OVERVEW OF COMPLEXITY SCIENCE AND ITS RELATED AREAS OF STUDY

By

Brian Castellani, Ph.D.
Associate Professor of Sociology
Kent State University, OH, USA
Advisory Board Member
Center for the Study of Complex Systems
Kalamazoo College, MI, USA

The following is an extended list of names I compiled for many of the areas of study listed on my map of complexity science. I thought it might be useful for those new to the field—it is also my way of recognizing numerous important scholars I unfortunately could not include on my map due to the limits of space. Even still, this list is not exhaustive.

1. GENERAL SYSTEMS THEORY

A. Ludwig Bertalanffy (Founder/Biology)
B. Ralph Gerard (Biology)
C. Anatol Rapaport (Biology/Mathematics)
D. Kenneth Boulding (Economics/Peace & Mediation Studies)
E. James Grier Miller (Psychology/Medicine/Living Systems Theory)
=Miller links to Living Systems Theory in the 1970s.

Primary Sources:
Hammond, Debora 2002. "Exploring the Genealogy of Systems Thinking." Systems Research and Behavioral Science, 19:429-439.
International Society for the Systems Sciences (ISSS), Website, Historical Timeline.
Klir, George J. 2001. Facets of Systems Science, 2nd Edition. New York, NY: Kluwer Academic/Plenum Publishers. See Chapter Three.
American Society for Cybernetics (Notable Cyberneticians) www.asc-cybernetics.org.

SYSTEMS SCIENCE: It is at this point that General Systems Theory turns into Systems Science because of its direct link with cybernetics and its lines of thought.

2. Structural Functionalism:

A. Talcott Parsons (Sociologist/Founder)
B. Robert Merton (Sociologist)

Primary Sources:
Collins, Randall 1988. Theoretical Sociology. New York, NY: Harcourt Brace Jovanovich Inc.
Ritzer, George 2000. Sociological Theory, 5th Edition. New York, NY: McGraw-Hill.

3. Managerial Science:

A. Stafford Beer (Business/Founder)
Links to: Jay Forrester (Engineering/Computer Science/Systems Dynamics)

Primary Sources:
Hammond, Debora 2002. "Exploring the Genealogy of Systems Thinking." Systems Research and Behavioral Science, 19:429-439.
Rosenhead, Jonathan and Dick Martin 2002. "Stafford Beer." Systems Research and Behavioral Science, 20:81-83.
American Society for Cybernetics (Notable Cyberneticians) www.asc-cybernetics.org.

4. System (Simulation) Dynamics:

A. Jay Forrester (Engineering/Computer Science/Systems Dynamics)
Links to Ecological Systems Theory and Donella Meadows

Primary Sources:
Institute of Electrical and Electronic Engineering (IEEE).
American Society for Cybernetics (Notable Cyberneticians) www.asc-cybernetics.org.

5. Soft Systems Methodology:

A. Peter Checkland (Management/Founder)

Primary Sources:
Checkland, Peter 2000. "Soft Systems Methodology: A Thirty Year Retrospective." Systems Research and Behavioral Science, 17:S11-S58.
American Society for Cybernetics (Notable Cyberneticians) www.asc-cybernetics.org.

COMPLEXITY SCIENCE LINK: At this point systems science is now the product of complexity science as well as cybernetics and systems theory.

6. Ecology of Mind:

A. Gregory Bateson (Anthropology/Biology/Ecology of Mind)—links with cybernetics founders.

Primary Sources:
International Society for the Systems Sciences (ISSS), Website, Historical Timeline.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.
American Society for Cybernetics (Notable Cyberneticians) www.asc-cybernetics.org.

7. Ecological Systems Theory:

A. Donella Meadows (Biophysics/Whole Systems Research/World3/Sustainability)—linked to Jay Forrester.
B. Dennis Meadows (Management/Whole Systems Research/World3)
C. James Lovelock (Biology/Geophysics/Gaia Theory)
D. Lynn Margulis (MicrobiologyGaia/Evolution)
E. Fritjof Capra (Physics/Ecoliteracy)

Primary Sources:
For information on James Lovelock and Lynn Margulis, see: Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday. Chapter 1. For information on Donella Meadows, see the Sustainability Institute, www.sustainabilityinstitute.org/ .
Meadows, Donella, Dennis Meadows, and Jørgen Randers 1992. Beyond the Limits. White River Junction, VT: Chelsea Green Publishing Company.

8. New Social Systems Theory:

A. Niklas Luhmann (sociologist)—linked to Maturana and Varela & Parsons.
B. Kenneth Bailey (sociologist)—links to sociocybernetics.
C. Walter Buckley (sociologist)

Primary Sources:
Geyer, Felix and Johannes van der Zouwen 2001 (Editors). Sociocybernetics: Complexity, Autopoiesis, and Observation of Social Systems. Westport, CT: Greenwood Publishing Group.
Ritzer, George 2000. Sociological Theory, 5th Edition. New York, NY: McGraw-Hill.

9. George Klir (Systems Science/1980s): Key systems scientist who links to complexity science—link to fuzzy logic.

10. Living Systems Theory:

A. James Grier Miller (Psychology/Medicine/Founder)

Primary Sources:

Bailey, Kenneth 1994. Sociology and the New Systems Theory: Toward a Theoretical Synthesis. Albany, NY: State University of New York Press.
American Society for Cybernetics (Notable Cyberneticians) www.asc-cybernetics.org.

11. CYBERNETICS:

A. John von Neumann (Game Theory/Cellular Automata)
B. Norbert Wiener (Founder)
C. Claude Shannon (Information Theory)
D. Gregory Bateson (Ecology of Mind)—linked to ecology of mind.
E. Warren McCulloch (Artificial Neural Network)

Macy Conference (1946): All of the above attended the Macy Conference in 1946. Additional key scholars were:

A. Margaret Mead (Anthropology)—linked to general systems theory.
B. John Pitts (Artificial Neural Network)—linked to McCulloch.

Primary Sources:

American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.
The Complexity and Artificial Life Research Concept for Self-Organizing Systems: www.calresco.org.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.
International Society for the Systems Sciences (ISSS), Website, Historical Timeline.
Klir, George J. 2001. Facets of Systems Science, 2nd Edition. New York, NY: Kluwer Academic/Plenum Publishers.

12. Second-Order Cybernetics:

A. Heinz von Forrester (Physics).

Primary Sources:

American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.
Geyer, Felix and Johannes van der Zouwen 2001 (Editors). Sociocybernetics: Complexity, Autopoiesis, and Observation of Social Systems. Westport, CT: Greenwood Publishing Group.

COMPLEXITY SCIENCE LINK: At this point systems science is now the product of complexity science as well as cybernetics and systems theory.

13. Sociocybernetics:

A. Kenneth Bailey (Sociology)
B. Francisco Parra-Luna (Sociology/Founder)
C. Richard Henshel (Sociology)

D. Felix Geyer (Sociology)
E. Jon van der Zouwen (Sociology)

Primary Sources:
American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.
Geyer, Felix and Johannes van der Zouwen 2001 (Editors). Sociocybernetics: Complexity, Autopoiesis, and Observation of Social Systems. Westport, CT: Greenwood Publishing Group.
The Research Committee on Sociocybernetics, RC51, International Sociological Association: www.unizar.es/sociocybernetics.

14. Radical Constructivism:

A. Ernest von Glasersfeld (Founder)
B. LINKS: =Immanuel Kant (German philosopher 1724-1804)
=Giambattista Vico (Italian philosopher (1668-1744)
=American pragmatism
=Social Constructionism/constructivism (sociology)
=Jean Piaget (Swiss social scientist)
=Humberto Maturana and Francisco Varela

Primary Sources:
American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.
Klir, George J. 2001. Facets of Systems Science, 2nd Edition. New York, NY: Kluwer Academic/Plenum Publishers.

15. ARTIFICIAL INTELLIGENCE:

A. John McCarthy (Mathematics/Founder)

B. John von Neumann (Game Theory/Cellular Automata)
C. Norbert Wiener (Mathematics)
D. Claude Shannon (Information Theory)
E. Warren McCulloch (Artificial Neural Network)

F. John Pitts (Mathematics)
G. Allen Newell and Herbert Simon (Logic Theorist/General Problem Solver)
H. Allen Turing (Turing Machine)
I. Marvin Minsky (Founder MIT-AI Lab)
J. Arthur Samuel (Electrical Engineering/Games/Checkers)
K. Oliver Selfridge (Pandemonium)

Dartmouth Conference 1956

The four creators of the conference
=Claude Shannon (Mathematics)
=Marvin Minsky (Mathematics and Neurology)

=N. Rochester (Computer Engineering)—links to neural networks
=John McCarthy (Mathematics)

Primary Sources:
American Association of Artificial Intelligence: www.aaai.org.
American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.

16. Cellular Automata:

A. John von Neumann (Creator)
B. John Conway (Mathematics/Game of Life)
C. Stephan Wolfram (Mathematics/Mathematica)

Links to Humberto Maturana and Stuart Kauffman.

Primary Source:
Stephan Wolfram 2002. A New Kind of Science. Champaign IL: Wolfram Media.

17. Artificial Neural Networks/Distributed Artificial Intelligence:

A. Warren McCulloch and John Pitts—link to Cybernetics and AI
B. N. Rochester—link to Dartmouth group
C. Arthur Samuel (Checkers)—link to artificial intelligence
D. Minsky—link to artificial intelligence

E. Donald O. Hebb (Hebb Rule)
F. Frank Rosenblatt (Creator of CONNECTIONISM/parallel distributed processing/back-propogation/perceptron)
G. Bernard Widrow (Adaline/Madaline systems)
H. Stephen Grossberg (Adaptive Resonance Theory)
I. Tuevo Kohonen (Self-Organizing Map)
J. John Hopfield (Hopfield Neural Net)

Links to connectionism, cognitive science, and philosophy and to agent-based modeling and MAS—multi-agent systems.

Primary Source:
Garson, D. 1998. Neural Networks: An Introductory Guide for Social Scientists. Thousand Oaks, CA: SAGE Publications.

18. Fuzzy Logic:

A. Lotfi Zadeh (Electrical Engineering/Founder)
B. Bart Kosko (Mathematics/Engineering/Philosophy)
C. Ebrahim Mamdani (Electrical Engineering/First Application)

D. Klir (Systems Science)—link to systems science.
E. Toshiro Terano (Laboratory for International Fuzzy Engineering Research/Hosei University, Japan)
E. Takeshi Yamakawa (Fuzzy Logic Systems Institute/ Kyushu Institute of Technology)
F. Michio Sugeno (Fuzzy Math)

Primary Sources:
Kosko, Bart 1993. Fuzzy Thinking: The New Science of Fuzzy Logic. New York, NY: Hyperion.

19. DYNAMICAL SYSTEMS THEORY:

Links to Self-Organization and Agent- Based Modeling.

Primary Sources:
The Complexity and Artificial Life Research Concept for Self-Organizing Systems: www.calresco.org.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.

20. Fractal Geometry:

A. Benoit Mandelbrot (Founder)

B. Jules Henri Poincaré (French Mathematician)
C. Gaston Julia (French Mathematician)

Primary Sources:
The Complexity and Artificial Life Research Concept for Self-Organizing Systems: www.calresco.org.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.
Mandelbrot, Benoît 1983. The Fractal Geometry of Nature. New York, NY: Freeman.

21. Catastrophe Theory:

A. Rene Thom (Founder)

Primary Source:
Mathews, K.., M. White, and R. Long 1999. "Why Study the Complexity Sciences in the Social Sciences?" Human Relations, 52(4): 439-462.

22. Chaos Theory:

A. Edward Lorenz (meteorology/Lorenz Attractor/Butterfly Effect)
B. Tien Yien Li and James Yorke (coined term)

C. Mitchell Feigenbam (Chaos Constant)
D. Yoshisuke Ueda (Ueda Attractor)

Primary Sources:
The Complexity and Artificial Life Research Concept for Self-Organizing Systems: www.calresco.org.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.
Gleick, J. 1987. Chaos: Making a New Science. New York, NY: Penguin Books.

23. COMPLEXITY SCIENCES:

24. Self-Organization and Dynamics of Complex Systems:

Cybernetics 1960s

A. Heinz von Forrester (Physics)—links to cybernetics (1960s)
He also links to Macy Conference, Second-Order Cybernetics (founder), and Radical Constructivism.
B. Ross Ashby (Medicine/Psychiatry)—links to cybernetics (1960s)

Complexity Science 1970s

C. Ilya Prigogine (Physics/Dissipative Structures/Phase Transitions)—links to system evolution and adaptation.
D. Herman Haken (Lasers)
E. Manfred Eigen (Hypercycles)
F. Erich Jantsch (Self-Organizing Universe)
G. Humberto Maturana and Francisco Varela—links to Ecology of Mind and Emergence and Autopoiesis.
H. Stuart Kauffman (Biology/Self-Organization in Evolution)—links to NK Networks, Santa Fe Institute, Artificial Life, International Conference, Cybernetics

Primary Sources:
American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.
International Society for the Systems Sciences (ISSS), Website, Historical Timeline.
The Complexity and Artificial Life Research Concept for Self-Organizing Systems: www.calresco.org.
Geyer, Felix and Johannes van der Zouwen 2001 (Editors). Sociocybernetics: Complexity, Autopoiesis, and Observation of Social Systems. Westport, CT: Greenwood Publishing Group.
Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.
Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.

25. Emergence and Autopoiesis in Complex Systems:

A. Humberto Maturana (Autpoiesis/Biology of Cognition)
B. Francisco Varela (Mathematics/Autopoiesis/Biology of Cognition)
C. John Holland (Emergence/Genetics Algorithms/L-Classifiers)

Primary Sources:

American Society for Cybernetics (Notable Cyberneticians): www.asc-cybernetics.org.
Capra, F. 1996. The Web of Life. New York, NY: Anchor Books Doubleday.
International Society for the Systems Sciences (ISSS), Website, Historical Timeline.
The Complexity and Artificial Life Research Concept for Self-Organizing Systems: www.calresco.org.
Geyer, Felix and Johannes van der Zouwen 2001 (Editors). Sociocybernetics: Complexity, Autopoiesis, and Observation of Social Systems. Westport, CT: Greenwood Publishing Group.
Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.
Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.

26. Agent-Based Modeling of Complex Systems:

Links to Artificial Neural Networks, Cellular Automata and Fuzzy Logic, and outward to Game Theory, Simulation, Systems Dynamics, and Ecological Systems Theory.

27. Artificial Life:

A. John von Neumann (Cellular Automata)*
B. John Conway (Game of Life)
C. John Holland (Genetic Algorithm/Classifier Systems)*

D. Christopher Langton (Founder)*
E. Doyne Farmer*
F. Norman Packard
G. Stuart Kauffman*
H. Steen Rasmussen (Physics/VENUS)
I. Walter Fontana (Algorithmic Chemistry)
J. James Crutchfield (Physics/Complexity in AI)
K. Gerald Joyce (AI used to address AIDS)
L. David Jefferson (AI Ants/AntFarm from his work with Collins)
M. Richard Dawkins (Evolution/Biomorphs)*
N. John Koza (Computer Science)
O. Robert Axelrod (Politics Science/Complexity of Cooperation)
P. Stephanie Forrest
Q. William Daniel Hillis (mathematics/computer science)*
R. Karl Sims (Computer Science)
S. Thomas Ray (Biology/Tierra)

T. Aristid Lindenmayer (Physiology/L-Systems)
U. Alvy Ray (Mathematics/Fractals)
V. Peter Oppenheimer (student of Mandelbrot)
W. Stewart Wilson (Computer Science, worked with Holland Classifiers, Animats)
X. Charles Taylor (Biologist and co-worker with Wilson/RAM)
Y. David Ackley (Computer Science/AL)
Z. Fred Cohen (computer science/Computer Viruses as AL)*
AA. Larry Yaeger, Apple Computer, creator of PolyWorld

Primary Sources:

Adami, Christopher 1998. An Introduction to Artificial Life. New York, NY: Springer Verlag.
Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.
Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.
Levy Steven 199? Artificial Life. New York, NY: Vintage Books.
Ward, Mark 1999. Virtual Organisms: The Startling World of Artificial Life. New York, NY: St. Martin's Press.

28. Social Simulation/Artificial Societies:

Links to Rational Choice Theory, Exchange Theory, Social Network Theory, Symbolic Interactionism (particularly Anselm Strauss), Structuration Theory, New Systems Theory.

A. Thomas Schelling (Economics)
B. Kenneth Arrow (Economics)—links to Santa Fe

D. Nigel Gilbert (Key Founder/Editor of JASSS/Center for Research and Social Simulation, Department of Sociology, University of Surrey)
E. Jurgen Kluver (Mathematical Sociology)
F. Robert Axelrod (Key Founder/Cooperation/Game Theory)
G. Christopher Goldspink (Management Science)
H. Joshua Epstein and Robert Axtell (Economics/Agent-Based Modeling/Growing Artificial Societies)—link to Santa Fe

Primary Sources:

Epstein, Joshua M., and Robert Axell 1996. Growing Artificial Societies: Social Science from the Bottom Up. Washington DC: Brookings Institute Press.
Journal of Artificial Societies and Social Simulation (JASSS): jasss.soc.surrey.ac.uk.

29. Genetic Algorithms/LClassifiers:

A. John Holland (Creator Genetic Algorithm/L-Classifiers/Echo/Emergence)
Links to Santa Fe, Michigan, and Emergence

Primary Sources:

American Association of Artificial Intelligence: www.aaai.org.
Holland, John 1998. Emergence: From Chaos to Order. Camridge, MA: Perseus Books.
Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.
Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.

30. NK Networks:

A. Stuart Kauffman

Primary Sources:

Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.
Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.

31. Multi-Agent Systems:

A. Katia Sycara (Editor AAMAS)
B. Michael Wooldridge (Editor AAMAS)
C. Cristiano Castelfranchi
D. Ed Durfee
E. Nicholas Jennings
F. Victor Lesser
G. Bendifallah, Blanchard, Cambrosio, et al. 1988.

Primary Sources:

Jennings, Nicholas, Katia Sycara and Michael Wooldrige 1998. "A Roadmap of Agent Research and Development." Autonomous Agents and Multi-Agent Systems 1(1): 7-38.
Strübing, Jörg 1998. "Bridging the Gap: On the Collaboration between Symbolic Interactionism and Distributed Artificial Intelligence in the Field of Multi-Agent Systems Research." Symbolic Interaction 21(4): 441-464.
Wooldridge, M 2002. An Introduction to Multi-Agent System Research. Chichester, England: John Wiley & Sons.

32. Santa Fe Institute:

A. George Cowen (Physics/Founder)
B. Philip Anderson (Physics)
C. Murray Gell-Mann (Physics)
D. Brian Arthur (Economics)
E. Kenneth Arrow (Economics)
F. John Holland (Computer Science/Center for the Study of Complex Systems)
G. Brian Goodwin (Economics)
H. Stuart Kauffman (Biology/Evolution/AL/NK Networks/Self-Organization)
I. Norman Packard (Computer Science/AL)
J. J. Doyne Farmer (Computer Science/AL)
K. Per Bak (Physics/Self-Organized Criticality)
L. Christopher Langton (Computer Science/Founder AL)
M. Robert Axelrod (Social Simulation/Artificial Societies)
N. Melanie Mitchell (Computer Science/Evolutionary Computation/AL)
O. Stephanie Forrest (Computer Science/Computation)
P. Jennifer Dunne (Ecology/Computational Ecology)

Primary Sources:

Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.

Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.

33. Evolution and Adaptation in Complex Systems:

A. Stuart Kauffman (Biology/Evolution/Fitness Landscapes)
B. Per Bak (Self-Organized Criticality/Fractal Scaling)
C. Robert Axelrod (complexity of cooperation)
D. Agent-Based Modeling, in particular MAS and Straussian Negotiation
E. Geoffrey West (Biology/Scaling Laws)

Primary Sources:

Lewin, Roger 1992. Complexity: Life at the Edge of Chaos. New York, NY: MacMillan Publishing Company.

Waldrop, M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York, NY: Simon & Schuster.

32. Complex Network Theory:

A. Gestalt Theory and Sociometrics; Sociology; Anthropology; Cognitive Science; Exchange Theory; Rational Choice Theory; Biology; Ecology.
B. Stanley Milgram (Social Psychology/Six-Degrees of Separation)
C. Paul Erdős and Alfréd Rényi (Mathematics/Graph Theory)
D. Mark Granovetter (Sociology/Strength of Weak Ties 1970s)
E. Malcom Gladwell (Tipping Points)
F. Barry Wellman (International Network for Social Network Analysis 1978)
G. Duncan Watts and Steve Strogatz (mathematics/Small Worlds)
H. Albert-László Barabási (mathematics/Linked)

Primary Sources:

Ambulard, Frédéric 2004. "Simulating Social Networks: A Review of Three Books." Journal of Artificial Societies and Social Simulation, jasss.soc.surrey.ac.uk

Barabási, Albert-László 2002. Linked: The New Science of Networks. Cambridge, MA: Perseus Publishing.

Bonacich, Phillip 2004. "The Invasion of the Physicists." Social Networks, 26: 285-288.

Buchanan, Mark 2002. Nexus: Small Worlds and the Groundbreaking Science of Networks. New York, NY: W.W. Norton.

Collins, Randall 1988. Theoretical Sociology. New York, NY: Harcourt Brace Jovanovich Inc.

B. AREAS AND THEIR LINKS:

GENERAL SYSTEMS THEORY

1. Gestalt Psychology (forerunner to GST)
2. Organismic Biology (forerunner to GST)
3. Ecology (forerunner to GST and later links to Systems Ecology)

4. General Systems Theory

5. Society for General Systems Research (SGSR) (1954)

6. Systems Science (1950s)

7. Structural Functionalism (1950s)
(Also influenced by P.A. Sorokin / Emile Durkheim / Max Weber / Karl Marx / Malinowski / Radcliffe-Brown)

8. Managerial Science (1950s)

9. System (Simulation) Dynamics (1960s)

9. Ecology of Mind (1970s)

COMPLEXITY SCIENCES LINK

10. Ecological Systems Theory (1970s)
Links to this node: ecology, ecosystem, ecological modeling, ecofeminism, social (human) ecology, and Arne Ness who founded Deep Ecology)

11. New Social Systems Theory (1980s)
Links to sociocybernetics.

12. International Society for the Systems Sciences (ISSS) (1988)

CYBERNETICS

1. Mathematics
2. Computer Science
3. Engineering

4. Cybernetics (1940s)

    5. Macy Conference (1946)

    6. Self-Organizing Systems (1960s)

    7. Second-Order Cybernetics (1970s)
       Links to New Social Systems Theory, Radical Constructivism and Sociocybernetics.

    8. Radical Constructivism (1980s)

    COMPLEXITY SCIENCES LINK

    9. Sociocybernetics (1980s)

10. ARTIFICIAL INTELLIGENCE (1950s)

    11. Dartmouth Conference (1956)

    12. Cellular Automata (1970s)

    13. Artificial Neural Networks/Distributed Artificial Intelligence (1970s)

    14. Fuzzy Logic (1970s)

DYNAMIC SYSTEMS THEORY

    16. Fractal Geometry (1970s)

    17. Dynamical Systems (Chaos) Theory (1970s)

    18. Catastrophe Theory (1970s)

COMPLEXITY SCIENCES (1970s)

Self-Organization and System Dynamics (1970s)

Emergence and Autopoiesis (1970s)

Computation and Agent-Based Modeling (1980s)

Links to Artificial Neural Networks, Cellular Automata and Fuzzy Logic. Additional Links to Game Theory, Statistics, Nonlinear Mathematics, Systems Dynamics and Ecological Systems Theory.

Artificial Life (1980s)

Social Simulation/Artificial Societies (1980s)

Links to Rational Choice Theory, Exchange Theory, Social Network Theory, Symbolic Interactionism (particularly Anselm Strauss), Structuration Theory, New Systems Theory.

Genetic Programming/Genetic Algorithms (1980s)

Multi-Agent Systems (MAS) (1990s)

NK Networks (1980s)

Santa Fe Institute (1984)

System Evolution and Adaptation (1980s)

Self-Organized Criticality

Fractal Scaling

Stuart Kauffman

Cooperation/Axelrod

MAS and Straussian negotiation

Complexity Journal (1995)

First International Conference on Complexity (1997)
=Yaneer Bar-Yam (President, New England Complex Systems Institute)

Networks/Small Worlds (1990s)