Understanding human decision making and bias: *The foundation of effective analytics and data science*

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Agenda

- Why should we understand decision making?
- Common decision-making approaches
- Cognitive bias
- Business decisions and decision support
- Decision-centric analytics
- Implications for analytics in organisations

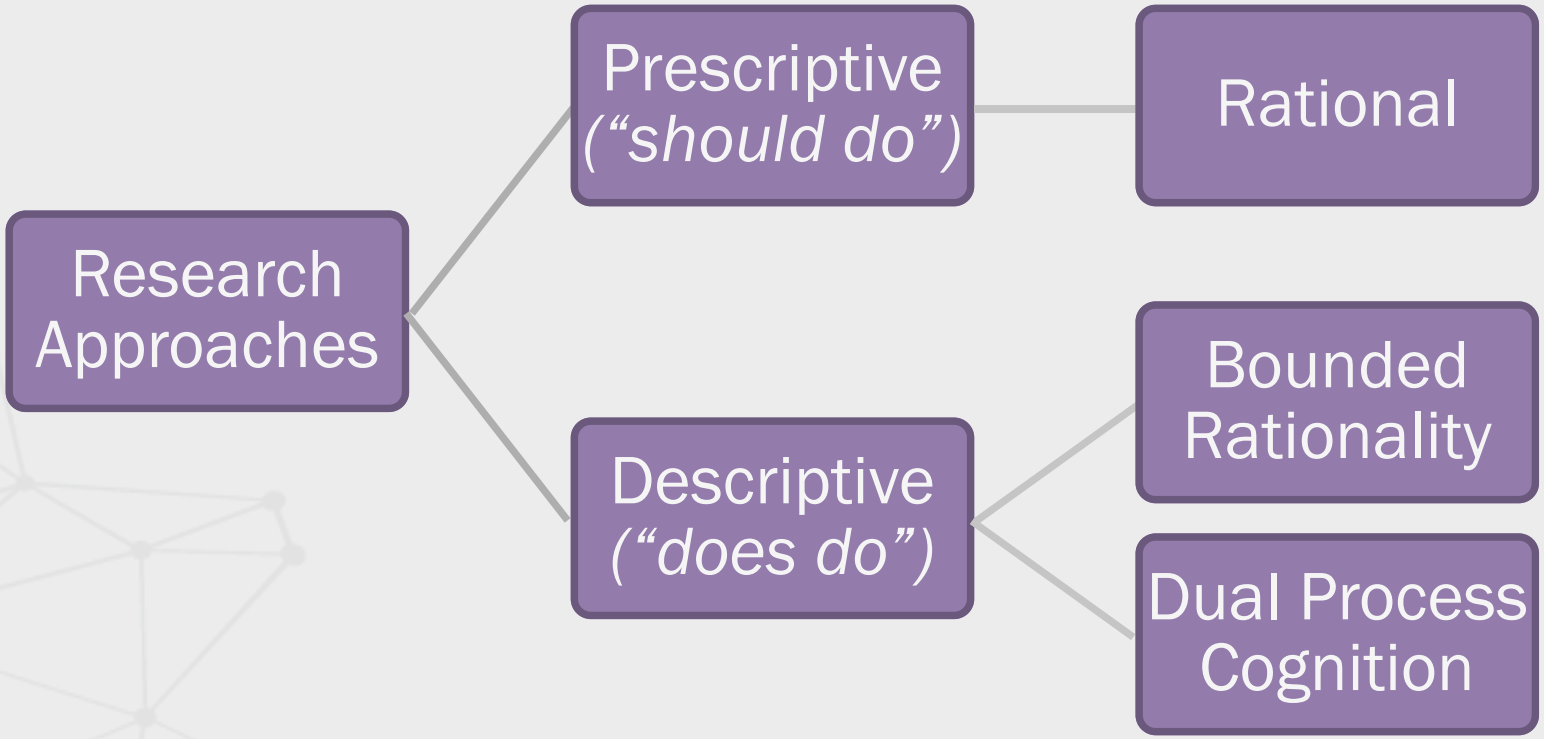
Why should we understand decision-making?

Analytics is the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to monitor organisation performance and ***support or automate decision making***

Adapted from Davenport and Harris, 2009

Human Decision Making

Decision making is a mental or behavioural commitment to a course of action.



How did you make the decision to attend the presentation tonight?

Rational Decision Making

- Often associated with economic modelling
  - *"Homo Economicus" – Rational Man*
- Assumes people…
  - *…are consistently rational*
  - *…always have perfect information*
  - *…always have sufficient time*
  - *…always seek to maximise utility*

Rational Decision Making

Humans rarely make purely rational decisions.

The Typical Process

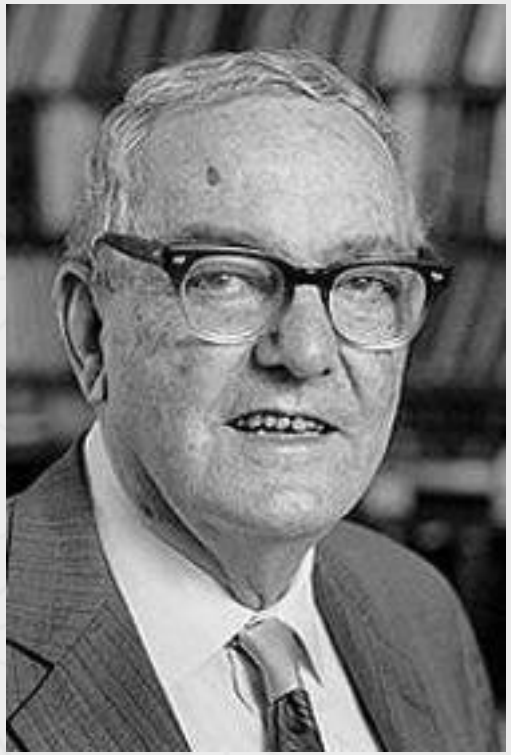
1. Define the problem
2. Identify the decision criteria
3. Weight the decision criteria
4. Generate alternatives
5. Rate each alternative against criteria
6. Compute optimal decision

The Common Problems

- Is the problem perfectly defined?
- Are ***all*** decision criteria identified?
- Are ***all*** decision criteria weighted ***fairly***?
- Are ***all*** alternatives considered?
- Are ***all*** alternatives rated ***fairly***?
- Is the best alternative actually chosen?

Bazerman and Moore, 2009

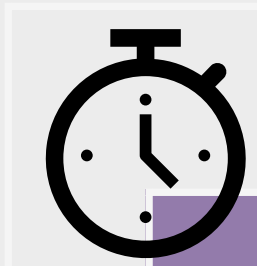
Bounded Rationality



- Human cognition is limited or ***"bounded"***
  - *Information is not always readily available or is too expensive (time or money)*
  - *All options cannot easily be identified or accurately considered*
  - *Subjective viewpoints cannot be eliminated*
- Usually a ***satisfactory*** or "good-enough-under-the-circumstances" decision is made
- A rough model of human decision making

17 x 24

Dual Process Cognition



System 1

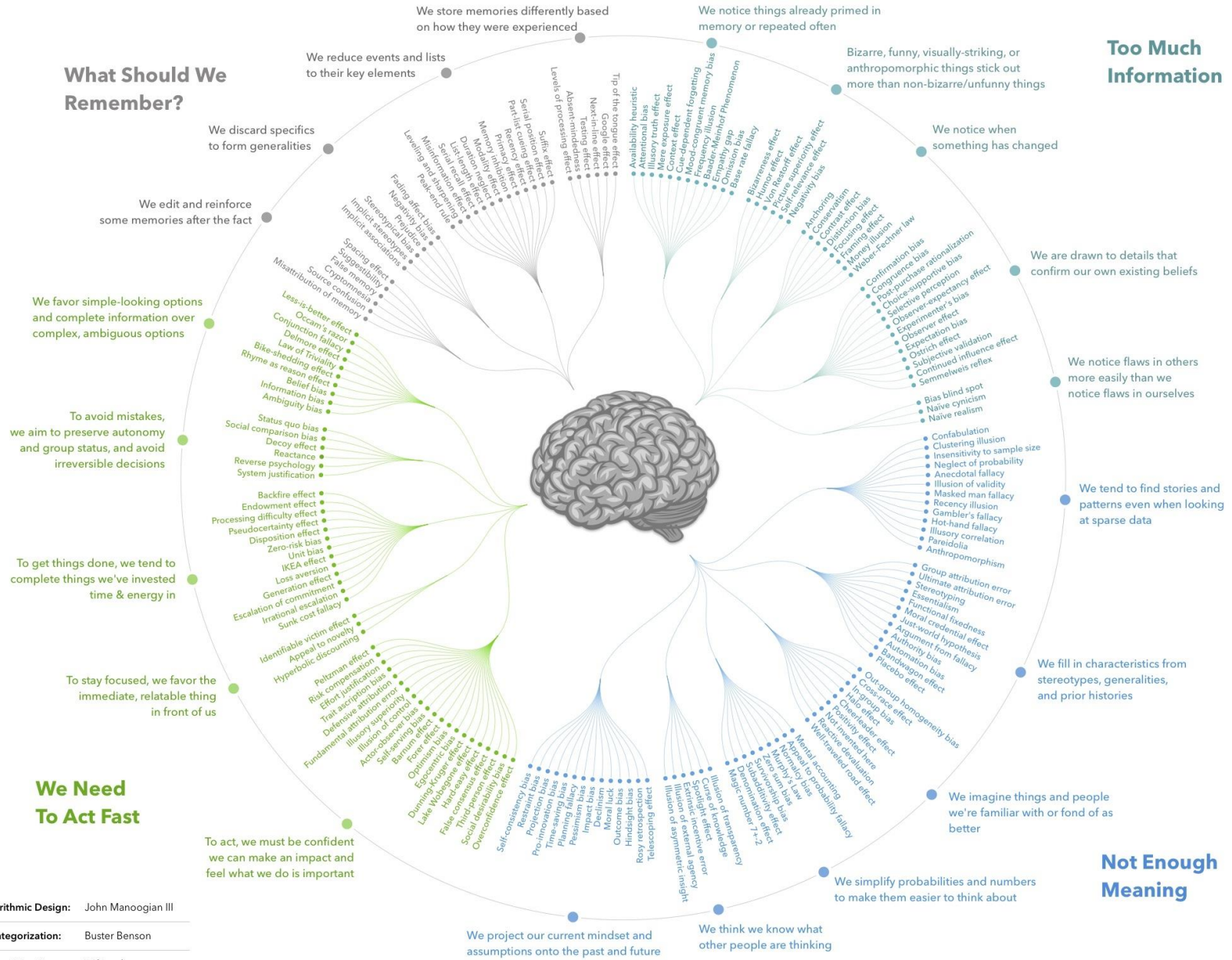
- "Fast"
- Unconscious
- High Capacity
- Automatic
- Effortless
- Heuristics-Based
- Skilled
- Error-Prone

System 2

- "Slow"
- Conscious
- Low Capacity
- Controlled
- Effortful
- Rule-Based
- Process-Following
- Predictable

Kahneman, 2011

COGNITIVE BIAS CODEX



Visual & Algorithmic Design:	John Manoogian III
Concept & Categorization:	Buster Benson
List of 188 Cognitive Biases:	Wikipedia

designhacks.co

Cognitive Biases

A systematic deviation from rational decision making outcomes

- A consequence of applying the heuristics of System 1 thinking
- **The Availability Heuristic** – Over reliance on readily available information
  - ***Retrievability Bias*** – *Unintended employment discrimination*

- **The Representativeness Heuristic** – Over reliance perceptions of stereotypical groups
  - ***Ignoring Base Rate Bias*** – *Over-optimistic start-up founders*

- **The Confirmation Heuristic** – Over emphasise importance of information we agree with
  - ***Anchoring and Adjustment Bias*** – *Post graduate salary negotiations*

Bazerman and Moore, 2009

Decision Making Exercise

The Scenario

You have been diagnosed with a very serious illness, which, if left untreated, will become fatal.

Your doctor has presented you with data that describes the outcome statistics for each treatment option.

Your doctor has asked you to read the outcome statistics and decide which treatment option you would choose.

Survival Framing

Treatment A

Of 100 people having Treatment A, 90 live through the post-treatment period, 68 are alive at the end of the first year and 34 are alive at the end of five years.

Treatment B

Of 100 people having Treatment B, all live through the post-treatment period, 77 are alive at the end of the first year and 22 are alive at the end of five years.

Mortality Framing

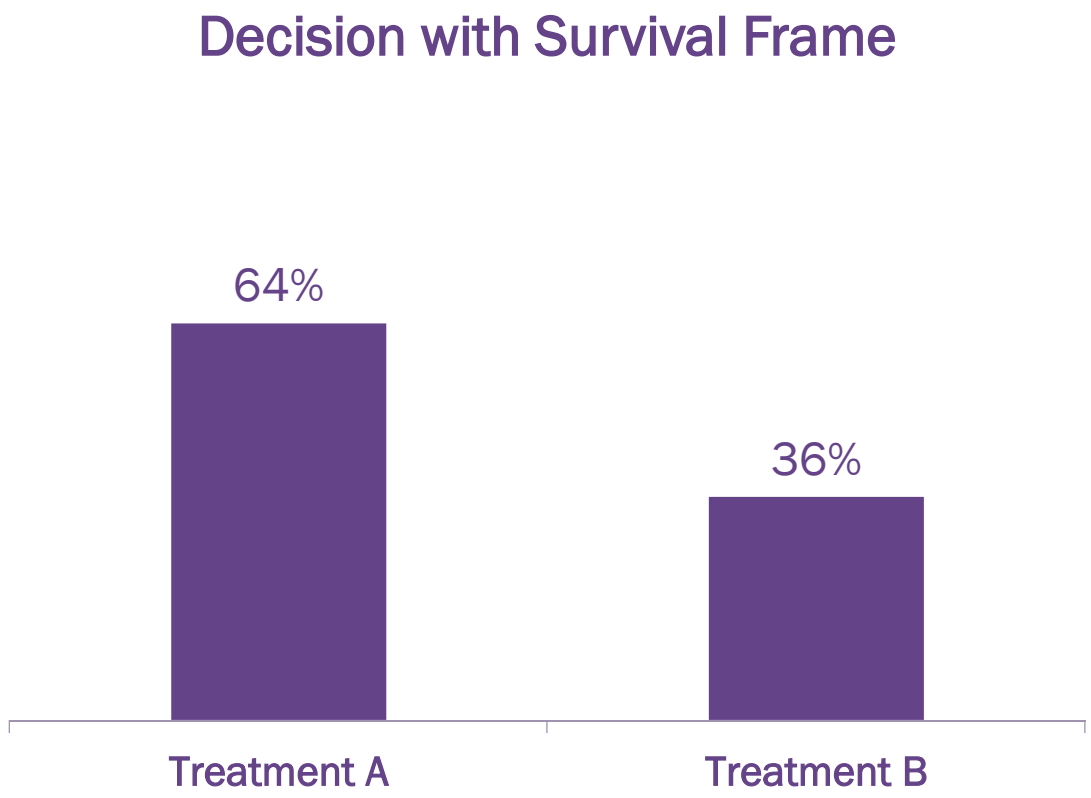
Treatment A

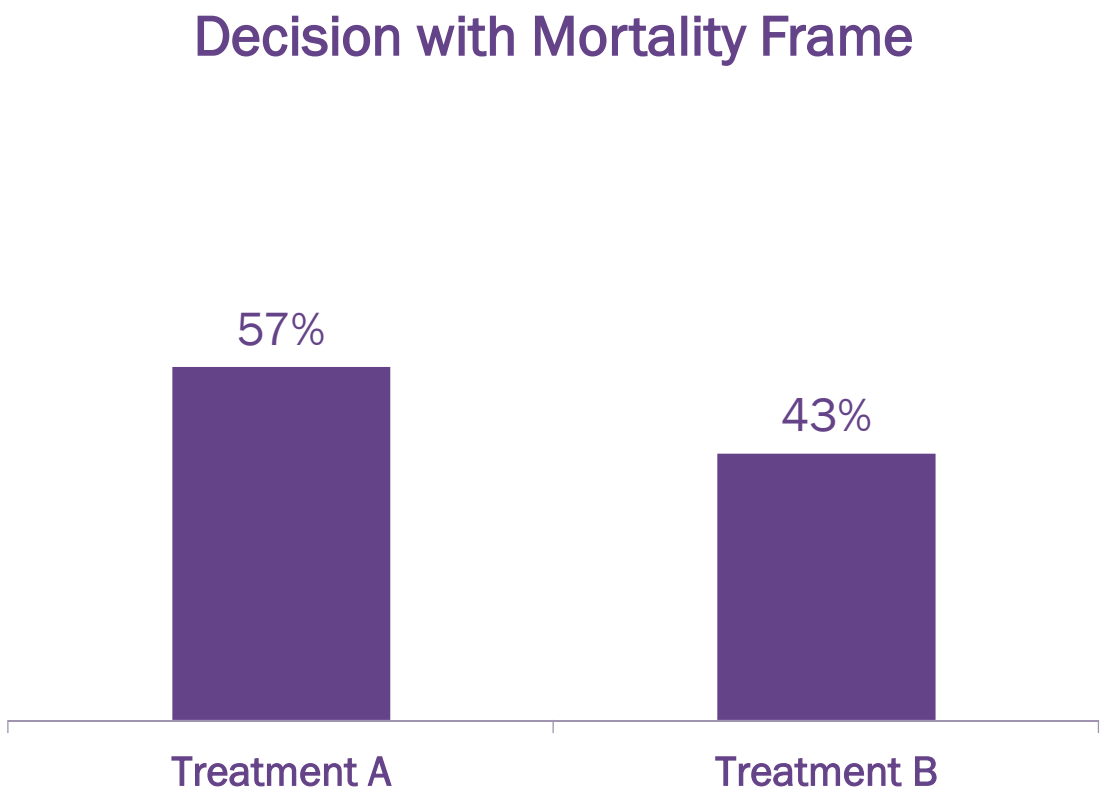
Of 100 people having Treatment A 10 die during the treatment or in the post-treatment period, 32 die by the end of the first year and 66 die by the end of five years.

Treatment B

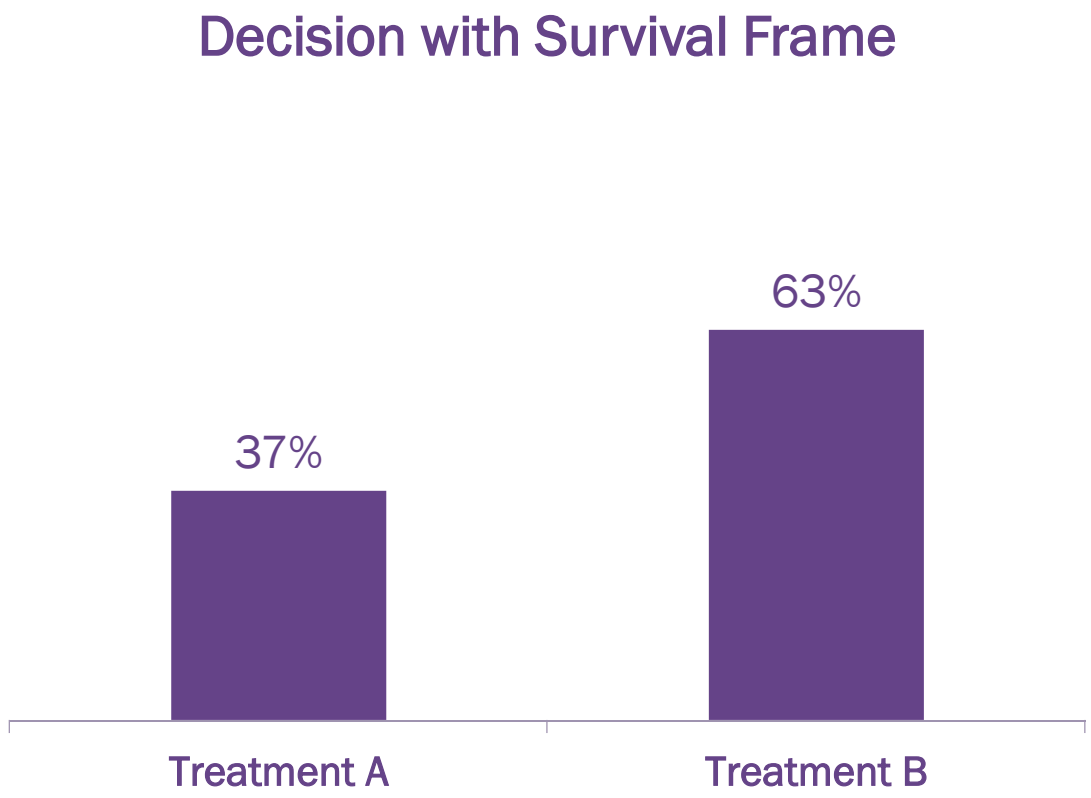
Of 100 people having Treatment B none die during treatment, 23 die by the end of the first year and 78 die by the end of five years.

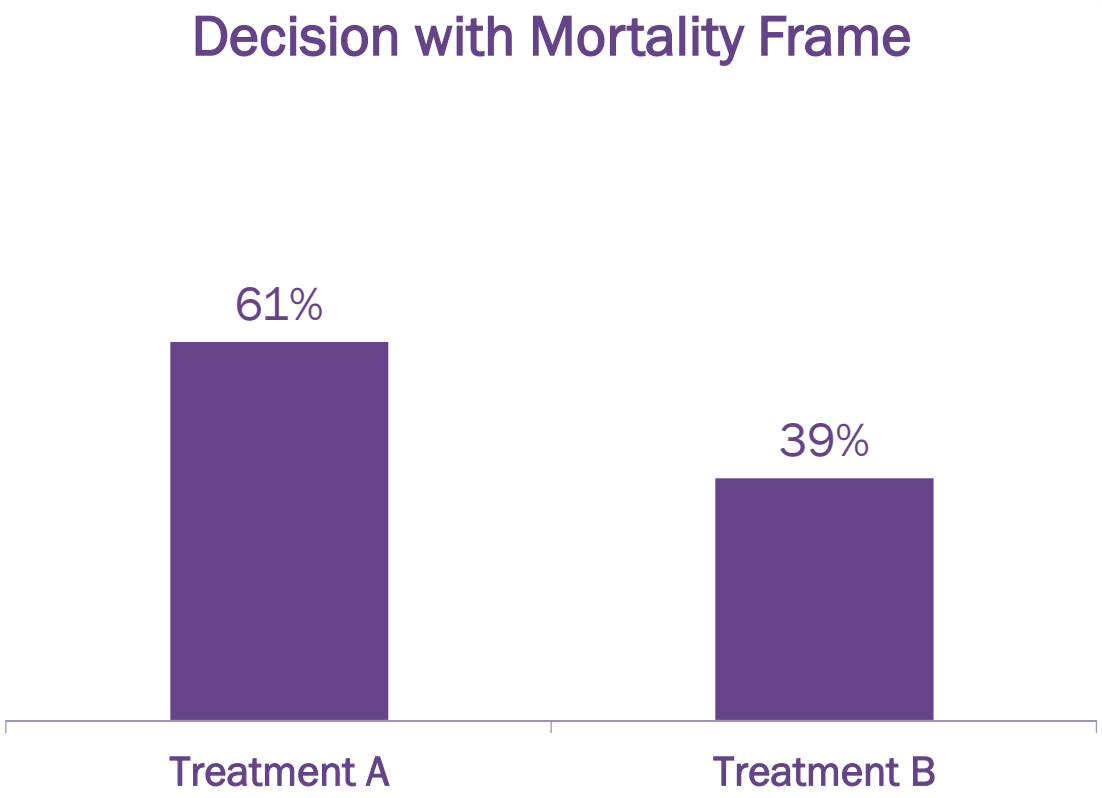
Framing and Decision Making – *Jakarta*





Framing and Decision Making – *Research*





Minimising Cognitive Bias

The effect of cognitive biases can never be eliminated, only minimised

- **Use decision support and automation tools**
  - *Identify decisions prone to bias*
  - *Analyse the decision process*
  - *Build tool to support or make decision*
    - Beware of bias being built into tool
- **Acquire More Domain Expertise**
  - *Learn when System 1 fails you*
  - *Move from System 2 to System 1*
    - Requires long-term, accurate and immediate feedback on outcomes
- **Debias Judgement**
  - *Unfreeze – Show person their biases*
  - *Change – Examples with explanations*
  - *Refreeze – Practice and review*
- **Review Decision Making Processes**
  - *Good for approach strategic decisions*
  - *Focus on identifying bias in advisers*
    - Use systematic approach to identify biases in advice provided

Bazerman and Moore, 2009 | Kahneman, 2011

Business Decisions

Types

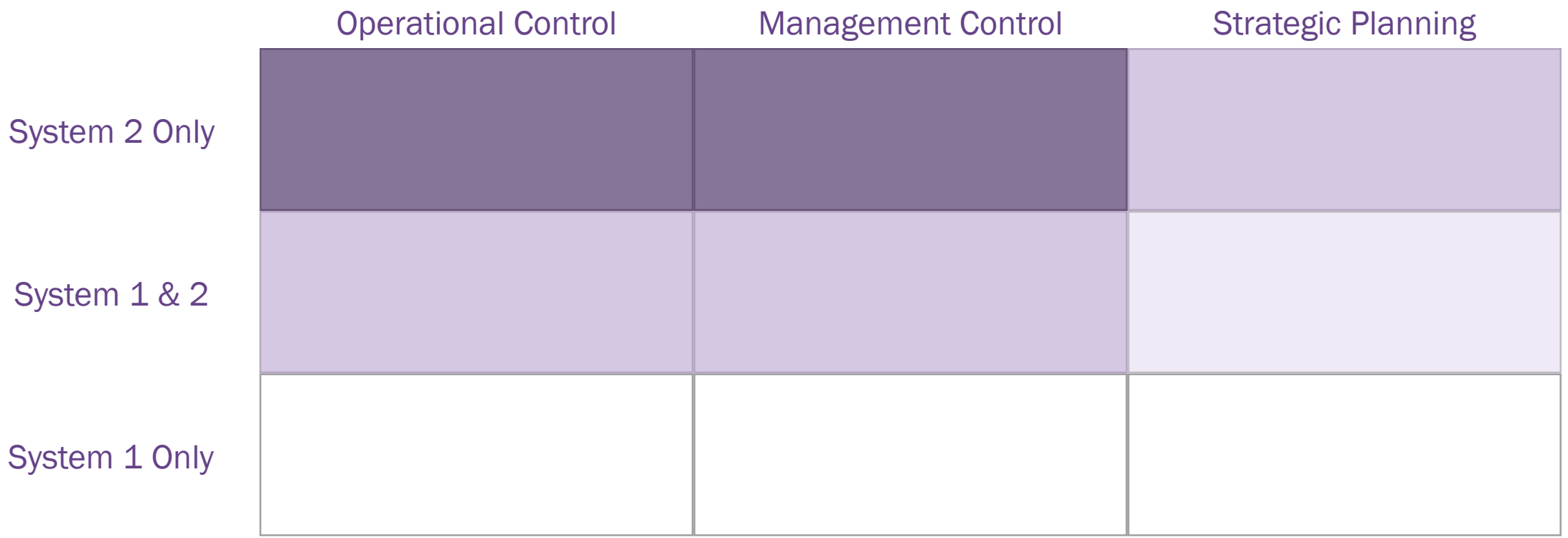
- System 2 Only
  - *Decisions with clear context and known process to solve*
- System 1 and System 2
  - *Decisions where intuitive responses are reviewed and revised with processes*
- System 1 Only
  - *Decisions that can only be made with skill and intuition (i.e. no process)*

Levels

- Strategic Planning
  - Set long-term goals and determine resources required
- Management Control *(a.k.a. "Tactical")*
  - *Obtain resources and allocate them efficiently and effectively*
- Operational Control
  - *Ensure tasks are completed efficiently and effectively*

Arnott, Lizama & Song, 2017

Decision-Centric Analytics



Adapted from Arnott, Lizama & Song, 2017

Types of Analytics

Descriptive

- Standard Reports
- Dashboards
- Ad Hoc Reports
- Query / Drill Down
- Alerts

Explanatory

- Statistical Analysis
- Numerical Analysis

Predictive

- Forecasting
- Propensity
- Segmentation
- Network Analysis

Prescriptive

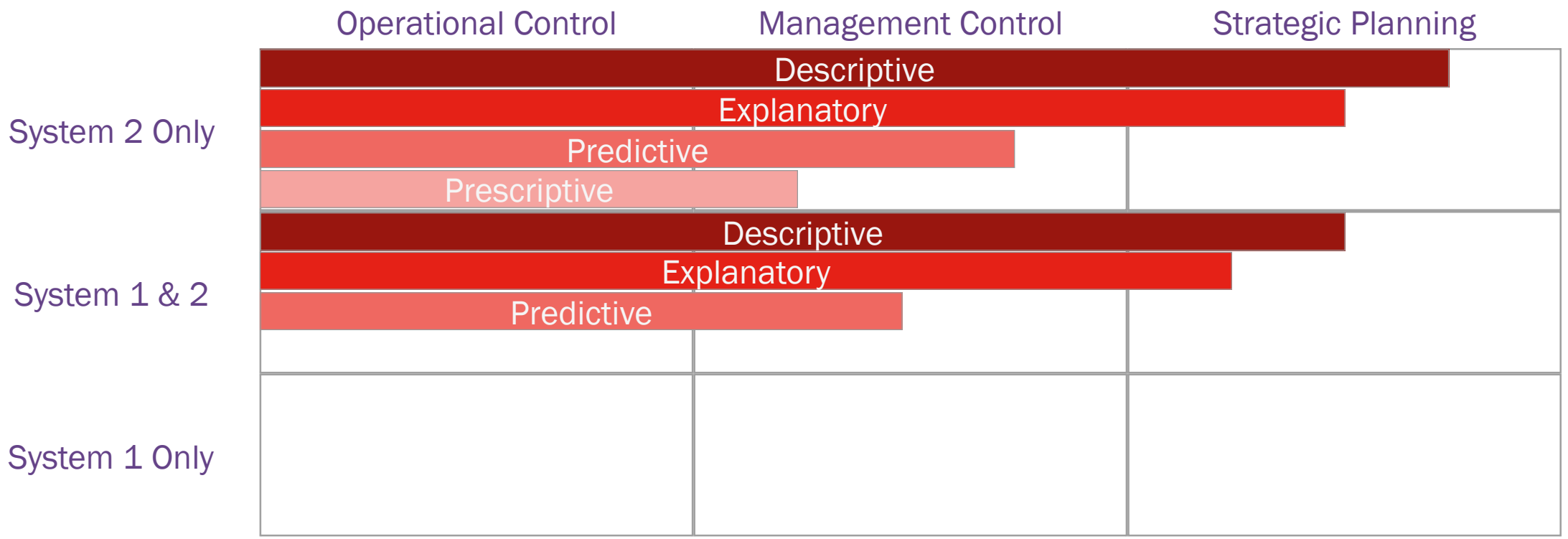
- Optimisation
- Machine Learning
- Experiments

← *"Traditional"?, "Low-Value"?* →

← *"Modern"?, "High-Value"?* →

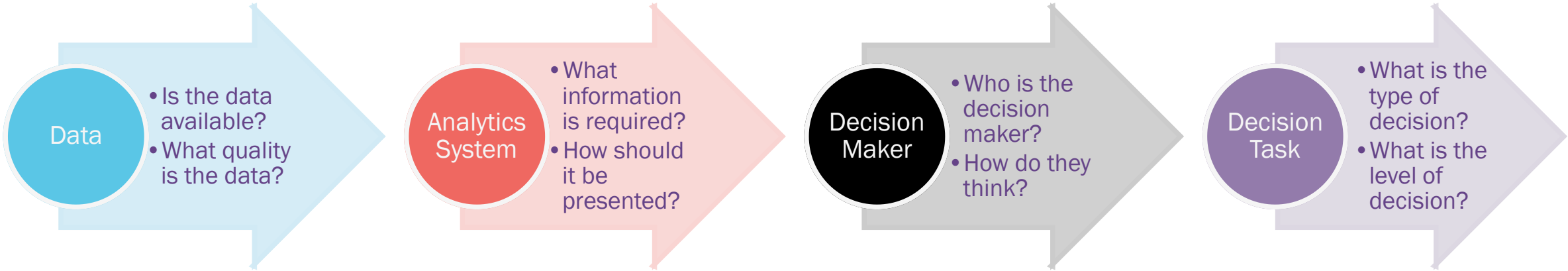
Davenport, 2017

Decision-Centric Analytics



Adapted from Arnott, Lizama & Song, 2017

The Decision-Centric Approach



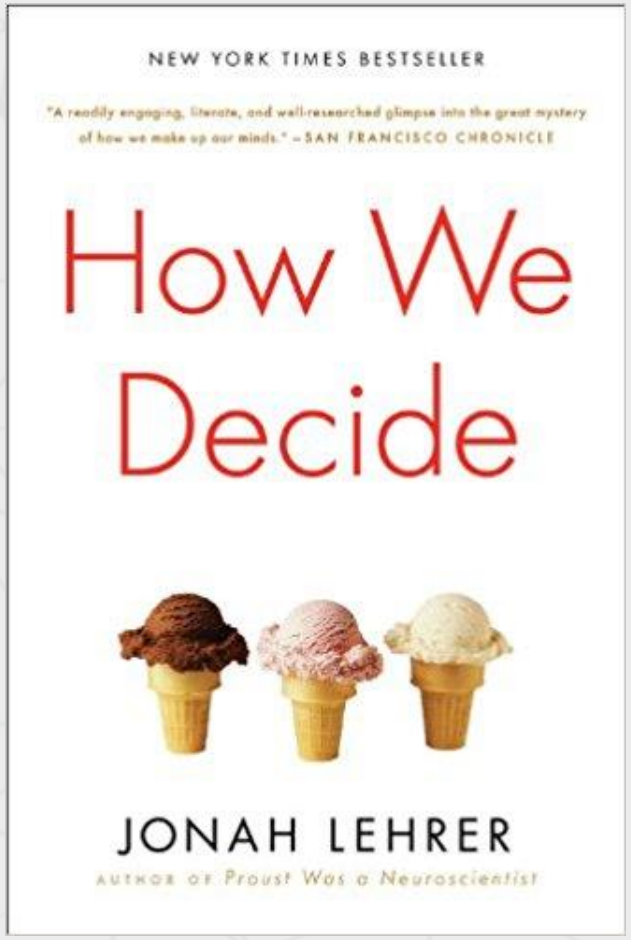
Summary of Human Decision Making

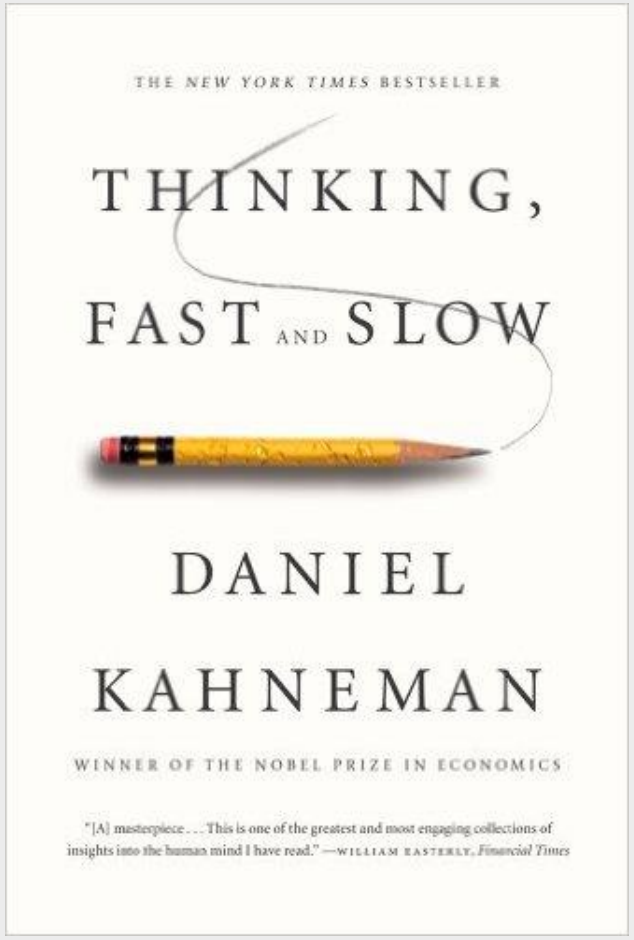
- Humans rarely (~5% of the time) make pure rational decisions
- Bounded Rationality is a rough approximation of the decision making process
- Dual Process Cognition is the most accurate model of human decision making
  - *System 1: "Fast", Unconscious, High Capacity, Effortless, Heuristics-Based, Error-Prone*
  - *System 2: "Slow", Conscious, Low Capacity, Controlled, Rule-Based, Predictable*
- Dominance of System 1 often leads to cognitive biases, especially when cognitive load is high.
- Cognitive biases mean human decision making is subject to personal preference
  - *Same decision task can lead to different decision for different people*
- Inherently ambiguous, especially for strategic decisions – No one right process or answer.

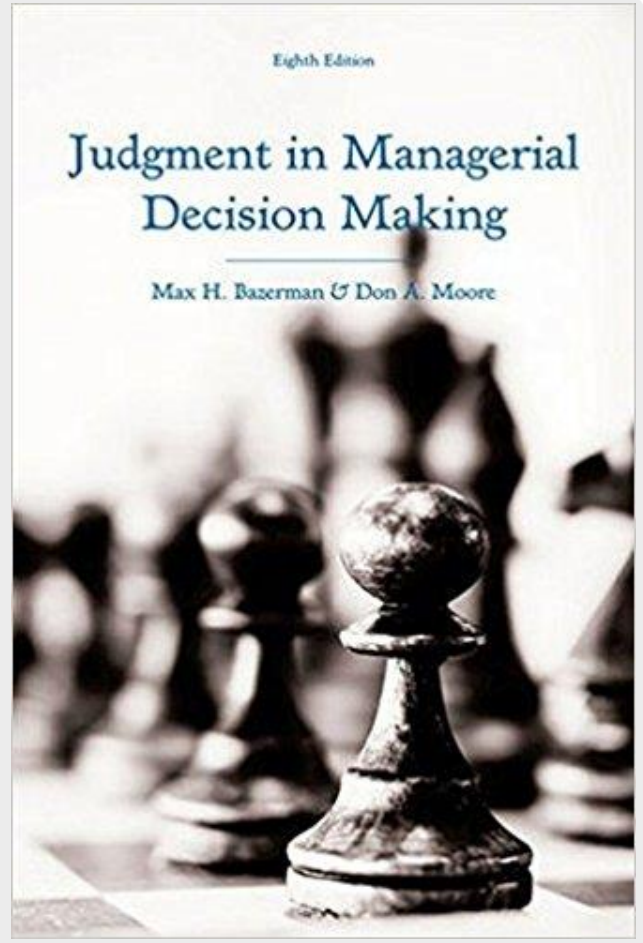
Implications for Analytics Programs

- Business Analytics should be decision-driven and business-owned
  - *Ensures output from analytics function is more closely aligned with business needs*
- There are no traditional/modern or high-value/low-value types of analytics
  - *All type or analytics are valuable.*
  - *Match the type of analytics to the type and level of decision being made*
- Intuitive decision-making is not intrinsically good or bad
  - *Both System 1 and System 2 thinking have their place in organisation decision-making*
- Just having good analytics systems and technically competent teams is not enough
  - *Data-driven decisions require both managers and analytics teams to understand decision-making and biases*

Want to Learn More?







Questions and Comments

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