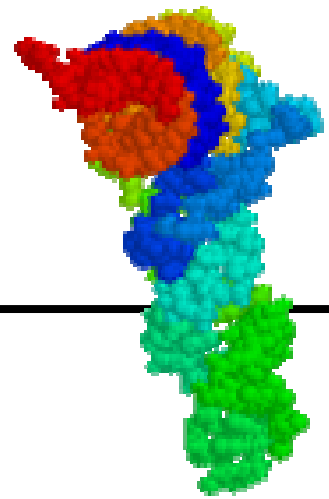# Genomics, Computing, Economics & Society

10 AM Thu 22-Sep 2005

MIT-OCW Health Sciences & Technology 508/510

Harvard Biophysics 101

Economics, Public Policy, Business, Health Policy

Class outline

(1) Topic priorities for homework since last class

(2) Quantitative exercise

(3) Project level presentation & discussion

(4) Sub-project reports & discussion

(5) Discuss communication/presentation tools

(6) Topic priorities for homework for next class

(1) Topic priorities for homework since last class

(a) Your notes

(b) Follow up on the "experiment" from Tue:
Tversky & Kahneman (1974) Judgement under Uncertainty:
Heuristics and Biases. Science 185:1124).

(c) Exponential growth xls example

2 (& 7): 8 x 7 x 6 x 5 x 4 x 3 x 2 x 1 (& rev)
Our answers 2: 1000 4000 10000 20000 20000 35000 43000 500000
Our answers 7:   700 5040 10000 35000 36000 40000 45000   60000
Actual: 40320   1974 median: 2250 descending; 512 ascending

3: 70 engineers and 30 lawyers; probability that Dick is an engineer
0.05 0.5 0.7 0.7 0.7 0.7 0.7
Actual: 0.7 Previous observations: 0.5

Human experiment results

```
4:  TTTTTTTTTT  HHTHTTTTHH  HTHTTTHHTH
    THHTTHTHHH  HTTTHHTTTH  HTTHHHTHTH
```
1974: more than two in row are rare. Expect: 2 See: 8,2,1,1,2,1

5: 10 people, # committees of 2 or 8 members?
(45, 45) (45, 45) (45, 45) 50
Actual: 45.   1974 median for 2 was 70; for 8 was 20.

6: 4/5 vs 12/20 -- Odds that actually 2/3?
0 2 0, 0 100 "high"
Actual: [C(5,4)(2/3)^4 (1/3) / C(5,1)(2/3)(1/3)^4]= 8
[C(20,12)(2/3)^12 (1/3)^8 / C(20,8)(2/3)^8(1/3)^12]= 16
Most 1974 people felt that 4/5 is better evidence.

(2) Quantitative exercise

Tversky & Kahneman (1974)

Figure removed due to copyright reasons.

part two

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Draft: **Prove, Predict, prioritize, practice**
Breaking barriers & building bridges

Prove, predict: Connect problems, technologies, modeling options
Example: Evolution - replicating &/or intelligent machines
stem cells, abortion
Model: Quantitatively define life. **

Prioritize, practice: Metabolic networks
Example: Carbon & Energy
Model: Multilevel from molecular to global.

Prioritize: Privacy vs openess
Example: Personal genomics
Model: Evolutionary conservation, etc.

Prioritize, practice: Synthetic Biology & chemistry
Examples: biosecurity, bioterrorism, GMOs
Withholding experimental drugs (e.g. HIV & Cancer)
Substance abuse, Vioxx
Models: Risk & benefit, systems models

What to optimize?

Morten Sommer: "which 'societal' parameters that we wish to link to the lower level processes. Is it: bio capital, average lifetime, public health and GDP."

Quantitative definition of life (& utility of such)

http://freebiology.org/wiki/Talk:ALife_Boston#A_universal_definition_of_life

"papers incubating where we *do* calculate the statistical complexity of various real-world processes"

http://cscs.umich.edu/~crshalizi/notebooks/complexity-measures.html

Figures removed due to copyright reasons.

James P. Crutchfield and Karl Young, "Inferring Statistical Complexity," *Physical Review Letters* **63** (1989) 105--109

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Representation of data: Feynman

Realism vs. abstraction

Feynman diagrams for the calculation of atomic energy levels of high-Z He-like ions: (a) Photon exchange diagram representing the interaction of electrons; (b) Vacuum polarization and self-energy processes contributing to the Lamb shift; (c) Correlation ladder and crossed photon ladder; and (d) radiative corrections to photon exchange (screening of the Lamb shift).

Figure removed due to copyright reasons.

http://www.llnl.gov/urp/HBCU/images/analytic.gif

The Visual Display of Quantitative Information
1983,2001 Tufte (& Minard 1861)

Figure removed
due to copyright
reasons.

Other examples

Jeffrey Yip suggests:

Ben Fry's Genomic Cartography work

http://acg.media.mit.edu/people/fry/

Image and Meaning Initiative

http://web.mit.edu/i-m/intro.htm

Photo removed due
to copyright reasons.

The Gettysburg Powerpoint Presentation11/19/1863

http://www.norvig.com/Gettysburg/

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