My Two Presentations at 2012 Buckminster Fuller Legacy Conference

Posted on 12 December 2012 by **cjf**

I participated in the ReVIEWING Black Mountain College 4: Looking Forward at Buckminster Fuller's Legacy conference on September 28-30, 2012 in Asheville, NC, USA. I gave two talks (click on the links below to see the PDF presentations):

- Education Automation Now and in the Future. In this talk I recognize Buckminster Fuller as one of the conceptual founding fathers of the Open Educational Resources (OER) movement, detail six of his educational ideas, and give a brief review of several OER courses I've taken to indicate the kind of comprehensive education now possible using freely available on-line courses.
- Synergetics and Model Thinking. In this talk I synthesize Scott E. Page's Model Thinking with Buckminster Fuller's Synergetics. I introduce both subjects, then discuss the importance of model thinking. Then I sketch some ideas about how Model Thinking and Synergetics can inform a more incisive approach to science.

Please share any thoughts you might have about these presentations in the comments. I would value your feedback.

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Tags: Buckminster Fuller, Education, Education Automation, model thinking, OER, Online Courses, Open Educational Resources, Science, Synergetics

Posted in Education, News, Synergetics | Print

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- **17 December 2014**: Addenda to My Conversation With Harold Channer (10 comments)
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- **10 April 2019**: Robert Sapolsky's Edutaining "Human Behavioral Biology" (1 comment)

2 Responses to “My Two Presentations at 2012 Buckminster Fuller Legacy Conference”

1. **mom** on 13 December 2012 at 4:50 pm

   I do like to try to keep up with what you are doing !!
   Keep it up.

   Reply

2. **Don Briddell** on 3 March 2013 at 12:36 am

   CJ,

   Read what looked like a powerpoint presentation on modeling. This is naturally what I think about. Calling it “structural anayltics” these days.

   In 900.31, can’t a model be a special case as well?

   

   I think of the 3-D models I build as my equations. The are self-proofing, something math equation has to do only instead of symbols representing forms in Nature, the models are nature itself without the symbol. The problem with symbols is they can mean anything you want them to mean whereas in Nature they can only mean what Nature allows. For that reason my trust in Natural models feels more real and solid, so to speak. Don

   Reply

3.

Education Automation Now and in the Future
CJ Fearnley
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http://www.SynergeticsCollaborative.org
cjf@CJFearnley.com
http://blog.CJFearnley.com
28 September 2012
Presentation to ReVIEWING Black Mountain College 4: Looking Forward at Buckminster Fuller’s Legacy at the University of North Carolina at Asheville
On-line version of this presentation:
http://www.CJFearnley.com/Asheville.Education.Automation.pdf
Introduction Bucky’s Vision on Education A Survey of OER Conclusion
Introduction to OER and Bucky’s Education Automation
My Background
I earned a BA in Mathematical Sciences and Philosophy from Binghamton University in 1989. But knowledge has changed so much in 25 years that I’m enjoying an educational refresh using free on-line video courses!
My involvement in the Synergetics Collaborative which is an educational and scientific non-profit makes me an educator of sorts. But I see myself mostly as a student. I

have “taken” 18 on-line video courses in 5 years.
The next Synergetics Collaborative event will be the Fourth Biennial Design Science Symposium at RISD on the theme of Bridging Morphology, Biomimicry, Sustainability, and Synergetics to be held in February 2014 in Providence, RI.
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The Open Educational Resources (OER) Movement
Open Educational Resources (OER) are freely usable, re-usable and modifiable on-line educational materials.
The Internet makes video and audio effective ways to deliver education. Also, lecture notes, assignments, textbooks, exams, etc.
The OER movement is an Internet-powered expansion of the practice of students and teachers sharing materials.
The wikipedia entry has many more details:
http://en.wikipedia.org/wiki/Open_educational_resources
My essay “Buckminster Fuller and the Open Educational Resources Movement” (2010) has more thoughts:

http://blog.cjfearnley.com/2010/10/26/buckminster-fuller-and-the-oer-movement/
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
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Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
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CapeTown Open Education Declaration
"We are on the cusp of a global revolution in teaching and learning. Educators worldwide are developing a vast pool of educational resources on the Internet, open and free for all to use. These educators are creating a world where each and every person on earth can access and contribute to the sum of all human knowledge. They are also planting the seeds of a new pedagogy where educators and learners create, shape and evolve knowledge together, deepening their skills and understanding as they go."
CapeTown Open Education Declaration, 2007
http://www.capetowndeclaration.org/read-the-declaration
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Introduction to Education Automation

Buckminster Fuller's short book Education Automation, a
transcript of a 22 April 1961 lecture, was published in 1962.
It preceded J. C. R. Licklider's memos on computer
networks in August 1962.
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Introduction to Education Automation (continued)
I am amazed at how prescient Bucky was in anticipating
what has become the Open Educational Resources (OER)
movement.
This talk will discuss six (6) of Bucky's key visions from his
book and look at the OER movement as a present-day
embodiment of that vision.
Buckminster Fuller is, in my view, one of the conceptual
founding fathers of the OER movement.
The future that Bucky envisioned is now!
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
Bucky's Vision in Education Automation
The BIG Problem of Education
"We know our world population is increasing
incomprehendibly swiftly. There are enormous numbers to
be educated."
— R. Buckminster Fuller, Education Automation
80 million more people per year = 152 more per minute =
2.5 more every second. Billions more people can be
expected. Unprecedented population growth.
1.9 billion children under 15 (the largest cohort ever!)
currently represents 27% of world population
http://www.gapminder.org/news/world-peak-number-of-children-is-now/
6.7% of the worlds population has a college degree. "Since
1950, the average number of years of schooling for people
15 and older has more than doubled to 7.76."
http://www.sfgate.com/business/article/6-7-of-world-population-has-a-college-degree-31
70% of the global population does not attend college.
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky’s Vision on Education A Survey of OER Conclusion
Bucky’s Vision in Education Automation
The BIG Problem of Education (continued)
“The big question is how are we, as educators, going to handle the enormous increase in the new life? How do we make available to these new students what we have been able to discover fairly accurately about the Universe and the way it is operating? How are we going to be able to get to them the true net value won blindly through the long tradition of ignorant dedications and hard-won lessons of all the unknown mothers and all the other invisibly heroic people who have given hopefully to the new life, such as, the fabulous heritage of men’s stoic capacity to carry on despite immense hardships?”
— R. Buckminster Fuller, Education Automation
Millions of people are already using free OER resources. It can scale to service billions!
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Introduction Bucky’s Vision on Education A Survey of OER Conclusion
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Introduction Bucky’s Vision on Education A Survey of OER Conclusion
Bucky’s Vision in Education Automation
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Can OER help preserve and propagate Humanity's vast cultural heritage?
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
Bucky's Vision in Education Automation
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
Bucky's Vision in Education Automation
A Vision of Video Education
"I have taken photographs of my grandchildren looking at television. Without consideration of the 'value,' the actual concentration of a child on the message which is coming to him is fabulous. They really 'latch on.' . . . I am quite certain we are soon going to begin to do the following: At our universities we will take the faculty leaders in research or in teaching. We are not going to ask them to give the same lectures over and over each year from their curriculum cards. . . . They will give their basic lecture course just once to a group of human beings, including both the experts in their own subject and bright children and adults without special training in their field."
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I particularly value OER video courses for their edutainment value. Even if I do not care to master the details, I get a feeling for the subject. I can stop and rewind the video to reflect or take detailed notes when my interests or needs require it.
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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A Vision of Video Education (continued)
"I am quite sure we are going to get research and development laboratories of education where the faculty will become producers of extraordinary moving-picture documentaries. That is going to be the big, new educational trend."
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Fuller's prognostication of subject matter experts preparing videos has come to fruition with the advent of the OER movement! Top professors are rushing to get their pet courses on-line to influence students around the world!
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Education as the major world industry
"Our education processes are in fact the upcoming major world industry. . . . I would say, then, that you are faced with a future in which education is going to be number one amongst the great world industries, within which will flourish an educational machine technology that will provide tools such as the individually selected and articulated two-way TV and an intercontinentally networked, documentaries call-up system . . .."
— R. Buckminster Fuller, Education Automation
Bucky anticipated the importance of global information networks! Now 50 years later, Fuller's vision is spontaneously emerging using the Internet instead of two-way TV.
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Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Research and development in education
“As we now disemploy men as muscle and reflex machines, the one area where employment is gaining abnormally fast is the research and development area. Research and development are a part of the educational process itself. We are going to have to invest in our people and make available to them participation in the great educational process of research and development in order to learn more. When we learn more, we are able to do more with our given opportunities.”
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Wouldn’t school be so much more engaging if we applied our knowledge to build and discover new things as an integral part of an R&D process?
Witness:
http://www.wired.com/wiredscience/2010/12/kids-study-bees/
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky’s Vision on Education A Survey of OER Conclusion
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Introduction Bucky’s Vision on Education A Survey of OER Conclusion
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The importance of unlearning

“. . . to discover whether the capable student is able to unlearn everything he has learned, . . . experience has shown that that is what he is going to have to do if he is to become a front-rank scientist. The frontiers of science are such that almost every morning many of our hypotheses of yesterday are found inadequate or in error. So great is the frontier acceleration that now in a year of such events much of yesterday’s conceptioning becomes obsolete.”

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The unlearning process is vital to human affairs as it can help allay the negative effects of a “hardening of the categories” which can blind us to deeper previously undiscovered realities.

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Introduction Bucky’s Vision on Education A Survey of OER Conclusion
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The future of education is Individual Education

“I think . . . primarily the individual is going to study at home. . . . I am quite sure that the students of all ages will keep on going to ‘school houses’ to get social experiences — to be ‘baby-sat.’ . . . Real education, will be something to which individuals will discipline themselves spontaneously under the stimulus of their individually unique chromosomes . . . No two people have the same appetite at the same time. . . . Simultaneous curricula are obsolete.”

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I deeply agree with Bucky about individual education. Although I prefer archived courses in many ways over simultaneous curricula such as Coursera.org and EdX.org. Education and learning is really a deeply social process and simultaneous courses are more engaging (a cohort of peers, deadlines, extra faculty attention, etc.).

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My first OER Video Courses
My first OER Video Course: Financial Markets
Since 2008, I’ve “taken” 18 OER video courses.
ECON 252: Financial Markets, Spring 2008, Robert Shiller, Yale http://oyc.yale.edu/economics/econ-252-08
2011 version: http://oyc.yale.edu/economics/econ-252-11
Rober Shiller is the “Shiller” in the Case-Shiller Home Price Indices
I unlearned that government is an impediment to business; instead, I learned that contract law is the basis for business.
I treated the course as “edutainment”, so I want to take the new 2011 version to try to understand the subject in more depth (and learn more about the financial crisis from this leading economist).
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky’s Vision on Education A Survey of OER Conclusion
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Introduction Bucky’s Vision on Education A Survey of OER Conclusion
My first OER Video Courses

MIT 8.01 Physics I: Classical Mechanics
MIT 8.01 Physics I: Classical Mechanics, Fall 1999, Walter Lewin
http://ocw.mit.edu/courses/physics/8-01-physics-i-classical-mechanics-fall-1999/
Scholar Course version:
http://ocw.mit.edu/courses/physics/8-01sc-physics-i-classical-mechanics-fall-2010/
I saw an article in the New York Times about this course: it helped inspire me to replace TV with Internet video.
Lewin says he spent about 40 hours preparing each lecture: it shows, they are exquisite!
He demonstrates every principle he teaches so you get a tactile feel for the physics (it is MIT: so he covers the math in depth too).
I treated the course as "edutainment" and did not master the material (I took calc-based physics in college, but it has long since been mostly forgotten).

My first OER Video Courses
MIT 18.06 Linear Algebra
MIT 18.06 Linear Algebra, Spring 2010, Gilbert Strang
http://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010
Scholar Course version:
http://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011
My Review:
http://blog.cjfearnley.com/2011/04/15/study-linear-algebra-at-mit-with-gilbert-strang
Linear Algebra is, perhaps, the most important and most useful of the college-level math courses available.
This was the first course I studied in depth taking 2+ final exams, quizzes and doing homeworks (even though I did well in my college Linear Algebra course: it was 20+ years before and needed serious refreshing).

A Comprehensivist Curriculum for myself
Physics C10/LS C70V: Physics for future Presidents
Physics C10/LS C70V: Physics for future Presidents AKA Descriptive Introduction to Physics, Spring 2008 (link is for Fall 2010), Richard Muller, Berkeley
http://www.youtube.com/view_play_list?p=810FF8DB5EB87B5F
My review:
http://blog.cjfearnley.com/2011/02/24/the-most-important-video-course-on-line-physics-
Muller explains physics in terms even a President can understand (no advanced math). The course focuses on socially important issues such as energy, radioactivity, nukes, electricity & magnetism, gravity, satellites, orbits, space, waves, light, global warming, etc.
I unlearned that radioactivity is so dangerous. It is dangerous, but not as dangerous as most of us think.
I watched the Spring 2008 version which is no longer on-line (I have a copy, but it is not yet on-line).

EEB 122: Principles of Evolution, Ecology and Behavior
EEB 122: Principles of Evolution, Ecology and Behavior, Spring 2009, Stephen Stearns, Yale
http://oyc.yale.edu/ecology-and-evolutionary-biology/eeb-122
My review:
http://blog.cjfearnley.com/2011/08/23/a-big-picture-conceptual-introduction-to-biology-
I unlearned that "survival of the fittest" is valid. Stearns says the concept wasn't even part of Darwin's first edition of On the Origin of Species, it was introduced by Herbert Spencer, and it is wrong.
Stearns is a big picture thinker and he connects life to all the atoms in Universe and discusses the big picture of geology and ecology. See my review for details.

ESS 15 Blue Planet: Introduction to Oceanography
ESS 15 Blue Planet: Introduction to Oceanography, UCLA
http://www.youtube.com/view_play_list?p=86F7D2B9DFC5E52F

4 of Earth is water. The oceans generate our weather and our climate? But how? This course covers the basics very nicely.
I learned that plate tectonics was controversial until we saw what was under the oceans. We still haven't explored the oceans to a significant degree.
This course is very good edutainment as the pace is slow enough that I didn't need to take many notes nor watch the videos twice.

ITAL 310: Dante in Translation
ITAL 310: Dante in Translation, Fall 2008, Giuseppe Mazzotta, Yale
http://oyc.yale.edu/italian-language-and-literature/ital-310
My review:
http://blog.cjfearnley.com/2012/04/29/dantes-great-commedia-or-poetry-as-a-way-of-know
A comprehensivist needs to study the Humanities as well! How else can you imagine bridging the sciences with the humanities?
Dante is a Big Picture . . . cosmic thinker. Bucky people would do well to know him.
To say that the Commedia is rich in a multidimensional way is an understatement. The Commedia is intricate, dramatic, thrilling, mind-blowing, cosmic, shocking, ineffable, sometimes oppressive, and altogether extraordinary.
I unlearned that there was no science in the middle ages: Beatrice describes an experiment.

Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
A Comprehensivist Curriculum for myself
MCDB 150: Global Problems of Population Growth
MCDB 150: Global Problems of Population Growth, Spring
2009, Bob Wyman, Yale
http://oyc.yale.edu/molecular-cellular-and-developmental-biology/mcdb-150
Wyman considers population growth from practically every
imaginable perspective. It is a fascinating and unsettling
presentation.
I unlearned that the correlation between energy production
and population growth is significant (as Bucky asserted).
Instead it seems that the fall in the death rate, fall in infant
mortality, rise in per capita income (economic rise), literacy,
urbanization, industrialization, and education (either female
or male) all correlate with a decline in fertility. But
correlation is not causation!!
The spontaneous, global, disapproved by both government
and religion, transition from high fertility to low fertility is a
profound mystery that has so far evaded all attempts by
demographers to find its cause!
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
A Comprehensivist Curriculum for myself
MIT 3.091 Introduction to Solid State Chemistry
MIT 3.091 Introduction to Solid State Chemistry, Fall 2010,
Donald Sadoway
http://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-so
This is, perhaps, the most important course I took from the
perspective of understanding how our physical world works:
it is all explained by electronic structure!
The course is elementary and satisfies MIT's all college
chemistry requirement, but it is at the MIT level (so it
demands a lot of effort). I want to master it . . ..
Sadoway is a brilliant teacher who ties in the humanities
and applications in his lectures. The course answers basic
questions about how materials behave: it has a materials
science perspective.
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
A Comprehensivist Curriculum for myself
World History / World Civilization to 1500 CE
W3902: World History to 1500 CE, Richard Bulliet, Columbia
http://www.youtube.com/view_play_list?p=49C7AA14331CFEF3
HIST 3379: World Civilization to 1500, Sally Vaughn, UHouston
http://www.youtube.com/view_play_list?p=32431938AF5F757F
Bucky suggests that by speculatively looking deep into the
past we can obtain leverage on the arc of history. So I am
using these freely available courses to take a fresh look at
our global history.
Bulliet makes me think by discussing how we understand
and imagine history. He doesn't cover the facts of history in

any breadth (maybe if I had read his book). But his perspective is very big picture.
Vaughn has done a brilliant job finding public domain artwork to illustrate her lectures. Her lecture notes provide good entry points for Wikipedia readings, so I can get a more complete coverage of the facts of history.

A Comprehensivist Curriculum for myself
Model Thinking with Scott E. Page
COMPLXSYS 391: Model Thinking, Coursera, U Michigan, Scott E. Page
http://www.modelthinker-class.org
My Review:
http://blog.cjfearnley.com/2012/06/14/the-importance-of-model-thinking
Profound course with a strong Synergetics flavor.
See my talk on Sunday for more details!

My Next/Current Comprehensivist Courses
The Art of Living, Stanford
The Art of Living, R. Lanier Anderson, Kenneth Taylor, & Joshua Landy, Stanford
http://humanexperience.stanford.edu/artofliving
Studies Plato's Symposium, Shakespeare's Hamlet, Kierkegaard's Fear and Trembling, Nietzsche's The Gay Science, and Morrison's Song of Solomon to gain insights into how to live life . . . "the art of living".
Each author suggests a highest value for your life: reason, authenticity, faith, art, and community.

My Next/Current Comprehensivist Courses
MIT 18.02 Multivariable Calculus
MIT 18.02 Multivariable Calculus, Denis Auroux
http://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007
Scholar Course:
http://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010
I want to study advanced sciences but I've forgotten my Calculus from college.
Bucky is right that Calculus has some philsophical issues.
But all models are partially wrong (even Bucky's). Calculus is a powerful tool that (despite its issues) gives excellent approximations that come close enough to truth for the purpose of standard engineering and more.

My Next/Current Comprehensivist Courses
Computing for Data Analysis, Johns Hopkins
Computing for Data Analysis, Roger D. Peng, Johns Hopkins, just started, 4 weeks
https://www.coursera.org/course/compdata

The statistical revolution of the 20th century has
transformed our understanding and practice of science.
Moreover, we now have a data deluge. I want to understand
statistics and the analysis of data more deeply.
This course is about the R programming language which is
an advanced FOSS (free and open source software) tool for
statistical programming.
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
My Next/Current Comprehensivist Courses
Design: Creation of Artifacts in Society, UPenn
Design: Creation of Artifacts in Society, Karl T. Ulrich,
UPenn, Starts 22 October 2012 for 8 weeks
https://www.coursera.org/course/design
I am very excited about this course! My Synergetics
Collaborative colleagues, design professor, John Belt, and
Amy Leidtke and her colleages at RISD have left me feeling
ignorant about design given that my background consists of
only one 3D design class from college 25 years ago.
So I plan to do a deep dive into this course!!! Join me!
I will be using Blender http://www.blender.org as my
3D modeling tool, because I insist on using FOSS (free and
open source software) technology and it is reported to be
excellent but difficult to master. So I will have my work cut
out for me this fall!
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
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Major OER Archives
MIT OpenCourseWare:
http://ocw.mit.edu/courses/audio-video-courses
Yale Open Courses: http://oyc.yale.edu
NPTEL (National Programme on Technology Enhanced
learning): A Joint Venture of Indian Institutes of Technology (IIT)
and The Indian Institute of Science: 269 video courses!
http://nptel.iitm.ac.in
YouTube: http://www.youtube.com/nptelhrd
The University of Houston: http://www.youtube.com/UHouston
University of California, Berkeley:
http://www.youtube.com/UCBerkeley
Khan Academy: http://www.khanacademy.org
Connexions: http://cnx.org
Coursera: https://www.coursera.org
Udacity: http://www.udacity.com
Edx: http://www.edxonline.org
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
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MIT OpenCourseWare:
http://ocw.mit.edu/courses/audio-video-courses
Yale Open Courses: http://oyc.yale.edu

NPTEL (National Programme on Technology Enhanced learning): A Joint Venture of Indian Institutes of Technology (IIT) and The Indian Institute of Science: 269 video courses!
http://nptel.iitm.ac.in
YouTube: http://www.youtube.com/nptelhrd
The University of Houston: http://www.youtube.com/UHouston
University of California, Berkeley: http://www.youtube.com/UCBerkeley
Khan Academy: http://www.khanacademy.org
Connexions: http://cnx.org
Coursera: https://www.coursera.org
Udacity: http://www.udacity.com
Edx: http://www.edxonline.org

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MIT OpenCourseWare: http://ocw.mit.edu/courses/audio-video-courses
Yale Open Courses: http://oyc.yale.edu
NPTEL (National Programme on Technology Enhanced learning): A Joint Venture of Indian Institutes of Technology (IIT) and The Indian Institute of Science: 269 video courses!
http://nptel.iitm.ac.in
YouTube: http://www.youtube.com/nptelhrd
The University of Houston: http://www.youtube.com/UHouston
University of California, Berkeley: http://www.youtube.com/UCBerkeley
Khan Academy: http://www.khanacademy.org
Connexions: http://cnx.org
Coursera: https://www.coursera.org
Udacity: http://www.udacity.com
Edx: http://www.edxonline.org
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
Conclusion
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So join the movement!
Make your educational materials accessible on the Internet with a license that supports re-use and modification.
Take courses to become a comprehensivist, to learn how the world works, build your generalist and tactical skills so you can contribute to making civilization work better.
I can be your OER guidance counselor: feel free to contact me for help finding some good courses.

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Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky’s Vision on Education A Survey of OER Conclusion
Conclusion
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Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative
Introduction Bucky's Vision on Education A Survey of OER Conclusion
Thank You
Thank You
Thank You!
Any Questions?
On-line version of this presentation:
http://www.CJFearnley.com/Asheville.Education.Automation.pdf
Education Automation Now and in the Future CJ Fearnley, Synergetics Collaborative

Synergetics and Model Thinking
CJ Fearnley
cjf@SynergeticsCollaborative.org
http://www.SynergeticsCollaborative.org
cjf@CJFearnley.com
http://blog.CJFearnley.com
30 September 2012
Presentation to ReVIEWING Black Mountain College 4: Looking Forward at Buckminster Fuller's Legacy at the University of North Carolina at Asheville
On-line version of this presentation:
http://www.CJFearnley.com/Asheville.Synergetics.Model.Thinking.pdf
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Synergetics?
What is Synergetics?
Synergetics is the system of comprehensive thinking which R. Buckminster Fuller introduced, primarily, in his two volume magnum opus, Synergetics: Explorations in the Geometry of Thinking, 1975, 1979.
"Synergetics, in the broadest terms, is the study of spatial complexity, and as such is an inherently comprehensive discipline. ... Experience with

synergetics encourages a new way of approaching
and solving problems. Its emphasis on visual and
spatial phenomena combined with Fuller's wholistic
approach fosters the kind of lateral thinking which so
often leads to creative breakthroughs."
– Amy Edmondson, A Fuller Explanation, 1987
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
What is Synergetics?
Synergetics is multi-faceted
Synergetics is multi-faceted:
Joe Clinton (2007) defines it as a kind of synergism with
elements of self-similarity (fractal) and self-organizational
behavior.
SynergeticsCollab video: Synergetics 101:
http://www.youtube.com/watch?v=y-mpwMPeCm8
It is one comprehensive thinker's vision for a discipline of
"synergy"; a vision for a system of thinking about the
"behavior of whole systems unpredicted by the behavior of
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
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What is Synergetics?
Resources
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Both volumes of Synergetics: Explorations in the
Geometry of Thinking are on-line at
http://www.rwgrayprojects.com/synergetics/synergetics.html
Amy Edmondson’s book A Fuller Explanation: The
Synergetic Geometry of R. Buckminster Fuller
http://bfi.easystorecreator.com/items/books/a-fuller-explanation-the-synergetic-geometr
Reading Synergetics: Some Tips
http://www.cjfearnley.com/synergetics.essay.html
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
What is Model Thinking
What is Model Thinking
Model Thinking is an attempt by Scott E. Page to
synthesize the modern approach of complex systems
which has transformed our understanding of the social
sciences over the past 40 years into a new intellectual
discipline.
Model Thinking provides a toolkit for understanding,
decision-making, prediction, strategy, and design.
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
What is Model Thinking
Model Thinking MOOC
I took a MOOC (Massive Open Online Course) on Model
Thinking led by Scott E. Page last spring wherein he explains
how models can help us understand, strategize, predict,
re-design, and make decisions in our worlds!
http://www.modelthinker-class.org/
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative

What is Model Thinking

Model Thinking Helps us Change the World

“So if you want to be out there helping to change the world in useful ways, it’s really really helpful to have some understanding of models.”

— Scott E. Page

http://www.modelthinker-class.org/

Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion

What is Model Thinking

Study Model Thinking Now!

The Model Thinking MOOC is running again now (92,000 students!). It started early this month. The second homework is due Tuesday. But I think you can catch up: the course runs with liberal deadlines.

My review of the course is at

http://blog.cjfearnley.com/2012/06/14/the-importance-of-model-thinking/

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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion

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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative

Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion

What is Model Thinking

What is a Model

A model is a (simplified) conceptual representation of the world or of part of the world.

Effectively, any conceptuality provides a model (Page does not say this).

But most models provide little discernability, no predictive leverage, and no deeper understanding.

Consider the case of Opposite Proverbs:

Nothing ventured, nothing gained

Better safe than sorry

Most (all?) proverbs have an opposite. No discerning power there!!!

What we want to do with models is find leverage to discern how the world or at least a sub-system in the world operates.

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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
Models Right and Wrong
“Essentially all models are wrong, but some are useful.” — George E. P. Box
Also, I suspect all models are right, but some provide better leverage or clarity or insight in some aspects of the system modeled than others.
That is, the question with models is in what ways does it provide a better understanding than the several other models of the given system? Or, what are the models’ strengths and weaknesses?
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
Formal Models
A formal model is a written out characterization that
defines the parts and their behavior or interrelationships.
From this we explore how this idealized system works with
a view to understanding the real system it models.
900.21 “Synergetics is a book about models: humanly
conceptual models; lucidly conceptual models; primitively
simple models; rationally intertransforming models; and
the primitively simple numbers uniquely and holistically
identifying those models and their intertransformative,
generalized and special case, number-value accountings.”
http://www.rwgrayprojects.com/synergetics/s09/p0000.html#900.21
900.31 “Model is generalization; form is special case.”
http://www.rwgrayprojects.com/synergetics/s09/p0000.html#900.31
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
An Elementary Model: Schelling’s Segregation Model
Agent-Based Models: many agents or individuals (the objects of the model) are programmed with behaviors (rules) and interact in a computer simulation.
Schelling Dynamic Models of Segregation (1971)
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
An Elementary Model: Schelling’s Segregation Model
Agent-Based Models: many agents or individuals (the objects of the model) are programmed with behaviors (rules) and interact in a computer simulation.
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
Schelling and Synergy
Schelling’s 1978 book “Micromotives and Macrobehaviors”
Macrobehavior 6 = Micromotives
Synergy: “behavior of whole systems unpredicted by the behavior of their parts taken separately.”
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
What is Model Thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion

What is Model Thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
Why is it important to use multiple model thinking?
Why is it so important to use multiple model thinking?
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
The Problem with Experts
Dawes (1979): "The Robust Beauty of Improper Linear Models in Decision Making": Even "improper" linear models outperform experts
Tetlock (2005): twenty-year study with some 284 experts and 28,000 predictions: even crude extrapolation is more reliable than human prediction in every domain studied.
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
A Model for Problem-Solving
Hong and Page (2005): Groups of diverse problem solvers can outperform groups of high-ability problem solvers
The problem space is modeled as a complex 3D landscape
A perspective is the representation of the problem space used by any given problem solver
A heuristic is the particular way a given problem solver searches for solutions from their perspective in the landscape
Many antecedents for the result: 1) difficult problems 2) local optima must be rankable 3) For any local optimum, someone else can do better and 4) there must be many problem-solvers in the pool.
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Evidence for the importance of multiple model thinking
No Free Lunch Theorem
Wolpert and Macready (1995, 1996, 1997): For problems of search, optimization, and machine learning, there is no “best” algorithm (no best heuristic).
Corollary: Your favorite model is suboptimal at least some of the time.
Corollary: Bucky’s Vector Equilibrium model is suboptimal at least some of the time.
Corollary: You need multiple tools, heuristics, perspectives, and models to understand, decide, predict, strategize, and design effectively.

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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
Diversity Prediction Theorem
$CE = AE - D$
Crowd Error = Average Individual Error − Diversity
Diversity is just variance.
It is a mathematical identity.
$(c - \theta)2 = 1$

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i=1
(Si − θ)2 − 1
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Evidence for the importance of multiple model thinking
Understanding the Diversity Prediction Theorem
CE = AE − D
Crowd Error = Average Individual Error − Diversity
The wisdom of crowds: if CE is small and AE is large, then
D (diversity) must be large to balance the equation.
The madness of crowds: if CE is large and AE is large,
then D (diversity) must be small to balance the equation.
Mathematically speaking, diversity is very important!!!

Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
Replicator Dynamics
Replicator Dynamics models learning in psychology, population learning in economics, and ecology in evolutionary biology. (It is related to the generalized Lotka-Volterra Theorem and the Price Equation.)
Fisher’s fundamental theorem (1930): higher variation increases the rate of adaptation
But six sigma is an engineering practice to reduce variation that is responsible for low cost, high quality widgets of all sorts. Gawande (2009) shows how checklists (reducing variability) save lives in hospitals.
When the landscape is changing, we should foster diversity; when a situation is well understood, we should

eliminate variation.
Warning: diversity is not always good!
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Evidence for the importance of multiple model thinking
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Dawes and Tetlock observe that even "bad" models beat most experts most of the time.
Hong and Page observe that diversity can trump ability.
Wolpert and Macready say there is no best heuristic.
The diversity prediction theorem shows the mathematical importance of diversity.
Fisher's fundamental theorem says diversity enhances adaptability.
Conclusion: we need many, many diverse models to understand, decide, predict, strategize, and design effectively.
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
Synergetics and Model Thinking
Models in Synergetics
109.00–117 Chrome-Nickel-Steel Synergy model
401.00–401.07 Tetherball model (twelve vectors of
restraint)
410.00–419.05 Closest Packing of Sphere model of
Nature’s Coordinate System
450.00–459.03 Great Circle models
460.00–465.30 Jitterbug model
506.00–506.30 Knot model (pattern integrities)
522.00–522.36 Deliberately Nonstraight Line model
700.01–707.03 Tensegrity model
910.00–924.20 Quanta Module model
986.00–986.874 Demass model
1009.80–1009.98 Gyroscope model
Synergetics is filled with models!!!
Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
Synergetics and Model Thinking
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative

Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Synergetics and Model Thinking
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Synergetics and Model Thinking CJ Fearnley, Synergetics Collaborative
Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Lessons for Science & Synergetics from Model Thinking
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http://www.rwgrayprojects.com/synergetics/s01/p6000.html#161.00
“Science is basically culture’s answer to the big problem of
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The standard view of modern science is given by the
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
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The Method of Multiple Working Hypotheses

In 1890, T. C. Chamberlin proposed the Method of Multiple Working Hypotheses in an absolutely wonderful paper which I have read and recommend highly.

http://www.auburn.edu/~tds0009/Articles/Chamberlain%201965.pdf

> "In the use of the multiple method, the re-action of one hypothesis upon another tends to amplify the recognized scope of each, and their mutual conflicts whet the discriminative edge of each. The analytic process, the development and demonstration of criteria, and the sharpening of discrimination, receive powerful impulse from the co-ordinate working of several hypotheses."
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The scientific method needs a deep infusion of T. C. Chamberlin, Scott E. Page, and Synergetics.

Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Lessons for Science & Synergetics from Model Thinking
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science Conclusion
Lessons for Science & Synergetics from Model Thinking
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Thomas Kuhn’s Influence
Thomas Kuhn: “The Structure of Scientific Revolutions”
(1962)
Kuhn argues that science advances through revolution by
“paradigm shift”.
Was the Copernican Revolution an “overthrowing” of the
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Introduction The Importance of Model Thinking Synergetics, Model Thinking, & Science
Conclusion
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A paradigm shift is just a new model. From the perspective of Model Thinking, we need lots of models . . . lots of paradigms!
But psychologically and sociologically new models often feel revolutionary!
Steven Stearns tells how Stephen Jay Gould was bewitched by the allure of Kuhn's ideas and over-ambitiously argued that punctuated equilibrium was a revolution in evolutionary thought.
Bucky also got a bit too carried away thinking that Synergetics was revolutionary. Synergetics has many profound insights and many exciting new models.
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A new more incisive science
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Study Model Thinking with Scott E. Page: it is a grand vision for
understanding how the world works, it refines the notion of
models in Synergetics, it builds and expands on the vision of
Synergetics. It may be the most Synergetic development in
thinking deeply and incisively about how the world works since
the publication of Synergetics itself.
http://www.modelthinker-class.org/

Thank You
Thank You
Thank You!
Any Questions?
On-line version of this presentation:
http://www.CJFearnley.com/Asheville.Synergetics.Model.Thinking.pdf