# 2018 ASNY PRESENTATION

# ASSUMPTION DEVELOPMENT: HYBRID BETWEEN TRADITIONAL METHODS AND ADVANCED TECHNIQUES

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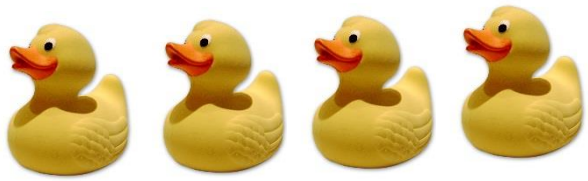
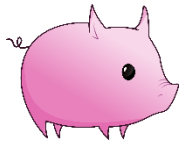
*Views expressed in this presentation are presenter's only*

# Roadmap

- Intro and definitions
- Assumption Setting: general principles
- Advanced techniques
  - adding value
  - creating challenges
  - ineffective
- Conclusion

# Intro and definitions

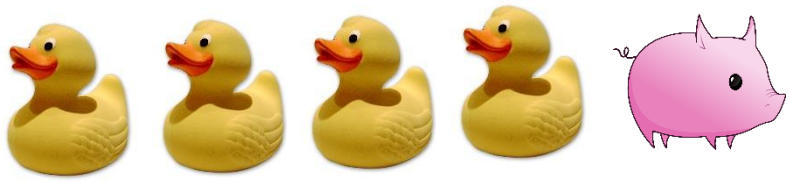




…Predict the next 3 observations

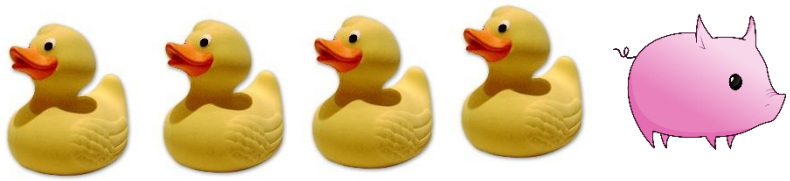
- **Best Estimate Assumption:** your single source of truth
- **Traditional methods:** initial judgement, A/E analysis, confidence intervals, credibility theory, etc.
- **Advanced techniques**: data mining, predictive modelling, machine learning, etc.
- **Assumptions perspective:** where you stand depends on where you sit!
  - short term vs long term products
  - inforce size
  - pricing vs valuation

# Assumption Setting: general principles



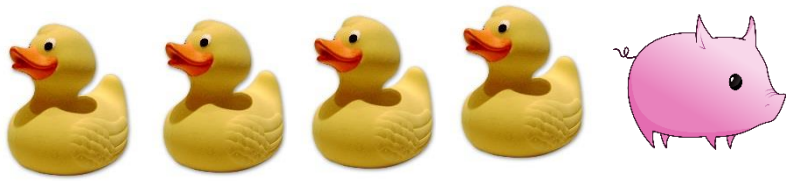
- ❑ Credible and relevant data — Are you ready?
- ❑ Confidence before change — Are you sure?
- ❑ Granularity needed — Interesting vs important?
- ❑ Comprehensive vs isolated — Study deep enough?
- ❑ Directionally appropriate — Want to go half way?
- ❑ Account for implementation — Will users be happy?

# Advanced techniques: adding value



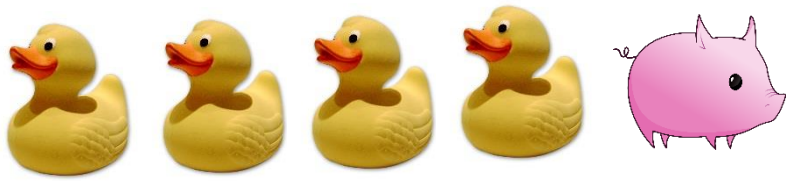
- Use data more efficiently
- Capture insights into main drivers, discover new drivers, more complex trends, interactions, correlated variables.
- More granular view if the application requires it, e.g. new product pricing, targeted inforce management, customer-level predictions.
- R&D efficiency
- Reduce reliance on SMEs

# Advanced techniques: creating challenges



- Complex is the enemy of good (and management)
- Increases cost of development and maintenance
- Complicates validation and controls
- Implementation fun: multiple uses, models, users, and model limitations.

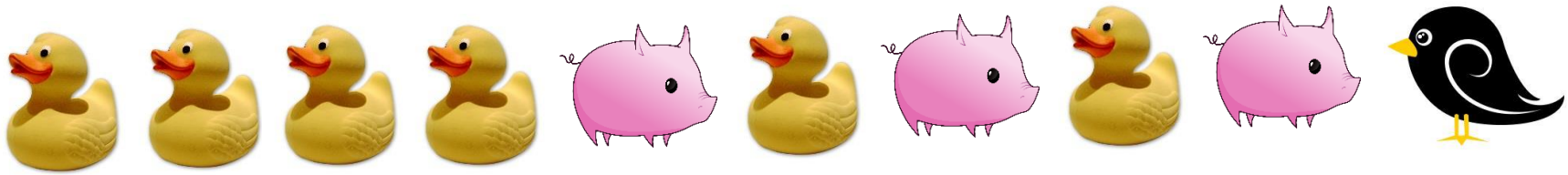
# Advanced techniques: ineffective



- Little data
- Data selection decisions: outliers, time period, etc.
- **Extrapolation: long term projections or extreme stochastic scenarios, which could very well be most interesting to management.**

# Conclusion

- Be smart: good judgement is as important as latest techniques.
- Where you stand depends on where you sit.
- Solution to the riddle: the sequence will alternate between ducks and pigs and that pattern will work for a while…until it doesn't and we start all over again.



# Agent Based Models and Assumption Setting

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Julia Romero and Eric Budde

# Overview

- Agent based models – things. making choices for reasons. in a system
- Building and maintaining ABMs – Getting ready to be ready
- ABMs and Assumptions – The there there

# What / When

# What are agent based models (ABMs)

## Agents

Make decisions, responding to stimuli

Have states, goals, and histories

Policyholders, advisors, companies, household members, ...

## Environments

Circumstances that agents live within

Change with time and external factors

Financial, labor, real estate markets; natural and political conditions; other agents ...

## Calibration

Assign weights to agent decision functions

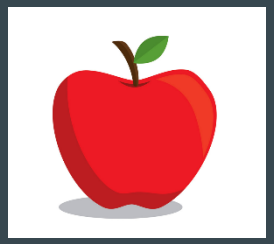
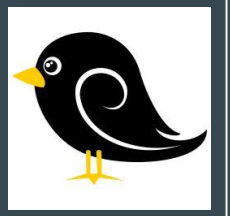
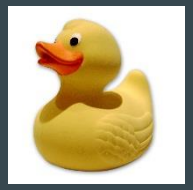
Iterative process

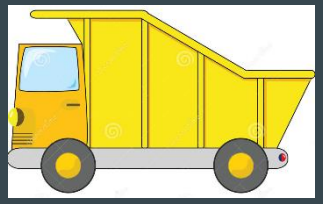
Ceteris paribus and mutatis mutandis

Data, algorithms, and power

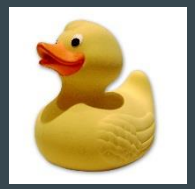
# When are ABMs a good idea?

Possible Outcomes

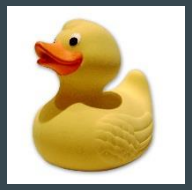


Observed Outcomes



# DON’T DO IT!!

Possible Outcomes



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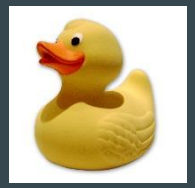


# ABMs are Hard:
# How to succeed at ABMs

# The hard parts….

- Data perfection
  - Fully descriptive
  - Historically complete
  - Unbiased
- Managing complexity
  - Dev culture
  - Debugging complex systems
- Efficient calibration
  - ~100k agents, ~20 years
  - Broad search space

***Avoid simulation disasters***

# Data Perfection: Fully descriptive & historically complete

"Hey it's 1995 and I want to retain transaction level data"

**Block Blobs**

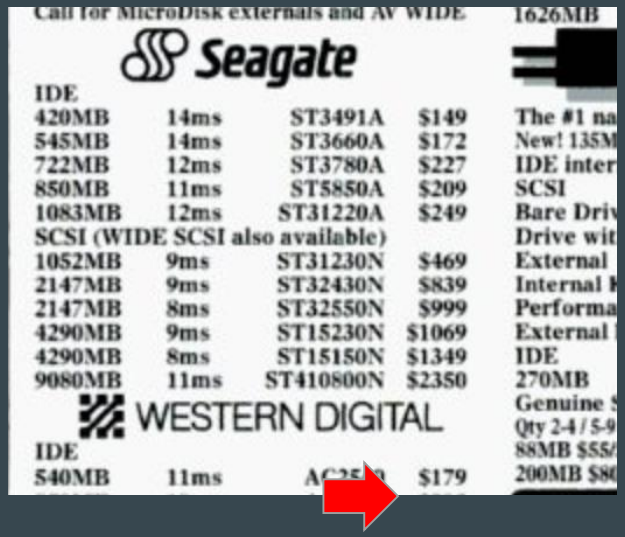
Scalable object storage for documents, videos, pictures, and unstructured text or binary data. Choose from Hot, Cool, or Archive tiers.

Prices for locally redundant storage (LRS) Archive Block Blob start from:

**$0.002**/GB per month

See Pricing >





# Data Perfection: Accurate and unbiased

Using legacy reporting infrastructure can be problematic

- “Shoe-horning”
- “Black box daisy chain”

Data is ***not*** missing at random, data is ***not*** inaccurate at random

***The Inforce bias***

- Generalizing from the inforce

# Solution: Dealing with unknowns

Locate and assess your historical datasets before you start

Missing ***values*** need to be imputed

- Be careful

Missing ***attributes*** need to be appended from other sources

- Statistical matching
- Age, Gender, Zip+4

# Solution: Source data from policy admin systems

Get as close to the policy admin system as possible

- Admin systems are typically ***Authoritative Systems of Record***

*Find the product expert*

- Prepare visualizations
- Have this person ***sanity check*** the data
- It works

# Managing complexity: Debugging complex systems

## Agents

Make decisions, responding to stimuli

Have states, goals, and histories

Policyholders, advisors, companies, household members, ...

## Complexity

Emergent behavior not known in advance

Agents are complex, interacting, and stateful

If an agent is a policyholder, a complete product implementation is required

***Lots of code***...

# Solution: Dev culture

| | |
|---|---|
| Version Control | • Github, gitlab, vsts/azure devops, etc<br>• Platforms for collaborative coding |
| Code Review | • “Merge requests”<br>• Branch policy enforcing tests and peer review |
| Automated Testing | • Unit tests, regression tests, integration tests |
| Test Coverage | • Bonus points |

# Solution: Test product against the admin system

Product implementation, environment (market), historical data in a high performance environment

Process the entire dataset through your implementation

Why not?

***"The ultimate test"*** of your product implementation

# Efficient calibration

## Calibration

Assign weights to agent decision functions

Iterative process

Ceteris paribus and mutatis mutandis

Data, algorithms, and power

## Scale

One simulation:

- ~100k agents
- ~20 years

Calibration

- One simulation per set of weights
- Broad search space for the optimizer

# Solution: Performance

Choose the right language

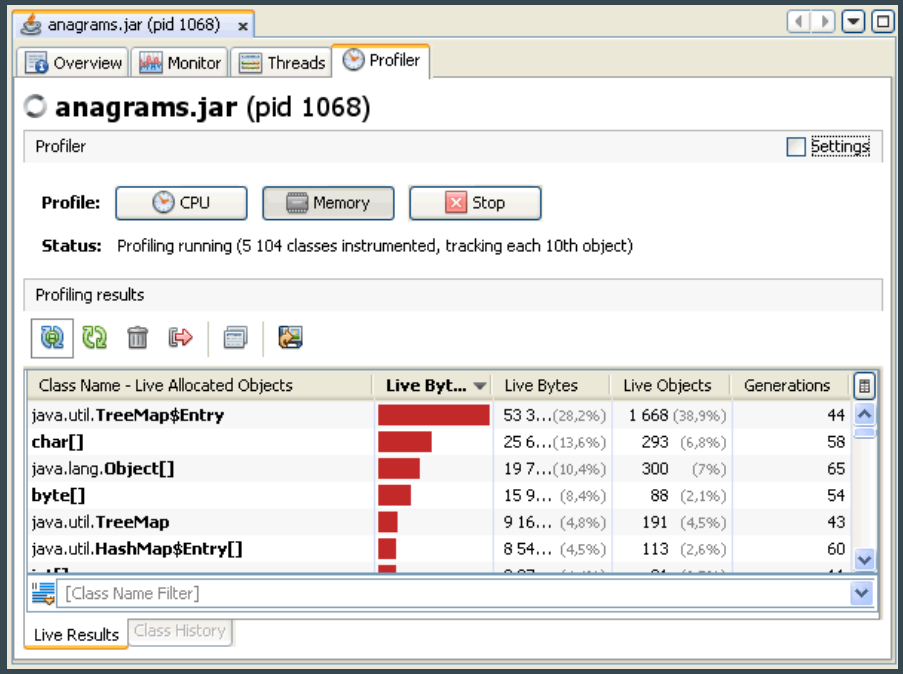
- Compiled, statically typed

Use a profiler

- Find the slow parts, make them faster

Don’t DIY the optimizer

- Support for parallelization



# The hard parts….

- Data perfection
  - Fully descriptive
  - Historically complete
  - Unbiased
- Managing complexity
  - Dev culture
  - Debugging complex systems
- Efficient calibration
  - ~100k agents, ~20 years
  - Broad search space


***Avoid simulation disasters***

# The fun parts….

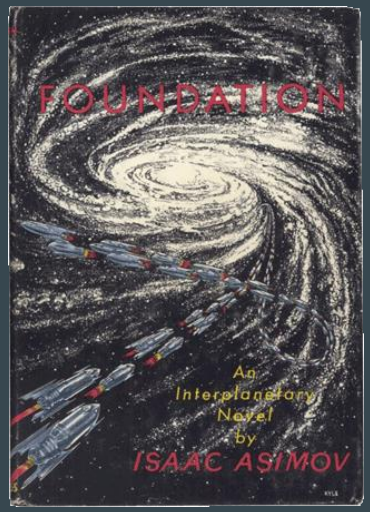
- Data perfection
  - Valuable, reusable
- Managing complexity
  - Important, normal
  - Establishes a dev practice
- Efficient calibration
  - Access to scale

***Discover interesting, emergent behaviors***

# How do you use ABMs to set assumptions?


Laboratory






Future experience

Direct integration of stochastic behavior

Thank you.

Q&A