How to Measure Anything

Itana Book Club Report-out
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Book Club Participants

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Contributors:

- J.J. Du Chateau, University of Wisconsin
- Betsy Draper, Kansas State University
- Chris Eagle, University of Michigan
- Louis King, Yale University
- Piet Niederhausen, University of Washington
- Tim O'Connor, University of Washington
- Brenda Reeb, IData
- Andrea Tanner, Community College of Baltimore County
- Kurt Zoglmann, Kansas State University

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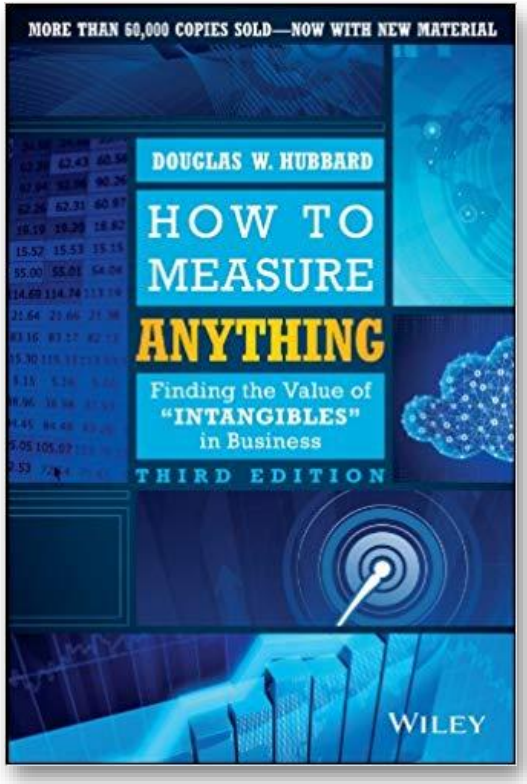
The book

How to Measure Anything: Finding the Value of Intangibles in Business
by Douglas W. Hubbard
(3rd edition, published 2014)



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In this deck

- Book Report: Key concepts (Rupert & Lonnie)
  - What is measurement?
  - Useful measurement assumptions
  - Towards a universal approach to measurement
  - Managing the biases of experts
- Use case applications

  How do you think you might use or could have used the learnings from the book in your work? What kind of measures would you make?
  - Document Management (Tim, University of Washington)
  - Monitoring (Louis, Yale University)
- Observations about the book (Book Club Contributors)

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Key Concepts

What is measurement?

"If we incorrectly think that measurement means meeting some nearly **unachievable standard of certainty**, then few things will be measurable"

What is measurement?

"A ***quantitatively* expressed *reduction of uncertainty*** based on one or more observations."

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Measurement solution is within reach

Useful measurement assumptions:

1. It's been measured before.
2. You have far more data than you think
3. You need far less data than you think
4. Useful, new observations are more accessible than you think

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It’s been measured before

“No matter how difficult or ‘unique’ your measurement problem seems to you, assume it has been done before by someone else, perhaps in another field if not your own.”

Implication: Do some research before you measure.

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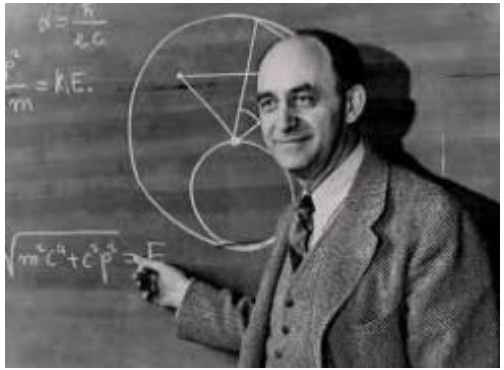
You have more data than you think



Enrico Fermi asked his students: “How many piano tuners are there in Chicago?”

You don’t know, but you can:

- Estimate the current population of Chicago
- Estimate the average number of people per household
- Estimate the share of households with regularly tuned pianos
- Estimate the frequency of tuning
- Estimate how many pianos a tuner could tune in a day
- Estimate how many days a year each tuner works

… = about 30 to 150 piano tuners.

Next: which element are you least certain about? Go after measuring that one (***reduce your uncertainty***).

This method has become known as ***Decomposition***.

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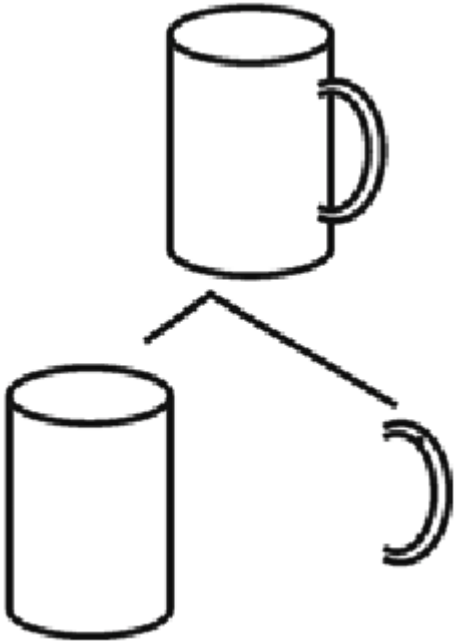
Decomposition



Decomposition:

- Decompose an uncertain variable into constituent parts to identify directly observable things that are easier to measure.
- A good decomposition will include at least some variables that are directly observable.
- Start by decomposing parts that have high information value.

Decomposition effect: the phenomenon that the decomposition itself sometimes turns out to provide such a sufficient reduction in uncertainty that further uncertainty reduction through new observations is not required.

Of the author's 180 analyses, including 7,000 variables, only 150 of the 7,000 needed decomposition, and about 25% were addressed with decomposition alone.

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You need far less data than you think

“When you know almost nothing, almost anything will tell you something” (Hubbard 62, 162).

Eratosthenes, born ca. 276 B.C. estimated circumference by looking at length of shadows in different cities at noon and applying simple geometry.

While in the library of Alexandria, he read that a certain deep well in Syene (southern Egypt) would have its bottom completely lit by the noon sun one day a year.

He observed that in Alexandria at the same time of year, the shadows made a 7.2 degree angle

Therefore, using geometry, he calculated the circumference of the earth to be 50 times the distance between Alexandria and Syene.

No instruments. Turned out to be within 3% of actual value.

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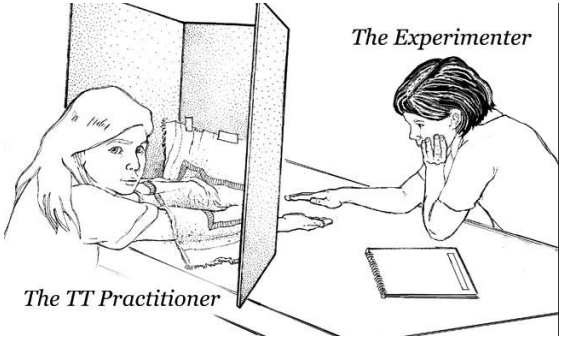
New observations are more accessible than you think



In 1996, Emily conducted a very simple experiment for her 4th grade science project that debunked "therapeutic touch," a controversial method of health treatment that involved manipulating patients' "energy fields."

Set-up:

- 21 therapists
- A table and cardboard screen with cut-outs for hands
- A coin flip to see which subject's hand to hold the tester's hand over

Results (including again in 1997 for TV episode):

- In 280 attempts (28 tests x 10 attempts each), the subjects correctly identified the position of Emily's hand 44% of the time.

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Towards a universal approach to measurement

1. Define a decision problem and the relevant uncertainties.
2. Determine what you know now.
3. Compute the value of additional information.
4. Apply the relevant measurement instrument to high value measurements.
5. Make a decision and act on it.

Define the decision problem

What is the decision this measurement will support? A decision must be defined well enough to be modeled quantitatively.

Example: Will a project investment “improve IT security”? Is the cost justified?

Before we can measure, must ask: What is IT security? What are you observing when you observe improved IT security?

If we decide: A reduction in the frequency and severity of a list of events (virus attacks, unauthorized access).

From there, we can ask, for example:

- How often does a pandemic virus attack occur?
- When an attack occurs, how many people are affected?
- For those affected, what is the reduction of productivity?
- What is the duration of downtime?
- What is the cost of labor during the productivity loss?

Requirements for a decision:

1. A decision has two or more realistic **alternatives**.
2. A decision has **uncertainty**.
3. A decision has potentially **negative consequences** if you make the wrong decision.
4. A decision has a **decision maker**.

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Determine what you know now.

Knowing what you know now about something impacts how you should measure it or whether you should measure it.

Confidence Interval (CI) = a way to express how much we know now, however little that may be. In statistics, a range that has a particular chance of containing the correct answer.

Example: If your systems are brought down by a computer virus, how long does the downtime last? What is the 90% CI that it is between 4 hours and 12 hours?

The problem is that few people are naturally ***calibrated*** estimators.

But experts can be calibrated.

Once you can provide ***calibrated*** probabilities, you can quantify your current uncertainty.

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Compute the value of additional information

If you don't compute the value of measurements, you are probably measuring the wrong things, the wrong way.

In the author's consulting practice that analyzed 20 major IT investments, each with 40-80 variables:

- The vast majority of variables in almost all models had an information value of zero.
- The variables that had high info value were routinely those that the client didn't measure.
- The variables that the client spent the most time measuring usually had low info value.

Tools for calculating the value of information:

- Expected Value of Information (EVI) = reduction in expected opportunity loss (EOL) where … EOL = chance of being wrong x cost of being wrong
- Shortcut: EVPI = Expected Value of Perfect Information.

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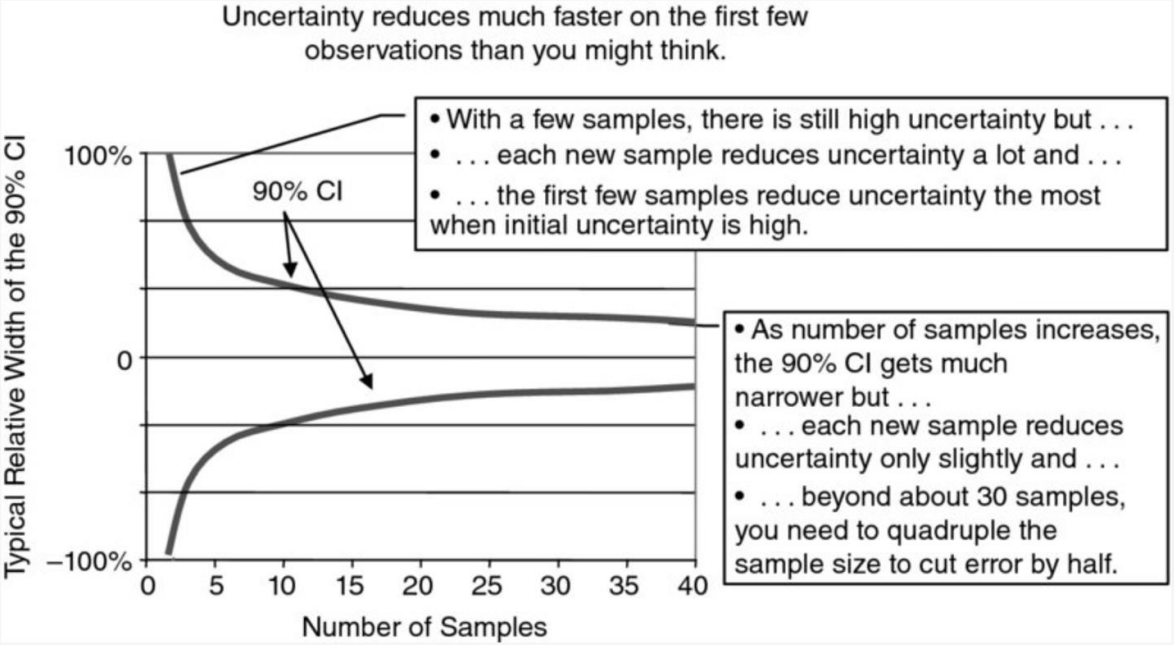
Apply the relevant measurement instrument to high value measurements e.g. Sampling

Rule of Five: If you randomly sample five of any population, there is a 93.75% chance that the *median* of the population is between the largest and smallest values in the sample. Read more.

Sample of just 1 makes a big difference! Urn of Mystery

Small random samples are often better than large non-random samples. Example: A random sampling of sales reps on different days and different times will be better than audit of all time sheets.



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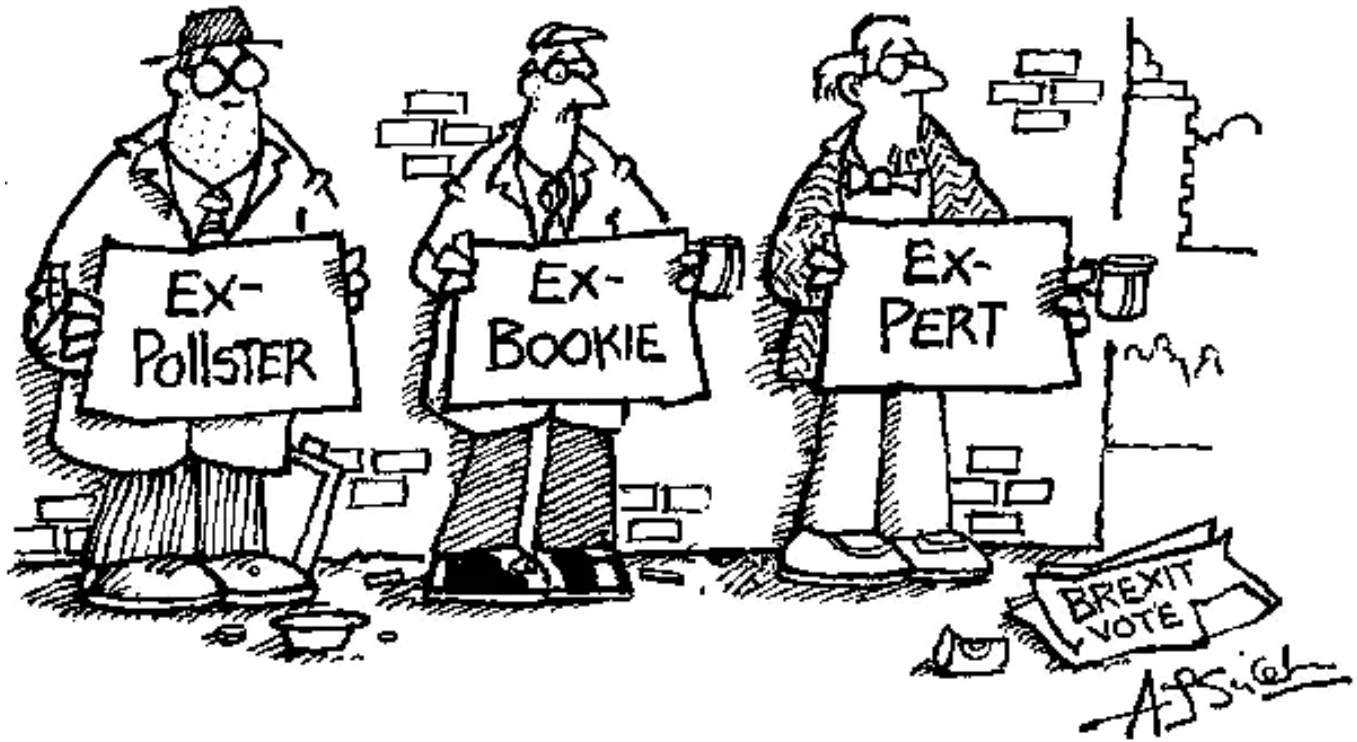
Experts



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Biases

We are all subject to similar biases. Some examples:

1. Halo/Horns effect - If we first see one attribute that predisposes us to favor or disfavor one alternative, we are more likely to interpret additional subsequent information in a way that supports their predisposition.

1. Bandwagon bias - If we see others answering questions a certain way, our need to conform may override our ability to answer correctly.

1. Emerging preferences - If someone begins to prefer one alternative, say the Leave side of the Brexit debate, they will change their preferences about additional information in a way that support their earlier decision. (In the Brexit example, once they had started to prefer Leave, they may change an earlier view on the tariffs on imported goods to support their preference toward Leave)

Manage the bias of experts

Don’t rely on experts to **make** better decisions, but rather rely on them to supply the **criteria** for better decisions.

Adapted Lens Model:

1. Identify experts
2. Calibrate them
3. Ask them to identify a list of factors
4. Generate a set of 30-50 scenarios for each judge
5. Gather estimates from experts
6. Perform a regression analysis
7. Develop model from regression weights and reassess judgments

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Use Case: Document Management @ UW

How do you think you might use or could have used the learnings from the book in your work? What kind of measures would you make?

- Avoid measuring just to measure - focus on real decisions and reducing uncertainty.
  - Senior leadership: The Enterprise Document Management (EDM) team is asking for more funding to meet unmet demand - I'm uncertain of the ROI.
  - Potential Customer: With a new EDMS, the pain of changing our Document processes is high - I'm uncertain of the ROI.
- Decomposition and small measurements can reduce a lot of uncertainty very little is known.
  - Customer Onboarding now includes an impact analysis before Go Live (Paper based) and after with an EDMS
    - Staff Time saved for Printing, Archiving/Filing, Retrieval, Recreation, Automated Processes, Search, Deletion (Record Retention)
    - Compliance Risk: FOIA requests not met, Record Retention failures
    - Costs Saved: Printing, Storage, Compliance Fee's

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Use Case: Monitoring @ Yale

How do you think you might use or could have used the learnings from the book in your work? What kind of measures would you make?

- Enterprise monitoring, alerting and performance metric project
- A quantitatively expressed reduction of uncertainty based on one or more observations is at the heart of the project
- First, determine what decisions we are driving and the processes they impact
  - Monitoring: SLA compliance, incident, problem--->leading to change
  - Performance: Planning, maintenance, and operations
- Determine where the highest value for measurement falls
  - Network, data center equipment, architectural building blocks, and enterprise applications
- Identify the minimum data elements needed to drive those decisions
- Develop a minimum viable product for high-value metrics
- Assess value proposition and expand as indicated

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Observations about the book itself

- Look for bias or seek second opinions in what you choose to measure. Emily concluded Therapeutic Touch was not effective because patients could not feel or sense it. A critic might ask - Did you measure recovery times for patients who received TT and those who did not? (Brenda/IData)
- Skip the Bayesian math for sure; maybe forget the actual process, but REMEMBER that anything can be measured. So, when you or a person blocking you is stuck, go get the book and practice the methods. These are methods that the average smart person can apply. (Brenda/IData)
- Parts I and II target what to measure and are definitely valuable for architects and decision makers; part III focuses on the how, including statistics, and may be less relevant for people who aren't actually planning to do or design measurement. (Rupert)
- The need for well defined decisions
  - The organization must actually be ready to measure (just as important as having the right quantitative methods) (Piet)
  - As an architect and leader, you can help the organization figure out what kinds of measurement it's ready to do and get value from (Piet)

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End of slides