

LAB2-T09 - First Principles Risk Forecasting: From Theory to Practice

Rick Howard



Founder — First Principles Consulting
CEO — Cybersecurity Canon Project

Brandon Karpf



Global Security Leader — NTT, Inc.



Hands-On Workshop: Housekeeping

- * Laptops Open
- * Connect to the RSAC WiFi Network:
 - Network Name: To Be Determined
 - Password: To Be Determined
- * Connect to the Workshop URL:

<https://learnfirstprinciples.com/>





Disclaimer

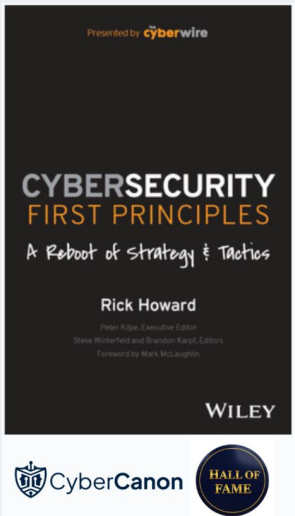
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Why We are Here



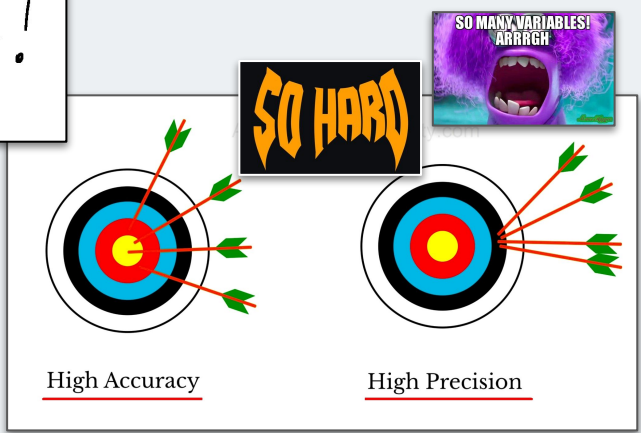
Reduce the probability of a material cyber event within the next business cycle.

"[Heat Maps are] all Ouija boards for conjuring the lowest common denominator of corporate groupthink."
-- Richard Seiersen

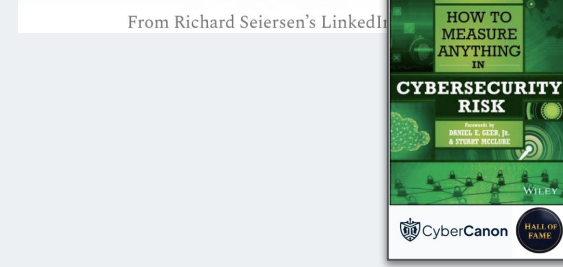


Heat Map

THAT'S NOT TRUE!



Quantitative data:	Qualitative data: easy
<ul style="list-style-type: none"> My best friend is 5 feet and 7 inches tall They have size 6 feet They weigh 63 kilograms My best friend has one older sibling and two younger siblings They have two cats My best friend lives 100 miles away from me They go swimming four times a week 	<ul style="list-style-type: none"> My best friend has curly brown hair They have green eyes My best friend is funny, loud, and a good listener They can also be quite impatient and impulsive at times My best friend drives a red sports car They have a very infectious and contagious laugh



From Richard Seiersen's LinkedIn



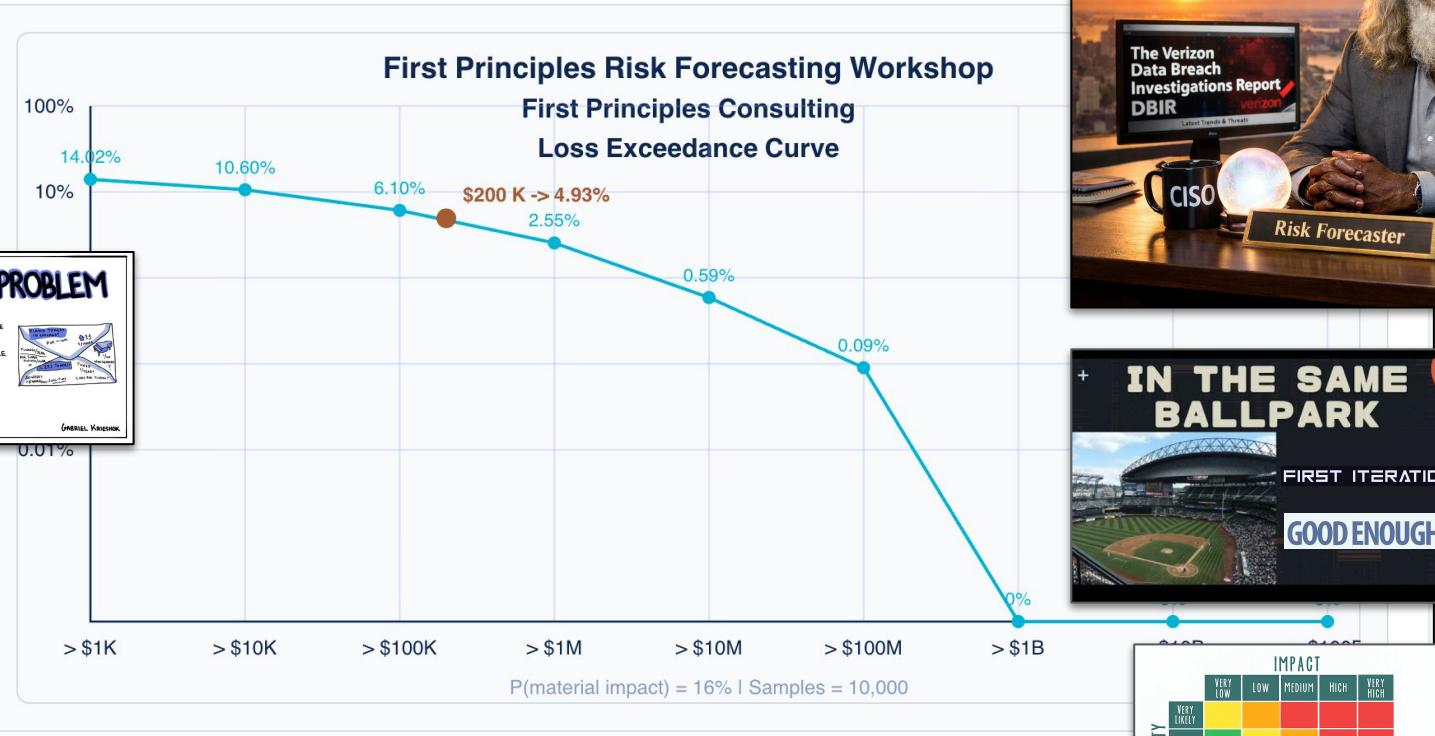
The Promise



Loss Exceedance Curve

Interactive Monte Carlo simulator (lognormal, 90% bounds).

● Threshold probabilities ● Material threshold



Ready.



Bayes' Algorithm

Thomas Bayes Richard Price Pierre-Simon Laplace
Bayes - Price - Laplace Algorithm

FERMI PROBLEM

ENRICO FERMI
A rough calculation to arrive at a reasonable estimate - unknowns and all - where the result could be considered logically approximate.

HOW MONTE CARLO SIMULATIONS WORK

- 1 Design a Model.
- 2 Run the Model 10,000 Times & Collect the Answers.
- 3 Plot the Answers on a Lognormal Curve.

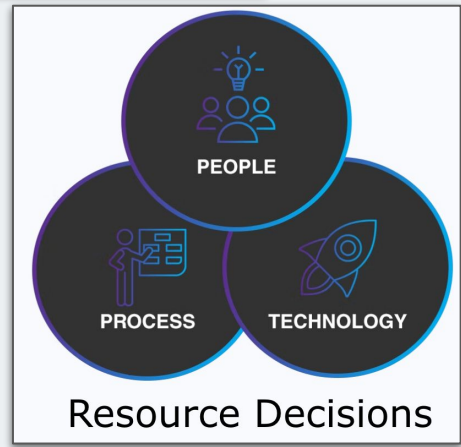
WHAT CAN HAPPEN? = HOW LIKELY IS IT?

IN THE SAME BALLPARK

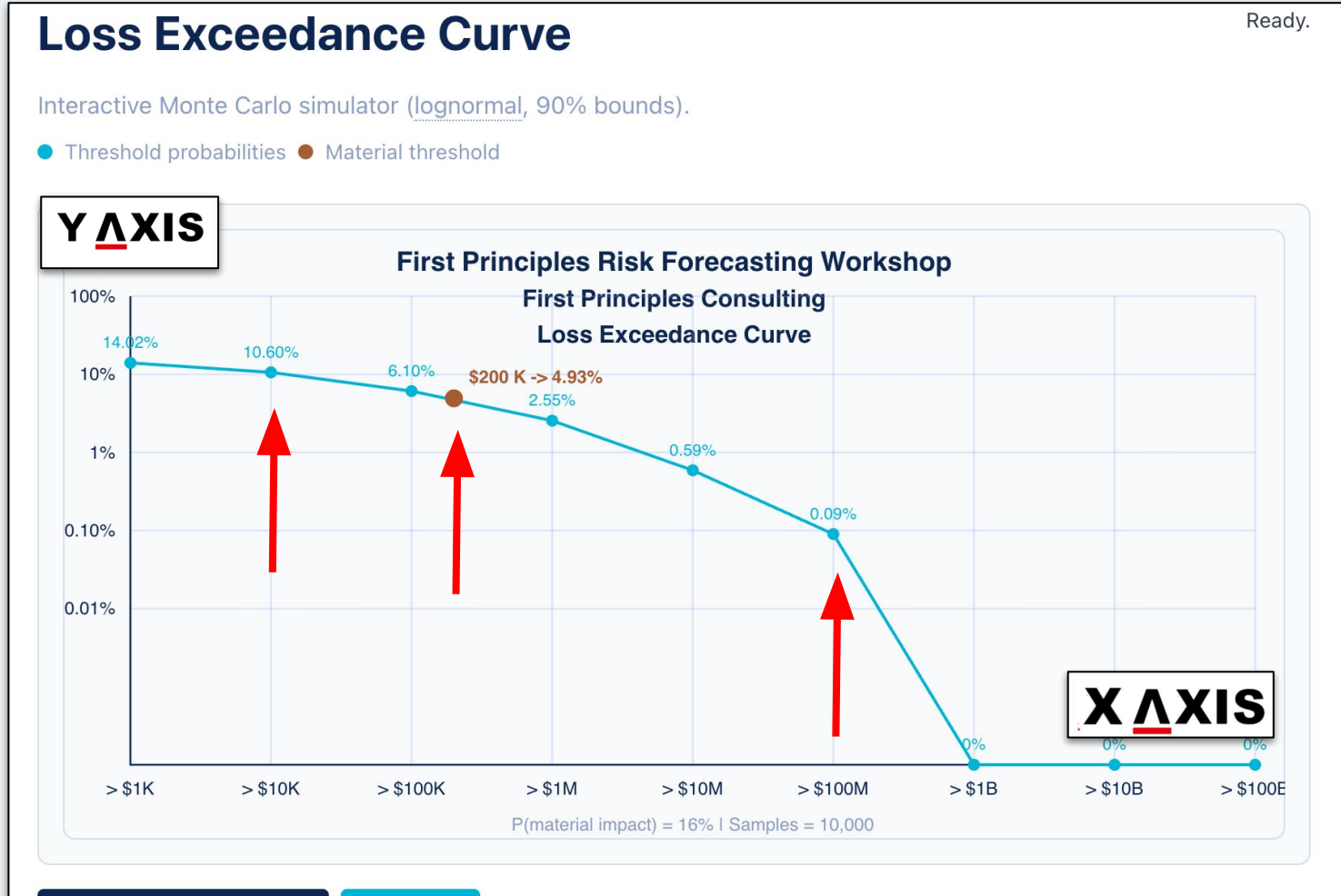
FIRST ITERATION
GOOD ENOUGH!

PROBABILITY	IMPACT				
	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
VERY LIKELY	Green	Yellow	Orange	Red	Dark Red
LIKELY	Green	Yellow	Orange	Red	Dark Red
POSSIBLE	Green	Yellow	Orange	Red	Dark Red
UNLIKELY	Green	Yellow	Orange	Red	Dark Red
RARE	Green	Yellow	Orange	Red	Dark Red

Typical Heat Map



The Promise

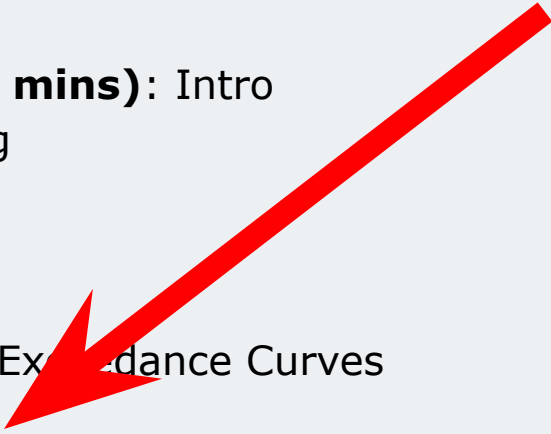


Timing



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Hour 2

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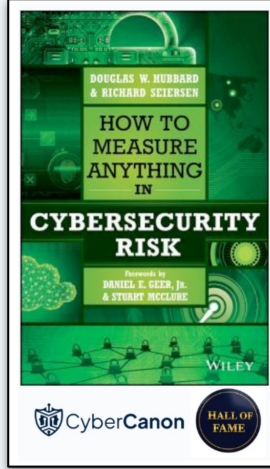
Foundational Books Overview



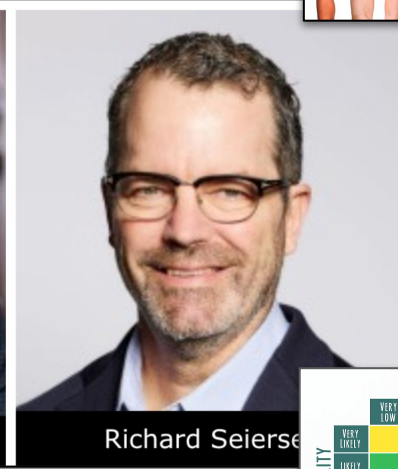
**POWER OF
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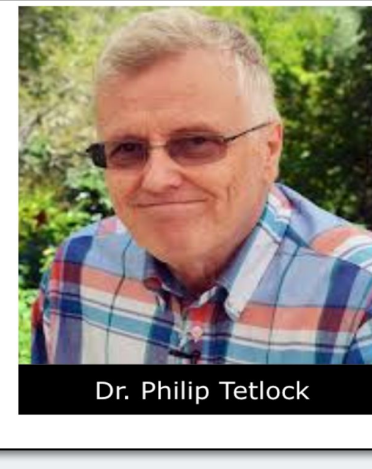
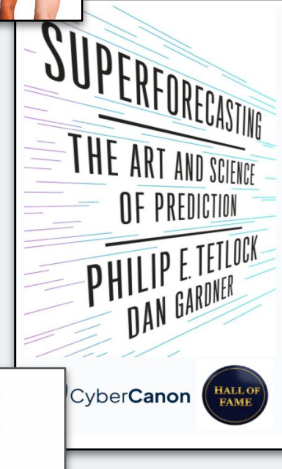
Audience Poll



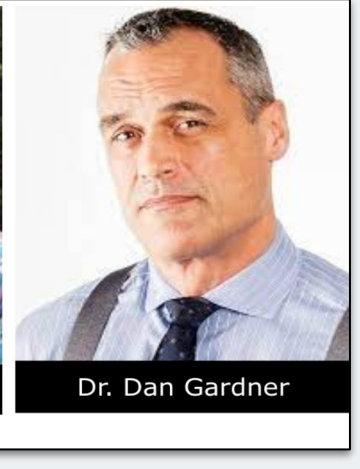
Doug Hubbard



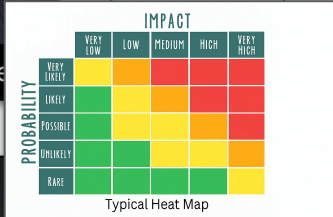
Richard Seierse



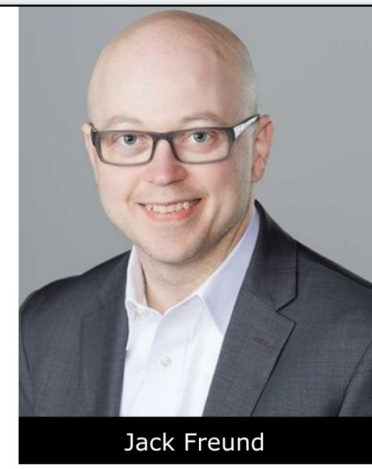
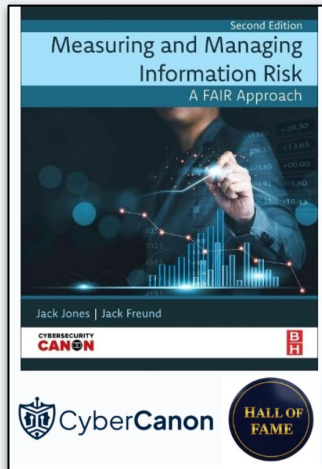
Dr. Philip Tetlock



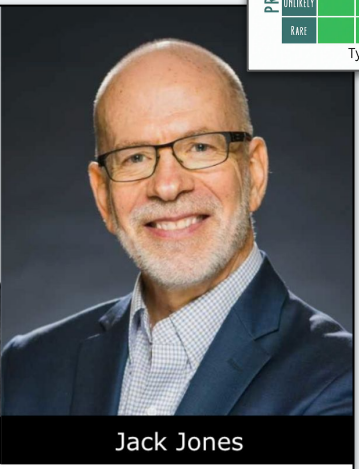
Dr. Dan Gardner



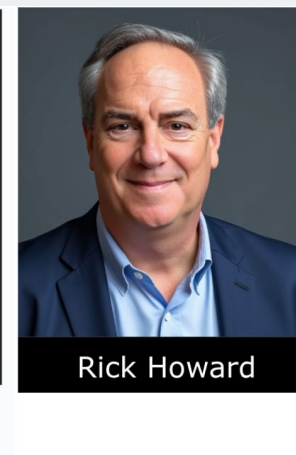
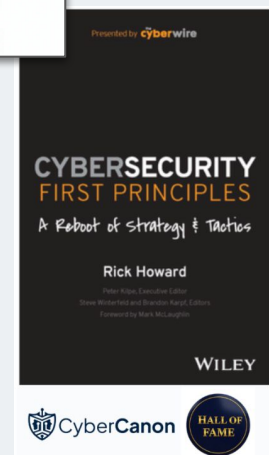
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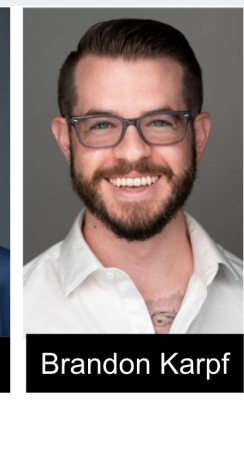
Jack Freund



Jack Jones



Rick Howard



Brandon Karpf




Steve Winterfeld




Foundational Books



2015
2023



Dr. Philip Tetlock



Dr. Dan Gardner

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TLDR: It's Learnable





Foundational Books



2016

2017

TLDR:

- Heat Maps are bad science
- Loss Exceedance Curves are better
- Bayes Algorithm rules
- Normies can build Monte Carlo simulations
- Chapter 3 - 8: Models you might use

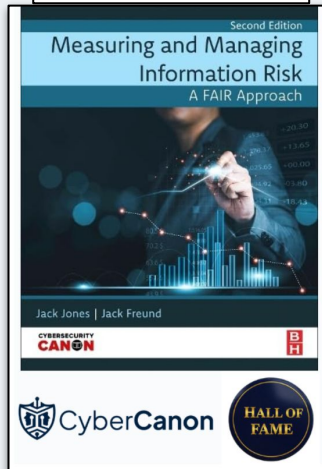




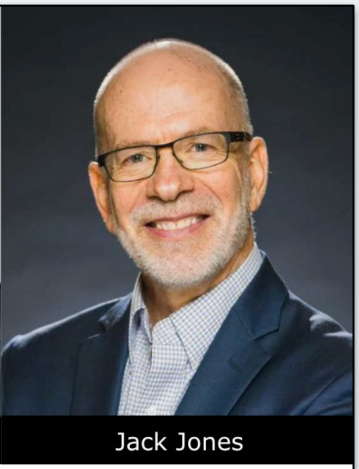
Foundational Books

2014

2017



Jack Freund



Jack Jones

TLDR:

- Jones invents FAIR (2000s)
- The Open Group formalized the standard
- Jones creates the FAIR Institute in the 2010s (Community)
- Adoption has been slow





Foundational Books



10

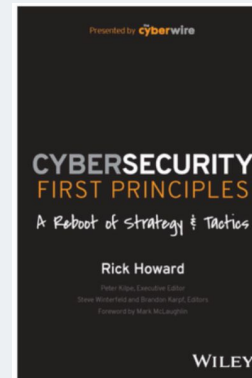
RSAC 2026 Conference

TLDR:

- Chapter 6: Practical How-to

2023

2026*



Rick Howard



Brandon Karpf



Steve Winterfeld



Four Core Techniques to Master

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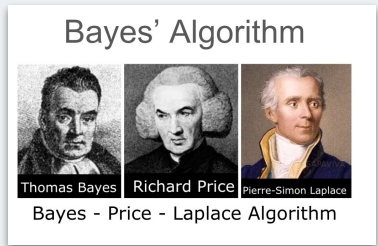
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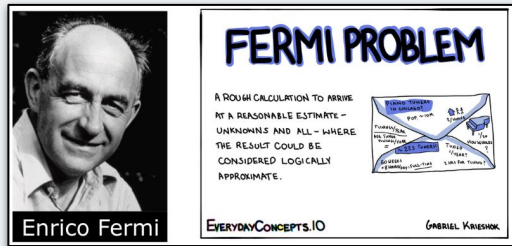


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Four Core Techniques to Master



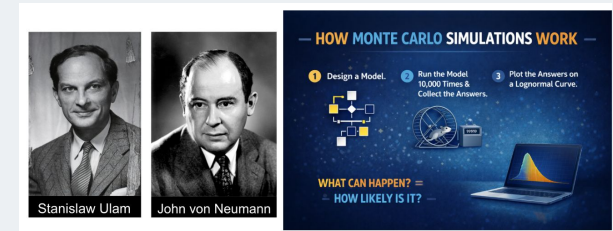
Bayes



Fermi



Applied Forecasting



Monte Carlo



Bayes Algorithm Explainer

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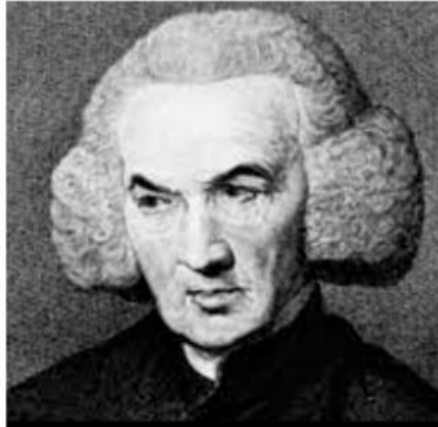
Core Technique: More Iterations; Better Forecasts



Bayes' Algorithm



Thomas Bayes



Richard Price



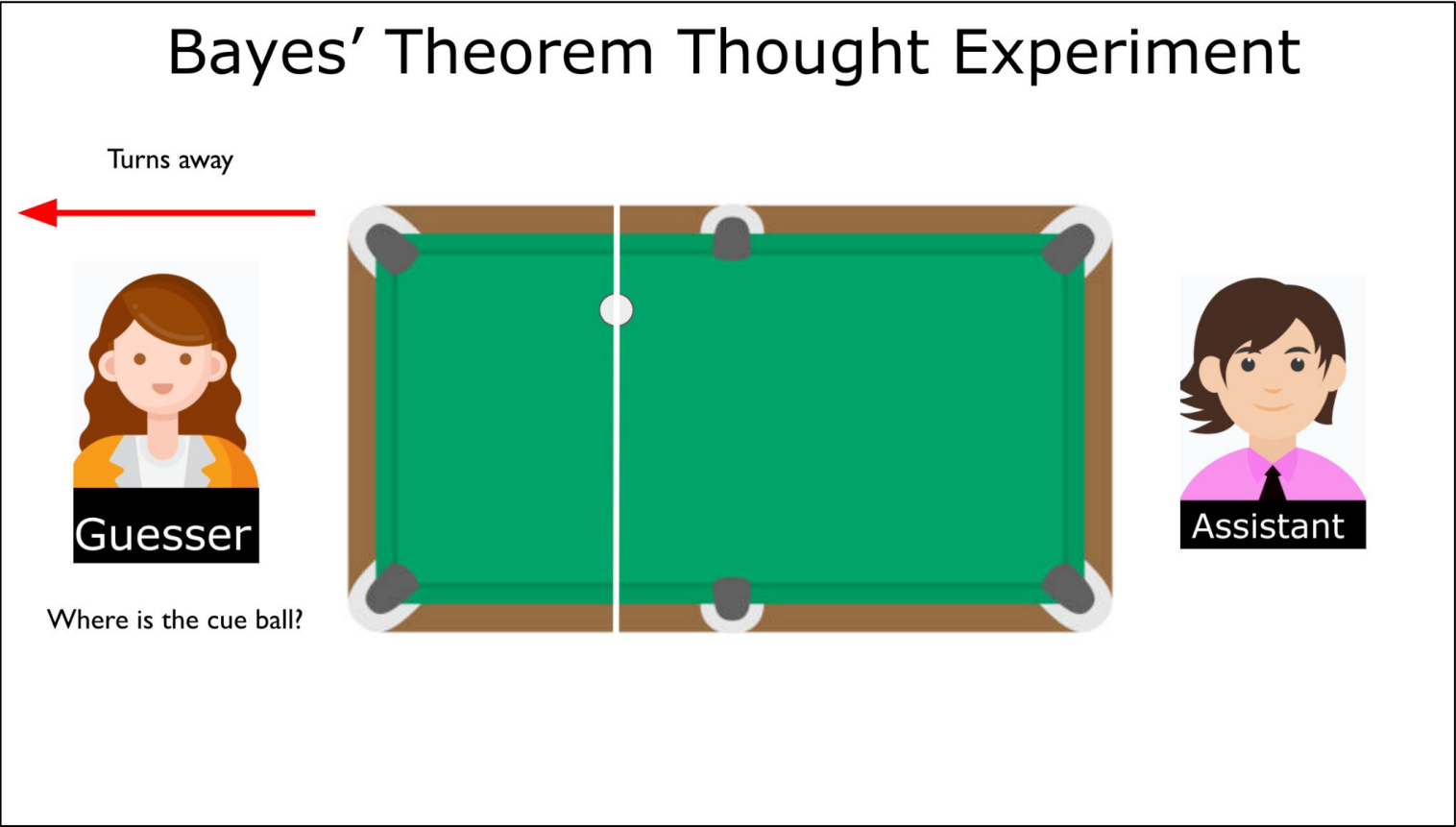
Pierre-Simon Laplace

Bayes - Price - Laplace Algorithm

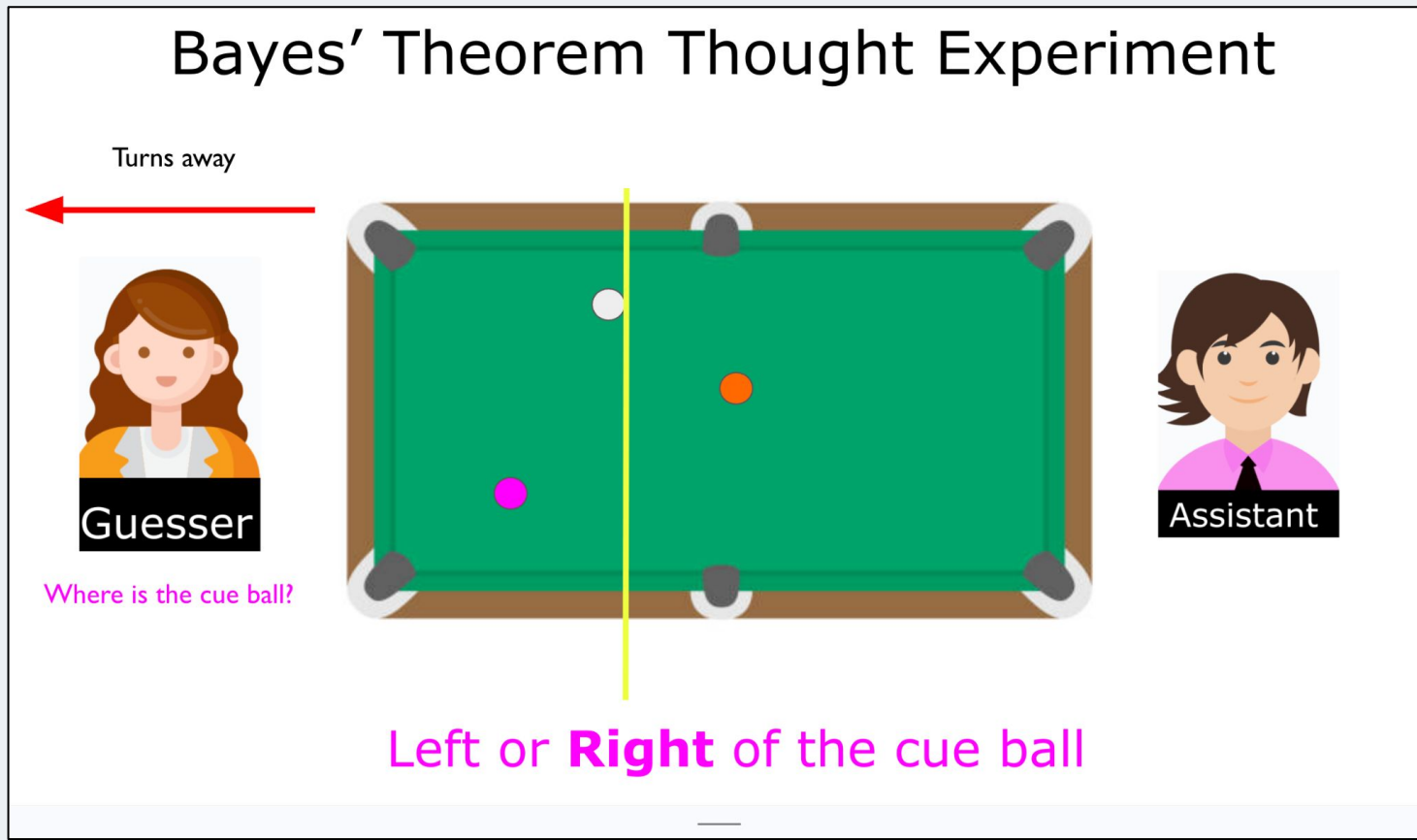
Prior belief + New evidence = Updated probability



Core Technique: More Iterations; Better Forecasts



Core Technique: More Iterations; Better Forecasts



Core Technique: More Iterations; Better Forecasts



Bayes' Theorem

A diagram illustrating Bayes' Theorem using a pool table. On the left is a woman icon labeled "Guesser". In the center is a pool table with a green felt top and a brown wooden frame. On the table are several colored balls: purple, white, yellow, red, cyan, orange, black, and pink. On the right is a man icon labeled "Assistant".

Guesser

Assistant



Pool Table Thought Experiment

A Bayes Demonstration (Hands On #1)

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Pool Table Simulation - Hands on #1

First Principles Risk Forecasting Workshop

About Tools Instructors Resources [Get Started](#) High contrast Dark mode

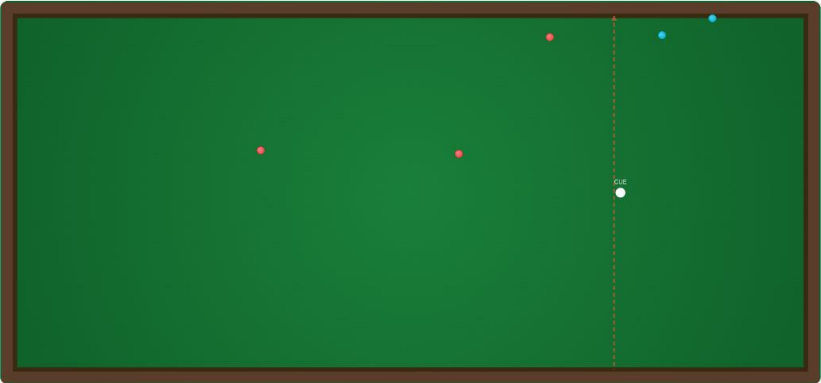
Learning Objectives

How It Works

- Roll cue ball (hidden on table)
- Click table to forecast where you think it is
- Roll evidence balls to gather clues:
 - Red = landed LEFT of cue ball
 - Blue = landed RIGHT of cue ball
- Update your forecast based on evidence

What You're Learning

Each time you update your guess based on new evidence, you're doing **Bayesian reasoning**—the same logic used to interpret threat intelligence in cybersecurity.



● Your Forecast ● Left Evidence ● Right Evidence

Cue ball revealed!

[Roll Cue Ball](#)
[Roll Evidence Ball](#)
[New Game](#)

Current Forecast

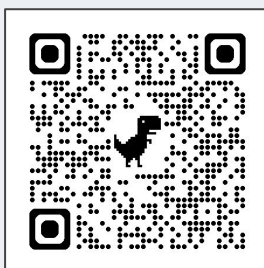
Position: 1242px
Error: 0.8%

Game Stats

5 FORECASTS | 5 EVIDENCE BALLS | 99% BE ACCU

The Bayesian Connection

- Prior:** Your first guess (no information)
- Evidence:** Each red/blue ball roll
- Update:** Adjust belief with new data
- Posterior:** Your refined estimate



<https://learnfirstprinciples.com/bayes>



Bayes Algorithm Takeaways

- * The more evidence you collect, the better the forecast.
- * The more adjustment iterations, the better the forecast.

But

- * There is a point of diminishing returns

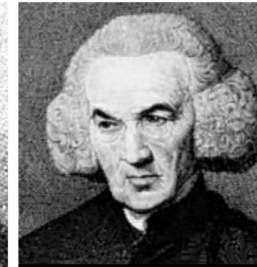
And

- * Not all evidence gets you closer

What did we learn?



Thomas Bayes



Richard Price



Pierre-Simon Laplace

Fermi Explainer

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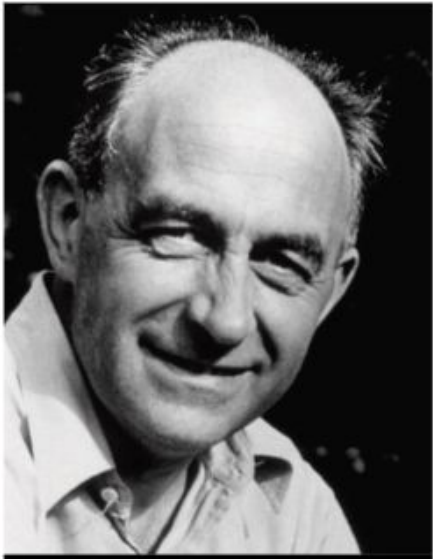
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Core Technique: Back of the Envelope Calculations are Good Enough Most of the Time

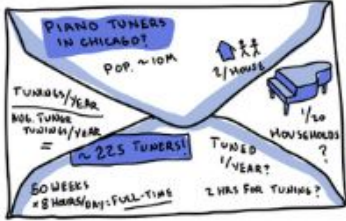




Enrico Fermi

FERMI PROBLEM

A ROUGH CALCULATION TO ARRIVE AT A REASONABLE ESTIMATE - UNKNOWNNS AND ALL - WHERE THE RESULT COULD BE CONSIDERED LOGICALLY APPROXIMATE.



EVERYDAYCONCEPTS.IO

GABRIEL KRISHOK



Fermi Estimates

Hands On #2

Timing

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Fermi Exercises - Hands on #3



Intro Tutorial Problem 1 Problem 2 Results

Back Reset all Next

Tutorial: Chicago Piano Tuners

This tutorial is interactive. Change a number to see the estimate move.

Your decomposition
Start with a few parts. Add or remove as needed.

* Required field

Piano tuners needed **DIVIDE** Add component

Annual piano tunings needed **MULTIPLY** Add component

Households in Chicago households
Enter a number.

Homes with pianos fraction
Enter a number.

Tunings per piano per year tunings/year
Enter a number.

Tunings per tuner per year tunings/year
Enter a number.

Live calculation
Watch the formula update as you type.

$(\text{Households in Chicago } (0) \times \text{Homes with pianos } (0.00\%) \times \text{Tunings per piano per year } (0)) / \text{Tunings per tuner per year } (0)$

Estimate: enter values to calculate.

Enter every value to see feedback.

Sensitivity will appear once values are complete.

► Answer range



<https://learnfirstprinciples.com/fermi>

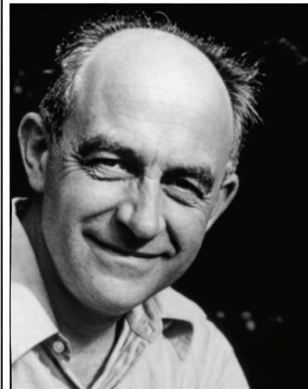




Fermi Estimate Practice Takeaway

Ballpark forecasts are probably good enough in many cases

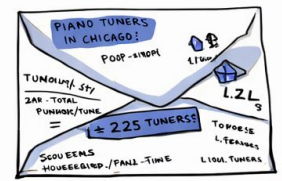
What did we learn?



Enrico Fermi

FERMI PROBLEM

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GABRIEL KRESHOK



Applied Forecasting Explainer

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Applied Forecasting Explainer



Dr. Philip Tetlock

Dr. Dan Gardner



Applied Forecasting Rules of Thumb



Six Forecasting Rules

1: Quantitative not qualitative

2: Get rid of heat maps

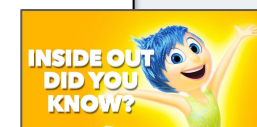
3: Practice

4: Embrace Fermi Estimates

5: Check your assumptions

6: Use dragonfly eyes

7: Forecast at a 90 percent confidence level:



Applied Forecasting Estimates

Hands On #3

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- **1:25 to 1:55 (30 mins): Interactive Element:** Build a Loss Exceedance Curve
- **1:55 to 2:00 (5 mins):** Wrap it up: Learning Points



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Forecasting Rules of Thumb Exercise - Hands on #4



First Principles Risk Forecasting Workshop

About Tools Instructors Resources Get Started High contrast Dark mode

Workshop Home / Applied Forecasting Exercise 3 of 4 APPLICATION

Build a Structured Forecast

Use outside-in rates and distinguishing details to land on a defensible probability.
This is a hands-on forecast. You will build every step.

Learning Objectives

Intro Scenario Step 1 Step 2 Step 3 Results

Back Reset at Next

Scenario

Estimate the probability that a mid-size healthcare provider (5 hospitals, 8,000 staff, 2 million patient records) experiences a material data breach in the next 12 months.

Material breach means unauthorized access that triggers regulatory notification and costs more than \$1M in response.
Timeframe: next 12 months.

Initial gut reaction (optional)
Record your quick estimate before the structured steps.

Gut reaction (%)

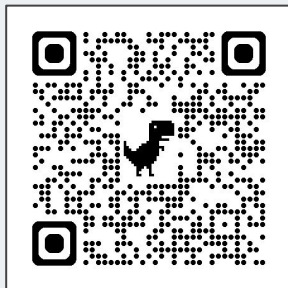
Optional: You can skip this.

Read scenario brief

Scenario context
5 hospitals
8,000 staff
2 million patient records

Learning Debrief

Restart Exercise Continue to Loss Exceedance Curve



<https://learnfirstprinciples.com/forecasting/>





Applied Forecasting Takeaways

Not high end math

Willing to adjust your forecast with new evidence

Take advantage of Bayes' Algorithm

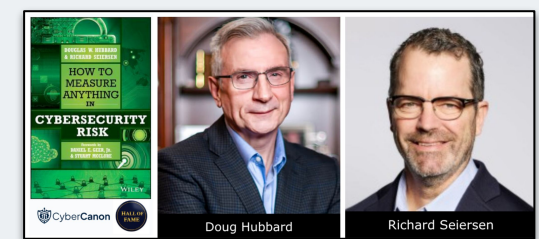
Use Fermi Estimates





From Applied Forecasting to Loss Exceedance Curves

- 1: **Outside In Forecast:** What is the probability that any organization like yours will have a material cyber event?
- 2: **Inside Out Forecast:** What risk reduction do you get with your deployed strategies and tactics?
- 3: What is the **range of dollar losses** typical for your industry?
- 4: What does your organization consider to be a **material loss**?
- 5: What **model** will you use for your Monte Carlo Simulation
- 6: Build your **Loss Exceedance Curve**



Monte Carlo Explainer

Timing

Hour 1

- **0:00 to 0:10 (10 mins):** Intro
 - HouseKeeping
 - Disclaimer
 - Our Purpose
 - The Promise
 - Intro to Loss Exceedance Curves
 - The Agenda
- **0:10 to 0:20 (10 mins):** Foundational Book Overview
- **0:20 to 0:21 (1 min):** Forecasting Techniques
 - Four core techniques to master
- **0:21 to 0:25 (4 mins):** Bayes Algorithm Explainer
- **0:25 to 0:40 (15 Mins): Interactive Element:** Bayes' Algorithm pool table thought experiment.
- **0:40 to 0:45 (5 mins):** Fermi Explainer
- **0:45 to 0:60 (15 mins): Interactive Element:** Fermi estimates

Hour 2



- **1:00 to 1:05 (5 mins):** Applied Forecasting Explainer
- **1:05 to 1:20 (15 Mins): Interactive Element:** Applied Forecasting estimates
- **1:20 to 1:25 (5 mins):** Monte Carlo Explainer
- **1:25 to 1:55 (30 mins): Interactive Element:** Build a Loss Exceedance Curve
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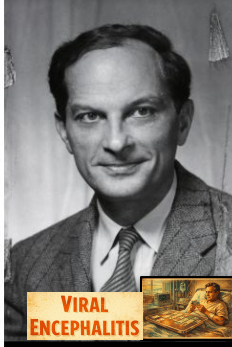


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Core Technique: Monte Carlo Simulations


Nuclear vs. Hydrogen Bomb

Atomic Bomb (Fission)	Hydrogen Bomb (Fusion)
	
Smaller Explosions	Vastly Larger Explosions
Explosion Size: Kilotons (Thousands of Tons of TNT)	Explosion Size: Megatons (Millions of Tons of TNT)



VIRAL ENCEPHALITIS

Stanislaw Ulam



John von Neumann

HOW MONTE CARLO SIMULATIONS WORK

- 1 Design a Model.
- 2 Run the Model 10,000 Times & Collect the Answers.
- 3 Plot the Answers on a Lognormal Curve.

WHAT CAN HAPPEN? = HOW LIKELY IS IT?





MODERN USES OF MONTE CARLO SIMULATIONS

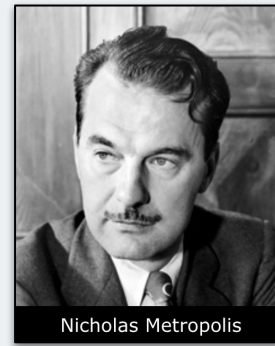
- Physicists use it to confirm the Higgs boson.
- Doctors use it to aim radiation at tumors.
- Chemists use it to discover new drugs.
- Climate scientists use it to model the future of the planet.
- Even Pixar uses it to simulate light in movies.

PREDICTING THE CHAOS

LOS ALAMOS MISSION: BUILD THE H-BOMB

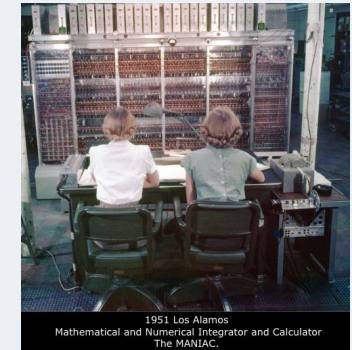


UNCERTAINTY → COLLISIONS → CHAIN REACTION → RESULT





The ENIAC 6 were the original group of ENIAC programmers

©womenengineered 04




Constructing Your First Loss Exceedance Curve

Bayes' Algorithm



Thomas Bayes Richard Price Pierre-Simon Laplace
Bayes - Price - Laplace Algorithm




FERMI PROBLEM

A ROUGH CALCULATION TO MAKE
AT A REASONABLE ESTIMATE -
UNKNOWABLE AND FL - UNKLE.
THE RESULT COULD BE
CONSIDERED LOGICALLY
APPROXIMATE.

EVERYDAYCONCEPTS.IO GEMELL KASNER

SUPERFORECASTING
THE ART AND SCIENCE
OF PREDICTION
PHILIP E. TETLOCK
DAN GARDNER



Dr. Philip Tetlock Dr. Dan Gardner

CYBERSECURITY
HOW TO
MEASURE
ANYTHING



Doug Hubbard Richard Seiersen

HOW MONTE CARLO SIMULATIONS WORK

- Design a Model.
- Run the Model 10,000 Times & Collect the Answers.
- Plot the Answers on a Lognormal Curve.

WHAT CAN HAPPEN? =
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Build a Loss Exceedance Curve

Hands On #4

Timing

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Applied Forecasting: Six Variables

- 1: Outside In Probability
- 2: Inside Out Probability
- 3: Dollar Loss Upper Bound
- 4: Dollar Loss Lower Bound
- 5: Materiality Risk Dollar Threshold
- 6: Number of Monte Carlo Simulation Iterations



Building Your LEC - Hands on #5



LOSS EXCEEDANCE CURVE

Build a Loss Exceedance Curve

Use a simple Monte Carlo simulation to visualize loss exceedance probabilities.

This web tool mirrors the spreadsheet workflow used in the workshop.

Learning Objectives ▼

Recall from Superforecasting: Run 1 feeds Outside-In, and Run 2 feeds Inside-Out reduction. Dismiss

Loss Exceedance Curve Ready.

Interactive Monte Carlo simulator (lognormal, 90% bounds).

● Threshold probabilities ● Material threshold

Inputs

* Required field

Organization name ?
First Principles Consulting

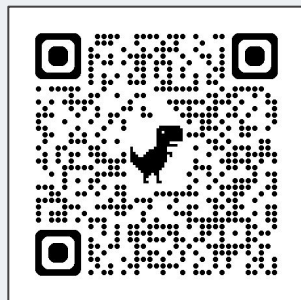
Outside-In forecast ? *
20%
Enter 9% or 0.09.

Inside-Out risk reduction ? *
4%
Enter 3% or 0.03.

Dollar loss lower bound ? *
\$200 ⋮
Try 375K or 375,000.

Dollar loss upper bound ? *
\$9 M
Try 9.1M or 9,100,000.

Export chart (PNG) Reset



<https://learnfirstprinciples.com/lec>





Loss Exceedance Curve Takeaways

Outside In Forecasts

then Inside Out

Dollar Loss Range

What is material for your business?

Monte Carlo Simulations are your friends



Wrap It Up: Learning Points

Timing

Hour 1

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Key Learning Points

- * Heat Maps are bad science (Qualitative Risk Forecasting)
- * Precise and accurate Quantitative Risk Forecasting is not as hard as you think
- * Replace heat maps with Loss Exceedance Curves
- * More iterations means better forecasts (Bayes)
- * Ballpark estimates work most of the time (Fermi)
- * Some things you can't count, but you can simulate (Monte Carlo)
- * Five variables are all you need to build a loss exceedance curve.
- * Even you can be a superforecaster





Apply What You've Learned

- * Next week you should:
 - Start reading the four books
- * In the next three months:
 - Run this workshop with your team
- * In the next six months:
 - Talk to each member of your senior executive team to get their feedback
- * Within a year you should:
 - Talk to each member of your board to get their feedback



References



Rick Howard, 2025. **Heat Maps are Just Bad Science** [Analysis]. Rick's First Principles Newsletter - Substack. URL <https://diffuser.substack.com/p/heat-maps-are-just-bad-science>

Rick Howard, 2023. **Research Summary on Why Heat Maps are Poor Vehicles for Conveying Risk** [List]. Book Appendix. URL <https://rebrand.ly/Heatmaps-Bad-Summary-List>

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- Amazon Affiliate Link: <https://amzn.to/4pgaiv8>

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- Amazon Affiliate Link: <https://amzn.to/3JZ4ze1>



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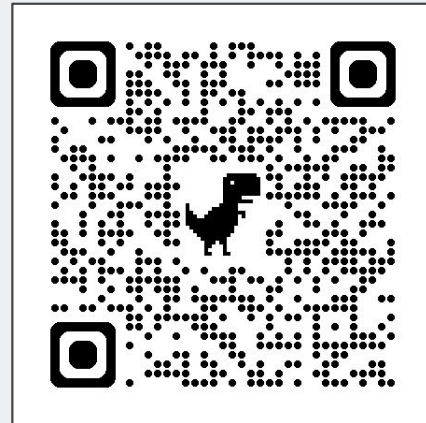
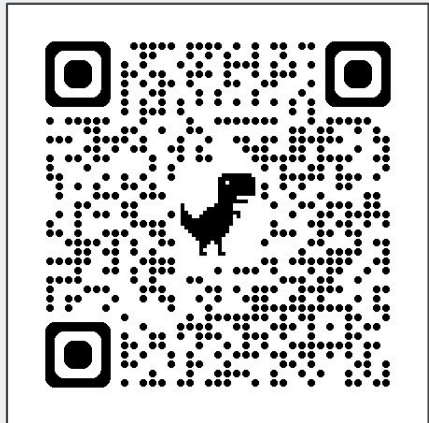
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- Amazon Affiliate Link: <https://amzn.to/4mI7QMU>

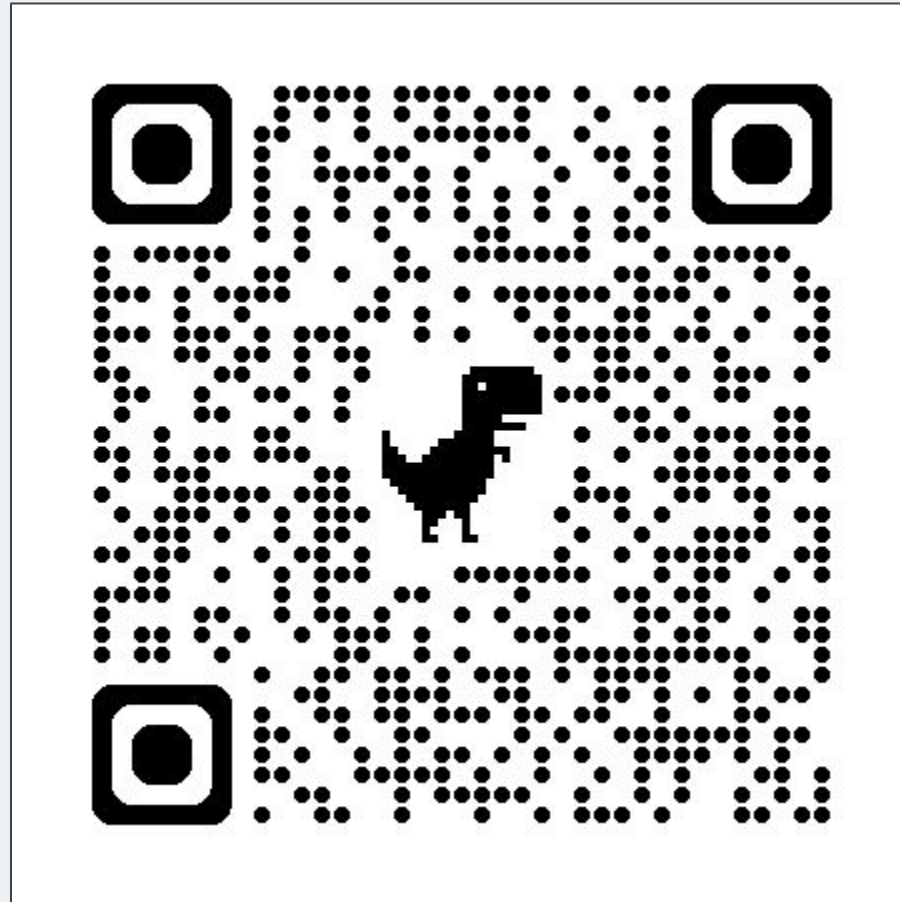
Contact Information



Resources



<https://learnfirstprinciples.com/>



Thank You



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