Chaos in Cincinnati

Benoit Mandelbrot's
5- Ring Fractal Circus!

I. Begin at the beginning of the beginning before the beginning of the beginning ....

At the beginning:

September 13th

1987

5 A.M.

Monday

when the observer,

travelling from St. Louis en route to New York City , stops off in

Cincinnati for 5 days,

to attend a conference on *Fractal Geometry* at the

University

of

Cincinnati.

Masterminding the 5-ring fractal circus is the mathematician who discovered and named this object of pure mathematics,

{ BENoIt Mandelbrot }.

He gives most of the lectures, relevant or irrelevant, leaving a little bit of time over for the study of Chaos and Catastrophes in lectures given by James Yorke, Heinz-Otto Peitgen and Bob Devaney.

II. Preamble to a Prologomena

From a long overdue visit with friends in

historical   low key

       antique   colorful

          déjà vu   stagnating

          (lost?)

               St Louis,

Missouri,

I arrived, at

     5 A.M.

       Monday morning

           September 13th

             1987

in the Greyhound Bus Terminal by the   dreary

             moonscaped

           lower

           riverside basin

    of

downtown

      Cincinnati, Ohio.

Collecting numerous items of gear I tumbled off the bus.

     Cincinnati deserves at least one visit.

     After even one visit, Cincinnati is unforgettable.

#3...

At least it's not Cincinnati.

Ah, but it is!

I was present 3 hours later, when a renowned, self-propagandizing composite of

stockiness

brains

erudition

pedantry

ceremoniousness

wry humor

known as a BENOIT Mandelbrot

stubbed his toe while entering onto the gloomy

garish

STAGE

of the

sunken

basin   of the   Old

Chemistry

Building

at the

University of Cincinnati!

Dr. Mandelbrot announced to a congregation of mathematicians and computer scientists, that problems abound in the theory of fractals which are simple to state yet almost impossible to solve. He went onto say that one might think of a

fractal as a house eternally under construction: first come the walls, (infinitely added to); then the rooms, (infinite in number); then the furniture, furnishings, shelvings, nooks, cubby holes, goods, bric-a-brac, books, cutlery, clothing, boxes, groceries, place mats, candlesticks, curios, coins, buttons, beads, beans, pepper, salt......................................

plus an infinitude of guests who lie around all day doing nothing at all. .

Here is an example: Why is the Mathematics Department of the University of Cincinnati located in the Old Chemistry Building, and not in the Old Mathematics Building? Mandelbrot himself gave us a clue; when he went on to say that a fractal may be thought of " as a house which is constantly being added to."

Mathematics is basically a branch of Old Chemistry, even as chemistry is a modern branch of Old Numerology . The unifying link is Kabbala, of which several gifted exponents were in the audience on that day.

Interest in the interplay of Microcosmos and Macrocosmos is not new; it goes back to Paracelsus, and further, to the ancient distinction between the forests and the trees - which fractals erases entirely.

The entire conference had been underwritten by either IBM or the NSF, I forget which.

Mandelbrot's swagger evoked melodious resonances of self-

similarities (" not to be confused with affinities", he warned

us), to the gyrations I myself performed when stepping off the Greyhound bus that morning. For the greater part of that day and the next I, reeling in a delirium of acute sleeplessness, generated a chaotic trajectory structurally akin to that of a spot of dust on the surface of a liquid agitated by the Brownian motion of its molecules, (which Mandelbrot calls, " the most natural example of a fractal motion in everyday life."

What had happened was this: At 6 PM Monday evening during a reception hosted by either IBM or the NSF, I placed a call to Cincinnati's Youth Hostel from a telephone in the Faculty Club a U. Cincinnati. I had every confidence that the call would go through; had we not learned that very morning that fractals were successfully applied to the probability distributions of telephone transmission errors? Phil the Hostel manager, told me to hurry over immediately: he was closing the hostel at 6:30 P.M.

   I hung up the telephone

           set off at a run

           misestimated the distance

           to the Youth Hostel by more than a mile

      Such errors in judgment are given the name of 'lacunarity' in fractal analysis, the degree of difficulty involved in obtaining the correct value for the fractal dimension.

        Zeno's paradoxes have some application here: the path might after all have diverged. The boundary between divergent and convergent paths is called the Julia set. It is either connected,

                        or disconnected

       Indeed , the key to

#6...

                                        nowhere dense
        Nature

                                        and, sometimes, very   may
lie

                                        beautiful
        somewhere

                    Phil
        between

                    met me   the
Julia set

                    just as   and
the

                    he was going
        Anthropic

                    out the door.
        Principle

        He had me sign the register, took my Hostel card
        and $6.00 from me.
        stepped into

He promised to be back   his

around eleven.   car

     Driving off, he pointed to a patch of earth in his
backyard
where I might

    try

      to get

  some

    sleep!

    Back to the conference and the free snacks; and a
conversation with Dr. Mandelbrot himself. I was able to
remind him of the last time we'd met: it was on the underground
quais of the subway station at Harvard Square, Cambridge. I'd
just stopped playing the violin there long enough to explain to an
acquaintance the possible applications of Shannon's Second
Information Theory Theorem to the problems of playing the violin
(SIGNAL) against a background os subway sound (NOISE).
Mandelbrot happened to be walking past at just that moment,
turned his head in out direction at the words " Shannon's Second
Theorem", squinted suspiciously, then moved on.
    Now, sitting across from me in the Faculty Club in

Cincinnati's University of Cincinnati, he didn't recall the encounter, but it was obvious that he felt that his academic credibility was being compromised by letting me tell him such a story. Throughout the entire conference indeed, he continued to regard me as something far stranger than those exotic 'attractors' and 'tremas' and 'homoclinic points' that he does understand so very well.

The fractal party shirt in 6 outrageous colors that I'd bought at the Santa Fe Goodwill Thrift Shop for $3.50, and which I wore at 6 of his 9 lectures, did not increase his sense of security. Hey!! he seemed to be saying: " Who's Mr. Fractal around here? Him or me?"

Return to the Youth Hostel again at 9 P.M. The difficulties involved in finding a decent sleeping posture were complicated by the bucolic slope of the hillside. Self-similarity we must never forget , is not the same as self-affinity; you can feel it in your spine. this verity was neatly illustrated the next morning by a slide projection of the "Devil's Staircase", yet one more ingenious Mandelbrotian construction: but I did manage to get about an hour's sleep.

Arriving at midnight

profuse in apology

came Phil

He had other good traits as well. I was

admitted into the

building   taken up

to the attic

where

as the lone occupant

I slept

in one of the steel-framed beds

of a linear set

of eight.

Is not Hamlet's statement : "I could be bounded in a nutshell, yet count myself a lord of infinite space, were it not that I have bad dreams", a clear forerunner of the fractal concept?

Not to exaggerate : I was booted out onto the street again at 6Am the

next morning: *Phil*

had

to go to

WORK!

This

was

by far

the worst   I ended up

Youth Hostel

staying

FOUR

nights.

in all my experience with the organization.

Turbulence, Mandelbrot told us, is the central stumbling block of physics.

"That's not a Youth Hostel" , commented an IBM computer analyst

over morning coffee (courtesy of the NSF). We were standing about, once again, in the basement of the Old Chemistry Building and under the Big Top of the Five-Ring Fractal Circus.

                As our stomachs

                                        kneaded doughnuts ,

        Danishes

                        coffee and bagels

        together in a gooey

                        paste, he said:

                                " That's a hostile youth!!"

                        ❀❀❀❀❀❀❀❀❀❀

            Four days later I joined a queue of about a dozen persons all waiting for a Greyhound bus to take us either to Columbus, Pittsburgh, or New York, depending on one's orientation. The line was
side-swiped by

                                                a teenager

                        of

blunt

                                        " I've got a

manner

                                    check right here

cantering gait

                                    worth *$150* ."

resonant voice

                        "I can only cash it

(The kid rattled a paper scrap)

#11...
                    in

                Columbus,

Ohio!   This check can be

            yours

            if you buy me

a

ticket

to

                Columbus! "

        His statement having done little more than reinforce

the frigid ambience , he upped the ante:

                            " I'll give you

            $300 !!

when the banks open

                tomorrow !

No one present

myself included

believed the young man; however

I did point out

the Traveler's Aid office   Norbert Wiener

visible right across   is said to have

the hall.   remarked

                                          that all

                                          mathematics

                                          problems are

                                          impossible

The crowd laughed at my   *before*

good-natured   they're solved

folly   but afterwards

for according any   they are

sincerity   trivial.

to the boy.

Astonishing prescience is apparent in the Upanishads.

❊❊❊❊❊❊❊❊❊

"The theory of fractals" , **Mandelbrot informed us in a**
boasting tone,
" has been rescued from the trash cans of mathematicians. "
      The analysis of dust is one of the great glories of fractal
geometry. One entire ring of the 5-ring fractal circus is filled
with nothing but dust:

      car exhausts
        Brownian motion
  rottings
     fly specks
         sandstorms
     nebular clusters
whirlwinds
  beaches
  cinders
       dessications.
Turbulence is the central stumbling block of physics.
❊❊❊❊❊❊❊❊❊

   For several days I found myself oscillating chaotically

(though with a well-defined fractal dimension of 2.7) between
Cincinnati's two strange attractors: each morning and late in every
afternoon, waving his *baguette enchantée* Benoit Mandelbrot lifted
the bloody bandage off the skin of our wounded cosmos to reveal
and endlessly convoluted web of

spark within speck

within mote within

flack within flack

within cinder within mote

swirling in vortices

of filaments within snakes

within chains within

threads

within wires within ropes

within strings

within hairs

within strands

within skeins

tangling, weaving, knotting, binding, splicing, twining, splitting,
combining dangling, gyrating and wresting, joining....

gauzes   *buried in auras*

buried in phizzes

buried in fuzzes

buried in furs

buried in textures

buried in molds

buried in steamings

within

seepings

within

  leechings

   within

    drippings of

     droppings

      of nodes

      of nodules

     of globs

     of globules

of blobs within glop of suds

and slop

and slime

and grime

and grease

    decomposing the finite

    into the infinite

    coalescing into the finite

    shattering into the infinite

    coagulating into the finite

    splintering into

    the infinite

    lumping

     into

     the

     finite.........

   *M*o*t*h*e*r   N*a*t*u*r*e*

   Or, as the poet saith:

To see a World in a Grain of Sand
And a Heaven in a Wild Flower
Hold Infinity in the Palm of your Hand
And Eternity in an Hour
All this in but a single ring of the 5-ring fractal circus!

❅❅❅❅❅❅❅❅❅❅

Inbetweentimes , when not in attendance at the conference,
I journeyed to the inner city, (a distance of 3 miles) carrying
a violin, cassette tapes and a ghettoblaster to deliver
luncheon concerts of Bach, Vivaldi, Mozart and Schubert,
desperately and beatifically serene within the eye of a raging
 cyclone of

smog.

ash,

garbage,

trash,

cigarette butts,

soda cans,   *propaganda,*

newsprint,

vomit,

spittle,

smoke,

gas,

distemper,

rudeness,

fear,

hostility,

stupidity,

ignorance,

contempt,

violence,

yelling,

cursing,

rant,

explosions,

discharges,

staggerings,

stammerings,

cracking and crashing and howling and breaking and raging and belching and debauching and disembowelling

and.....

A black youth, after dropping a quarter into my violin case returned a few minutes later to pan-handle a dollar for bus fare. His approach was somewhat unusual and eventually, well, I did give him the dollar. He was poorly dressed, partially blind , could talk knowledgeably about music: sympathetic in other words, which may or may not be quantifiable by the economists.

Which

ties

in

very nicely!

Given that Benoit Mandelbrot himself began His own career as a mathematical consultant to economists. He changed fields after he'd designed a test to plummet the depths of scientific credibility of the gloomiest of all sciences. Mandelbrot took an object familiar to mathematicians , known as a Weierstrass no-where no-here no-there, no-anywhere everywhere no-way

differentiable continuous curve , gave it a PhD (that is to say, doctored it up) and sent it to a wide sample of professional economists. Was it, he wanted to know, a possible model for the business cycle? The response was 50 –50, what he would have gotten by flipping a coin.

The snobbery of mathematicians is boundless as Aleph-2, yet narrow as a misplaced decimal in a long ledger of calculations.

Still there can be no doubt that a familiarity with fractals, dynamical systems and chaos might have helped the city planners of Cincinnati. These mathematical tools have, after all, been applied to the efficiency of Diesel engines, the passage of oil and water through porcelain filters, the variations of resistors in a grid, the distributions of frequencies of gamma rays in H-bomb explosions, and all the other things that Professor Mandelbrot told us about.

Cincinnati's downtown shopping area is at least as dirty as that of any major American city. The archaic buses rolling down the streets pour dense jets of stinking indigo smudge out their backsides. The winds blow filth and smog and dirty water that soaking clothing and skin, the skies are forever dimmed by sheets of particulate dust clogging slight, breathing and taste.

❋❋❋❋❋❋❋❋❋❋

It was here, in this very stinkhole, that three Fascist hunks masquerading as city cops stopped my performance long enough for one of them to recite an ordinance ratified by the Downtown Merchants Association and proclaiming that no music be allowed for 6 blocks in either direction... beyond which one finds only tortured wastelands, scarped deserts, moonscapes , and barking Greyhound bus terminals....

In a clumsy attempt to be friendly, one of these gargoyles used his coppy prerogative to pick my violin up from its case and attempt to play a tune!...

"I've wanted to do this all my life!"

he bleated in ecstasy. It is relatively easy to forgive

even an arrant bully

after such a confession.

III.

That within the desiccated heart of lowly dust unfathomed treasures may be stored, was known to mankind even before the advent of the fractal, which Mandelbrot immemorially metaphorized as " the most intuitive form of geometry".

Archaeology teaches much the same thing. And there is no doubt that archaeologists would find much to interest them in downtown Cincinnati. They would date a certain Youth Hostel back to the Early Pleistocene. A Greyhound bus terminal buried in the marshes of an

`   eroded

alluvial

plain

bordered by exotic   colossal

cloverleafing

metal structures

may have served

 the inhabitants

\   for purposes

of transportation

"Think of a fractal as a house that is constantly being added to."

And, if the Old Chemistry building had collapsed on top of our conference and not been excavated for a thousand years, the archaeologists of the 30th century would be able to fill a building the size of the beautiful museum at the University of Pennsylvania, with artifacts from the 5-ring fractal circus!

One can perambulate at infinite length, (though with fractal dimension a comfortable 1.3) about the University of Pennsylvania. However, that this would take us out of the frame of the logistic difference equation, its boundaries given by the city of Cincinnati, its strange attractors the Youth Hostel, the University, the Greyhound bus terminal, and the downtown shopping district of Cincinnati.

IV.

About one issue there can be no doubt: the public understanding of a Congress of Mathematicians leaves much to be desired. This opinion of mine is obviously shared by the sociable secretary of the mathematics department at Cincinnati U, whose cork memo board is covered with exotic nude male pin-ups from magazines not readily available in public circulation.

Even mathematicians have trouble with this conceptual dilemma. On the third night of the conference, Mandelbrot displayed slides of computer-derived 2-dimensional projections of hideous 3-dimensional fractals. These, he assured us, were *"objects of pure mathematics"* . Few

understood his wry sense of humor, most of them being IBM's with little direct contact with 98.6% pure mathematics.

Phil also. He asked me what had brought me to Cincinnati. At the mention of something so exotic as a mathematics conference, his eyes sparkled with admiration: "Hey!..."

, he squealed,

" Is that Star Wars stuff?"

Well, yes and no. Population Biology is one of an area in which fractals and chaos are traditionally applied.

And bullet wounds probably have fractal edges... And lungs! Now those things are one hell of a beautiful example of a fractal structure!

James B. Conant and other poison gas manufacturers must certainly have been making use of them indirectly in their calculations of toxic efficiencies!

And, why yes, now that I think of it, the Star Wars project *has* been accused of destabilizing world peace, promoting 'chaos' and all that, (though it may turn out to be a stable chaos after all , what they call a 'strange attractor') …..

And, my oh my ... there's *disinformation theory* , which is just information theory in reverse: what signal to noise ratios MAXIMIZE confusion? How much redundancy is required to so trivialize a message that people no longer recognize its significance?

And one might ponder the positing of a brand new brand of logic, one in which the following statement cannot be formulated : " In war, the first casualty is truth." Something like this:

Let ω be a member of the class W of wars. Let L_ω be its casualty list, in temporal order. Then, for all ω, the first member of Lω will always be T, where T is the "truth value" of some appropriate Boolean Algebra.

If, indeed, Truth and Falsehood be uniformly dispersed throughout the universe, then fractal geometry may indeed have some clarifying role.

One ought also take a look at Ernst Cassirer's theory of concept formation as laid down in the introductory section of "Structure and Function."

❈❈❈❈❈❈❈❈❈❈

This is the appropriate place to relent and acknowledge that my debt of gratitude to Phil. He manages Cincinnati's only Youth Hostel in Cincinnati, which just means that he's turned the attic of his own home into a dormitory. And he may, indeed certainly is, a hostile youth. but his

enterprise is a labor of love.

One of the many technical problems he's has had
to deal is that he and his wife are separated. Formerly either he or she could be at home in the evening to receive guests. As it stands now, when Phil goes to sleep, everybody goes to sleep. And when Phil leaves, everybody leaves.

This is not said with the intention of exonerating this
juvenile

arrogant

bossy crypto-Marine with

his crew-cut,

his macho misery,

his

"do it yourself by my rules"

mentality, his

strained apologetics...

Yet his praises must also be sung.

Were it not for Phil's hostel, people like myself wouldn't dream of visiting Cincinnati. Bikers and hikers, the mainstay of the AYH membership, don't pass through here. Even the ubiquitous Germans who swell the mode in youth hostels around the world, don't often come to visit this quintessentially German city.

Phil doesn't receive more than 300 customers per year; I doubt it's enough to pay for the upkeep to the attic.

Let's

face

it!

Phil is one of those neglected heroes of modern society somewhere between a

walking wounded

and a

living legend.

V.

By the 4th day of the conference, Professor Mandelbrot ran out of things to talk about. There is just not enough material in an introductory course on the generic properties of fractals to fill more than three lecture-days. He therefore filled up the time by reeling off a dozen or so anecdotes about the lives and wives of

the French mathematical establishment between the wars: the thrilling secret loves and adulterous affairs of Poincare´, Cartan, Lesbegue, Painleve´ ...... ´

One story merits the retelling. In World War II the famous number theorist Jacques Hadamard took refuge in the United States. He needed a job and answered an ad for a position in the math department of a small New Jersey college. At the interview the department chairman remarked that his name sounded familiar. Hadamard walked over to the wall and pointed to a chart holding the names, dates and portraits of famous mathematicians through history. "That person over there is me" , he said.

Needless to say, he didn't get the job. Paradigms don't teach in small New Jersey colleges. As Mandelbrot related his I watched the face of the department chairman of U Cincinnati's math department turning pink, green and purple in turn. Hadamard wouldn't have gotten a job at U. Cincinnati either.

Despite everything that Dr. Mandelbrot had been trying to teach us,

The
Microcosm
and the
Macrocosm
DON'T mix!!
❈❈❈❈❈❈❈❈❈❈
❈❈❈❈❈❈❈❈❈❈

#24...