

*Some Thoughts on Decision-Making and
Uncertainty:
The Scientist and the Decision-Maker*

Presented to the

IOM Committee on Environmental Decision-Making Under Uncertainty

by

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Decisions and Uncertainty



The decisions

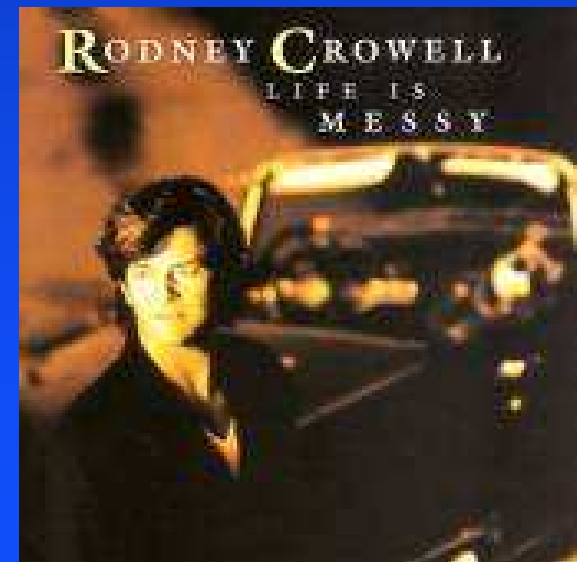
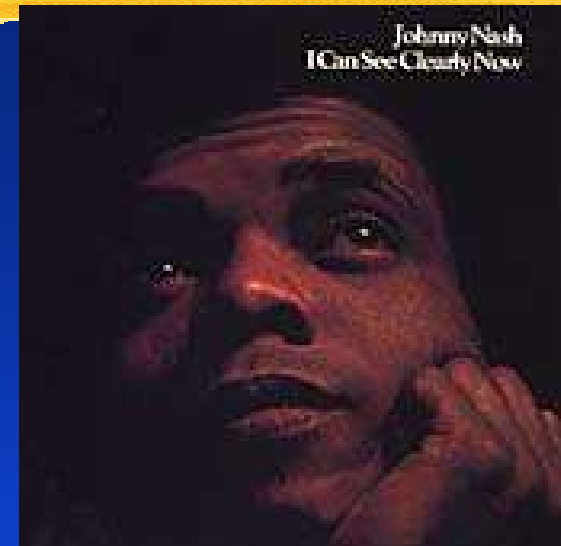
- The policy decision-maker
- The implementation decision-maker

Uncertainty and the decisions

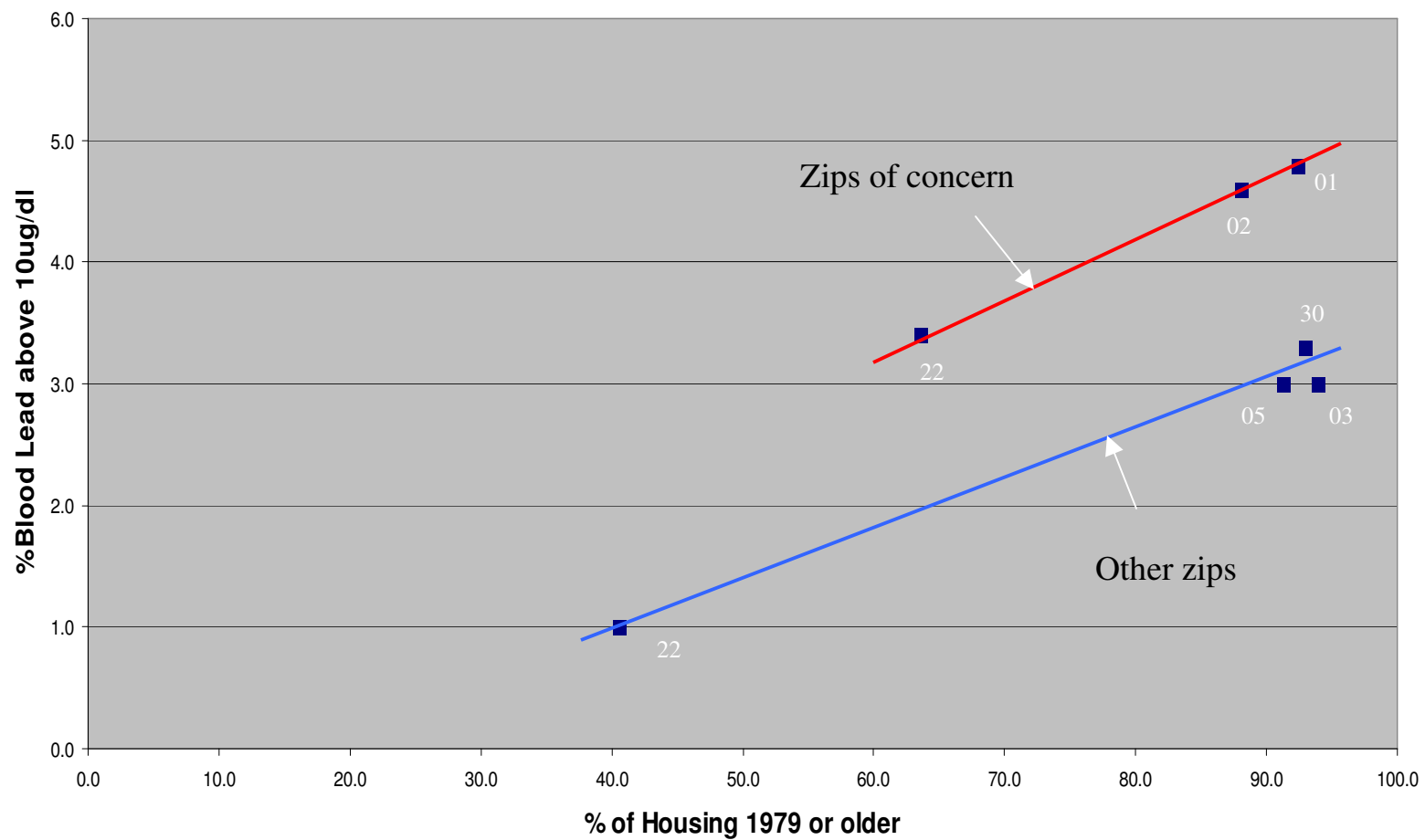
- The scientist
- The decision-maker

Decisions: Policy and Implementation

- The policy decision-maker
- The implementation decision-maker



Comparison of Blood Lead >10 with Age of Housing by Zip Code



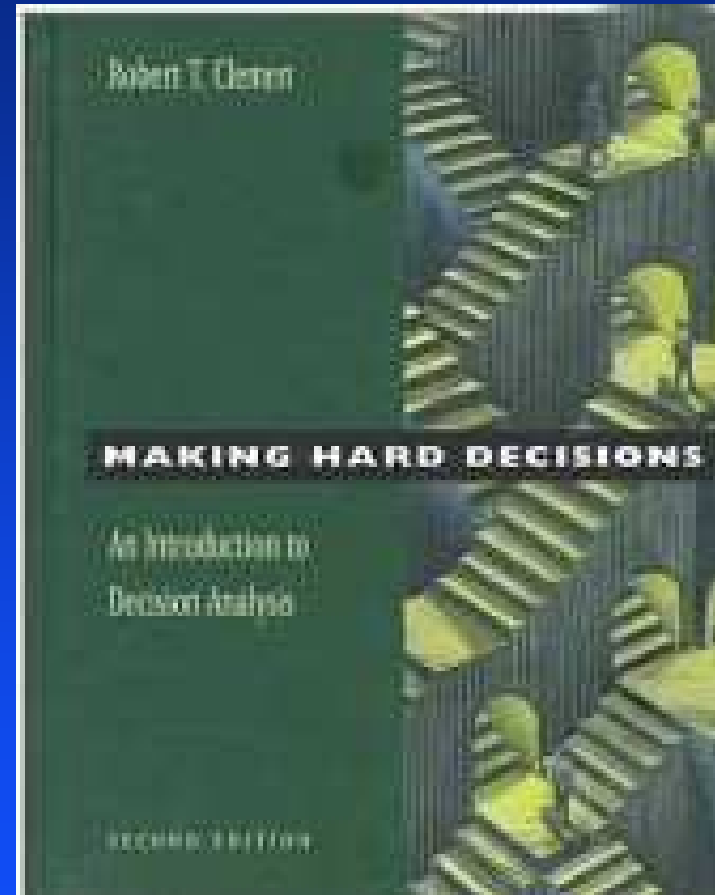
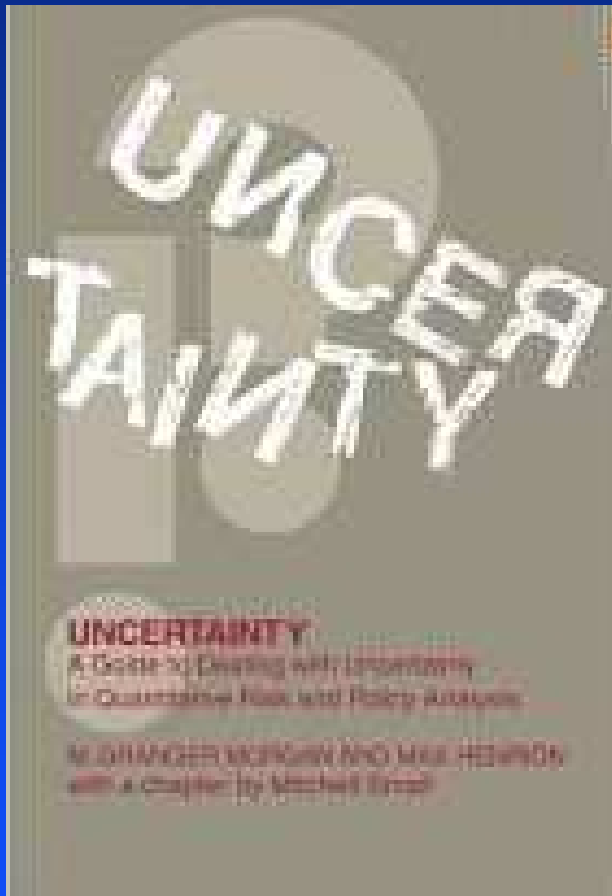
The Scientist



- Trained to look at uncertainty
- Tends to look at it quantitatively
- Talks of ranges, “pedigrees” of data
- Measurement, model, other uncertainty

- **Occupational hazard: Tends to attribute an uncertainty of “zero” to things that are outside the boundary assumptions of the analysis. “Simplifying assumptions” in the analysis may or may not be revisited in the uncertainty analysis.**

The Scientist (continued)



The Decision-Maker



- What's the probability of something bad happening?
- If something bad does happen, how bad will it be?
- What do I need to deal with first?
- What's fair?

- **Uncertainty:** What's the probability that new information will come in tomorrow and make it obvious that the decision I make today is wrong?

“Risk Assessment doesn’t work for us...”



- **Why?**
- **Some things are left out, e.g.,**
 - Non-conventional stressors**
 - Cascading effects**
 - Vulnerability**

Non-Conventional Stressors

Unreconciled Loss: Physical and Symbolic

Loss of land	Loss of language	Loss of spirituality
Loss of extended family relationships	Loss of sense of belonging	Loss of autonomy
Loss of rights	Loss of self-sufficiency	Loss of social structure
Loss of connection to land	Loss of culture and tradition	Loss of identity
Loss of sovereignty	Loss of history	Loss of control
Loss of cultural pride	Loss of community	Loss of trust

Loss of life: Multiple traumatic deaths related to disease, violence, genetic risk factors...

Source: Lemay and Piotrowski, 2002

Cascading Effects



An “Energy Conversion Unit”

= a trash incinerator

1. Rat population increases
2. Diesel fumes and noise at night
3. A small business opportunity

Vulnerability

- **Vulnerability: The state of being open to harm due to the inability to cope with a hazard because of biological susceptibility, prior exposure or disease state, or lack of the resources for resilience.**
- **Vulnerability = Hazard + Inability to cope**
- **Vulnerability can mean that the exact same exposure can result in widely different effects**

Levels of Coping

- First Stage: *Non-erosive Coping*, includes insurance, risk-minimizing, loss management, loans, reduction in dietary intake, cheaper foods, reduction of meals, sale of small stock and non-productive assets
- Second Stage: *Erosive Coping*, includes disposal of productive assets, shark loans, sale of large livestock, land and tools, bonded labor arrangements, child labor
- Third Stage: *Failed Coping*, results in destitution, dependency on charity, out-migration, and in extreme cases prostitution, or even sale of children. (WHO, 1998)

In Summary



- **Decisions being asked of policy makers and implementers are often different.**
- **Scientists tend to think of uncertainty in a quantitative way.**
- **Quantitative uncertainty analysis is useful and necessary, but needs to be focused on those uncertainties that could change the decision being made.**
- **To a decision-maker, uncertainty is more a function of whether the decision is the “correct” one; large uncertainties that would not affect the decision being made are often acceptable.**

In Summary (continued)

- **“Simplifying assumptions” are boundary conditions on an analysis, and often lead to assignment of “zero” uncertainty to things outside the boundary – even if those boundary conditions are violated, e.g., in risk assessment.**
- **There are a number of things left out of conventional risk assessments that may be important enough to change decisions.**
- **Decision-makers are rarely presented with information about what is left out of an analysis.**

The Decision-Maker

- What's the probability of something bad happening?
- If something bad does happen, how bad will it be?
- What do I need to deal with first?
- What's fair?
- Uncertainty: What's the probability that new information will come in tomorrow and make it obvious that the decision I make today is wrong?
- What's left out of the analysis my staff has provided that might change the decision?

References

- Clemen, Robert T., 1996. *Making Hard Decisions: An Introduction to Decision Analysis*. 2nd Ed. Duxbury Press, Wadsworth Publishing Co., Belmont, CA. ISBN 0-534-26034-9. p. 5.
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