Week 2: Popular Articles

All of the articles for this week deal with finding false positives and/or multiple testing without control over the error rate.

a) Trawling the Brain, Laura Sanders (*Science News*), December 19, 2009

Many "hot spots" appear when scanning (with fMRI) a dead salmon while showing emotional scenes

We have the importance of replication pointed out

"voodoo correlations" between brain activation and social variables

Multiple comparisons problem solutions (at our web site: sgep_weekly_readings):

Random field theory: see the references in "Neural correlates of interspecies perspective taking in the post-mortem Atlantic salmon: An argument for proper multiple comparisons correction" (Craig Bennett, et al.)

Nonparametric permutation tests: "Nonparametric permutation tests for functional neuroimaging: A primer with examples" (Thomas Nichols and Andrew Holmes)

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Reverse Inference Problem: if a region lights up under some condition, it does not follow that if the region lights up, the condition is occurring.

"If p, then q" does not imply "if q, then p" (the fallacy of affirming the consequent) – but see the Charles Peirce idea of Abductive Inference:

Abduction is a form of logical inference that goes from observation to a hypothesis that accounts for the reliable data (observation) and seeks to explain relevant evidence. The American philosopher Charles Sanders Peirce (1839 – 1914) first introduced the term as "guessing." Peirce said that to abduce a hypothetical explanation a from an observed surprising circumstance b is to surmise that a may be true because then b would be a matter of course. Thus, to abduce a from b involves determining that a is sufficient (or nearly sufficient), but not necessary, for b.

For example, the lawn is wet. But if it rained last night, then it would be unsurprising that the lawn is wet. Therefore, by abductive reasoning, the possibility that it rained last night is reasonable. Moreover, abducing rain last night from the observation of the wet lawn

can lead to a false conclusion. In this example, dew, lawn sprinklers, or some other process may have resulted in the wet lawn, even in the absence of rain.

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Craig Bennett and colleagues got an Ig Noble Prize for their work on scanning the salmon: here's an NPR transcript of an interview with Scott Simon –

Host Scott Simon speaks with Craig Bennett and Michael Miller about being awarded a 2012 Ig Nobel prize for their paper on the brain waves of dead Atlantic Salmon, published in the Journal of Serendipitous and Unexpected Results.

SCOTT SIMON, HOST:

In a couple weeks, the prestigious Nobel Prizes will be announced. But this week, the Ig Nobels honored the silliest discoveries of 2012. A study on the physics of the ponytail; a paper on why coffee spills when you walk; and a prize for a group of psychologists who scanned the brain of an unpromising patient: a deceased Atlantic salmon. Even more unlikely were their findings: the dead fish had thoughts. Who knows – maybe dreams. Craig Bennett did the experiment and accepted the award with good humor, and a couple of fish jokes.

CRAIG BENNETT: Some have called functional neuroimaging, which is an important method for studying the human brain, a fishing expedition. Some have even called the results a red herring. But...

SIMON: Craig Bennett and his colleague, Dr. Michael Miller, joins us now from studios at

Harvard University. Gentlemen, thanks for being with us.

MICHAEL MILLER: Thank you, Scott.

: Yeah, it's good to be here.

SIMON: Is there any defensible reason to study the brain of a dead fish?

MILLER: Well, not for genuine, functional brain activities there's not.

: We wanted to illustrate kind of the absurdity of improper statistical approaches, that you can find false positives, or what is essentially garbage results. And using the incorrect statistical approach you can actually see that there are voxels of activity in the dead, frozen salmon's brain.

MILLER: You know, while the salmon was in the scanner, we were doing the testing exactly like a human would have been in there.

SIMON: I'm sorry, did you say to the post-mortem salmon, just press this button in case you get antsy?

: We actually did, because we were also training our research assistants on the proper methods on how to interact with humans. And so not only did we give the experimental instructions to the salmon but we also were on the intercom asking if the salmon was OK throughout the experiment.

SIMON: Did you just go into Legal Seafood and say give me a mackerel - forgive me, an Atlantic salmon?

MILLER: It was a Saturday morning and we were conducting the testing very early so that

we didn't interrupt the running of humans later in the day. So, I walked into the local supermarket at 6:30 in the morning, and I said, excuse me, gentlemen, I need a full-length Atlantic salmon. And I'm not a morning person, I just kind of added - for science. And they kind of looked at me funny, but then they were like, you know, we'll be happy to oblige. That'll be $27.50, and before I knew it, I had a full-length Atlantic salmon that we ready to scan.

SIMON: Gentlemen, I'm sorry if this question sounds indelicate, but when your experimentation was done, grilled or poached?

: Baked. That was dinner that night.

(LAUGHTER)

SIMON: Well, science was served, I expect, right?

: And science was tasty.

SIMON: Craig Bennett and Michael Miller, University of California Santa Barbara, won the Ig Nobel Prize this week. They joined us from Harvard University. Gentlemen, thanks for being with us.

MILLER: Thank you, Scott.

: Thanks.

SIMON: You can hear more highlights from the Ig Nobel Awards later this fall on a special Thanksgiving edition of NPR's SCIENCE FRIDAY. This is NPR News.

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Btw, this Russ Poldrack mentioned so prominently in the "Trawling the brain" piece is one of ours (a Neal Cohen student; statistics from me and others in the quantitative division)

b) The Cancer-Cluster Myth, Atul Gawande (*New Yorker*), February 8, 1999

When searching or observing without control, false-positives are always a problem – such as clusters of cancer cases in a particular residential area

The Texas sharpshooter fallacy: draw the bullseye *after* the shoots have been fired

We always seem to have a reason why a cluster might be present (post hoc reasoning at its worst)

Occupational clusters are better: e.g., scrotal cancer among chimney sweeps in the 18th century

Or Medical clusters: the anti-miscarriage drug DES and cervical cancer; or thalidomide and birth defects

Poison clumping should be a way of studying this in a simulation to assess whether cancer mapping differs from randomness; this is similar to the study of bombing in London in World War II, or Tversky's study of the "hot-hand" in basketball, i.e., there isn't ...

(Poisson clumping, or Poisson bursts, is the phenomenon wherein random events have a tendency to occur in clusters, clumps, or bursts.)

c) Duped, Margaret Talbot (*New Yorker*), July 2, 2007

Screening and false positives again, but this time for lies

Polygraphs and related methods don't work very well; humans are terrible lie detectors

Brain scans also don't work well either, irrespective of the "hype" around them (supposedly, lies take more cognitive effort so we get more BOLD signals in fMRI scans)

Two nice pieces in the journal Psychological Science in the Public Interest (these are at our web site):

Editorial: Catching Liars, Elizabeth F. Loftus

Main article: Pitfalls and Opportunities in Non-verbal and Verbal Lie Detection, Aldert Vrij, Par Anders Granhag, and Stephen Porter

Duping delight is a term coined by Dr. Paul Eckman. He says, "duping delight is the pleasure we get over having someone else in our control and being able to manipulate them"

The article also discusses William Marston who we will see in a number of contexts over the semester:

William Moulton Marston (May 9, 1893 – May 2, 1947), also known by the pen name Charles Moulton, was an American psychologist, inventor and comic book writer who created the character Wonder Woman. Two women, his wife Elizabeth Holloway Marston and Olive Byrne (who lived with the couple in an extended relationship), served as exemplars for the character and greatly influenced her creation.

No Lie MRI is also mentioned in the article; from their web site:

No Lie MRI, Inc. provides unbiased methods for the detection of deception and other information stored in the brain.

The technology used by No Lie MRI represents the first and only direct measure of truth verification and lie detection in human history!

No Lie MRI uses techniques that:

Bypass conscious cognitive processing

Measure the activity of the central nervous system (brain and spinal cord) rather than the peripheral nervous system (as polygraph testing does).