
Thriving in a polyglot world

Genesis 11:1–9 (KJV)

11 And the whole earth was of one language, and of one speech.

2 And it came to pass, as they journeyed from the east, that they found a plain in the land of Shinar; and they dwelt there.

3 And they said one to another, Go to, let us make brick, and burn them thoroughly. And they had brick for stone, and slime had they for morter.

4 And they said, Go to, let us build us a city and a tower, whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth.

5 And the Lord came down to see the city and the tower, which the children of men builded.

6 And the Lord said, Behold, the people is one, and they have all one language; and this they begin to do: and now nothing will be restrained from them, which they have imagined to do.

7 Go to, let us go down, and there confound their language, that they may not understand one another's speech.

8 So the Lord scattered them abroad from thence upon the face of all the earth: and they left off to build the city.

9 Therefore is the name of it called Babel; because the Lord did there confound the language of all the earth: and from thence did the Lord scatter them abroad upon the face of all the earth.

ᒥ. ᐦᒪᒼ ᑕᕮᐦ ᕆᕐᒪ ᑕᕮᐦ ᔪᕆᔭ ᒣᒥ ᔪᕐᐦ ᕋᕮᔪ.

ᑦ. ᐦᒪᒼ ᔪᕮᒧ: ᔭᒪᕋᘁᕐᐦ ᒪᒥᕮᐃᔭᕐ, ᒧᕆᕋᕮᖴ ᑭᕐᒪᐃᕮᔪ ᕆᒪᐃᓴᒥᔪᒪᓂᒪᐦ, ᐦᒪᒼ ᕋᕮᐃᒥᘁ ᒪᒪᐃᕮᓴᑦ.

ᕒ. ᐦᒪᒼ ᓂᕮᕆᔭᔪ ᔭᕮᕆ: ᕆᕮᐦ, ᕋᕮᒧᑭᒥᑭ ᐃᕆᔭᒥᕋᕆᕋᕆᕆᒧ ᐦᒪᒼ ᐃᕆᑭᒥᔪᕋᕆᒧᔭᒪᓂ.

ᔑ. ᐦᒪᒼ ᓂᕮᕆ ᔭᕮᕆ: ᕆᕮᐦ, ᘁᒥᕮ ᔪᕮᔭᔪᒪᘁ ᓂᒥ ᑕᕆᔭᒥᕋᕆᕆᔪᕮᕮᕮᕮᕮ ᐦᒪᒼ ᔭᕮᒪᐃᕮᔪ ᒧᕆᕆᐃᕮᓂ. ᑭᕮᕆᘁᕮᐃ ᖁᕮᕮ ᑭᕮᕋᕮᕆᑦᒪᕮᕮᕮ, ᔨᒥᕆᕮᐦ ᕋᕮᔪ ᒧᕮᔪᖁᕮᕮᕮᕮᕮ

And the whole earth was of one language, and of one speech.

And they said,
Go to, let us build us a city, and a tower, whose top may reach unto heaven;
and let us make us a name, lest we be scattered abroad upon the face of the whole earth.

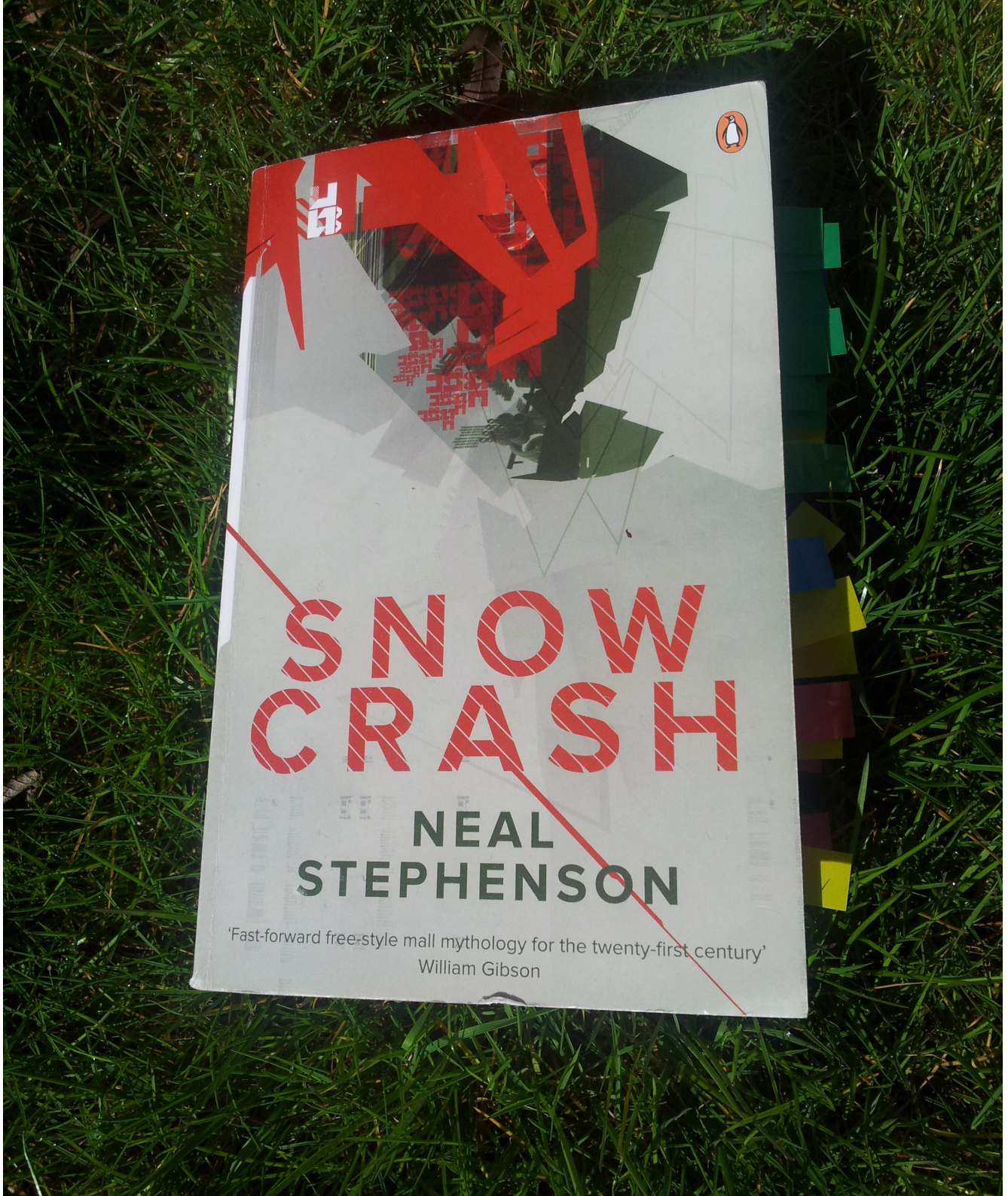
And the LORD said, Behold, the people is one, and they have all one language; and this they begin to do: and now nothing will be restrained from them, which they have imagined to do.

Go to, let us go down, and there confound their language, that they may not understand one another's speech.

So the LORD scattered them abroad from thence upon the face of all the earth: and they left off to build the city.

Therefore is the name of it called Babel; because the LORD did there confound the language of all the earth: and from thence did the LORD scatter them abroad upon the face of all the earth.


TOWER OF BABEL
BY BRUEGHEL
EU PARLIAMENT
STRASBOURG
But the Lord came
down to see the city
and the tower the
people were building.
The Lord said,
"If as one people
speaking the same
language they have
begun to do this,
Genesis 11: 5 - 6


SNOW
CRASH
NEAL
STEPHENSON
'Fast-forward free-style mall mythology for the twenty-first century'
William Gibson

Hiro Protagonist
Y.T.

Enki / Asherah

Sumerian/Glossolalia

machine code for the brain

Anthony Van Dick, via
Google Art Project

I speak Spanish to God,

I speak Spanish to God,
Italian to Women,

I speak Spanish to God,
Italian to Women,
French to Men,

I speak Spanish to God,
Italian to Women,
French to Men,
and German to my Horse.

This is, basically, the Sapir-Whorf hypothesis

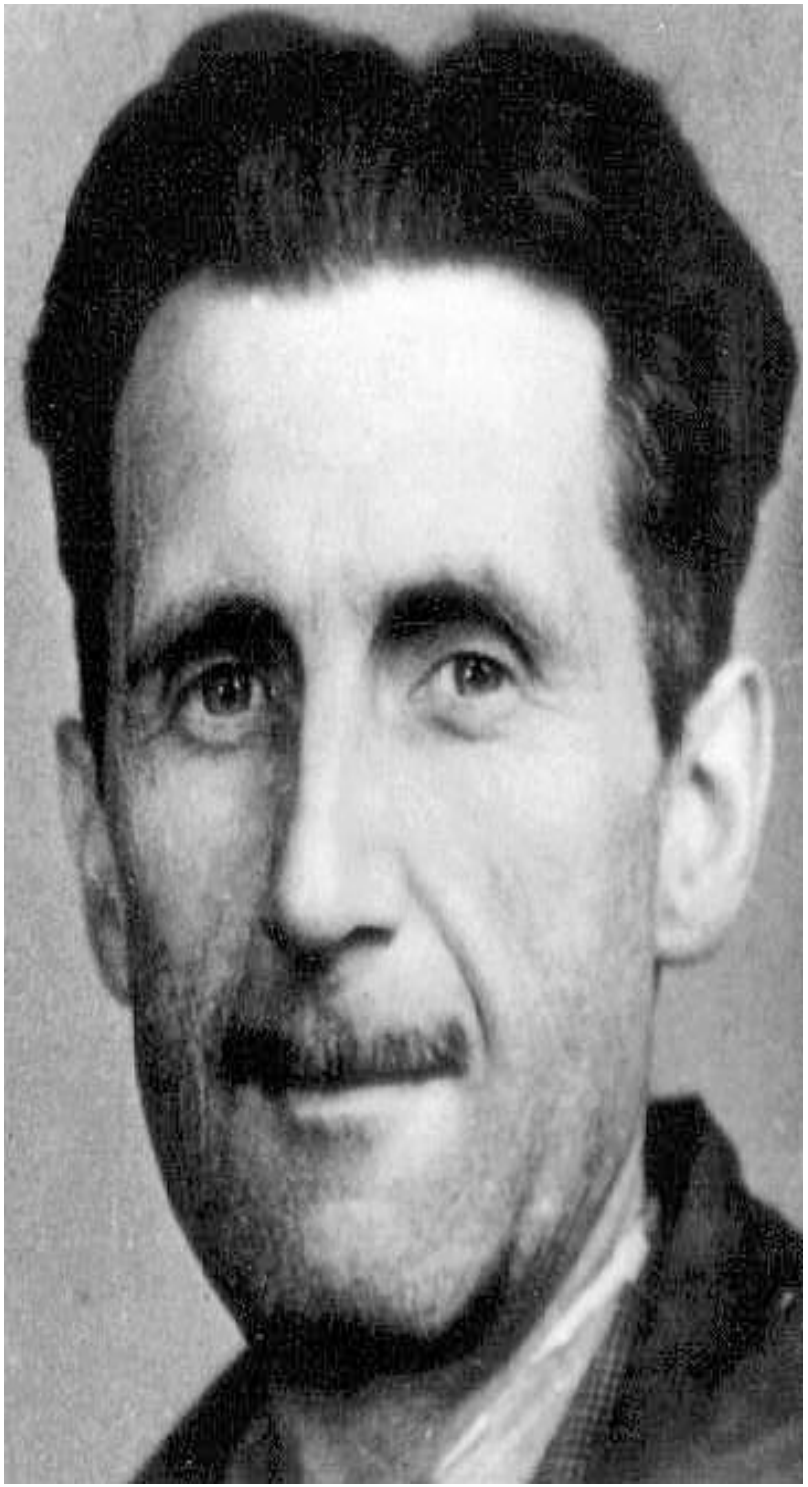
@hirojin

Sapir-Whorf Hypothesis
“Linguistic Relativity”

Linguistic relativity

“The principle of linguistic relativity holds that **the structure of a language affects the ways in which its respective speakers conceptualize their world**, i.e. their world view, or otherwise influences their cognitive processes”

http://en.wikipedia.org/wiki/Linguistic_relativity



"The purpose of Newspeak was not only to provide a medium of expression for the world-view and mental habits proper to the …, **but to make all other modes of thought impossible.** Its vocabulary was so constructed as to give exact and often very subtle expression to every meaning that a Party member could properly wish to express, while excluding all other meaning and also the possibility of arriving at them by indirect methods."

I speak Spanish to God,
Italian to Women,
French to Men,
and German to my Horse.


ORLANDO LASSO FIAMINGO COMPOSIT. NASCE L'ANO
1520. E MORI NELL' 1593 FATTO CAVAGLIERE DA MASSMIL.
II. IMPER.

Orlando de Lassos:

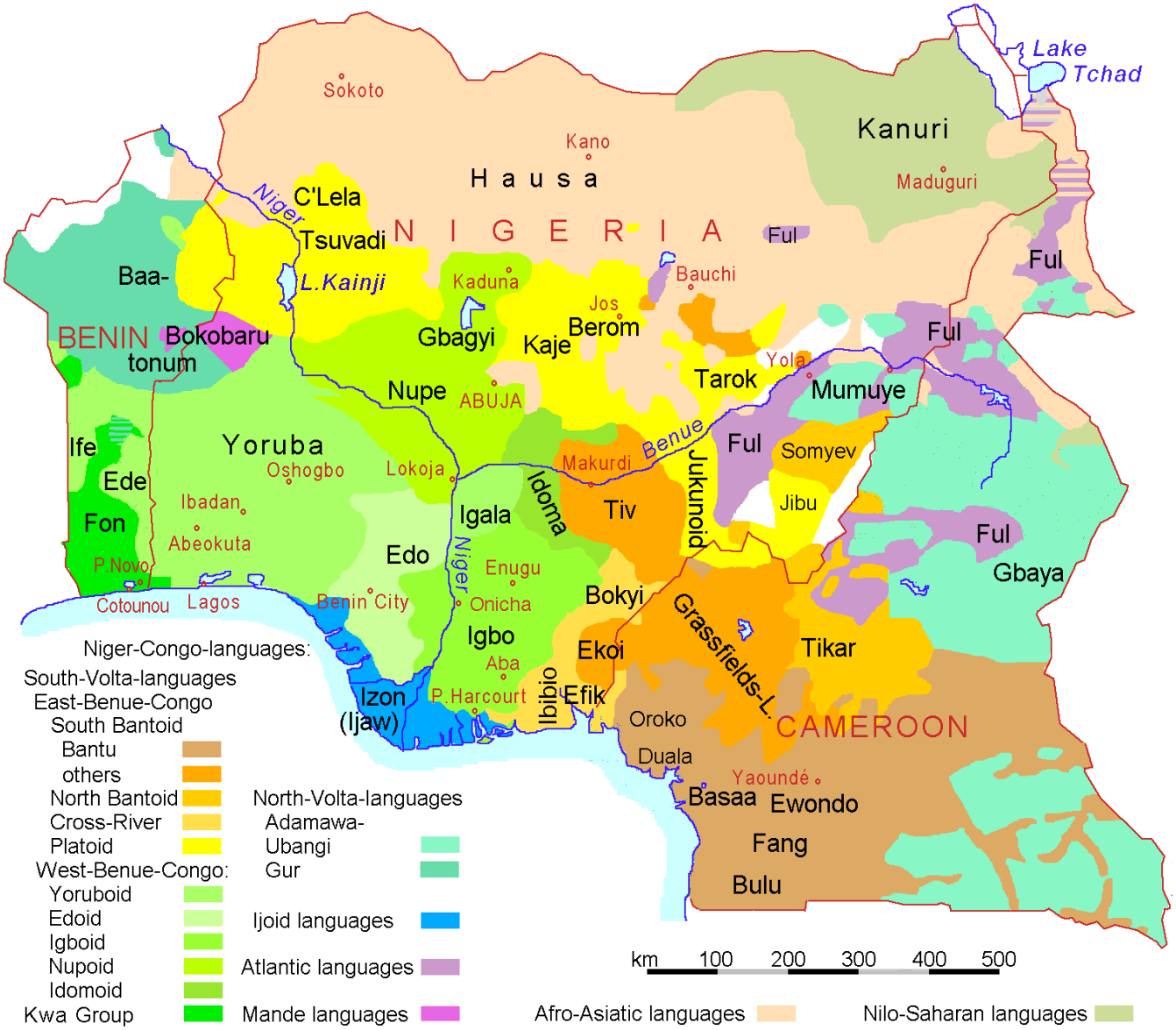
Born in Belgium
Moved to Italy aged 12
Traveled to France & England
Back to Holland
Court Composer in Bavaria
Wrote music in Italian, French, German, Dutch, Latin

Being monolingual is
not the norm
in human history

Being monolingual is
not the norm
in modern society

[citation, please!]

174,000,000 people
521 languages


Lake Tchad
Sokoto
Kano
Kanuri
Maduguri
Hausa
Niger
C'Lela
Tsuvadi
NIGERIA
Ful
L.Kainji
Baa-
Kaduna
Bauchi
Jos
Berom
Gbagyi
Kaje
BENIN
Bokobaru
tonum
Yola
Tarok
Mumuye
Nupe
ABUJA
Ife
Yoruba
Oshogbo
Lokoja
Makurdi
Benue
Somyev
Ede
Ibadan
Igala
Idoma
Tiv
Jukunoid
Jibu
Fon
Abeokuta
Edo
Enugu
Gbaya
P.Novo
Cotounou
Lagos
Benin City
Onicha
Bokyi
Grassfields-L.
Igbo
Ekoi
Tikar
Aba
Izon
(Ijaw)
P.Harcourt
Ibibio
Efik
Oroko
CAMEROON
Duala
Yaoundé
Basaa
Ewondo
Fang
Bulu
km 100 200 300 400 500
Niger-Congo-languages:
South-Volta-languages
East-Benue-Congo
South Bantoid
Bantu
others
North Bantoid
Cross-River
Platoid
West-Benue-Congo:
Yoruboid
Edoid
Igboid
Nupoid
Idomoid
Kwa Group
North-Volta-languages
Adamawa-Ubangi
Gur
Ijoid languages
Atlantic languages
Mande languages
Afro-Asiatic languages
Nilo-Saharan languages

Benefits of multilingualism

Delaying the onset of Alzheimer disease

Bilingualism as a form of cognitive reserve

Fergus I.M. Craik, PhD, Ellen Bialystok, PhD, and Morris Freedman, MD

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Abstract

Go to:

Objectives: There is strong epidemiologic evidence to suggest that older adults who maintain an active lifestyle in terms of social, mental, and physical engagement are protected to some degree against the onset of dementia. Such factors are said to contribute to cognitive reserve, which acts to compensate for the accumulation of amyloid and other brain pathologies. We present evidence that lifelong bilingualism is a further factor contributing to cognitive reserve.

Methods: Data were collected from 211 consecutive patients diagnosed with probable Alzheimer disease

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3033609/

“There is strong epidemiologic evidence to suggest that older adults who maintain an active lifestyle in terms of social, mental, and physical engagement are protected to some degree against the onset of dementia. Such factors are said to contribute to cognitive reserve, which acts to compensate for the accumulation of amyloid and other brain pathologies. **We present evidence that lifelong bilingualism is a further factor contributing to cognitive reserve.**”

Learn
More
Languages!

It is practically impossible to teach good programming to students that have had a prior exposure to BASIC: as potential programmers they are mentally mutilated beyond hope of regeneration.

Languages affect cognition

Languages affect cognition

Across the board, object gender influenced the participants' judgments.
For example, the word "key" is masculine in German and feminine in Spanish. German speakers in the study tended to describe keys as *hard, heavy, jagged, metal,* and *useful*. Spanish speakers, on the other hand, used words such as *golden, intricate, little, lovely*, and *tiny* when describing keys.

Languages affect cognition

Small, unnoticed features of language can influence our thoughts, sometimes in big ways. Knowing that, imagine how else language, culture, and society might affect our thoughts, feelings, and behaviors.

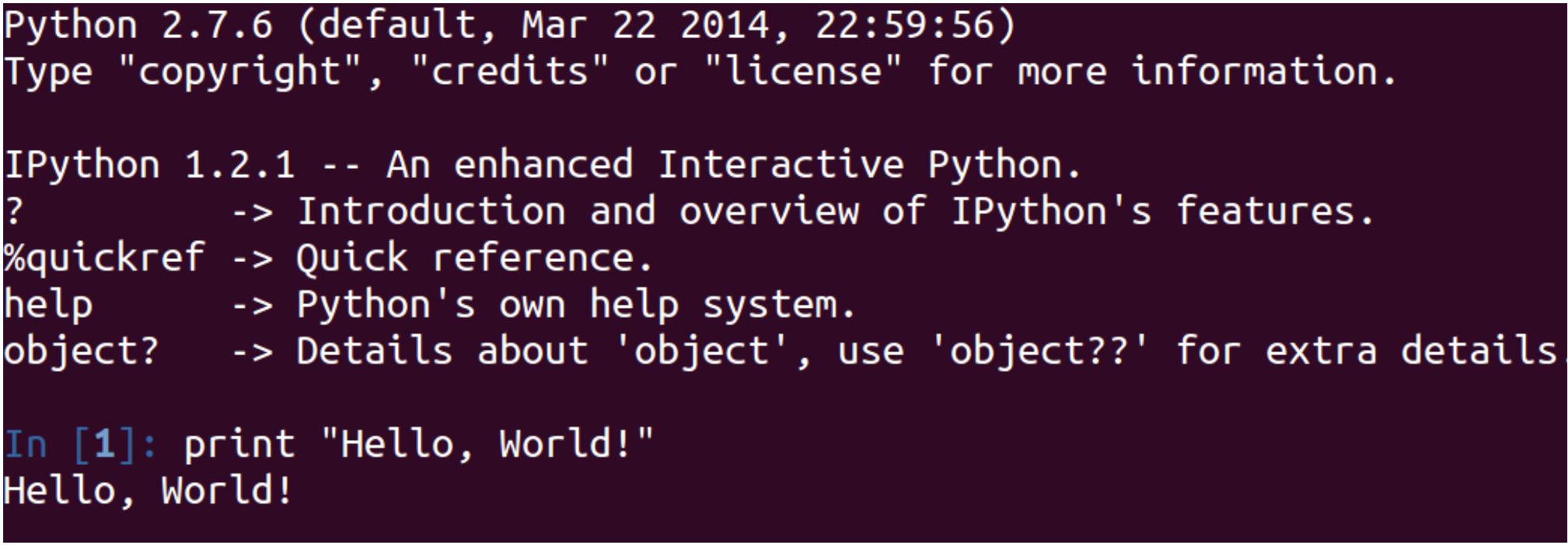
@hirojin

"A programming language is a tool that has a profound influence on our thinking habits"

- Edsger Dijkstra

```
org 100h

; set video mode
mov ax, 3     ; text mode 80x25, 16 colors, 8 pages (ah=0, al=3)
int 10h       ; do it!

; cancel blinking and enable all 16 colors:
mov ax, 1003h
mov bx, 0
int 10h

; set segment register:
mov     ax, 0b800h
mov     ds, ax

; print "hello world"
; first byte is ascii code, second byte is color code.

mov [02h], 'H'
mov [04h], 'e'
mov [06h], 'l'
mov [08h], 'l'
mov [0ah], 'o'
mov [0ch], ','
mov [0eh], 'W'
mov [10h], 'o'
mov [12h], 'r'
mov [14h], 'l'
mov [16h], 'd'
mov [18h], '!'

; color all characters:
mov cx, 12  ; number of characters.
mov di, 03h ; start from byte after 'h'

c:  mov [di], 11101100b   ; light red(1100) on yellow(1110)
    add di, 2 ; skip over next ascii code in vga memory.
    loop c

; wait for any key press:
mov ah, 0
int 16h

ret
```

```java
/**
 * The HelloWorldApp class implements an application that
 * simply prints "Hello World!" to standard output.
 */
class HelloWorldApp {
    public static void main(String[] args) {
        System.out.println("Hello World!"); // Display the string.
    }
}
```


Python 2.7.6 (default, Mar 22 2014, 22:59:56)
Type "copyright", "credits" or "license" for more information.
IPython 1.2.1 -- An enhanced Interactive Python.
? -> Introduction and overview of IPython's features.
%quickref -> Quick reference.
help -> Python's own help system.
object? -> Details about 'object', use 'object??' for extra details.
In [1]: print "Hello, World!"
Hello, World!

You can't be a polyglot and make code that looks the same in all your languages. Approach each lang idiomatically, and embrace its strengths

Bryan Liles (@bryanl)

```python
from abc import ABCMeta, abstractmethod, abstractproperty

class IWidget(object):
    __metaclass__ = ABCMeta

    @abstractproprty
    def thing(self):
        ''' get / set thing '''

    @abstractmethod
    def foobar(self):
        ''' is it better to foo, or to bar? '''


class AbstractWidgetFactoryManager(object):

    ....
```

```python
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class IWidget(object):
    __metaclass__ = ABCMeta

    @abstractproprty
    def thing(self):
        ''' get / set thing '''

    @abstractmethod
    def foobar(self):
        ''' is it better to foo, or to bar? '''


class AbstractWidgetFactoryManager(object):

    ....
```

DON'T BE THAT GUY/GAL

When in Rome...

Write C++ in C++,
Java in Java,
Python in Python.

The Start of Polyglot Programming

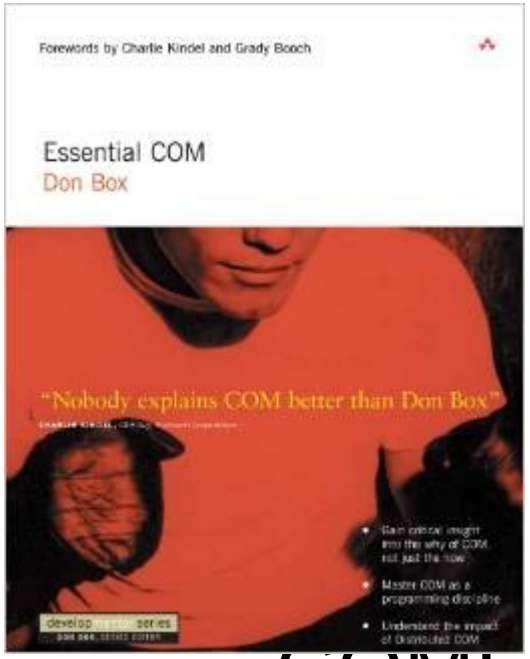
(okay, Unix has always been slightly polyglot, with shells, sed, awk) – but even on Unix it didn't really kick off until Perl(yuck) came along

In the Windows World, we were stuck with C. Or C++. And huge great switch statements.

Of course, in theory, you could create dlls in different languages
- calling conventions
- object lifetimes
- even between compiler versions it could be tricky

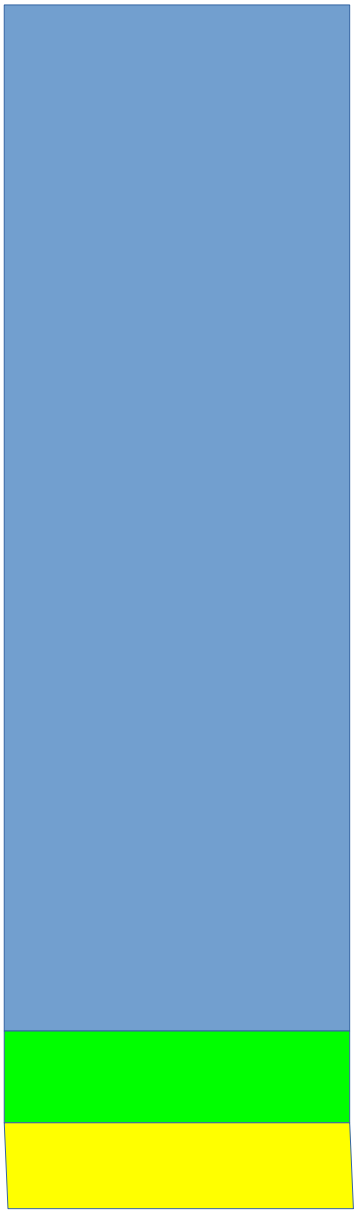
Then came
Visual Basic

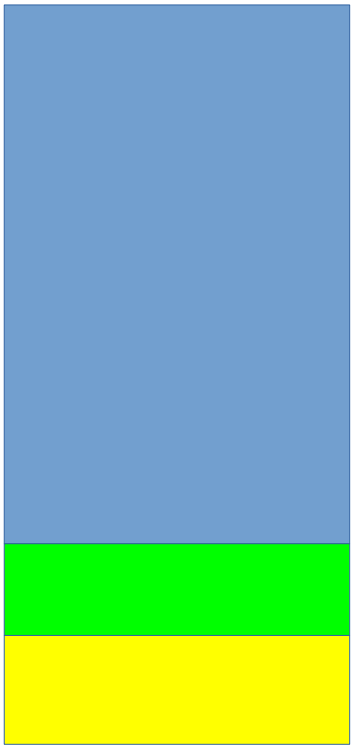
And COM, and OCXes, and Excel Addins



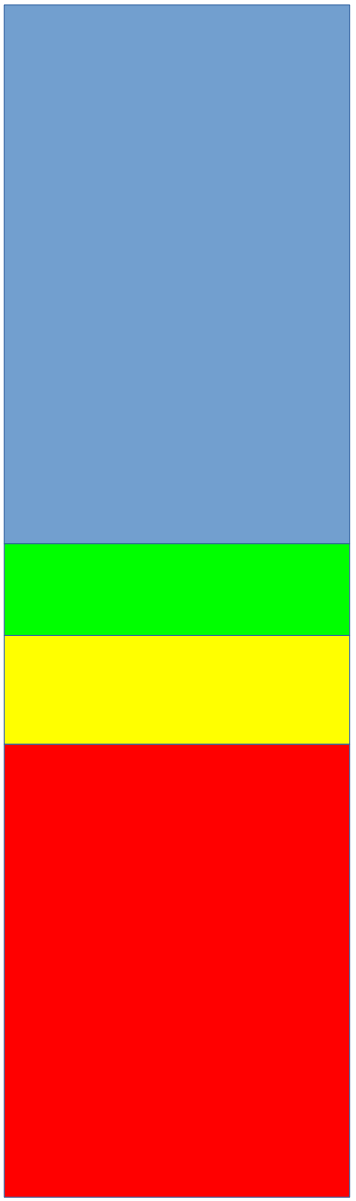
Don Box Book:
COM: A Really Elegant Concept

COM: Horrid in Practice!


C++
SQL
shell



Java
SQL
shell

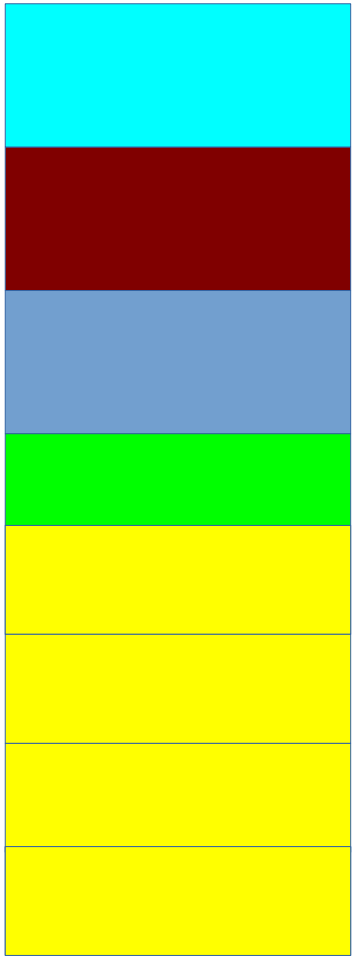


Java

SQL

shell

XML



HTML

CSS

JS

NOSQL

shell/docker/...

N+1

JS Frameworks

...

Alternate Hard And Soft Layers

PatternForm **Version:**

Aliases: Scripting System, Interpreter, Extensible Middle Layer

Problem: The mapping between the primitives available and the driver that controls them is too static. Combinations of the primitives ar

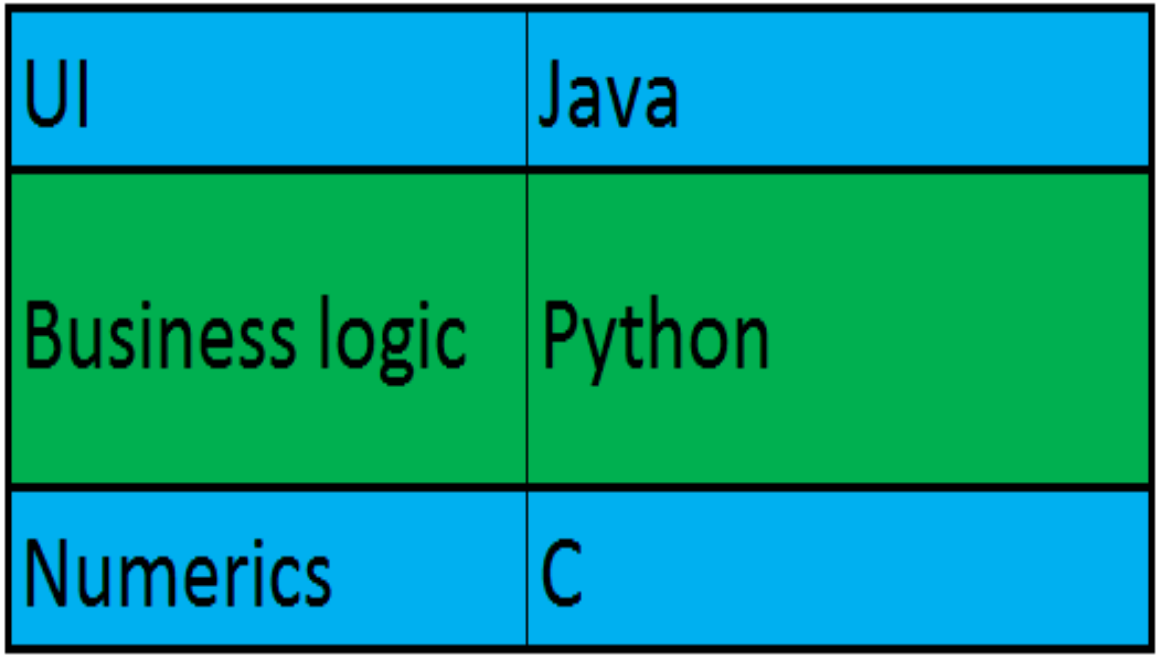
Context: The primitive elements of the system are used in a limited but effective way. The applications serve existing needs using well- the new needs into the system depends in part on the changes to the work flow that supporting the new features produces.

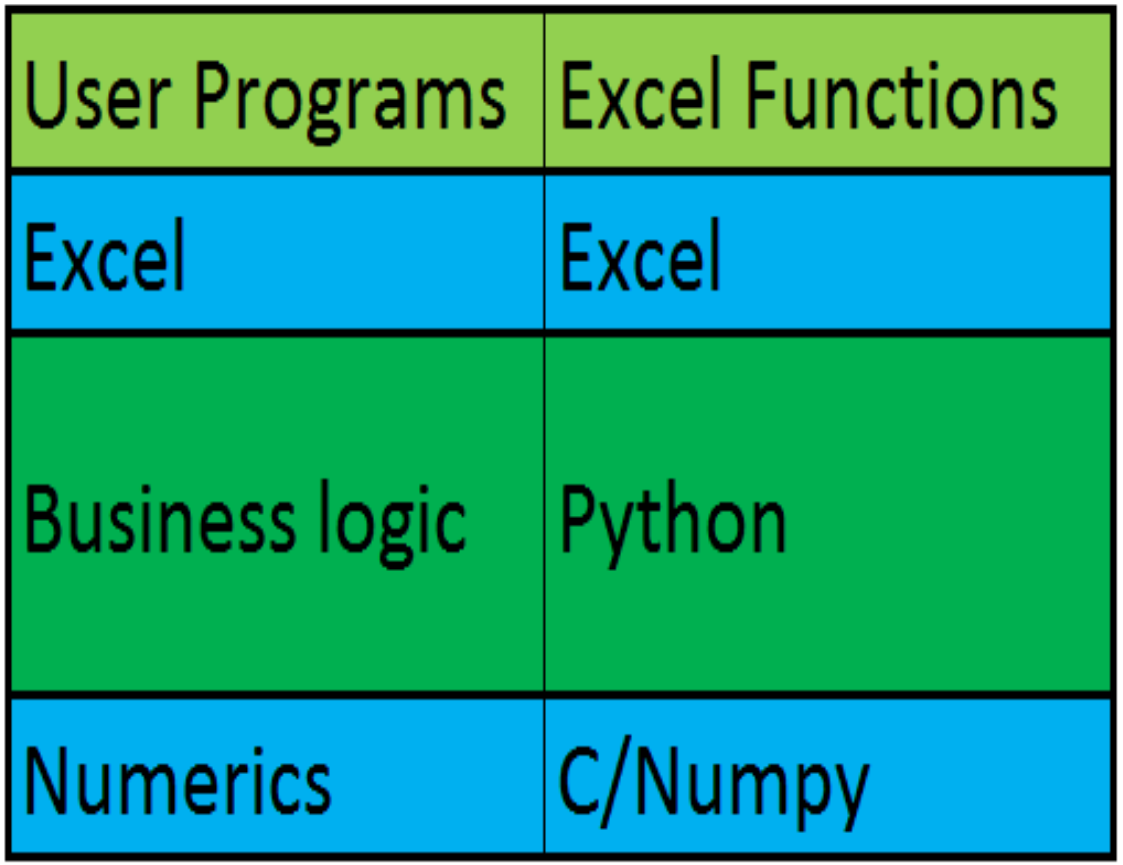
Forces: A context for rapid experimentation and novel functionality requires new infrastructure. New data types must be created to acc markedly reduce efficiency of the existing system functions.

Solution: Build an extensible interpreter environment that makes all the primitive elements of the existing system available via universal d

Resulting Context: A single generic driver system provides an entry point for a data type that relates the combinations and relationshi a much larger context has been created at the same time.

Hard	Difficult to change
Soft	Flexible, but can be slow
Hard	Optimised for speed


UI
Java
Business logic
Python
Numerics
C


User Programs
Excel Functions
Excel
Excel
Business logic
Python
Numerics
C/Numpy

Python C API example

```
#include <Python.h>
#include <math.h>
```

Python C API example

```c
#include <Python.h>
#include <math.h>
/*   Wrapped cosine function   */
static PyObject* cos_func(PyObject* self, PyObject* args)
{
    double value;
    double answer;
```

Python C API example

```c
#include <Python.h>
#include <math.h>
/*  wrapped cosine function */
static PyObject* cos_func(PyObject* self, PyObject* args)
{
    double value;
    double answer;
    /*  parse the input, from python float to c double */
    if (!PyArg_ParseTuple(args, "d", &value))
        return NULL;
    /* if the above function returns -1, an appropriate Python exception will
     * have been set, and the function simply returns NULL
     */
```

Python C API example

```c
#include <Python.h>
#include <math.h>
/*  wrapped cosine function */
static PyObject* cos_func(PyObject* self, PyObject* args)
{
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    double answer;
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        return NULL;
    /* if the above function returns -1, an appropriate Python exception will
     * have been set, and the function simply returns NULL
     */
```

```c
    /*  construct the output from cos, from c double to python float */
    return Py_BuildValue("f", answer);
}
```

Python C API example

```c
/*  define functions in module */
static PyMethodDef CosMethods[] =
{
     {"cos_func", cos_func, METH_VARARGS, "evaluate the cosine"},
     {NULL, NULL, 0, NULL}
};

/* module initialization */
PyMODINIT_FUNC

initcos_module(void)
{
     (void) Py_InitModule("cos_module", CosMethods);
}
```

Python C API example

```c
#include <Python.h>
#include <math.h>
/* wrapped cosine function */
static PyObject* cos_func(PyObject* self, PyObject* args)
{
    double value;
    double answer;
    /*  parse the input, from python float to c double */
    if (!PyArg_ParseTuple(args, "d", &value))
        return NULL;
    /* if the above function returns -1, an appropriate Python exception will
     * have been set, and the function simply returns NULL
     */

    /* call cos from libm */
    answer = cos(value);

    /*  construct the output from cos, from c double to python float */
    return Py_BuildValue("f", answer);
}
```

Python ctypes

```
>>> from ctypes import *
>>> print windll.kernel32
<WinDLL 'kernel32', handle ... at ...>
>>> print cdll.msvcrt
<CDLL 'msvcrt', handle ... at ...>
>>> libc = cdll.msvcrt
>>>
```

```
>>> print libc.time(None)
1150640792
>>> print hex(windll.kernel32.GetModuleHandleA(None))
0x1d000000
>>>
```

Swig python example

```
/* example.i */
%module example
%{
/* Put header files here or function declarations like below */
extern double My_variable;
extern int fact(int n);
extern int my_mod(int x, int y);
extern char *get_time();
%}

extern double My_variable;
extern int fact(int n);
extern int my_mod(int x, int y);
extern char *get_time();
```

Swig python example

```
/* example.i */
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extern double My_variable;
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extern int my_mod(int x, int y);
extern char *get_time();
```

Boost python example

```
#include <iostream>

using namespace std;

void say_hello(const char* name) {
    cout << "Hello " <<  name << "!\n";
}

#include <boost/python/module.hpp>
#include <boost/python/def.hpp>
using namespace boost::python;

BOOST_PYTHON_MODULE(hello)
{
    def("say_hello", say_hello);
}
```

Cython python example

```
def fibonacci(n):
    ''' calculates the first n numbers in the fibonacci series'''
    assert n > 0, "don't be silly, n must be > 0"
    assert n > 2, "surely you can work out the first two yourself?"

    fibo = [1, 1]
    for _ in range(2, n):
        fibo.append(fibo[-2] + fibo[-1])

    return fibo
```

Cython python example

```
def test_fibo_function(f):
    def check_equal(lhs, rhs):
        assert lhs == rhs, "%s != %s" % (lhs, rhs)

    check_equal(f(3), [1, 1, 2])
    check_equal(f(8), [1, 1, 2, 3, 5, 8, 13, 21])
    print f.__name__, "passed"
```

Cython python example

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def fibonacci(n):
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    fibo = [1, 1]
    for _ in range(2, n):
        fibo.append(fibo[-2] + fibo[-1])

    return fibo
```

Cython python example

```
from distutils.core import setup
from Cython.Build import cythonize

setup(
            ext_modules = cythonize("cython_fibo.py")
            )


    python setup.py build_ext --inplace
```

Cython python example

```
In [11]: import python_fibo, cython_fibo

In [12]: %timeit python_fibo.fibonacci(100)
10000 loops, best of 3: 23.4 µs per loop

In [13]: %timeit cython_fibo.fibonacci(100)
100000 loops, best of 3: 9.41 µs per loop
```

Cython python example

```
/* Generated by Cython 0.20.1post0 (Debian 0.20.1+git90-g0e6e38e-1ubuntu2) on Thu Apr 16 0
8:30:31 2015 */

#define PY_SSIZE_T_CLEAN
#ifndef CYTHON_USE_PYLONG_INTERNALS
#ifdef PYLONG_BITS_IN_DIGIT
#define CYTHON_USE_PYLONG_INTERNALS 0
#else
#include "pyconfig.h"
#ifdef PYLONG_BITS_IN_DIGIT
#define CYTHON_USE_PYLONG_INTERNALS 1
#else
#define CYTHON_USE_PYLONG_INTERNALS 0
#endif
#endif
#endif
#include "Python.h"
#ifndef Py_PYTHON_H
    #error Python headers needed to compile C extensions, please install development versi
on of Python.
#elif PY_VERSION_HEX < 0x02040000
    #error Cython requires Python 2.4+.
"cython_fibo.c" 3380L, 134148C                                1,1           Top
```

Cython python example

```
def fibonacci(int n):
    ''' calculates the first n numbers in the fibonacci series'''
    assert n > 0, "don't be silly, n must be > 0"
    assert n > 2, "surely you can work out the first two yourself?"

    cdef int i
    fibo = [1, 1]
    for i in range(2, n):
        fibo.append(fibo[-2] + fibo[-1])

    return fibo
```

Cython python example

```
In [14]: import cython_fibo2

In [15]: %timeit python_fibo.fibonacci(100)
10000 loops, best of 3: 24.6 µs per loop

In [16]: %timeit cython_fibo.fibonacci(100)
100000 loops, best of 3: 8.16 µs per loop

In [17]: %timeit cython_fibo2.fibonacci(100)
100000 loops, best of 3: 6.97 µs per loop
```

Good artists copy;
great artists steal.

The easiest way to build an interface...

… is to use one that’s already built.

numpy

```
In [12]: import numpy as np

In [13]: np.log(np.arange(1, 360,5))
Out[13]:
array([ 0.        ,  1.79175947,  2.39789527,  2.77258872,  3.04452244,
        3.25809654,  3.4339872 ,  3.58351894,  3.71357207,  3.8286414 ,
        3.93182563,  4.02535169,  4.11087386,  4.18965474,  4.26267988,
        4.33073334,  4.39444915,  4.4543473 ,  4.51085951,  4.56434819,
        4.61512052,  4.66343909,  4.7095302 ,  4.75359019,  4.79579055,
        4.83628191,  4.87519732,  4.91265489,  4.94875989,  4.98360662,
        5.01727984,  5.04985601,  5.08140436,  5.11198779,  5.14166356,
        5.170484  ,  5.19849703,  5.22574667,  5.25227343,  5.27811466,
        5.30330491.  5.32787617.  5.35185813.  5.37527841.  5.3981627 .
```

PyXLL example

```
from pyxll import xl_func

@xl_func("string name: string", thread_safe=True)
def hello(name):
    """return a familiar greeting"""
    return "Hello, %s" % name

@xl_func("int n: int", category="fibonacci", thread_safe=True)
def fibonacci(n):
    """naive iterative implementation of fibonacci"""
    a, b = 0, 1
    for i in xrange(n):
        a, b = b, a + b
    return a
```

Rcpp / Rinline examples

```cpp
#include <Rcpp.h>
using namespace Rcpp;
#include <algorithm>


// [[Rcpp::export]]
double vectorSum(NumericVector x) {
   return std::accumulate(x.begin(), x.end(), 0.0);
}
```

```
require (inline)

src <- "
int n = as<int>(ns);
int fact = 1;
  for (int i = 1; i < n; ++i)
    fact *= i;
  return wrap(fact);
"

fact <- cxxfunction(signature(ns = "integer"),
                    plugin = "Rcpp",
                    body = src)
```

Great!

Impedance Mismatch

Another term we've stolen from engineering

Hard	Difficult to change
Soft	Flexible, but can be slow
Hard	Optimised for speed

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Impedance Mismatch

Different Skillsets
Different Ways of Thinking
Different Levels
Context Switching / Debugging


julia

Julia is a high-level, high-performance dynamic programming language for technical computing, with syntax that is familiar to users of other technical computing environments. It provides a sophisticated compiler, distributed parallel execution, numerical accuracy, and an extensive mathematical function library. The library, largely written in Julia itself, also integrates mature, best-of-breed C and Fortran libraries for linear algebra, random number generation, signal processing, and string processing. In addition, the Julia developer community is contributing a number of external packages through Julia's built-in package manager at a rapid pace. IJulia, a collaboration between the IPython and Julia communities, provides a powerful browser-based graphical notebook interface to Julia.

```
function mandel(z)
    c = z
    maxiter = 80
    for n = 1:maxiter
        if abs(z) > 2
            return n-1
        end
        z = z^2 + c
    end
    return maxiter
end

function randmatstat(t)
    n = 5
    v = zeros(t)
    w = zeros(t)
    for i = 1:t
        a = randn(n,n)
        b = randn(n,n)
        c = randn(n,n)
        d = randn(n,n)
        P = [a b c d]
        Q = [a b; c d]
        v[i] = trace((P.'*P)^4)
        w[i] = trace((Q.'*Q)^4)
    end
    std(v)/mean(v), std(w)/mean(w)
end
```

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@georgebernhard (play)
@numericalR (work)