PredictionX

Radcliffe Research Team 2020

London Vallery

Elliott Hyman

Simon Levien

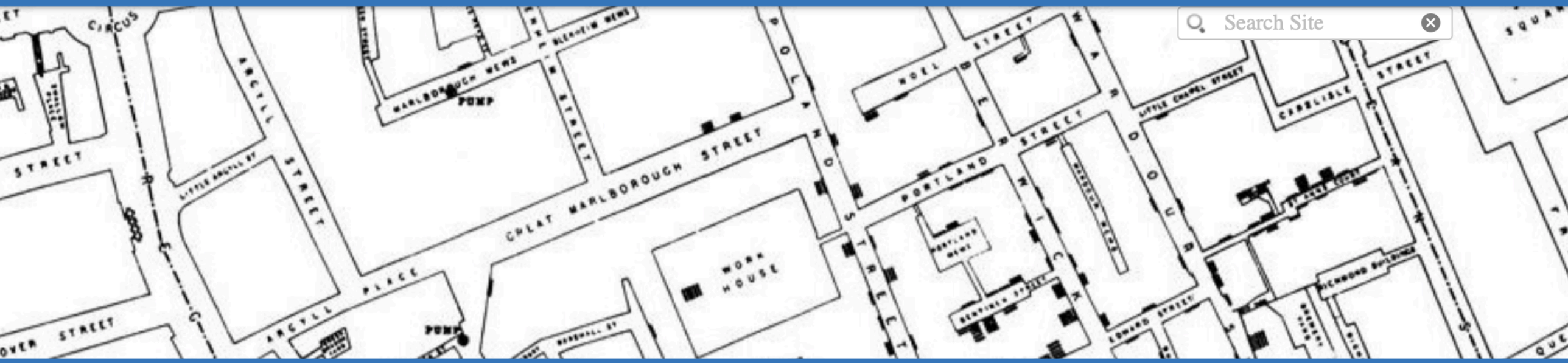
Alyssa Goodman

Immaculata De Vivo

The Prediction Project

The Past and Present of the Future

tinyurl.com/PredictionX-Preview



Prediction Essentials

Take a look at the essential elements of the course, including the framework for predictive systems.

→

Omens & Oracles

Gain insight into prediction as a human venture by studying the most ancient forms of prediction in Omens and Oracles.

→

Rise of Theory

Learn how humanity moved from mystical divination practices to genuine, scientific theories to explain natural phenomena.

→

Modern Prediction

Discover the cutting edge predictive methods and modeling from preeminent experts across many fields.

→

How it all fits together

PredictionX

PredictionX: The Past & Present of the Future

Essentials

Predictive Systems Framework

Phenomena →Predictions

Understanding Uncertainty

Study Design

Timelines

Why predict?

Omens, Oracles & Prophecies

Mesopotamian Haruspicy

Roman Augury

Chinese Oracle Bones

Oracle of Delphi

Aztec Rituals

Egyptian Priests

Tarot

The Diviner's Guide

Turkish Tasseography

Maya Spacetime

Yoruba Ifa

Casting Lots

Greek Astronomy

Astrology

Comets of Doom

cross-cultural conversations

The Rise of Theory

Ancient Mesopotamia, Egypt, Greece & Rome

Islamic Science

The Path to Newton

Indian Mathematics

European Renaissance

The Royal Society

Lost without Longitude (Navigation)

Help, I'm Lost!

Tools of the Navigator

Modern Prediction

John Snow & Cholera

Cholera Map

Health

- *Epidemiology*
- *Personal Genomics*
- *Population Genetics*

Wealth

- *Climate & Wealth*
- *Behavioral Economics*

The Future of the Future

- *AI, Derek's Day*
- *Philosophy*
- *Uncertainty*

Earth

- *Climate & Energy*
- *Climate Policy*
- *Tent Tarot*
- *Earthquakes*

Space

- *Futures of our Universe*
- *SETI*

Coming Soon | Interactive Resource | ▶ video(s) | available on edX | available on LabXchange

WGBH 2008

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PREDICTIONX

2014

HarvardX

edX

2015

HARVARD COLLEGE
Freshman Seminar Program

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The TIMELINE CONSORTIUM

2019

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2020

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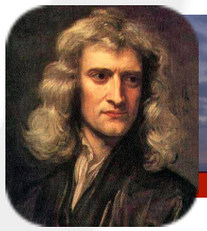

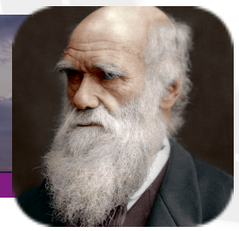

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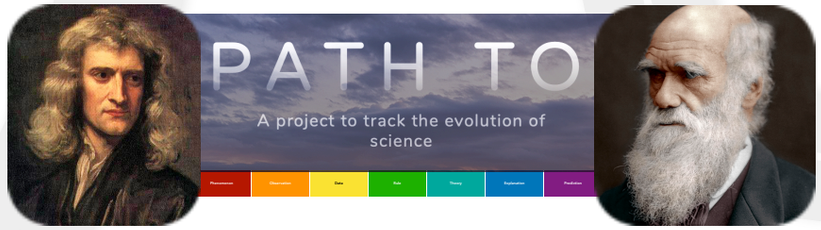

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The Past and Present of the Future

HOME ABOUT PREDICTION TOPICS COURSES COMMENTARY CREDITS

Commentary

Title
Uncertain Risks

Possible Tagline
We know how to express risk and uncertainty with numbers, but it's not always easy to take rational actions based on those numbers.

Text
"One shot." Any fan of the classic film, *The Deer Hunter,* will recognize that two-word phrase, and its double-meaning. *One shot* to kill a deer is humane, and *one shot* in the game of Russian Roulette is all that's needed to kill its player–or not. The odds of shooting a deer with a single shot while hunting depend on the skill of the hunter, the weather, the quality of the rifle, and more–and so are quite hard to estimate with great certainty. The odds of being shot in the head in a single round of Russian Roulette are, on the other hand, very easy to estimate--they are *exactly* 1 in 6. *One* bullet loaded into a *six*-chamber gun barrel that's then spun to a random stopping point and then fired by the player at their own head can be expected to blow a hole in the player's head *exactly* one in six times. This kind of certainty when assessing risk is extremely uncommon. Life is usually much more like hunting–with many factors influencing risk, so that estimating odds is hard, and uncertain.

Life is filled with decisions about risk in the face of uncertainty, so misunderstanding the words "risk" and "uncertainty" can be dangerous. These terms are commonly used In everyday life, where we talk about activities being "safe" or "risky", and we talk about being "sure" or "uncertain," but we don't usually attach specific numerical odds to such statements. Instead, psychologists like Dan Gilbert tell us, we humans typically group likelihood into three categories: it will happen; it won't happen; and it might happen. Percentages and numerical odds are relatively new constructs for the human race, so using the word "might" to capture everything between "will" and "won't" is understandable. But, in some cases, numbers can--and should--mitigate fear.

Our non-naturally-mathematical minds are not just bad at estimating and understanding nuanced risk: they also despise uncertainty. Evolution has left us survivors with a "fight or flight" response to fear and risk, so it can be difficult--even for those of us with plenty of mathematical training--to not let emotion overrule calculation.

What *does* it look like, though, to see risk and uncertainty through a mathematical lens, unclouded by emotion? Let's consider the answer to that question using a morbid but fully unambiguous example: the risk of death.

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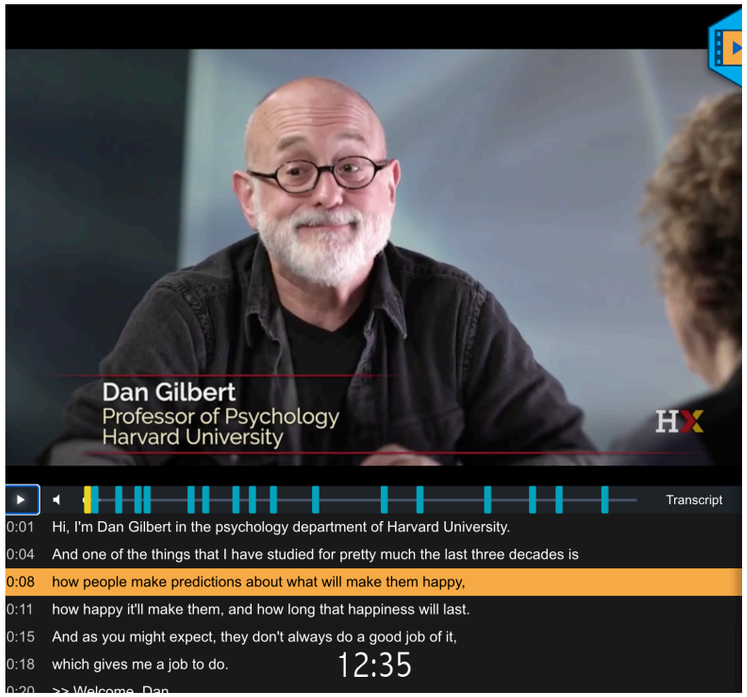

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Thoughts, Resources, Course, Seminar and Someday a Book

WELCOME PREDICTION TOPICS COURSES TALKS COMMENTARY CREDITS

Essays

PREDICTIONX
- Essentials: Ways to Frame Discussions about Prediction
- Omens & Oracles
- Rise of Theory
- Modern Predictive Systems
- Sneak Preview: Video Interviews with Experts
  - Agustin Rayo (philosophy)
  - Avi Loeb (astronomy)
  - Ben Shneiderman (artificial intelligence)
  - Brendan Meade (earthquakes) and Susan Murphy (computer science)
  - Daniel Gilbert (psychology

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Daniel Gilbert (psychology and prediction)

Daniel Gilbert is a Professor of Psychology at Harvard University. In this conversation with Professor Goodman, he discusses the ways in which people understand -- or fail to understand -- prediction in their daily lives.

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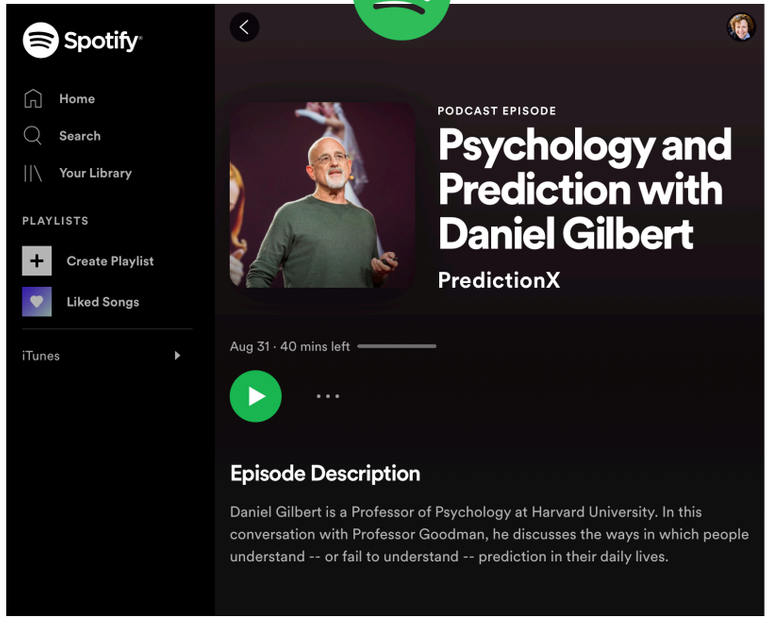
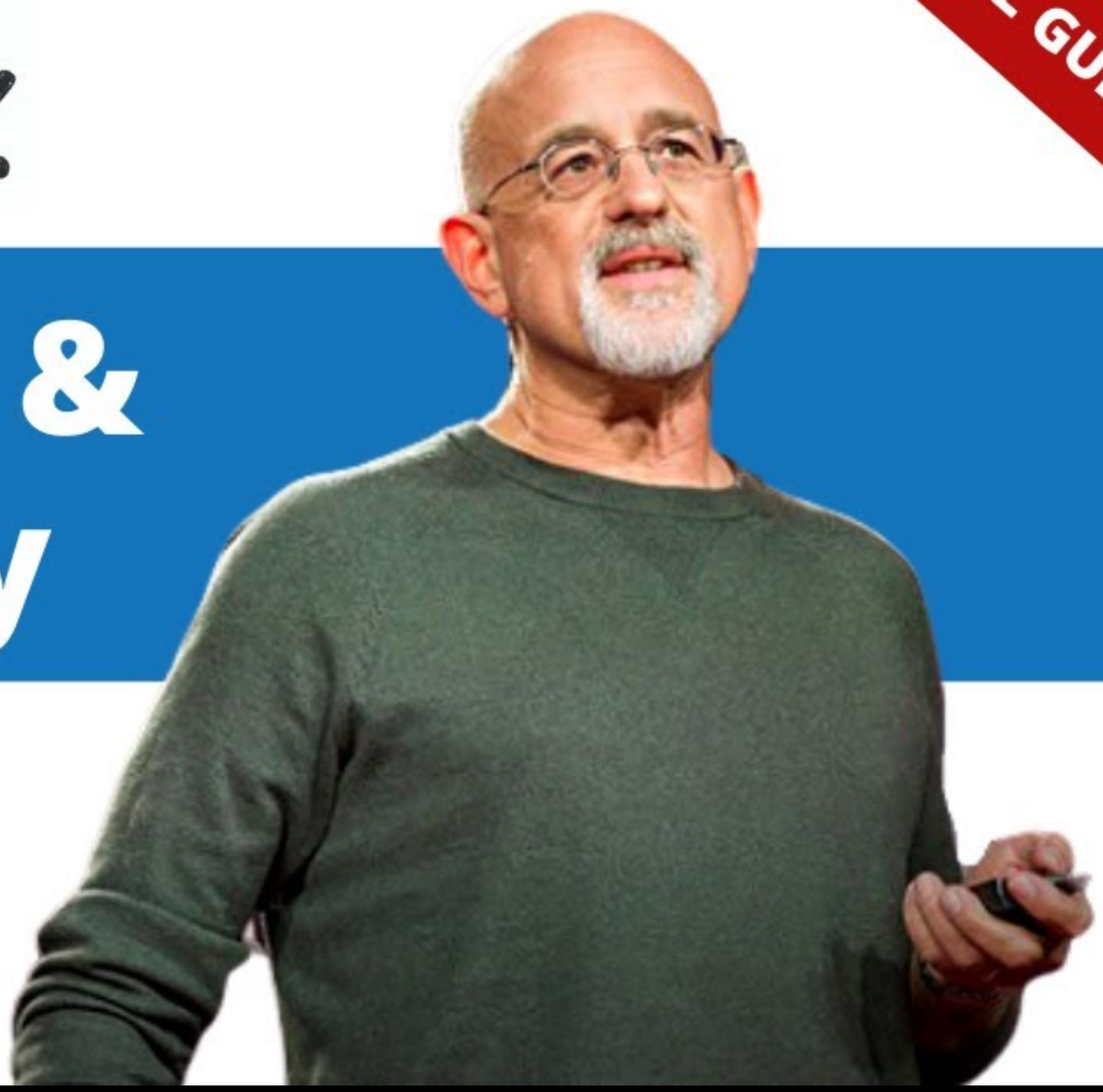


PREDICTIONX

SPECIAL GUEST

Prediction & Psychology

with Daniel Gilbert



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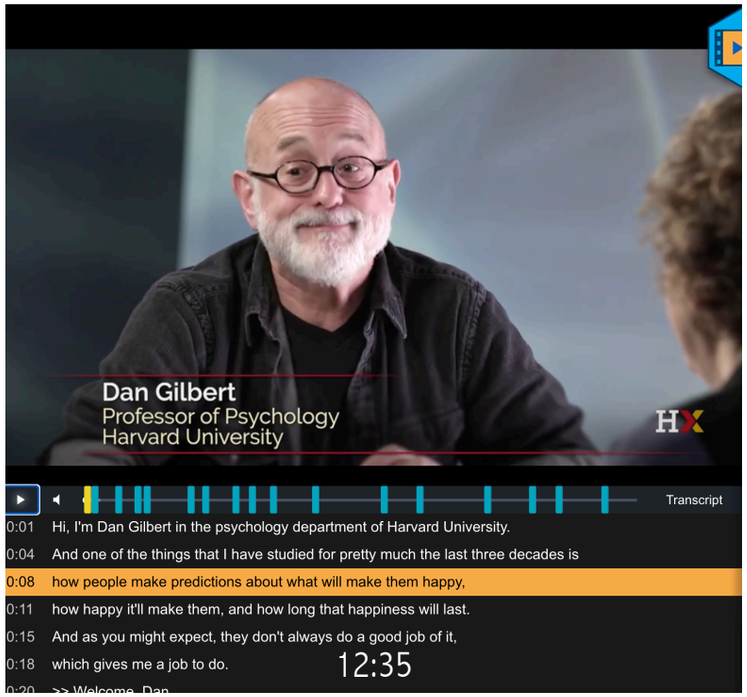

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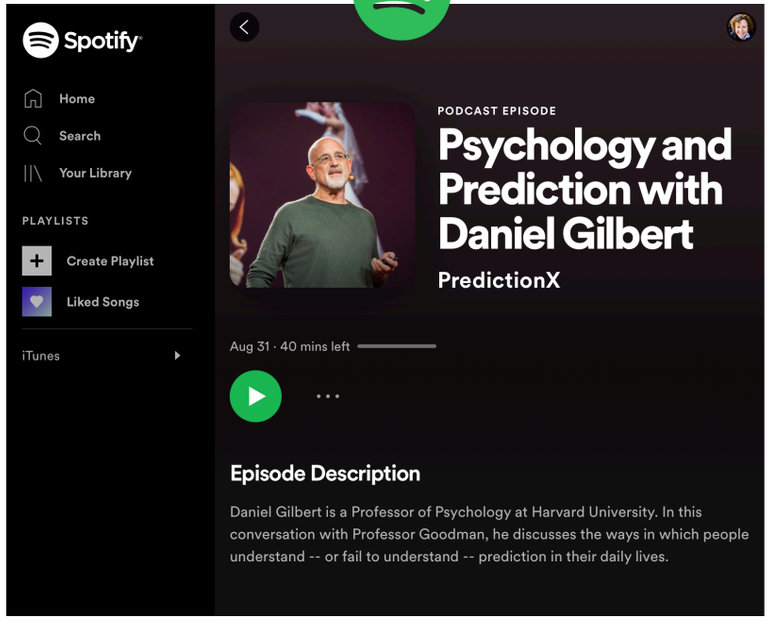

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2020

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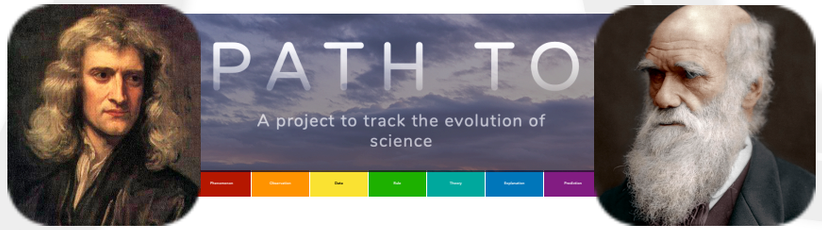

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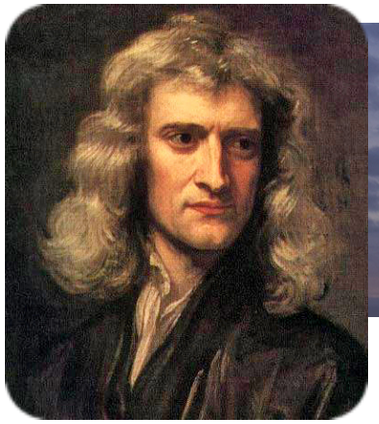
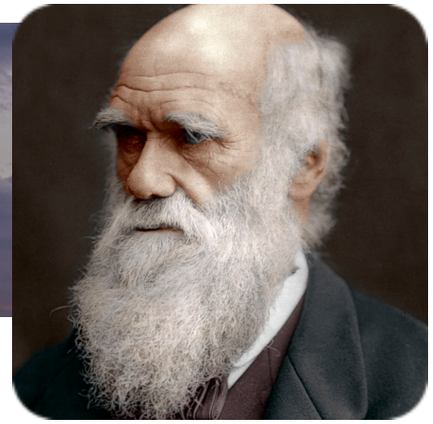


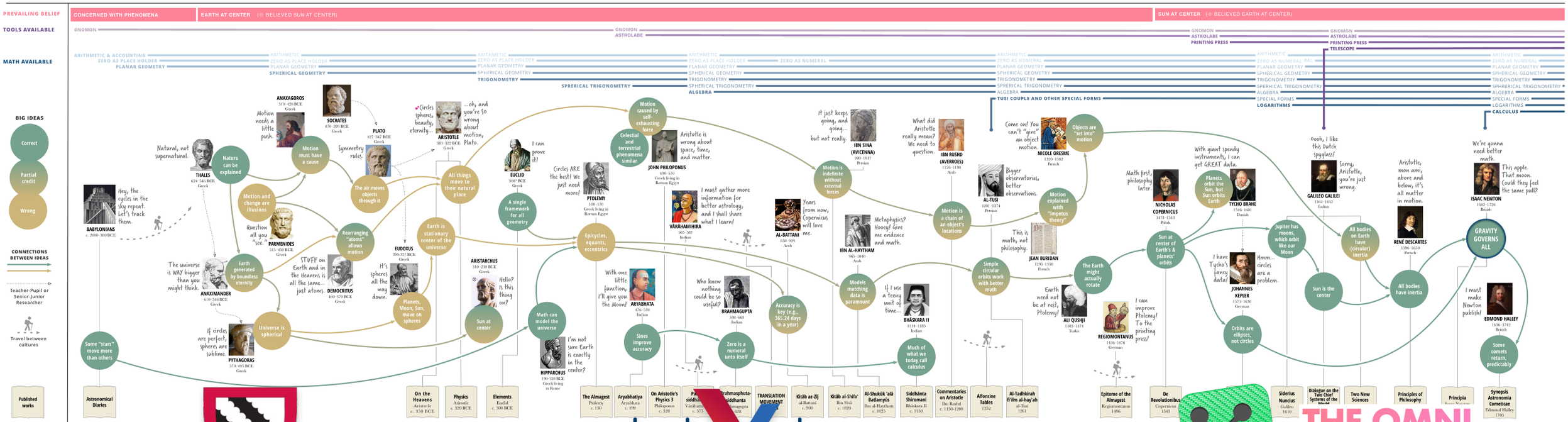
PATH TO

A project to track the evolution of science



The Path to Newton

PredictionX



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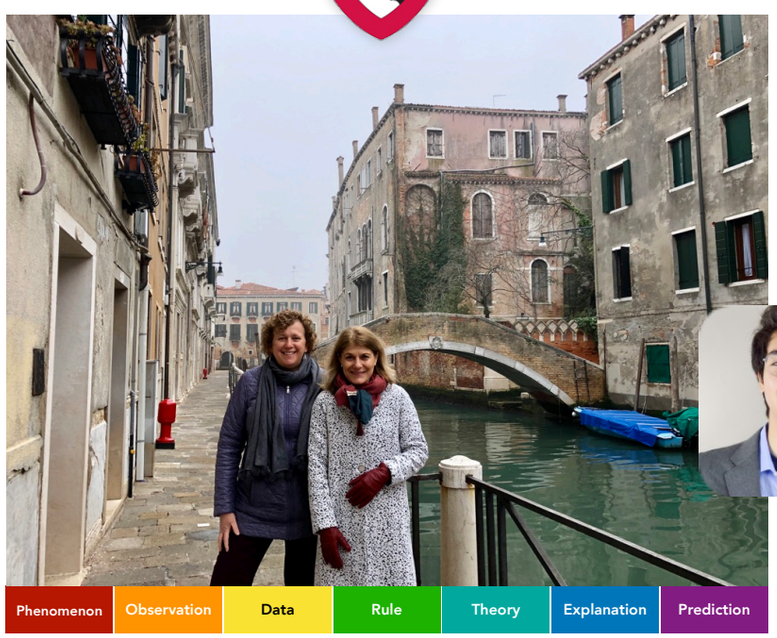
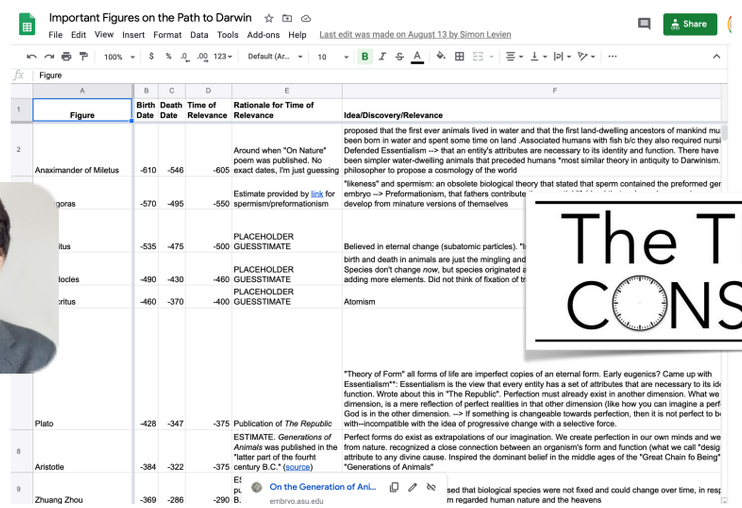
THE OMNI SHOW





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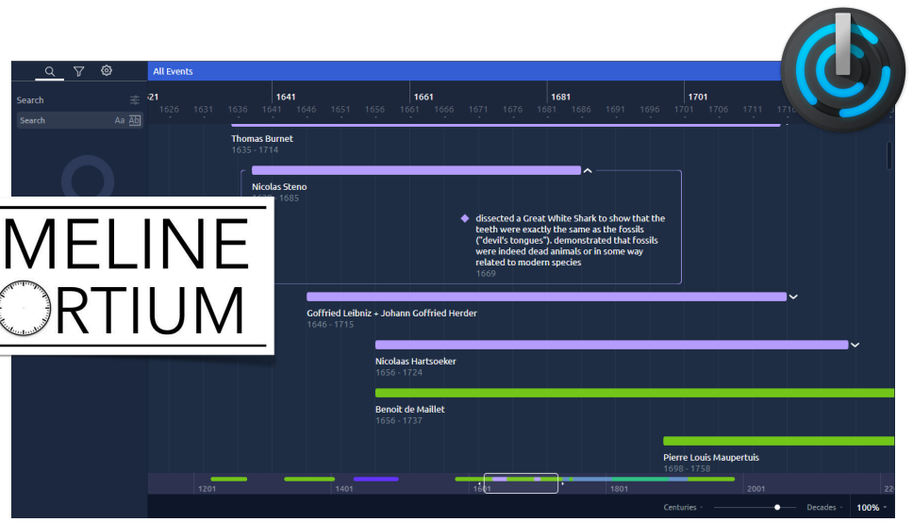

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PREDICTIONX

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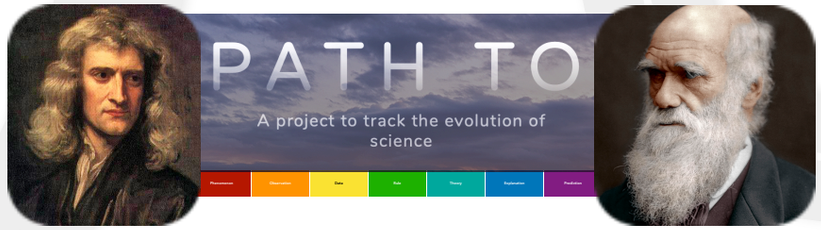

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WIX

Contagion (2017)

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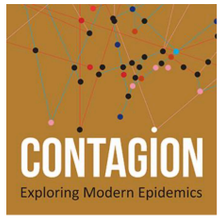
EVENTS

Conferences & Symposia

Contagion: Exploring Modern Epidemics

Radcliffe Institute Science Symposium



Epidemic disease spreads quickly in our interconnected, globalized world. This symposium looks at new ways of tracking epidemics using big data and social networks to predict and stem the rise of emergent diseases.

Epidemiologists, journalists, physicians, public officials, scientists, and sociologists will discuss their cutting-edge research, prediction mechanisms, and possible solutions to the range of epidemics that face our world today—from Ebola and SARS to the more recently recognized social epidemics of the opioid crisis and gun violence.

The symposium will conclude with a talk by Laurie Garrett, a Pulitzer Prize–winning journalist who specializes in global public health and foreign policy.

Free and open to the public.

#radsciepidemics

This event took place on October 27, 2017.

VIDEO

Contagion | 1 of 5 | Infectious Disease ›

Contagion | 2 of 5 | Kevin M. Esvelt ›

Coming Soon

Radcliffe Science Symposia

on

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Making the Cut (2019)

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Conferences & Symposia

Making the Cut: Promises and Challenges of Gene Editing

Gene editing, a technology that enables scientists to change an organism's DNA, holds promise for the prevention and cure of such complex human diseases as cancer, heart disease, and sickle cell anemia.

The techniques used, including CRISPR, have generated a great deal of excitement for their efficiency and potential impact on human health, but they have also raised legal and ethical issues regarding germline and embryo manipulation, and many countries have banned such techniques due to these concerns.

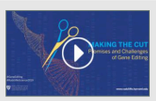
The 2019 Radcliffe Institute science symposium will bring together leading international scientists, clinicians, and ethicists to explore case studies of particular gene therapies as well as the legal and bioethical implications of this research.

Free and open to the public.

#GeneEditing
#RadcliffeScience2019

This event took place on October 25, 2019.

VIDEO



Making the Cut | Session 1: Science and Society ›

Making the Cut | Session 2: Cardiovascular Disease and Sickle Cell Anemia ›

The Undiscovered (2018)

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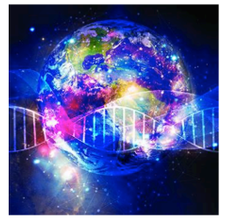


Many great discoveries in science are surprises.

To paraphrase Louis Pasteur, sometimes luck favors the prepared mind, as when Alexander Fleming discovered penicillin by noticing that mold growing accidentally in his lab seemed to kill bacteria. At other times, new instruments offer unanticipated revelations: until Galileo looked at Jupiter with his telescope, he didn't know it had moons or their importance to our understanding of the solar system. And, occasionally, methodical experiments find exactly the opposite of what they sought to prove. Scientists intending to measure the deceleration of the Universe's expansion, for example, found acceleration instead.

The 2018 Radcliffe Institute science symposium will focus on how scientists explore realities they cannot anticipate. Speakers from across the disciplines of modern science will present personal experiences and discuss how to train scientists, educators, and funders to foster the expertise and open-mindedness needed to reveal undiscovered aspects of the world around us.

Free and open to the public.

#theundiscovered

This event took place on October 26, 2018.

VIDEO

The Undiscovered | 1 of 5 | Stuart Firestein ›

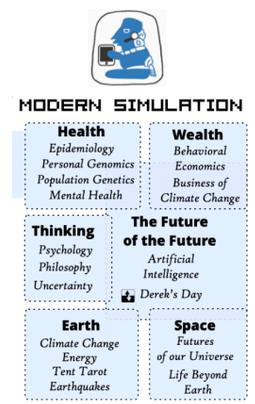
The Undiscovered | 2 of 5 | LIFE ›

The Future of the Future (2020/21)

April 30, 2021 Radcliffe Science Symposium
"The Future of the Future"
(shared planning document)

Draft blurb

Throughout time, humans have yearned to know what's next—to know their futures. Today, we have predictive systems our ancient ancestors dreamed about. Thanks to dramatic increases in science technology, we can foretell the coming weather, with remarkably little uncertainty, days in advance, and we can land spacecraft on the same speeding comets that our predecessors feared as harbingers of doom. But—what's next? What are the limits of computational systems for prediction? How much of the future is knowable? How do we assign interpretable uncertainty to our predictions? How much artificial intelligence is safe? How much do we want to know? These questions vex experts across fields ranging from climate science to space exploration to financial forecasting to epidemiology and health. At *The Future of the Future*, we will learn about modern predictive systems from their expert practitioners, and discuss what kinds of future may lie ahead.



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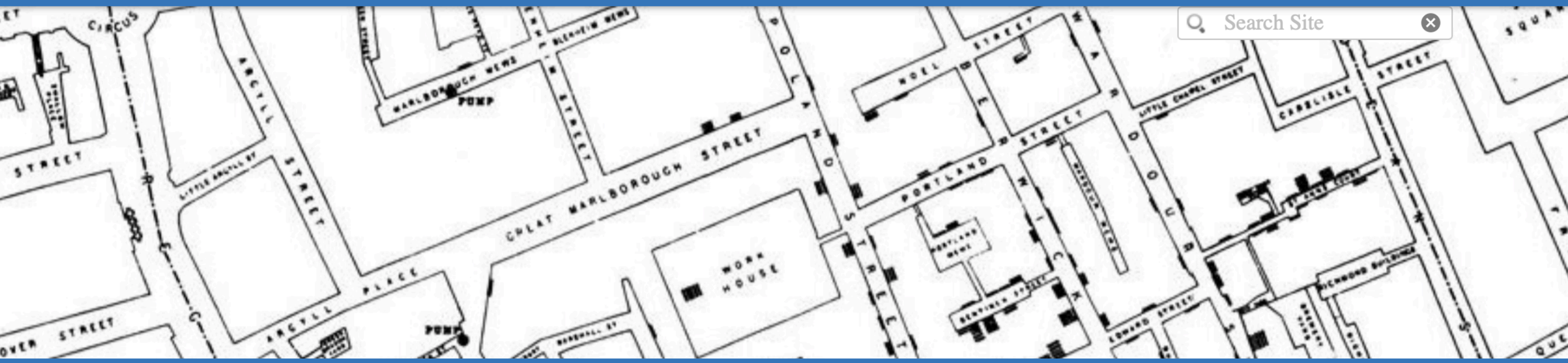

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Rise of Theory

Learn how humanity moved from mystical divination practices to genuine, scientific theories to explain natural phenomena.

→

Modern Prediction

Discover the cutting edge predictive methods and modeling from preeminent experts across many fields.

→

How it all fits together

Jody Blackwell
Assistant to Dr. Goodman

It was so much fun to work with our amazingly creative student collaborators Elliott Hyman and London Vallery on the Prediction Project this summer, and it was a gratifying process to watch the new content on our digital channels gradually come alive through the group's inspiration and effort.

Coming from a humanities/history background, I especially love the interdisciplinary community that Alyssa has brought together to explore the mesmerizing history of prediction and divination, and I think the videos and interviews will be fascinating to everyone who sees them, whether you're a scientist, a politician, or a poet.

I'll be excited to see the Prediction Project reach a wider global audience through all of the enhanced digital content this year, and no better time than now, when the need for a universal understanding of prediction science has become so critical in 2020. Thanks to our whole team for a really fun and meaningful experience.

Extra Slides

Some to be added to PredictionX.ORG SITE

SUMMER 2020 RADCLIFFE RESEARCH TEAM OPPORTUNITIES

The Radcliffe Research Team (RRT) program supports small group research projects led by Harvard faculty members affiliated with the Radcliffe Institute for Advanced Study during the summer of 2020. Each research team of two to four undergraduate students will contribute to a unique research project (project descriptions listed below). Undergraduate students hired as members of a research team will be paid a rate of $15/hour and can work up to 120 hours for the duration of their summer project.

APPLY NOW

HOW TO APPLY

> Frequently Asked Questions

Alyssa A. Goodman & Immaculata De Vivo
June–July
The Prediction Project & The Path to Darwin
History of Science/Philosophy/Psychology/Biology/Physics/Astronomy/Anthropology/Economics/Computer Science/Statistics
The Prediction Project creates, collects, and curates materials documenting and analyzing how humans have predicted their futures over time. The materials are presented online at the website **PredictionX.org**, which points to the many avenues where the content is already used: a set of modular “courses” on edX; a Freshman Seminar (FS17J) at Harvard; and GenEd 1112 at Harvard. In the future, the project will expand to include a book, museum exhibits, and potentially a documentary series. Professor Alyssa Goodman is the leader of the project, which now includes the work of, and interviews with, 30 other faculty from across Harvard's schools and Departments.
A key element of the Prediction Project is “The Path to Newton” (online at **path-to.org**), which features a linked textual and graphical online description of the history of ideas that led to Isaac Newton's theory of gravity. The Path starts in Ancient Mesopotamia, and ends, ~4000 years later, in the Renaissance, passing through many world cultures along the way. The Path to Newton's success has inspired Professor Immaculata De Vivo to initiate the creation of an analogous "Path to Darwin."
As the Prediction Project is so expansive and many-faceted, we can offer many potential projects for interested undergraduates, including:

- helping to create the "Path to Darwin" (research, writing, graphic design)
- writing essays and summaries that capture linkages between aspects of multi-media content (e.g., interviews on climate change and behavioral economics); or between ideas (e.g., philosophy and psychology of prediction)
- helping to establish and implement educational “pathways” through PredictionX materials, using new online Harvard-based learning sites—in particular **LabXchange.org**
- incorporating materials from Radcliffe Symposia (e.g., video clips) into PredictionX
- adding background material to particular video interviews, primarily on modern forms of prediction (e.g., more on genetic prediction models, to support Professor Goodman's interview with Professors De Vivo and Kraft about genomics and cancer, and Professor Goodman's interview with Professor George Church)

The Prediction Project (described at **http://predictionx.org**) covers a wide range of topical areas and connects them in unusual ways. Working on this project will broaden students’ perspective, letting them see how, for example, the predictive practices of ancient peoples relate to how we think about genetics, space exploration, or climate change today. Since the project has so many topical foci, we can adjust student's particular work plans to their interests, tailoring projects to make both for individual students, and for the group. All student output will be incorporated into predictionx.org and the Path to Darwin.
Specialized Skills: One or more of: web design; writing; graphic design; javascript; statistics knowledge; facility with genetics software.

Questions & Tools

Questions to Ask in Evaluating Predictions

1. What information (input) is being used to make predictions? Are the inputs “objective” as in measurable by anyone, or “subjective” in that special skills are needed to “read” the information?
2. How “predictive” is a prediction? How is success measured? Are those measurements objective? Are results repeatable? Can we predict the present from the past, and thus the future from the present? (e.g. can we predict the current climate from models of past climate, and therefore rely on models’ output (predictions) about the future?
3. Who is making a particular prediction--is there bias?Is the predicting individual or system biased in some particular way? Are controls (e.g. in epidemiology) possible to assess predictions’ accuracy? Does a system reward a particular prediction/outcome? Does the output of a system depend on who is using the input? (e.g. does one priest see something different in sheep entrails than another?)
4. What is an appropriate level of skepticism? Given inputs to and testability of a predictive system, how much faith should one put in the likelihood that a prediction will come true? How can uncertainty be assessed, and expressed?
5. How do people respond to predictions?Once a predictive system becomes testable, and is deemed “reliable,” what societal changes take place? (e.g. what do people do when a hurricane is forecast?)

Tools to Rigorously Assess Predictions

1. Is the model from which the prediction has been developed based on theory, on empirical data, or both?
2. If based on theory, what theory (theories)?
3. Is the theory appropriate, relevant, plausible in this context?
4. Is the theory sufficiently comprehensive?
5. What data inputs are required to drive the model?
6. What degree of certainty is there about those inputs?
7. What is the level of uncertainty in the theory itself? Can that uncertainty be quantified?
8. Does the model “converge”?
9. Does the outcome appear plausible?
10. If you input actual past data, does the model accurately predict the present?

https://canvas.harvard.edu/courses/2426/pages/questions-and-tools