

Can We Learn to Manage Uncertainty? Probably!



Robert Herbig
Lead Software Engineer





Can We Learn to Manage Uncertainty? Probably!

How was this talk?



📍 River B

⌚ 1:50 PM

⬆️ Intermediate

👉 Patterns & Practices Professional Skills

When we're asked when something will be done, it's tempting to answer the question. "It'll be done on March 32nd" or "it'll take 182.5 days" or "we need 15 sprints". It doesn't matter if that answer is the best-case, average, or worst-case scenario. The answer is fundamentally wrong because using a single value hides the fact that what we really meant was a distribution of possible dates, durations, or outcomes. The exact value is uncertain. Development may be faster or slower than we thought. What if the tech lead wins the lottery and retires? What if a global pandemic forces us to change the way we work? While we can't control any of those factors, we can be mindful of their existence and communicate more clearly. In this talk we will introduce "bet" language, which makes uncertainty and luck an explicit part of the conversation. This mindset helps us accurately assess risks, pick the right risks to embrace, and avoid analysis paralysis. It also helps us learn in an uncertain world, where even if we make good decisions, we may experience bad outcomes (and vice versa!).



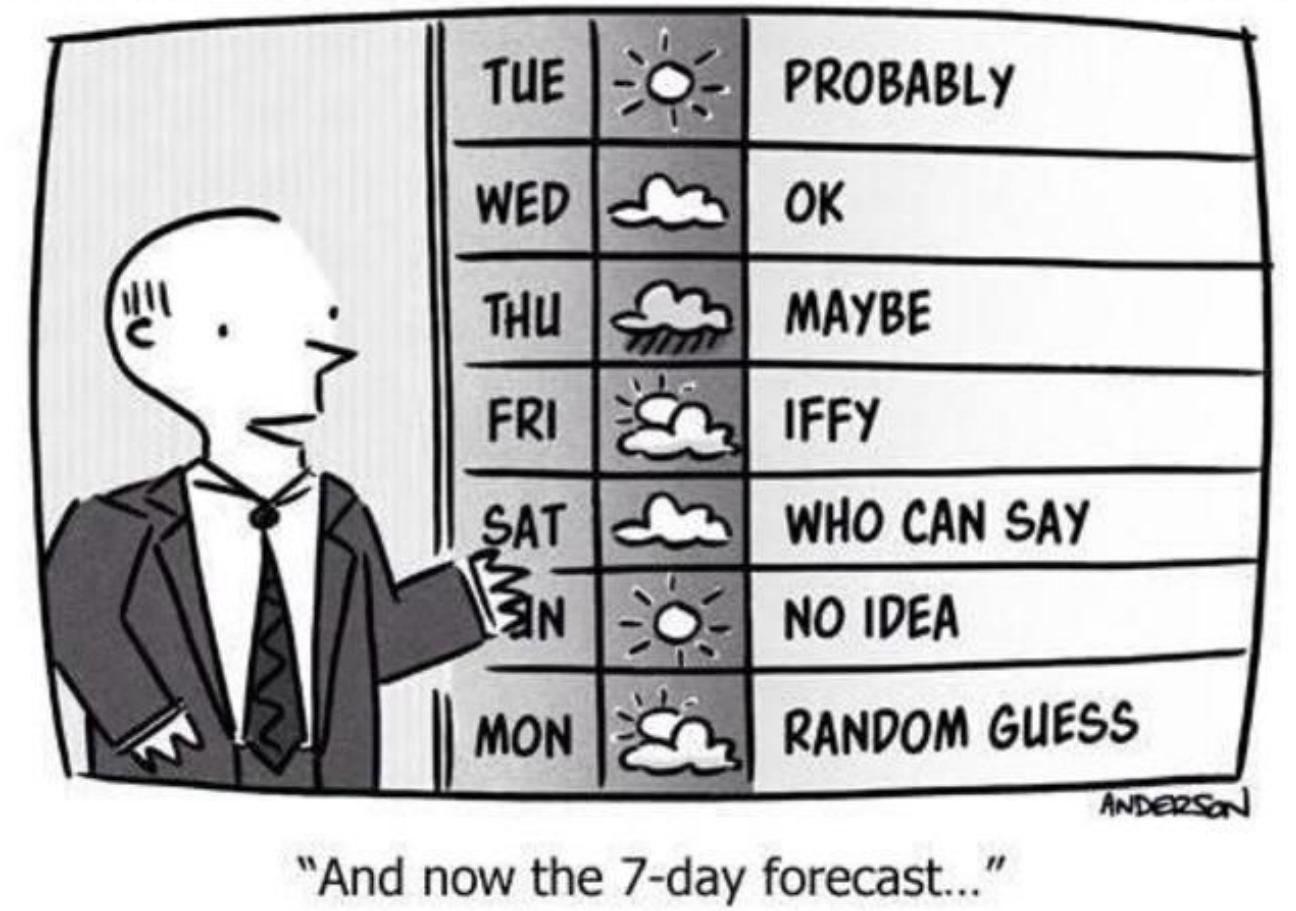
Robert Herbig

AI Practice Lead at SEP

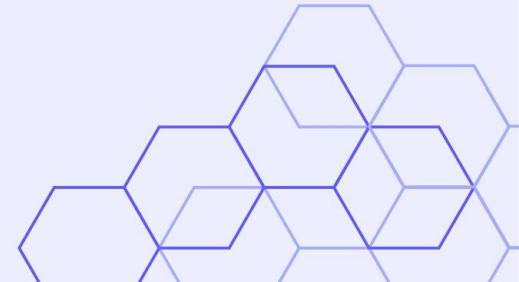




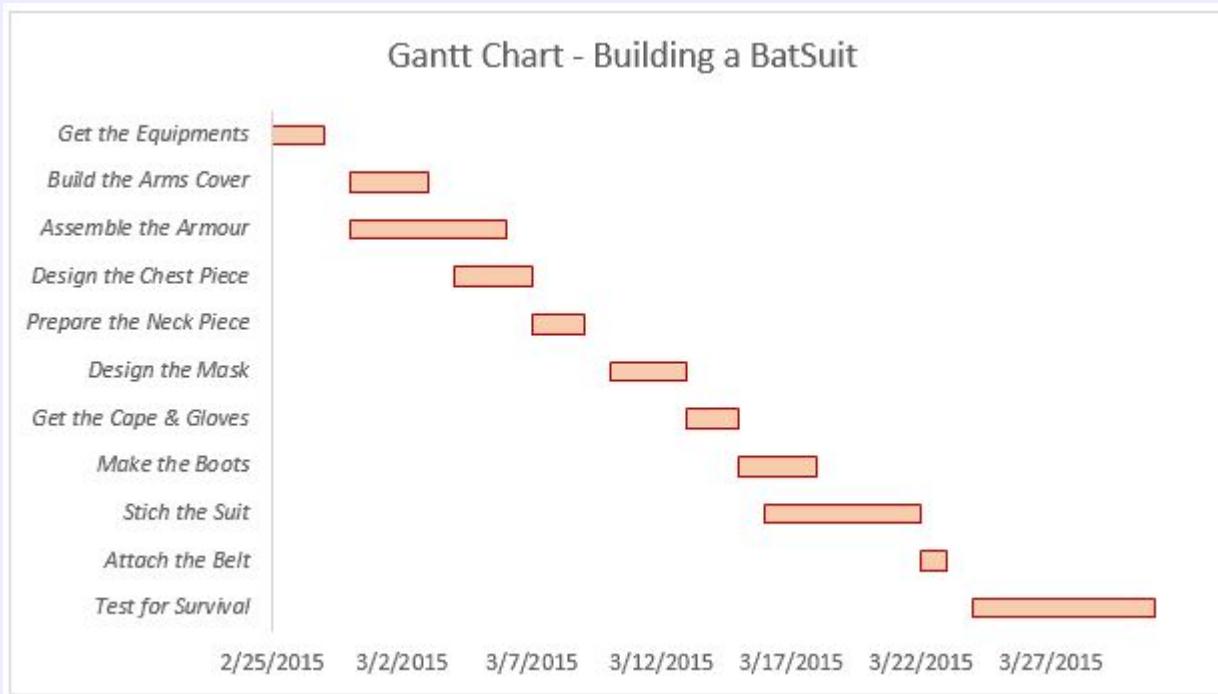
@RobertHerbig



“When Will It Be Done?”



“When Will It Be Done?”



Takeaways

Think probabilistically, not deterministically

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-
-

Use probabilistic forecasting

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-
-

Communicate the uncertainty

-
-
-

Takeaways

Think probabilistically, not deterministically

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Use probabilistic forecasting

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Communicate the uncertainty

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-
-

“I don’t know”



Takeaways

Think probabilistically, not deterministically

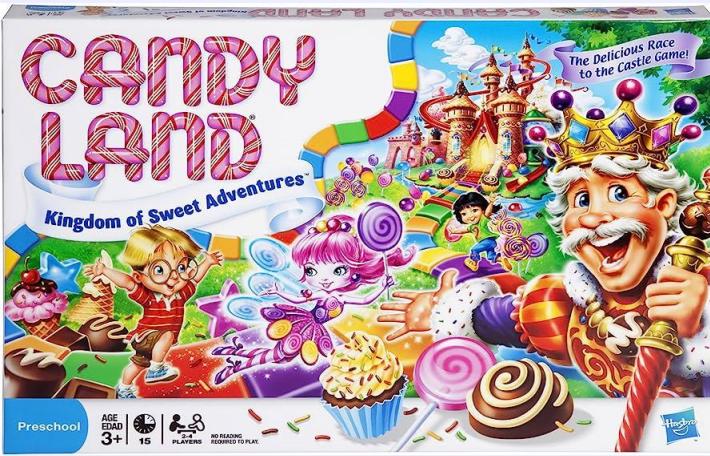
- Luck and skill both contribute to the actual outcome
-
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Use probabilistic forecasting

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Communicate the uncertainty

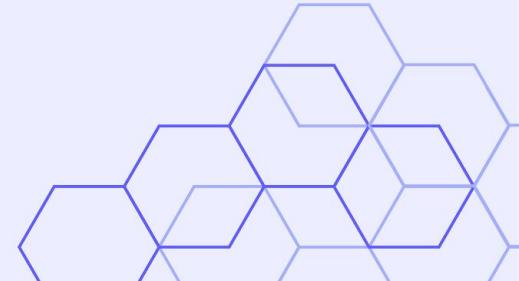
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Pure
Luck



Pure
Skill



@RobertHerbig

Takeaways

Think probabilistically, not deterministically

- Luck and skill both contribute to the actual outcome
- **There is more than one possible outcome**
- **Not all outcomes are equally likely**

Use probabilistic forecasting

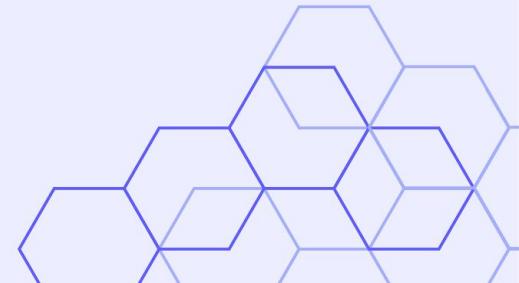
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Communicate the uncertainty

-
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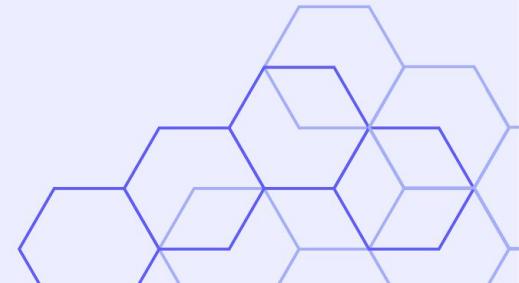
@RobertHerbig





Smash Gotham City

→ Profit

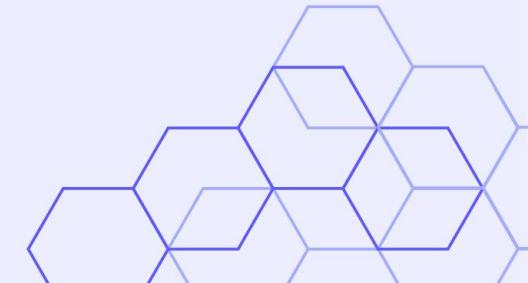




Smash Gotham City

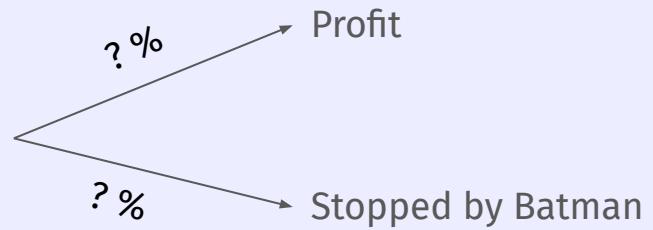
Profit

Stopped by Batman



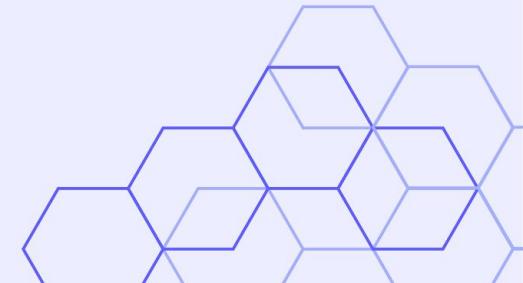


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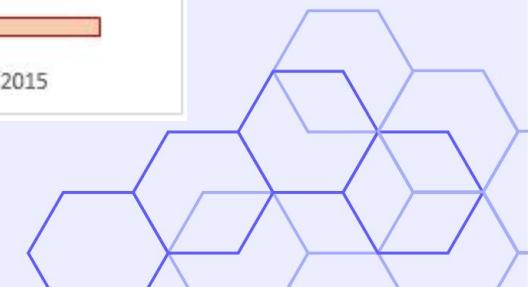
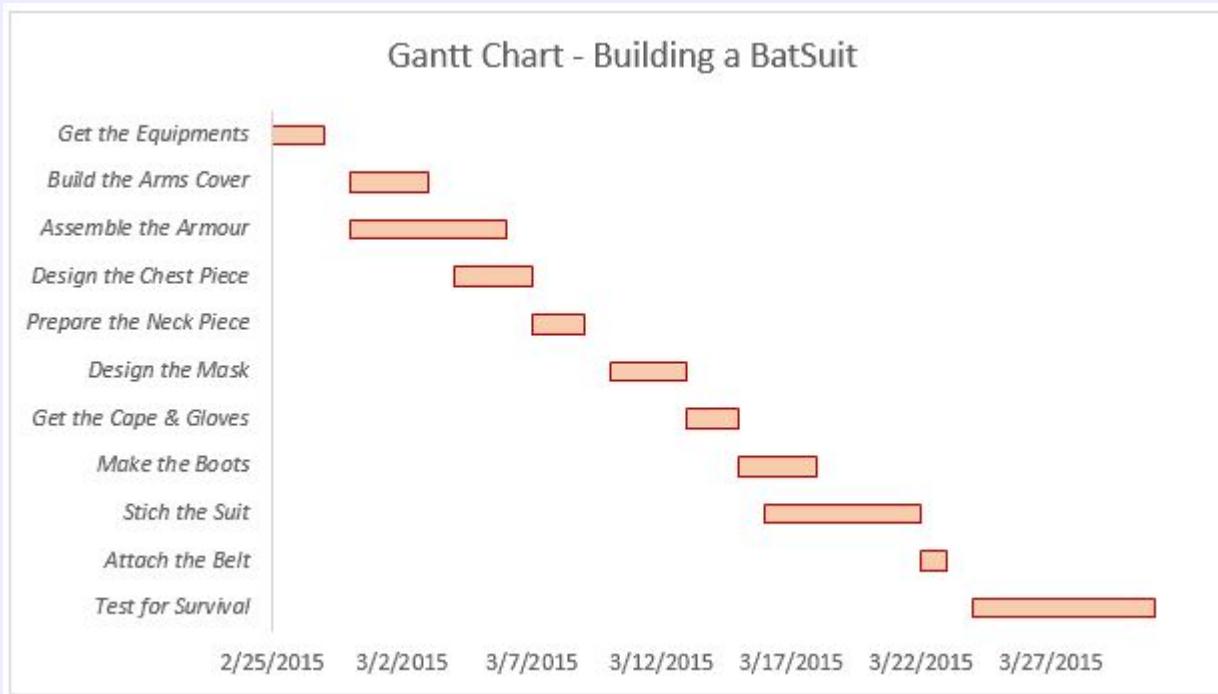




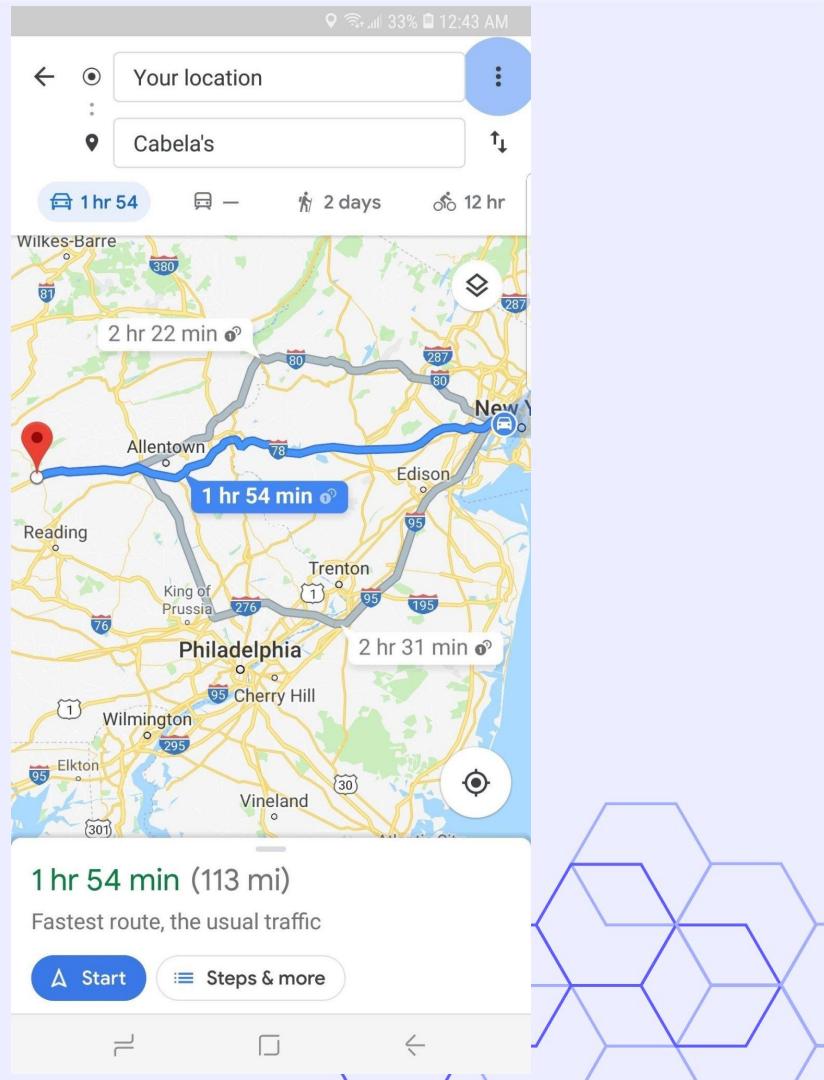
@RobertHerbig



“When Will It Be Done?”



Probabilistic Forecasting



Probabilistic Forecasting



Probabilistic Forecasting

A good forecast:

1. Shows multiple options



Probabilistic Forecasting

A good forecast:

1. Shows multiple options
2. Is clear about the level of uncertainty (confidence)



Probabilistic Forecasting

A good forecast:

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Probabilistic Forecasting

A good forecast:

1. Shows multiple options
2. Is clear about the level of uncertainty (confidence)
3. **Can be tested against the actual outcome**



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Probabilistic Forecasting

A good forecast:

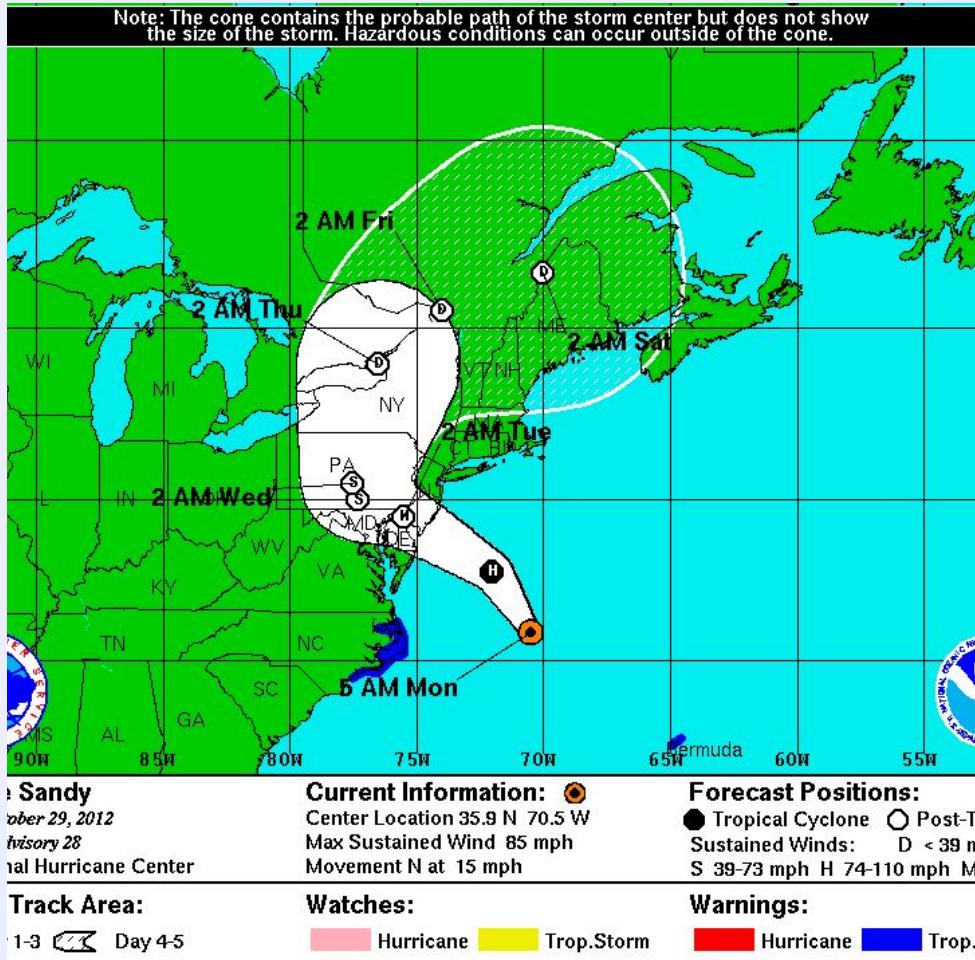
1. Shows multiple options
2. Is clear about the level of uncertainty (confidence)
3. Can be tested against the actual outcome
4. **Is updated as new information is received**



Probabilistic Forecasting

A good forecast:

1. Shows multiple options
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Takeaways

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- Luck and skill both contribute
- There is more than one possible outcome
- Not all outcomes are equally likely

Use probabilistic forecasting

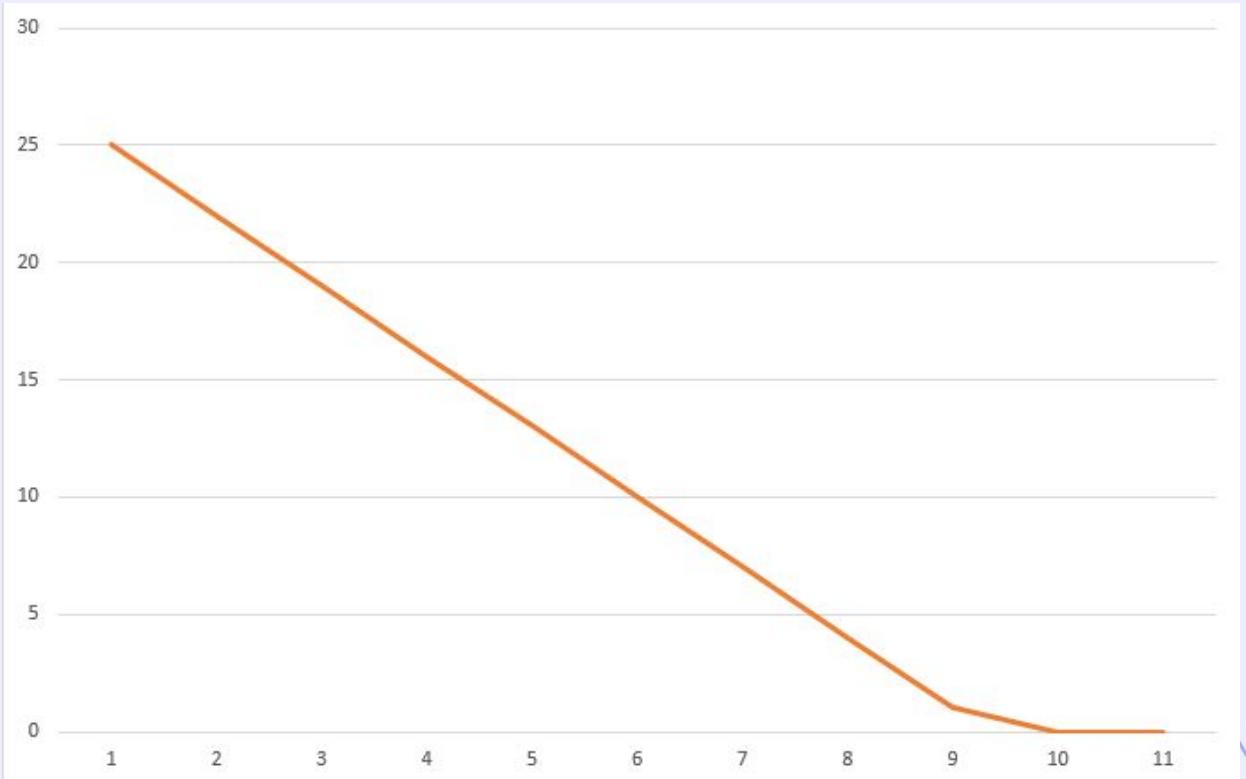
- **Show multiple options (with their confidence)**
- **Test the actual outcome against the forecast**
- **Update the forecast with new info**

Communicate the uncertainty

-
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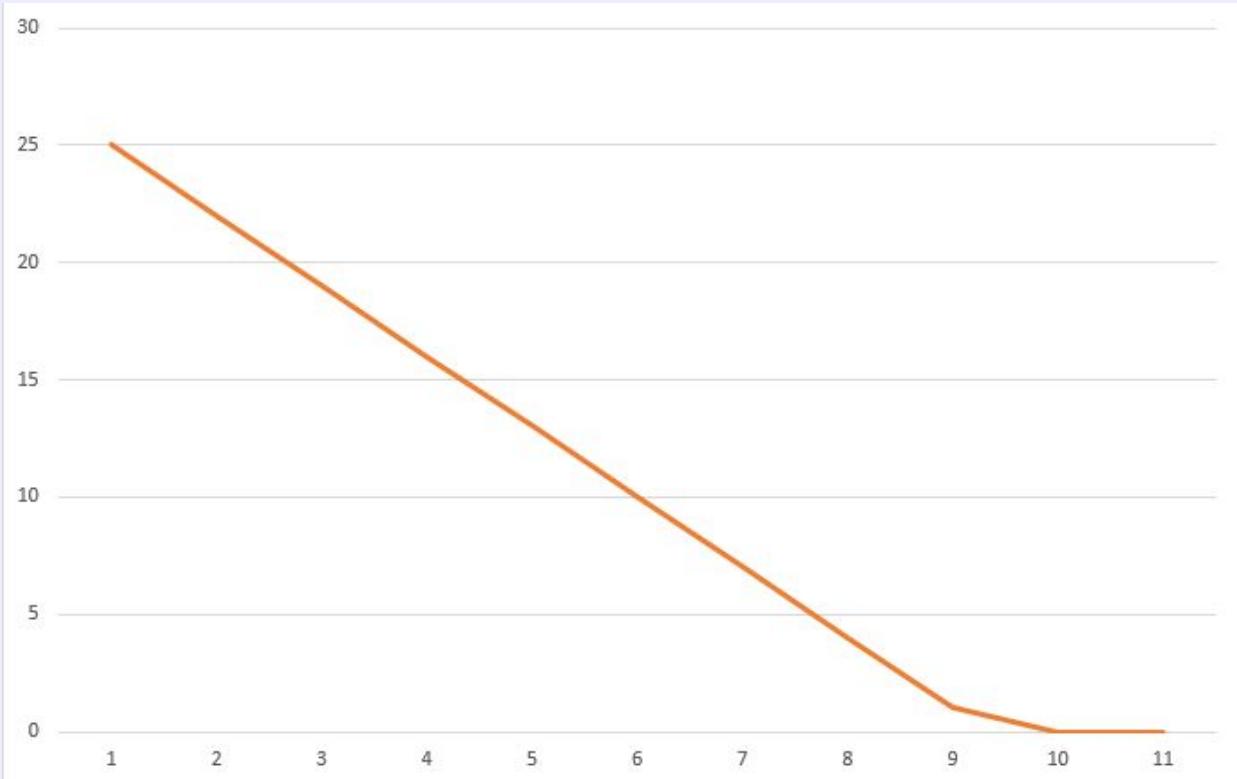
Initial backlog = 25 stories

Velocity = 3/sprint



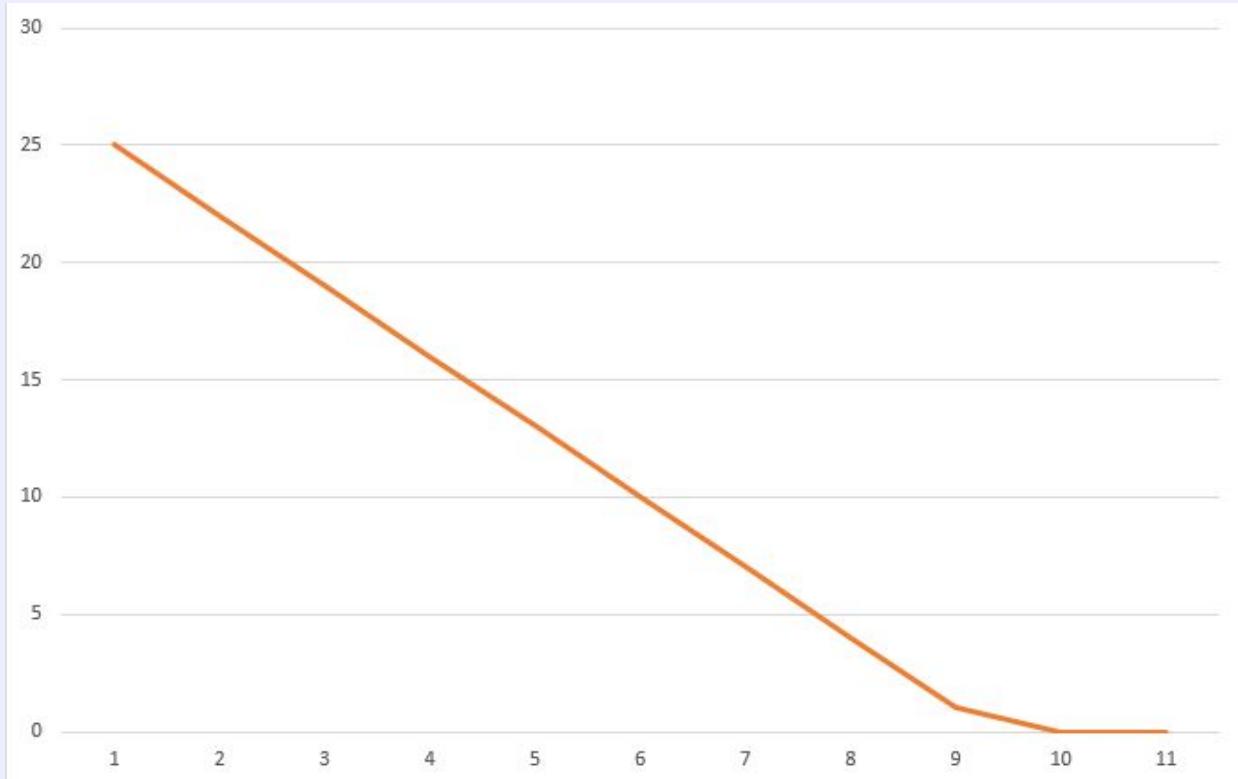
Initial backlog =
20-30 stories

Velocity =
2-4/sprint



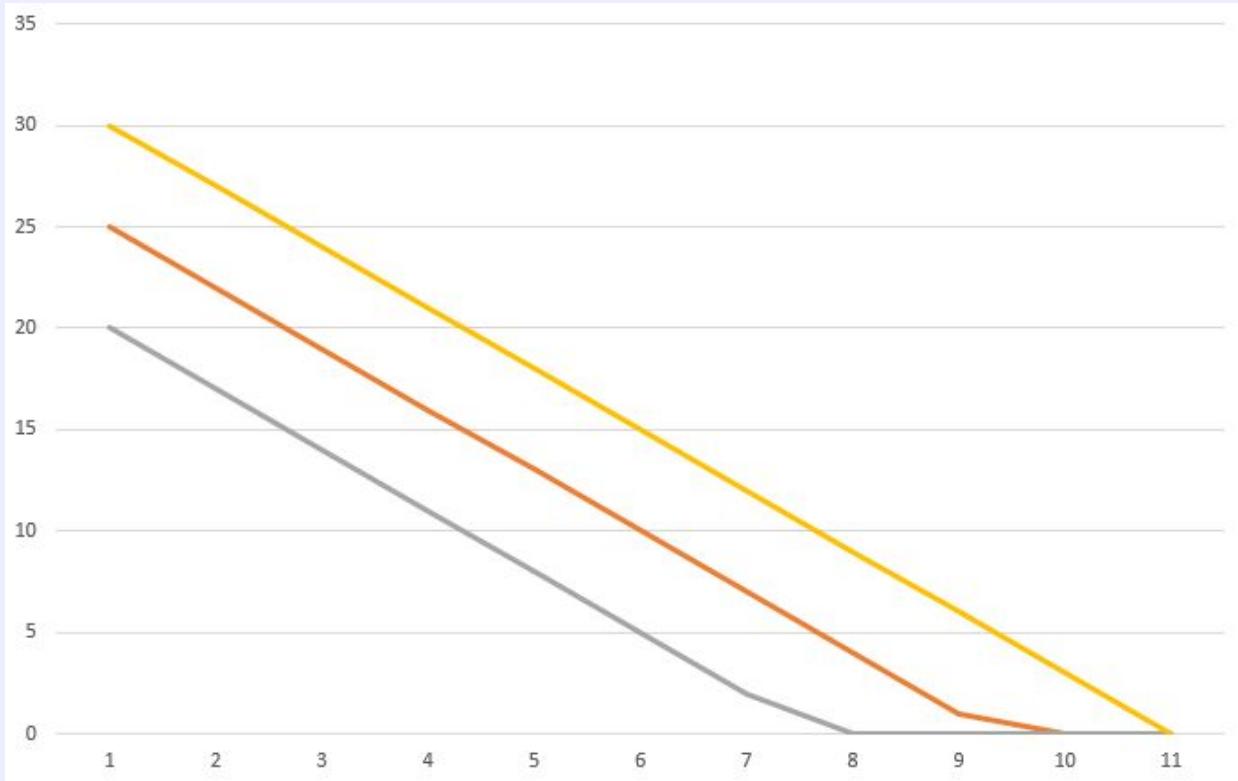
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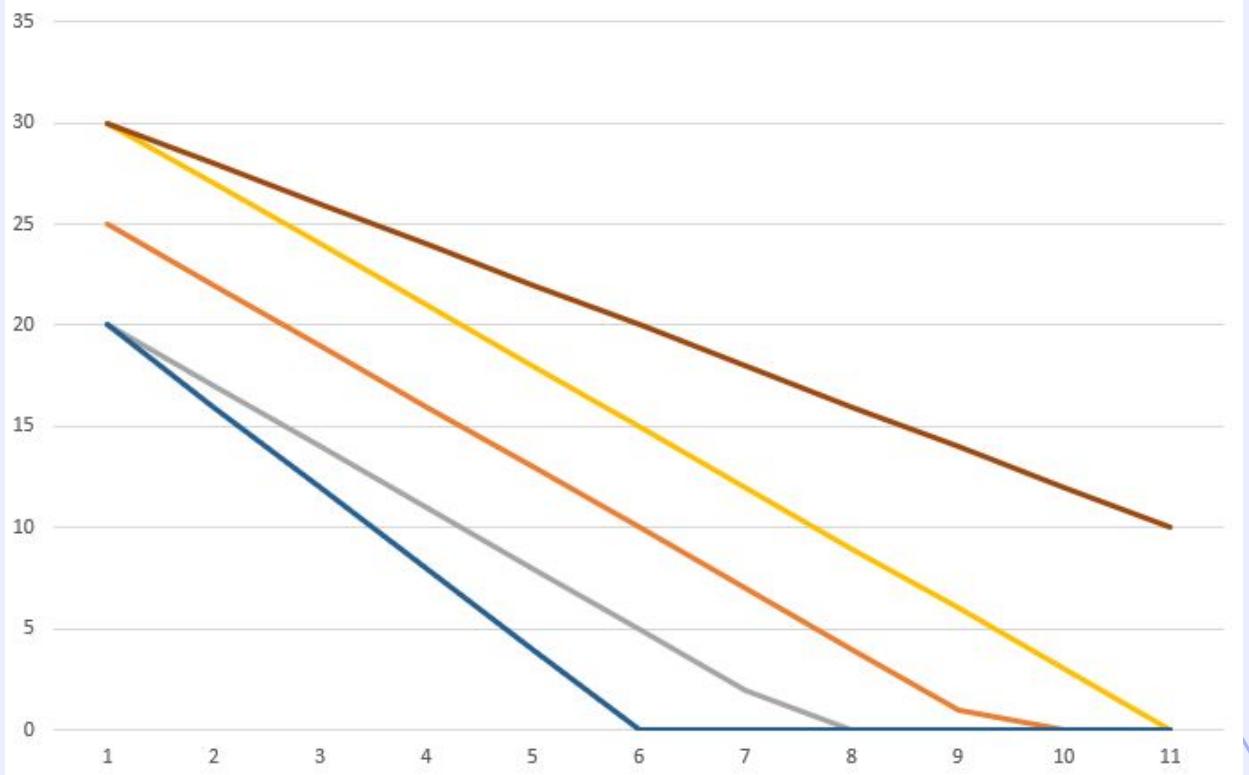
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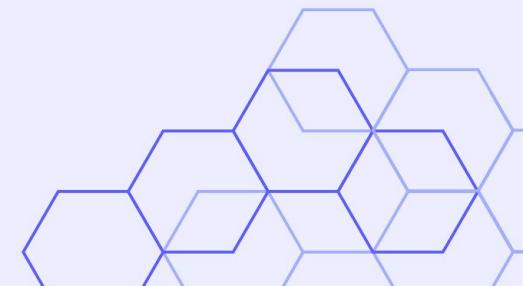
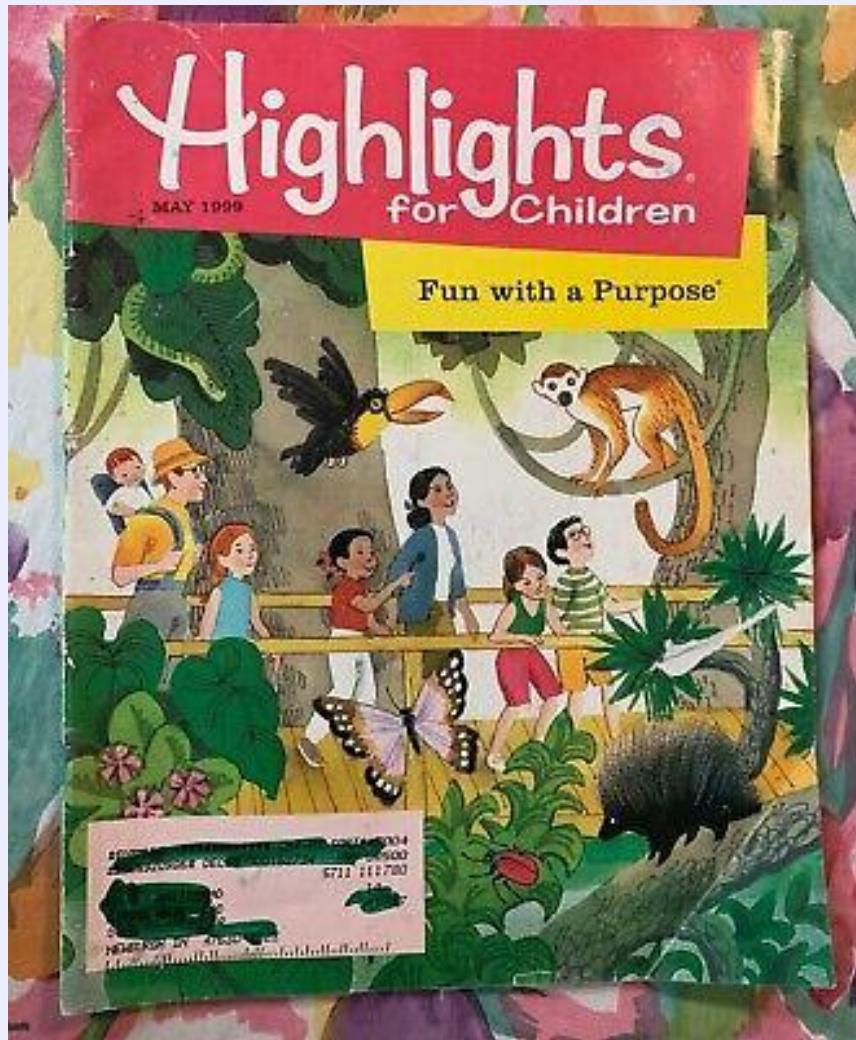
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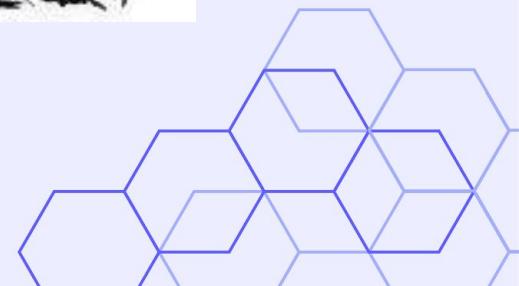
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Goofus and Gallant

By Gerry Cleveland Myers
Illustrated by Marion Hall Hammett



Goofus and Gallant

By Gerry Cleveland Myers
Illustrated by Marlo Hall Hammel



Goofus has poor code quality and therefore erratic sprint velocity

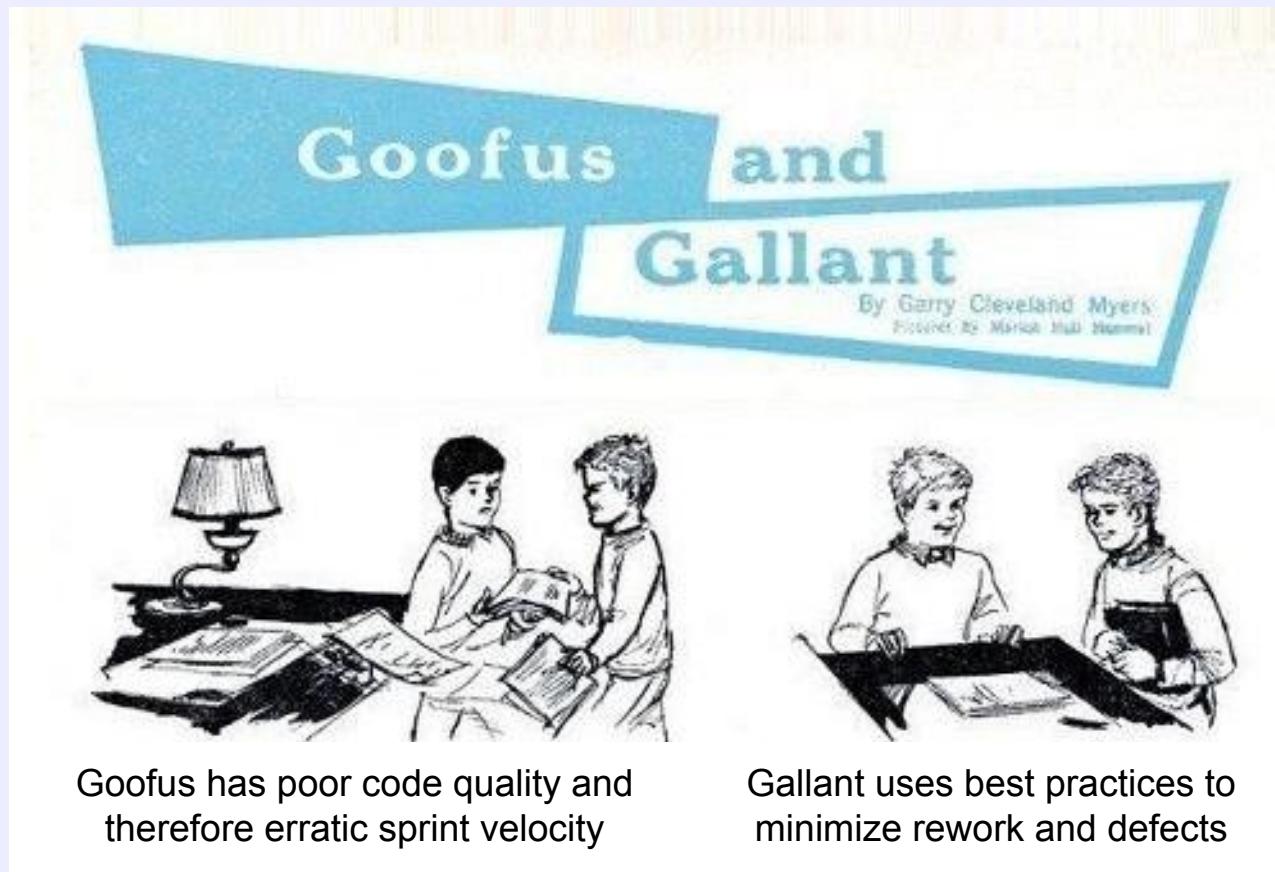


Gallant uses best practices to minimize rework and defects



Historical data:
• 4, 5, 10, 11

Average: 7.5



Historical data:
• 6, 7, 8, 9

Average: 7.5



Goofus and Gallant

By Gerry Cleveland Myers
Illustrated by Marlo Hall Hammel



Goofus has poor code quality and therefore erratic sprint velocity



Gallant uses best practices to minimize rework and defects

Historical data:

- 4, 5, 10, 11

Average: 7.5

Standard deviation: 3.5

Historical data:

- 6, 7, 8, 9

Average: 7.5

Standard deviation: 0.5

In order to use an average...

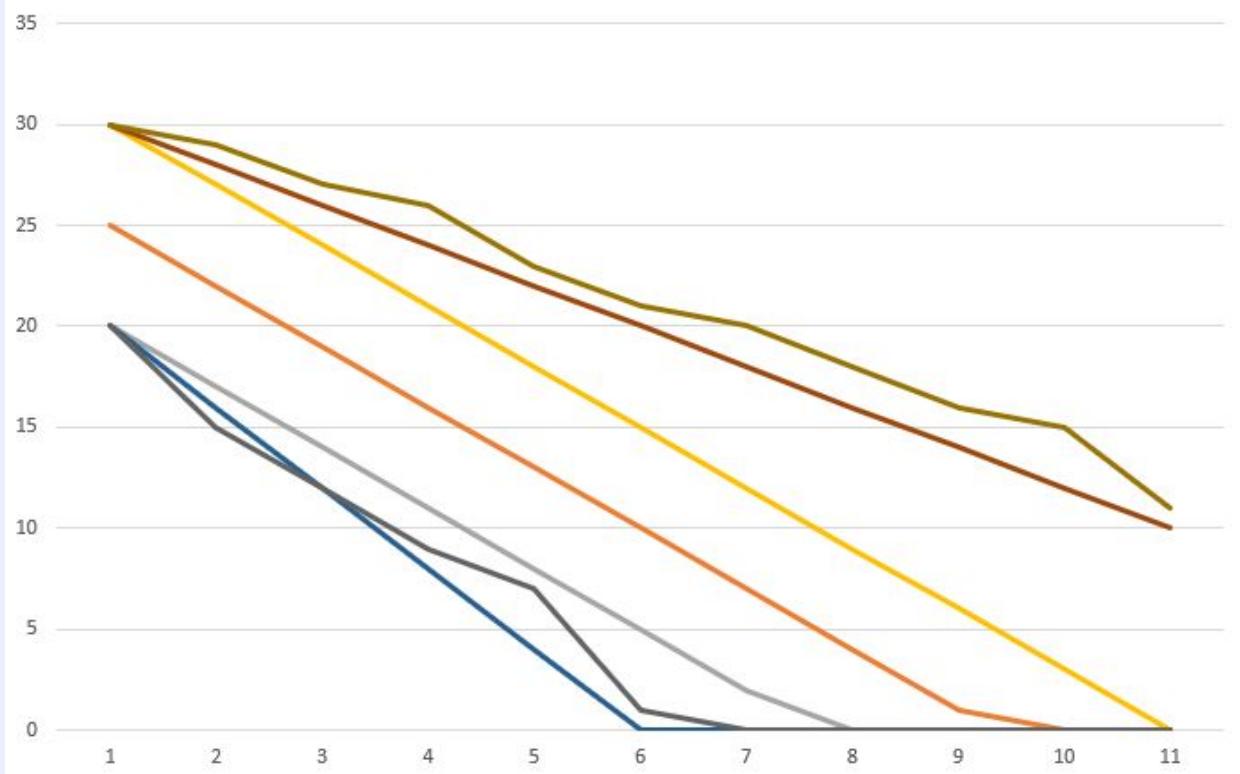
“The members of the population must be statistically independent - rarely is this the case in engineering or software development.”



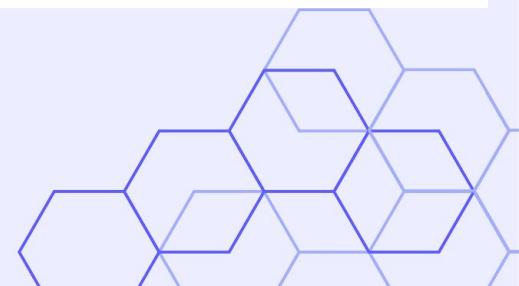
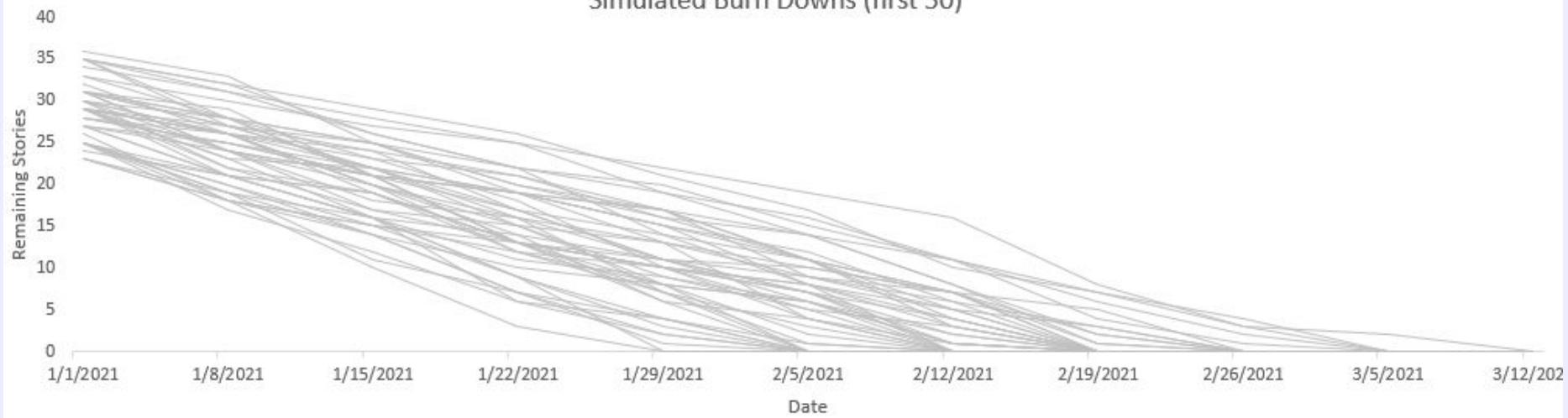
Glen Alleman
*Increasing the Probability of
Project Success*

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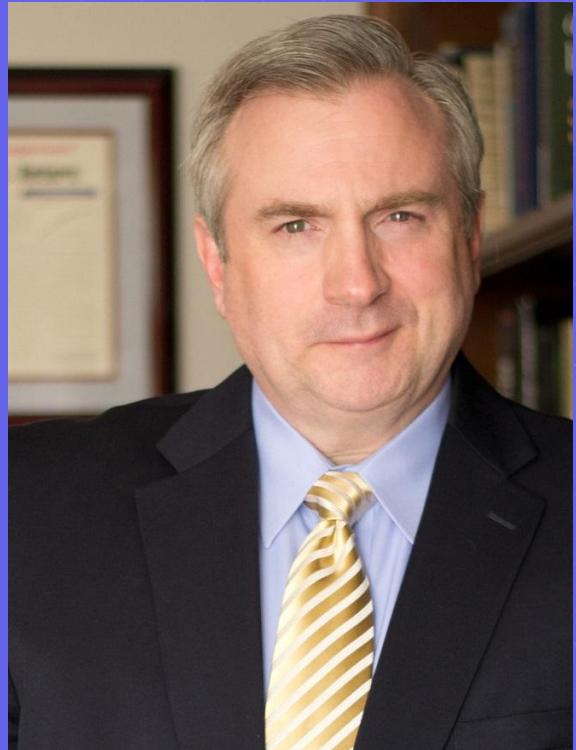
Simulated Burn Downs (first 50)



The Monte Carlo method



“Running Monte Carlo is the only way to analyze big uncertain decisions.”



Douglas Hubbard
How to Measure Anything



^ Forecasting and Metric Spreadsheets

To be honest, you probably know us because of our spreadsheet tools.
That's OK, but now consider training :)

[Throughput Forecaster: I want to forecast how long a single feature may take](#)

[Multiple Feature Cut Line Forecaster: I want to forecast multiple features at once](#)

[Team Dashboard: I want to quickly create an team dashboard](#)

[Skill and Capability Survey and Matrix: I want to quickly survey teams to understand skill constraints](#)

[Time Series Forecasting for Demand](#)

[MORE - A lot more on our GitHub repo](#)

^ Simulation Application

<https://www.focusedobjective.com/pages/free-spreadsheets-and-tools>



Troy Magennis

2. How many stories are remaining to be completed?

low guess

20

high guess

25

scope complexity

Clear and understood

(change this list and growth factors in the "Settings" worksheet)

adjusted scope

20

25

3. Stories are often split before and whilst being worked on. Estimate the split rate low and high bounds.

Often the throughput/velocity in the backlog is pre-split, but captured completed stories post-splitting by the dev team making forecasts optimistic.

low split guess

1.00

highest split guess

1.50

4. Throughput. How many completed stories per week or sprint do you estimate low and high bounds?

Throughput/velocity data or estimate is for

1 week

7 days

Use historical throughput/velocity data OR enter a low and high estimate below. Use [Estimate](#)

worst case

1

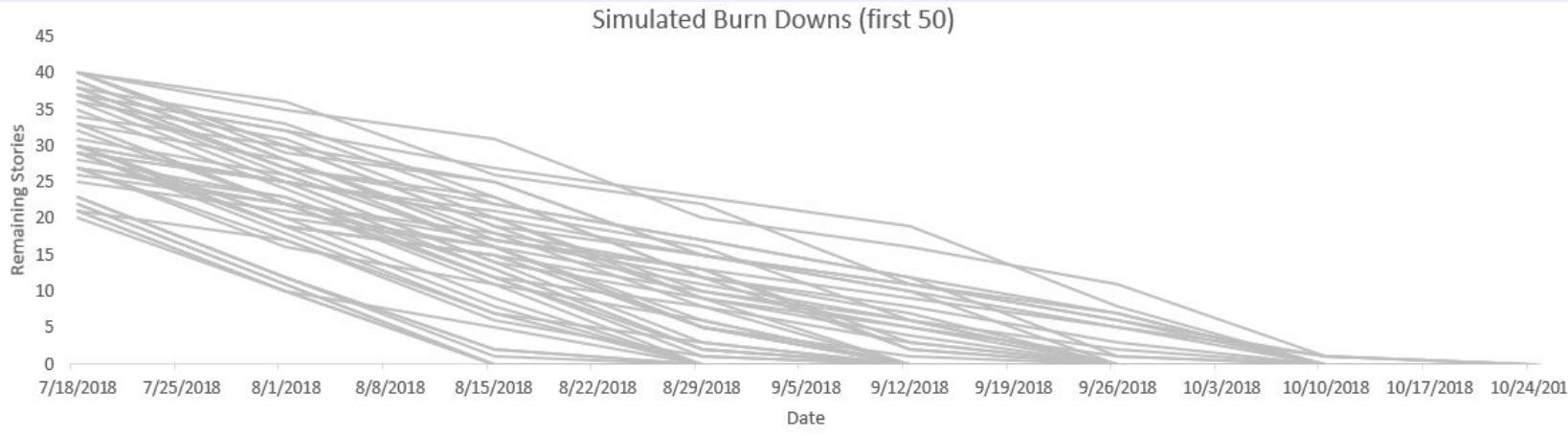
most often

3 (optional)

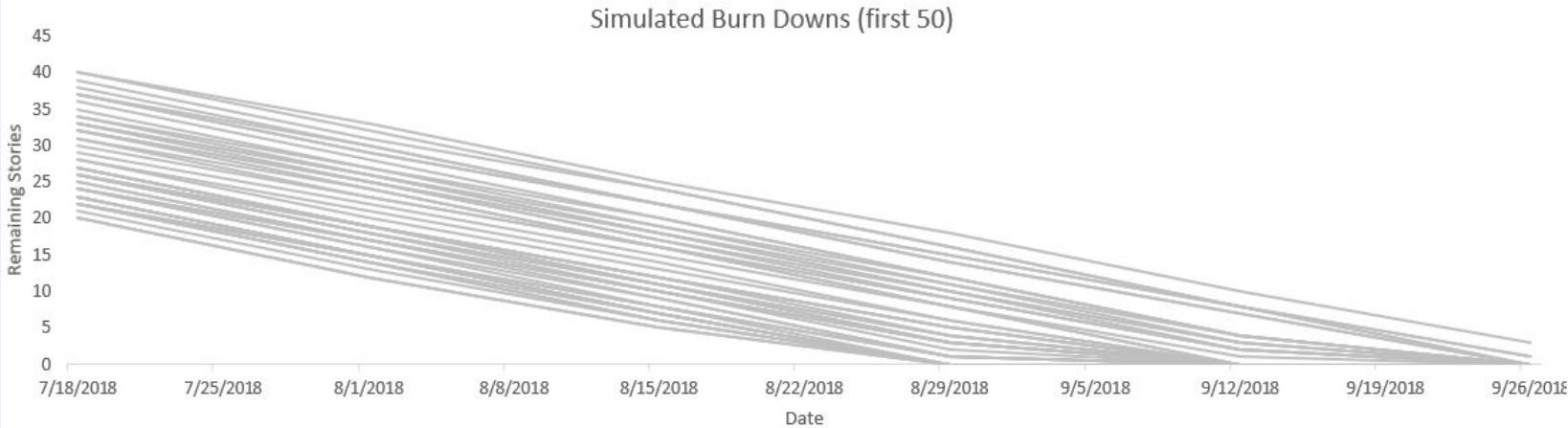
best case

10

Simulated Burn Downs (first 50)

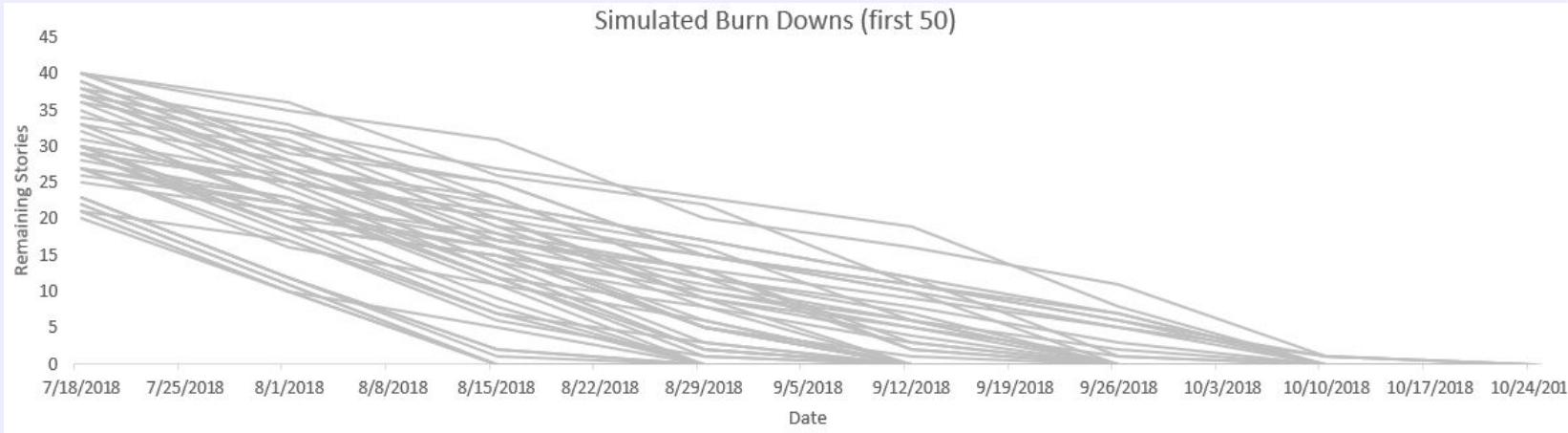


Simulated Burn Downs (first 50)



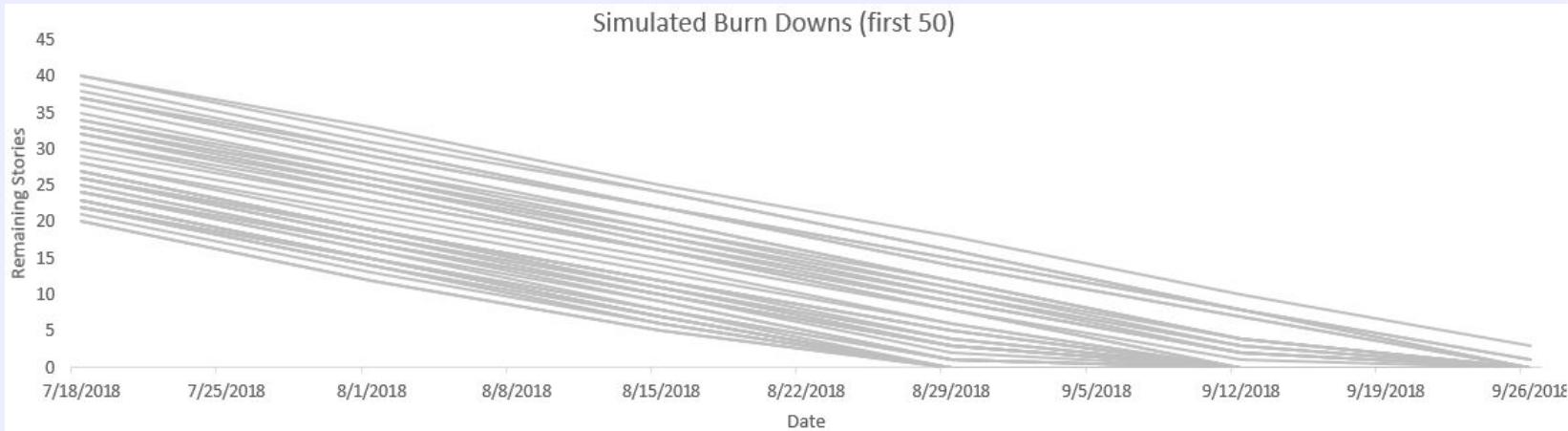
Team Goofus

Average: 7.5
StdDev: 3.5



Team Gallant

Average: 7.5
StdDev: 0.5



Takeaways

Think probabilistically, not deterministically

- Luck and skill both contribute
- There is more than one possible outcome
- Not all outcomes are equally likely

Use probabilistic forecasting

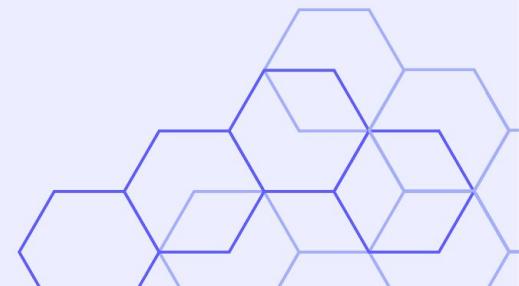
- **Show multiple options (with their confidence)**
- Test the actual outcome against the forecast
- Update the forecast with new info

Communicate the uncertainty

-
-
-

Results

Likelihood	Duration	Date
100%	11	3/19/2021
95%	9	3/5/2021
90%	9	3/5/2021
85%	8	2/26/2021
80%	8	2/26/2021
75%	8	2/26/2021
70%	7	2/19/2021
65%	7	2/19/2021
60%	7	2/19/2021
55%	7	2/19/2021
50%	6	2/12/2021
45%	6	2/12/2021
40%	6	2/12/2021
35%	6	2/12/2021
30%	6	2/12/2021
25%	6	2/12/2021
20%	5	2/5/2021
15%	5	2/5/2021
10%	5	2/5/2021
5%	5	2/5/2021
0%	4	1/29/2021



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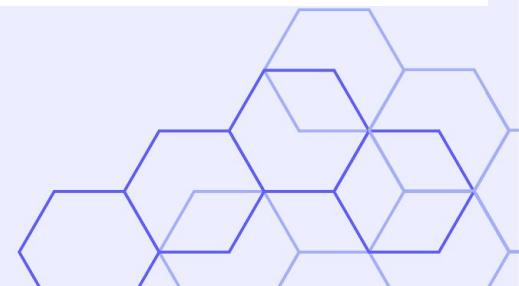
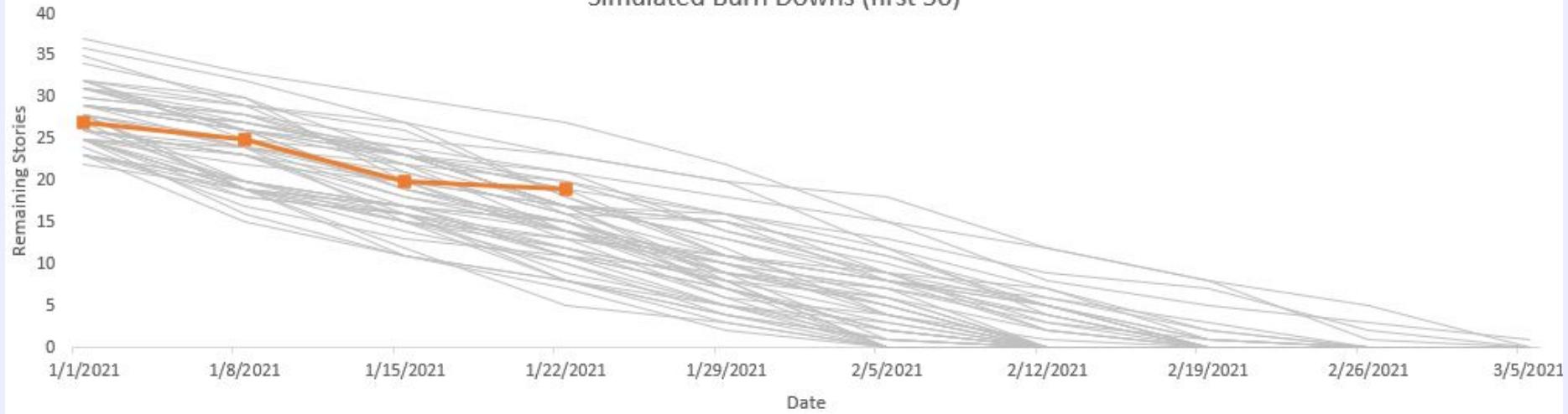
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Simulated Burn Downs (first 50)



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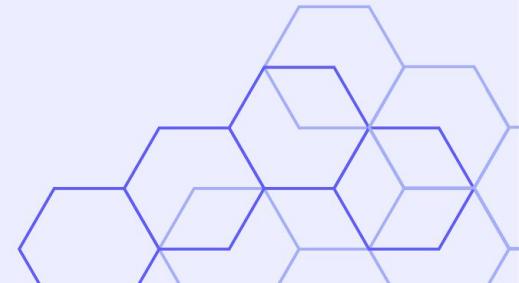
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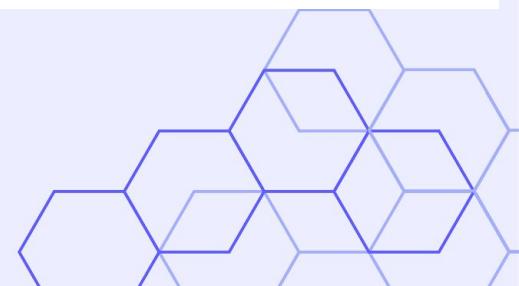
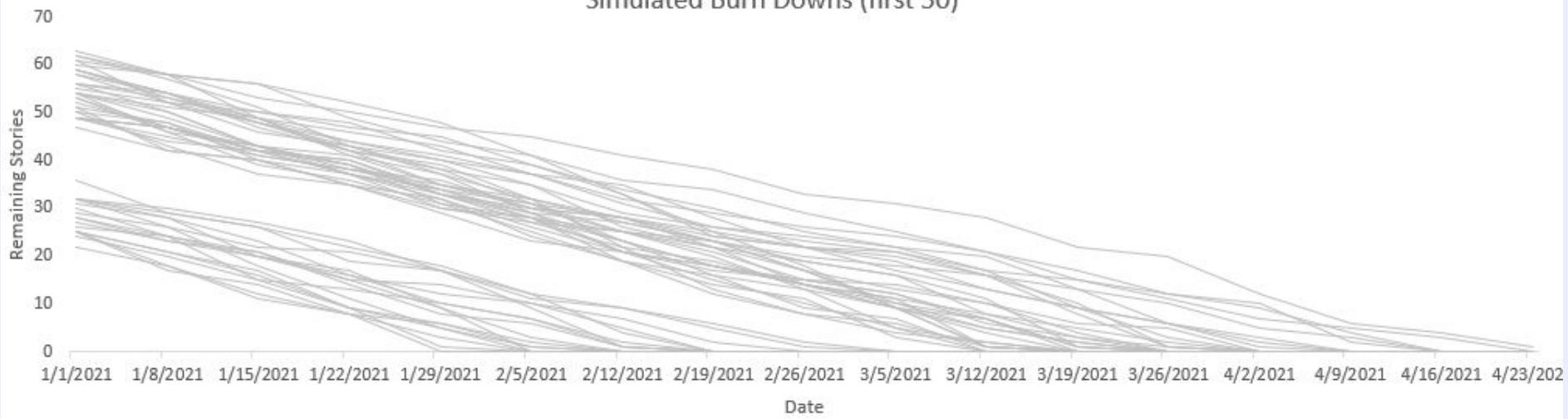
Communicate the uncertainty

-
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-

Likelihood	Impact Low	Impact High	Description
50%	20	30	Rewrite the front-end in a new framework



Simulated Burn Downs (first 50)



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Communicate the uncertainty

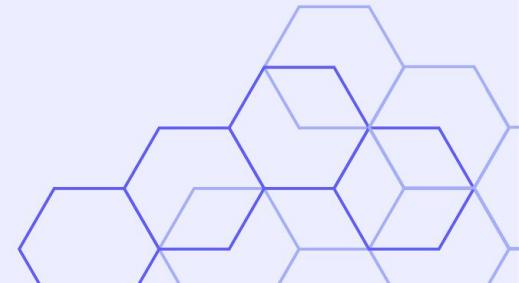
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“Bet”



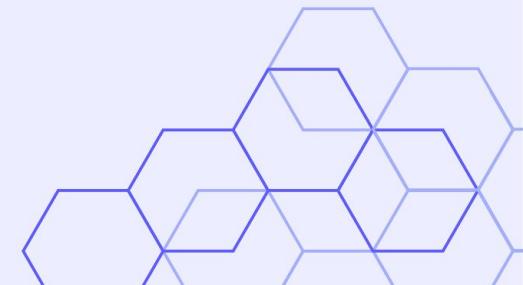
“Bet”

- Cost



“Bet”

- Cost



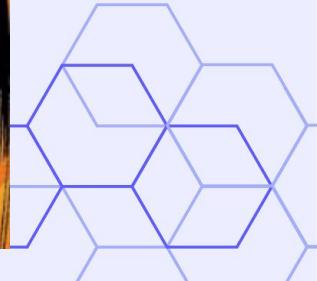
“Bet”

- Cost



“Bet”

- Cost
- Odds



“Bet”

- Cost
- Odds
- Outcome



Takeaways

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Use probabilistic forecasting

- Show multiple options (with their confidence)
- Test the actual outcome against the forecast
- Update the forecast with new info

Communicate the uncertainty

- Use “bet” language
- Bets have: cost, odds, and outcome
-

“Bet”

A good bet:

1.



“Bet”

A good bet:

1. Is outcome focused



“Bet”

A good bet:

1. Is outcome focused
2. **Acknowledges that “losing” is a possibility**



© DC (2020)



“Bet”

A good bet:

1. Is outcome focused
2. Acknowledges that “losing” is a possibility
3. **Has odds (sometimes known, sometimes not)**



“Bet”

A good bet:

1. Is outcome focused
2. Acknowledges that “losing” is a possibility
3. Has odds (sometimes known, sometimes not)
4. **Forces us to explore our assumptions and beliefs**



“Bet”

A good bet:

1. Is outcome focused
2. Acknowledges that “losing” is a possibility
3. Has odds (sometimes known, sometimes not)
4. Forces us to explore our assumptions and beliefs
5. **Frames conversations around risk, information, learning, validation, and outcomes**



“Bet”

A good bet:

1. Is outcome focused
2. Acknowledges that “losing” is a possibility
3. Has odds (sometimes known, sometimes not)
4. Forces us to explore our assumptions and beliefs
5. Frames conversations around risk, information, learning, validation, and outcomes
6. **If small, can “buy” learning to inform larger bets**



Press Esc to exit full screen



In the not-so-distant future we will see the commodification of [some customer/user need, technology service, etc.]. There will be a lowering of prices, and a focus on scale and reliability. This will present the following opportunities: [ways to exploit this shift to commodification], but also trigger the following challenges: [threats to mitigate].

We believe that by focusing on [some intervention] we will make it possible for customers to [achieve some outcome] more [efficiently, accurately, joyfully, effectively], which we believe will benefit the business by [some business benefit, or causal chain].

Operationally, we know we have been deprioritizing [some process, system, activity]. We realize this causes pain and frustration to our people by [some observable pain points, frustration]. The important bet that we hope will offset this short-term pain is that we are [some larger, valuable bet].

We are betting that customers will continue to use our product because [some value proposition] despite the fact that other products are more [positive attributes of competitive products].

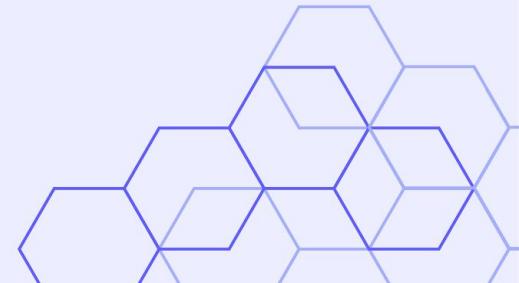
You could call [some set of interventions, or class of interventions] as our “safe bet”. We put time/money in, and get outcomes out. For example, [a scenario described with inputs and outputs]. As with all good things, this could come to an end. The most likely threats are [some list of threats to this predictability].

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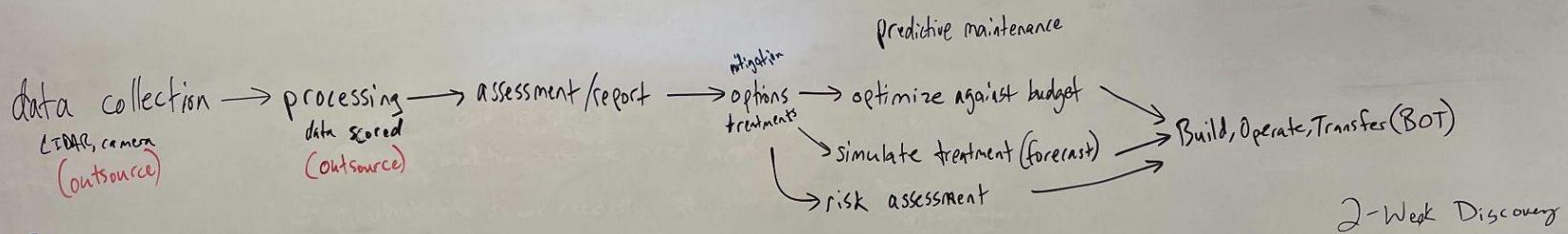


@RobertHerbig

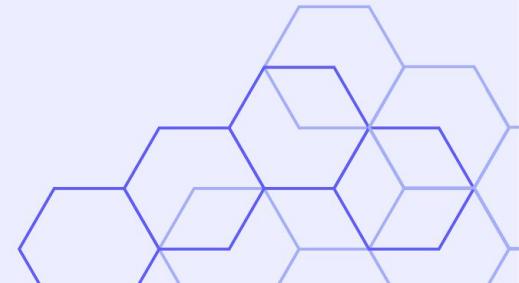
Bet #1: Business Model



Bet #1: Business Model



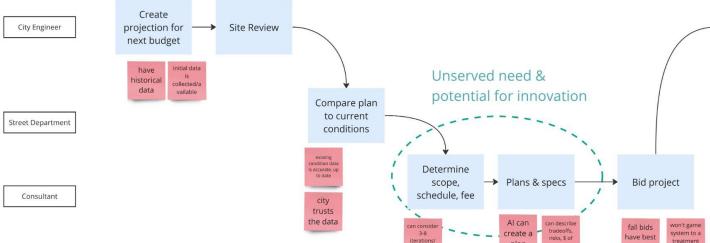
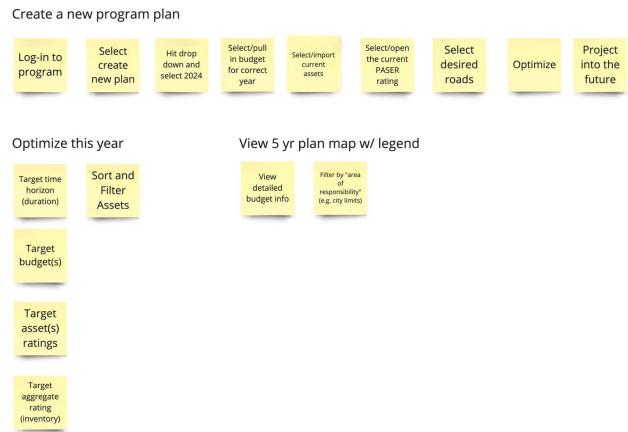
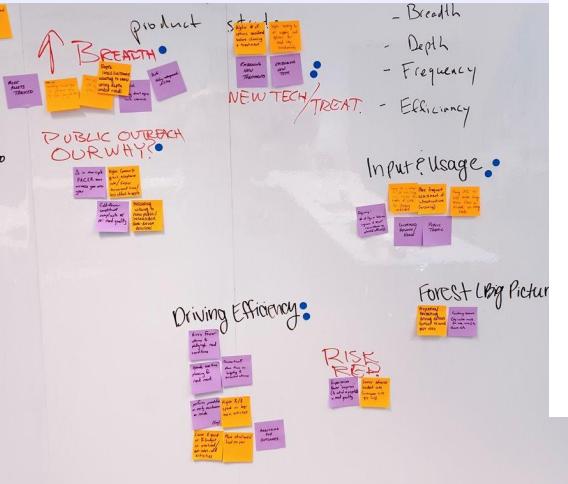
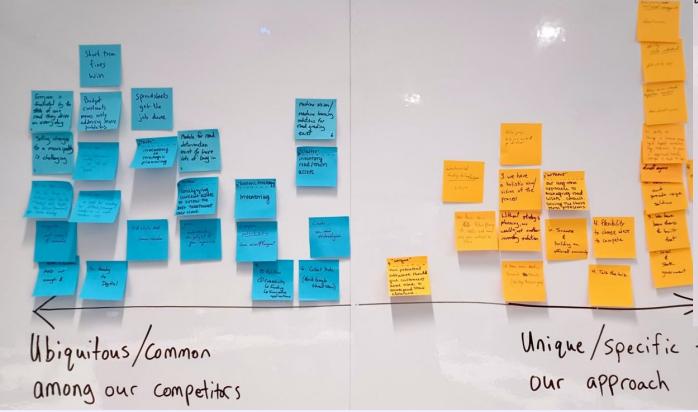
Bet #2: One week of Discovery



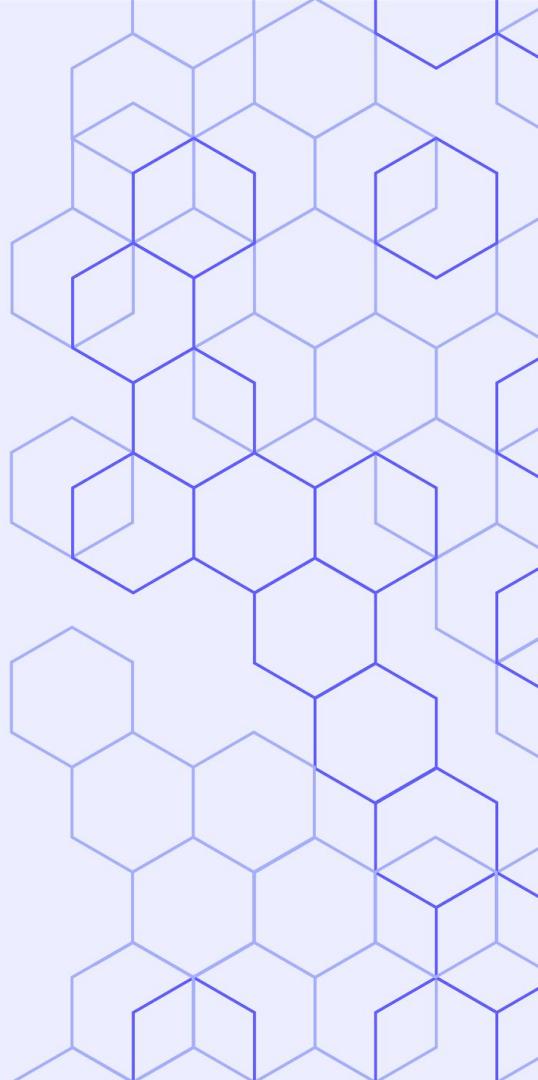
Bet #2: One week of Discovery



Bet #2: One week of innovation



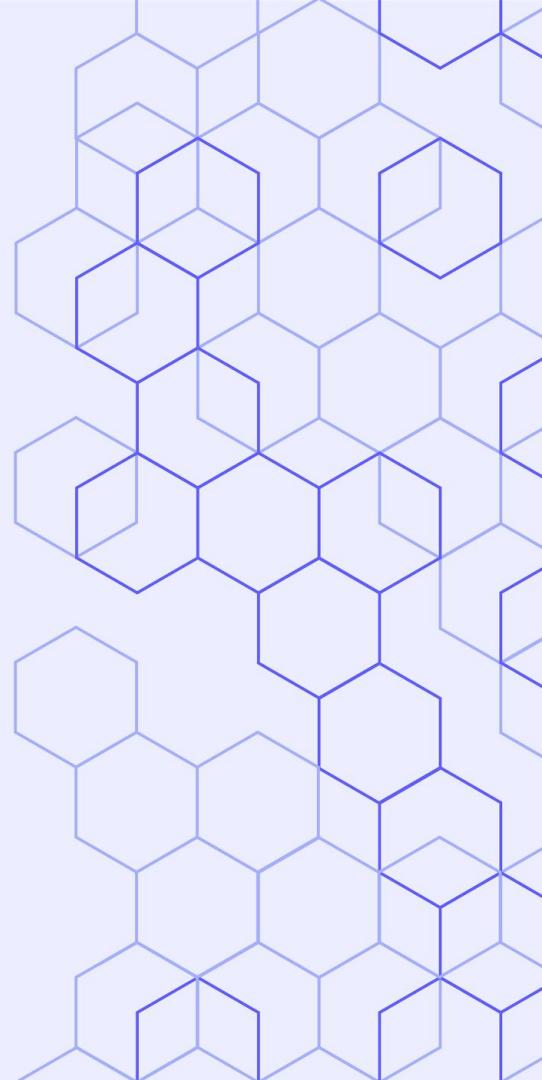
Bet #3: Two Feasibility Studies



Bet #3: Two Feasibility Studies

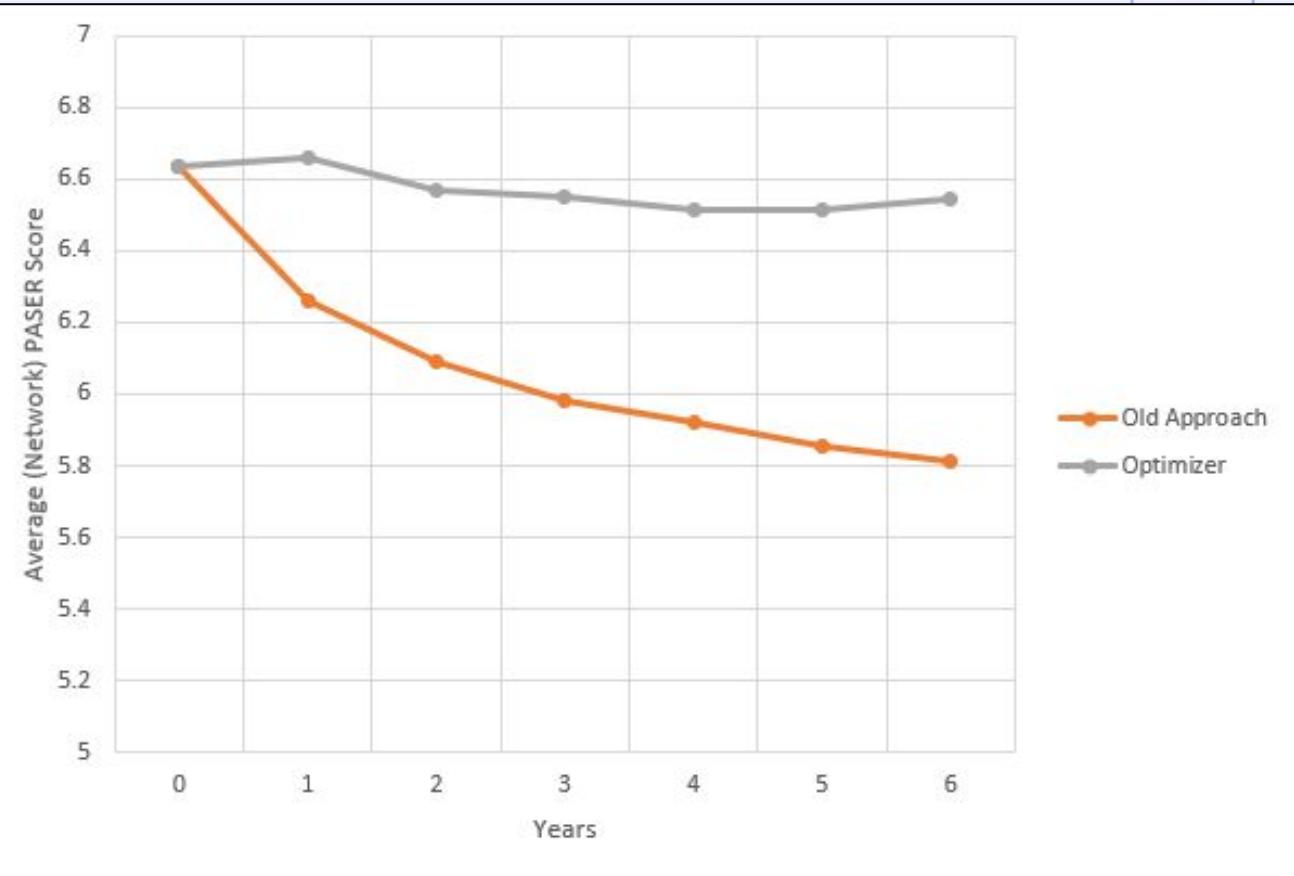
#3A: Technical Feasibility:

“Can AI produce good enough budgets
in a short enough time-frame?”



Bet #:

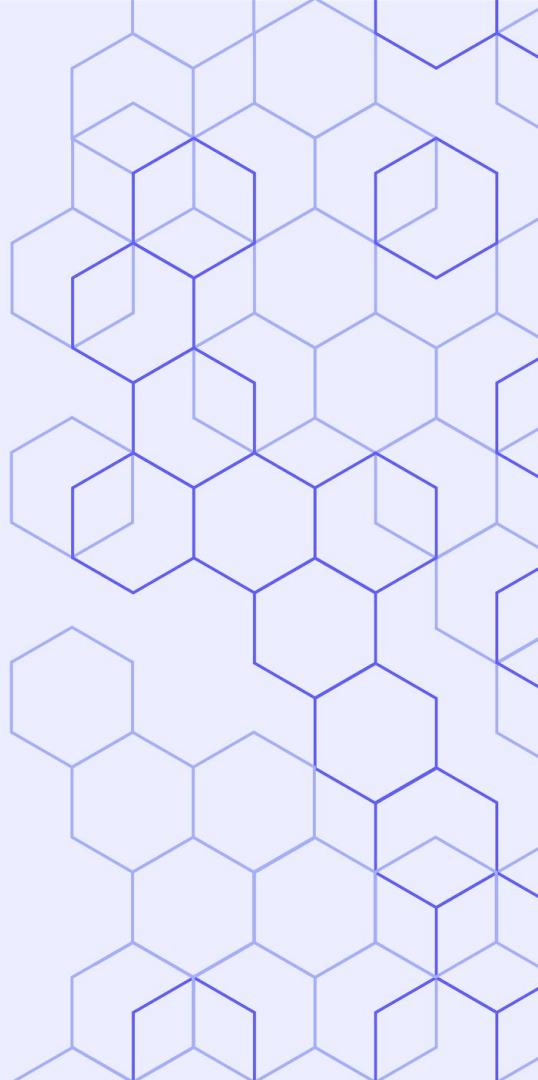
#3A: Test
“Can All
in a short



Bet #3: Two Feasibility Studies

#3B: Market Feasibility:

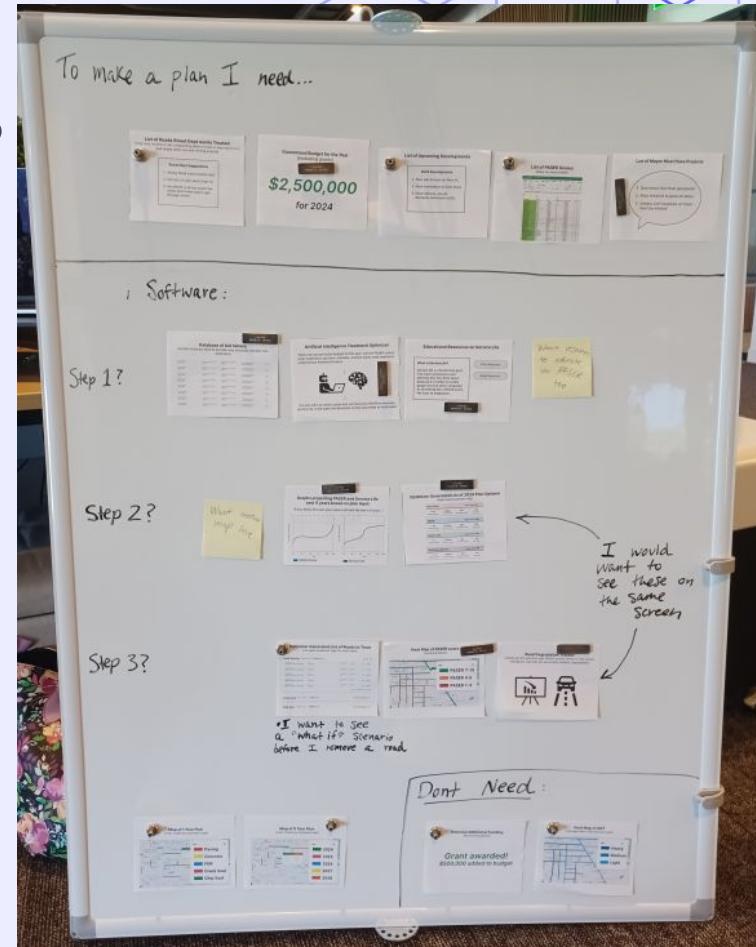
“Does the market want this product
and how would they use it?”



Bet #3: Two Feasibility Studies

#3B: Market Feasibility:

“Does the market want this product
and how would they use it?”



Bet #3: Two Feasibility Studies

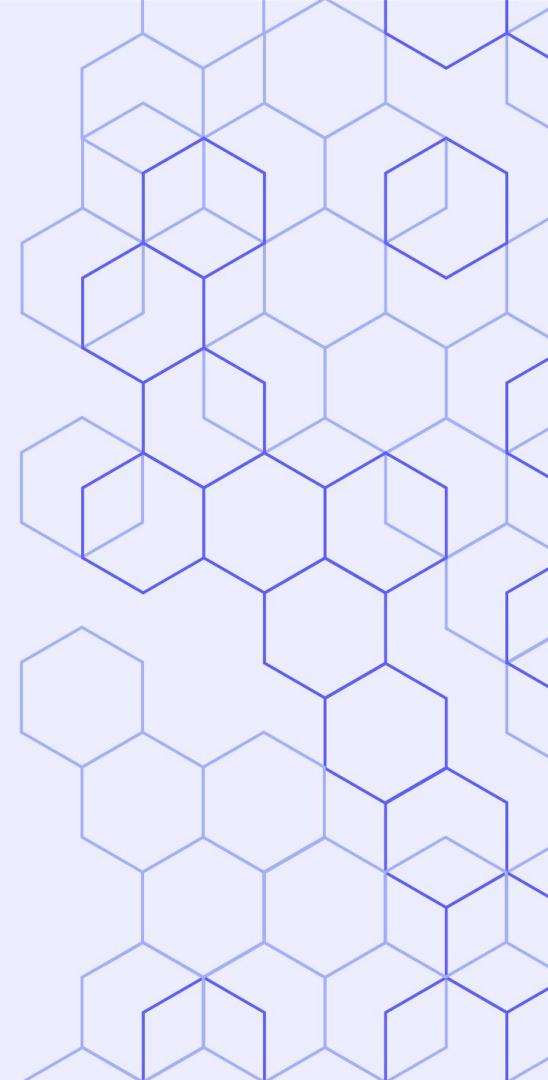
#3A: Technical Feasibility:

“Can AI produce good enough budgets in a short enough time-frame?”

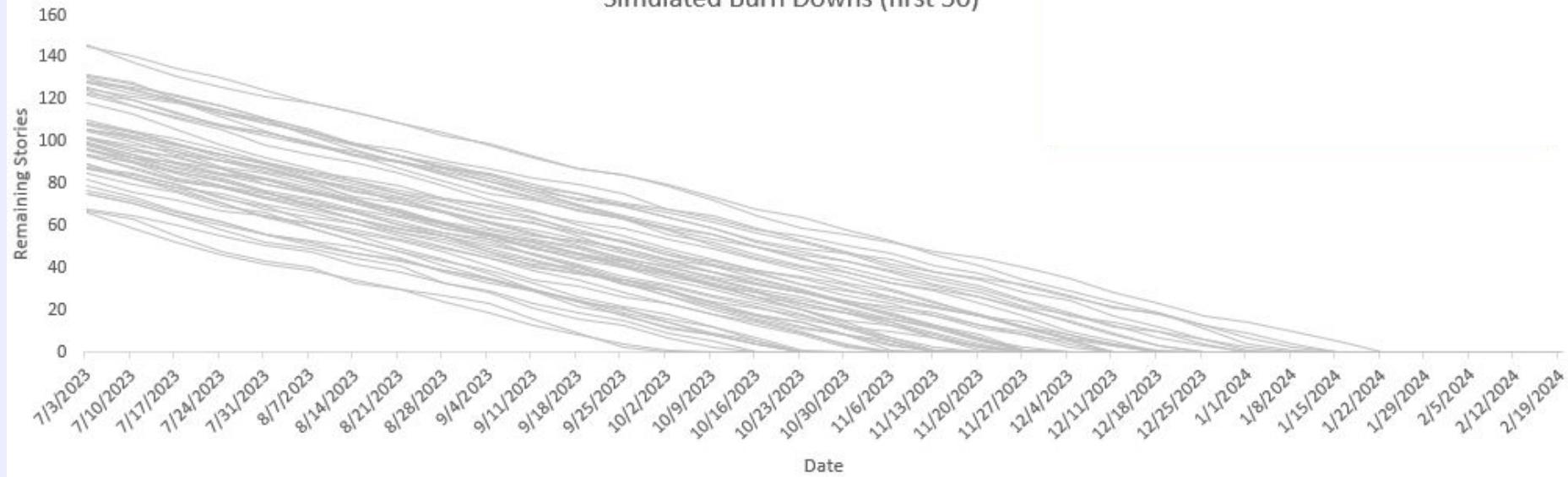


#3B: Market Feasibility:

“Does the market want this product and how would they use it?”



Simulated Burn Downs (first 50)



What would it take to bring [product name] to life?



Results

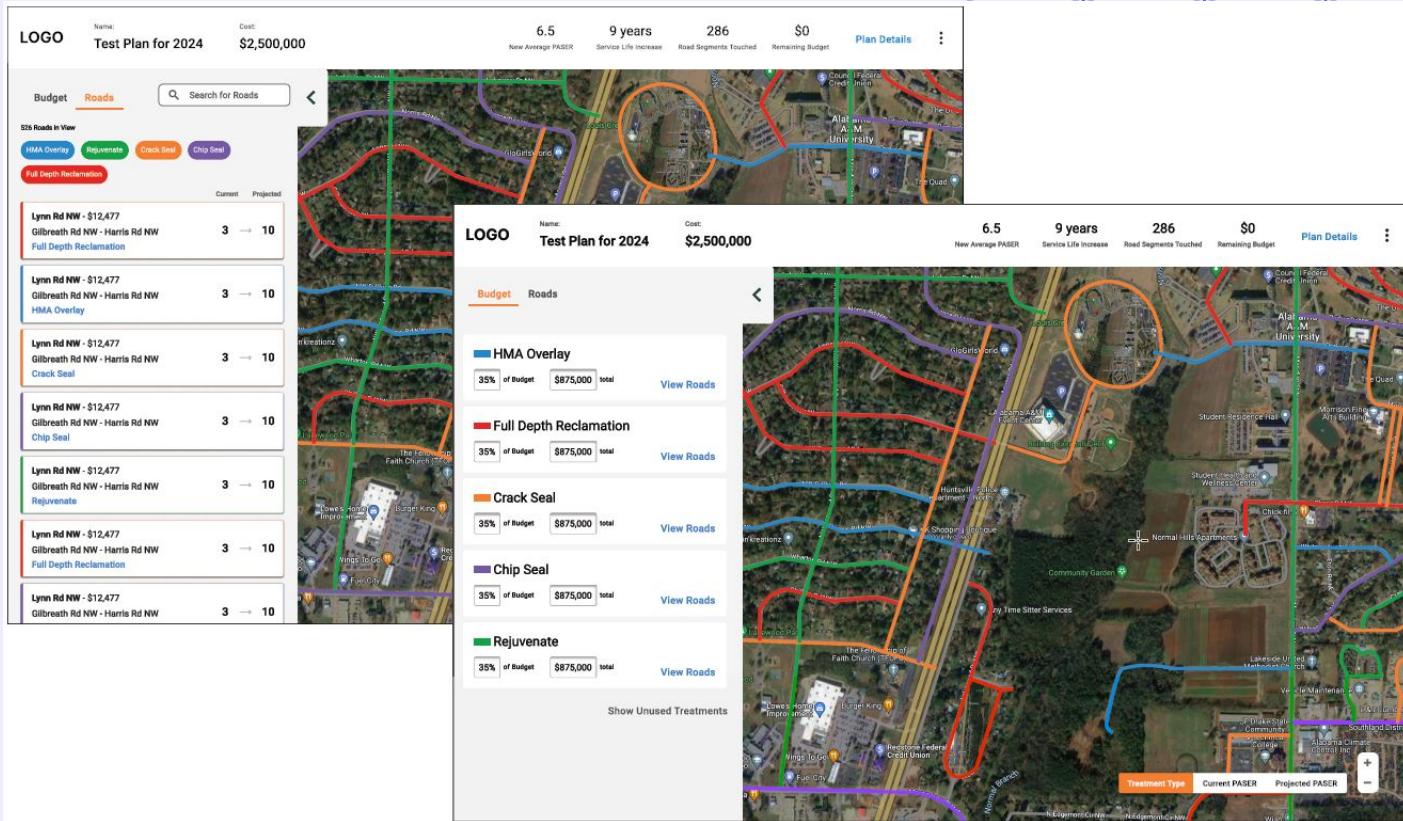
Likelihood	Duration	Date	
100%	34	2/26/2024	
95%	28	1/15/2024	
90%	27	1/8/2024	
85%	26	1/1/2024	
80%	25	12/25/2023	
75%	24	12/18/2023	
70%	23	12/11/2023	
65%	23	12/11/2023	
60%	22	12/4/2023	
55%	21	11/27/2023	
50%	21	11/27/2023	
45%	20	11/20/2023	
40%	19	11/13/2023	
35%	19	11/13/2023	
30%	18	11/6/2023	
25%	17	10/30/2023	
20%	17	10/30/2023	
15%	16	10/23/2023	
10%	15	10/16/2023	
5%	14	10/9/2023	
0%	12	9/25/2023	

Almost certain

Somewhat certain

Less than coin-toss odds. But if you are

Bet #4: Professional Services



Takeaways

Think probabilistically, not deterministically

- Luck and skill both contribute to the actual outcome
- There is more than one possible outcome
- Not all outcomes are equally likely

Use probabilistic forecasting

- Show multiple options (with their confidence)
- Test the actual outcome against the forecast
- Update the forecast with new info

Communicate the uncertainty

- Use “bet” language
- Bets have: cost, odds, and outcome
- **It's all about the assumptions & conversations**

Takeaways

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<https://info.sep.com/momentum>

<https://speakerfeedback.momentumdevcon.com>

Bibliography

1. Riddler Hat <https://www.pinterest.com/pin/435371488974838348/>
2. Traffic Congestion <https://www.geotab.com/blog/traffic-congestion/>
3. Weather Cartoon <https://andertoons.com/>
4. Not Sure If <https://www.buzzfeed.com/mikespohr/21-sounds-every-parent-will-immediately-recognize>
5. Malcolm In The Middle https://www.reddit.com/r/MemeTemplatesOfficial/comments/w0pbwi/dewey_behind_door/
6. BatSuit Gantt Chart <https://trumpexcel.com/gantt-chart-in-excel/>
7. Candyland
8. Chess
9. Euchre
10. Blockbuster [https://batman.fandom.com/wiki/Blockbuster_\(Mark_Desmond\)](https://batman.fandom.com/wiki/Blockbuster_(Mark_Desmond))
11. Dangling Riddler <https://comicvine.gamespot.com/riddler/4005-3718/>
12. Google Maps <https://smartphones.gadgethacks.com/how-to/see-what-traffic-will-be-like-specific-time-with-google-maps-0193097/>
13. Hurricane Sandy 1 <https://www.npr.org/2012/10/31/164046039/high-def-storm-models-yielded-accurate-predictions>
14. Hurricane Sandy 2 <https://metofficenews.files.wordpress.com/2012/10/nhc-hurricane-sandy-forecast-track-29-october-20121.gif>
15. Highlights for Children <https://www.ebay.com/itm/285201209609>
16. Goofus and Gallant https://en.wikipedia.org/wiki/Goofus_and_Gallant
17. Glen Alleman http://herdingcats.typepad.com/my_weblog/2011/03/use-and-misuse-of-the-normal-distribution.html
18. Monte Carlo Casino https://en.wikipedia.org/wiki/Monte_Carlo_Casino
19. Douglas Hubbard <https://www.hubbardresearch.com/about/hdr-staff/>
20. Troy Magennis <https://www.focusedobjective.com/>
21. Poker <https://www.sciencenews.org/article/poker-pros-arms-betray-their-hands>
22. Joker <https://nofilmschool.com/2020/07/joker-film-theory>
23. Riddler Reputation <https://girloncomicbookworld.wordpress.com/2015/06/24/the-riddler-character-analysis-psychopath/>
24. Two-Face [https://dc.fandom.com/wiki/Harvey_Dent_\(New_Earth\)](https://dc.fandom.com/wiki/Harvey_Dent_(New_Earth))
25. Batman With Bomb <https://www.slashfilm.com/1212116/batmans-famous-bomb-scene-highlighted-adam-west-s-favorite-part-of-the-show/>
26. Spotify Rhythm <https://blog.crisp.se/2016/06/08/henrikkniberg/spotify-rhythm>
27. Batman and Ghost-Maker <https://twitter.com/batman/status/1340341121759764481>
28. John Cutler Bet Template <https://www.mindtheproduct.com/bets-boards-missions-and-north-stars-by-john-cutler/>
29. Pavement Degradation <https://omdena.com/chapter-challenges/highway-asphalt-pavement-degradation-classification/>

