

# The Right Stuff: Perspectives on Building a Successful Interdisciplinary Career

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Notes for Biocomplexity LWI/CC Workshop

Biocomplexity LWI/CC Workshop:  
Designing a Capstone Experience for Recent PhDs  
Embarking on Interdisciplinary Careers

<http://people.whitman.edu/~weilercs/biocomplexity/>

October 3-6, 2003

Wrigley Marine Science Center  
Catalina Island, California

**It Works!**

■

Disciplinary

▼  
Multidisciplinary

▼  
Interdisciplinary

▼  
Trans-disciplinary

# Is Interdisciplinary Quality an Oxymoron?



# Is Interdisciplinary Quality an Oxymoron?



- Multidisciplinary accuracy
- Clarity of communications (non-jargonistic)
- Interdisciplinary Originality
  - #Emergent property of complex system
  - #Solve societal problem

# NOSTRADAMUS PREDICTS HOTTEST SUMMER IN HISTORY



FAMOUS seer Nostradamus wrote a clear and specific poem that reveals the horrors of our upcoming weather.

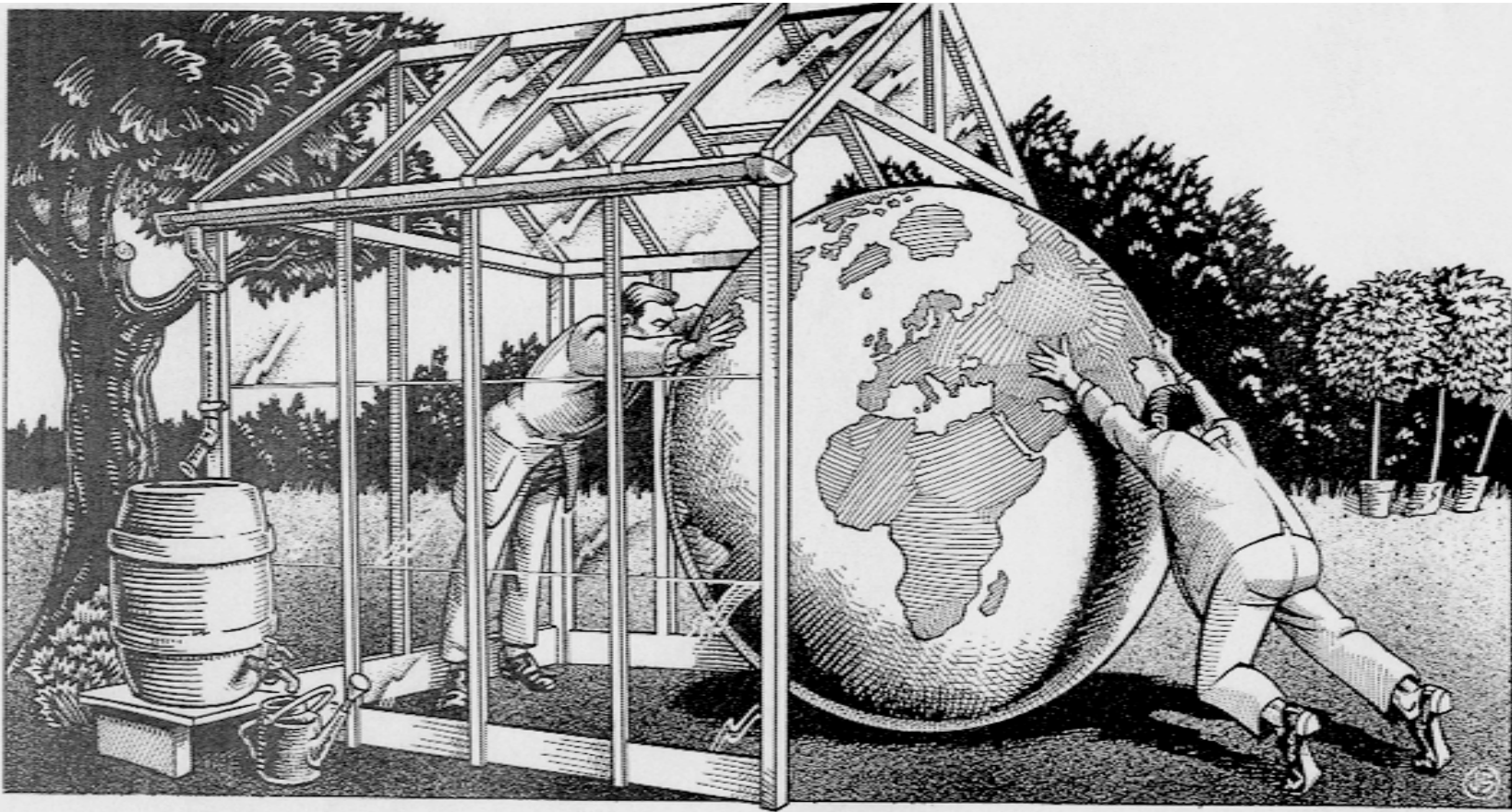
**RISK: PROBABILITY times CONSEQUENCES**

**DESCRIPTIVE SCIENCE: ♦ WHAT CAN HAPPEN  
♦ WHAT ARE THE ODDS**

**(But what probabilities? and from whom?)**

**NORMATIVE JUDGEMENTS:**

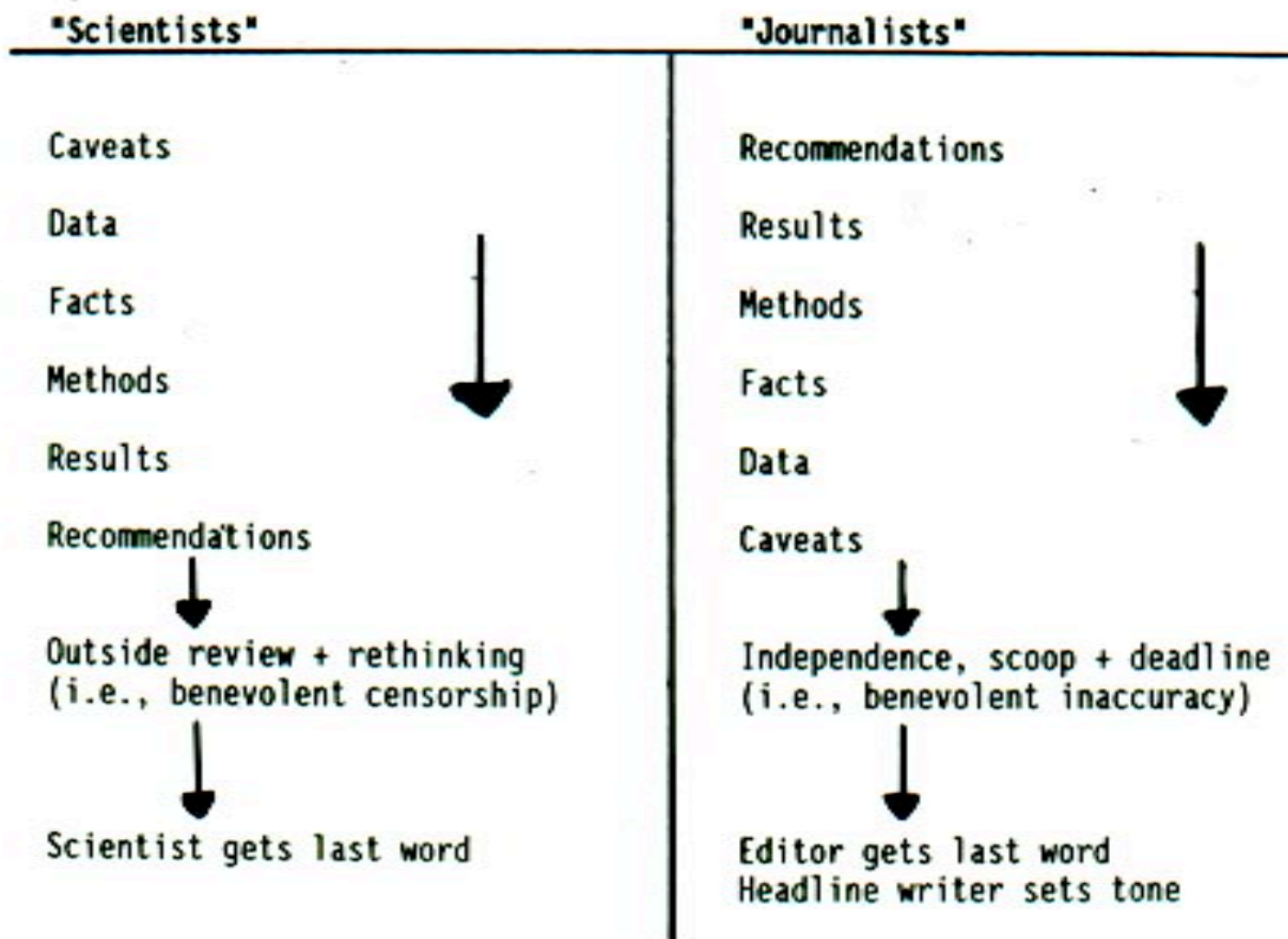
- ♦ **WHAT IS SAFE**
- ♦ **WHAT IS DANGEROUS**
- ♦ **WHAT IS FAIR**
- ♦ **WHO SHOULD PAY?**



**ENVIRONMENT**

# The greenhouse war

## PRESENTATIONAL STYLES





*"One thing I'll say for us, Meyer—we never stooped to popularizing science."*

Is a Scientist-advocate  
(or a Scientist-popularizer)  
an Oxymoron?

## **Table —Professional biases of scientists**

A favored theory

A familiar model or technique

A comfortable measurement or instrumental system

A crony

Our institution

A national report

A philosophical paradigm-epistemological construction of reality

## Table — Ideological Biases

- Entrepreneurial rights transcend protection of global commons
- “One dollar one vote” — cost/benefit efficiency is the best decision rule
- The present is more valuable than the future (meaning a high discount rate is deemed appropriate)
- The present generation has an obligation not to borrow from the future (a low discount rate is deemed appropriate)
- Commons protection justifies curbs on individual, corporate or national actions
- A risk aversion/precautionary principle is needed, especially for large-scale, potentially irreversible changes
- Other species have intrinsic existence rights, even if they fall outside of traditional cost/benefit calculations for human welfare
- Distribution of costs and benefits are as or more important than the values aggregated by traditional cost-benefit analyses (i.e., equity counts as much as efficiency)

## Table —Advocacy-Popularization “Rules”

Understand your own values and biases — use the relevant scientific/technical communities to help you overcome your own dogmatism and/or denial

Make your values and biases explicit, and separate them from your scientific priors on probabilities and consequences

Do not allow personal value positions to distort your subjective priors on the probabilities of various outcomes or “facts”

Defend value positions separately from assessments of probabilities and consequences

Encourage popularizers who follow responsible practices, and censure those who are unclear, obscure or biased

# The Bush Administration's "climate policy"

Keystone policies

[startribune.com](http://startribune.com)



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Sack  
Star

Published

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GLOBAL WARMING TRAFFIC COP

Scientists should take one additional step to more fully ensure their credibility. Those who make public statements should also produce a hierarchy of backup products ranging from op-ed pieces, to longer popular articles, which provide more depth, to full length books, which meticulously distinguish the aspects of an issue that are well understood from those that are more speculative. Books should also provide an account of how one's views have changed as the scientific evidence has changed.

Even if only a minute segment of the public really wants this level of detail, this hierarchy of articles and books in the popular and scientific literature provides integrity to the popularization process. Since "full disclosure" (like archetypal "scientific objectivity") is simply not possible in time-constrained congressional or media debates, the hierarchy of back-ups is crucial for elaborated disclosure beyond these forums.

**Citizens Get:**  
**[FROM EXPERTS]**

- ◆ **WHAT CAN HAPPEN?**
  - ◆ **WHAT ARE THE ODDS**
  - ◆ **(HOW DO YOU KNOW?)**
- 

**Citizens Give:**

- ◆ **VALUE JUDGEMENTS ON HOW TO TAKE RISKS, DECIDE WHO PAYS, ETC.**
- ◆ **CERTIFY OPENNESS OF EXPERT ASSESSMENT PROCESS**
- ◆ **AGENDA FOR EXPERT ASSESSMENT**

## Type 1 versus Type 2 errors and their consequences

<b>Decision</b>	Forecast proves false	Forecast proves true
Accept forecast—policy response follows	<b>Type I error</b>	Correct decision
Reject or ignore forecast—no policy response	Correct Decision	<b>Type 2 error</b>

# The Five Numeraires\*

{Vulnerabilities to Climate Changes}

- Market Impacts { \$ per ton C }
- Human Lives Lost { persons per ton C }
- Biodiversity Loss { species per ton C }
- Distributional Impacts { Income redistribution per ton C }
- Quality of Life { loss of heritage sites;  
forced migration; disturbed  
cultural amenities; etc. per ton C }

\*Disaggregate by value differences—provide traceable account of re-aggregations to make value differences transparent

Comments

Please

Morgan & Keith (1995) Env. Sci & Tech, 29.

## Experts interviewed in the study

Expert numbers used in reporting results do not correspond with either alphabetical order or interview order.

James Anderson, Harvard University

Robert Cess, State University of New York at Stony Brook

Robert Dickinson, University of Arizona

Lawrence Gates, Lawrence Livermore National Laboratories

William Holland, National Center for Atmospheric Research

Thomas Karl, National Climatic Data Center

Richard Lindzen, Massachusetts Institute of Technology

Michael MacCracken, U.S. Global Change Research Program

Syukuro Manabe, Geophysical Fluid Dynamics Laboratory

Ronald Prinn, Massachusetts Institute of Technology

Stephen Schneider, Stanford University

Peter Stone, Massachusetts Institute of Technology

Starley Thompson, National Center for Atmospheric Research

Warren Washington, National Center for Atmospheric Research

Tom Wigley, University Center for Atmospheric Research/National

Center for Atmospheric Research

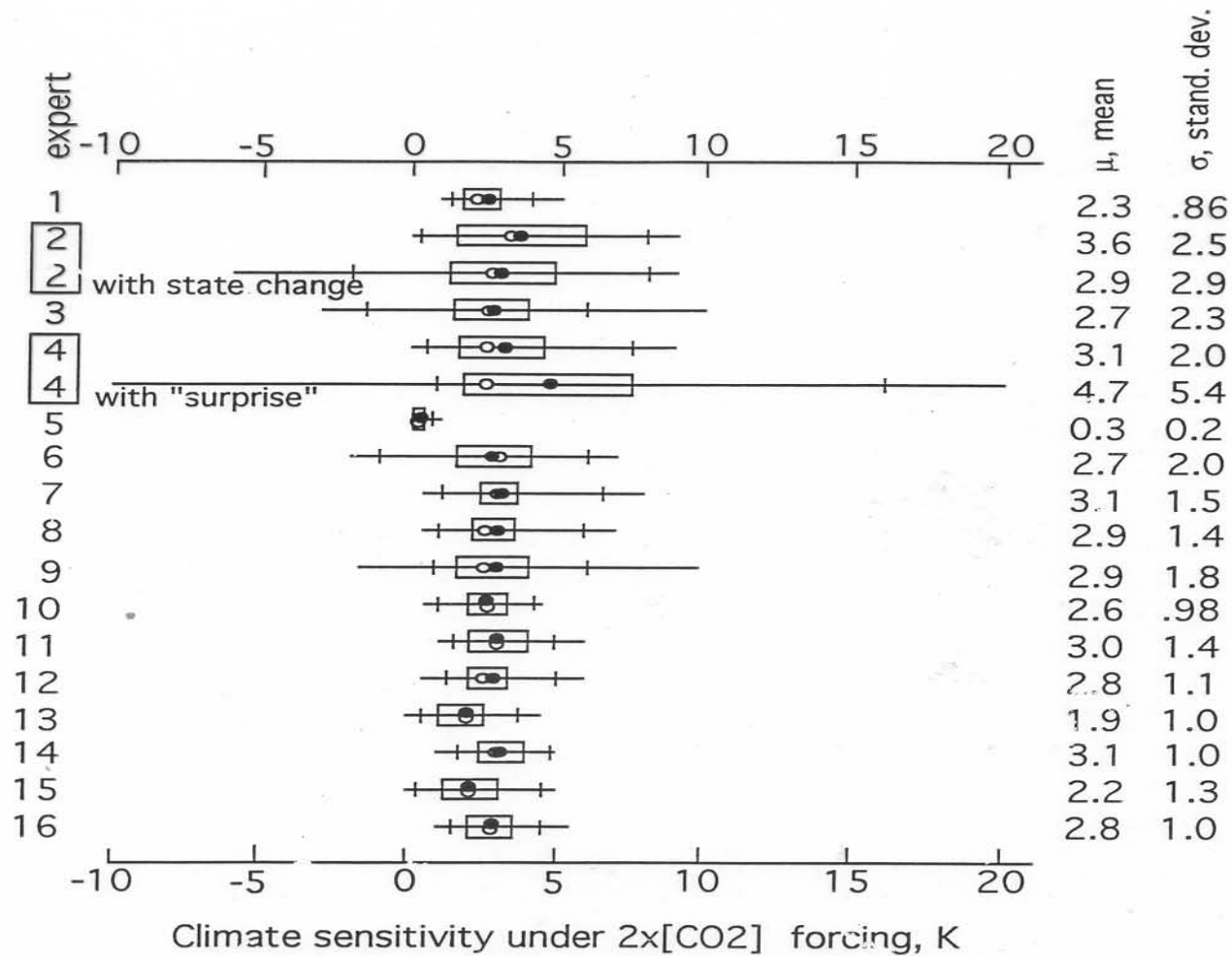
Carl Wunsch, Massachusetts Institute of Technology

...een a topic's importance and the marginal cost of  
...king research progress, we posed the question in  
two parts. Experts first placed 50 chips on a spe-  
cially designed game board indicating the relative im-  
portance of each of six categories. The game board  
was divided by "observational and data manage-  
ment" and "understanding and prediction" on one

We found that  
expand moni-  
though most s-  
cal, many gave  
and more flexi-  
tent coverage  
tation. Low-co-  
anic platforms  
greater attentio-  
paleoclimatic  
tional power a-

There was s-  
relative impor-  
observational  
certainties. The  
follows: "We h-  
stantial progre-  
mate predictio-  
ing what we h-  
power" and "T-  
the next few de-  
may occur. Ou-  
systematic cli-  
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determine the  
curs." Observa-  
position, but  
concluded.

On various  
of large "clima-  
spheric and



**Figure 2:** Box plots of elicited probability distributions of climate sensitivity, the change in globally averaged surface temperature for a 2x[CO<sub>2</sub>] forcing. Horizontal line denotes range from minimum to maximum assessed possible values. Vertical tick marks indicate locations of lower 5 and upper 95 percentiles. Box indicates interval spanned by 50% confidence interval. Solid dot is the mean and open dot is the median. The two columns of numbers on right hand side of the figure report values of mean and standard deviation of the distributions.

Subjective Probability Assessment

