Human Population 2017
Lecture 1
My Worldview
Imagine a stranger strikes up a conversation with you. They say:

“Consider the following...”
Global population is growing exponentially!
Cities are overcrowded
Oceans are being overfished
Fertile farmland is disappearing
the climate is changing

we are in a mass extinction event
everything points to disaster
And, no one seems to be paying attention!
How will it all end? Disease?

Still listening?
Famine?
How do you react?
Choose one.
1. Continue eating and ignore him.
2. Look at watch. Make excuse. Get out of there as fast as possible.
3. Reassure them politely that population is not a problem.
4. Engage in an animated conversation about the-end-of-life-as-we-know-it.
Is discussing population taboo?

- Absent in news.
- Absent in education.
- Absent in scientific research.
- Absent in policy making.
- Absent or misrepresented in economics.
Worldviews

- Science
- Engineering
- Social
  - Political
  - Economic
- Local
- Global
- Religious

Description
Modeling
Needs
Peace
Leadership
Peace
Justice
Family
Friends
Ethics
My psychological worldview

*Musical Dissonance* -- an uncomfortable feeling when notes or rhythms do not fall neatly into the current tonality.

*Cognitive Dissonance* -- an uncomfortable feeling when discussing data that does not fall neatly into current beliefs.
Is there a psychology of dissonance?

<table>
<thead>
<tr>
<th>Level of Dissonance</th>
<th>...in Music</th>
<th>...in Science</th>
<th>Human reaction to either</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>happy birthday</td>
<td>an arithmetic problem</td>
<td>ignore it.</td>
</tr>
<tr>
<td>medium</td>
<td>Bach tocatta</td>
<td>an unfinished theory in physics</td>
<td>study it!</td>
</tr>
<tr>
<td>high</td>
<td>Schönberg 12-tone row &quot;music&quot;</td>
<td>how to solve the overpopulation problem</td>
<td>flee from it!!!</td>
</tr>
</tbody>
</table>
Rubber stamping

input data with your opinion
light, or no, dissonance
Critical thinking

Your opinion

Input data with moderate dissonance
Denial, disavowal

no opinion

input data with
heavy dissonance
How reasoned responses might lead to a taboo on discussing population.
What do we reason about?

dots represent "concern density".

More thoughts are focused at local concerns, both in time and in relationship.

The Limits to Growth, 2nd Ed. (1972) Meadows et al,
The convergence of opinion of C.S. Pierce

"the father of pragmatism"

If a proposition is true, then anyone who inquires ‘into the nature of reality’ (well enough and long enough) is fated to believe it.

And of a proposition is false, then anyone who inquires.. is fated to disbelieve it.

Given that knowledge is "justified, true belief" [Plato], then science leads to common knowledge. Common knowledge is a form of agreement. Agreement leads to peace.

Misak, Cheryl, ed. The Cambridge Companion to Peirce. Cambridge University Press, 2004. Ch.5 p 133. by Christopher Hookway
My process worldview

What is science?
Science (from Latin scientia, meaning "knowledge") is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.
My process worldview

DIPA

- **Descriptive**
  - Data, information (or cited sources).

- **Interpretive**
  - Models, explanations, analysis.

- **Predictive**
  - Projections given *status quo*.

- **Active**
  - Recommendations. Actions.

Note: A given statement may mix tasks. For example, “there are 7-billion people on the planet, *so let's stop breeding*.” mixes **Descriptive** and **Active** tasks.

Science is a stepwise process...

- Descriptive ➔ Interpretive ➔ Predictive ➔ Active

Not proceeding methodically is called “Jumping to conclusions”
Descriptive task

• Comprised of
  • data
  and/or
  • cited data, model, or prediction.

  e.g. If someone publishes a model, it is a interpretive task in the context of that publication, but it is considered data in the context of any publication that cites it.

• Marked by "is" statements. Tables. Graphs. Cited works.
Interpretive task

- Based on the data or descriptions of prior work.
- Result of Interpretive task is a "model".
- Models are simpler than data.
- Uses knowledge of system behavior (which is a type of data).
- In writing, marked by any kind of "what this means" statement.
Predictive task

- based on the "model" (result of Interpretive task).
- predicts unseen data.
- results are "hypotheses."
- hypotheses may be validated by getting more data (i.e. by experimenting)
- Are generally future tense, "will" statements.
Active task

- based on predictions (results of Predictive task).
- invokes values, interests, desires.
- results are actions (i.e. experiments).
- may generate new data.
- Can be "would/should/could" statements.

Recommendations for action.

New cycle starts here!
Science is a feedback process...

- Descriptive → Interpretive → Predictive → Active

new experiment
Formal vs Informal models

Formal

- simulations
- equations, functions

Informal

words, analogies

Modeling: simplifying things for the purpose of understanding them

- InsightMaker
- Ecome
- I = PAT
- \( N_t = N_0 \times \exp(rt) \)
- positive feedback
- boom/bust

• positive feedback

• boom/bust
1. The Earth is a non-adiabatic chemical system.
2. Life is a catalyst for oxidation/reduction of carbon.
3. Total carbon is conserved. Energy is not.
4. Life grows exponentially.
5. Life is the product of evolution.
Me

- **My psychological worldview** -- The brain is not wired for logic. You have to train it to do that.

- **My process worldview** -- Science is a step-wise process, with feedback. DIPA.

- **My biochemist worldview** -- The world is an evolving life-catalyzed, closed non-adiabatic carbon cycle, never at equilibrium, always in flux.
Not generally my worldview:

- Economics
- Religion
- Politics
<table>
<thead>
<tr>
<th>Class meeting</th>
<th>Lecture, date</th>
<th>Readings from <em>Limits to Growth, The 30-year Update</em>, unless otherwise specified. Read and submit questions. Homework due dates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>My worldview</td>
<td>1/17</td>
</tr>
<tr>
<td>2</td>
<td>Overshoot. InsightMaker: zombies</td>
<td>1/20 M pp. 1-16</td>
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<tr>
<td>3</td>
<td>Guest Lecture: Bram Van Heuveln: Logic and fallacy</td>
<td>1/24 vanHeuveln HW1</td>
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<td>4</td>
<td>Growth 1. linear, exponential, logistic</td>
<td>1/27 M pp. 16-36</td>
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<td>5</td>
<td>Growth 2. hyperbolic. Debate prep</td>
<td>1/31 M vonFoerster</td>
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<tr>
<td>6</td>
<td>Debate 1: Doomsday.</td>
<td>2/3 D pp 37-50</td>
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<td>7</td>
<td>video: How Many People Can Live on Planet Earth?</td>
<td>2/7 pp. 51-86 HW2</td>
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<tr>
<td>8</td>
<td>Ecological footprint. Sustainability.</td>
<td>2/10 M Wackernagel</td>
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<td>9</td>
<td>Food webs, Food supply</td>
<td>2/14 M Hopfenberg</td>
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<tr>
<td>10</td>
<td>Non-renewables. Substitution. solar</td>
<td>2/17 M pp. 87-107</td>
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<tr>
<td>11</td>
<td>Guest lecture: Mimi Katz: Climate change.</td>
<td>2/24 NAS paper(s) HW3</td>
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<td>12</td>
<td>Debate 2. Pollution and sinks.</td>
<td>2/28 D pp. 108-127</td>
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<tr>
<td>14</td>
<td>World3. 2. Feedback</td>
<td>3/7 M pp. 136-147</td>
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<tr>
<td>15</td>
<td>World3. 3. Limits and Delays</td>
<td>3/10 P pp. 147-162</td>
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<tr>
<td>16</td>
<td>World3. 4. Oscillation and Collapse</td>
<td>3/21 P pp. 163-179 HW4</td>
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<tr>
<td>17</td>
<td>Ethical dilemmas</td>
<td>3/24 P Hardin</td>
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<tr>
<td>19</td>
<td>Technology and Markets</td>
<td>3/31 M pp. 203-234</td>
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<tr>
<td>20</td>
<td>Predictions. Adaptations.</td>
<td>4/4 M pp. 235-264</td>
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<tr>
<td>21</td>
<td>Transitions.Messaging.</td>
<td>4/7 P pp. 265-284</td>
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<tr>
<td>22</td>
<td>video: Mother: Caring for 7 Billion</td>
<td>4/11 P Uzochukwu</td>
</tr>
<tr>
<td>23</td>
<td>Family planning</td>
<td>4/14 P PamelaHerd</td>
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<td>24</td>
<td>Disavowal</td>
<td>4/18 M Coole</td>
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<td>25</td>
<td>Millenium Development Goals</td>
<td>4/21 M MDG</td>
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<td>26</td>
<td>Earth Week activity: TBD</td>
<td>4/25</td>
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<td>27</td>
<td>Term Projects 1</td>
<td>4/28 P</td>
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<tr>
<td>28</td>
<td>Term Projects 2</td>
<td>5/2 P</td>
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<tr>
<td></td>
<td>Final exam</td>
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</table>
Grading

Essay/talk : 20%
Homework : 20%
Debates : 15%
Bring a question to class: 15%
Term project : 20%
Final Exam: 10%
Course web page
www.bioinfo.rpi.edu/bystrc/courses/biol4961
Course contents

Debates 15%

Feb 3 -- Debate 1: Doomsday.
Feb 28 -- Debate 2: Food supply.
Debate format -- *tentative*

Karl Popper-style: Pro/Con/Judge

- **1 week prior**: Get your assignment. Meet in groups, research the topic, come up with a strategy for defending your position. Judges vote.
- **3 days prior**: Publish your arguments, one argument per debater.
- **Debate day**: Present arguments. Present rebuttals. All are timed.
- Take questions from judges.
- Judges vote.
Every class meeting has a reading, mostly from Limits to Growth. Set aside 1-2 hours for readings. When you have finished, write a question for class discussion. Upload the question to the course web page.

Supplementary material (available on web site)


Film: David Attenborough “How Many People Can Live on Planet Earth” (2011) (47 min) https://www.youtube.com/watch?v=1oi9z1aZXBQ


Essay/talk: Seven-minute science

Sign up for **podium presentations** using Sign-up Genius (http://www.signupgenius.com/). No slides allowed. Talks should be **7 minutes** with up to 5 minutes of questions/answers. Seven minutes is approximately 800 words or about **three pages** of text. Topics can be anything relating to human population. Present and attribute your data, construct an explanatory model, and predict future data, events or outcomes. Finish with a well-justified recommendation for future actions, such as studies, policies or experiments.

Essays will be graded on **clarity** and **content**. Clarity will be assessed by (1) correct **word usage**, (2) correct **sentence structure**, (3) correct **paragraph structure**, and (4) correct **essay structure**. Content will be assessed by (1) **logical progression** of statements, (2) **evidential support** of statements, (3) **correct attribution** of evidence, (4) **balance** of scientific "tasks".

Essays are text only, with citations and bibliography, in **Word** or **Pages** format.

Students are encouraged to visit the **Center for Communication Practices** in the Folsom Library to improve their skills in writing.

Sign-up for **two** 7-minute science presentations on Sign-up Genius (see email invite). One early, one late.
Course contents

Homework

1. DIPA (Jan 24)
2. Insight1: Doomsday model (Feb 7)
3. Insight2: Demographic transition theory (Feb 24)
4. Insight3: IPAT with feedback (Mar 21)

*Make InsightMaker account today!! Send me your username. You will be added to "Human Population at RPI" InsightMaker group
Term Projects

Connect population to a specific current event using a systems dynamics model. Predict the future. Work in groups of 2.
OPTIONAL
Written test of understanding of concepts and recall of facts -- based entirely on the lectures.
Experiential learning

• 40-hour fast
• From 12:00am 4/21 to 4pm 4/22
• optional!
• Potluck + pizza, 4pm Apr 22
• Video "Mother: Caring for 7 Billion"

Entre la civilización y la anarquía son siete comidas.
Course rules
Academic honesty

Confirmed plagerism, defined as unattributed use of published material, whether egregious or unintentional, will result in penalties as follows: First time "F" on assignment, 2nd time "F" in course.

_Dual submission:_ Copying is a form of plagiarism. The first incidence of confirmed copying will result in a "F" on the assignment for both parties. A second incidence will results in an “F” in the course. _Does not apply when working in groups and all authors names are on the paper._
Unexcused absences:

This is a participatory course. Attendance is required. Each unexcused absence will result in a 3% grade reduction. Documentation for excused absences is processed by the Student Experience Office, 4th floor Academy Hall, x8022, se@rpi.edu.
Avoid semantic arguments

Science requires that things be defined. We use words to define things. Words should have unique definitions to the extent possible. The alternative is confusion.
Treatment of student ideology in the classroom

This course deals with a sensitive subject for some religions and other ideologies. Students will not be graded on their religious views, political leanings or opinions in general. Religion and politics may be discussed where it is relevant to the course, but every attempt should be made to ensure that religious topics and political views are treated with respect, objectivity and non-judgement. Any student who uses this course as an opportunity to judge any religious doctrine or ideology will be warned and possibly graded down. Any student who uses non-falsifiable statements tied to ideology will be gently warned and may be graded down.
Office hours

- Wednesdays 10-12am
- J-Rowl 3c07
- or by appointment
- Send email! I always answer.