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Systems Science Friday Noon Seminar Series

Systems Science

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## Criticisms of Systems Science

Joshua Hughes

*Portland State University*

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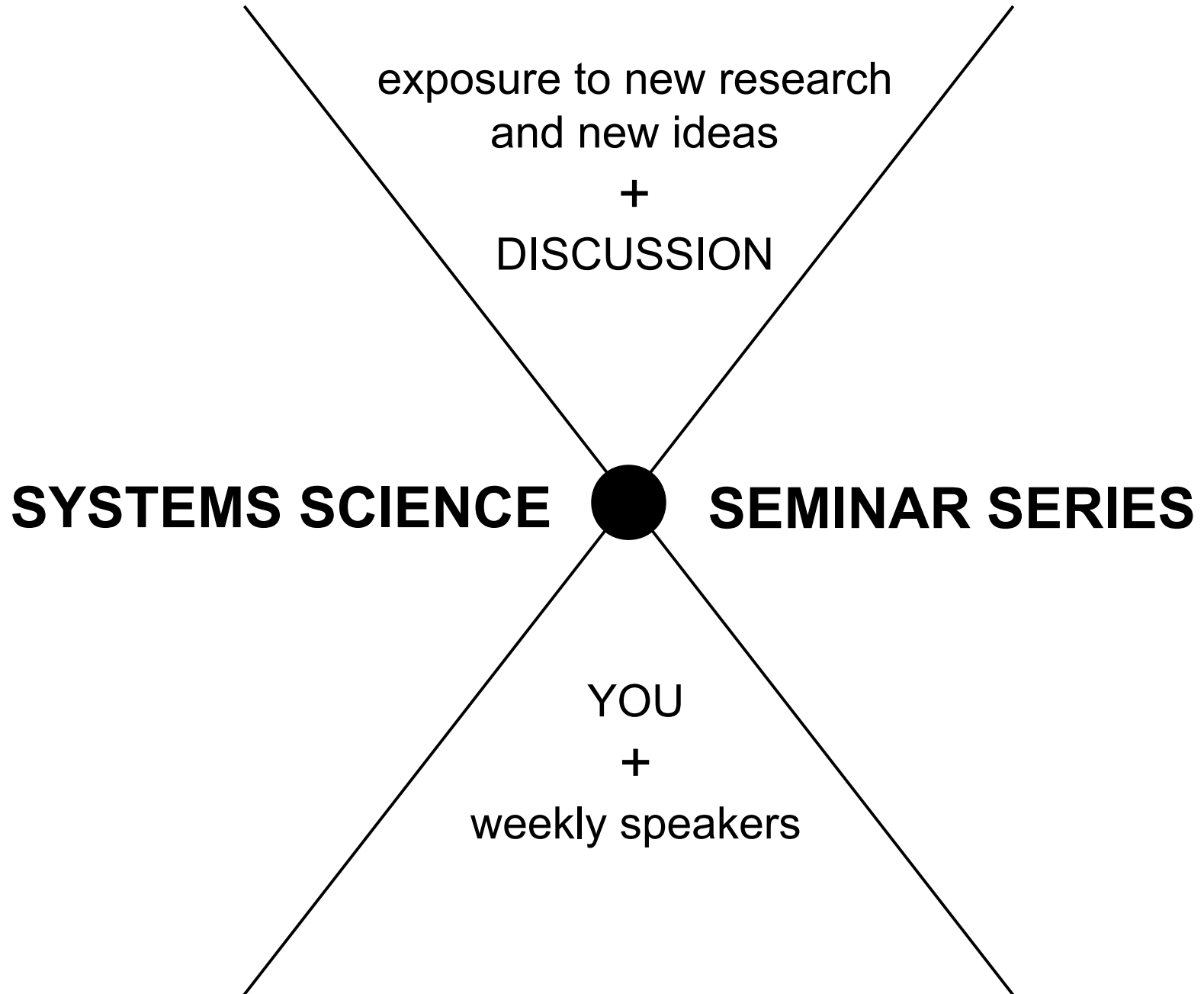
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# SYSTEMS SCIENCE SEMINAR SERIES

## REGISTERED STUDENTS

- Be sure to sign in every week.
- We will sign in online participants.
- You may not miss more than three seminars if you want to receive credit for the course.

## EVERYONE ELSE

- Sign up on the seminar email list if you would like to receive seminar announcements (either here or online) via the seminar email list.
- Graduate students receive seminar announcements via the graduate students email list.

## EVERYONE

- Seminars begin at 12 noon *sharp*.
- To see the schedule for upcoming seminars, to participate online, or to see slides and listen to recordings of previous seminars, visit the seminar website ([www.pdx.edu/sysc/seminar](http://www.pdx.edu/sysc/seminar)).
- Send suggestions for topics or presenters as well as comments and criticisms to Josh at [hughesjg@pdx.edu](mailto:hughesjg@pdx.edu).
- The last seminar of this year (June 4) will be dedicated to systems science jokes and an end-of-year wrap-up discussion about this year's seminars and ideas for next year's seminar series.

## SYSTEMS SCIENCE SEMINAR SERIES: WINTER 2010

<i>DATE</i>	<i>NAME and AFFILIATION</i>	<i>SEMINAR TITLE or TOPIC</i>
01/08/10	<b>Joshua Hughes</b> Ph.D. student, Systems Science Graduate Program, PSU	Discussion: "Criticisms of Systems Science"
01/15/10	<b>Tamara Hayes</b> Assistant Professor, Biomedical Engineering, OHSU	algorithms for health monitor and assessment data
01/22/10	<b>Grant Kirby</b> IT Program Director, Oregon Institute of Technology Ph.D. student, Systems Science Graduate Program, PSU	networks and cloud computing
01/29/10	<b>Barry Oken</b> Medical Director, Clinical Neurophysiology, OHSU student, Systems Science Graduate Program, PSU	"Recording electrical signals from the human brain: what information might be obtained?"
02/05/10	<b>Will Landecker</b> Graduate student, Computer Science, PSU	computer vision
02/12/10	<b>TBA</b>	
02/19/10	<b>Miguel Andres Figliozzi</b> Assistant Professor, Civil and Environmental Engineering, PSU	algorithms for vehicle routing
02/26/10	<b>Dan Hammerstrom</b> Professor, Electrical & Computer Engineering, PSU Associate Dean, Maseeh College of Engineering and Computer Science, PSU	"The <i>DARPA SyNAPSE</i> Program"
03/05/10	<b>Patrick Roberts</b> Computational Neuroscientist, In Silico Biosciences, Inc. Adjunct Professor, Systems Science, PSU Adjunct Professor, Biomedical Engineering, OHSU	"Computational psychopharmacology"
03/12/10	<b>James McNames</b> Associate Professor, Electrical and Computer Engineering, PSU	biomedical signal processing

# **CRITICISMS** OF **SYSTEMS SCIENCE**

(DISCUSSION)

Systems Science Seminar  
January 8, 2010

“Criticism may not be agreeable, but it is necessary. It fulfills the same function as pain in the human body. It calls attention to an unhealthy state of things.”

- *Winston Churchill*



## SOURCES

George Klir (2001), *Facets of System Science (2<sup>nd</sup> Ed.)*

Lars Skyttner (2005), *General Systems Theory: Problems, Perspectives, Practice (2<sup>nd</sup> Ed.)*

Eberhard Umbach (2000), "The Fundamental Tasks of Systems Science," Research Committee on Sociocybernetics (RC51).

+ original source material and reviews (noted)

# CRITICISMS

one of two types (generally speaking)

**“unjustified”**

*they* don't get it

**“justified”**

we don't get it

WE can...  
ignore it

or

learn from it

better communication  
better understanding  
better methods  
**better *results***



## **R.C. Buck (1956)**

### **“On the Logic of General Behavior Systems Theory”**

- If every system has subsystems and every system has its environment, one can't think of anything or any combination of things that isn't a system; if the concept of "system" can apply to everything, it is logically empty.
- The fact that the spread of neural impulses, rumours, and epidemics can all be described by similar mathematical models is sheer coincidence. "So what?" if these different systems are seen as analogous.
- If Joan's heart is the system, and Joan is the environment, isn't Joan's heart--being a part of her--also the environment?

# Ida Hoos (1972)

## *Systems Analysis in Public Policy*

- The so-called isomorphisms are nothing but tired truisms about the universality of mathematics, i.e.  $2 + 2 = 4$  prevails whether we consider soap, chickens, or missiles.
- Superficial analogies may camouflage crucial differences and lead to erroneous conclusions.
- Systems analysis and its related techniques created the notion that all human affairs could be managed and society's problems solved “rationally” (“management syndrome”).
- Systems practitioners in universities, governments, management companies, research organizations, and advisory labels resisted critical evaluation and prevented advancement of the field.
- There was little review of the failures of systems analysis that occurred in both public and private enterprises.

## David Berlinski (1976)

*On Systems Analysis: An Essay concerning the Limitations of Some Mathematical Methods in the Social, Political, and Biological Sciences* \*from review by Paul Gray, USC

- “Friends . . . have sometimes asked why I spend so much time denouncing as worthless theories that *are* worthless.”
- Very particular empirical principles cannot “somehow be eked out of overwhelmingly general definitions.”
- That programs can be written to simulate human computation (artificial intelligence) does not mean humans employ such programs themselves.
- While cybernetics and information theory are both real theories, it is a sign of debility that they are applied in sociology, psychology, political science, and management science.
- It is not warranted to transfer mathematical methods from physics (i.e. ordinary differential equations) to the social sciences.
- Forrester's world model equations use multipliers pulled “administratively” from graphs rather than from theoretical assumptions.

# Robert Lilienfeld (1978)

## *The Rise of Systems Ideology*

- Systems theory is the latest attempt to create a universal myth based on the prestige of science.
- Systems thinkers have a special weakness for definitions, conceptualizations, and programmatic statements, all of a vaguely benevolent moralizing nature, without concrete or even scientific substance.
- In the eyes of the "universality" of systems theory all things are systems by virtue of ignoring the specific, the concrete, and the substantive.
- Systems theory is a theory with applications which have never been really tested.
- As a theory, systems philosophy is a mixture of speculation and empirical data, neither of them satisfactory. It is an attempt to stretch a set of concepts into metaphysics that extends beyond and above all substantive areas.
- Systems theory is not a genuine philosophy and is not a science; it is an *ideology* and must be considered as such.

# Others from Umbach (2000)

## Kappel and Schwarz (1981)

- “...systems research lays a common basis for communication and cooperation of scientists of different disciplines,” but success in operations and modeling of higher types of systems has been very limited.
- Systems theories may have little empirical relevance if models are developed carelessly or without empirical feedback.
- “Systems research cannot forgo disciplinary experience.”

## Klaus Mueller (1996)

- Systems theory claims to be a formal and material unifying science relying on organismic heuristics, scientific conclusions by analogy, confidence in mathematics as a means of synthesis, fundamental ideas of order in nature and society.
- Systems theory is “a method of forming concepts that oscillates between materialising universal concepts of mathematics and logifying empirical conditions.”

# Others

*Scientific American*, June 1995

(John Horgan's "From Complexity to Perplexity")

- Jack Cowan: People that do simulations suffer from the “reminiscence syndrome,” i.e. identify models based on accidental features that are reminiscent of biological or physical phenomena.
- Naomi Oreskes: A model may be convincing in the way that a novel is, but “How much is based on observation and measurement of accessible phenomena, how much is based on informed judgment, and how much is convenience?”
- Philip Anderson: “You musn't give in to the temptation that when you have a good general principle at one level it's going to work at all levels.”

*Scientific American*, October 1999

- Herbert Simon: “I would hesitate to say that chaos theory has had any major impact on the social sciences to date... In psychology, where most of my own research resides, I have observed nothing of importance that relates to chaos, and I would be rather astonished if it plays any significant role in behavior extending over tens of milliseconds or longer.”

## Paul Krugman (1998)

“Algorithms: Probing the vice president's thought processes,”  
*Slate*, Friday, Feb. 13, 1998.

- “As geologist Nathan Winslow puts it in a gently skeptical review on self-organized criticality, 'A theory can, once in the pop science regime, acquire a level of acceptance and momentum that may or may not be warranted by its actual scientific credibility.' And the track record of pop science enthusiasms is uniformly dismal. Does anyone remember cybernetics or catastrophe theory?”
- “Occasionally, I have a nightmarish vision in which the Santa Fe Institute, that temple of 'complexity theory' (whose heavy hitters include Bak, biologist Stuart Kauffman and, yes, economist Brian Arthur) actually starts having direct input into major policy decisions. Now that would be scary.”

# SUMMARY OF CRITICISMS

(Umbach, 2000)

- The concepts of system and model are too general.
- Structural similarities (analogies and isomorphisms) cannot be realized by empirical study to a sufficient degree.
- The importance of interdisciplinary concepts such as open systems, hierarchies, feedback, self-organization, emergence, and networks are exaggerated in importance and do not exclusively belong to systems science.
- A universal scientific language based on systems science is impossible.
- Not all areas of reality—and especially society—can be sensibly quantified and mathematically modeled.
- Holistic thinking is not subject to empirical methods and therefore is unscientific.
- Empirical studies should not be replaced by simulation.
- System approaches to major world problems are often based on:
  - frivolous data foundations
  - methodological limitations not subject to careful reflection
  - exaggerated expectations based on mathematical models and computers
  - attacking the dominant preference for economic growth
  - propagation of fears of catastrophe



# SO WHAT CAN WE LEARN?

- The concepts of system and model are meant to be general—but we must make clear what we mean by “system” when we use it for a particular problem domain.
- Systems science cannot solve problems without specialized knowledge from both the empirical and formal disciplines (and the humanities). Analogies and isomorphisms can facilitate interdisciplinary work but require relevant specialized knowledge if they are to be more than superficial.
- Not all systems ideas apply to all problems at all levels.
- Developing of a universal scientific language of science is the not the responsibility of systems science—it is inevitable given the interdisciplinary nature of contemporary problems.
- A tendency toward holistic thinking is necessary, but the difficulties and limitations of this method must be made clear.
- Simulations and mathematical models have their place and are used in many (if not all) specialized disciplines, but they should either be verified with empirical data or their assumptions and limitations should be clearly explained.
- Use “good” data, understand the limitations of your model, do not exaggerate the importance of your work, do not overly rely on computers, do not disregard the knowledge of the specialized disciplines, and do not predict the end of the world.
- Learn from your (our) mistakes.
- Presentation, presentation, presentation