Myth Buster: Do Engineers Trust Parametric Models Over Their Own Intuition?

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Outline

- The Myth
- Research questions
- Tversky & Kahneman
  - Representativeness
  - Anchoring
- Experiment #1
- Experiment #2
- Threats to validity
- Discussion & implications

The Myth

Cost estimators rely entirely on parametric models to make decisions

Research Questions

- *How accurately can software engineers estimate future events given limited information?*
- *How much do engineers rely on their intuition to perform cost estimates?*

Tversky & Kahneman

2002 Nobel Prize in Economics

- Representativeness

  the degree to which *A* is representative of *B*

  A = *completed project*

  B = *project being estimated*

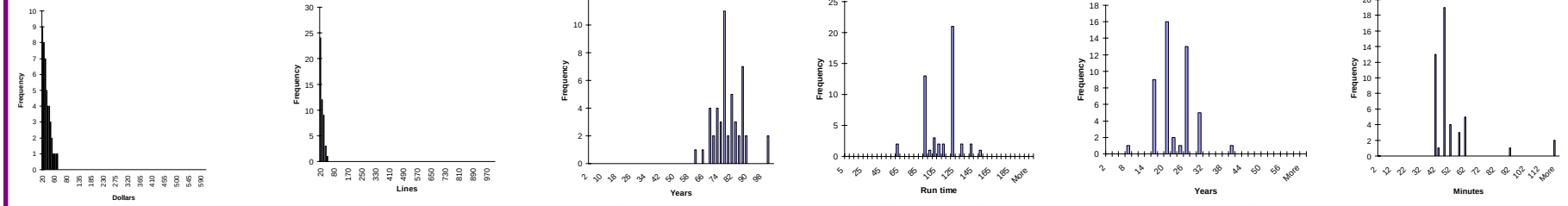
- Anchoring
  - the ability for people to make an estimate by starting from an initial value that is adjusted to yield the final answer
  - initial value = the progress of a project as it approaches completion

Experiment #1

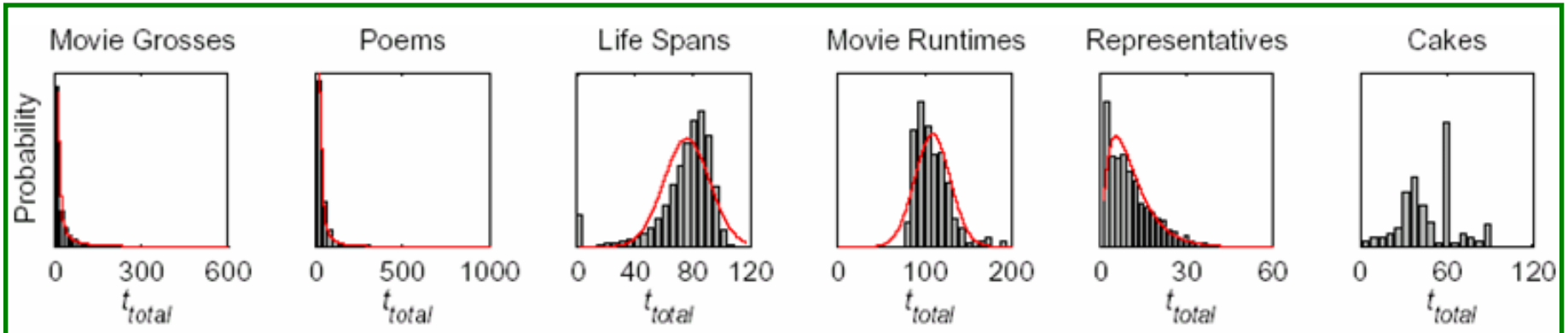
	Psychology Students (n = 142)	Engineering Students (n = 36)	Practitioners (n = 49)
Movie Grosses (in Millions)	40	41	42
Poems (lines)	22	20	21
Life Spans (years)	76	73	78
Pharaohs (years)	30	23	23
Movie Runtimes (Minutes)	120	105	108
Representatives (years)	18	21	22
Cakes (minutes)	53	48	50
Waiting times (minutes)	10	7	9

Experiment #1

Practitioners (n=52)



$\mu = 42$ $\mu = 21$ $\mu = 78$ $\mu = 108$ $\mu = 22$ $\mu = 50$



Psychology students (n=200)*

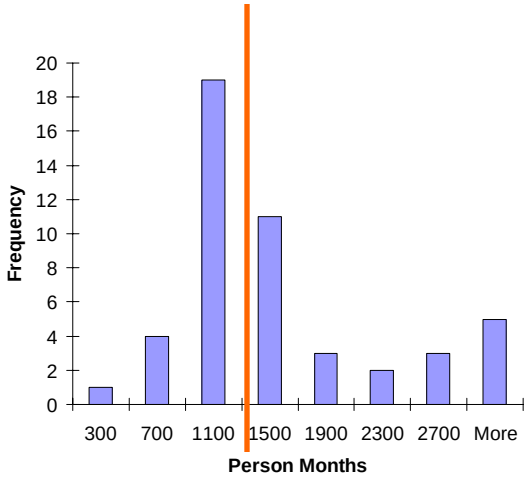
Experiment #2

	Engineering Students (n = 36)	Practitioners (n = 48)
Through one phase (PM)	**1516** *[1011]*	**1386** *[758]*
Through two phases (PM)	**666** *[266]*	**594** *[241]*
Through three phases (PM)	**401** *[129]*	**390** *[145]*
Project X (PM)	**112** *[7]*	**110** *[9]*
Project Y (PM)	**1140** *[128]*	**1122** *[111]*

Mean
[st dev]

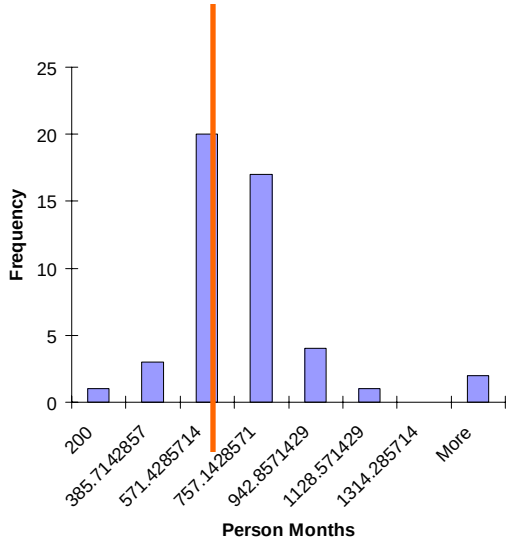
Experiment #2

SE Effort given **Conceptualize** took 300 PM



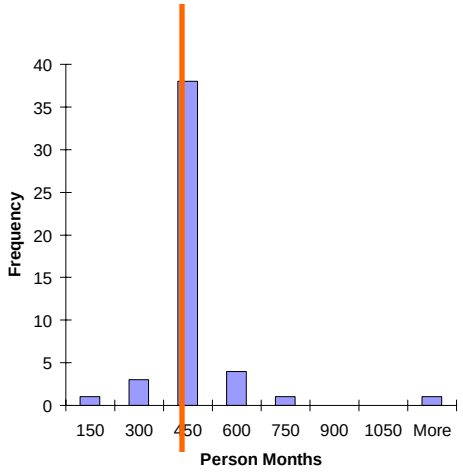
$\mu = 1386$

SE Effort given **Conceptualize & Develop** took 300 PM



$\mu = 594$

SE Effort given **Conceptualize, Develop, OT&E** took 300 PM



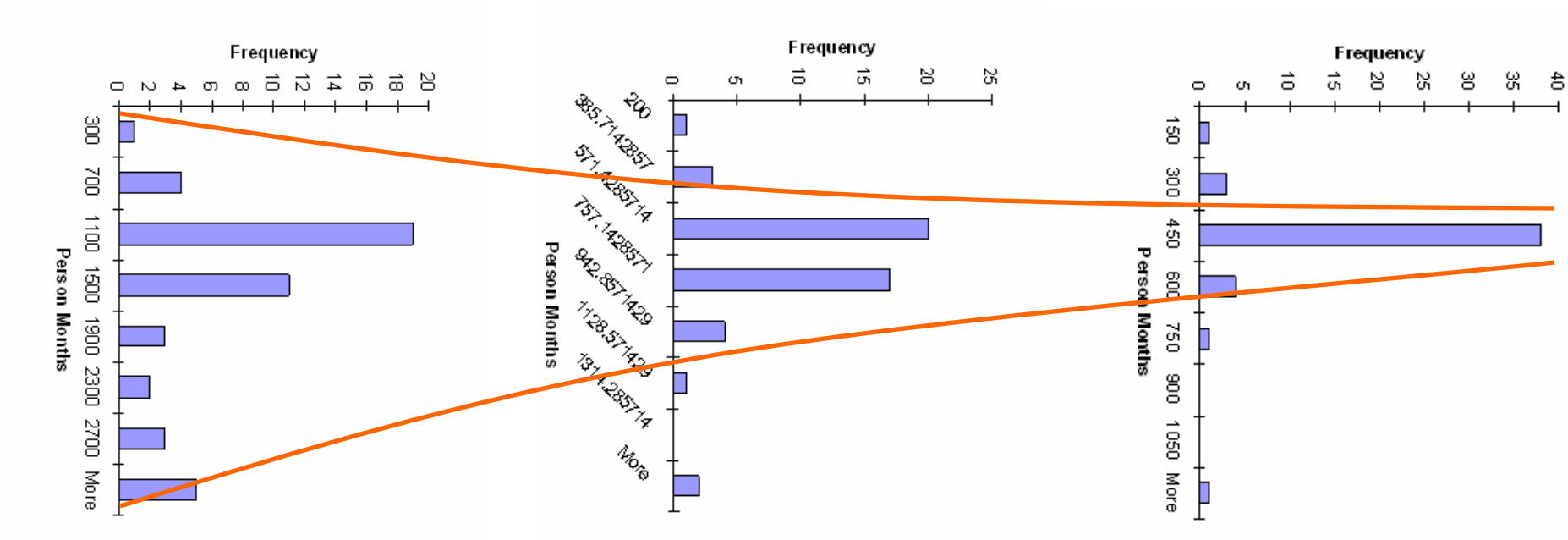
$\mu = 390$

Cone of Uncertainty

SE Effort given **Conceptualize** took 300 PM

SE Effort given **Conceptualize & Develop** took 300 PM

SE Effort given **Conceptualize, Develop, OT&E** took 300 PM



$\mu = 1386$

$\sigma = 758$

$\mu = 594$

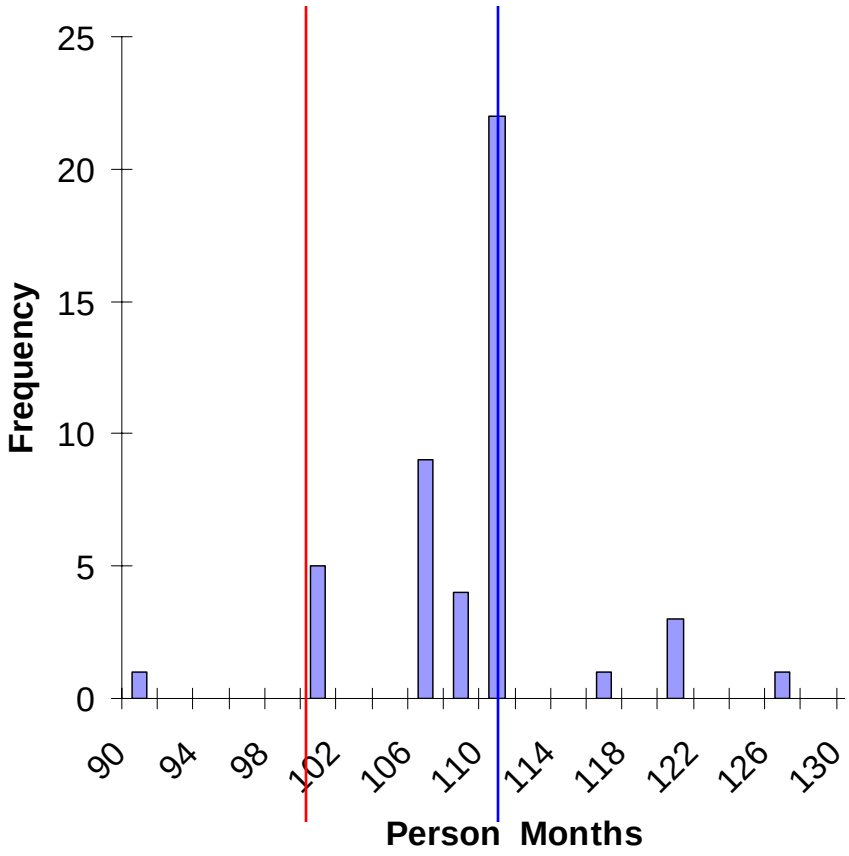
$\sigma = 241$

$\mu = 390$

$\sigma = 145$

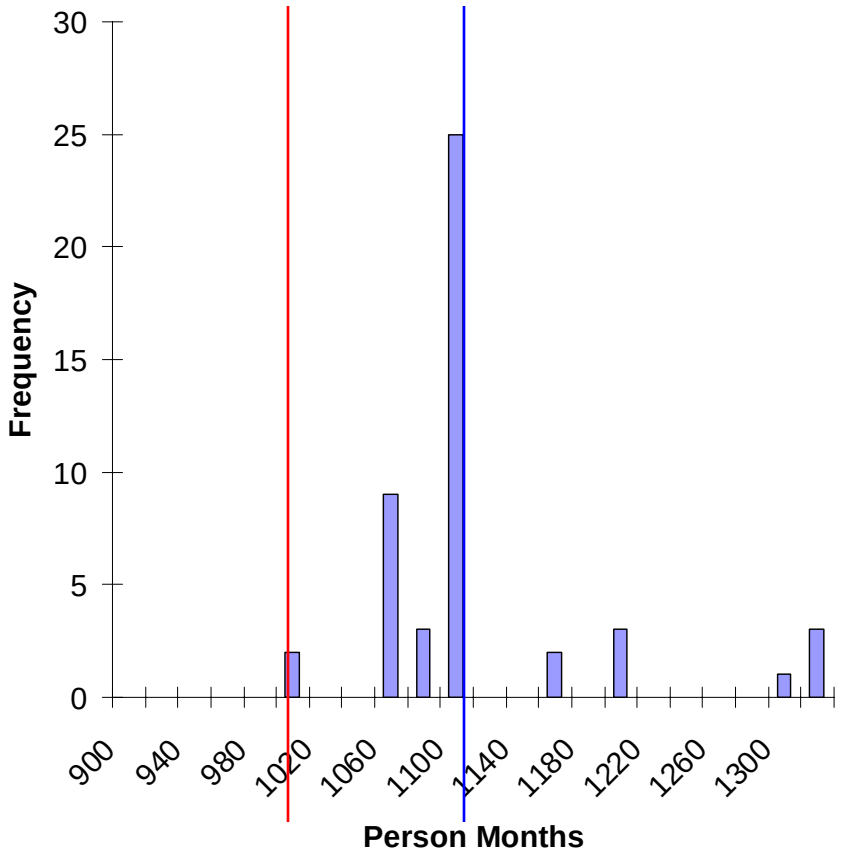
Myth Buster!

COSYSMO = 100 PM
Historical data = 110 PM



$\mu = 110$ $\sigma = 9$

COSYSMO = 1,000 PM
Historical data = 1,100 PM



$\mu = 1122$ $\sigma = 111$

Threats to Validity

- Survey execution/experimental setting
  - administration for the psychology students was performed by one set of researchers while the survey administration for the engineering students and practitioners was performed by another
- Survey participants trying hard to find the right answer
  - perception that this as a test of intelligence
  - well known effect in educational measurement (Pygmalion effect)
- Not a real world situation
  - Possible explanation for the chronic overestimation by the participants
- Population is not representative
  - practitioners are known to be involved in several process improvement initiatives; employed by organizations with high degree of process maturity
  - undergraduate psychology students and graduate engineering students are considered to be highly motivated and educated compared to the normal population and therefore could have know the correct answer to the questions being asked

Discussion & Implications

1. Students are pretty good estimators, though they tend to over estimate; this seems counterintuitive
   - Does experience really matter?

2. People favor intuition over models;
   - why do we spend so much energy on the models?

3. Everyone overestimates; for different reasons?
   - How can parametric models account for this?

Questions?