PORTLAND STATE UNIVERSITY
Systems Science Ph.D. Program
Professor Martin Zwick
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Fall 2023
MW 4:40 - 6:30
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# S Y S T E M S  P H I L O S O P H Y (SySc 421/521)

Relevant MZ papers in Systems Theory and Philosophy category on Works page:
https://web.pdx.edu/~zwick/

This seminar will consider some philosophical issues central to the systems field. Fundamental to these issues is Bunge's conception of systems science as a research program aimed at the construction of "an exact and scientific metaphysics," that is, a set of transdisciplinary concepts, models, and theories of broad generality and philosophical import, central to the sciences, and cast (or capable ultimately of being cast) in the exact language of mathematics.

This course draws from the literature of general systems theory and cybernetics, which launched the systems research program, and from the literature of chaos, complexity, and complex adaptive systems which continues this program today. It presents a broad range of systems ideas (from information theory, game theory, thermodynamics, non-linear dynamics, decision theory, and many other areas) and attempts to integrate these ideas into a coherent framework. These ideas will be organized around the theme of fundamental "problems," that is, difficulties (imperfections, modes of failure) encountered by many systems of widely differing types.

While most of these ideas are mathematically-based, they will be approached in this course primarily at a conceptual level (with mathematical details provided as necessary). Many of these systems ideas derive from the natural sciences and engineering, but they apply as well to the social sciences and to fields of professional practice (business, the helping professions, etc.). It is primarily their relevance to the human domain – to individuals, organizations, societies, and the global human community – and to technology which motivates this theoretical/philosophical inquiry. Some of these ideas pertain also to the arts and humanities.

Readings will be from (1) *Elements and Relations*, available from the PSU Bookstore, Amazon, or Springer (https://link.springer.com/book/10.1007/978-3-030-99403-7), augmented by (2) relevant MZ papers on Works page (at URL above). Supporting material consisting of systems-oriented Scientific American articles is available via Canvas.

Course work: Grad students: 6 mini-papers 15% each
Undergrads: 5 mini-papers (including #1 & 2) 18% each
Class participation will be roughly 10% of the grade; will often be tie-breaker
Prerequisites: 521: graduate status in Systems Science or permission of instructor
421: Upper division status and either admission to the Honors Program or having taken at least one SYSC 3xxU cluster course

**ER** = Elements & Relations
**W** = MZ Selected Works articles (optional); **S** = Scientific American Reader (just a resource)
**{ }** Information on assignments

General outline:

| | |
|---|---|
| Sept 27-Oct 11 | Systems paradigm |
| Oct 16-Nov 13 | Synchronics |
| Nov 13-Nov 20 | Diachronics |
| Nov 22-Dec 4 | Some systems ideas relevant to science, religion, politics |

Detailed outline:

**Sept 27** **Introduction & overview; immersion: reading from ER Essay**
**ER**: To the Reader (ix-xviii), *Essay,* Chapter 1 (1-37)
**W**: INH
https://media.pdx.edu/media/t/1_200v29r8

**Oct 2, 4** **The systems paradigm**
***Exact & scientific metaphysics; basic systems ideas***
**ER**: *Commentary*, Chapters 2-3 (39-122)
**{Oct 4, Assignment #1}** **S**: Ruthen, Horgen, Wakefield
Oct 2: https://media.pdx.edu/media/t/1_aqxvdeuv
Oct 4 recording is absent; recording of corresponding class in Spring 2022:
https://media.pdx.edu/media/t/1_jhxpk6g9

**Oct 9, 11** **The systems paradigm (continued)**
***Relation to other fields; challenge of unity***
**ER**: *Commentary*, Chapters 4-5 (123-191), Appendix (591-610)
**W**: TOP, UI
Oct 9: https://media.pdx.edu/media/t/1_jqtwx4kh
Oct 11: https://media.pdx.edu/media/t/1_8njg87m8

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**Oct 16, 18, 23** **Synchronics: Wholeness, Constraint, Distinction**
***Set & information theory; graph theory; dynamics***
**ER**: Synchronics, Sections 1-3 (7-10 [*Essay*], 285-372 [*Notes*])
**W**: STMC, IG, (ICM, WP); **S**: Crutchfield, Kosko, Kauffman, Jurgens
**{Oct 18: Assignment #2}**
Oct 16: https://media.pdx.edu/media/t/1_cs0trwcs
Oct 18: https://media.pdx.edu/media/t/1_eg0gdubt
Oct 23: https://media.pdx.edu/media/t/1_g2zizysd

**Oct 25** **Synchronics: Persistence, Identity**
***Catastrophe theory; stability, regulation, & control; thermodynamics***
**ER**: Synchronics, Sections 4-5 (10-13 [*Essay*], 373-401 [*Notes*])
**S**: Zeeman, Rubi
https://media.pdx.edu/media/t/1_5hcumhl0

**Oct 30** **Synchronics: Agency, Complexity**
**Nov1, 6** ***Game/decision theory, hierarchy/networks***
**ER**: Synchronics, Sections 6-7 (13-20 [*Essay*], 402-460 [*Notes*])
**W**: LA; **S**: Swets, Nowak, Smith
**{Nov 1: Assignment #3}**
Oct 30: https://media.pdx.edu/media/t/1_d424xdvt

Nov 1: https://media.pdx.edu/media/t/1_x1gtk8y2

Nov 6: https://media.pdx.edu/media/t/1_f8fcuisv

**Nov 8** **Synchronics: Cognition**
***Modeling subsystem***
**ER**: Synchronics, Section 8 (20-22 [*Essay*], 461-490 [*Notes*])
**W**: MND, FNP, WDRCR; **S**: Barabasi, Bonabeau, Blackmore
https://media.pdx.edu/media/t/1_3n6gb7hp

**Nov 13** **Synchronics: Summary**
**Diachronics: Origins, Development, Limitation**
***Dualities, system formation, growth/development***
**ER**: Synchronics, Section 9 (23 [*Essay*], 491-495 [*Notes*])
Diachronics, Sections 1-3 (24-27 [*Essay*], 496-526 [*Notes*])
**S**: Arthur
https://media.pdx.edu/media/t/1_a4azhu6l

**Nov 15, 20** **Diachronics: Complexification, Internal Opposition, Texture, Other Systems, Embeddedness, Impermanence**
***Morphogenesis, transformation, self-organized criticality, limits to growth***
**ER**: Diachronics, Sections 4-9 (27-37 [*Essay*], 527-589 [*Notes*])
**W**: HBL, DC **S**: Holland, Bak, Stix (35), Bennett
**{Nov 15: Assignment #4}**
Nov 15: https://media.pdx.edu/media/t/1_tsgawkrl

Nov 20: https://media.pdx.edu/media/t/1_3tsmevh9

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**Nov 22** **A systems view of history**
**ER**: *Commentary* Chapter 6.-6.1.3, 6.3.4 (193-206, 243-246)
**W**: HHH
**{Nov 22: Assignment #5}**
https://media.pdx.edu/media/t/1_klkpd1yi

**Nov 27** **Systems theory & science; systems theory & religion**
**ER**: *Commentary* Chapter 6.2.-6.3.3 (207-243)
**W**: BSR, PKIS, CT (SSAS, RDRS)
https://media.pdx.edu/media/t/1_af0cdy0c

**Nov 29** **Systems theory & politics**
**ER**: *Commentary* Chapter 6.4 (247-284)
**W**: OWS (CGC) **S**: Daly, Barrett, Popper
**{Nov 29: Assignment #6}**
https://media.pdx.edu/media/t/1_w8spae74

**Dec 4** **General discussion**
https://media.pdx.edu/media/t/1_xwvmp7kg

**Writing Assignments**: indicated on the syllabus with { }

*Grad students*: all 6 assignments
*Undergrads*: 5 assignments, specifically: 1 and 2 plus three more selected from #3,4,5,6

Assignments should be **emailed** as attachments (doc, docx, pdf) to me (zwick@pdx.edu) no later than 7:00 pm of the day they are due. **Assignments received late will not be commented on**. 12 pt font is best, but 11pt is OK; absolutely no smaller font than 11 pt. For assignment 1, there is no minimum or maximum number of words. Assignments 2-6 should be minimum 500 words, maximum 1400 words, not counting references (references are optional). **Maximum of two pages.** Single space on two pages at 11 pt gives approximately 1400 words, so that is the upper limit. *Check spelling and grammar before you submit assignments.* Errors in spelling/grammar should be rare in work done for 400-500 level courses; if they are present in what you submit they will affect your grade. Since these papers are short they should be of high quality: well written and well organized.

Assignment topics

*Assignments 2-6 are described in terms of portions of ER, but you can, if you wish, instead discuss any of the W or S readings associated with the indicated portions of ER.*

1. What are your interests and/or what would you like to get from this course? **{due Oct 4}**

2. Discuss your interests in terms of the ideas presented in ER Chapters 2-5. For example, how do the core systems concepts presented in Chapter 3 bear on your interest area? Comments on systems theory as an ontology of problems (e.g., comments on the section titled Metaphysician's Desk Manual) are especially welcome. What does – or might – your interest area contribute to the systems research program and what does – or might – systems theory/philosophy contribute to this interest area? **{due Oct 18}**

3. Apply some ideas from the *Synchronics* sections from Wholeness through/including Agency to your interest area. **{due Nov 1}**

4. Apply some ideas from the *Synchronics* sections on Agency, Complexity, Cognition, and/or Summary to your interest area. (If you used ideas from Agency in assignment #3, and want to do this again, either to further develop the ideas in your previous mini-essay or to use other Agency ideas, that's OK.) **{due Nov 15}**

5. Apply some ideas from *Diachronics* to your interest area. **{due Nov 22}**

6. Comment on some implication(s) of systems theory/philosophy to science, religion, *or* politics or to a systems view of history (topics discussed in E&R Commentary, chapter 6). **{due Nov 29}**

Anyone interested in working on updating the Scientific American Reader should contact me.

## SUPPLEMENTARY PAPERS from Systems Theory and Philosophy category. If a URL isn't given, the paper is available from the MZ Works page: https://web.pdx.edu/~zwick/

**Sept 27 Introduction**

Zwick, M. "Incompleteness, Negation, Hazard [INH]: On the Precariousness of Systems." *Nature and System*, 6 (1984) 33-42.
*An early form of Essay, superseded by ER.*

**Oct 2-11 Systems Paradigm**

Zwick, M. [TOP], "Towards an Ontology of Problems." *Advances in Systems Science and Applications*, 1, pp. 37-42, 1995.

Zwick, M. [UI], "Understanding Imperfection." In *Proceedings of The World Congress of the Systems Sciences and ISSS 2000*, Allen, J .K. and Wilby, J.M. eds., Toronto, Canada: International Society for the Systems Sciences, 2000.

Zwick, M. [SRSM], "Speculative Realism and Systems Metaphysics." Northwest Philosophy Conference, Lewis and Clark College, Portland Oregon, Oct 28-29, 2022

**Oct 16-23 Synchronics: Wholeness, Constraint, Distinction**

Zwick, M. [STMC], "Systems Theory and the Metaphysics of Composition." International Society for the Systems Sciences 2018, Corvallis, OR, July 22-27

Zwick, M. [IG]. "Ideas and Graphs, "International Journal of General Systems, Vol 47, No. 7, 731-750, 2018.
https://drive.google.com/file/d/11Mw__6wEYjvWPlGctYbhVQAvX5kGKr-f/view?usp=drive_link

Zwick, M. [ICM], "Information, Constraint, and Meaning." *General Systems* 29, 41-47, 1986.

Zwick, M. [WP], "Wholes and Parts in General Systems Methodology." The Character Concept in Evolutionary Biology. Günter Wagner, ed., Academic Press, NY, 2001.

**Oct 30-Nov 6 Synchronics: Agency, Complexity**

Zwick, M. and Fletcher, J. [LA], "Levels of Altruism." Biological Theory Vol 9, No.1 (2014): 100-107.

**Nov 8 Synchronics: Cognition**

Zwick, M. [MND] (2015). "Mind and Life: Is the Materialist Neo-Darwinian Conception of Nature False?" Biological Theory: 1-14.

Zwick, M. [FNP] (2015). "Freedom as a Natural Phenomenon." Foundations of Science Vol. 20, No. 3, DOI 10.1007/s10699-015-9433-z.

Zwick, M. [WDRCR] (2023). "Words and Diagrams About Rosenstock-Huessy's Cross of Reality." Culture, Theory and Critique DOI: 10.1080/14735784.2022.2161590

**Nov 15, 20 Diachronics: Complexification…Impermanence**

Zwick, M. [HBL], "Some Analogies of Hierarchical Order in Biology and Linguistics (HBL)." *Applied General Systems Research: Recent Developments and Trends*, George Klir, ed., Plenum Press, New York, pp.521-529, 1978.
Zwick, Martin. [DC], "Dialectics & Catastrophe." In: Sociocybernetics, vol. I, Martinus Nijhoff, Boston, pp. 129-154, 1978.

**Nov 22 Systems View of History**

Zwick, M. [HHH], "Holism and Human History." Metanexus conference: Cosmos, Nature, and Culture: A Transdisciplinary Conference. July 18-21, 2009; Phoenix, Arizona. https://metanexus.net/holism-and-human-history/

**Nov 27 Systems theory & science; & religion**

Zwick, M. [BSR], "Systems Metaphysics: A Bridge from Science to Religion." Metanexus conference: Transdisciplinarity and the Unity of Knowledge: Beyond the Science and Religion Dialogue. June 2-6, 2007; Philadelphia, Pennsylvania. https://www.metanexus.net/systems-metaphysics-bridge-science-religion/

Zwick, M. [CT], "A Conversation on Theodicy." The Global Spiral, January 9, 2008. https://metanexus.net/conversation-theodicy/

Zwick, M. [PKIS], "Personal Knowledge and the Inner Sciences." In Markus Locker, ed., *Systems Theory and Theology: The Living Interplay between Science and Religion*, pp. 49-61, 2010. Eugene: Pickwick Publications.

Zwick, M. [SSAS] "Symbolic Structures as Systems: On the Near Isomorphism of Two Religious Symbols." In Markus Locker, ed., *Systems Theory and Theology: The Living Interplay between Science and Religion*, pp.62-96, 2010. Eugene: Pickwick Publications.

Zwick, M. [WDRS] "Words and Diagrams about Rosenzweig's Star." Naharaim 2020; 14(1): 5–33. https://drive.google.com/file/d/1F9mbDvdvFrxVXZ4R53vOydCYpBXiB-Oi/view?usp=sharing

**Nov 29 Systems theory & politics**

Zwick, Martin (2013). [OWS] "Complexity Theory and Political Change: Talcott Parsons Occupies Wall Street." In *Complexity and the Human Experience*, Paul A. Youngman & Mirsad Hadzikadic, eds, CRC Press, pp. 141-160 https://drive.google.com/file/d/1eAxaEtehBo_8ZGAp_TSUC6PIqCtQQmOE/view?usp=sharing

**SCIENTIFIC AMERICAN READER in**
**SYSTEMS THEORY and COMPLEX SYSTEMS**

Professor Martin Zwick
Portland State University

This reader is a resource for Systems Philosophy and other SySc courses. These articles are available via Canvas: go to the module titled "Scientific American articles," click on the document titled "Scientific American Reader With Links for Canvas.docx," then click on the link for the particular article you want to read. The visibility of articles within Canvas is not ideal, but you can download articles to your own device.

These articles are very old; I stopped collecting them many years ago. **Please contact me if you want to help out by adding more current articles to this Reader.**

## *I. General:*

**1**. **Russell Ruthen**, **Adapting to Complexity (Trends in Nonlinear Dynamics).** 1/93: 130-140.
**2**. **John Horgan**, **From Complexity to Perplexity**. 6/95: 104-109.
**3**. **Julie Wakefield**, **Complexity's Business Model**. 1/2001: 31, 34

## *II. Order/disorder, Dynamics:*

4. Gregory Chaitin, **Randomness and Mathematical Proof.** 5/75: 47-52.
5. Gregory Chaitin, **The Limits of Reason**. 3/06: 74-81.
6. David Layzer, **The Arrow of Time**. 12/75: 56-69.
7. Paul Davies, **That Mysterious Flow**. 9/02:40-43.
8. Charles H. Bennett, **Demons, Engines, and the Second Law**. 11/87: 108-116.
**9. J. Miguel Rubí, The Long Arm of the Second Law**. 10/08: 62-67.
10. Seth Lloyd & Y. Jack Ng, **Black Holes Computers**. 11/04:52-61.
**11**. **James P. Crutchfield**, J. Doyne Farmer, Norman Packard, & Robert Shaw, **Chaos.** 12/86: 46-57.
**12**. **E. C. Zeeman**, **Catastrophe Theory**. 4/76: 65-83.
13. Daniel L. Stein, **Spin Glasses.** 7/89: 52-59
**14**. **Per Bak & Kan Chen**, **Self-Organized Criticality**. 1/91: 46-53
**15**. **W. Brian Arthur**, **Positive Feedbacks in the Economy**. 2/90: 92-99.

## *III. Form, Complexity, Morphogensis:*

16. Nicholas Pippenger, **Complexity Theory**. 6/78: 114-124.
17. Irvin Rock & Stephen Palmer, **The Legacy of Gestault Psychology**. 12/90: 84-90.
18. Leonard M. Sander, **Fractal Growth**. 1/87: 94-100.
**19**. **Hartmut Jurgens, Heinz-Otto Peitgen, & Dietmar Saupe**, **The Language of Fractals.** 8/90:60-67.
20. Karl J. Niklas, **Computer-simulated Plant Evolution**. 3/86: 78-86.
21. Benoit B. Mandelbrot, **A Multifractal Walk down Wall Street**. 2/99: 70-73.
22. Shawn Carlson, **Boids of a Feather Flock Together**. 10/00: 112, 114
23. Moshe Sipper & James A. Reggia, **Go Forth and Replicate**. 8/01: 35-43.
**24**. **Barabasi & Bonabeau**, **Scale-Free Networks.** 5/03: 60
25. Taylor, Richard P. **Order in Pollock's Chaos**. 12/02:117-121.

## *IV. Behavior, Rationality:*

26. Daniel Kahneman & Amos Tversky, **The Psychology of Preferences**. 6/78: 160-173.
**27**. **John A. Swets, Robyn Dawes, &John Monahan**, **Better Decisions through Science**.10/00:82-87
**28**. **John Maynard Smith**, **The Evolution of Behavior**. 9/78: 176-192.
29. Natalie S. Glance & Bernardo A. Huberman, **The Dynamics of Social Dilemmas**.3/94:70-81.
**30**. **Martin A. Nowak, Robert M. May, & Karl Sigmund**, **Arithmetic of Mutual Help**.6/95:76-81.
31. Karl Sigmund, Ernst Fehr, & Martin A. Nowak, **The Economics of Fair Play**. 1/02: 83-87.
32. Michael Shermer, **The Doping Dilemma**. 4/08: 82-89.
33. Frans B. M. de Waal, **How Animals Do Business**. 4/05:7279.
34. Douglas H. Blair & Robert A. Pollak, **Rational Collective Choice.** 8/83: 88-95.
**35**. **Gary Stix, The Science of Bubbles & Busts**. 7/09: 78-85.
36. Gary Stix, **When Markets Beat the Polls**. 3/08: 38-45.
**37.** Herman E. Daly, **Economics in a Full World**. 9/05: 100-107.

## *V. Adaptation, Evolution:*

38. Richard C. Lewontin, **Adaptation.** 9/78: 213-230.
**39**. **Stuart A. Kauffman**, **Antichaos and Adaptation**. 8/91: 78-84.
**40**. **John Holland, Genetic Algorithms**. 7/92: 66-72.
41. Koza, John R., Martin A. Keane, & Mathew, J. Streeter, **Evolving Inventions**. 2/03:52-59
42. John Rennie, **Living Together**. 1/92: 123-133.
43. Jeffrey Kephart, Gregory Sorkin, David Chess, Steve White, **Fighting ComputerViruses**. 11/97: 88-93
**44**. **Eric Bonabeau and Guy Therauloz**, **Swarm Smarts**. 3/00: 72-79.
**45**. **Susan Blackmore**, **The Power of Memes**. 10/00: 64-73.
**46**. **Charles H. Bennett, Ming Li, & Bin Ma**, **Chain Letters & Evolutionary Histories**. 6/03:76-81.

## *VI. Computation, Modeling:*

47. Stephen Wolfram, **Computer Software in Science and Mathematics.** 9/84: 188-203.
48. Harry R. Lewis & Christos H. Papadimitriou, **The Efficiency of Algorithms**. 1/78: 96-109.
49. John E. Hopcroft, **Turing Machines**. 5/84: 86-98.
50. Robert G. Bland, **The Allocation of Resources by Linear Programming**. 6/81: 126-144.
**51**. **Bart Kosko & Satoru Isaka**, **Fuzzy Logic**. 7/93:, 76-81.
52. DavidTank & John J.Hopfield, **Collective Computation in Neuronlike Circuits.** 12/87: 104-114.
53. W. Wayt Gibbs, **Cybernetic Cells**. 8/01: 53-57.
**54**. Chris L. Barrett, Stephen G. Eubank, & James P. Smith, **If Smallpox Strikes Portland**. 3/05:54-61.
**55**. Steven W. Popper, Robert J. Lempert, & Steven C. Bankes, **Shaping the Future**. 4/05:66-71.