

A Python Workshop

@

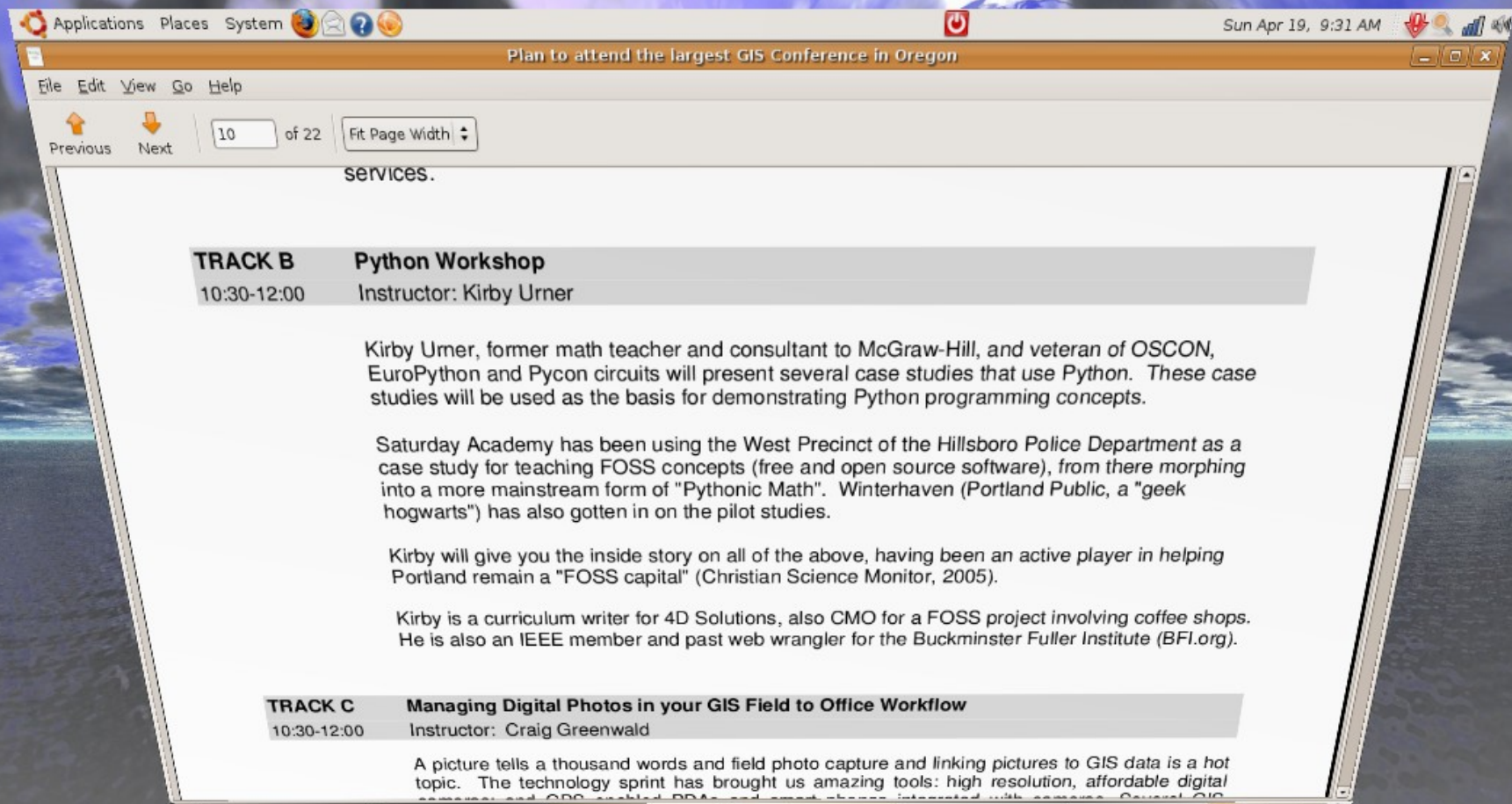
GIS in Action 2009

by K. Urner

In memory of Russell Towle, a place-based geometer

<http://home.inreach.com/rtowle/towle.html>

<http://rememberingrusselltowle.blogspot.com/>



Action: A screen shot Another example: A screen recording... then distribution media.

The screenshot shows a Mozilla Firefox browser window with the address bar displaying <http://www.orurisa.org/events/gisinact/2009event/>. The browser's title bar reads "GIS in Action 2009 - Mozilla Firefox". The page content includes a sidebar with links: "Registration and Conference Fees", "Conference at a Glance", "Full Program", "Special Events and Conference Highlights", "Exhibit Hall Information", and "Home". The main content area features the "GIS in Action 2009" logo, the dates "Tuesday April 21<sup>st</sup> Wednesday April 22<sup>nd</sup>", the location "Vancouver Conference Center and Hilton Hotel", and the address "301 West 6th Street Vancouver, Washington". A "Take Screenshot" dialog box is open, showing options to "Grab the whole desktop" or "Grab the current window", with a delay of 0 seconds. The dialog also includes an "Effects" section with a checked option to "Include the window border" and an "Apply effect" dropdown set to "None". Buttons for "Help", "Cancel", and "Take Screenshot" are visible at the bottom of the dialog. The website footer states: "More information about the conference will be updated as it is available".

Applications Places System Sun Apr 19, 9:59 AM

File Edit View History Delicious Bookmarks Tools Help

<http://www.orurisa.org/events/gisinact/2009event/> Google

Disable Cookies CSS Forms Images Information Miscellaneous Outline Resize Tools View Source Options

Gmail - Inbox (40...) BizMo Diaries Math Forum Disc... NCMT Memo synergeo : Messa... OS Garden | MODT GIS in Action 2009

**Registration and Conference Fees**

**Conference at a Glance**

**Full Program**

**Special Events and Conference Highlights**

**Exhibit Hall Information**

**Home**

*Presented by:*

OREGON & SOUTHWEST WASHINGTON **URISA**

THE IMAGING & GEOSPATIAL INFORMATION SOCIETY  
Columbia River Region

**GIS in Action 2009**

**Tuesday April 21<sup>st</sup>  
Wednesday April 22<sup>nd</sup>**

**Vancouver Conference Center  
and  
Hilton Hotel**

**301 West 6th Street  
Vancouver, Washington**

**use the special group code: GIS**  
The discounted room rate availability has been extended to April 17, 2009

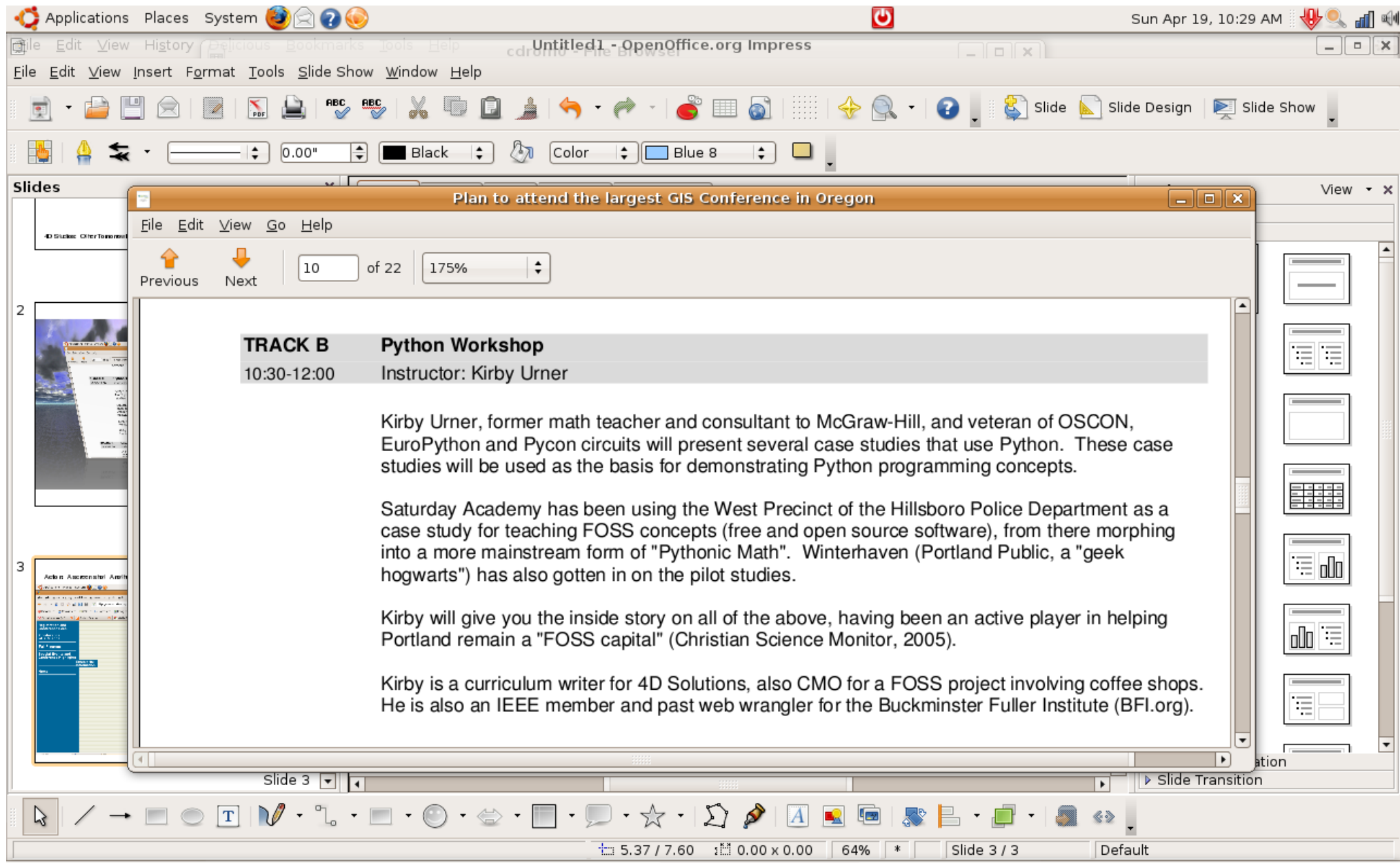
**Parking in downtown Vancouver**

Register [online](#) or download printable [Registration Form](#)

[Conference Flyer](#) | [Final Program](#)

**More information about the conference will be updated as it is available**

Place based curriculum: the GUI “desktop” is a place too (a geography, requires navigation)





# Where I've Just Been...

File Edit View History Delicious Bookmarks Tools Help

http://pycon.blip.tv/file/1997995/

Disable Cookies CSS Forms Images Information Miscellaneous Outline Resize Tools View Source Options

Gmail - Inbox ... Grain of Sand... Math Forum ... NCMT Memo synergeo : Me... OS Garden | ... GIS in Action ... Python for Te...

blip.tv Videos Dashboard Upload

Python for Teachers (and Teachers of Teachers) (Part 002)

```
always pegged to the origin
***
radius = 0.03

def __init__(self, xyz, color=(0,0,1)):
    self.v = vector(*xyz)
    self.xyz = xyz
    self.color = color
    self.cyl = None

def draw(self):
    """define and render the cylinder"""
    self.cyl = cylinder(pos = (0,0,0), axis = self.v, radius = self.radius, color =

def erase(self):
    """toss the cylinder"""
    if self.cyl:
        self.cyl.visible = 0
        self.cyl = None

def __repr__(self):
    return 'Vector @ (%s,%s,%s)' % self.xyz

# some vector ops, including scalar multiplication

def diff_angle(self, other):
```

PyCon

Visit show page All episodes

More from this show :

Python for Teachers (and Teachers of Tea.. 6:13

Using Twisted Deferreds (Part 002) 32:46

Older Newer

Share with Email go!

Featured Episodes Random Episodes

Cucumber Salad Fresh fr... Urban Sustainable Living 4:54

UN CC BY NC SA

As a geek with Python kung fu, you have fun skills to share with others, including those still in high school and seeking to master mathematical concepts that will



Lars @ Mozilla Corporation,  
uses Python on the server  
hand painted T-shirt  
by Oregon artist



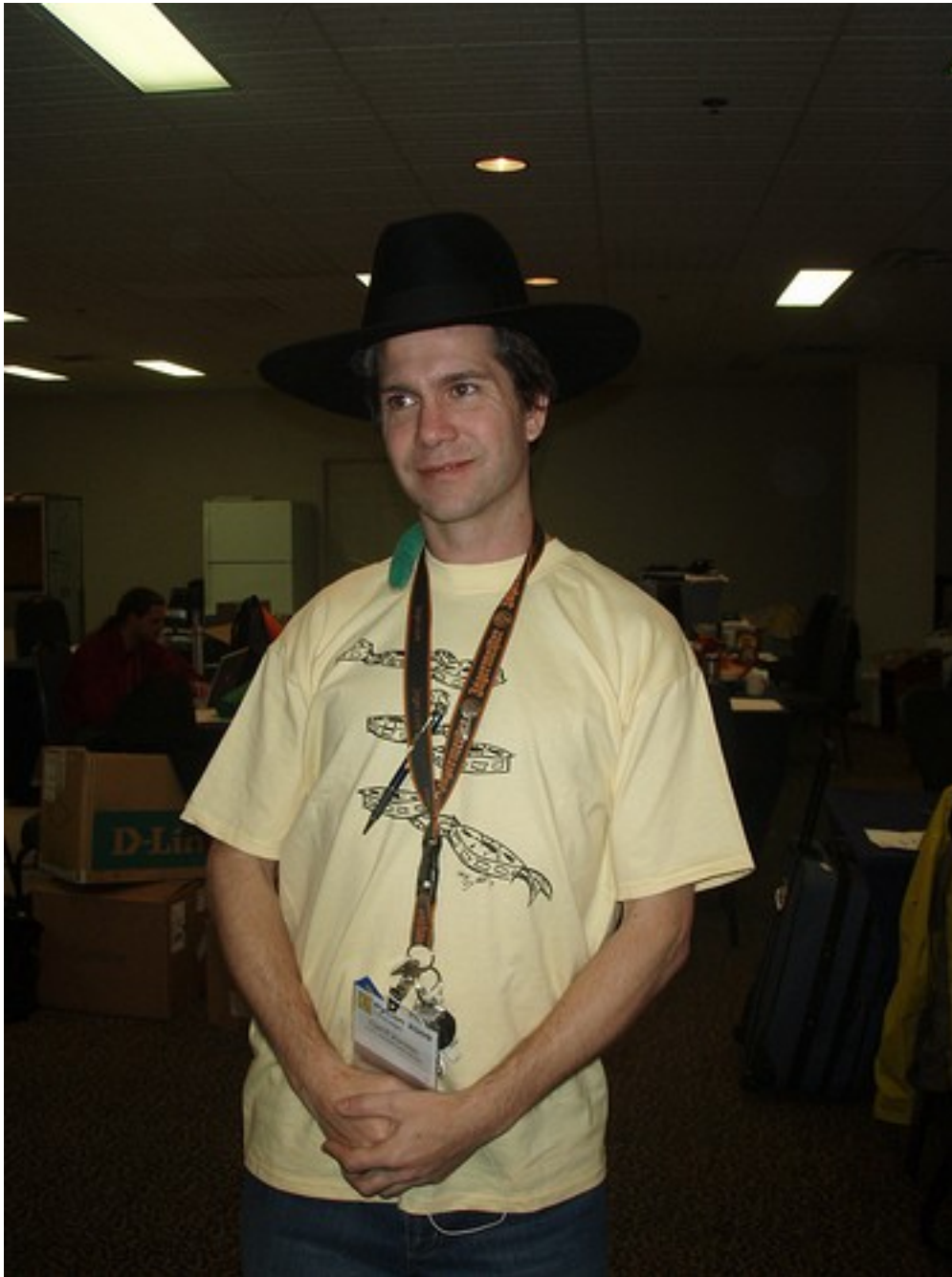
Steve Holden  
PSF chairman

Ian Benson  
Tizard / Stanford



Welcome to Rivendale... (see Blip TV)





Pycon 2009: top geeks, geek guitars

So What's New in  
Python Nation?

But first (since this is a  
GIS conference)...

# Where is Python Nation?

Guido: BDFL



... right next to  
the Republic of Perl



Note Netherlands, quite near





# *The State of the Onion*

*Starring*

**Larry Wall**

<http://www.perl.com/lpt/a/956>

Embedded in a FOSS context...



Webus Vancouverous



FOSS boss

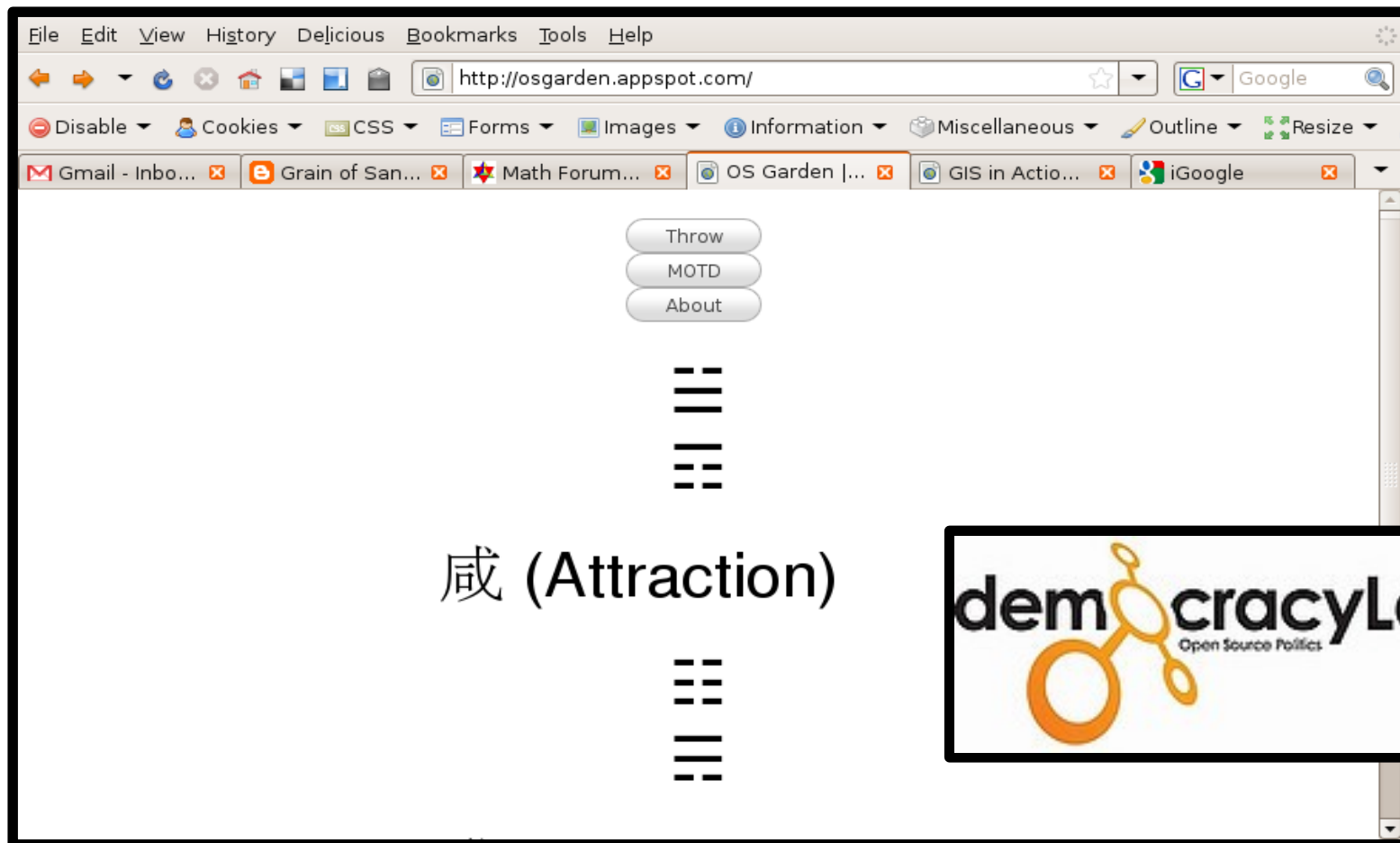
# Internals:

- Python artwork protected by PSF
- Class of '09 inducted
- "EduPython" grows a longer tail
- VM summit meeting
- Release strategy (2.7, 3to2...)
- python.org saga: cvs, svn, hg

So whassup with  
Python?



# Google App Engine



Python 3K

(like Y2k but more fun)

File Edit View History Bookmarks Tools Help


← → ↺ × 🏠

http://www.blogger.com/post-edit.g?blogID=8204942&f

Google

Getting Started Latest BBC Headlines

Control Room Blogger: Grain of Sand - ...

 Grain of Sand

kirby.urner@gmail.com Prietaisu skydelis Pagalba Atsijungti

Pranešimų rašymas

Nustatymai

Šablonas

(Peržiūrėti dienoraštį)

Sukurti






Redaguoti pranešimus

Redaguoti komentarus

Pavadinimas: Vilnius

Redaguoti Html

Sukurti

**b** *i*     

Peržiūrėti

```
<embed src="http://web.splashcast.net/go/so/2/p/KYNU4479UM" wmode="transparent" width="400" height="300" allowFullScreen="true" type="application/x-shockwave-flash" ></embed>
```

Yikes, my Blogger control panel is in Lithuanian! Today is a holiday and hardly anyone was strolling in the rain early this morning. I took a first few pix with my waterproof camera (my wind breaker proved less than waterproof).

The main street next to the hotel is torn up for replumbing. The hotel itself, Centrum Ratonda, is quite satisfactory, with wireless in the room and an ample breakfast buffet (included).

Laura flies in late tonight. I volunteered to help stuff bags and do other conference stuff. My hosts were very kind to fly me here.

All my puzzle pieces rejoined on this end minus the white 3-ring binder which I kindly (OK, unintentionally) left next to 31A for Lufthansa management, or the dumpster as the case may be.

The Vilnius lost and found women kindly sent a query in teletype language to Frankfurt, using some virtual TTY running on Windows (no one really uses teletypes anymore, right? but the

► Pranešimų nuostatos

žymės šiam pranešimui:  
pvz. motoroleriai, atostogos, ruduo

Šaukiniai: paspauskite **Ctrl** su: **B** = Paryškintas, **I** = Kursyvas, **P** = Publikuoti, **D** = Juodraštis [daugiau](#)

IDĖTI PRANEŠIMĄ

IŠSAUGOTI JUODRAŠTĮ

Done

MONDAY, MARCH 31, 2008

## Unicode Experiments



```
File Edit Shell Debug Options Windows Help
>>> iching.throw()
-----
:::
:::
32: (恒 Continuing)
:::
:::
34: (大壯 Great Power)
-----
>>> iching.throw()
-----
:::
:::
22: (賁 Grace)
:::
:::
9: (小畜 Restrained)
-----
>>> |
```

Ln: 4353 Col: 4

Glenn Stockton knows a lot about the *I Ching* and gave me a lesson today. I'd studied *The Book of Changes* before, but never as deeply as Glenn has.

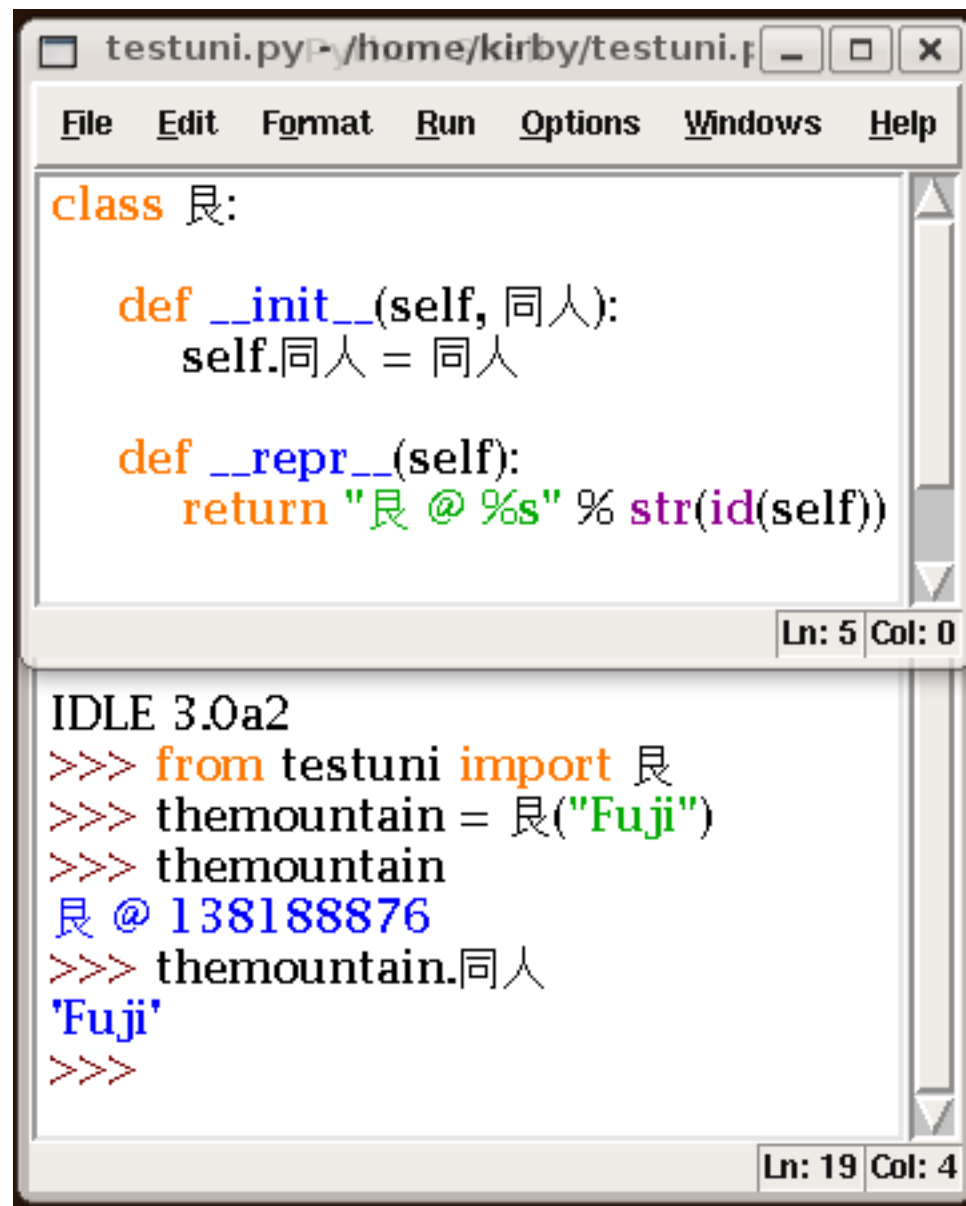
Now I have a new reason to revisit this ancient text: to experiment with unicode in Python.

POSTED BY KIRBY AT 11:55 PM



The       future       is now

- $3/2 == 1.5$
- no more classic classes
- `print('ñé')` - a function
- unicode source



The image shows a screenshot of the IDLE 3.0a2 Python IDE. The top window, titled 'testuni.py', contains a class definition for '山' (Mountain). The class has two methods: '\_\_init\_\_' which takes '同人' (Doujin) as an argument and assigns it to 'self.同人', and '\_\_repr\_\_' which returns a string '山 @ %s' where %s is the memory address of the object. The bottom window shows the IDLE prompt where the class is imported from 'testuni', an instance 'themountain' is created with the argument 'Fuji', and the instance is printed, showing its memory address and the value 'Fuji'.

```
testuni.py /home/kirby/testuni.py
File Edit Format Run Options Windows Help

class 山:

    def __init__(self, 同人):
        self.同人 = 同人

    def __repr__(self):
        return "山 @ %s" % str(id(self))
Ln: 5 Col: 0

IDLE 3.0a2
>>> from testuni import 山
>>> themountain = 山("Fuji")
>>> themountain
山 @ 138188876
>>> themountain.同人
'Fuji'
>>>
Ln: 19 Col: 4
```

# EduPython Track

- Edu-Sig to André Roberge
- Dr. Chuck at U Mich
- Vern Ceder as Watcher
- Crunchy, PyWhip, XO projects
- Viennese Turtles (Gregor & Co.)
- AlgebraFirst (Gattegno et al)



OLPC.XO.pippy includes Fibonacci's and Pascal's



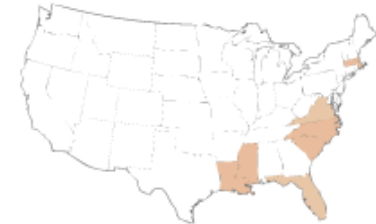


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## CONTACT



WHERE  
WE ARE



## Honoring Civil Rights

# But what about Portlandia?





She has a boyfriend in  
Gothenberg (Goth capital)

Lotsa FOSS bosses

EuroPython @ Chalmers 2005

Nano Tech (bucky tubes 'n balls)

HP4E (a meme campaign)

Guido's earlier CP4E (DARPA)

P4E (= programming + theater)

Shuttleworth Summit (London)

EuroPython @ CERN: Alan Kay

EuroPython @ Vilnius: more dots

Pycon @ Chicago (Bucky exhibit)



## Track A (lexical)

- Permutations (ascii / unicode)
- prime / composite
- gcd, lcd
- "modulo numbers"
- totative / totients
- finite groups, fields (algebra!)
- euler's theorem, RSA

# Fermat's Little Theorem

```
def gcd(a,b):  
    """Euclidean Algorithm"""  
    while b:  
        a, b = b, a % b  
    return abs(a)  
  
if isprime(p) and gcd(b,p) == 1:  
    try:  
        assert pow(b, p - 1, p) == 1  
    except:  
        raise \  
        Exception, 'Houston, we've got a problem.'
```

# Euler's Theorem

```
def tots(n):  
    return [i for i in range(1,n)  
            if gcd(i, n)==1]
```

```
def phi(n): return len(tots(n))
```

```
if gcd(b,n) == 1:  
    try:  
        assert pow(b, phi(n), n) == 1  
    except:  
        raise \  
        Exception, 'Houston, we've got a problem.'
```

# RSA

```
def demo():  
    """ Abbreviated from more complete version at:  
    http://www.4dsolutions.net/satacad/sa6299/rsa.py """  
    plaintext = "hello world"  
    m = txt2n(plaintext)  
    p,q = getf(20), getf(20) # two big primes  
    N = p*q  
    phiN = (p-1)*(q-1)  
    e = 3  
    s,t,g = eea(e, phiN) # Extended Euclidean Algorithm  
    d = s % phiN  
    c = encrypt(m,N) # pow(m, e, N) w/ booster  
    newm = decrypt(c,d,N) # pow(c, e*d, N)  
    plaintext = n2txt(newm)  
    return plaintext
```



# Math Objects:

grab from the library  
and/or build your own

```
>>> mypoly = Poly([ (7,0), (2,1), (3,3), (-4,10) ] )  
>>> mypoly  
(7) + (2*x) + (3*x**3) + (-4*x**10)
```

```
>>> int1, int2 = M(3, 12), M(5, 12) # used in crypto  
>>> int1 * int2 # operator overloading  
3  
>>> int1 - int2  
10
```

```
>>> tetra = rbf.Tetra()  
>>> bigtetra = tetra * 3 # volume increases 27-fold  
>>> bigtetra.render()
```

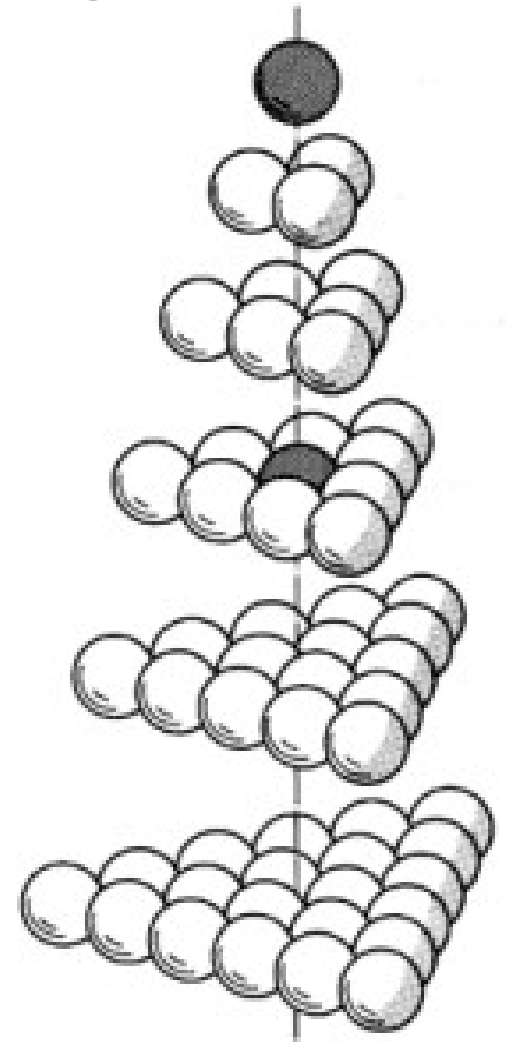
## Track B (graphical)

- animals, shapes, polymorphism
- figurate / polytopal numbers
- sphere packing
- vectors, trig, XYZ, lat/long etc.
- polyhedra as objects

# Sequence Generators

```
>>> def tritet():  
    term = trinum = tetranum = 1  
    while True:  
        yield (term, trinum, tetranum)  
        term += 1  
        trinum += term  
        tetranum += trinum
```

```
>>> gen = tritet()  
>>> [gen.next() for i in range(6)]  
[(1, 1, 1), (2, 3, 4), (3, 6, 10),  
(4, 10, 20), (5, 15, 35), (6, 21, 56)]
```



from *Synergetics*  
by RBF w/ EJA

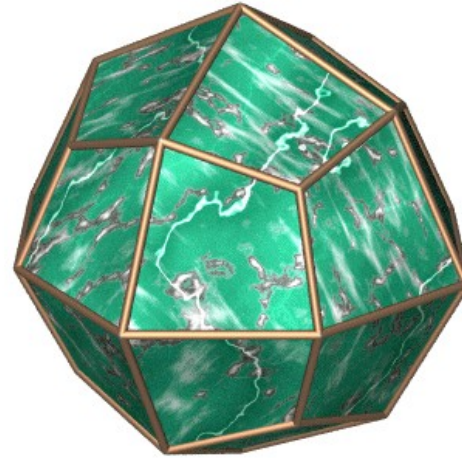
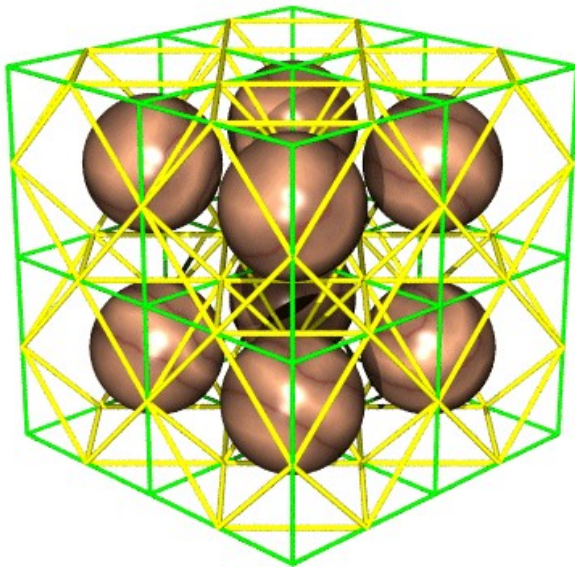
# Polyhedral Numbers



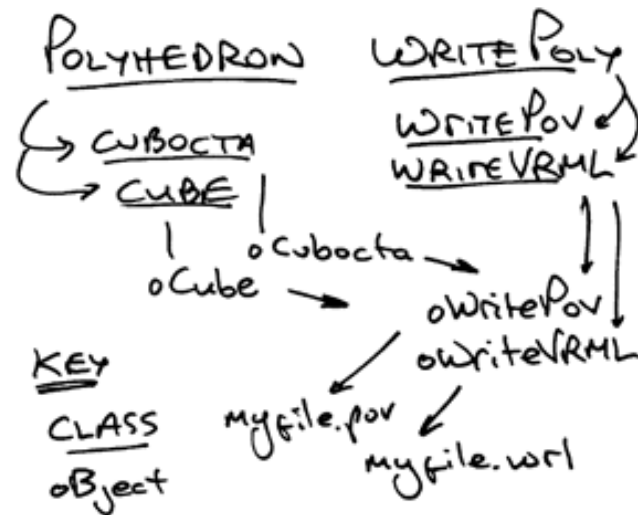
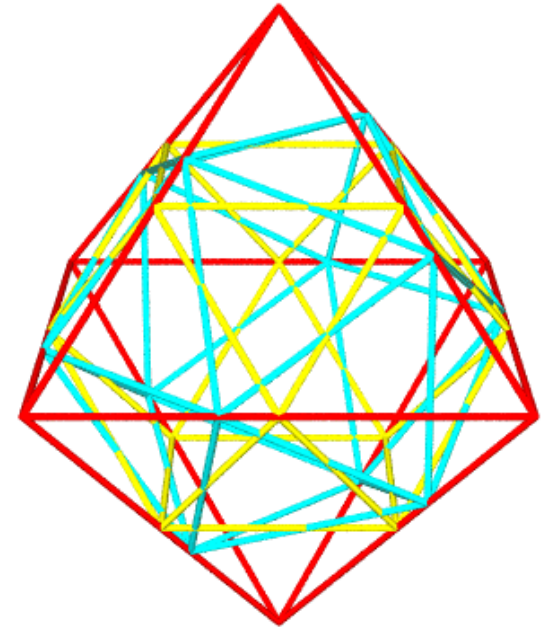
*Animation: growing cuboctahedron*

```
>>> gen = cubocta()  
>>> [gen.next() for i in range(6)]  
[(1, 1, 1), (2, 12, 13), (3, 42, 55),  
(4, 92, 147), (5, 162, 309), (6, 252, 561)]
```

# Python + POV-Ray

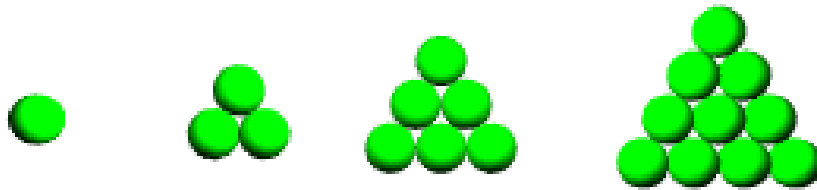


Trapezoidal Icositetrahedron



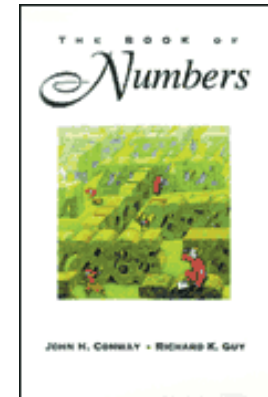
# Functions and Figurate Numbers

Triangular Numbers 1,3,6,10



Max = 4

$$\sum_{\text{Integer} = 1}^{\text{Max}} \text{Integer} = 10$$

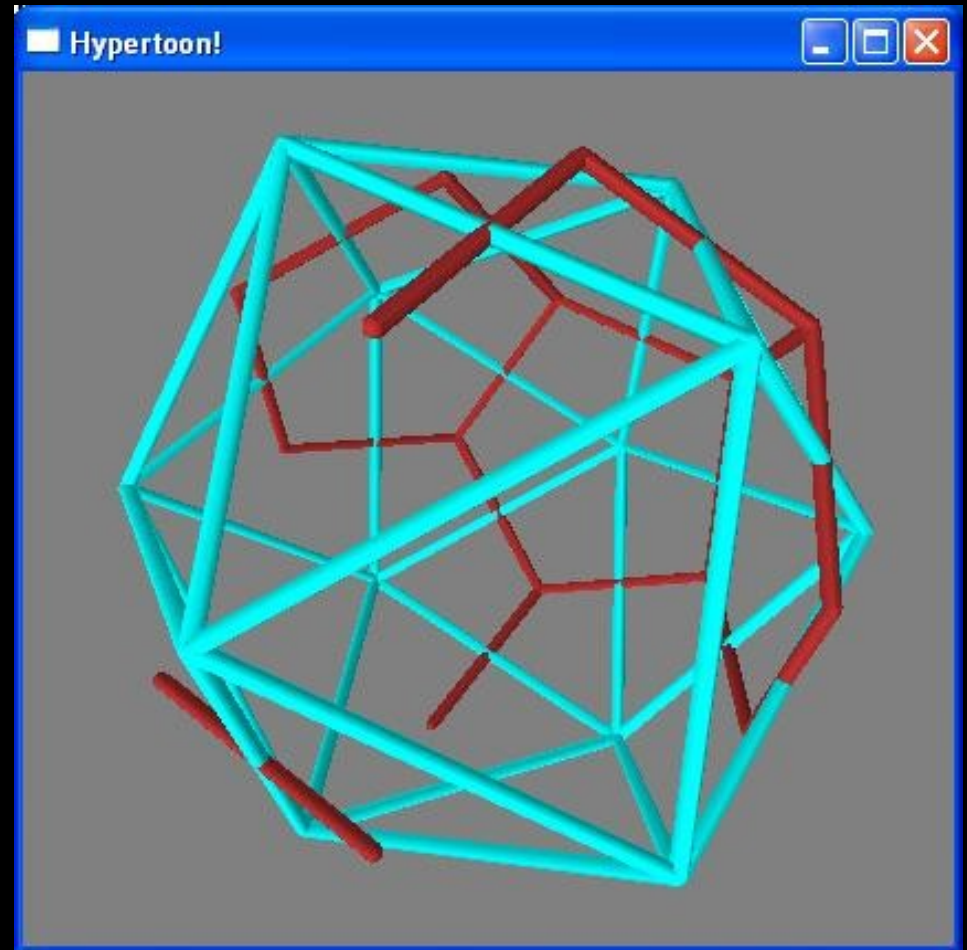
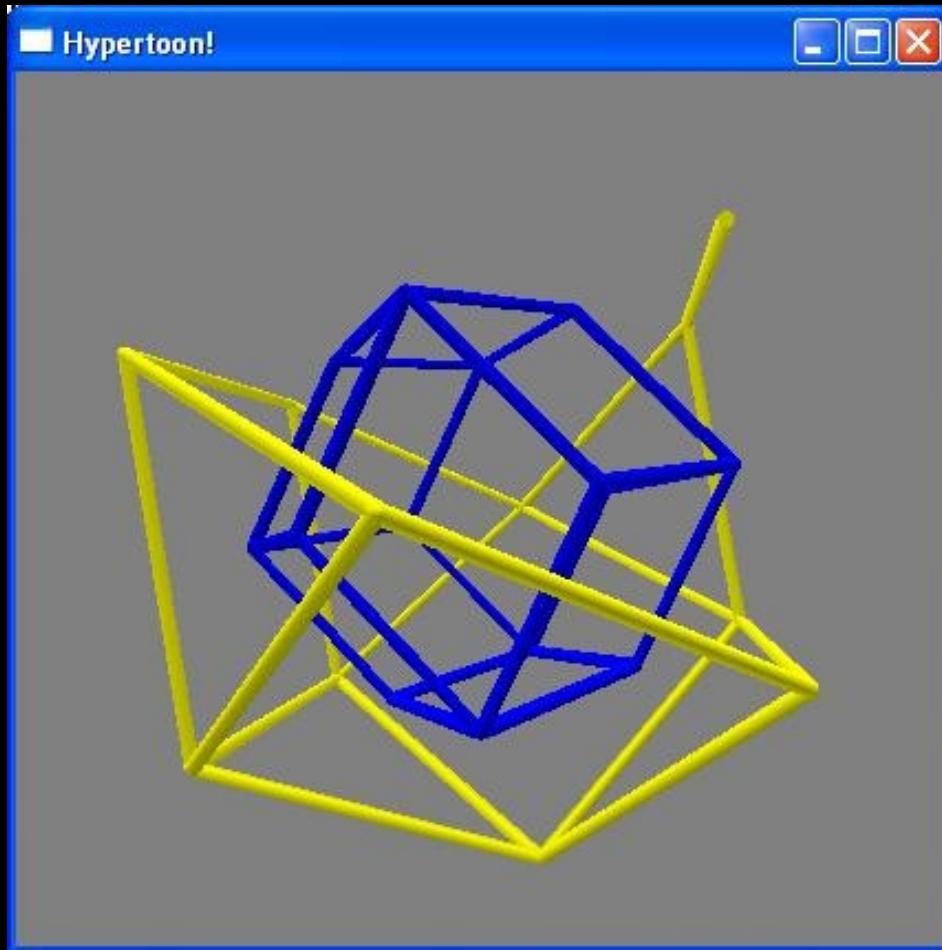


Front cover:  
*The Book of Numbers*  
by Conway & Guy

```
def tri(n):  
    return n * (n + 1) // 2
```

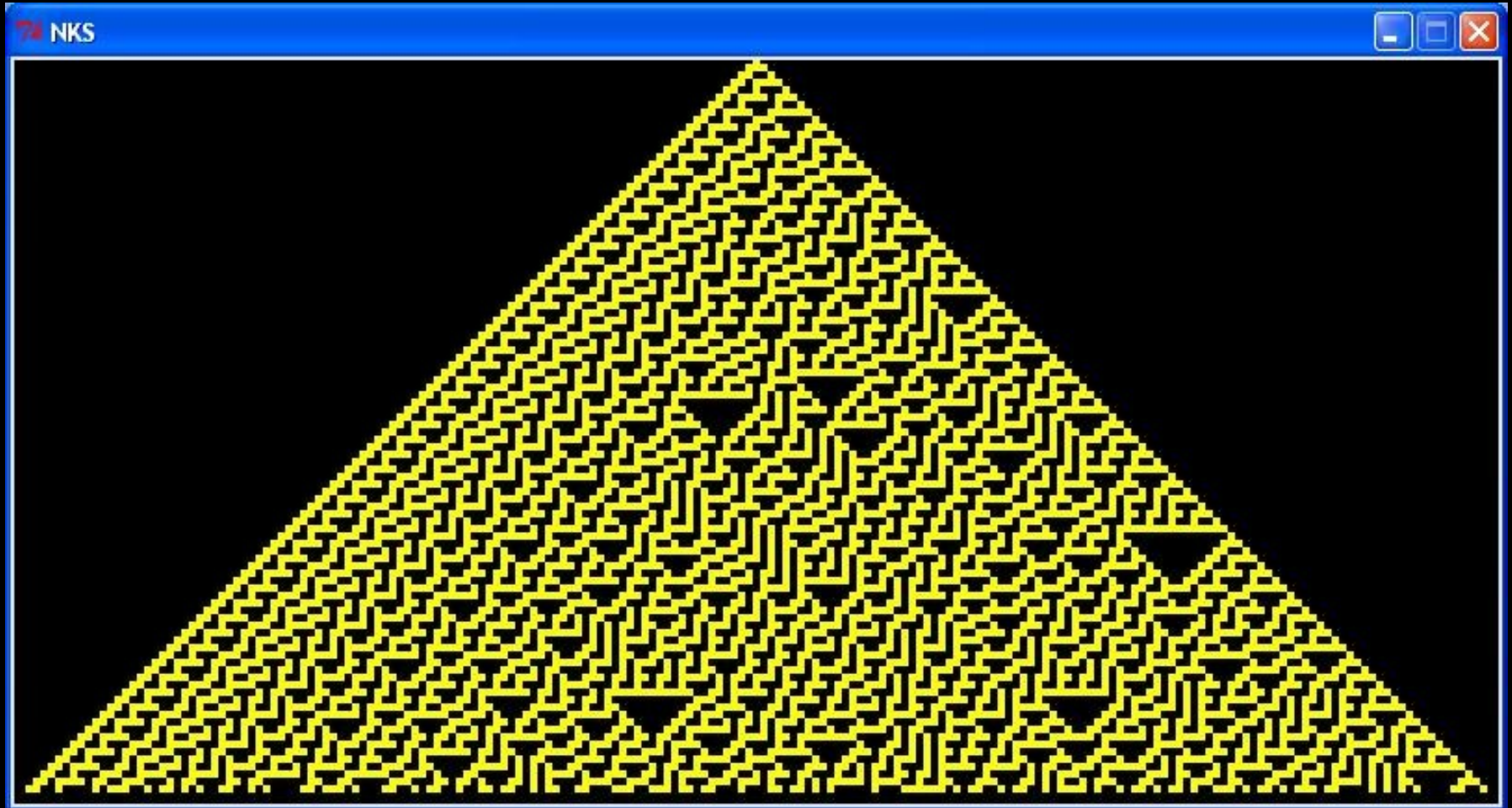
```
>>> [tri(x) for x in range(1, 10)]  
[1, 3, 6, 10, 15, 21, 28, 36, 45]
```

# Python + VPython

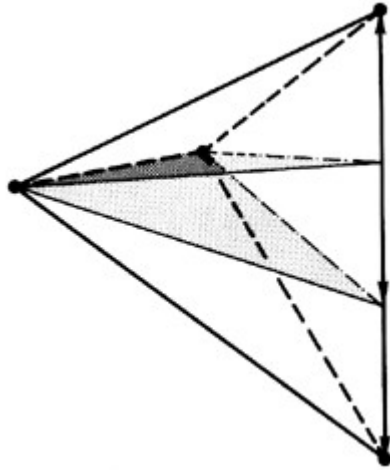




# Python + Tk



Cellular Automata ala Wolfram generated using graphics.py by John Zelle



Demo: Mite, Sytes, Kites  
with CubeIT!  
by Huntar Company

MITE =  $A+ A- B+$   
or  $A+ A- B-$



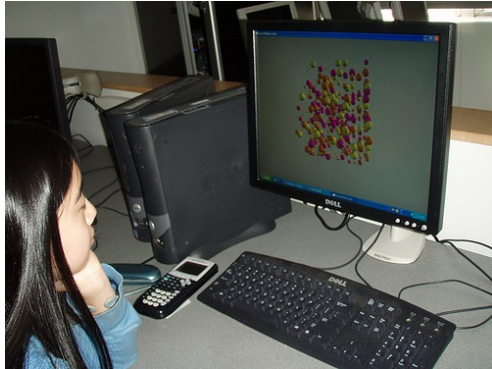
Some guy on YouTube



# Track C (synergetic)

- Rich data structures
- SQL (supermarket math)
- GIS / GPS (outdoor activities)
- mvps, time dimension
- user requests and events
- web framework (Django?)
- client / server, design patterns

SA:



Operation Other Tomorrow



XRLs: Extremely Remote Locations

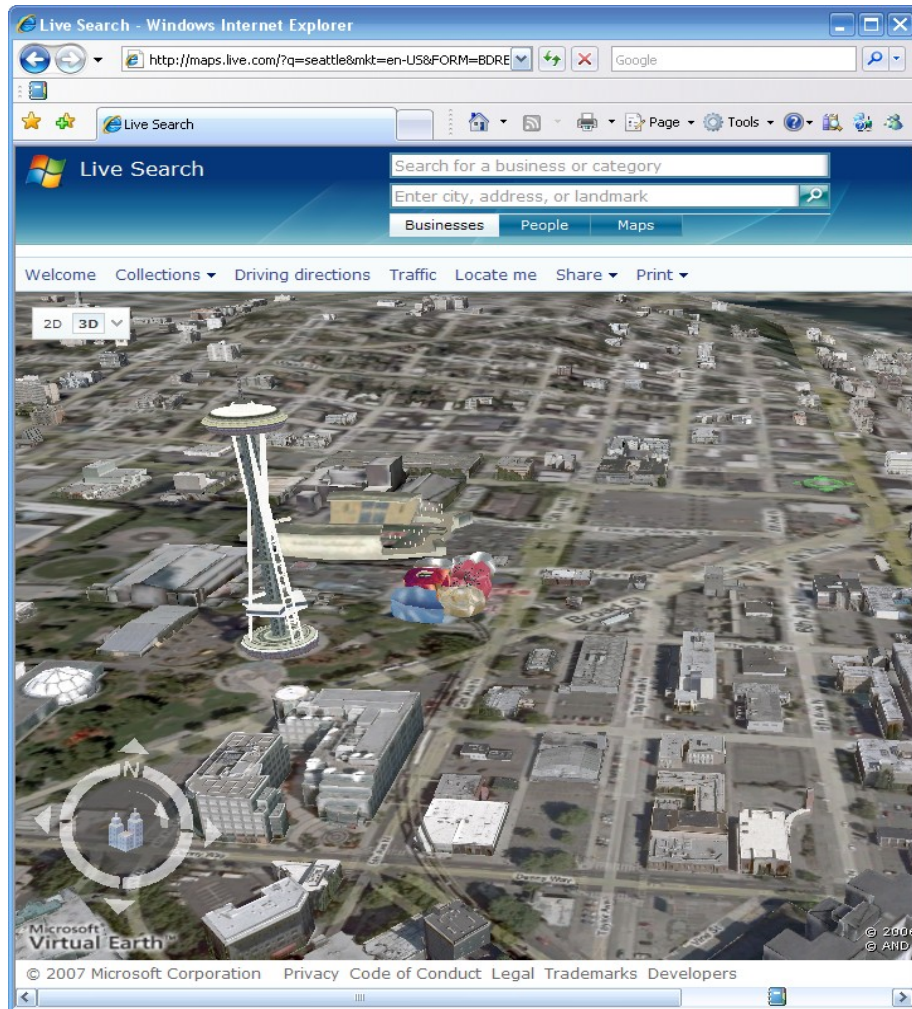
Storytelling...



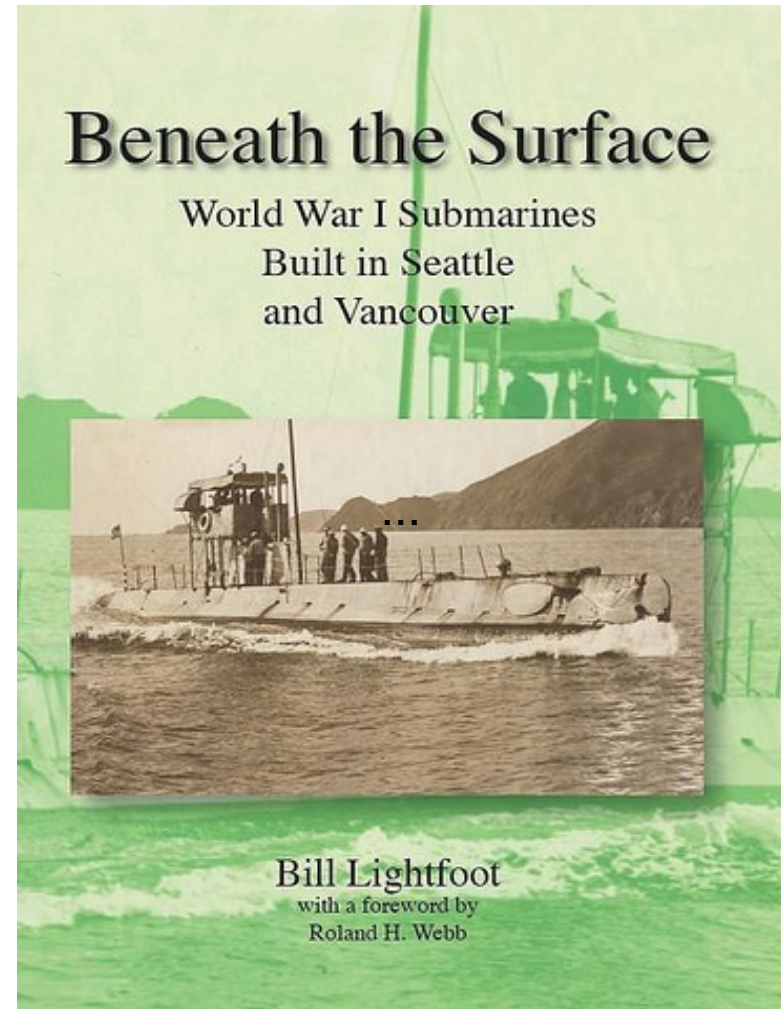
Dodeca Cams!



# Place-based Education: record to school intranet..

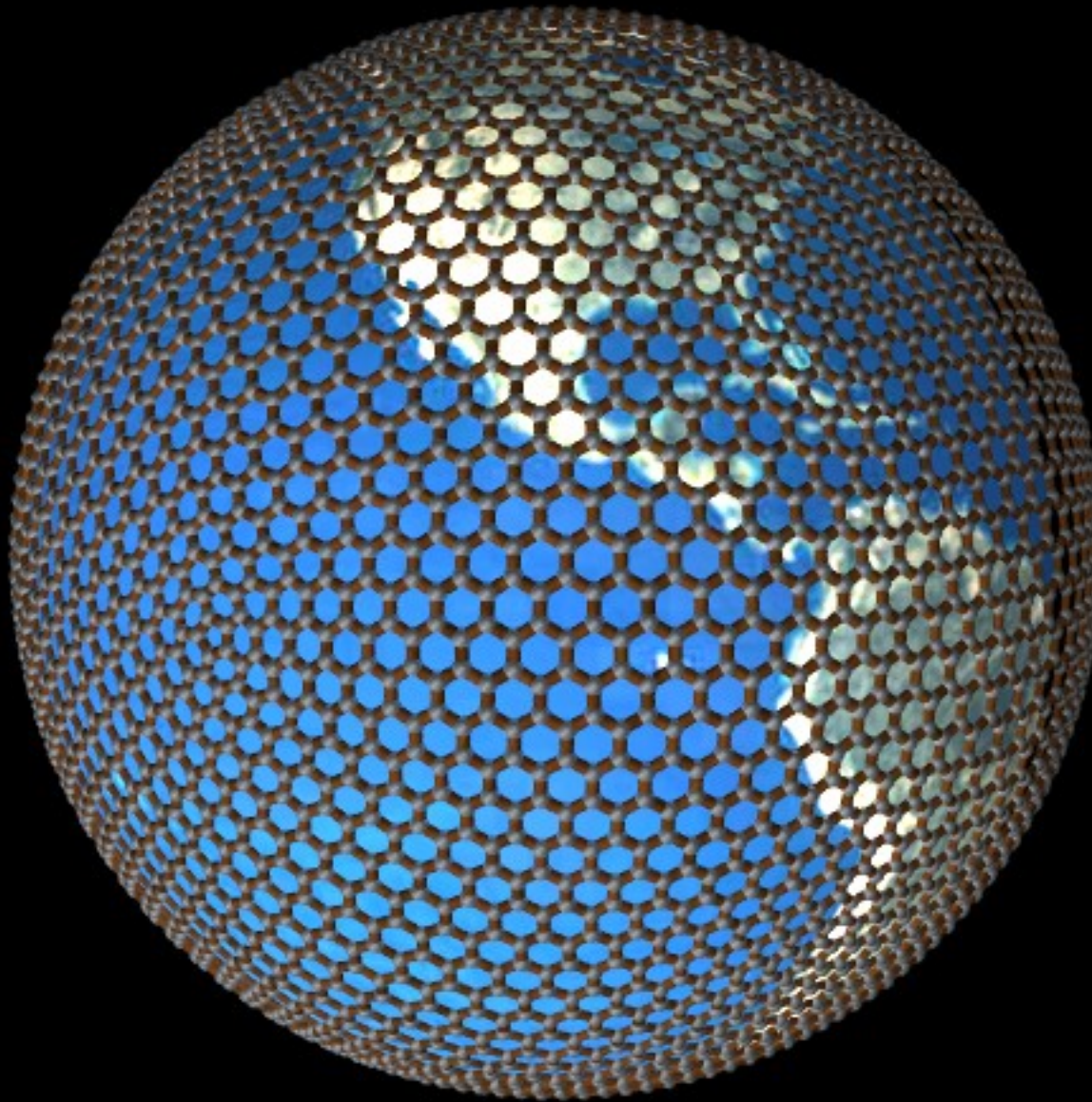


Seattle: Home of SAGE and  
Science Fiction museum



Recalling *GIS in Action*  
2005, Lunch Keynote

HP4E  
GST  
Global Matrix  
The Grid  
Geoscope  
Hexapent  
etc.

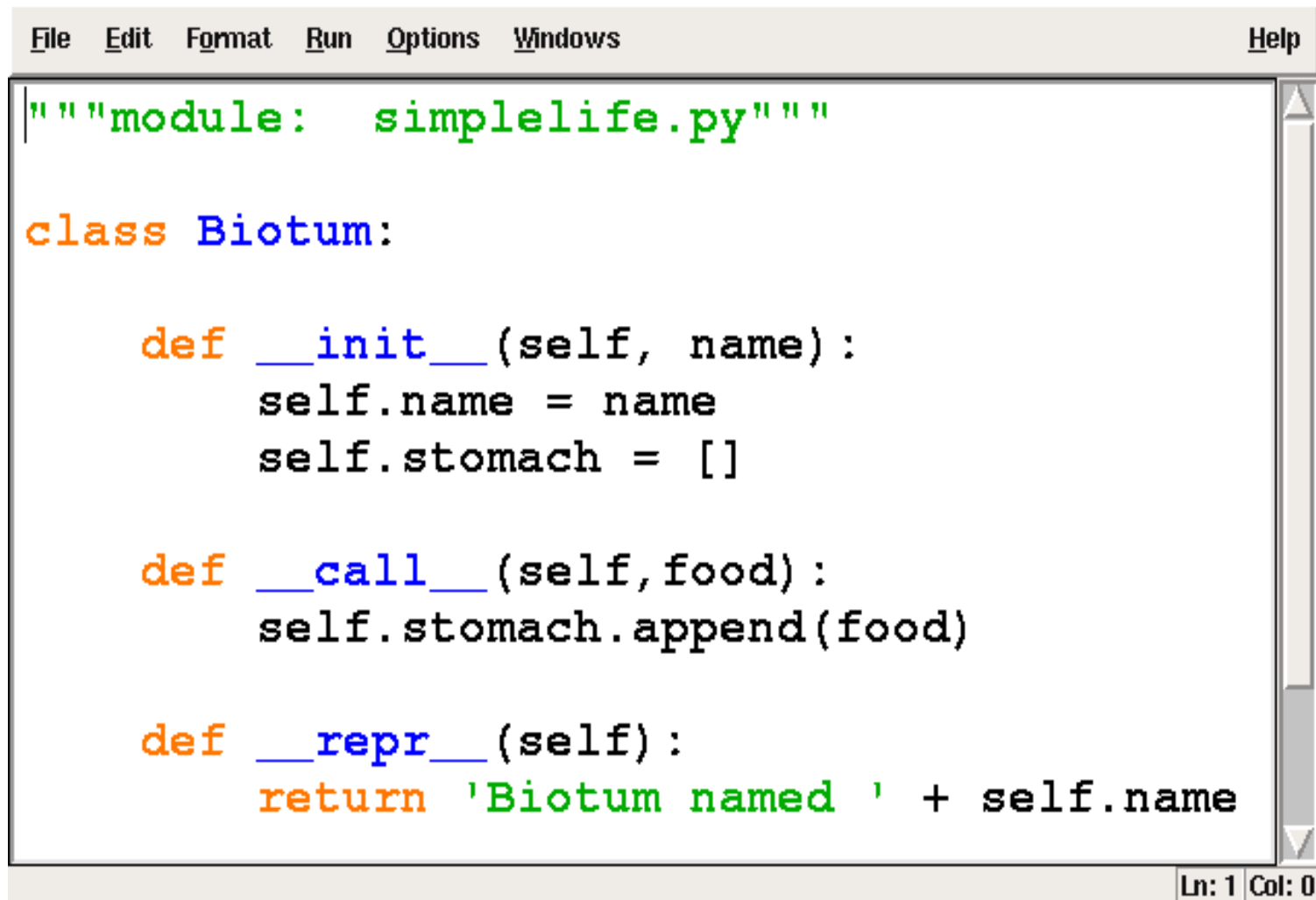


# Animal zOO

- Biotum class, instances = biota
- Monkey, Dog, Snake classes
- Eating and pooping (deque?)
- Animal class (common ancestor)
- Polymorphism: "passing the buck"
- The rib cage
- "everything's a python in Python"



Your job: train *House M.D.* in Python (a busy grumpy guy)

A screenshot of a Python IDE window. The window has a menu bar with 'File', 'Edit', 'Format', 'Run', 'Options', 'Windows', and 'Help'. The main text area contains Python code for a class named 'Biotum'. The code is color-coded: docstrings are green, class and function names are blue, and keywords are orange. The code defines a class 'Biotum' with three methods: '\_\_init\_\_' which sets 'self.name' and 'self.stomach' (an empty list), '\_\_call\_\_' which appends 'food' to 'self.stomach', and '\_\_repr\_\_' which returns a string 'Biotum named ' followed by 'self.name'. The status bar at the bottom right shows 'Ln: 1 Col: 0'.

```
File Edit Format Run Options Windows Help

"""module:  simplelife.py"""

class Biotum:

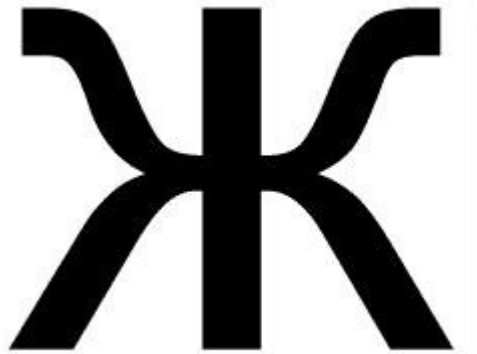
    def __init__(self, name):
        self.name = name
        self.stomach = []

    def __call__(self, food):
        self.stomach.append(food)

    def __repr__(self):
        return 'Biotum named ' + self.name

Ln: 1 Col: 0
```

```
>>> import simplelife
>>> imp.reload(simplelife)
<module 'simplelife' from '/home/ki
rby/simplelife.py'>
>>> from simplelife import Biotum
>>> cell1 = Biotum('xV')
>>> cell2 = Biotum('xY')
>>> cell1.stomach
[]
>>> cell1('**')
>>> cell1.stomach
['**']
>>> cell1('&&&')
>>> cell1.stomach
['**', '&&&']
>>> cell1(cell2)
>>> cell1.stomach
['**', '&&&', Biotum named xY]
>>>
>>> |
```



Gnu Math:

What the  
Bleep!?

Excerpt from edu-sig

Figurate Numbers

Pascal's Triangle (triangular and tetrahedral numbers)

Fibonacci Numbers (converge to phi, pentagon math)

Vectors (VPython -- xyz, spherical coordinates etc.)

Prime Numbers (sieves)

Prime Numbers (trials by division)

Polyhedra (as Python objects: scale, rotate, translate)

Polyhedral Numbers (icosahedral, geodesic spheres)

Modulo Numbers (override `__mul__`, `__add__`)

Finite Groups (Python module)

Euclid's Algorithm (Guido's gcd)

Euclid's Extended Algorithm (needed for inverses)

Totient and Totative (gcd based)

Fermat's Little Theorem (assert...)

Euler's Theorem for Totients (assert...)

Mandelbrot Set (chaotic sequences)

Miller-Rabin (or Jython probablePrime)

`RSA.encrypt(m, N)`

`RSA.decrypt(c, N, d=secretkey)`

More Lore (let's pick a couple) :

The Winterhaven Experiment

The ISEPP Story

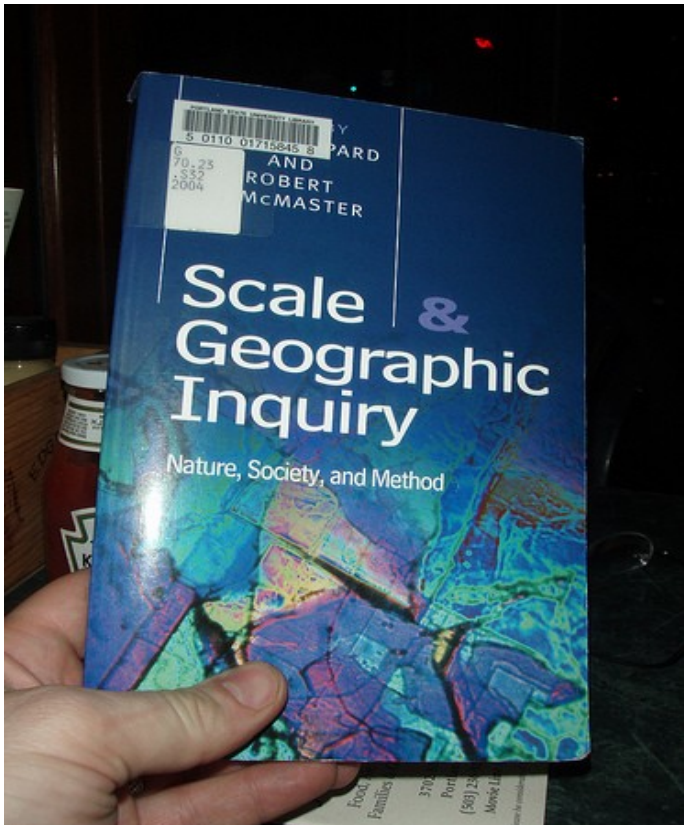
Recording the Columbia Gorge

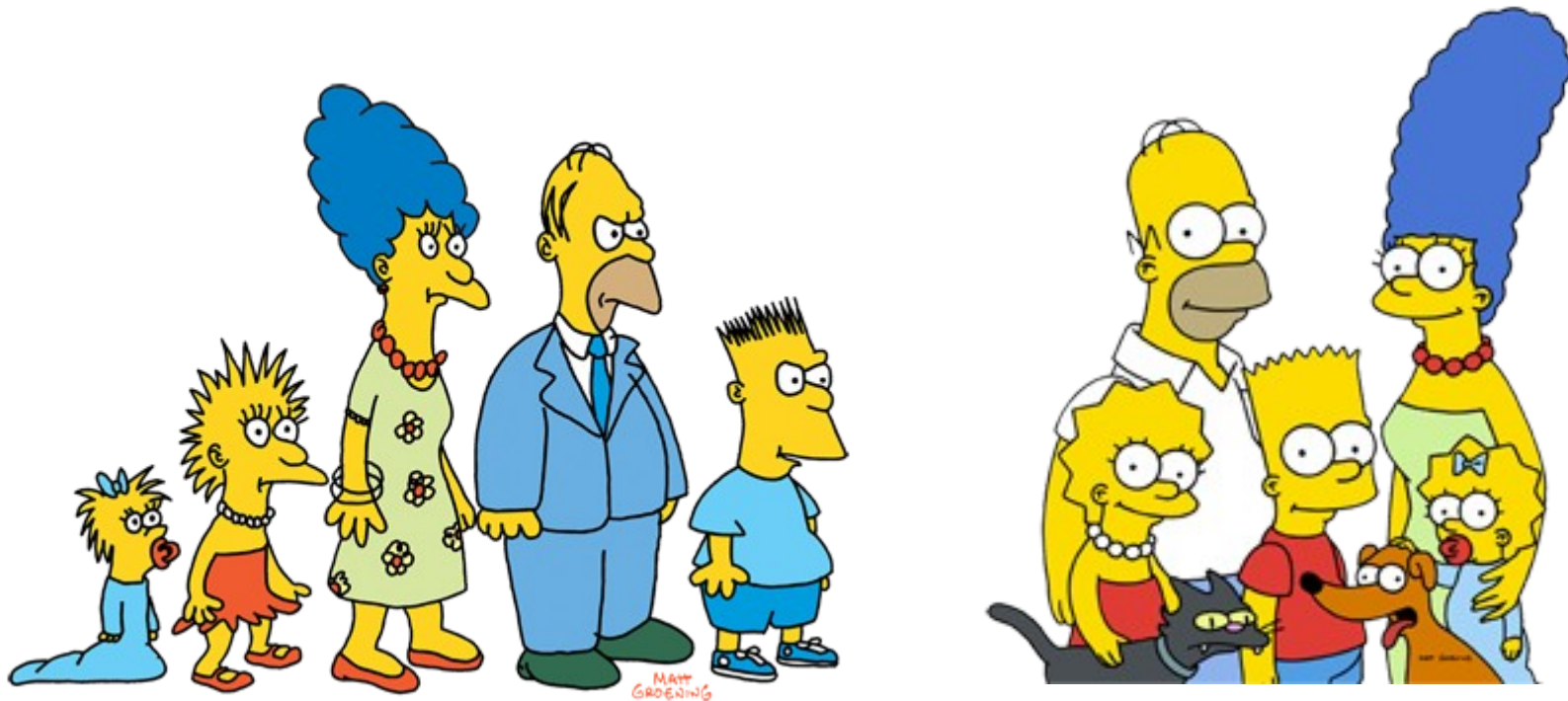
XRLs and BarCamps

Place based education w/ dodecacams

FOSS meets Design Science

Location Scouting





Oregon: home of the real Springfield  
(with thanks to Akbar font)



**Fine Grind  
Productions**



<http://coffeeshopsnet.blogspot.com/>