardens of almonds remained that people were

keeping with difficulties. Their baklava made of almonds is the sweet memory of those forests.
All the best and good luck
Yanis Hakeem (UK citizen)

December 5, 2008

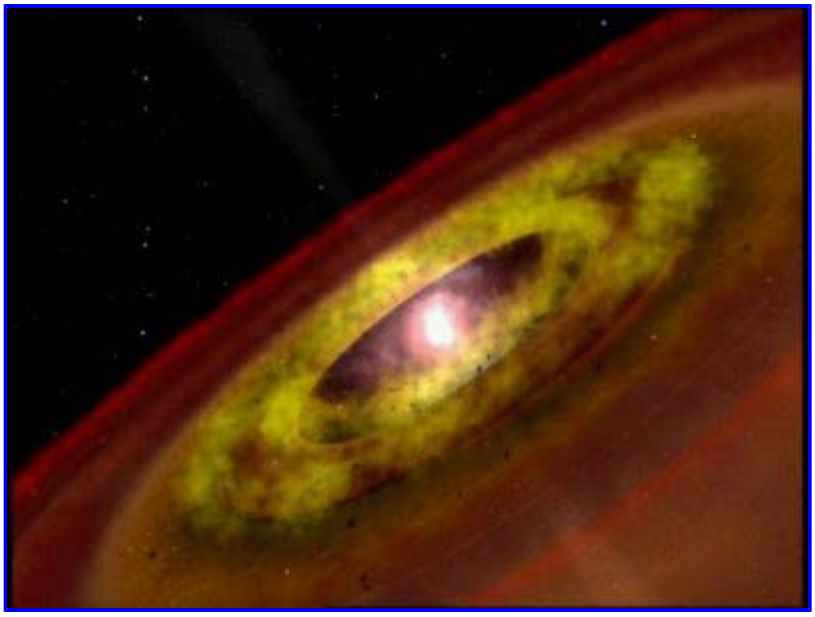
Kevin Kelly pointed me to an interesting article about "mineral evolution". The number of different minerals on this planet keeps going up — and ever since *life* ran wild, it's soared! Some examples are obvious: seashells become limestone, which gets squashed into marble. Some are less so: there was very little *clay* before the advent of life. But this article tackles the subject head-on:

- Robert M. Hazen, Dominic Papineau, Wouter Bleeker, Robert T. Downs, John M. Ferry, Timothy J. McCoy, Dmitri A. Sverjensky and Henxiong Yang, Mineral evolution, *American Mineralogist* **91** (2008), 1693-1720.

Here's a timeline loosely taken from this paper:

- **The era of planetary formation.**
    - Primary chondrite minerals (> 4.56 billion years ago): *60 species of mineral*.

      Chondrites are stony meteorites that formed early in the history of the solar system. They're made of chondrules — millimeter-sized spheres of olivine, pyroxene and other minerals — together with CAIs (calcium-aluminum rich inclusions) and other stuff. These chondrules began life as molten droplets back when the Sun was a T Tauri star, heated only by gravitational collapse.

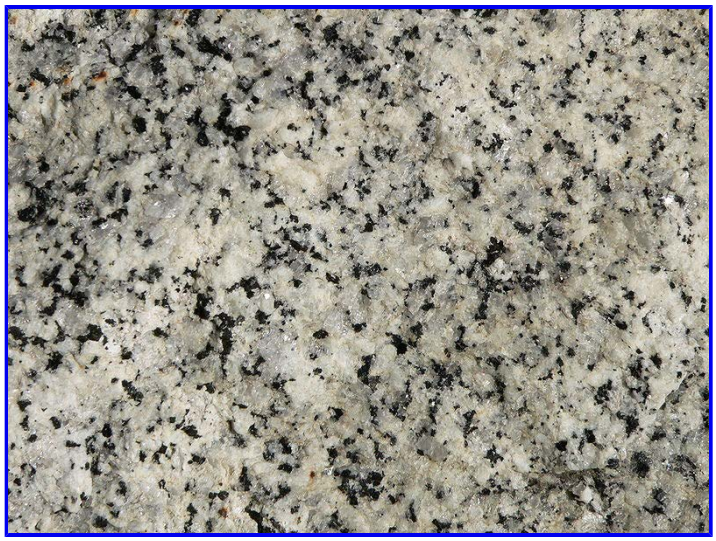
      

    - Aqueous alteration, thermal alteration, and shocks form achondrites and iron meteorites (4.56 to 4.55 billion years ago): *250 species of mineral*.
- **The era of crust and mantle reworking**.
    - Igneous rock evolution (4.55 to 4 billion years ago): *350 species of mineral*.

      The Hadean eon began with a bang: the event that formed the moon around 4.55 billion years ago! The currently popular explanation of this event is the giant impact theory, sometimes called Big Splat Theory. The idea is that a planet about the size of Mars occupying one of the Lagrange points of Earth's orbit gradually drifted out of this stable location and eventually smacked into the Earth. This hypothetical doomed planet goes by the name of Theia. You can watch a simulation of it hitting Earth. Ouch!

Whatever caused it, Earth's crust and outer mantle were melted by this event. No rocks on Earth are known to survive from before 4.03 billion years ago, so the details of this time period are greatly debated. However, many igneous rocks, especially basalt (composed mainly of plagioclase and pyroxene) must have been formed at this time.

- Granitoid formation and the first cratons (4 to 3.2 billion years ago): *1000 species of mineral*. Cratons are a bit like small early "plates" in the sense of plate tectonics: they're ancient fragments of the earth's crust and mantle, many of which survive today. While most cratons only finished forming 2.7 billion years ago, nearly all started growing earlier, in the Eoarchean era. Cratons are made largely of granitoids. Granitoids are more sophisticated igneous rocks than basalt. Modern granite is made in a variety of ways, for example by the remelting of sedimentary rock, and it consists of quartz, plagioclase and alkali feldspars. Early granitoids were probably simpler.



- Emergence of plate tectonics (3.2 to 2.8 billion years ago): *1500 species of mineral*.

  In the Paleoarchean and Mesoarchean eras, plate tectonics as we know it began. A key aspect of this process is the recycling of the Earth's crust through subduction: oceanic plates slide under continental plates and get pushed into the mantle. Another feature is underwater volcanism and hydrothermal activity.

- Anoxic biology leading up to photosynthesis (3.9 to 2.5 billion years ago): *1500 species of mineral*.

The earliest hints of life include some banded iron formations that date back 3.85 billion years. The real fun starts with the rise of photosynthesis leading up to the Great Oxidation Event about 2.5 billion years ago. But organisms from the domain Archea can do well in a wide variety of extreme environments without oxygen, and as the name suggests, many of these organisms are very ancient. These organisms gave rise to an active sulfur cycle and deposits of sulfate ores starting in the Paleoarchean era. They also made the atmosophere increasingly rich in methane throughout the Mesoarchean and Neoarchean.

- **The era of bio-mediated mineral formation**.
  - The Great Oxidation Event (2.5 to 1.9 billion years ago): *over 4000 species of mineral*.

    The Archean eon ended and the Proterozoic began with the Great Oxidation Event 2.5 billion years ago. In this event, also known as the Oxygen Catastrophe, photosynthesis put enough oxygen into the atmosphere to make it lethal to most organisms of the time. The oyxgen-rich atmosphere in turn led to a wide variety of new minerals.

  - The intermediate ocean (1.9 to 1 billion years ago): *over 4000 species of mineral*.

    In the Mesoproterozoic era, increased oxygen levels in the ocean put an end to many anoxic life forms. For example, around 1.85 billion years ago, banded iron formations suddenly ceased. The next gigayear was rather static and dull — if you're mainly interested in new minerals, that is.

  - Snowball Earth and the Neoproterozoic oxygenation events (1 to 0.54 billion years ago): *over 4000 species of mineral*.

    The Neoproterozoic era probably saw several Snowball Earth events: episodes of runaway glaciation during which most or all the Earth was covered with ice. Since ice reflects sunlight, making the Earth even colder, it's easy to guess how this runaway feedback might happen. The interesting questions are why this feedback doesn't happen now — and how it stopped back then!

    Here's a currently popular answer to the second question. Ice sheets slow down the weathering of rock. Weathering of rock is one of the main long-term processes that use up atmospheric carbon dioxide, by converting it into various carbonate minerals. On the other hand, even on an ice-covered Earth, volcanic activity would keep putting CO_2 into the atmosphere. So, eventually CO_2 would build up, and the greenhouse effect would warm things up again. This process might be very dramatic, with perhaps as much as 13% of the atmosphere being carbon dioxide (350 times what we see today), and temperatures soaring to 50 Celsius! But, the details are still the subject of much controversy.

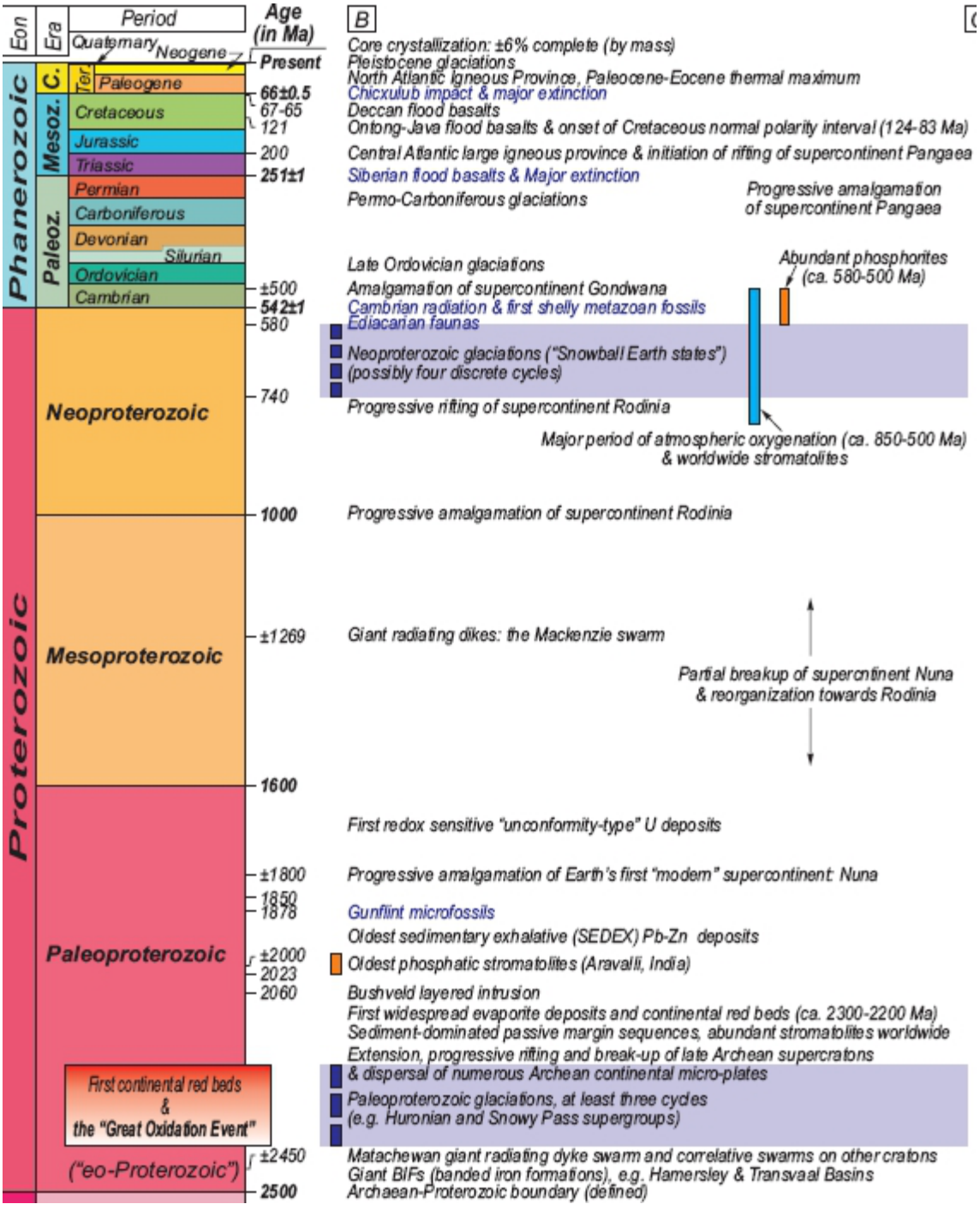
    At the end of these glacial cycles, it's believed that oxygen increased from 2% of the atmosphere to 15%. This may be why multi-celled oxygen-breathing organisms date back to this time. Others argue that the

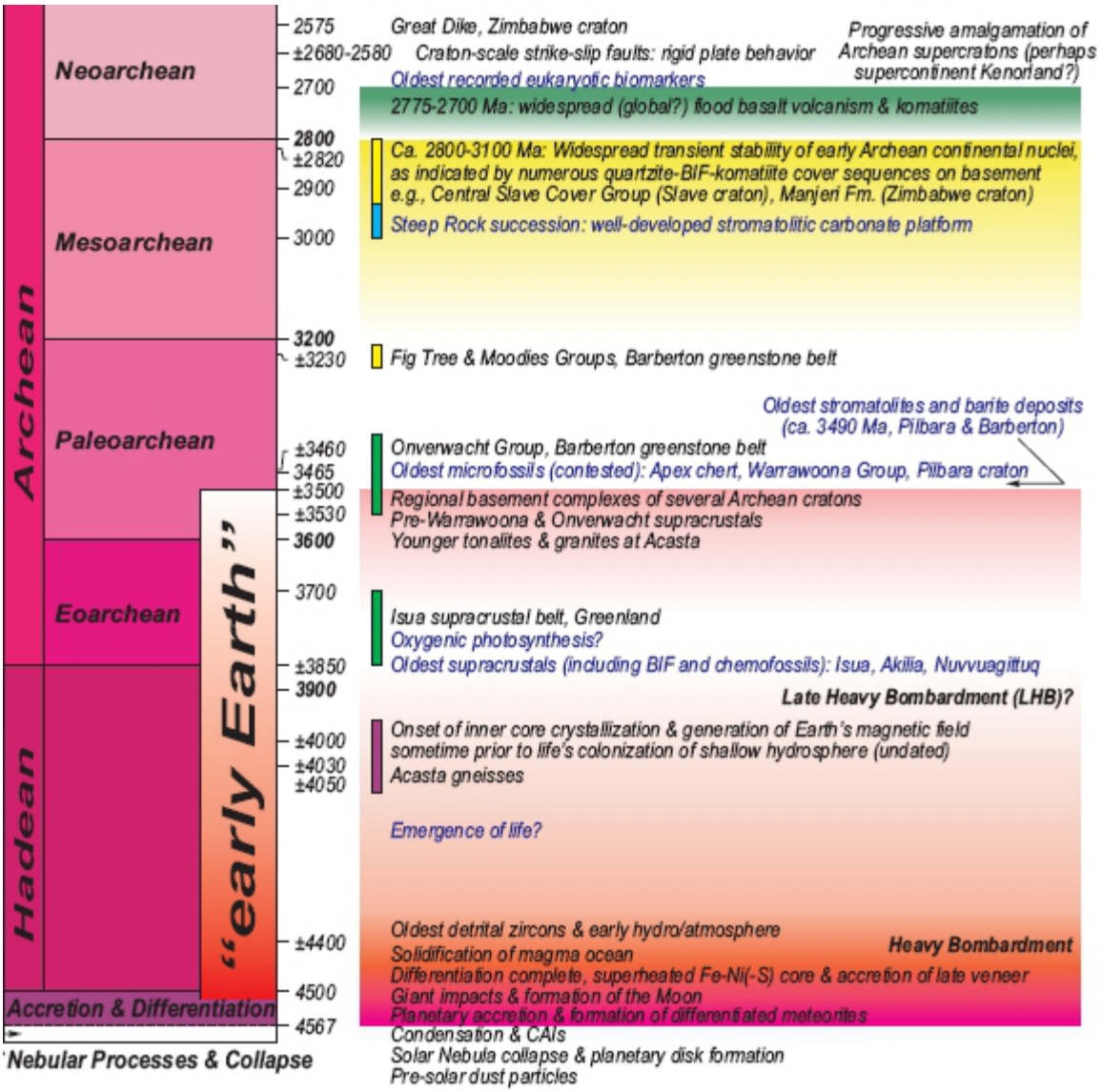
"freeze-fry" cycle imposed tremendous evolutionary pressure on life and led to the rise of multicellular organisms.

- Phanerozoic biomineralization (0.54 billion years ago to now): *over 4300 species of mineral*.

  The Phanerozoic eon, beginning with the Cambrian 540 million years ago, marks the rise of of life as we know it. During this time, sea life has given rise to extensive deposits of biominerals such as calcite, aragonite, dolomite, hydroxylapatite, and opal. There has also been increased production of clay and many different types of soil.

Here's a cool chart from the paper:





There are lots of cool things to learn about lurking in this chart: the Late Heavy Bombardment, dike swarms, the Slave craton and Archean supercratons, and those supercontinents with wonderful names like Kenorland, Nuna (also called Columbia), and Rodinia.

For a more polished version of the above story, see week273. I also added some of this inforation to my timeline.

In the future, various kinds of human trash will give rise to new species of minerals. You've already seen glass and styrofoam pellets on the beach, and huge landfills. A lot of this trash looks ugly now, but maybe time will beautify it... the glass already looks pretty.

December 8, 2008

Another sign of the economic crisis: the Tribune Company, which owns the *Chicago Tribune*, the *Los Angeles Times* and nine other newspapers, filed for bankruptcy today. They have $13 billion of debts and assets of only $7.6 billion. I quit taking the *LA Times* on August 24th — the management had run the paper into the ground. I didn't expect it to go under so soon. Indeed, the *LA Times* made $100 million in profits this year. But it seems Sam Zell's risky business strategies are part of the problem: they made him lots of money when times were good, but now he's in trouble.

December 12, 2008

I woke up to a phone call — my mother. I thought she said my father had died: I yelled out to Lisa, "Dad's dead!" But after some explanation it turned out he was alive. He had caught a virus that was running around the nursing home where lives, even though they'd locked down the place to prevent its spread: my mother wasn't able to visit him last Sunday, because of this quarantine. His blood pressure was extremely low: 60 over 30. They gave him a few hours to live.

I guess I haven't written about my father here since June 13, 2006. He's been in a nursing home ever since a serious illness laid him up in the hospital in the summer of 2007. His health has slowly deteriorated since then, though he certainly had plenty of good days. He stopped using a walker and started using a wheelchair. His memory gradually became worse. A few months ago he got a bad case of pneumonia and could barely breathe; they gave him oxygen. A recent checkup of his implanted defibrillator showed he'd had another heart attack at 7 in the morning a few weeks ago — he didn't recall this, so maybe it happened when he was asleep. He had more and more trouble doing the simplest things. Last week he called my mom at 3 am and asked her if it was day or night. Later she showed him how to open the blinds to look outside. All this has been very sad, so I feel a lot of the grief has already been squeezed out of me, though there's probably more somewhere.

Later I called my mom at the nursing home. She and my sister Alex had been visiting my father. Sometimes he was asleep, sometimes awake: when they arrived he said "What's up, girls?" By the end of their long vigil, the nurse said my dad might pull through.

December 13, 2008

I tried calling my mother but she wasn't available — she's never taken to cell phones. Around 11 am, while Lisa and I were in the middle of our usual shopping routine, having breakfast at a cafe near Trader Joe's, she called me. She had visited my father again; the nurse said he was somewhat better. She was back home, tired, and wanted a nap.

At dinner my mother called and told me my father had died. Shortly before midnight (back east) she'd been woken by a phone call with this news.

It turned out that at 5 pm, she'd been struck with an urge to visit my dad again. She drove over to the nursing home. He was in bed with his shirt pulled off, dripping in sweat. He asked her to massage his chest. As she did, he winced and said "Goudzie, Goudzie..." That was his nickname for her, since her maiden name was Goudzwaard. And those may have been his last words.

She wondered if he'd had another heart attack. She stayed for a long time, until he fell asleep. She asked the nurse if he should be transferred to a hospice. The nurse said to call about it on Monday. But there's no need now.

December 14, 2008

I talked to my mom and sister on the phone, took a hike with Lisa in the hills behind campus, and finished writing week273, which I dedicated to my father. It was a nice excuse to think about what he was like back when he was healthy, and all the cool things he did.

I wrote:

> I'd like to dedicate this issue of This Week's Finds to my father, Peter Baez, who died yesterday around midnight at the age of 87. His health had been failing for a long time, so this did not come as a shock. It's a curious coincidence that I was already writing an issue about minerals, since my dad majored in chemistry and returned to school for a master's in soil science after serving in the Army in World War II. After that he worked in the Blackfeet Nation in Browning Montana, riding around in a jeep, digging up soil samples, and testing them back at the lab for the Army Corps of Engineers. When he found "medicine wheels" - stone circles laid down by the native Americans for ritual reasons - he would report them to his friend the archeologist Tom Kehoe. Later he moved to California, became an editor for the Forest Service, and met my mother.

He got me interested in science at an early age because he was always taking me to museums, bringing me books from the public library, and so on. As a little kid, when I spilled something, he'd say "So you don't believe in the law of gravity?" He liked to joke around. Whenever I said an ungrammatical sentence, he'd tease me for it. "I'm not that hungry." "What do you mean? You're not *how* hungry?"

I learned a lot of math, physics and chemistry from his 1947 edition of the CRC Handbook of Chemistry and Physics - an edition so old that it listed "mesothorium" among the radioactive isotopes. He brought home the book "From Frege to Gödel" — a sourcebook in mathematical logic — because it was in the math section of the library and he misread "Gödel" as "Googol": he knew I liked large numbers! I didn't understand much of it, but it had a big effect on me.

I owe a lot to him.

December 17, 2008

It's been raining heavily for several days now, on and off. It's great! — the first really serious rain since spring. The hills will turn green. Up in the mountains, they're having heavy snows. Over the mountains in Victorville — normally a hot, dry and sunny place — here's what my friend's yard looks like:

When the clouds clear I'll have to go look at the mountains: by now they have several feet of snow. Maybe I'll even drive up there when the roads are cleared.

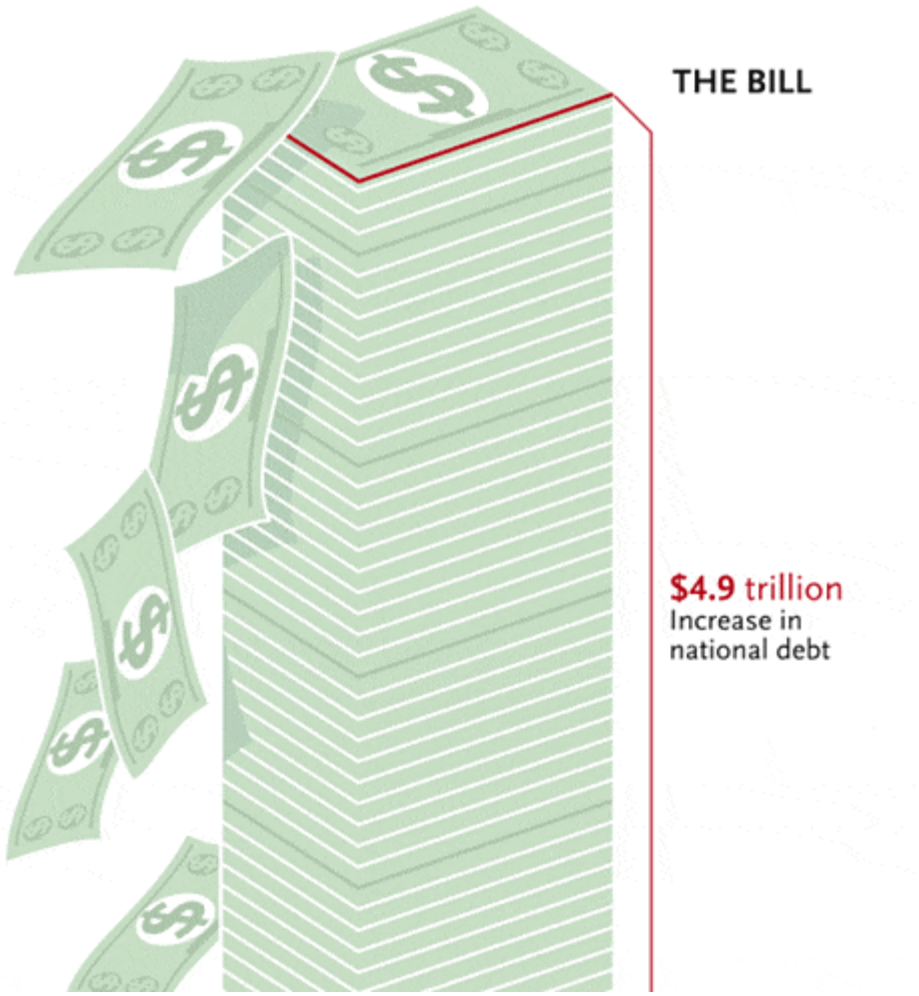
December 18, 2008

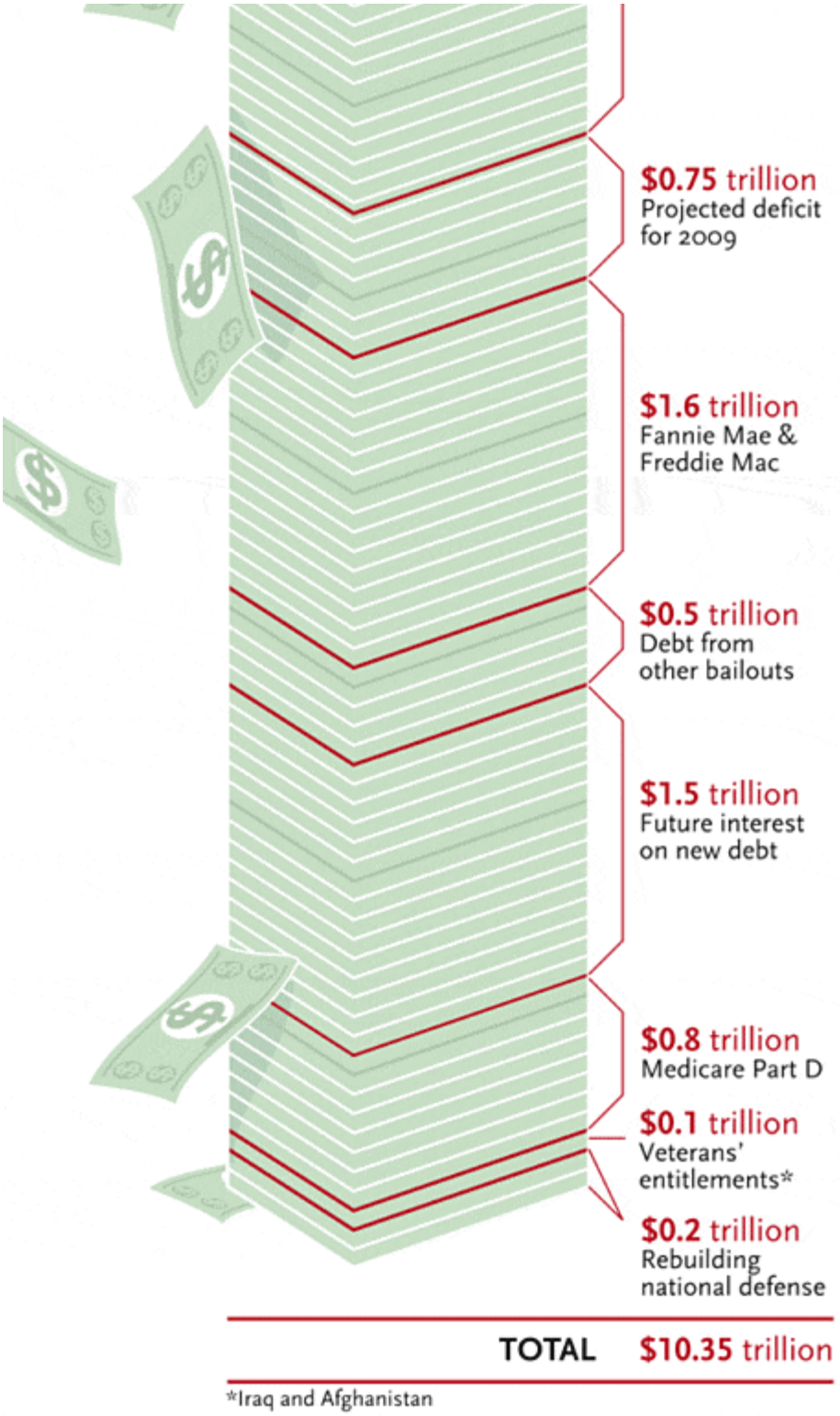
In Iraq, the reporter Muntader al-Zaidi flung his shoes at Bush, shouting "This is a gift from the Iraqis, this is the farewell kiss, you dog!....This is from the widows, the orphans and those who were killed in Iraq!"

Nobody knows how many Iraqis have died violent deaths since Bush led the invasion of Iraq based on false claims of "weapons of mass destruction": estimates range from 86,000 to 151,000 to 1,033,000.

It has been pointed out that if a journalist had thrown a shoe at Saddam Hussein, he and his family would have been tortured and killed. That's true. Al-Zaidi seems to have been beaten, but he probably won't be killed, and I hope his family is okay. It's a bit sad when we need to reach to a notorious dictator to find a comparison that makes Bush look good. We can only hope that Iraq someday winds up a better place than it was.

Here's a graphic from *Harper's Magazine* illustrating the 10-trillion-dollar bill Bush racked up during the two terms of his presidency. Click on the link for more details.





Obama has his work cut out for him. And not just when it comes to the economy: last Thursday, December 11th, Bush's Secretary of the Department of the Interior, Dirk Kempthorne, announced some new rules. He eliminated 35-year-old regulations in the Endangered Species Act that required an independent scientific review of federal projects to determine their effect on protected plants and animals. And, he allowed oil and gas drilling in polar bear habitat off Alaska's coast — a move designed to prevent the Endangered Species Act from being used to regulate greenhouse gas emissions.

These are just a few of Bush's last-minute regulatory moves — over 90 of them! Today Stephen Johnson, head of the Environmental "Protection" Agency, issued a memo saying that carbon dioxide is not a pollutant that needs to be considered when approving new power plants.

You can play an online game to see more of Bush's "midnight rules".

December 19, 2008

The clouds have cleared, so we can see the snowy mountains rising above the smog of San Bernardino:

It's beautiful here, but there's icy weather in the midwest and northeast of the country, and the news is not good.

After years of growing fat and stupid making lots of money on inefficient monster vehicles, the US auto industry was felled by the one-two punch of soaring oil prices followed by the collapse of the US economy. Gas is cheap again — I bought some for $1.85 today, and it was cheaper than that last week. But that's just because so many people are going broke — it's not making Americans want to buy more gas-guzzling SUVs, at least not yet. So now the Big Three automakers are begging for money from the US government. Today President Bush announced a $13.4 billion bailout plan for General Motors and Chrysler. Chrysler is taking an extended Christmas vacation, closing all its plants at least until January 19th.

I actually think it might be good, in the long term, if we let the auto companies fail. Lots of jobs would be lost, so it would be very painful for many people in the short term. But the US needs to move in a new direction, and the collapse of the auto industry could be history's way of telling us that certain dinosaurs are headed for extinction.

Another big company filed for bankruptcy today: Polaroid. Long past its heyday, crushed by the unexpected rise of digital cameras, Polaroid is by now owned by the "Petters Group" — whose founder, the entrepreneur Tom Petters, was accused of swindling and arrested in October, caught while he was preparing to flee in a yacht filled with bags of cash.

December 20, 2008

My sister Alexandra sent me this obituary which she is preparing for the local papers:

> Peter Baez, who worked for the USDA Forest Service for 25 years before retiring in 1994, died on Dec. 13 at the Inova Cameron Glen Care Center in Reston. He was 87 years old.

> Mr. Baez moved to the Washington area in 1964. He was born in Puebla, Mexico and grew up in Brooklyn, New York. His brother, the physicist Dr. Albert Baez, was the father of singer Joan Baez. Mr. Baez received his B.A. degree from Drew University and then served with the Air Transport Command in the China-Burma-India Theater during World War II. After this, he earned a B.S. degree in soils from Cornell University and an M.S. in soils from the University of Minnesota, Minneapolis.
>
> Mr. Baez worked as a soil scientist with the Bureau of Indian Affairs on two Indian reservations and afterwards, as an engineering technician with the U.S. Corps of Engineers. He then took a civilian editorial position with the U.S. Navy and later held editorial positions with the USDA Office of Information, the Agricultural Research Service, and the USDA Forest Service.
>
> After retiring from Federal service, Mr. Baez volunteered for the Forest Service for three years. Subsequently, he volunteered as an ESL tutor in a county program for about two years. Finally, he volunteered as on ombudsman at the Inova Cameron Glen Care Center in Reston for four and a half years.
>
> Survivors include his wife of 49 years, Phyllis Baez, of Great Falls, VA, his son, John Baez, of Riverside, CA, and his daughter, Alexandra Baez, of Alexandria, VA.

An obituary of this sort, like the dehydrated remains of man's life, doesn't really say anything about what he was *like*.

For example, it says "Mr. Baez worked as a soil scientist with the Bureau of Indian Affairs on two Indian reservations."

But, it doesn't say that while working in the Blackfeet Reservation near Browning Montana my dad lived in a shack, cooked using laboratory glassware, built stereo speakers into a door for good resonance, and received a gift of buffalo meat from some native American friends on Christmas... or that he and his friends had to drive 50 miles to the town of Cut Bank to get a drink.

Nor does it say that he later moved to the Colorado River Indian Reservation in Poston: a tiny town in Arizona that had been an internment camp for Japanese Americans during World War II... or that he quit his job in disgust after complaining about how his bosses discriminated against a Jewish colleague and friend of his.

And these anecdotes, too, are just a pale shadow of a man's daily life.

December 22, 2008

Some good news: grownups will soon be running US science policy.

Barack Obama appointed Nobel laureate physicist Steven Chu as head of the Department of Energy. On May 9, 2007, Chu said "If I were emperor, I would put the pedal to the floor on energy efficiency and conservation." As director of the Lawrence Berkeley National Laboratory, Chu pushed scientists to develop technologies to reduce greenhouse gas emissions.

Obama appointed Macarthur prizewinner and Woods Hole director John Holdren to be his science advisor. Holdren recently compared our current approach to climate change to:

being in a car with bad brakes driving towards a cliff in the fog.

In the October issue of *Scientific American*, Holdren wrote:

> Unfortunately, the Bush administration has wasted the last eight years. It should have been taking decisive action but engaged instead in systematic understatement of the danger: it has made ridiculous assertions that the U.S. should not do anything that China does not agree to do and has stubbornly insisted that no action should be taken to improve climate change 'if it hurts the economy.' This last rationalization translates into 'if it costs anybody any money' and is roughly akin to saying that the country should not defend itself against terrorism because that costs money.

He recently gave this speech at Harvard:

- John Holdren, Global Climate Disruption: What Do We Know? What Should We Do?, speech at the John F. Kennedy School of Government at Harvard University, November 6, 2007.

He begins by explaining the problem and its causes. Then, starting on page 30 of the PDF file of his speech, he describes what we can realistically do. The short answer: there's no panacea; we need to pursue many strategies. But the "cheapest, fastest, cleanest, surest source of emissions reductions is to *increase the efficiency of energy use* in buildings, industry and transport."

Obama has also appointed Macarthur prize winner and zoology professor Jane Lubchenco to head NOAA, the National Oceanic and Atmospheric Administration, which does most of the US government research on climate change, and regulates fisheries.

Jane Lubchenco surveying the seafloor off Oregon.
Photo by Kenneth R. Weiss

She recently gave this speech:

- Jane Lubchenco, Advocates for Science: The Role of Academic Environmental Scientists, speech at the conference *The Scientist as Educator and Public Citizen: Linus Pauling and His Era*, Oregon State University, October 29-30, 2007.

She says that her research in oceanography started out being fun, but then

> Over time, many, many ecologists observed that the systems they were studying were changing before their very eyes. Ecologists that would go back to the same places year after year after year started seeing changes that had not been documented before. The changes were different, they were happening faster, and many more ecologists began to take note of "how is it changing," and "why is it changing," not just "how does it work?" The next sort of step in that process was "what are the consequences of these changes," not just to the ecosystems but to the people who depend on them, and finally, "how can we do a better job of managing activities that are causing the changes, or of mitigating the changes that are underway?" And so, over the thirty years that I've been a practicing scientist, there has been a real revolution in the nature of the questions that ecologists have been asking of the world, driven in part by larger-scale changes that they were observing.

As part of this revolution, she helped propose Sustainable Biosphere Initiative. I hope that at NOAA she can start to implement some of these ideas. The oceans, in particular, are under a double assault by climate change and overfishing. She writes:

Fisheries peaked in the mid 80's and have been on the decline since then. This represents, in part, the sequential depletion of one fishery after another, after another. We also have data suggesting that 90% of all the big fish of the ocean are gone. The huge tuna, sharks, swordfish, marlin, and other icons of the sea have been very significantly depleted primarily by industrial-scale fishing over the last couple of decades.

There are major changes underway in oceans. In addition to that, more and more ocean ecosystems are undergoing very rapid, abrupt change. They are complex, nonlinear systems that are characterized by tipping-points, and we're seeing very rapid changes, loss of resilience in these systems, loss of ability to cope with changes, and in fact very radical change as a result.

For my January 2009 diary, go here.

Empty-handed I entered the world
Barefoot I leave it.
My coming, my going -
Two simple happenings
That got entangled. - Kozan Ichikyo, 1360.

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home