Roughly Right

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"It's better to be roughly right than to be exactly wrong."

~ Many People, but not Keynes

This is especially true in forecasts:

I can run a mile in under 15 minutes. *

I can run a mile in under 4 minutes.**

I can run a mile in 3 minutes and 53.29 seconds.**

* True Story!

** Not even remotely true

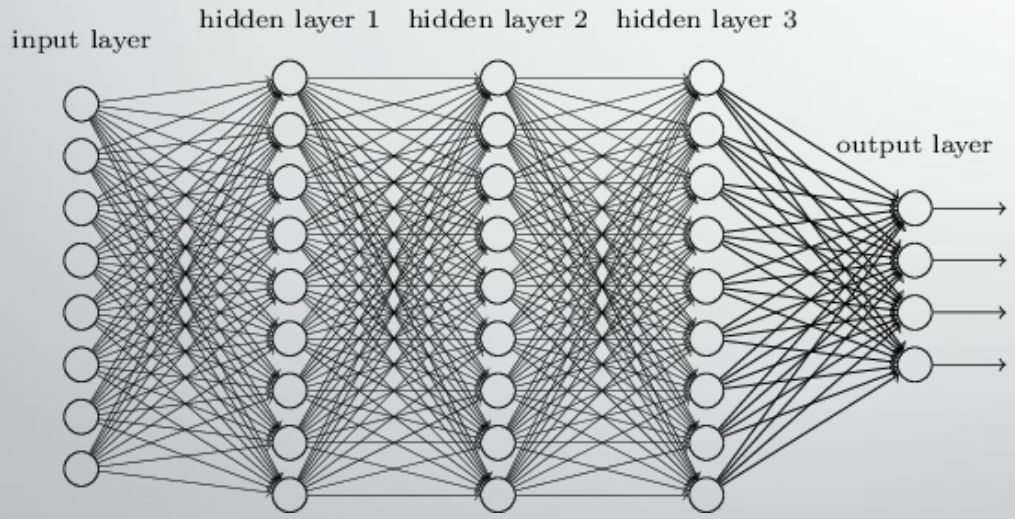
Key Modeling Principles

- Complex models should be supported by simpler models.
- Projections should be back-tested.
- Precision implies confidence.
- Consider a priori assumptions – yours and theirs.
- Ensure that you are directing stakeholders to fundamental questions.

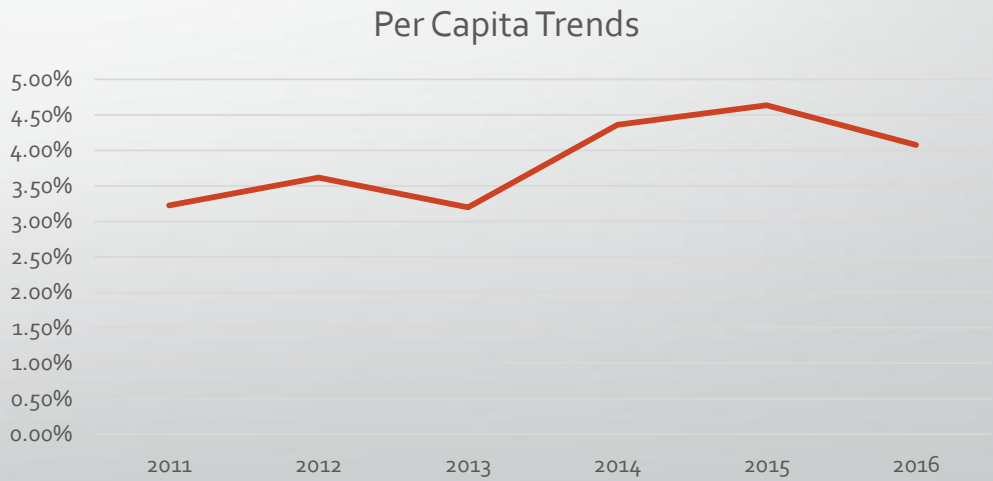
Principle 1:
Complex models should be supported and explained through the use of corroborating models.

They hired you because they don't WANT to know the gory details.

What You Did



What They Need to See



What is a corroborating model?

- A corroborating model is one that gets to the same ‘rough’ conclusion as your more complex model but:
  - Can be easily explained to a non-actuary
  - Goes beyond the numbers
  - Is small enough to fit in an email
- Once you’ve established the baseline model, your stakeholders will accept that there is a more complex model that refines the estimates.

Picture Superiority Effect

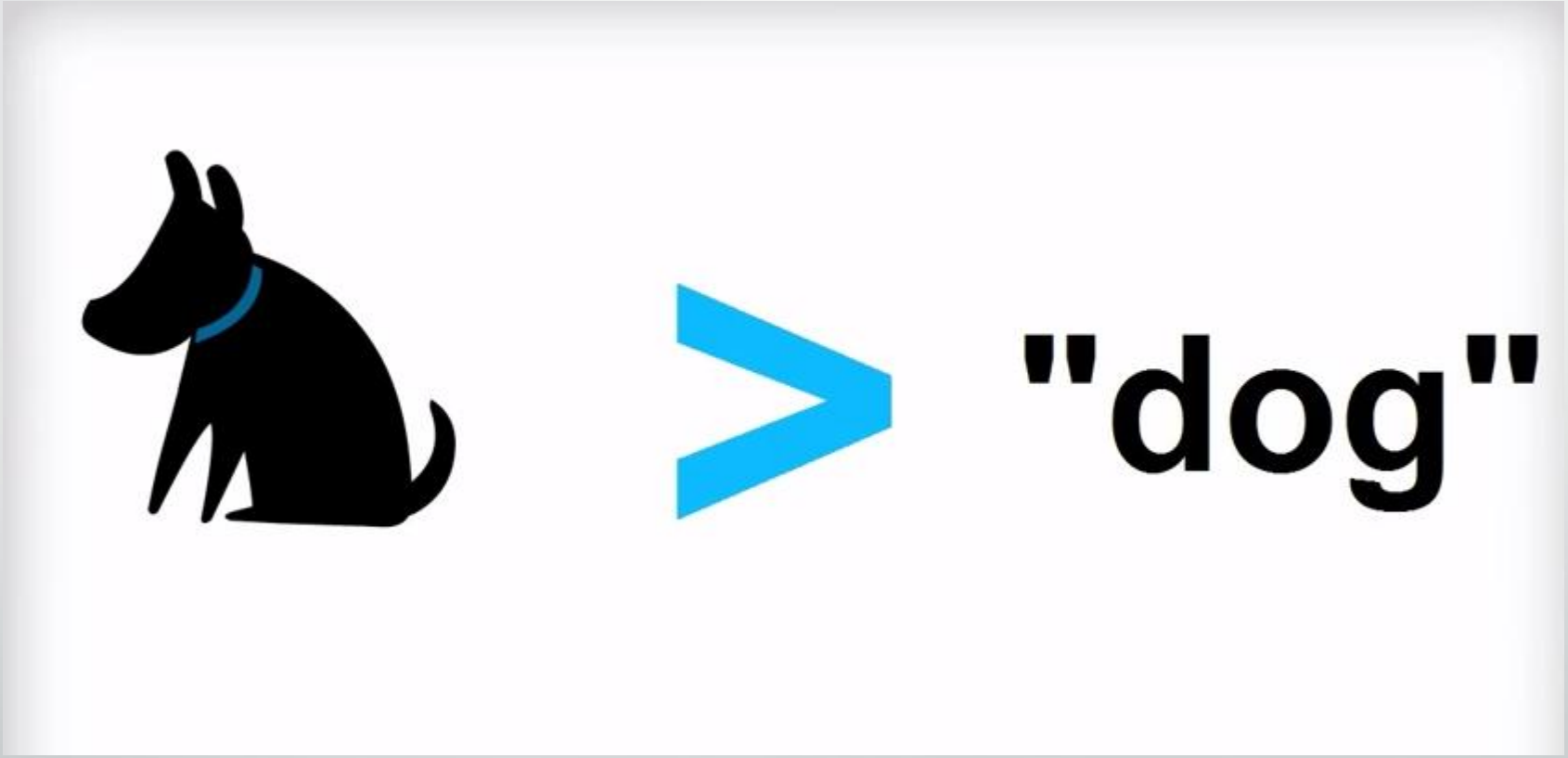
- People internalize visual displays of information far more effectively than textual displays.
- One test: 72 hours after exposure, test subjects recalled 10% of oral information, 65% of visual information (Medina, 2008).
- Effect increases with age.

- Consider this when communicating results.

Medina, J. (2008). *Brain rules*. Seattle, WA: Pear Press

Picture Superiority Effect

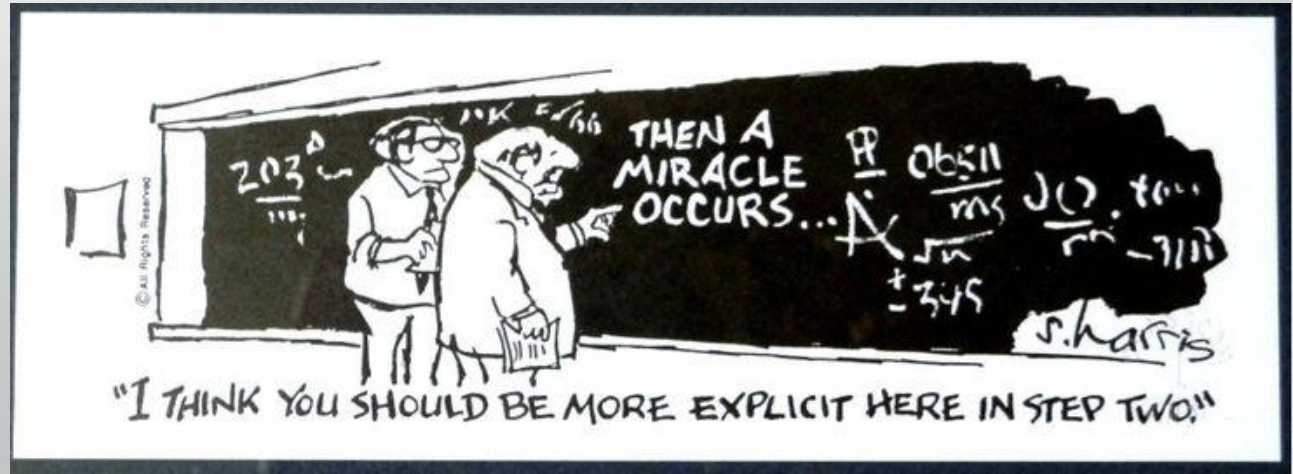
Senior Version



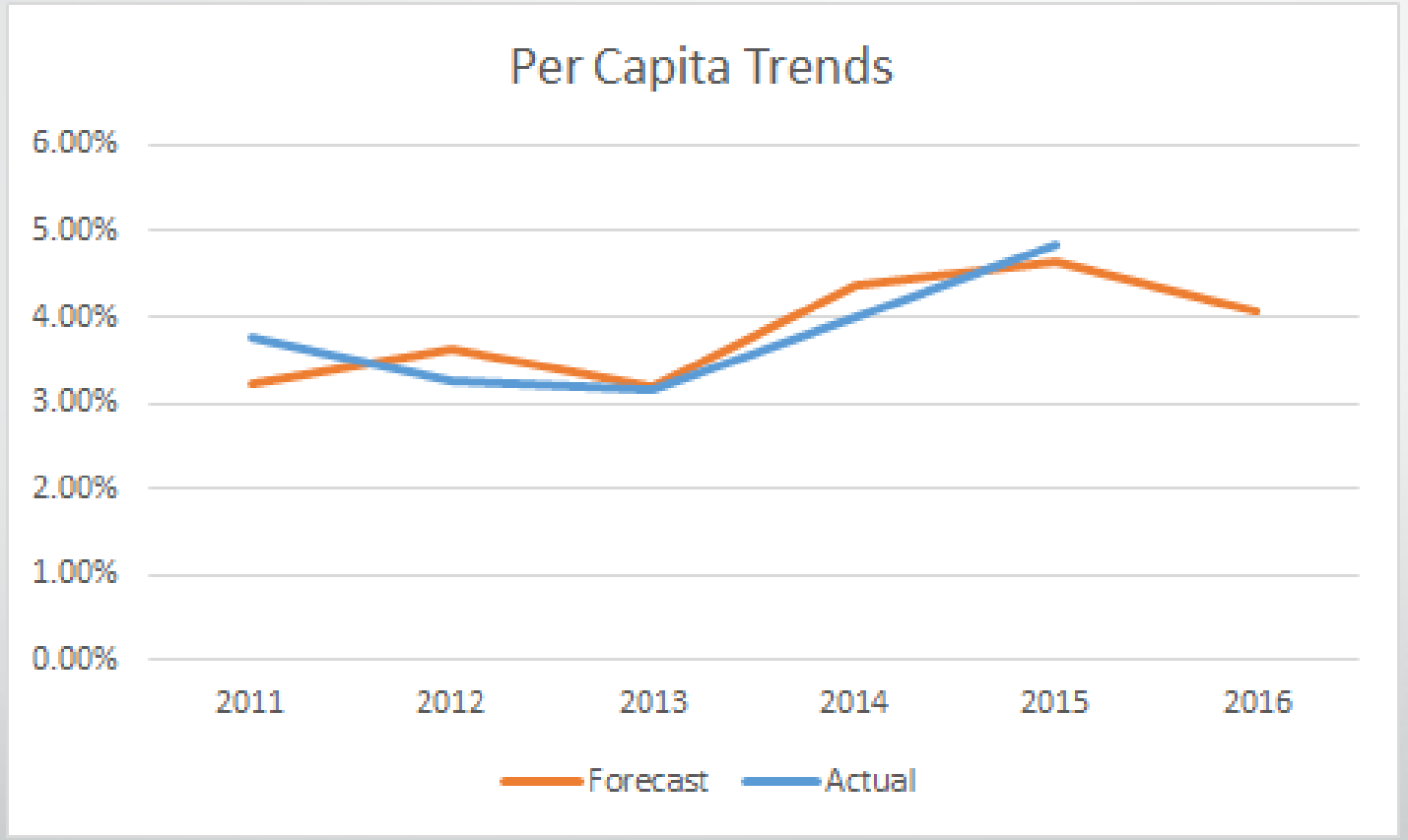
Principle 2:
Modeling approaches should be back-tested transparently.

Demystifying the actuarial black box

- Despite your best efforts at explaining a model, it may still be considered a ‘black box’ to your stakeholders.
  - This term is rarely complementary.
  - A black box is in the eye of the beholder.
- Comparing previous forecasts to actual results may build confidence in a method that is not understood by your audience.

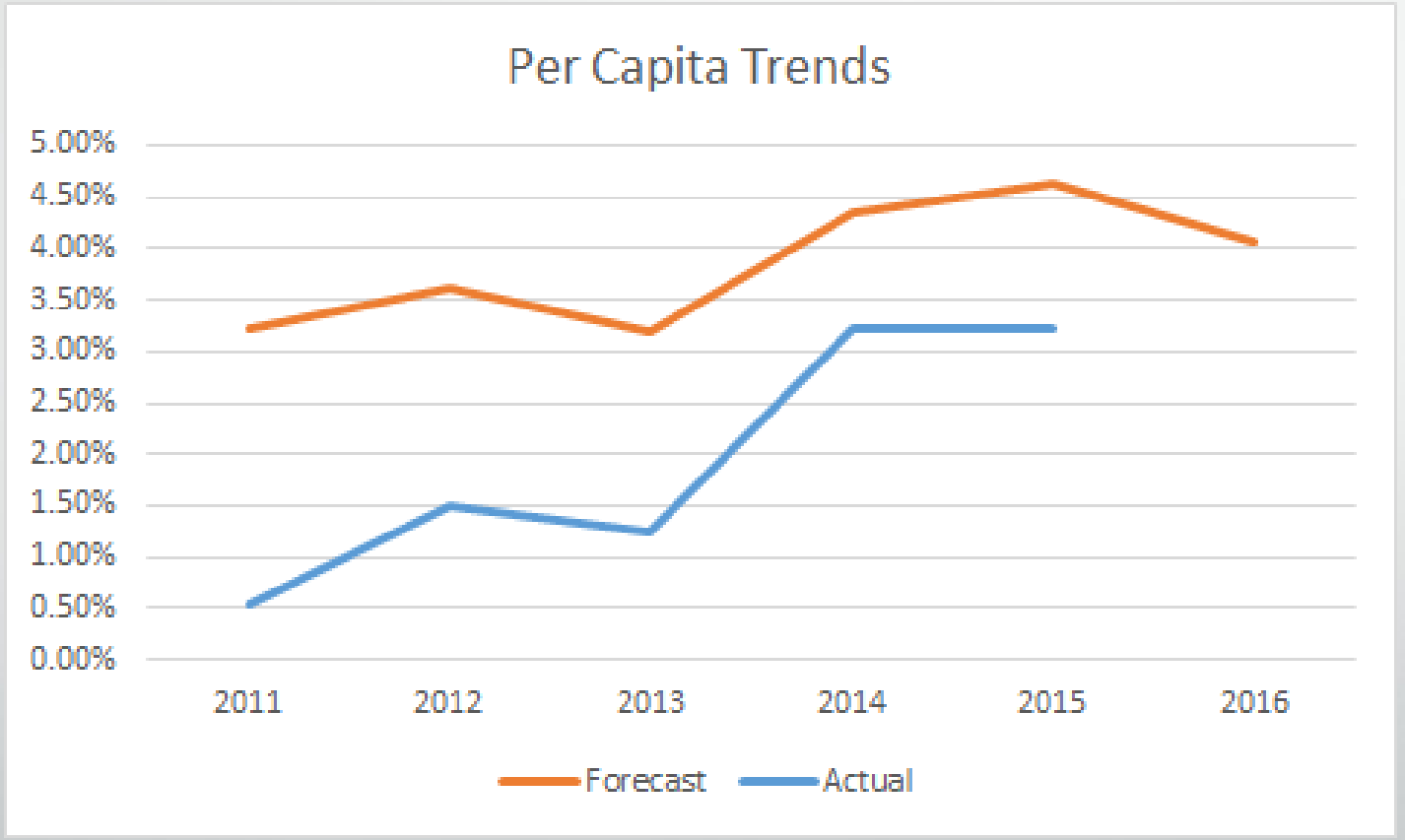


Back-Testing



Back-Testing

Uh-Oh



Principle 3:
Precision implies confidence.

Precision Implies Confidence

- CMS actuaries have projected that $166.8 billion will be spent on dental care in 2022. [July 2015 National Health Expenditures forecast]
- "Sir, your table will be ready in 18 minutes."
- "We estimate that net income next year will be $75 million."

Precision Implies Confidence

- Confidence intervals – or less rigorous ranges – can provide some wiggle room.
  - The confidence intervals in our line of work can be quite large, which in a way proves the need for them.
- Scenarios can be a more palatable alternative to ranges.
- Point estimates are still sometimes needed. They should be accompanied by discussion of risks and sensitivity to key assumptions.
  - This isn't just my idea … ASOP 41 states (Article 3.4.1) – "*The actuary should consider what cautions regarding possible uncertainty or risk in any results should be included in the actuarial report.*"

Principle 4:
Consider *a priori* assumptions.

"The work of science is to substitute facts for appearances and demonstrations for impressions."

~ John Ruskin

Motto of the Society of Actuaries

In order to replace *appearances* and *impressions*, one must first observe appearances and have impressions.

Why Do Impressions Matter?

- From a Bayesian perspective, it's obvious … those prior assumptions are valid data points that may carry even more weight that what we observe or calculate.
- Even for pure frequentists, a priori assumptions matter, as stark differences can point to errors or new emerging patterns or trends.
- You should also consider stakeholders' a priori assumptions, as deviation from these expectations will drive the discussion and the need for further explanation.

Principle 5:
Use analyses to point toward more fundamental business issues.

What's interesting to you may not be the most important result to your stakeholder.

- "We've determined that the average premium for next quarter is $325.15"
- "Premiums in county X are going to be set 12 percent higher than the statewide average."

Failure to anticipate the next question by doing just a little more work can marginalize the hard work that you've already done.

FUZZY LOGIC

Our world is full of fuzzy questions.

- Are you old?
- Am I bald?
- Is this presentation interesting?
- Is this glass empty?
- Is this hotel on the coast?
- Is Maryland in the southeast?
- Are you wealthy?

The answers to all of these questions depend on your context, on your perspective, and also on your interpretation of the meanings of these delineations.

Sorites Paradox

Sorites Paradox, or Paradox of the Heap:

- Premise 1: A billion grains of sand constitutes a heap.*
- Premise 2: A heap of sand minus one grain is still a heap.
- Conclusion: A single grain of sand must still be a heap.

Fuzzy logic provides a way out of the paradox, by establishing a range of "heapiness" from "definitely not a heap" to "definitely a heap".

* A million grains of sand wouldn't even fill up a coffee cup, so I upped the example a little.

This sounds a lot like probability theory.

- From Kosko:
  - "The chief, but superficial similarity, is that both systems describe uncertainty with numbers in the unit interval [0,1]."
  - "The key distinction concerns how the system deal simultaneously with a thing A and its opposite A'."
  - "Fuzziness describes event ambiguity. It measures the degree to which an event occurs, not whether it occurs. Randomness describes the uncertainty of event occurrence. An event occurs or not."

Kosko (1989). "Fuzziness vs. Probability". International Journal of General Systems.
http://sipi.usc.edu/~kosko/Fuzziness_Vs_Probability.pdf

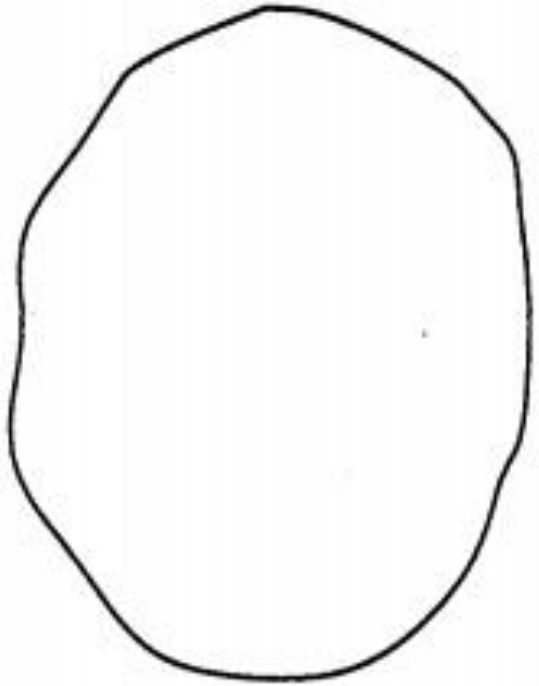


Figure 1 Inexact oval. Which statement better describes the situation: (a) "It is probably an ellipse" or (b) "It is a fuzzy ellipse"?

This is fun, but what does this have to do with me?

k-Means clustering is an example of fuzzy logic.