Supporting decisions for sustainability

Dr. Joe Arvai, *Director, Erb Institute for Global Sustainable Enterprise*
University of Michigan • Ann Arbor, MI, USA
Decision Research • Eugene, OR, USA
e-mail: JLArvai@umich.edu @DecisionLab

FREDERICK A. & BARBARA M.
ERB INSTITUTE
UNIVERSITY OF MICHIGAN

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FREDERICK A. & BARBARA M.
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Two Questions

1. **What progress has been made** in developing models that are appropriate for supporting decisions related to sustainability?

2. **What new efforts might be required** to address needs and opportunities related to sustainability?

Research on decision-making is popular…

- Over the past several years, there has been an explosion of popular interest in research on human judgment and decision-making.
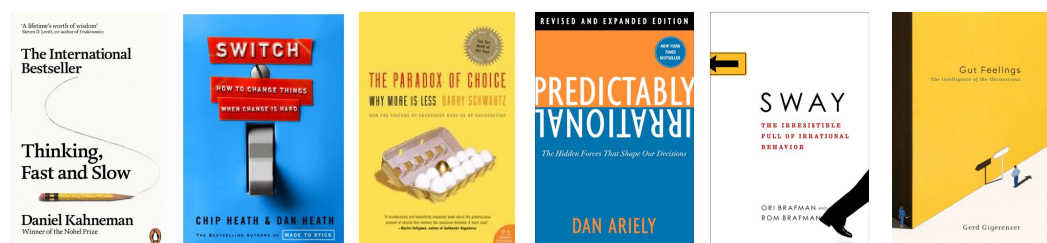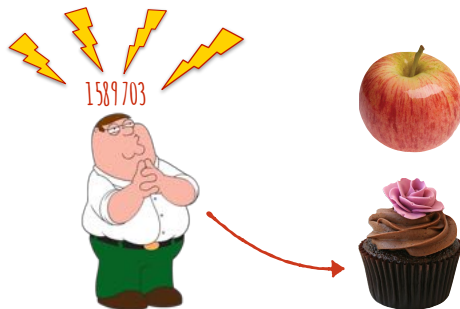
Emotion vs. Cognition
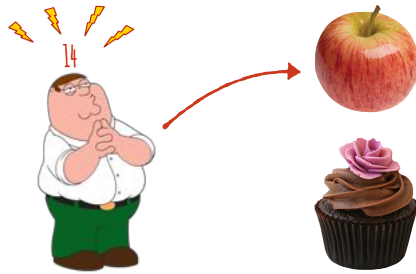
Baba Shiv, and Alexander Fedorikhin. 1999. Heart and Mind in Conflict: The Interplay of Affect and Cognition in Consumer Decision Making. Journal of Consumer Research **26**: 278-292.

Emotion vs. Cognition

- If processing resources are limited, spontaneously evoked affective reactions rather than cognitions tend to have a greater impact on choice.

- As a result, people are more likely to choose alternatives that are superior on affective dimensions, but inferior on cognitive dimensions.

Baba Shiv, and Alexander Fedorikhin. 1999. Heart and Mind in Conflict: The Interplay of Affect and Cognition in Consumer Decision Making. Journal of Consumer Research **26**: 278-292.

Tradeoffs and Preferences
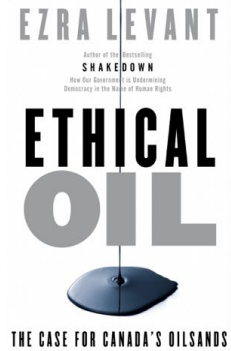
Tradeoffs and Preferences

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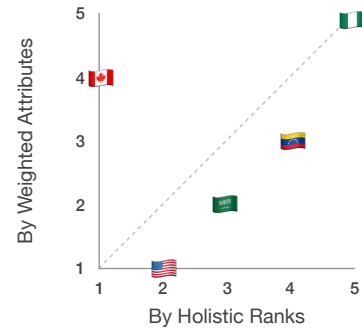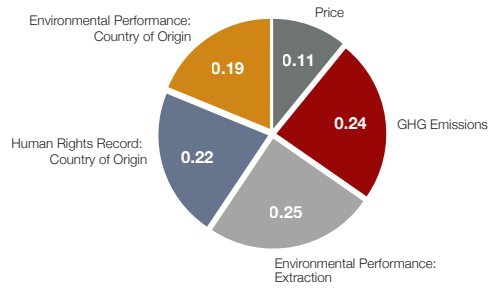

Bessette, D. and J. Arvai. 2014. A lack of internal consistency plagues consumer and policy preferences. *In prep.*
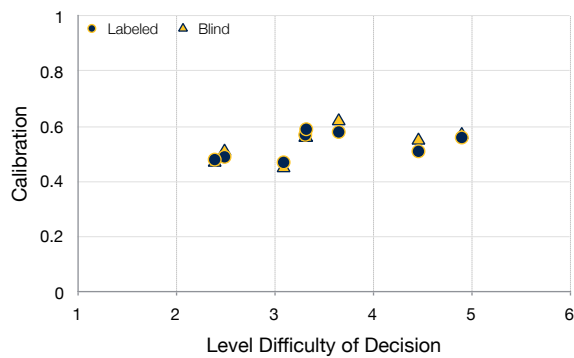

Tradeoffs and Preferences

Attribute	Units	Preferred Direction	Canada Oil Sands	Saudi Arabia Conventional	Nigeria Conventional	Venezuela Heavy	Texas Offshore
Price per Litre	$/L (CDN)	Lower	CA$1.35	CA$1.35	CA$1.35	CA$1.35	CA$1.35
Well-to-Wheels GHG Emissions	Kg CO_2/L	Lower	3.7	2.7	3.3	3.3	2.9
Environmental Impact: Extraction Method	1 - 7 Scale	Lower	7	1	4	4	2
Overall Human Rights Score: Country of Origin	1 - 7 Scale	Higher	7	1	4	3	7
Overall Environmental Performance: Country of Origin	1 - 10 Scale	Higher	7.3	6.7	3.9	5.8	6.8

Tradeoffs and Preferences

Environmental Performance: Country of Origin 0.19

Price 0.11

GHG Emissions 0.24

Human Rights Record: Country of Origin 0.22

Environmental Performance: Extraction 0.25

By Weighted Attributes

By Holistic Ranks

Tradeoffs and Preferences

Calibration

Level Difficulty of Decision

Labeled   Blind

Choosing a Restaurant

Buying a Mobile Phone

Buying a Car

Renting a Home

Petrol Preferences

Investment Portfolios

Climate Change Mitigation Strategies

Military Interventions in Syria

Level of Difficulty Increasing
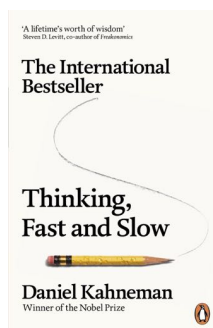
Nudge-mania!

"Eat To Get Slimmer"

A heavy lift, instead of a nudge

A heavy lift, instead of a nudge

Improved decision quality isn't just a function of speed.
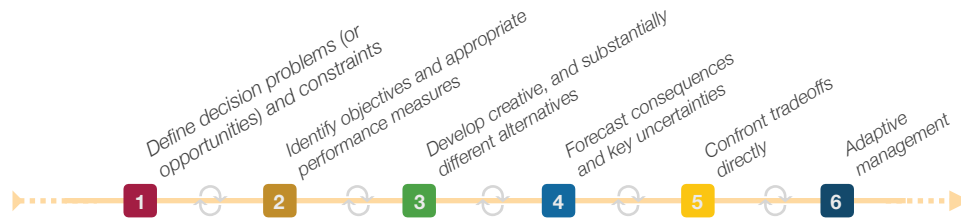
A heavy lift, instead of a nudge

- A commonly accepted narrative about how to improve decision-making about in the name of sustainability — and all kinds of policies for that matter — includes:

  - **Consultation** involving decision-makers, key stakeholders, and content area experts.

  - Access to **high-quality information** (science, local knowledge, etc.) upon which to base choices: science-based decision making.

  - Processes (or environments) that facilitate **negotiation**.

  - The importance of fostering **transparency** and building **trust** with respect to the participants and the process: *"Fairness"* and *"Competence"*

Two Questions

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Decision aiding for sustainability

1. Define decision problems (or opportunities) and constraints
2. Identify objectives and appropriate performance measures
3. Develop creative, and substantially different alternatives
4. Forecast consequences and key uncertainties
5. Confront tradeoffs directly
6. Adaptive management

Decision aiding for sustainability

Decision aiding for sustainability

- An applied research effort to design and test a decision-aiding approach for energy transitions.

- Initial test site was MSU's TB Simon Power Plant. Subsequent research in partnership with industry partners in Canada.

  - Highly interdisciplinary research.

  - Multi-party research involving corporate, government, and public stakeholders.

- Peak Electricity: 99.3 MWh

- Peak Thermal: 1.3×10^6 lb/h

Decision aiding for sustainability

Interactive software developed by Compass Resource Management, Vancouver, BC, Canada.
Database from Black & Veatch, Overland Park, KS, USA.

Decision aiding for sustainability

Decision aiding for sustainability

- Positive evaluations from users:
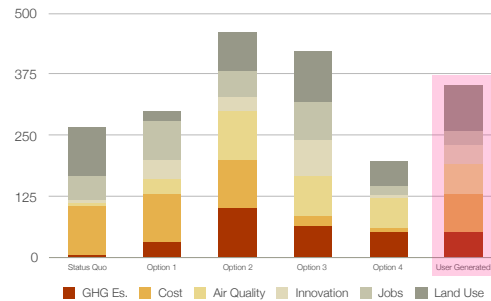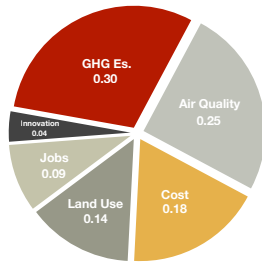 - Significant increases in learning about energy transitions
  - High self-reported ease-of-use (of decision-support tools)
  - High self-reported internal consistency
  - High overall self-reported satisfaction with process
  - High self-reported comfort with final decisions
- A paired-down version of this decision-support platform is on display in the NAS's Koshland Science Museum in Washington, DC.
  - https://koshland-science-museum.org/sites/all/exhibits/mitigationsim/index.html

Bessette, D., J. Arvai, and V. Campbell-Arvai. 2014. Decision support framework for developing regional energy strategies. *Environmental Science & Technology*, 48:1401–1408.

Conclusions

1. What progress has been made in developing models that are appropriate for supporting decisions related to sustainability?
   - *We know more about how humans instinctively make decisions than at any time in the history of science.*

2. What new efforts might be required to address needs and opportunities related to sustainability?
   - *There's a need to expand from behavioral studies of decision making to prescriptive approaches for decision-support.*
   - *Nudges, though wildly successful in some limited contexts, aren't enough.*

Thank you

FREDERICK A. & BARBARA M.
ERB INSTITUTE
UNIVERSITY OF MICHIGAN

Dr. Joe Arvai
Director, Erb Institute for Global Sustainable Enterprise
Max McGraw Professor of Sustainable Enterprise

School of Natural Resources & Environment, and
Ross School of Business
University of Michigan

E JLArvai@umich.edu • Twitter @DecisionLab • Tel +1 734 647 3891
www erb.umich.edu • meanjoe.net

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