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The Fallacy of Best-Model Design: Info-Gap Analysis of Epistemic Uncertainty

§ **The problems of uncertainty:**
- Design or decide. • Robustness to noise and info-gaps. • Opportuneness: exploit windfall.
- Satisfice or optimize.

§ **Information-gap uncertainty:**
- Uncertainty is a limitation of knowledge.
- Uncertainty is a gap between what is known and what could be known.
- Surprises and ignorance.

§ **Models:** • Characterize reality. • Attributes of model correspond to attributes of reality.

§ **Model-based decision:** adapt decision to attributes of model.

§ **Optimal model-based decision:** Use best model to choose decision with best outcome.

§ **Fallacy of optimal model-based decision:**
- Severe uncertainty:
  - Best model errs seriously.
  - Some model attributes are **correct.**
  - Some model attributes **err greatly.**
- Best-model optimization:
  - Exploits **all model attributes** to the extreme.
  - Vulnerable to model error.

§ **Resolution:** robust-satisficing
- Trade performance for robustness.
- Satisfice performance. • Optimize robustness to uncertainty.

§ **Robust-satisficing syllogism:**
- Adequate performance must be attained.
- High reliability of adequate performance preferred over Low reliability of optimal performance.
- Max reliability of adequate performance is best.

§ **Trade-off:** • Robustness vs. performance. • Pareto efficiency.

§ **Preference reversal:** crossing of robustness curves.

References:

◦ Yakov Ben-Haim, 2001, *Information-gap Decision Theory: Decisions Under Severe Uncertainty,* Academic Press, San Diego.

◦ Yakov Ben-Haim, 2004, Uncertainty, probability and information-gaps, *Reliability Engineering and System Safety,* 85: 249–266.

◦ Yakov Ben-Haim, 2005, Info-gap Decision Theory For Engineering Design. Or: Why 'Good' is Preferable to 'Best', chapter 11 in *Engineering Design Reliability Handbook,* Edited by E. Nikolaides, D. Ghiocel and Surendra Singhal, CRC Press.

◦ Yohay Carmel and Yakov Ben-Haim, Info-gap robust-satisficing model of foraging behavior: Do foragers optimize or satisfice?, *American Naturalist*, to appear.

◦ Helen M. Regan, Yakov Ben-Haim, Bill Langford, Will G. Wilson, Per Lundberg, Sandy J. Andelman, Mark A. Burgman, Robust decision making under severe uncertainty for conservation management, *Ecological Applications*, vol.15(4): 1471–1477.

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