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# Introduction to Structured Decision Making

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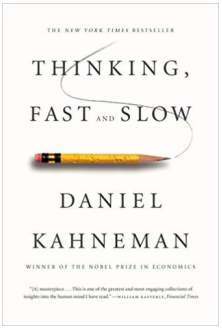
## Human Decision Making

**Daniel Kahneman**
2002 Nobel Prize in Economics

For work he did in partnership with Amos Tversky on how people make decisions

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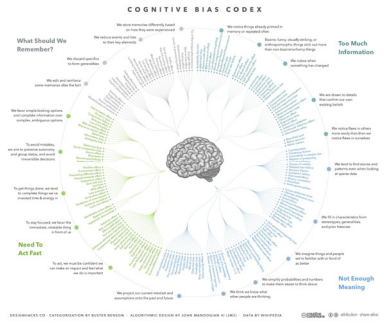
## Cognitive Biases

Now, there's a large body of work on cognitive biases

Two stand out:
1. We tend to jump right to alternatives, without thinking about objectives
2. We tend to anchor on an alternative, and only make small adjustments

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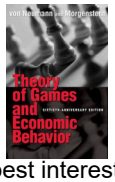
## But earlier…

- The tenets of decision theory were established before there was a Nobel prize in economics:
  - Frank Ramsey (1931)
  - John von Neumann (1944)
  - Leonard J Savage (1954)
- Explore how people should make decisions, if they're acting rationally in their own best interests





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## Structured Decision Making

- The use of a broad set of tools to aid decision makers
  - Drawing from the fields of decision analysis, operations research, economics, human dimensions, management science, behavioral psychology, expert judgment
- A key benefit is to help *structure conversations* about complex decisions
  - Problem decomposition
  - Values-focused thinking

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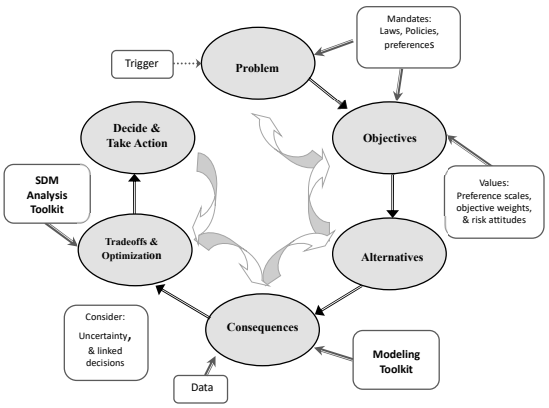


Source: Jean Fitts Cochrane

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## Decision Context

- Who is the decision maker?
- What is their authority to act?
  - How does their authority guide their long-term aims?
- What decisions do they face?
- What is the timeframe and spatial scope of the decision?
- What is the trigger for the decision?

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## Objectives

- The *fundamental objectives* are the desired future conditions that the decision maker is seeking to achieve
- The objectives may be multi-faceted, conflicting, and contentious
- The objectives guide the rest of the planning

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## Alternatives

- A decision is a choice among alternatives
  - But we often fail to consider the range of alternatives that are possible
- There is value in creative development of alternatives
  - Often, we reject creative ideas before we've analyzed them

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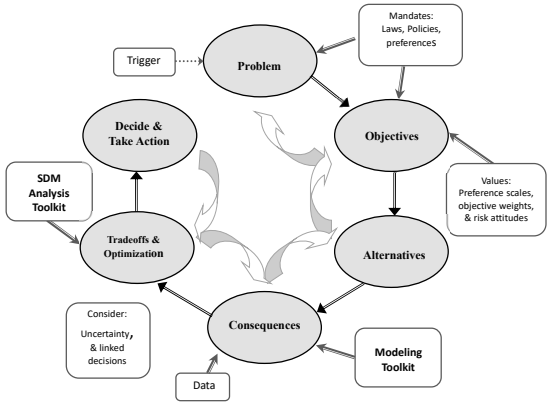


Source: Jean Fitts Cochrane

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## Non-native Fish Control below Glen Canyon Dam

Multiple Objectives

Alternative Strategies

Runge et al. 2011a

The challenge with multiple-objective problems is how to trade-off gains in one objective for gains in another. What balance do we prefer?

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## Competing Objectives

- How do these arise?
  - Resource constraints (space, money…)
  - Inherent antagonism
  - Complicated negative feedbacks in the system
- What can we do?
  - Change the decision frame
  - Develop new alternatives
  - Balance objectives

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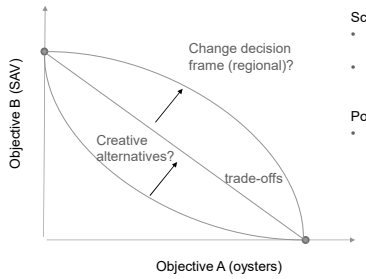
## Competing Objectives




Science questions:
- Can we estimate these Pareto curves?
- Can we design new alternatives?

Policy questions:
- How do we balance the trade-offs?

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## Shallow-water Habitats

- Are there difficult decisions about resource allocation in tidal or non-tidal habits that involve competing objectives?
  - Would any benefit from a formal SDM process?
- Where are there apparent competing objectives?
  - How well do we understand the trade-offs?
  - Is there uncertainty about whether we can find solutions that remove the trade-offs?
  - Are there some places where we just need to grapple with the trade-offs and balance objectives?

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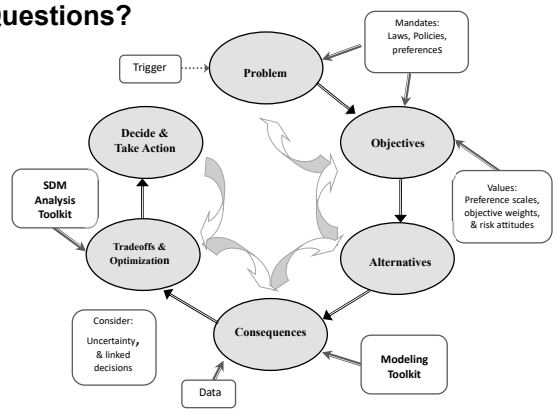
## Questions?

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