

# Course Overview for PoCS

Last updated: 2020/09/26, 14:41:34 EDT

Principles of Complex Systems, Vol. 1 | @pocsvox  
CSYS/MATH 300, Fall, 2020

Prof. Peter Sheridan Dodds | @peterdodds

Computational Story Lab | Vermont Complex Systems Center  
Vermont Advanced Computing Core | University of Vermont



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Sealie & Lambie  
Productions



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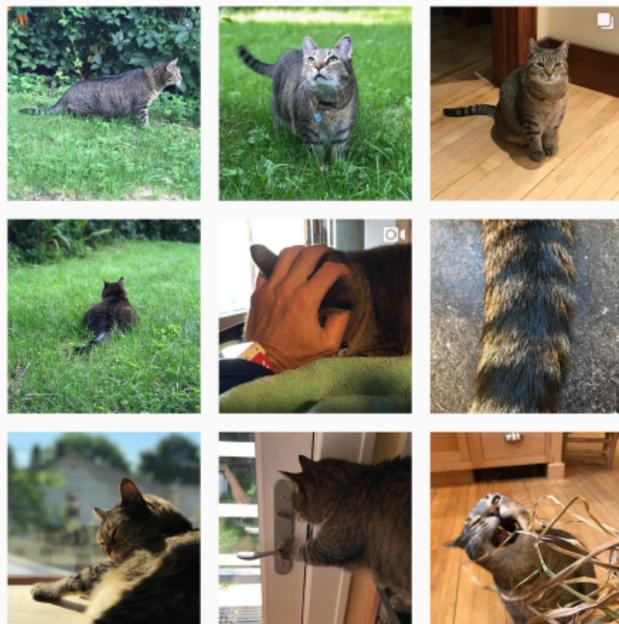
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## Special Guest Executive Producer



 On Instagram at [pratchett\\_the\\_cat](https://www.instagram.com/pratchett_the_cat) 

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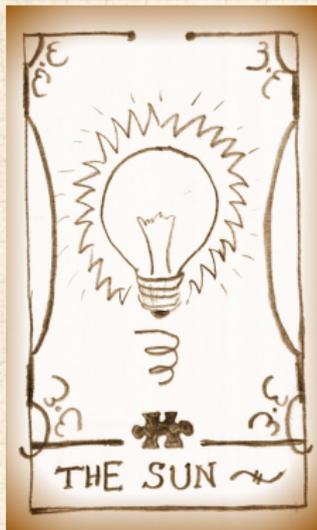
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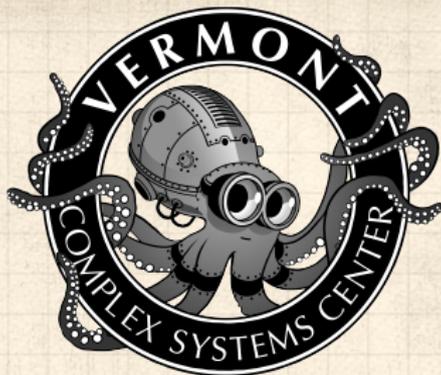
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Describe | Explain | Create | Share | Ethos: Play



[vermontcomplexsystems.org](http://vermontcomplexsystems.org) 



## Vermont Complex Systems Center (2006–):

-  Diverse research and teaching portfolio (> 400 papers in 2010–2015).
-  Funding from many sources: NSF, NIH, DARPA, Microsoft, MITRE, Computer Associates, MassMutual, Google, foundations.
-  Regular global press coverage: NYT, BBC, WaPo, NatGeo, ...
-  Conferences: “Big Data, Big Stories”, “Big Scale, Big Fail”, “Prediction: the Next Big Thing”, [NetSci 2019](#) , [ALife 2020](#) .
-  Fully developed educational platform in Complex Systems and Data Science.
-  [Complex Networks Winter Workshops in Quebec City \(“Canoe”\)](#) 
-  Faculty hires of true Complex Systems scholars.
-  Numerous NSF CAREER awards (including PECASE).
-  Connecting Graduate and Undergraduate Students across campus (SCRaPS).
-  Paper Shredder, Research Jam, and ComplexiTea.
-  [Talkboctopus](#) 

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## Major support:



MassMutual Center for Excellence in Complex Systems and Data Science

[vermontcomplexsystems.org/partner/MMCOE/](https://vermontcomplexsystems.org/partner/MMCOE/)



University of Vermont-Google Open-Source Complex Ecosystems And Networks (OCEAN)

[vermontcomplexsystems.org/partner/OCEAN/](https://vermontcomplexsystems.org/partner/OCEAN/)

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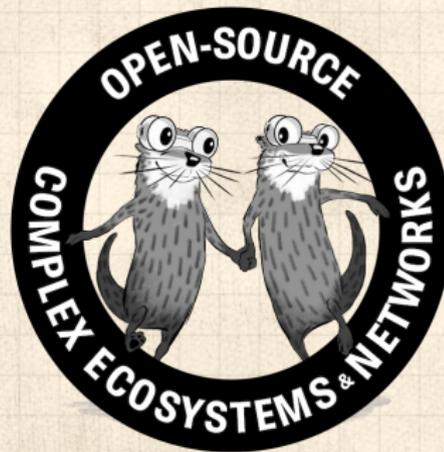
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## Vermont Complex Systems Center—Misfit toys:



Peter  
Dodds,  
Math/Stats



Josh  
Bongard, CS



Chris  
Danforth,  
Math/Stats



Maggie  
Eppstein, CS



Juniper  
Lovato,  
Education



Hugh  
Garavan,  
Neuro,  
Psychiatry



Jane Adams,  
Digital Artist



Safwan  
Wshah, CS



Jim Bagrow,  
Math/Stats



Paul Hines,  
EE



Brian  
Tivnan,  
MITRE



Puck  
Rombach,  
Math/Stats



Laurent  
Hébert-  
Dufresne,  
CS

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# We're interested in many things:



Sociotechnical systems



Social Contagion and Influence



Happiness and Well-being



Language and Stories



Social unrest



Conflict



Robotics



Artificial Intelligence



Complex Networks



Climate



Biology



Ecology



Geomorphology



Space



Complex Fluids



(Smart) Power Grids



Critical infrastructure



Defense



Public Policy



Health and Medicine



Brainz Brains



Neuroscience



Food systems



Epidemiology



Pandemics



Organizations



Economics



Wealth inequality



Financial Systems

## Leveling up—Scaffolded educational mission:

 Data Science Undergrad.



 Graduate Certificate in Complex Systems and Data Science



 Fall, 2015–: MS in Complex Systems and Data Science



 Fall, 2018–: PhD in The Study of Interesting Things Complex Systems and Data Science



All the words: <http://vermontcomplexsystems.org> 

## Graduate Certificate in Complex Systems (and Data Science):

-  Principles of Complex Systems is one of three core requirements for UVM's five course Certificate of Graduate Study in Complex Systems .
-  Prof. Laurent Hebert-Dufresne's "Modelling Complex Systems" (CSYS/CS 302).
-  Prof. Jim Bagrow's "Data Science I" (STAT 287)
-  The Sequel to PoCS:  
"Complex Networks" (CSYS/MATH 303).
-  In fact:  
Principles of Complex Systems Vols. 1 and 2

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# Framing (funfully):

Science = Area of study + Instruments of study

-  Stars and Telescopes = Astronomy
-  Rocks and Hammers = Geology
-  Water and Partial Differential Equations = Fluid Dynamics
-  Brains and Giant Imaging Machines = Neuroscience
-  People and Deception = Social Psychology
-  Mathematics and Mathematics = Pure mathematics
-  Mind and Mind = Psychotherapy, Insight meditation, ...
-  Complex Systems + Data Science = Postdisciplinary Systems Science





Michael Arnold   Jane Adams   Todd DeLuca   Sophie Hodson   Sandhya Gopchandani   Anne Marie Stupinski   Summer Jang



Tyler Gray   Aaron Schwartz   Eric Clark   Ben Emery   David Dewhurst   Cainn Van Dort   Laura Jennings



Abby Ross, Northfield Mount Hermon School   Chris Easting, Data Science Consultant   Ryan Callagher, Northeastern PhD student   John Ring   Lindsay Ross   Brendan Whitney   Henry Mitchell



Nick Allgeier, Psychiatry Res Asst Prof   Dylan Kiley, Chobanian Group   Tom Mohrweid, Cardiovascular Research foundation   Emily Casey, Data Scientist Adobe   Morgan Frank, MIT Media Lab PhD Student   Cathy Bliss, UVM Lecturer   Mark Ibrahim, Data Scientist Insight



Ross Lind, Lappin Dartmouth PhD & Engineering Laboratory   Liam Peberneck, Maine School of Science & Math   Andy Reagan, Data Scientist MassMutual   Sveni McCall, Maps, Apple



Lewis Mitchell, Adelaide Faculty   Jake Williams, Drexel Faculty   Isuhil Kleummti, Cornell PhD Facebook Data Scientist   Fletcher Hazlehurst   Sharon Alajajian, Research Scientist Univ of Pennsylvania   Kameron Harris, U Washington Postdoc   Paul Lessard, Colorado PhD Student   Suma Desai, Apple Data Scientist   Mike Foley, Northeastern PhD student   Garey Glenn, Climate Science, UC London, MS student   Lindsay Van Lier, VC+IP



Chris Danforth   Peter Dodds



compstorylab.org

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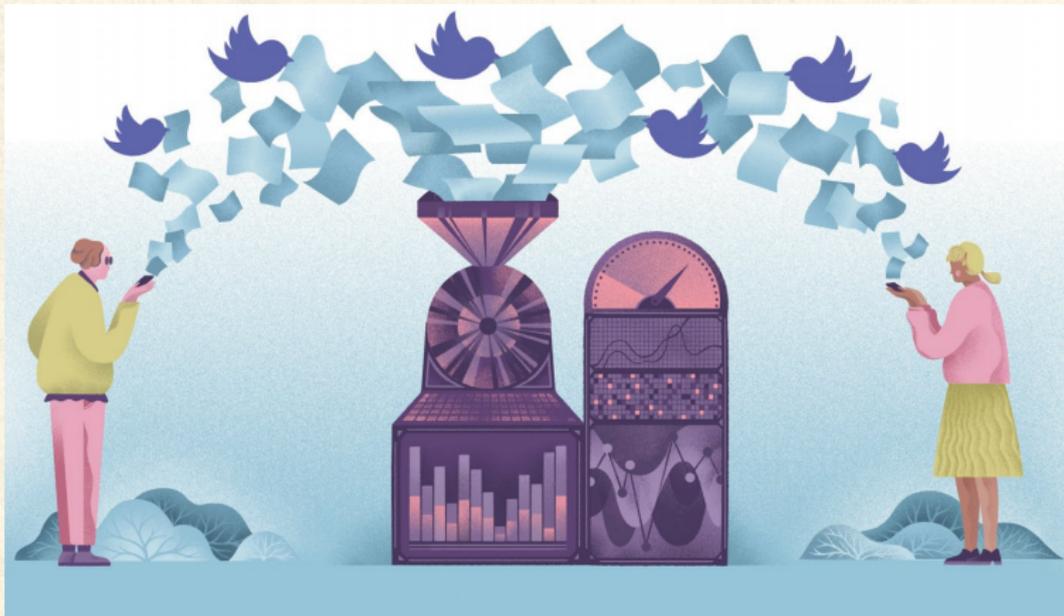
 Funding: NSF, NIH, NIDA, NASA, MITRE, James S. McDonnell Foundation, ONR, DARPA, MassMutual, Google, Computer Associates; [YOUR WONDERFUL FUNDING AGENCY HERE]

 Adjacent: **Strava Story Lab team**



# Outside

Inside the Lab that's Quantifying Happiness   
by Rowan Jacobsen, August 2017.  
(Reprinted in UVM Quarterly, 2018.)



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# Courses:

 CSYS/MATH 300: Principles of Complex Systems (@pocsvox )

 CSYS/MATH 303: Complex Networks (@networksvox )

 MATH 124/122: Matrixology (Linear Algebra) (@matrixologyvox and @svdthematrices )

 MATH 237: Numerical Analysis (@MachEps237 )

 MATH 266: Chaos, fractals & dynamical systems (@NonperiodicFlow )

 MATH 330: Ordinary Differential Equations (@dallthethingsdt )

 Courses act as research incubators and have helped generate many papers  (60+)

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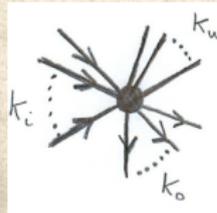
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# Basics:

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 Instructor: Prof. Peter Sheridan Dodds

 Lecture room and meeting times:  
Online, To be sorted out

 Office: (in theory) Innovation, fourth floor

 email: peter.dodds@uvm.edu

 Course Website:  
<http://www.uvm.edu/pdodds/teaching/courses/2020-08UVM-300> 

 Course Twitter handle: @pocsvox

 Course hashtag: #FallPoCSVol12020

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## Potential paper products:

 The Syllabus  and a Poster .

## Office hours:

 Tuesdays, 12 to 12:50 pm; Wednesdays, 1:15 pm to 2:05 pm; Thursdays, 12 to 12:50 pm; all scheduled on Teams, Innovation, fourth floor

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# Exciting details regarding these slides:



Three versions (all in pdf):

1. Presentation,
2. Flat Presentation,
3. Handout (3x2 slides per page).



Presentation versions are **hyperly navigable**:

back + search + forward.



Web links look like this



References in slides link to full citation at end. <sup>[1]</sup>



Citations contain links to pdfs for papers (if available).



Some books will be linked to on Amazon.



Brought to you by a frightening melange of

X<sub>Y</sub>TeX , Beamer , perl , PerlTeX , fevered  
command-line madness , and an almost  
fanatical devotion to the indomitable emacs .

**#evilsuperpowers**

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# More super exciting details:



We use Open Sans and make math look good:

```
\setmainfont[Ligatures=TeX]{Open Sans}  
\setsansfont[Ligatures=TeX]{Open Sans}  
\usefonttheme[onlymath]{serif}
```



Still working towards putting the course on  
Github/Gitlab



And finishing writing the books ...

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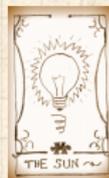
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# Yet more super exciting details:

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What's the John  
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- 🧱 This is Season 15 of Principles of Complex Systems, Vol. 1.
- 🧱 Lectures will be called Episodes.
- 🧱 Episodes will be broken into clips.
- 🧱 2020 on: new clips will be recorded in a pretend studio.
- 🧱 All lectures are bottle [↗](#) episodes [↗](#).
- 🧱 Other tropes [↗](#) will be involved.
  
- 🧱 Last season's Episodes are here [↗](#).

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## Wonderful foundational support for PoCS and CoNKS CocoNuTs has come from the NSF:

-  "CAREER: Explorations of Complex Social and Psychological Phenomena through Multiscale Online Sociological Experiments, Empirical Studies, and Theoretical Models." 2009–2015.
-  SES Division of Social and Economic Sciences  
SBE Directorate for Social, Behavioral & Economic Sciences
-  Abstract is [here](#) .

-  People have also [said nice things about PoCS](#) 

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## Microsoft Teams + Slack

- Teams = main place for discussions about all things PoCS including assignments and projects.
- Slack = main place for students and faculty in Complex Systems and Data Science to talk about everything.
- Teams—Automatic if enrolled in the course.
- Slack—Once invited, please sign up here:  
<https://csdsgrads.slack.com/>
- Very good: Install Microsoft and Slack apps on laptops, tablets, phone, cats, dogs. Nothing will go wrong.
- Everyone will behave wonderfully.

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# Grading breakdown:

 **Assignments (75%)**—All assignments will be of equal weight and there will be  $10 \pm 1$  of them.

 **Projects/talks (24%)**—Students will work on semester-long projects. Students will develop a proposal in the first few weeks of the course which will be discussed with the instructor for approval. Details: 8% for the first talk, 8% for the final talk, and 8% for the written project.

 **General attendance/Class participation (1%)**—Everyone is expected to behave well.

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# How grading works:

Questions are worth 3 points according to the following scale:

-  3 = correct or very nearly so.
-  2 = acceptable but needs some revisions.
-  1 = needs major revisions.
-  0 = way off.

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# Important things:

1. Classes run from Monday, August 31 to Friday, December 4.
2. Add/Drop, Audit, Pass/No Pass deadline—Monday, September 14.
3. Last day to withdraw—Thursday, October 29 (Sadness!).
4. Reading and Exam period—Monday, December 7 to Friday, December 11.

**Do** check the course Twitter account, @pocsvox, for updates regarding the course (part of the course site).

**Academic assistance:** Anyone who requires assistance in any way (as per the ACCESS program or due to athletic endeavors), please see or contact me as soon as possible.



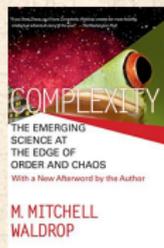
# Popular Science Books:

PoCS, Vol. 1

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Historical artifact:



“Complexity: The Emerging Science at the  
Edge of Order and Chaos” [a](#) [↗](#)  
by M. Mitchell Waldrop (1993). <sup>[16]</sup>

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Shout-out: Dr. Andrew P. Morokoff [↗](#),  
MBBS PhD FRACS D.Thau (Bug) [↗](#)

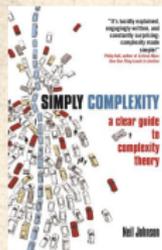


# Popular Science Books:

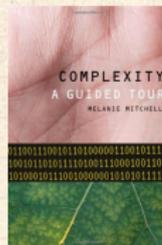
PoCS, Vol. 1

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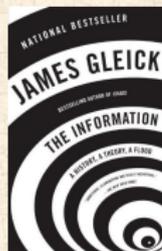
What's the John Dory?



“Simply Complexity: A Clear Guide to Complexity Theory” [a](#) [🔗](#)  
by Neil F. Johnson (2009). <sup>[9]</sup>



“Complexity: A Guided Tour” [a](#) [🔗](#)  
by Melanie Mitchell (2009). <sup>[12]</sup>



“The Information: A History, A Theory, A Flood” [a](#) [🔗](#)  
by James Gleick (2011). <sup>[6]</sup>

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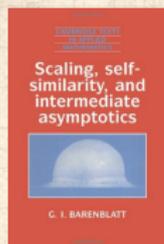


# Books on Complexification:

PoCS, Vol. 1

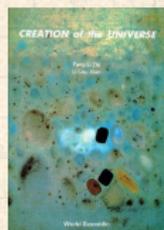
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What's the John Dory?



“Scaling, self-similarity, and intermediate asymptotics” [a](#) [↗](#)  
by G. I. Barenblatt (1996). <sup>[3]</sup>

Have to strongly disrecommmend “Scale” by West. No.



“Creation of the Universe” [a](#) [↗](#)  
by Zhi and Xian (1989). <sup>[17]</sup>

See Freeman Dyson’s [↗](#) The Key to Everything [↗](#).

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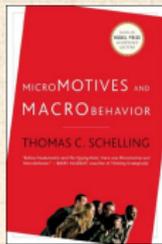
# On complex sociotechnical systems:

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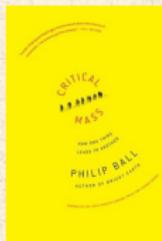
What's the John  
Dory?



“Human Behaviour and the Principle of Least-Effort” [a](#) [↗](#)  
by G. K. Zipf (1949). [18]



“Micromotives and Macrobehavior” [a](#) [↗](#)  
by Thomas C. Schelling (1978). [14]



“Critical Mass: How One Thing Leads to Another” [a](#) [↗](#)  
by Philip Ball (2004). [2]

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# It's all about algorithms (stories):

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"The Engine of Complexity: Evolution as  
Computation" [a](#) [↗](#)

by John E. Mayfield (2013). <sup>[10]</sup>



"On the Origin of Stories: Evolution,  
Cognition, and Fiction" [a](#) [↗](#)

by Brian Boyd (2010). <sup>[5]</sup>



"The Storytelling Animal: How Stories Make  
Us Human" [a](#) [↗](#)

by Jonathan Gottschall (2013). <sup>[7]</sup>

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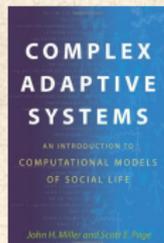
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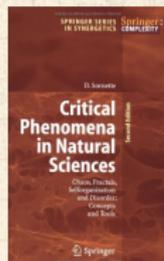


# A few textbooky books (dated):



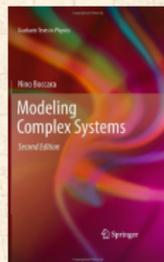
“Complex Adaptive Systems: An introduction to computational models of social life” [a](#) [↗](#)

by Miller and Page (2007). <sup>[11]</sup>



“Critical Phenomena in Natural Sciences” [a](#) [↗](#)

by Didier Sornette (2003). <sup>[15]</sup>



“Modeling Complex Systems” [a](#) [↗](#)

by Nino Boccara (2004). <sup>[4]</sup>

Eventually: “Principles of Complex Systems”



# Centers:

-  Santa Fe Institute (SFI)
-  Networks Institute at Northeastern
-  Northwestern Institute on Complex Systems  
([NICO](#) )
-  MIT Institute for Data, Systems, AND Society
-  New England Complex Systems Institute (NECSI)
-  Michigan's Center for the Study of Complex  
Systems ([CSCS](#) )
-  Some Data Science groups (highly variable)
-  Also: Indiana, Davis, Brandeis, University of  
Illinois, Duke, Warsaw, Melbourne, ...,
-  Us!!!: [Vermont Complex Systems Center](#) 



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# Other inputs:

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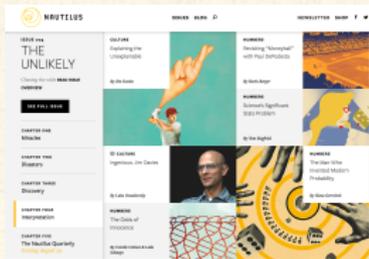
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Complexity Digest:

<http://www.comdig.org>

<https://twitter.com/@cxdig>



Nautilus Magazine:

<http://nautilus.us/>



Aeon: <http://aeon.co/>



Quanta Magazine:

<https://www.quantamagazine.org/>

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# The nature of PoCS:

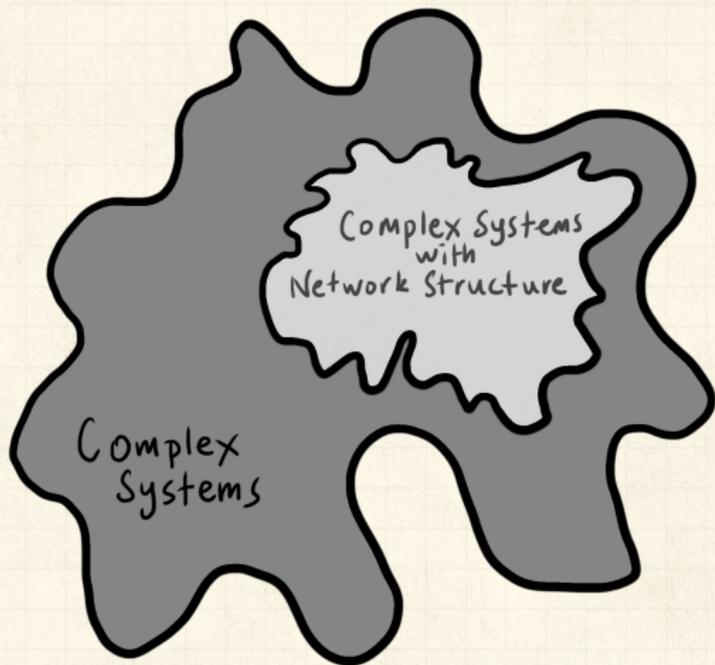
- Transitioning from standard coursework to research-focused work. **#alittle scary**

## Major themes:

- The Complexity Manifesto 
- Complex Systems  $\equiv$  Modern, Normal Science;
- Roles and limits of Data, Theory, and Experiment;
- Emergence;
- Universality and Accidents of History;
- Structure and Stories: Micro-to-macro Mechanisms;
- Elements: Scaling, Surprise, Networks, Robustness, Failure, and Spreading.
- The Theory of Anything: Why Complexify?
- It's all about stories.**



# Complex Systems are the Big Story:



Only a bit networky: Fluids-at-large (the atmosphere, oceans, ...), organism cells, ...

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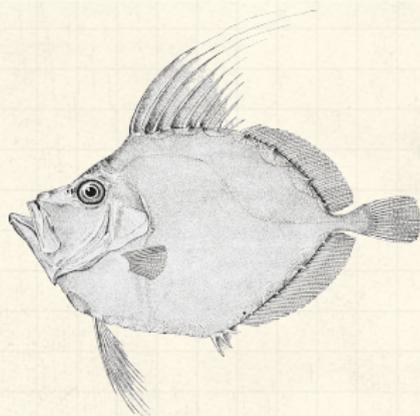
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# Cryptolect:

Course mascot:



-  What's the Story?
-  What's the John Dory?
-  What's the John Dory for Rhyming Slang ?
-  Hemiteleia: beers  $\Rightarrow$  Edward Lears  $\Rightarrow$  Edwards.
-  Also: Taxis  $\Rightarrow$  Boris Spasskies   $\Rightarrow$  Borises

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# Topics:

## Scaling phenomena:

-  Allometry.
-  Scaling of social phenomena: crime, creativity, and consumption.
-  Scaling in biology (elephants and platypuses).
-  Dimensional Analysis and Renormalization.
-  Power law size distributions and non-Gaussian statistics.
-  The 80/20 rule, the 1%.
-  Zipf's law.
-  Order from randomness.
-  Fundamental mechanisms for generating power law size distributions.
-  The rich-get-richer mechanism.

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# Topics:

## Robustness—Integrity of complex systems:

-  Generic failure mechanisms.
-  Highly Optimized Tolerance (HOT): Robustness and fragility.
-  How to build optimal forests.
-  Minimization of risk as a driver of heterogeneous structures in complex systems.
-  How to optimally locate facilities: hospitals, schools, and coffee shops.

## Fundamentals of Complexity:

-  Emergence: More is Different.
-  Measurement and mismeasurement.
-  Universality versus path dependence.
-  Complexification (it all starts with gravity<sup>[17]</sup>).





# Topics:

PoCS, Vol. 1

@pocsvox

What's the John  
Dory?

## Complex networks:

-  Statistical Mechanics
-  Structure and Dynamics
-  Phase transitions
-  Random Networks
-  Scale-free Networks
-  Small-world Networks
-  Why your friends are better than you.
-  More in PoCS, Vol. 2 in the spring.

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## Sociotechnical Systems:

-  Biological and social spreading models
-  Schelling's model of segregation <sup>[13]</sup>
-  Granovetter's model of imitation <sup>[8]</sup>
-  Collective behavior and synchrony
-  Global cooperation from bad actors
-  Global conflicts from good actors
-  Stories (Homo Narrativus)
-  The Sociotechnocene

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# Topics:

## Collective decision making:

- Wisdom and madness of crowds.
- Systems of voting.
- The role of randomness and chance.
- Success inequality.
- The paradox of unpredictable global fame.
- Bonus knowledge: How to make things spread.
- Bonus knowledge: Fate does not exist in a world of fame.

## Large-scale social patterns (maybe):

- Movement
- Cities
- Happiness
- Social media

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## Season's Narrative Arc (or Places We Will Go):

-  Overview of Complex Systems with bonus Manifesto .
-  Thread of Understanding Sociotechnical Systems.
-  Allometric scaling in complex systems.
-  Size distributions of system elements:
  -  Power-law size distributions.
  -  Description and Mechanisms of Becoming.
-  Robustness of Complex Systems.
-  Complex networks—how system elements are connected:
  -  Structure, Growth Mechanisms, Processes on Networks.
-  Social Contagion, Voting, Fame and Fate, Stories.
-  Complexification: The Theory of Anything and the Rise of Algorithms





# Projects

- Semester-long projects, teams.
- Develop proposal in first few weeks.
- May range from novel research to investigation of an established area of complex systems.
- Two talks + written piece.
- Usage of the VACC  is encouraged (ability to code well = super powers).
- Massive data sets available, including Twitter.
- Possible: Work with Twitter data and Story Lab on socially meaningful problems.
- Academic output (journal papers) resulting from Principles of Complex Systems and Complex Networks can be found here . Add more!
- We'll go through a list of possible projects soon.

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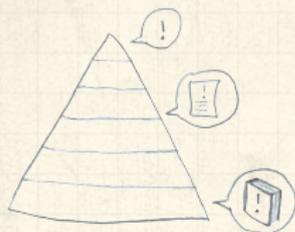
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# The narrative hierarchy—Stories and Storytelling on all Scales: ↗

PoCS, Vol. 1  
@pocsvox  
What's the John  
Dory?



 1 to 3 word encapsulation = a  
soundbite = a buzzframe,

 1 sentence, title,

 few sentences, a haiku,

 a paragraph, abstract,

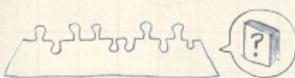
 short paper, essay,

 long paper,

 chapter,

 book,

 ...



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# References I

- [1] P. W. Anderson.  
More is different.  
Science, 177(4047):393–396, 1972. [pdf](#) 
- [2] P. Ball.  
Critical Mass: How One Thing Leads to Another.  
Farra, Straus, and Giroux, New York, 2004.
- [3] G. I. Barenblatt.  
Scaling, self-similarity, and intermediate asymptotics, volume 14 of Cambridge Texts in Applied Mathematics.  
Cambridge University Press, 1996.
- [4] N. Boccara.  
Modeling Complex Systems.  
Springer-Verlag, New York, 2nd edition, 2004.

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# References II

- [5] B. Boyd.  
On the Origin of Stories: Evolution, Cognition, and Fiction.  
Belknap Press, 2010.
- [6] J. Gleick.  
The Information: A History, A Theory, A Flood.  
Pantheon, 2011.
- [7] J. Gottschall.  
The Storytelling Animal: How Stories Make Us Human.  
Mariner Books, 2013.
- [8] M. Granovetter.  
Threshold models of collective behavior.  
Am. J. Sociol., 83(6):1420–1443, 1978. pdf ↗

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# References III

- [9] N. F. Johnson.  
Simply Complexity: A Clear Guide to Complexity  
Theory.  
Oneworld Publications, London, UK, 2009. pdf 
- [10] J. E. Mayfield.  
The Engine of Complexity: Evolution as  
Computation.  
Columbia University Press, New York, 2013.
- [11] J. H. Miller and S. E. Page.  
Complex Adaptive Systems: An introduction to  
computational models of social life.  
Princeton University Press, Princeton, NJ, 2007.

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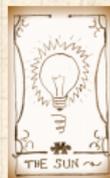
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# References IV

- [12] M. Mitchell.  
Complexity: A Guided Tour.  
Oxford University Press, New York, NY, 2009.  
[pdf](#) 
- [13] T. C. Schelling.  
Dynamic models of segregation.  
J. Math. Sociol., 1:143–186, 1971. [pdf](#) 
- [14] T. C. Schelling.  
Micromotives and Macrobehavior.  
Norton, New York, 1978.
- [15] D. Sornette.  
Critical Phenomena in Natural Sciences.  
Springer-Verlag, Berlin, 2nd edition, 2003.

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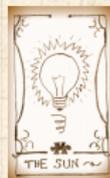
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# References V

- [16] M. M. Waldrop.  
Complexity: The Emerging Science at the Edge of  
Order and Chaos.  
Simon & Schuster, New York, NY, 1993.
- [17] F. L. Zhi and L. S. Xian.  
Creation of the Universe.  
World Scientific Publishing Company, 1989.
- [18] G. K. Zipf.  
Human Behaviour and the Principle of  
Least-Effort.  
Addison-Wesley, Cambridge, MA, 1949.

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