

PSYCH 214 - functional MRI methods

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The plan

1. functional MRI methods;
2. how to work with functional MRI data.

The plan again

1. functional MRI methods;
2. how to work with functional MRI data.

Why “how to work with”?

Functional MRI is really hard to learn and teach:

- ▶ neuroanatomy;
- ▶ neurophysiology;
- ▶ data analysis;
- ▶ physics;
- ▶ signal processing;
- ▶ image processing;
- ▶ linear algebra;
- ▶ statistics;

Current practice

- ▶ learn some of some of the areas;
- ▶ pick the rest up as you go;
- ▶ “makes sense” epistemology;
- ▶ wing it.

So, what's the problem?

- ▶ like science, but not science;
- ▶ many mistakes;
- ▶ inefficient;
- ▶ hard to collaborate.

Like science, but not science

Richard Feynman, What is Science? (1969)

Science alone of all the subjects contains within itself the lesson of the danger of belief in the infallibility of the greatest teachers in the preceding generation. . . . Learn from science that you must doubt the experts . . . Science is the belief in the ignorance of experts

Take no-one's word for it



(by kladcat under CC BY 2.0, via Wikimedia Commons)

Ubiquity of error

The scientific method's central motivation is the ubiquity of error - the awareness that mistakes and self-delusion can creep in absolutely anywhere and that the scientist's effort is primarily expended in recognizing and rooting out error."

Donoho, David L, et al. 2009. Reproducible research in computational harmonic analysis. *Computing in Science & Engineering* 11, 8–18.

Science vs advertising

An article about computational science in a scientific publication is not the scholarship itself, it is merely advertising of the scholarship. The actual scholarship is the complete software development environment and the complete set of instructions which generated the figures"

The wavelab front page

Understanding by building

“What I cannot create, I do not understand”

Richard Feynman

Many mistakes

Open access, freely available online

Essay

Why Most Published Research Findings Are False

John P.A. Ioannidis

- ▶ <http://dx.doi.org/10.1371/journal.pmed.0020124>
- ▶ http://matthew-brett.github.io/teaching/ioannidis_2005.html

When most research findings are false 1

Corollary 1: The smaller the studies conducted in a scientific field, the less likely the research findings are to be true. Small sample size means smaller

When most research findings are false 2

Corollary 2: The smaller the effect sizes in a scientific field, the less likely the research findings are to be true.

When most research findings are false 3

Corollary 3: The greater the number and the lesser the selection of tested relationships in a scientific field, the less likely the research findings are to be true. As shown above, the post-study

When most research findings are false 4

Corollary 4: The greater the flexibility in designs, definitions, outcomes, and analytical modes in a scientific field, the less likely the research findings are to be true.

When most research findings are false 5

Corollary 5: The greater the financial and other interests and prejudices in a scientific field, the less likely the research findings are to be true.

When most research findings are false 6

Corollary 6: The hotter a scientific field (with more scientific teams involved), the less likely the research findings are to be true.

Inefficient

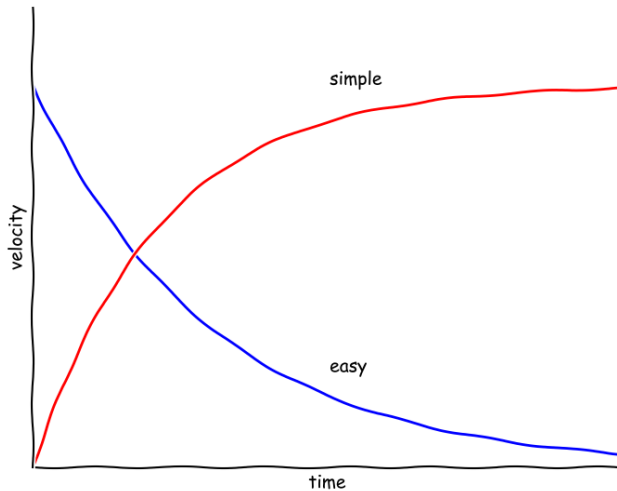
- ▶ Simple comes from Latin *simplex* - one fold. The opposite of *complex* - Latin for twisted together.
- ▶ Easy comes from old French *aiser* to Latin *adjacens* “lying close by”.

Easy is what you are familiar with, not far from something you already know. Simple is when you have succeeded in breaking the problem into separate ideas.

See: <http://www.infoq.com/presentations/Simple-Made-Easy>

Also: Oxford dictionary of Word origins edited by Julia Cresswell.

Choose simple over easy



The plan returns

1. functional MRI methods;
2. how to work with functional MRI data.

Strategy

We start with:

- ▶ Python;
- ▶ correct coding;
- ▶ version control.

We'll use that as a foundation for teaching imaging analysis.

We'll emphasize:

- ▶ collaboration;
- ▶ transparency;
- ▶ learning from your peers.

We intend

The “Berkeley Way”

https://en.wikipedia.org/wiki/The_Toyota_Way

Where we're going

See:

<https://bic-berkeley.github.io/psych-214-fall-2016/projects.html>

Logistics

See:

<https://bic-berkeley.github.io/psych-214-fall-2016/logistics.html>

End of talk

Start of work . . .