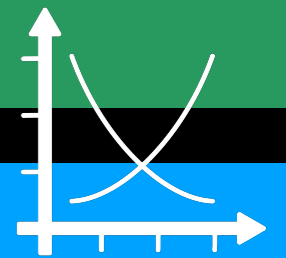


Prediction: Week 10

*Money, People, our Earth & our Future:
Human Behavior, Simulations & AI*



Money



Rational Choice, Behavioral Economics, Regression, AI

SIM CITY 2000
THE ULTIMATE CITY SIMULATOR

How would ChatGPT play

Due: Wed Apr 5, 2023 5:30pm




0 Possible Points

 Add Comment

▼ Details

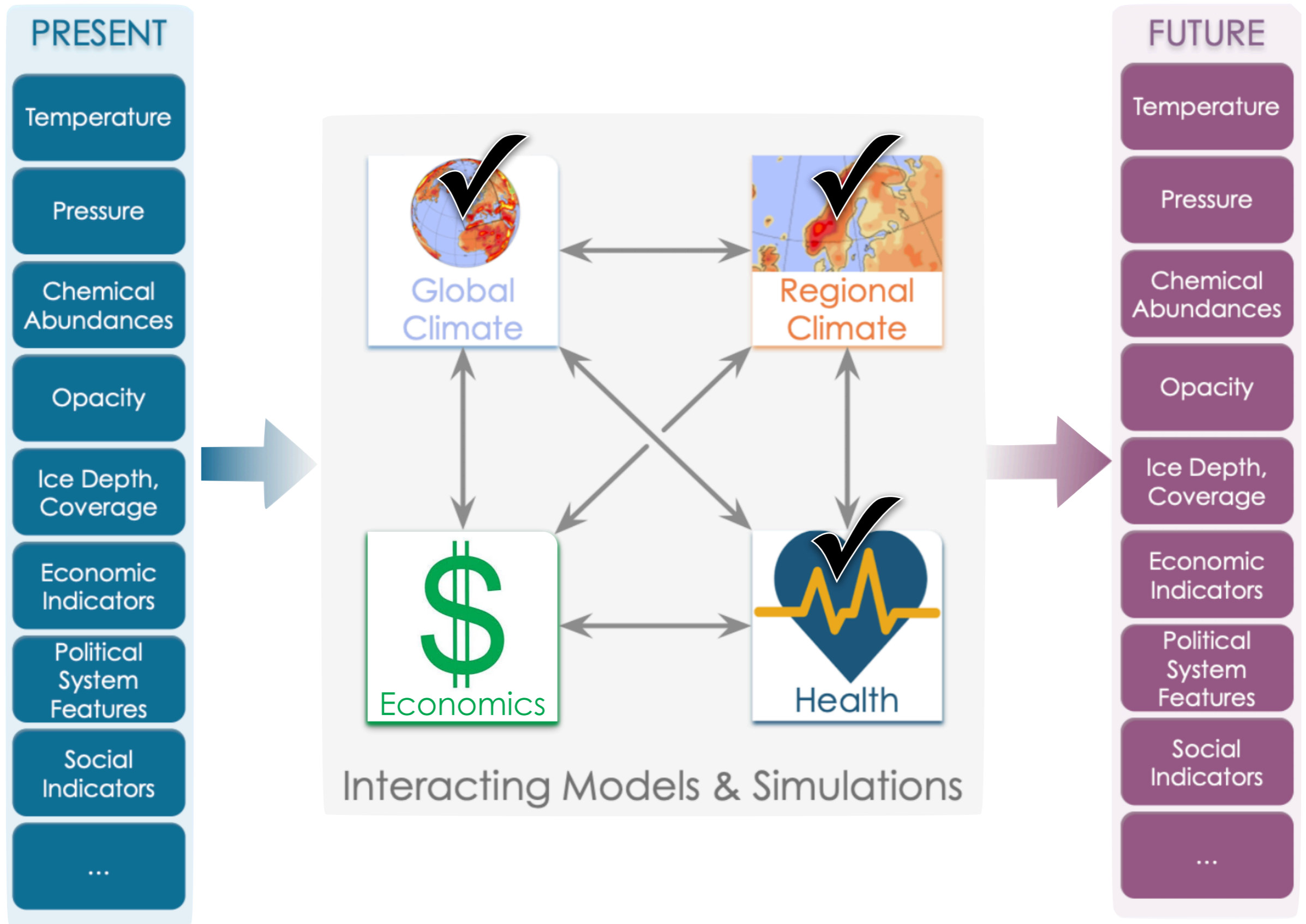
In class during Week 10, we should have time to follow up on the [Let's talk about AI...](#) contributions you made, using your new expertise to think about how ChatGPT would "play" SimCity 2000. Here's how this will go.

1. Find a partner--and one of you should have a laptop.
2. Give your 2-person "team" a name, which can be comprised of your real names if you like.
3. Make sure that the website <https://dos.zone/sim-city-2000-1993/>  works on a laptop your pair can use. (FYI, if we don't have enough laptops, groups of three will be permitted.)
4. One member of the team should build a city in SimCity, while the other member of the team "takes notes" on how aspects of what we've discussed in class about prediction and planning come into play as decisions (e.g. about zoning, building schools, etc.) are made.
5. At some point during play, do switch roles, so that each person has a chance to make some notes, and to play.
6. Stop playing after you feel that your city is "functioning on its own." This might take about 15 minutes.
7. Now discuss with your partner, and with your table mates if timing works out, how a NEW version of SimCity 2000 (let's say "SimCity 2100" would simulate cities using AI/LLM approaches.
8. As a "submission" to this initial assignment, which one person should submit, please enter your during-game notes, and also your thoughts on ChatGPT playing SimCity. Please make sure to include the NAMES of those who played/chatted in your submission.

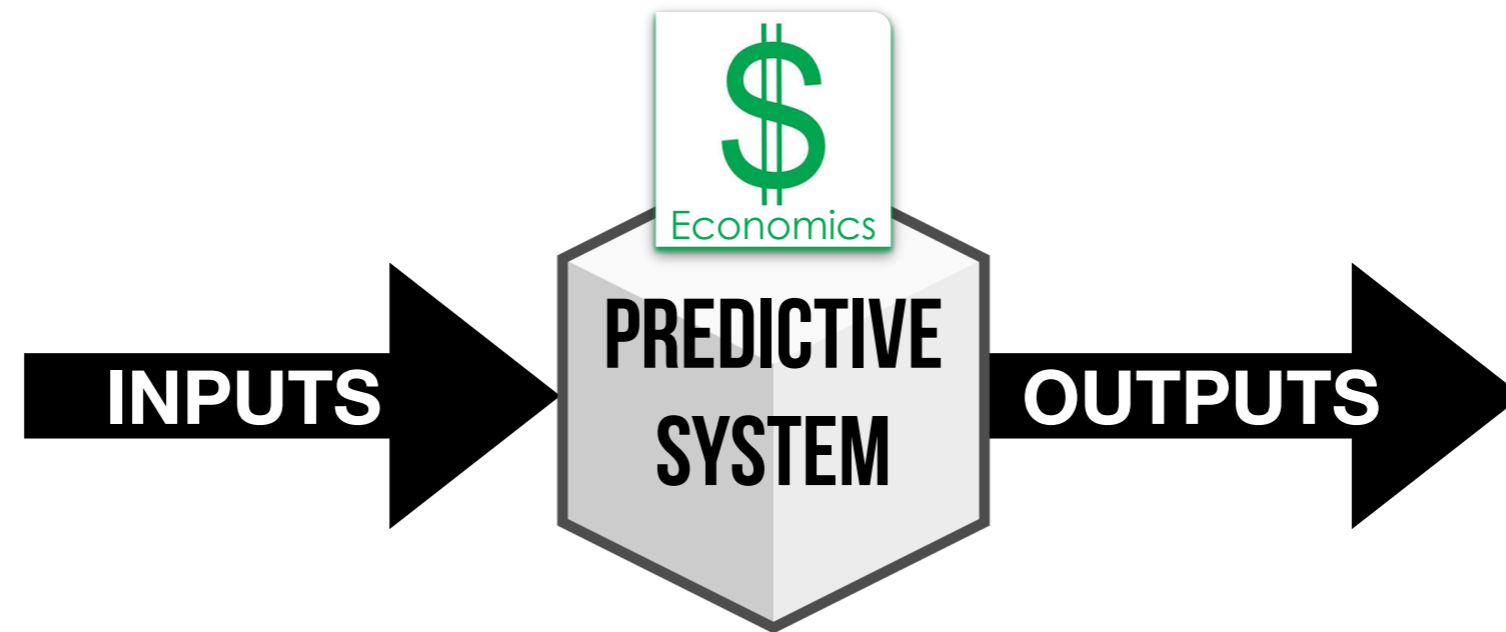
We will follow up on these initial impressions in section, and in class.

canvas.harvard.edu/courses/113038/assignments/694367

Where are we? We need **money**.



How does prediction work in the world of wealth, today?



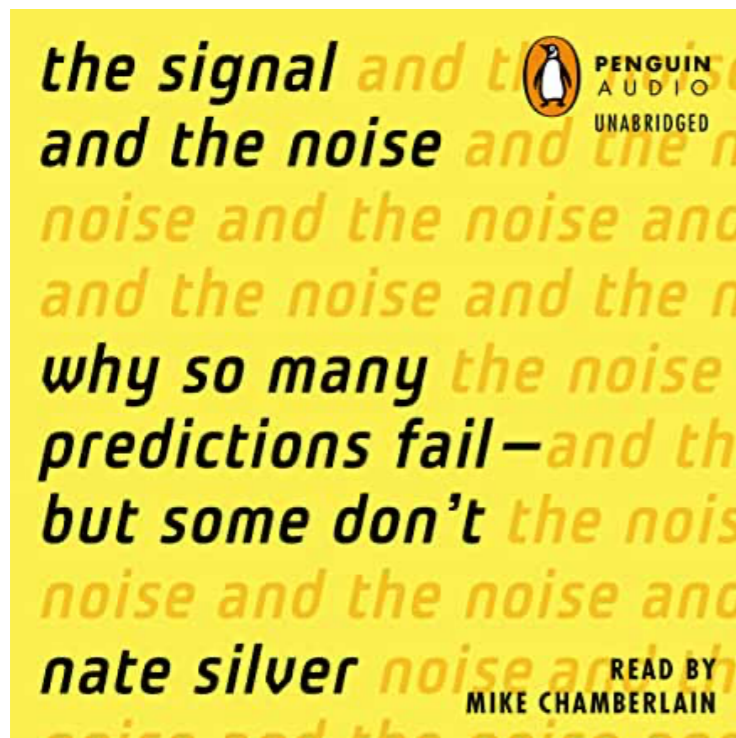
“HUMAN”

STATISTICAL

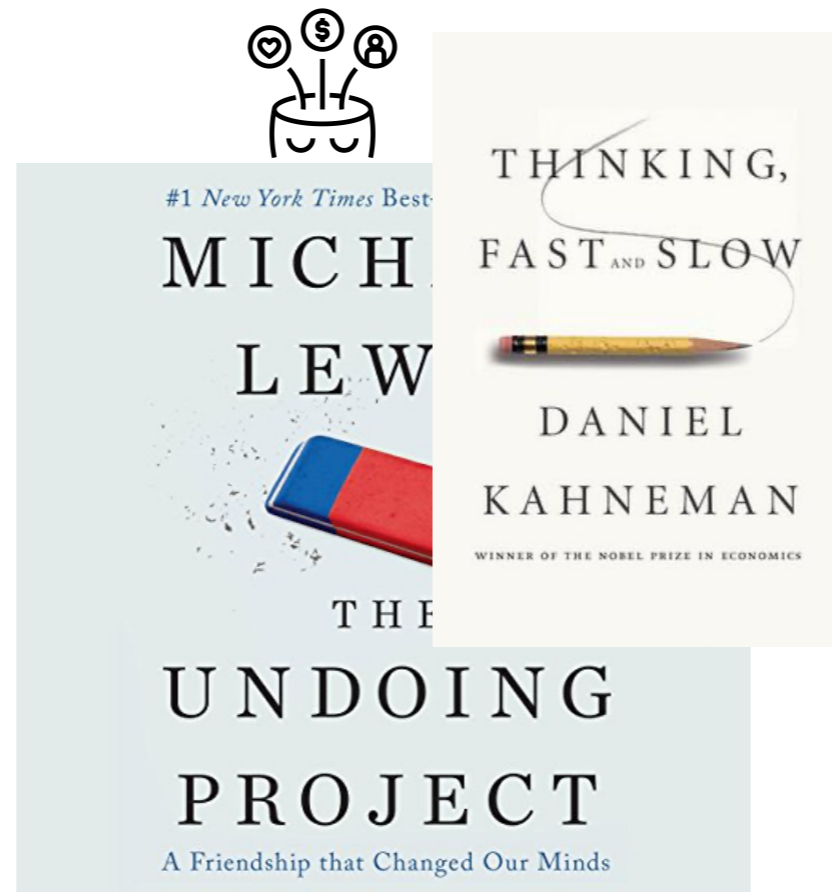
SIMULATION

COMBINATIONS

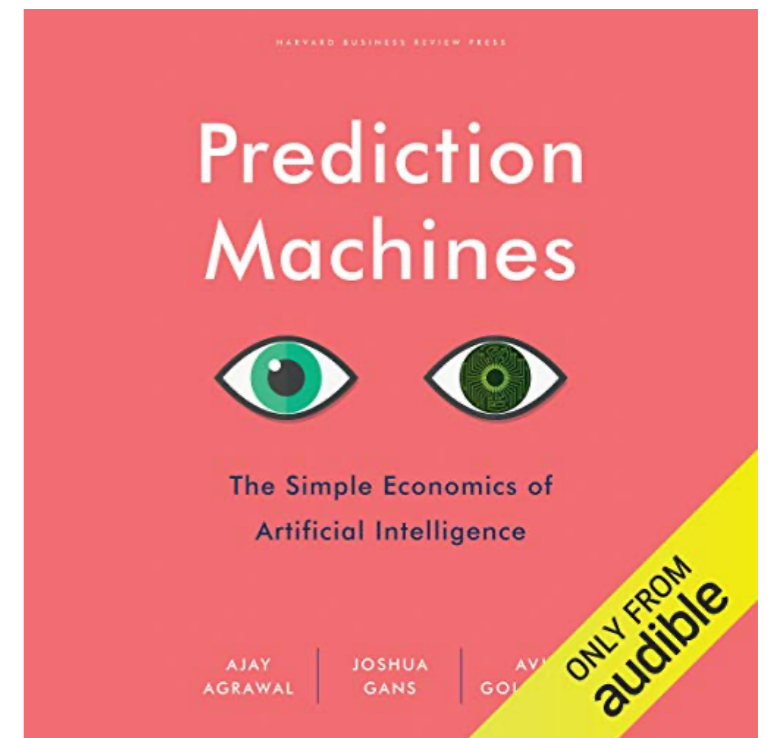
Highly recommended books on



(your textbook)



Behavioral Economics



AI & Economics

Quick discussion: What's a “prediction” vs. “decision” vs. “inference”?

How much do you know about Economics?

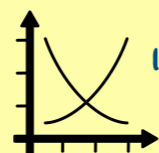
It's my
major **A**

Ec10 **B**

Next to
nothing... **C**

Economics as a Predictive "Science"

Basics: Supply, Demand, Preferences, Payoffs, Risk, Incentives, Optimization, Equilibrium, Empiricism



"Classical Economics"

Rational Choice Theory

Prisoner's Dilemma

Cooperation

		Prisoner B	
		Prisoner B stays silent (<i>cooperates</i>)	Prisoner B betrays (<i>defects</i>)
Prisoner A	Prisoner A stays silent (<i>cooperates</i>)	Each serve 2 years	Prisoner A: 10 years Prisoner B: goes free
	Prisoner A betrays (<i>defects</i>)	Prisoner A: goes free Prisoner B: 10 years	Each serve 5 years

Economics

(when, during the process, or directly by prediction)

Behavioral Economics

[Libson]



Government

to better
res?

For whom?

Economics in Business

What's different about how business' make decisions, in comparison with individuals, or governments?

And what about AI?

Does making prediction "cheap" change how individuals, businesses, or governments make economic decisions?

How would you contrast Rational Choice Theory with Behavioral Economics for a college student? (Let's ask AI.)



how would you contrast rational choice theory with behavioral economics for a college student?



how would you contrast rational choice theory with behavioral economics for a college student?



Rational choice theory and behavioral economics are two different approaches to understanding human behavior in decision-making. Rational choice theory assumes that individuals make rational decisions by weighing the costs and benefits of each option and choosing the one that maximizes their utility. On the other hand, behavioral economics takes into account the psychological and social factors that influence decision-making.

For a college student, the contrast between these two approaches can be understood in the following way:

Rational choice theory would suggest that a student would carefully evaluate the costs and benefits of each class and choose the one that maximizes their expected grade point average. The student would consider factors such as the difficulty of the course, the workload, and the availability of the professor, and make a decision based on these factors.

In contrast, behavioral economics would take into account the various biases and heuristics that can affect a student's decision-making process. For example, a student might choose a class based on the availability heuristic, where they choose the class that is most readily available or advertised, rather than evaluating all the options. They might also be influenced by social norms or the behavior of their peers, leading them to choose a class based on its popularity rather than its quality.

Overall, while rational choice theory assumes that individuals are rational decision-makers, behavioral economics recognizes that humans are not always rational and that various cognitive biases and heuristics can affect decision-making.

 Regenerate response



Rational choice theory and behavioral economics are both popular approaches to understanding human decision-making, but they have some fundamental differences.

Rational choice theory assumes that individuals make decisions based on rational calculations of costs and benefits, and that they seek to maximize their own self-interest. In other words, individuals are assumed to be perfectly rational and capable of making optimal decisions. This theory is often used in economics and political science to explain behavior such as voting, consumer choice, and market competition.

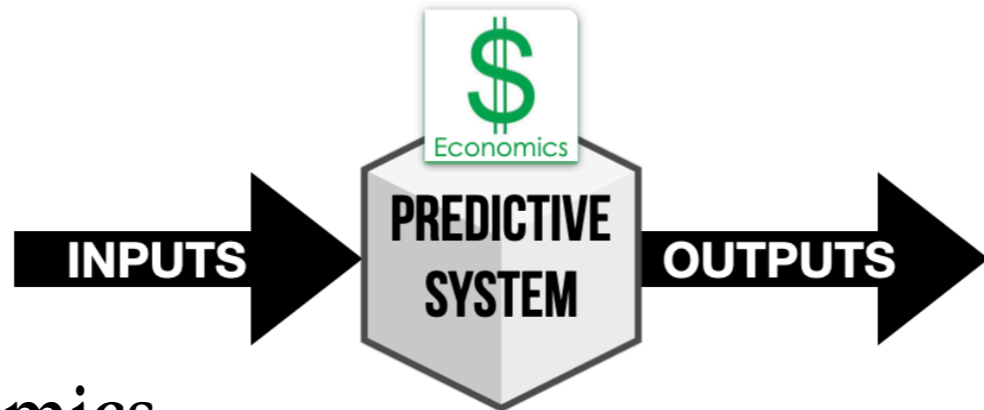
On the other hand, behavioral economics incorporates insights from psychology and other social sciences to understand how people actually make decisions. Behavioral economists recognize that humans are not always perfectly rational, and that we are often influenced by cognitive biases and other psychological factors. This theory takes into account the ways in which emotions, social norms, and other non-rational factors can impact decision-making.

To put it simply, rational choice theory assumes that people are rational decision-makers who always act in their own self-interest, while behavioral economics recognizes that people are not always rational and can be influenced by factors beyond pure self-interest.

For a college student, these two theories can help them better understand how they and others make decisions in different contexts. They can use rational choice theory to analyze their own decision-making process when making choices about classes, extracurricular activities, or career paths. They can also use behavioral economics to better understand how social influence, cognitive biases, and emotions can affect their choices and those of others. By considering both perspectives, college students can make more informed decisions and develop a more nuanced understanding of human behavior.







Please read it to me, Snoop Dogg



Classical Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Regression

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Behavioral Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

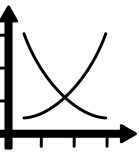
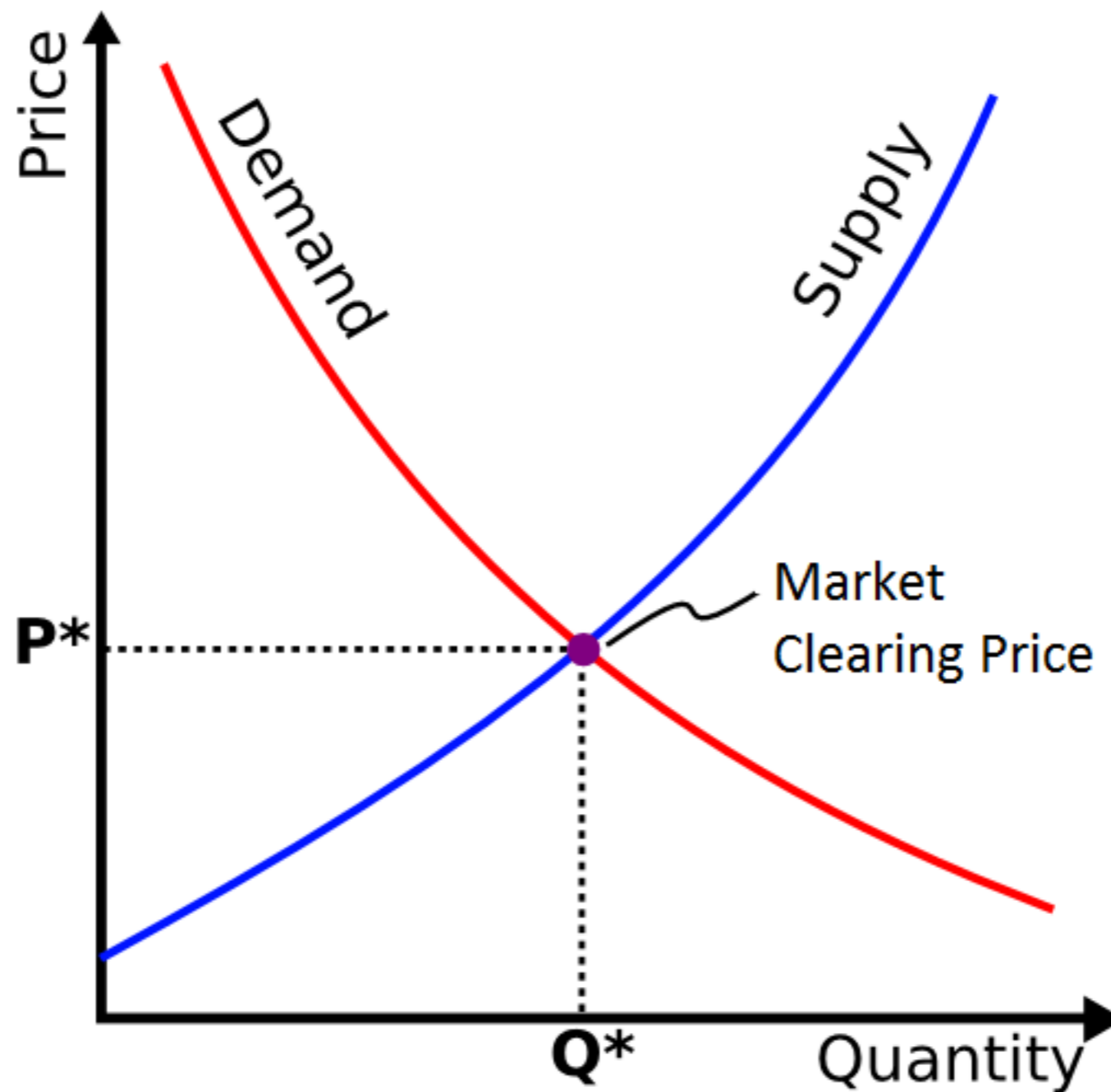
Artificial Intelligence

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

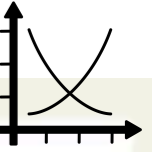
Note: this illustrative diagram is meant to provoke conversation. It's not a definitive declaration!

The “Law” of Supply and Demand

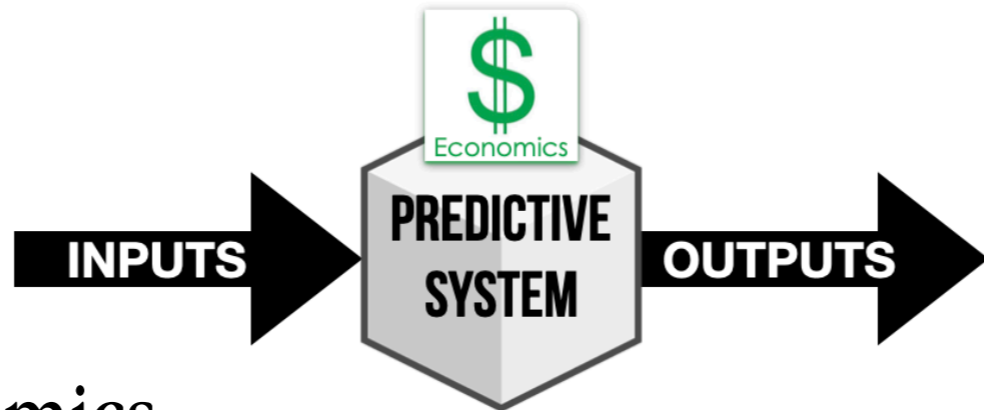
“Classical Economics”



popularized by Adam Smith, 1776



ADAM SMITH: THE FATHER OF ECONOMICS



Classical Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Regression

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Behavioral Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

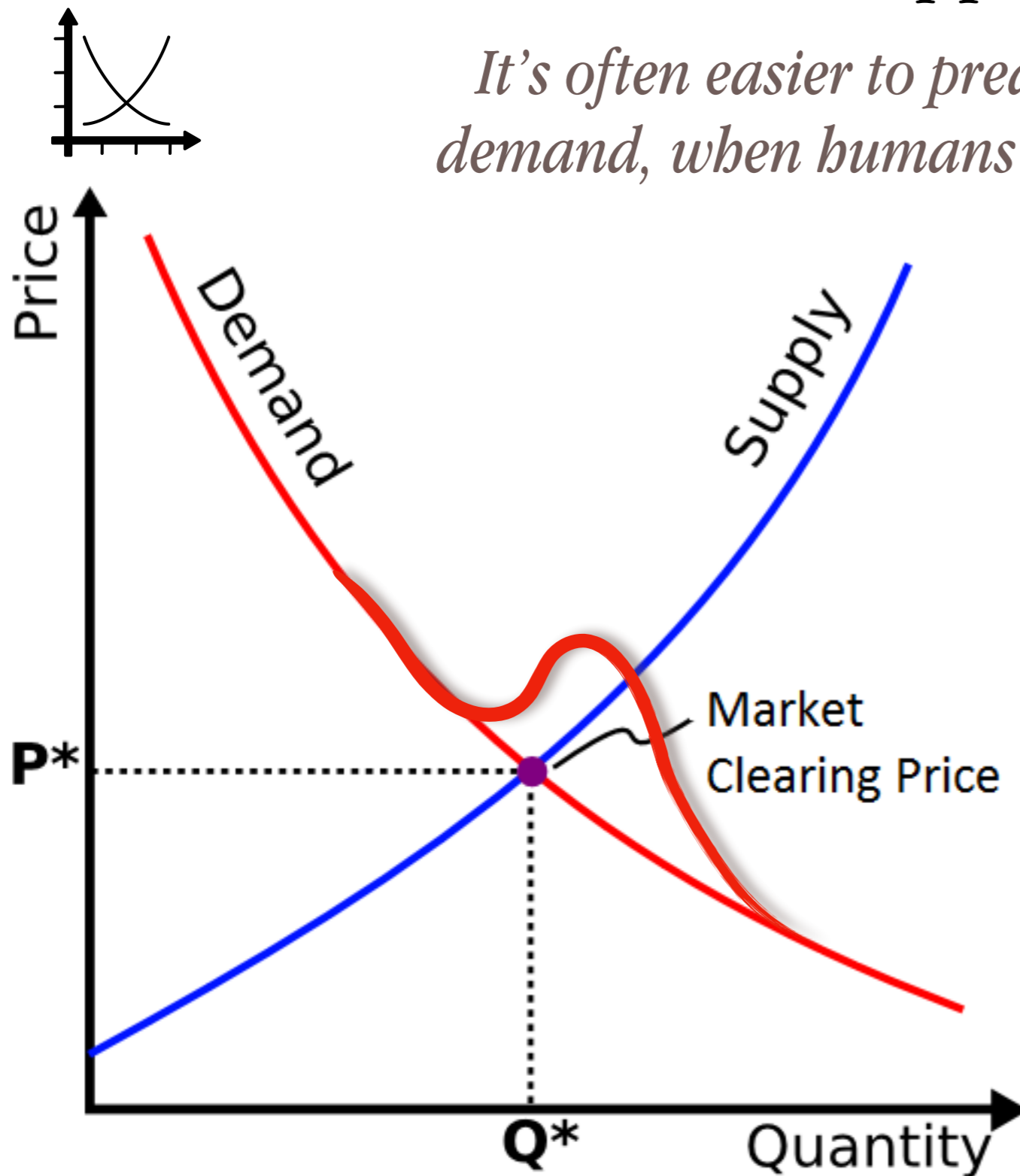
Artificial Intelligence

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

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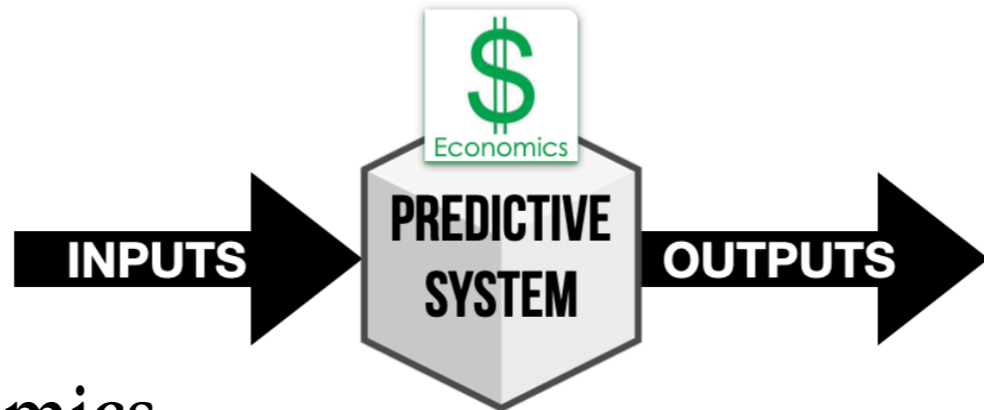
The “Law” of Supply and Demand

It's often easier to predict supply than demand, when humans are involved...



*“As price of a good increases, the demand for the product will—except for a few obscure situations—decrease.”**





*<https://www.investopedia.com/articles/economics/11/intro-supply-demand.asp>



Classical Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	


Regression

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Behavioral Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

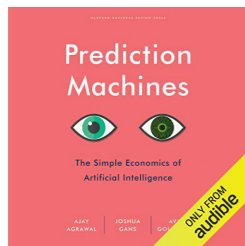
Artificial Intelligence

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Note: this illustrative diagram is meant to provoke conversation. It's not a definitive declaration!

Regression

REGRESSION



from "Prediction Machines" by Agrawal, Ajay, 2018

“The financial crisis of 2008 was a spectacular failure of regression-based prediction methods. Partly driving the financial crisis were predictions of the likely default of collateralized debt obligations, or CDOs. In 2007, ratings agencies like Standard & Poor’s forecasted that AAA-rated CDOs had a less than $[1/800]$ chance of failing to deliver a return in five years. Five years later, $[> 1/4]$ CDOs failed to deliver a return. The initial prediction was staggeringly wrong despite very rich data on past defaults.

The failure was not due to insufficient data, but instead how analysts used that data to form a prediction. Ratings agencies based their prediction on multiple regression-like models that assumed house prices in different markets were not correlated with one another. That turned out to be false, not just in 2007 but also previously. Include the possibility that a shock might hit many housing markets simultaneously, and the probability goes way up that you lose out on CDOs, even if they are distributed across many US cities.

Analysts built their regression models on hypotheses of what they believed mattered and how—beliefs unnecessary for machine learning. Machine learning models are particularly good at determining which of many possible variables will work best and recognizing that some things don’t matter and others, perhaps surprisingly, do. Now, an analyst’s intuition and hypotheses are less important. In this way, machine learning enables predictions based on unanticipated correlations, including that housing prices in Las Vegas, Phoenix, and Miami might move together.”

Agrawal, Ajay, Gans, Joshua & Goldfarb, Avi.

Prediction Machines . Harvard Business Review Press. Kindle Edition.

Or... (*warning—profane language*)



F HD

Margot Robbie explains in “The Big Short”

And then...



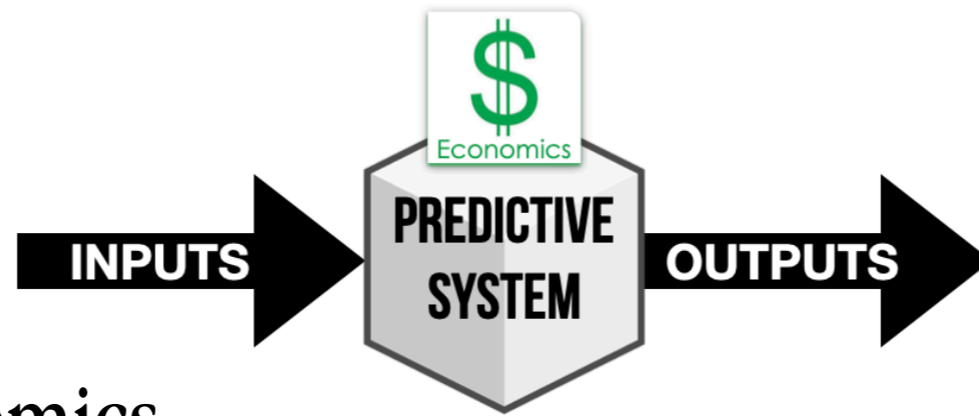
"Hot-hand fallacy"

"Irrational Exuberance"



F HD





Selena Gomez & Richard Thaler explain in "The Big Short"



Classical Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	





Regression

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Behavioral Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Artificial Intelligence

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Note: this illustrative diagram is meant to provoke conversation. It's not a definitive declaration!

What's the *key* difference between Regression & AI?

Regression

things humans understand are *independent variables* (they are "semantic," in that their names have meaning to humans, e.g. "price of steel")

Artificial Intelligence

e.g. unsupervised Machine Learning

uses "features" that may or may not correspond to semantic variables (they might be completely abstract and indescribable; so that meaningful phrases like "price of steel" usually cannot describe them)

value of company

simplest example
(usually many independent variables at once, for "multiple regression")

price of steel

...prediction of company's value, based on many measures (including potentially "price of steel"), but there's no "equation" describing how they each effect value




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[Outcomes](#)

[Rubrics](#)

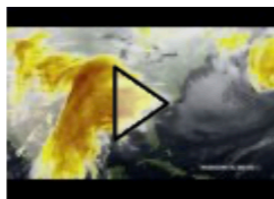
[Settings](#)

Modern Predictions & AI

Weather & Climate (NASA Goddard)

[Weather & Climate Game/Curriculum Google Doc](#)

[NASA | Supercomputing the Climate](#)



particularly note discussions of different data sets for te

Climate Change simulation, including "hindcast" machine learning and artificial intelligence CrashCourse computer science

[How Climate Scientists Predict the Future](#)



Chaos

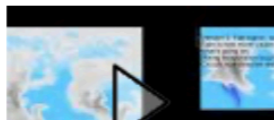
[El Niño and Why It's So Hard To Predict the Weather](#)



Weather Sandbox (Simulation Game output)

[Simulation code: https://mega.nz/#!xZ9TxJpT!RGF4ToGHRD..](#)

https://www.youtube.com/watch?v=AYW_awzW4Es



Artificial Intelligence

Short example "learning to speak AI" video

<https://www.youtube.com/watch?v=DHN7mVYzxSA&feature=youtu.be>



based on AI/ML glossary [here](#)

Best resource: [Crash Course series on PBS](#)

[Intro Episode on Artificial Intelligence](#)

[Neural networks from crash course stats](#)

<https://youtu.be/JBIm4vjNMY>

*Canvas Page on
Modern Predictions & AI
lists several helpful videos
& websites
(To be updated based on
2023 contributions!)*

machine learning and artificial intelligence CrashCourse computer science

<https://youtu.be/z-EtmaJieY>

[Google maps info](#)

Google Ground Truth

<https://youtu.be/FsbLEtS0uls>



[About AI & ML in Google maps](#)

[ML translation](#)

The A-Z of AI and Machine Learning: Comprehensive Glossary

Ultimate Terminology You Need to Know



Oleksii Kharkovyna [Follow](#)
Jul 8, 2019 · 14 min read ★



Hmm... how about just “classification”?

I don't know whether you know it or not... but there are a lot of misconceptions surrounding artificial intelligence. While some assume it means robots coming to life to interact with humans, other ones believe it is a superintelligence that soon will take over the world. Well, I consider this to be very discouraging. Not for me to explain the importance of knowing what AI is and what it can really do (especially if you are thinking about establishing your own AI expertise, or you are already using it).

Today, I offer to take care of terminology and don't be so naive anymore. In this article, I'll aim to highlight some of the most necessary concepts in a clear, straightforward way.

So, feel free to grab your coffee and a comfortable chair, and just dive in. Or use it as a reference anytime you want to brush up your knowledge.

Artificial Intelligence and Machine Learning Terms A to Z:



knowledge.

L

- **Limited memory**

systems with short-term memory limited to a given timeframe

All those algorithms build a mathematical model, known as “training data”, in order to make predictions or decisions.

While AI is a technique that enables machines to mimic human behavior, Machine Learning is a technique used to implement Artificial Intelligence. It is a certain process during which machines (computers) are learning by feeding them data and letting them learn a few tricks on their own, without being explicitly programmed to do so. So all-in-all, Machine Learning is the meat and potatoes of AI.

- **Machine Perception**

Machine perception is the capability of a computer system to interpret data in a manner that is similar to the way humans use their senses to relate to the world around them. The basic method that the computers take in and respond to their environment is through the attached hardware.

- **Machine translation**

Machine translation (MT) is an automated translation. It is the process by which computer software is used to translate a text from one natural language (such as English) to another (such as Spanish).

N

- **Narrow Intelligence**

Narrow AI is AI that is programmed to perform a single task — whether it's checking the weather, being able to play chess, or analyzing raw data to write journalistic reports.

- **Natural language processing (NLP)**

Natural Language Process, or NLP for short, is a field of study focused on the interactions between human language and computers. NLP helps machines “read” text by simulating the human ability to understand language. It sits at the intersection of computer science, artificial intelligence, and computational linguistics.

- **Neural networks**

Learning to speak “artificial intelligence” ...

Classification

In *machine learning* and *statistics*, *classification* is a *supervised learning algorithm* technique that allows *machines* to assign categories to data points (categorize *data* into a given number of *classes*). *Classification* (*decision trees* and *neural network* classifiers) can be used for text classification in marketing.

machine learning *statistics* *classification* *supervised learning*

algorithm *machines* *data* *classes* *decision trees* *neural network*

data (input) information

statistics an approach to analyzing data,

using an **algorithm** defined by rules, which can be

implemented on **machines**

one **algorithmic** approach

to (**statistical**) tasks is **artificial intelligence (AI)**

classification **algorithms'** task is to categorize **data**

using examples of categories desired, one can "train" or "**supervise**" an **algorithm** to learn to **classify data**. Such an **algorithm** is just one kind of

AI, called **supervised learning** which itself is one type of the more general class of **algorithms** known as **machine learning (ML)**

types of **supervised ML classifiers** are **decision trees** and **neural network**

which ultimately sort **data** into **classes**

A **random forest** is simply a collection of *decision trees* whose results are aggregated into one final result. Their ability to limit overfitting without substantially increasing error due to bias is why they are such powerful models.

How does this work?

An (economically & politically “neutral”) example of machine learning & random forests, supervised by experts.

Are they “partnerships”? (Shneiderman says *no!*)

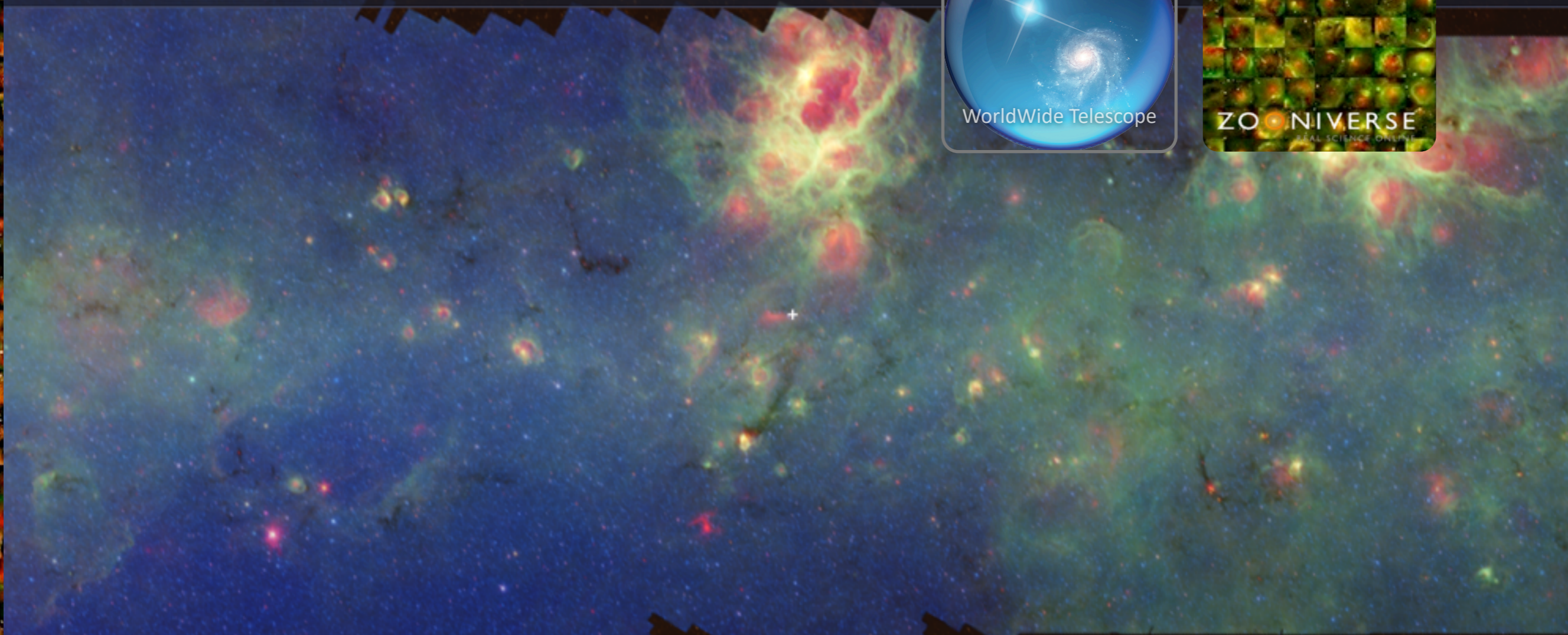
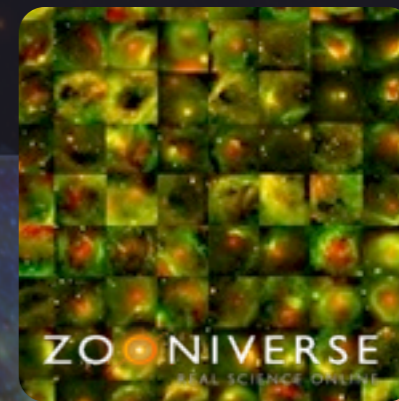
Use Layer Manager to Control User Settings



Name My Location
Lat 37:47:15 Alt 0 m
Lng -123:35:23
 View From This Location

2015/02/11 04:40:33
Real Time
[Play] [Pause] [Stop] [Refresh] [Now]

Galactic Plane Mode



Look At: Sky Imagery: Digitized Sky Survey (Color) Image Crossfade: [Slider]

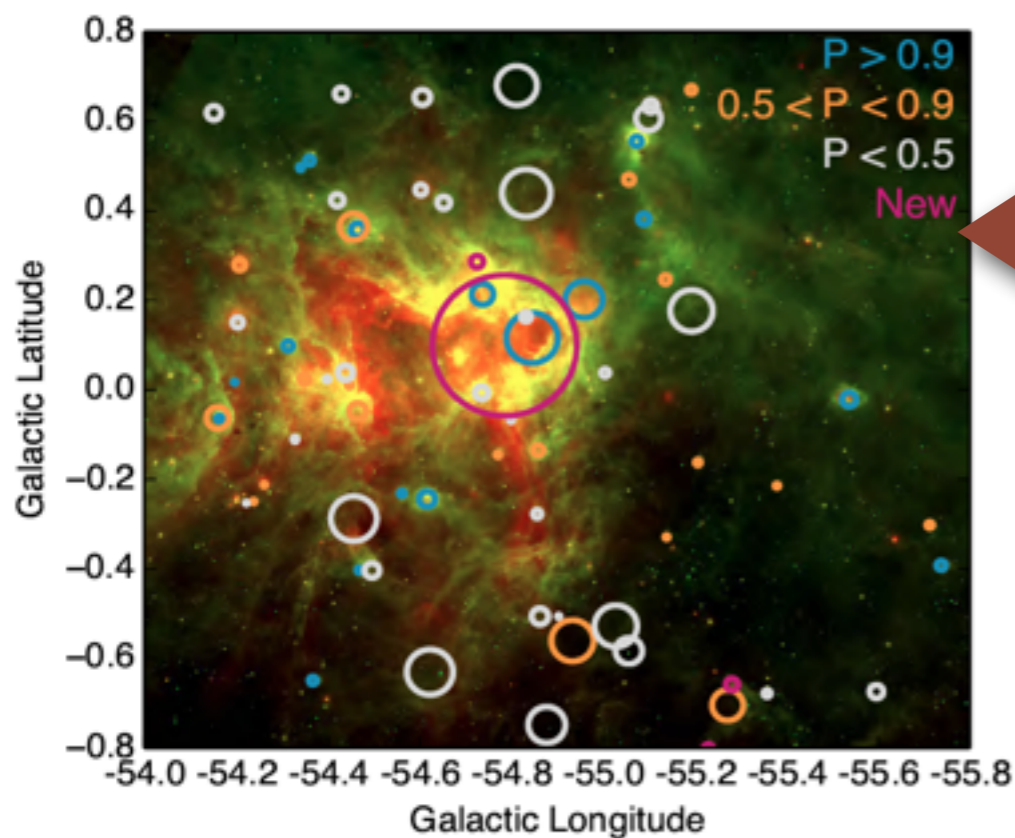
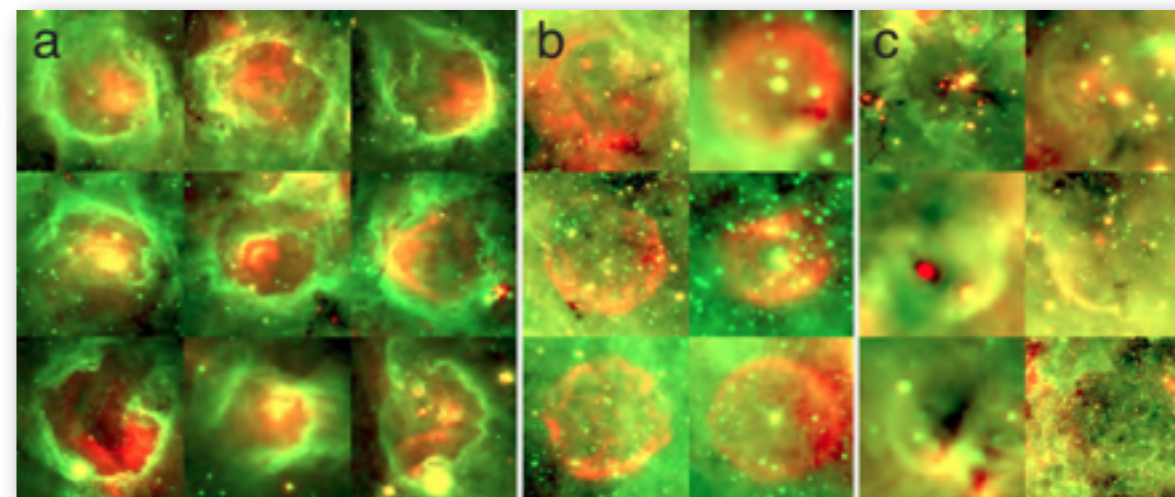
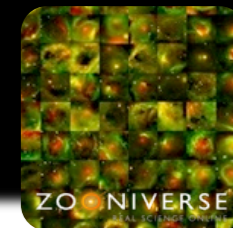
Tracking: GLIMPSE/MIPSGAL 1 of 3

Scorpius 03:10:14

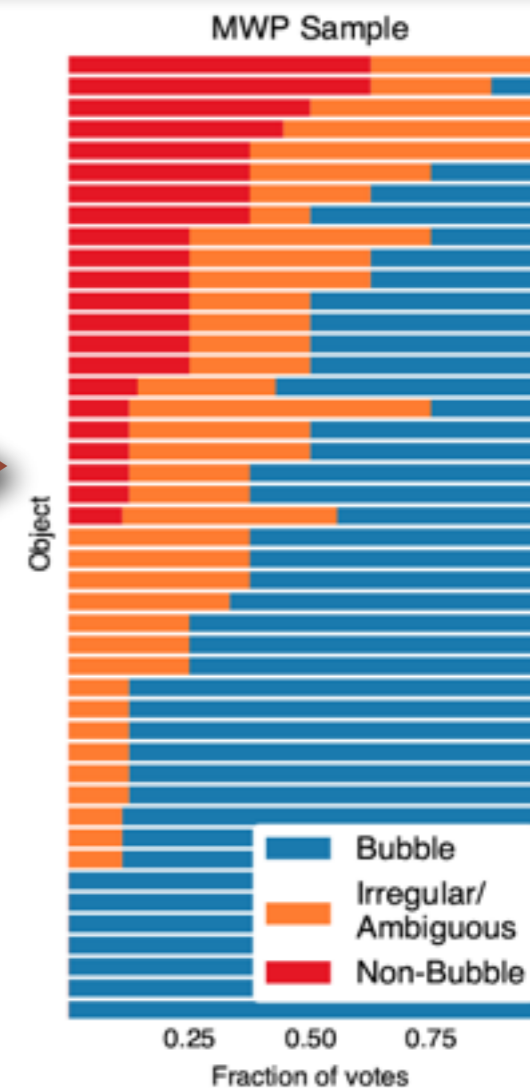
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- Pismis 24 and
- NGC6334
- NGC6357
- NGC6374
- NGC6383
- NGC6396
- NGC6404
- Lesath
- Shaula
- HR6397
- HR6405

BIG DATA AND "HUMAN-AIDED COMPUTING"

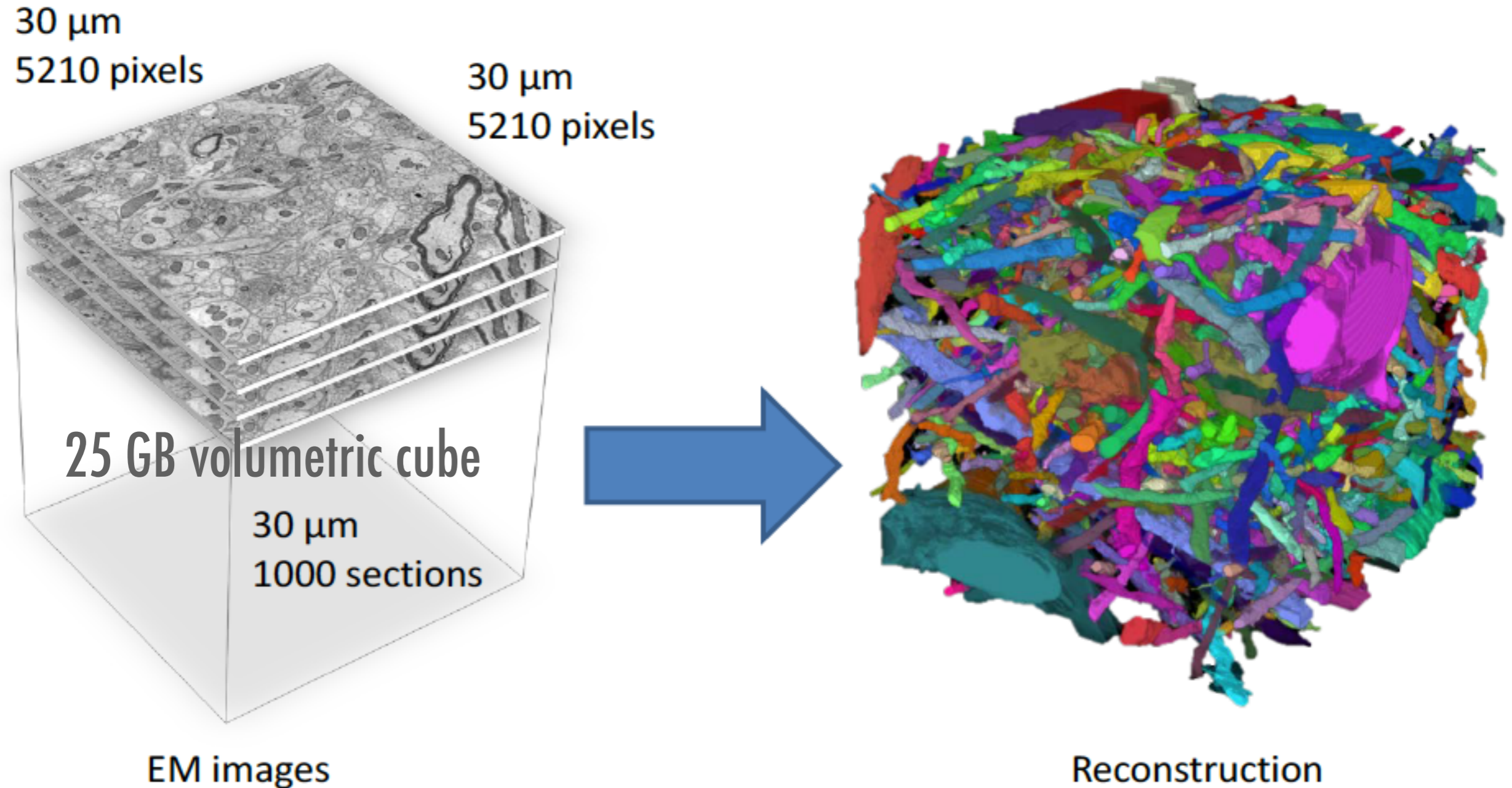


random forest
machine
learning

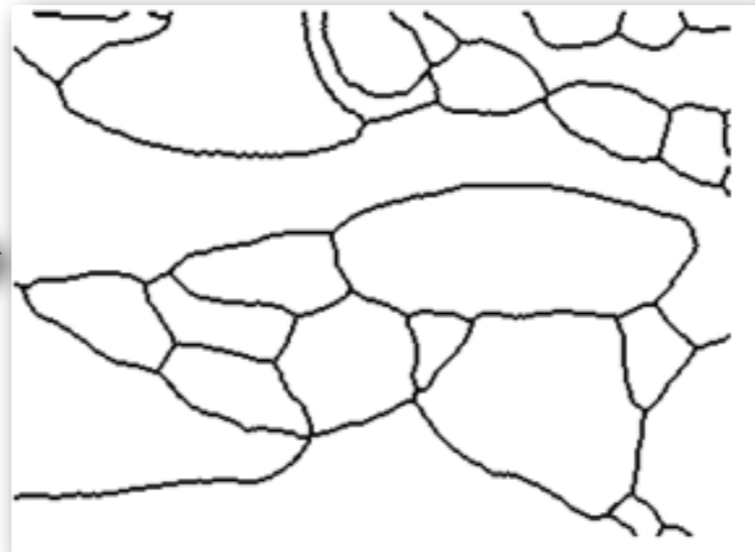
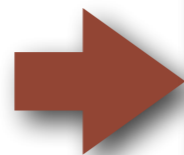
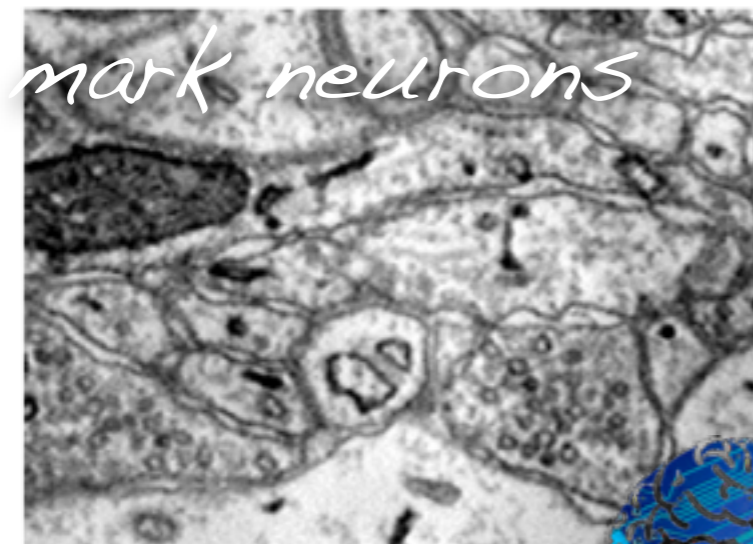


example here from: **Beaumont**, Goodman, Kendrew, Williams & Simpson 2014; based on **Milky Way Project** catalog (Simpson et al. 2013), which came from **Spitzer/GLIMPSE** (Churchwell et al. 2009, Benjamin et al. 2003), cf. Shenoy & Tan 2008 for discussion of HAC; **astroml.org** for machine learning advice/tools

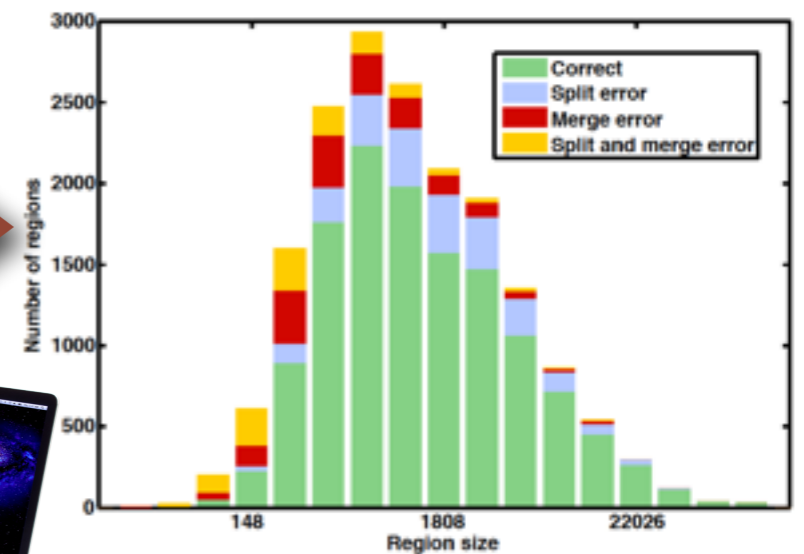
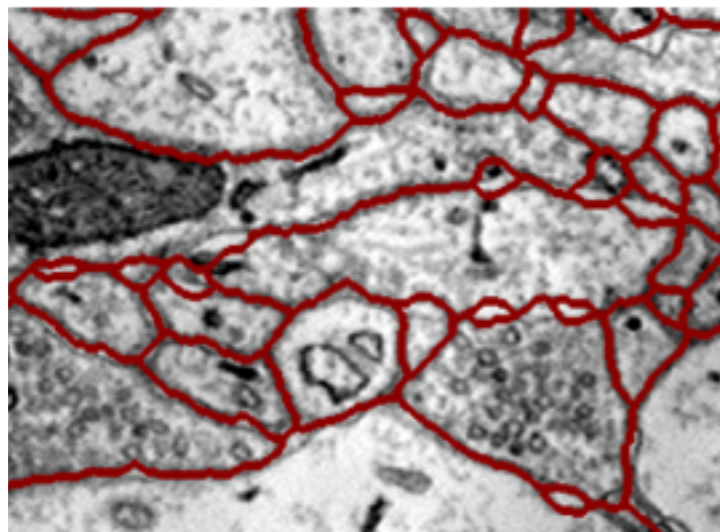
BIG DATA AND "HUMAN-AIDED COMPUTING"



BIG DATA AND "HUMAN-AIDED COMPUTING"



random forest
machine
learning



Money, People, our Earth & our Future: Human Behavior, Simulations & AI

< Behavioral Economics

LabXchange



INTERACTIVE VIDEO
PredictionX
Behavioral Economics



00:00:03

Meet David Laibson.

[Watch clip](#)

#david_laibson

00:03:59

Understanding behavioral economics.

[Watch clip](#)

[Learn more](#)

#behavioral_economics #rational_choice
#psychological_bias

00:09:22

Repetition and rationality.

[Watch clip](#)

[Learn more](#)

#flawed_rationality #homo_economicus
#sample_size #uncertainty

00:11:58

Behavioral economics and climate change.

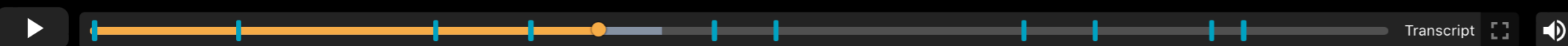
[Watch clip](#)

[Learn more](#)

#climate_change #climate_modeling

00:16:59

Is human behavior predictable?



Money, People, our Earth & our Future: Human Behavior, Simulations & AI

< Behavioral Economics

Lab change



INTERACTIVE VIDEO
PredictionX
Behavioral Economics



*What does “out of sample”
mean for AI & simulation?*

00:00:03

Meet David Laibson.

Watch clip

#david_laibson

00:03:59

Understanding behavioral economics.

Watch clip

Learn more

#behavioral_economics #rational_choice
#psychological_bias

00:09:22

Repetition and rationality.

Watch clip

Learn more

#flawed_rationality #homo_economicus
#sample_size #uncertainty

00:11:58

Behavioral economics and climate change.

Watch clip

Learn more

#climate_change #climate_modeling

00:16:59

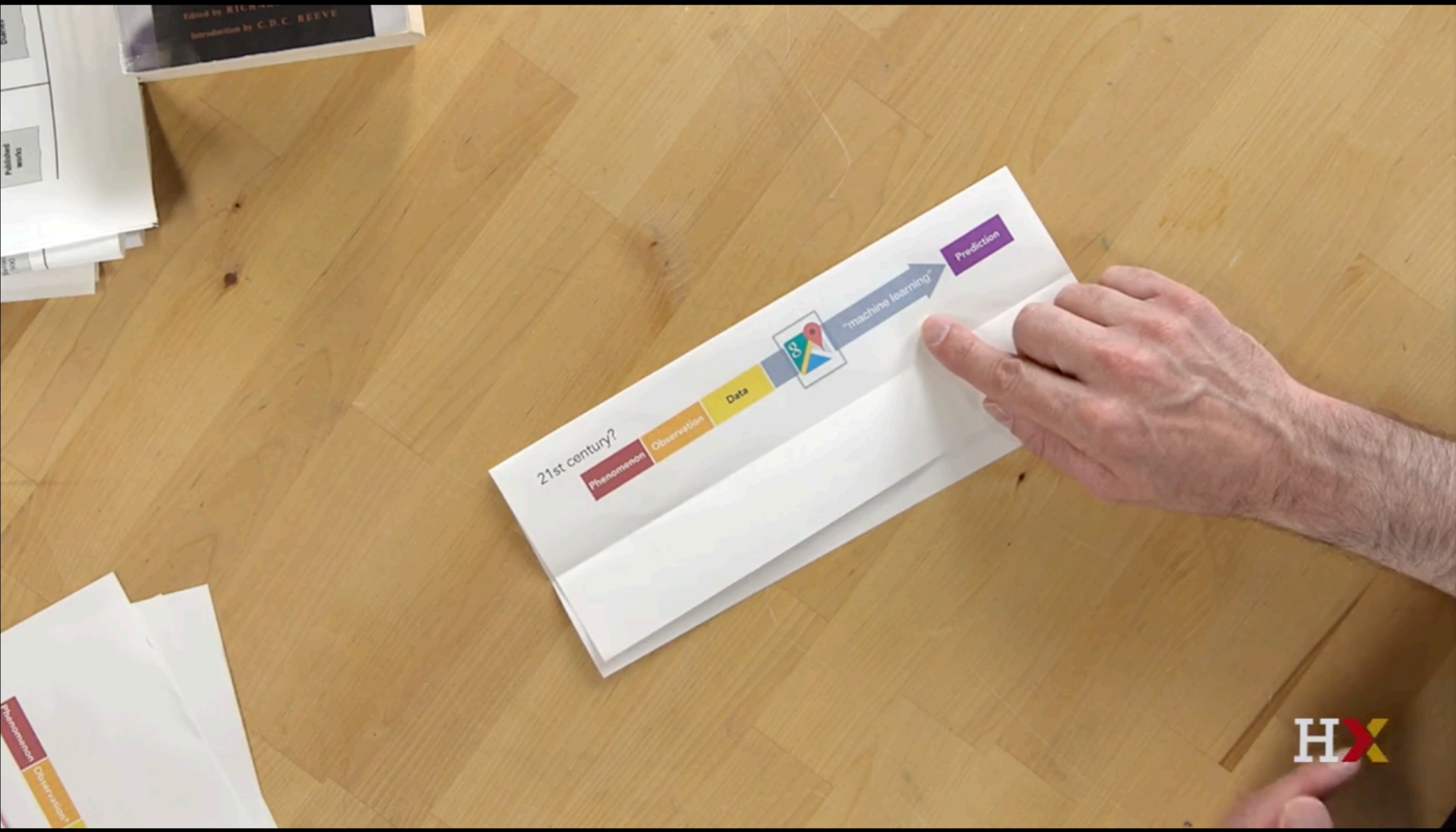
Is human behavior predictable?



Transcript



Money, People, our Earth & our Future: Human Behavior, Simulations & AI



00:09:22

Repetition and rationality.

[Watch clip](#) [Learn more](#)

#flawed_rationality #homo_economicus
#sample_size #uncertainty

00:11:58

Behavioral economics and climate change.

[Watch clip](#) [Learn more](#)

#climate_change #climate_modeling

00:16:59

Is human behavior predictable?

[Watch clip](#)

#deterministic_vs_probabilistic #predictability
#uncertainty

00:18:40

What can machine learning help us predict? For a fascinating example of ML use in an area previously thought unattainable.

[Watch clip](#) [Learn more](#)

#machine_learning #predictability
#artificial_intelligence

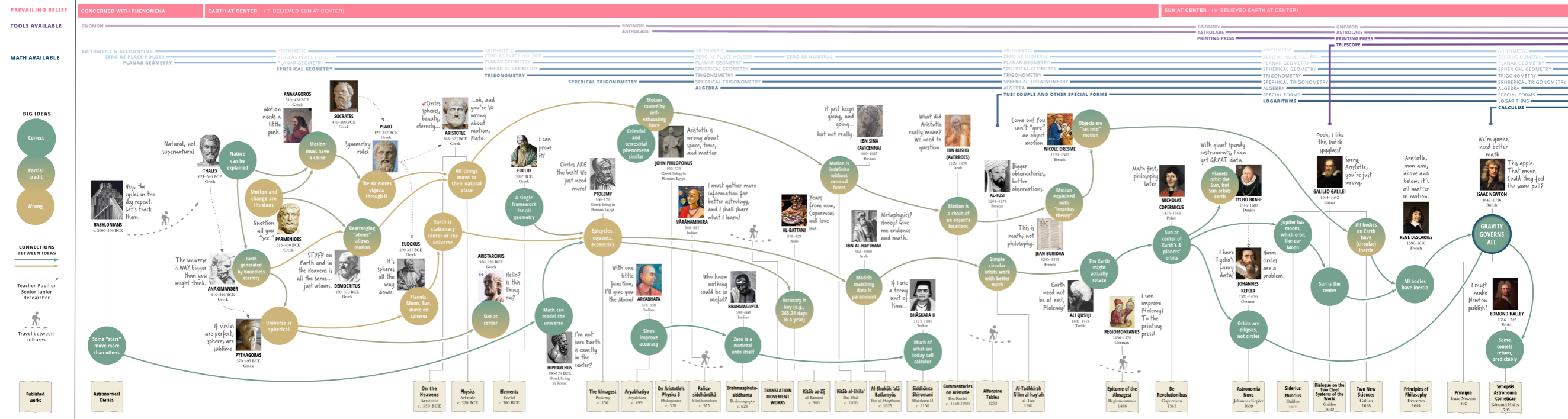
00:25:26



The "Padua" Rainbow



The Path to Newton



© Harvard University, created by Alyssa Goodman, Jais Brohinsky, Drew Lichtenstein & Katie Peek. re-use is allowed, with attribution, version 1, 2019

or, Experiment



Mendel



Darwin



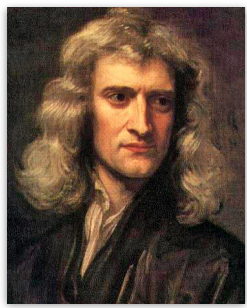
BIOLOGY

#theoretical_empirical

PHYSICS



Kepler



Newton

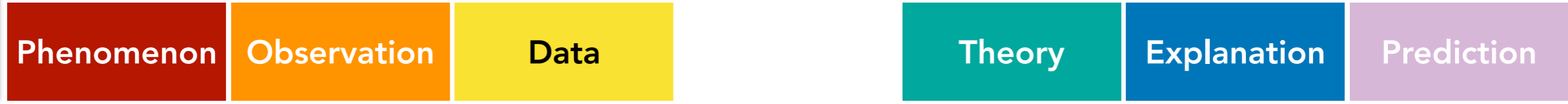




Mendel 1865



Darwin 1859



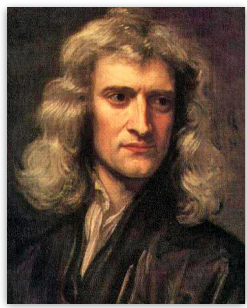
NO FULLY PREDICTIVE GENERAL THEORY

#deterministic_vs_probabilistic

FULLY PREDICTIVE GENERAL THOERY



Kepler 1609



Newton 1687

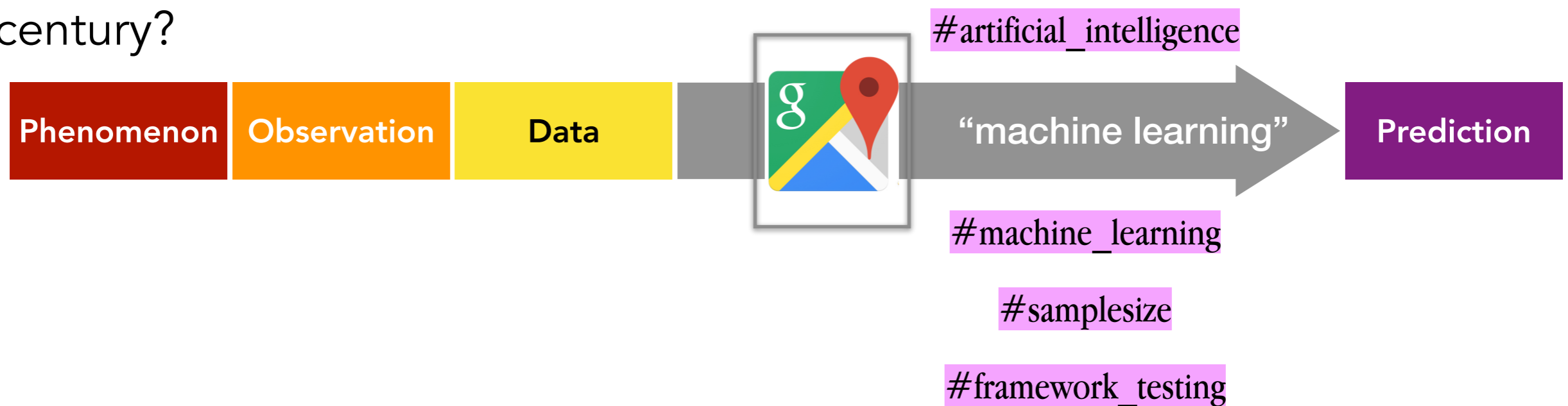


THE FUTURE OF THE FUTURE

20th century



21st century?

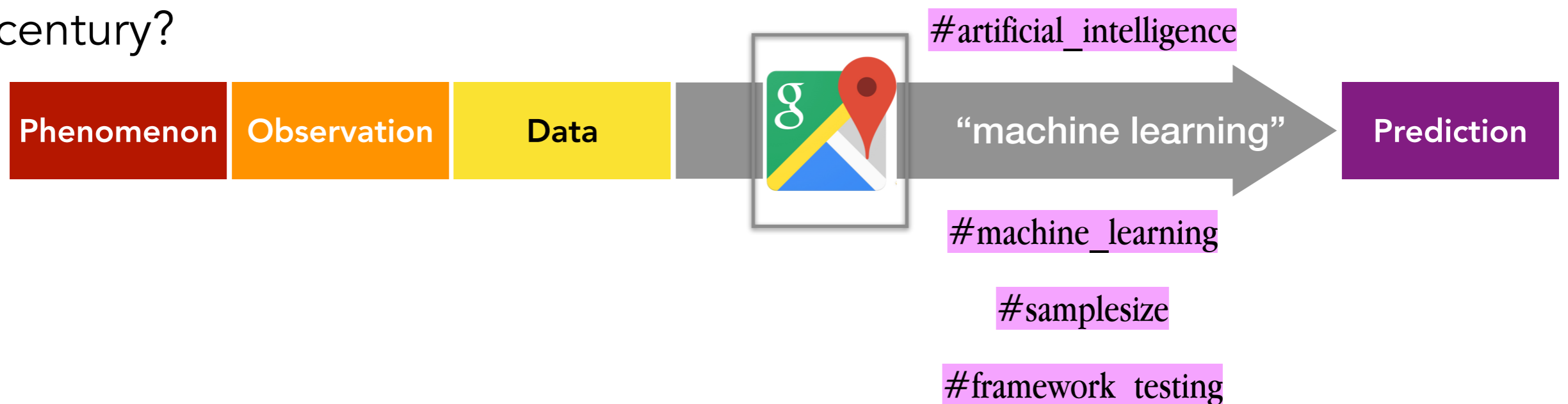


IMPORTANT: NOT ALL DATA SCIENCE IS AI

20th century



21st century?



IMPORTANT: NOT ALL DATA SCIENCE IS AI

#theoretical_empirical

The Prediction Project

The Past and Present of the Future



[HOME](#) [ABOUT](#) [MATERIALS](#) [COURSES](#) [TALKS](#) [WRITINGS](#) [PRESS](#) [FORUM](#)

Data-Driven Dilemmas posed by COVID-19

This commentary was submitted on April 21, 2020 as a proposed Op-Ed for the NYT, by Prof. Alyssa A. Goodman, Harvard University. It represents the personal views of the author, not an official position of Harvard University.

I teach "[Prediction](#)." At Harvard. But I cannot predict the outcome of the current pandemic. I am equipped, as a scientist, to understand, evaluate, and potentially act upon, the infection and death statistics we all now read every day. But as a person, I can also act out of fear. The constant dialogue in my mind between my rational self and my emotional self helps me appreciate the dilemma facing our leaders now, as they try quite literally, to save the world.

I am trained as a physicist and astronomer. I specialize in data science, and data visualization, and I teach some epidemiology in my Prediction class. While this background does not qualify me to expertly advise leaders on COVID-19 strategy, it does put me at 1 or 2 degrees of separation from many experts quoted in the press every day. And, it's very clear to me from this privileged vantage point that even true experts' predictions do not agree. Traditional [mathematical models of epidemics](#) use the now-infamous "R₀" reproduction number, lethality rates, understanding of infection mechanisms, analysis of co-morbidities, and other medical measures to estimate outcomes. [Bold data-science approaches](#) eschew understanding of infectious disease, and base predictions purely on "training data" that amounts to information about what has actually happened in countries farther along in their epidemic curves than others.

Both groups—epidemiologists using infectious disease expertise to model a pandemic's course and data scientists making predictions using algorithms trained only on real-world actions and outcomes, suffer at this point from a [severe lack of reliable data](#) to input to their forecasts. In the understand-to-predict disease spread approach, uncertainty is reduced as more is known about mechanisms of infection and recovery, about true numbers of people susceptible and immune to the disease, and about the properties of the virus and of the people upon whom it has a range of effects. In the least medically-oriented of the data-science approaches, what's needed is a wide variety of circumstances (e.g. ranges of policies on social distancing, travel restrictions, population density, population demographics), measured over long-enough time spans, to let algorithms base forecasts on what happened elsewhere in the past. We simply do not have enough data at this point for either of these approaches to work with high precision, but either is good enough to forecast extremes.

predictionx.org/data-driven-dilemmas

Mechanism v. “Data Science”

#theoretical_empirical

Both groups—epidemiologists using infectious disease expertise to model a pandemic’s course and data scientists making predictions using algorithms trained only on real-world actions and outcomes, suffer at this point from a severe lack of reliable data to input to their forecasts. In the understand-to-predict disease spread approach, uncertainty is reduced as more is known about mechanisms of infection and recovery, about true numbers of people susceptible and immune to the disease, and about the properties of the virus and of the people upon whom it has a range of effects. In the least medically-oriented of the data-science approaches, what’s needed is a wide variety of circumstances (e.g. ranges of policies on social distancing, travel restrictions, population density, population demographics), measured over long-enough time spans, to let algorithms base forecasts on what happened elsewhere in the past. We simply do not have enough data at this point for either of these approaches to work with high precision, but either is good enough to forecast extremes.

#samplesize

#technology_theoretical_computation_and_math

#public_reaction

#unknown_unknowns

#uncertainty

#biases

#framework_testing

#personal_or_societal

Mechanism (v.) Data Science & Uncertainty

#samplesize

#technology_theoretical_computation_and_math

#public_reaction

#unknown_unknowns

#uncertainty

#biases

#framework_testing

#personal_or_societal



The Prediction Project

The Past and Present of the Future



HOME ABOUT MATERIALS COURSES TALKS WRITINGS PRESS FORUM

Uncertainty about Uncertainty

by [Alyssa A. Goodman](#), May 18, 2020

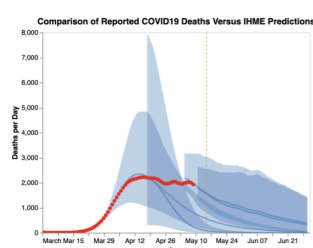
This essay accompanies the release of an online [tool for visualization of IHME COVID-19 forecasts'](#) evolution over time and a [community discussion](#) of visualizations created with the tool.

Uncertainty about the future has motivated predictions for millennia. Sometimes, we're just curious—but other times, we really need to know. As the present pandemic evolves, our urgent societal need to plan has motivated many scientists to predict the spread and effects of the novel coronavirus.

BACKGROUND: TWO BROAD CLASSES

ns being used by governments to asses: infectious disease models of how contagion spreads; and statistical models informed outcomes. To the uninitiated, rich rely on statistical ne—but they are not.

take into account, with varying ny, and importantly why, people are susceptible, infected, immune, or any given point in time and space. The mathematics of these models os called "Susceptible," "Exposed," "Infected," and "Removed," and so are t the philosophical other end of the modeling spectrum, what we call ach uses information about cases, testing, hospital admissions, and hat forecast what will happen under various combinations of conditions, r similar conditions in the past. Purely mechanism-agnostic medically-informed information about how an infectious disease spreads.



IHME Model Uncertainty, Visualized over Time

The [Institute for Health Metrics and Evaluation \(IHME\)](#) creates, maintains, updates, and publishes an open-source statistical [model](#) of the impact of the COVID-19 pandemic, based on open-data resources. As a public service, [glue solutions, inc.](#) here offers an online tool for visualizing the evolution of the IHME models over time.

The general public has seen many versions of the IHME "Daily Deaths" plots, including in several White House briefings. Our goal here is to offer a look at **how the models change**—appropriately, in response to new data and information—over time, and how that affects model updates. In a [companion essay online at the Prediction Project](#) site, we offer more context on why this evolution is so interesting.

(Banner above shows sample IHME "Daily Deaths" [graphic](#), from 14 May 2020.)

IHME Models over time, for the United States, for 4 representative dates, made with the interactive tools offered below.

What's this tool for? Using the interactive graphics below, you can re-create the display of deaths/day akin to what would have been visible at [IHME's site](#) on a range of modeling dates, for any region you select. In addition, you can show more than one model (date) at a time, to make comparisons.

How should I interpret what I see? In each of the panels below: red dots show reported *actual* deaths per day; solid blue lines show forecasts, and light regions show uncertainty bands. Those **uncertainty bands** indicate ranges of possible outcomes, as forecast on the date when the model was made. TI should account for 95% of possible outcomes. As one can see by moving the time slider below each graph, the model and its associated uncertainty bar time. As more and more models are added, regions where shading appears darkest are regions where models have been most consistent.

There are **four versions** of the IHME evolution visualization offered below. They are as follows (with source links in [brackets]):

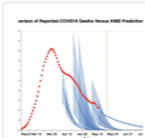
1. For the United States, showing only 4 representative model dates. [[source, GitHub](#)] [[mobile site](#)]
2. For the United States, offering a wide range of model dates [[source, GitHub](#)]
3. For the World, showing only 4 representative model dates [[source, GitHub](#)] [[mobile site](#)]
4. For the World, offering a wide range of model dates [[source, GitHub](#)]

This content is licensed as [CC BY](#), with attribution "glue solutions, inc." Static graphics can be extracted using the three dots at the upper right of each

How can I share interesting graphs I create? Join the discussion at the [10QViz.org IHME COVID-19 Model Uncertainty Visualization](#) page to upload your graphic and tell the world what it shows you. (You can download your graphic using the three dots at the top right of each panel below.)

At present, this site's visualization interactions work best on larger screens. We provide links to standalone views of the visualization showing 4 representative model dates that may work better on many mobile devices.

Tweet Analytics



Alyssa A. Goodman @AlyssaAGoodman
We think everyone needs to SEE how the @IHME_UW #Covid_19 models have changed, so we made a tool <https://www.gluesolutions.io/social-impact> to visualize the forecasts over TIME, and explained it here <https://predictionx.org/uncertainty-covid19> This is a preview. More to come... pic.twitter.com/41tQlk1qFa

Impressions

times people saw this Tweet on Twitter

58,682

Total engagements

times people interacted with this Tweet

9,097

gluesolutions.io/social-impact

predictionx.org/uncertainty-covid19

Volume 46, Issue 3 Winter 2021/22

February 25 2022

Prediction and Judgment: Why Artificial Intelligence Increases the Importance of Humans in War

Avi Goldfarb, Jon R. Lindsay

Author and Article Information

International Security (2022) 46 (3): 7-50.

https://doi.org/10.1162/isec_a_00425



Cite PDF Permissions Share Views

Abstract

Recent scholarship on artificial intelligence (AI) and international security focuses on the political and ethical consequences of replacing human warriors with machines. Yet AI is not a simple substitute for human decision-making. The advances in commercial machine learning that are reducing the costs of statistical prediction are simultaneously increasing the value of data (which enable prediction) and judgment (which determines why prediction matters). But these key complements – quality data and clear judgment – may not be present, or present to the same degree, in the uncertain and conflictual business of war. This has two important strategic implications. First, military organizations that adopt AI will tend to become more complex to accommodate the challenges of data and judgment across a variety of decision-making tasks. Second, data and judgment will tend to become attractive targets in strategic competition. As a result, conflicts involving AI complements are likely to unfold very differently than visions of AI substitution would suggest. Rather than rapid robotic wars and decisive shifts in military power, AI-enabled conflict will likely involve significant uncertainty, organizational friction, and chronic controversy. Greater military reliance on AI will therefore make the human element in war even more important, not less.

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Push and Pull on the Periphery: Inadvertent Expansion in World Politics

Social Cohesion and Community Displacement in Armed Conflict

Cited By



Previous Article Next Article

Article Contents

- Abstract Introduction The Political and Technological Context of Decision-Making AI Complements in Business and War AI Performance in Military Decision-Making Tasks

Discuss: these approaches
re: climate change mitigation



Classical Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Regression

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Behavioral Economics

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Artificial Intelligence

"HUMAN"	
STATISTICAL	
SIMULATION	
COMBINATIONS	

Note: this illustrative diagram is meant to provoke conversation. It's not a definitive declaration!

Which *can* we simulate?



With... Rules? Theory? Data?

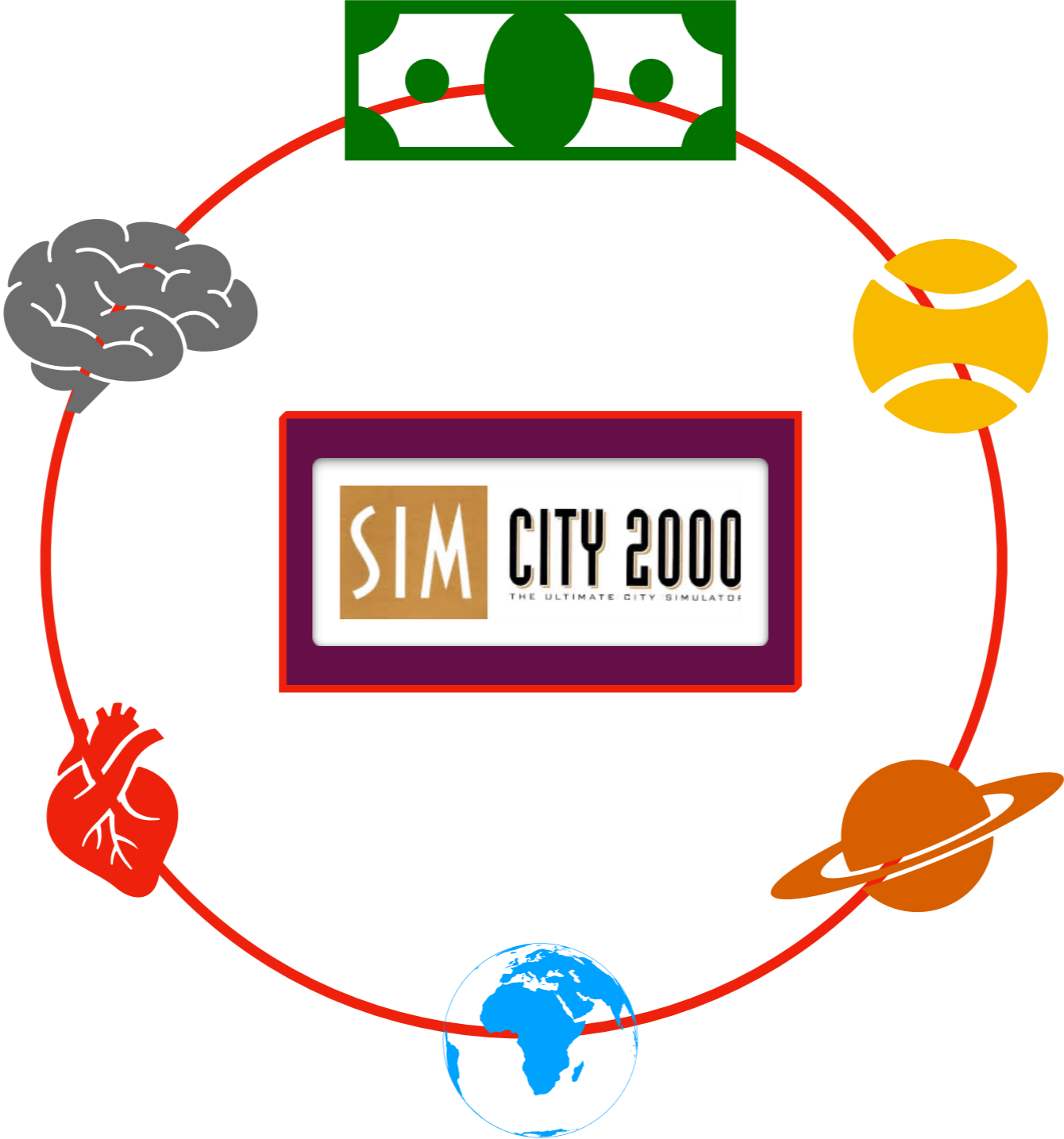
20th century



21st century?



Which *can* we simulate?





Play/Demo

(in pairs, note how resolution and algorithms matter
+ see Canvas assignment)

Simulated Economics in "SimCity 2013"



How would ChatGPT play

Due: Wed Apr 5, 2023 5:30pm




0 Possible Points

 Add Comment

▼ Details

In class during Week 10, we should have time to follow up on the [Let's talk about AI...](#) contributions you made, using your new expertise to think about how ChatGPT would "play" SimCity 2000. Here's how this will go.

1. Find a partner--and one of you should have a laptop.
2. Give your 2-person "team" a name, which can be comprised of your real names if you like.
3. Make sure that the website <https://dos.zone/sim-city-2000-1993/>  works on a laptop your pair can use. (FYI, if we don't have enough laptops, groups of three will be permitted.)
4. One member of the team should build a city in SimCity, while the other member of the team "takes notes" on how aspects of what we've discussed in class about prediction and planning come into play as decisions (e.g. about zoning, building schools, etc.) are made.
5. At some point during play, do switch roles, so that each person has a chance to make some notes, and to play.
6. Stop playing after you feel that your city is "functioning on its own." This might take about 15 minutes.
7. Now discuss with your partner, and with your table mates if timing works out, how a NEW version of SimCity 2000 (let's say "SimCity 2100" would simulate cities using AI/LLM approaches.
8. As a "submission" to this initial assignment, which one person should submit, please enter your during-game notes, and also your thoughts on ChatGPT playing SimCity. Please make sure to include the NAMES of those who played/chatted in your submission.

We will follow up on these initial impressions in section, and in class.

canvas.harvard.edu/courses/113038/assignments/694367

Search game...

dos.zone/sim-city-2000-1993/

DOWNLOAD PC VERSION

Play Sim City 2000 | DOS game online in browser

Sim City 2000 Browser Version

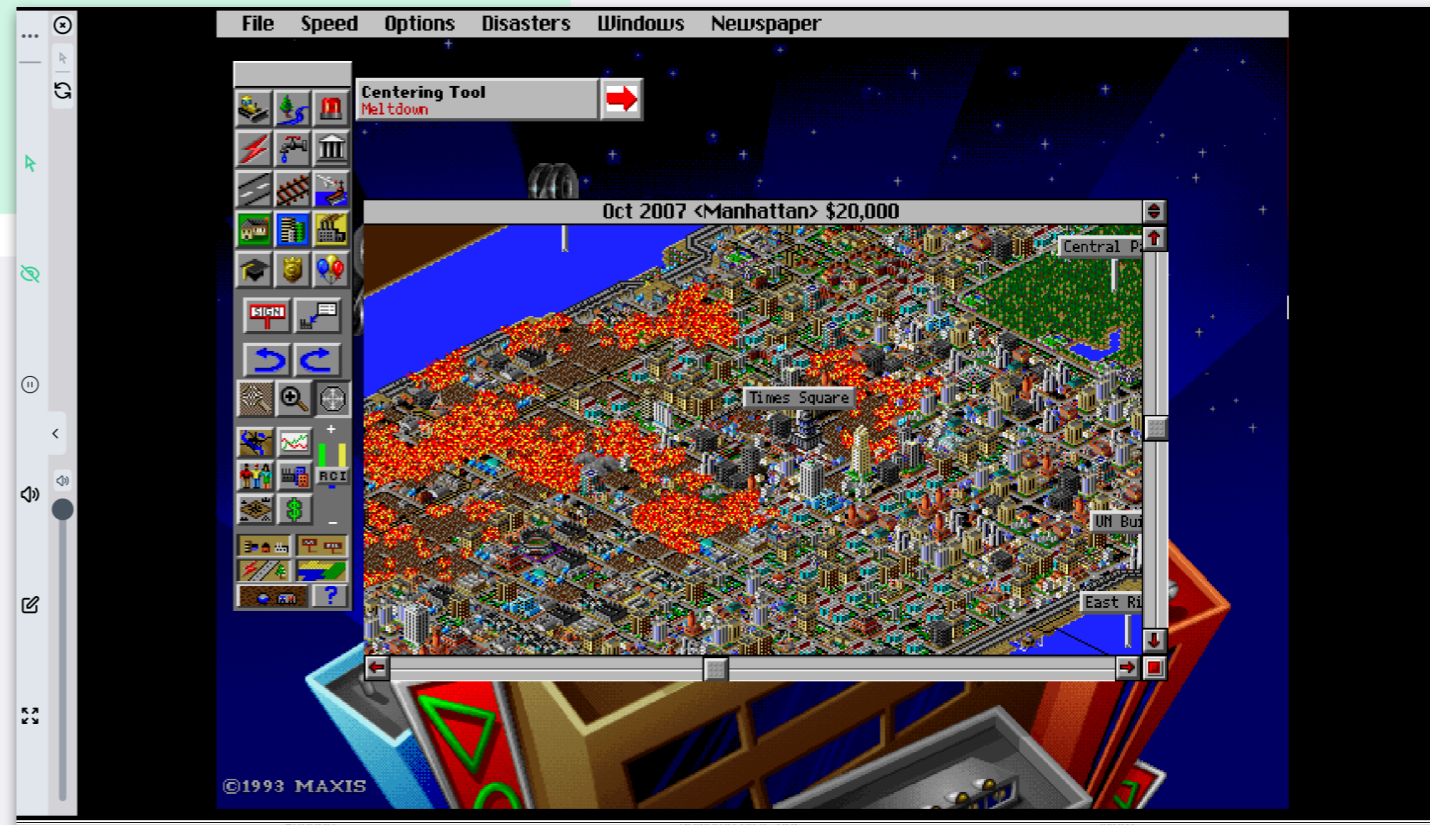
[Play online](#)

[ENG](#)

[Mobile](#)

[</>](#) [↔](#)

Sim City 2000: Video and Screenshots



Extra Slides

Remember to always ask...

“Simulation” or “Numerical Experiment”?

- Simulation: goal is reality
- Numerical Experiment: A “what if” question, about one parameter or idea.

What to do about critical inputs you can't have?

- e.g. underground activity in earthquake forecasting, true # of COVID-19 infections, aspects of human behavior?

Is a more complicated system always better?

- SimCity 2000 vs. The Sims...





SIM CITY 2000

THE ULTIMATE CITY SIMULATOR

☆ Favorite ↗ Share ⋮

Modern Prediction

This cluster includes expert interviews with researchers across an array of disciplines with the unifying topic of modern predictive systems. Learn about prediction efforts in Earth, Space, Health, Wealth, and the Future of the Future, accompanied by annotations and links to deepen your understanding.



★ Favorites
0

✎ Subject
Biological Sciences
+5

🗣️ Language
English

📖 Background Knowledge
None

📄 License
LabXchange
Standard License



Earth



Space



Health



Wealth



The Future of the Future



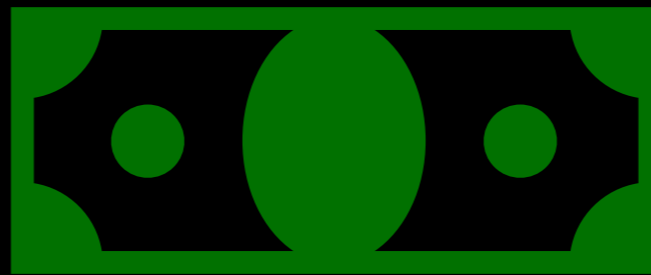


Weather/Climate
simulating spatial
processes

Systems Biology
simulating non-spatial
processes

Genomics
statistical predictions
of physical traits

Mobile Health
statistical predictions
of behavior





Centering Tool
Citizens Demand Road & Rail

Groundwork Laid For GenEd 1112-2021

GenEd 1112-2021 Chronicle

Sunday 7, January 2050

Just A Dollar
Weather with Merle
Chilly Weather
50F 10mph 15mm

Locals Want Transit



Struggle Over Land Rights

Health Care Battle

Tornado Twirls Manchester

Survey



Trees \$3
PAUSED

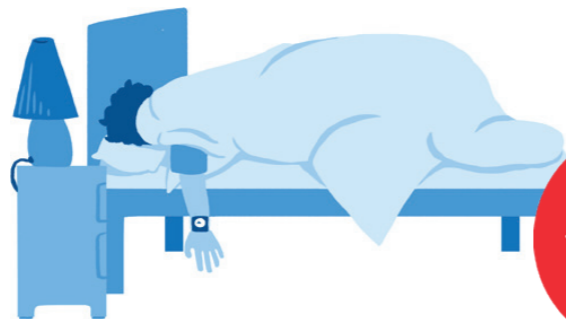
Apr 2054 <GenEd 1112-2021> \$5,587

©1993 MAXIS

Morning

START

WAKE UP



You slept 9 hours

PERFORM MORNING ROUTINE



Refresher

FINISH



Watch Next

AI and Algorithms

The Adpocalypse

Landing optimization

Bayesian theory in juries

Mental health

Sales forecasting

Spam filtering

Plagiarism checker

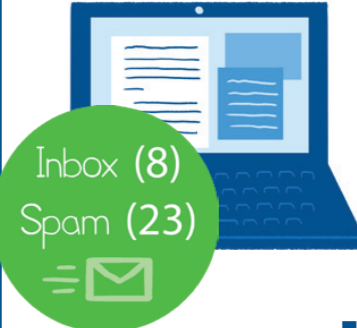
Longevity assessment

DEREK'S DAY

Algorithmic Forecasting in Everyday Life

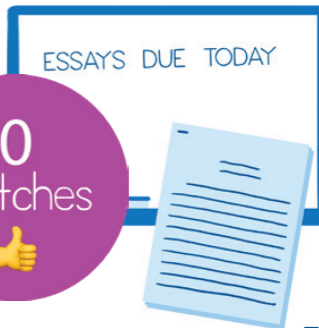


CHECK EMAIL



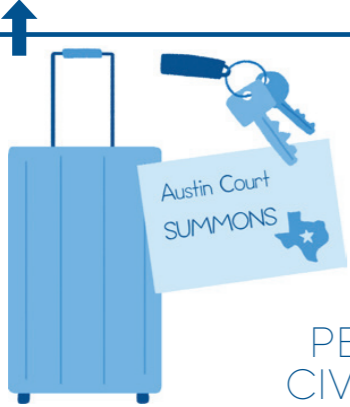
Inbox (8)
Spam (23)

GO TO CLASS



0 matches

FLY HOME



JURY DUTY

PERFORM CIVIC DUTY



REWARDS
* Buy 9, get 1 free *

GET COFFEE

You have a new message



ATTEND SEMINAR

Calories
950/2000



EAT LUNCH

Evening

Afternoon

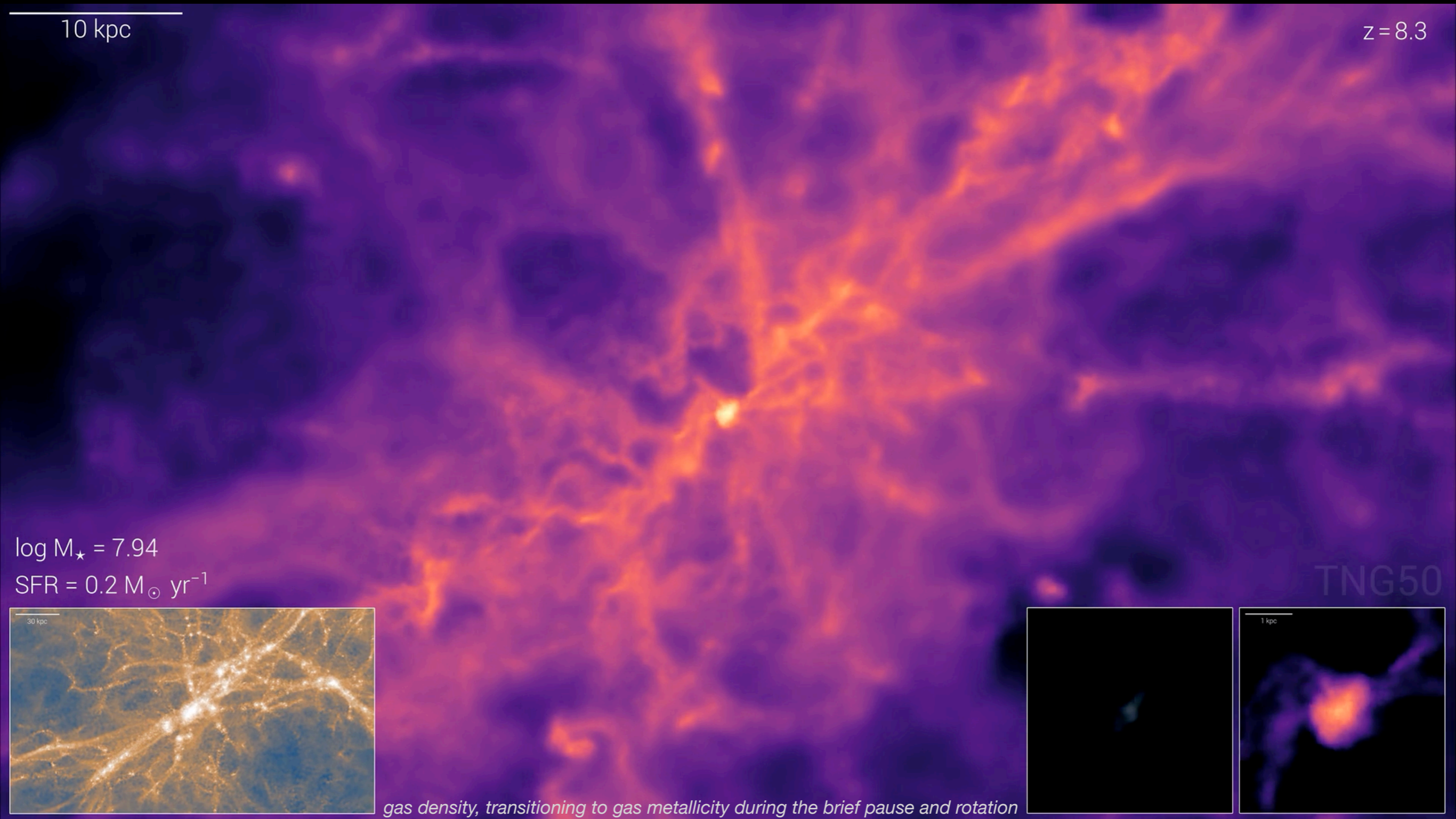
The IllustrisTNG Project

“The next generation of cosmological hydrodynamical simulations.”

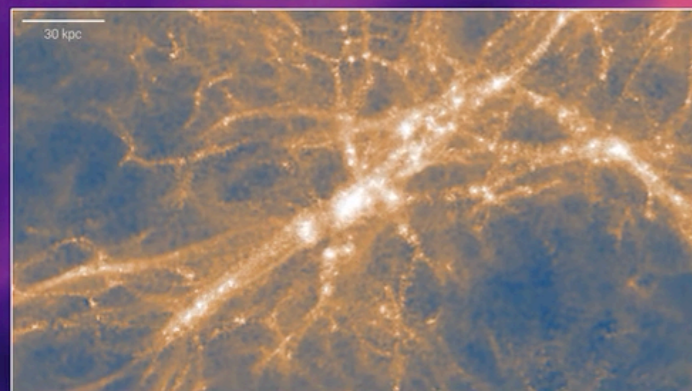
tng-project.org

10 kpc

$z = 8.3$

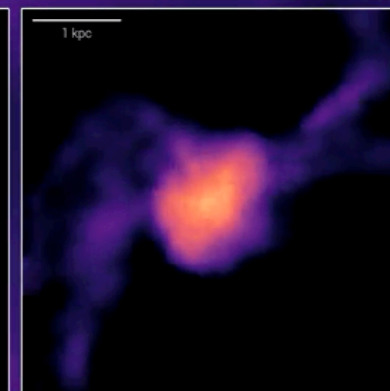


$\log M_{\star} = 7.94$
 $\text{SFR} = 0.2 M_{\odot} \text{ yr}^{-1}$



gas density, transitioning to gas metallicity during the brief pause and rotation

large-scale dark matter, then gas



small-scale stellar & gaseous distributions