Prediction: Week 10

understanding & simulating wealth & humans

Logistics: Forum (thanks!), Evaluations, Overall Plan

Economics & Prediction

Breakout Room Showdown Rational Choice, Behavioral Economics, Regression, AI

Thursday

Thanks!

The Prediction Project

Past and Present of the Future

HOME ABOUT MATERIALS COURSES TALKS WRITINGS PRESS FORUM

Search the forum and more...

Mar 29

Comment

Following Post

14 views

0 comments

Categories

PredictionX Team

Space

Health

your

insert your

files with the

and

What

a URL

than in

posts.

ect" the text you want to link to

ppear. Please do use that

Thanks--the PredictionX team.

Survey on GenEd 1112 (so far)

Due Apr 6 at 10:25pm | 21 Questions

Modern Prediction (Plan)

Week	Topic	Date			Date	Assignments
8	Intro to Modern Simulations	3-18	Where does Uncertainty come from?	Weather & Climate: Special guest: Prof. M.Linz	3-23	Gina McCarthy, Dan Kammen, Rebecca Henderson (by 3/30)
9	Modeling	3-25	Meaning of "Models" (Climate Change)	AI/Data Science/ Derek's Day	3-30	Ben Shneiderman (by 4/1), plus one of: Megan Murray, George Church, Immaculata De Vivo + Peter Kraft
10	The Future of Wealth & Health	4-1	Special AI & Health Event "at" Radcliffe	Human Behavior, Decisions, Predictions, and $$	4-6	Dan Gilbert, David Laibson (by 4/6) ["game"assignment will be due 4/13]
11	The Future of the Universe	4-8	Resolution & Uncertainty, Games	Simulating the Universe	4-13	Jill Tarter, Avi Loeb (by 4/20)
12	Artificial Intelligence & Bayesian Thinking	4-20	The Search for Life	Hypothesis-Free Prediction (including Bayes)	4-22	Brendan Meade + Susan Murphy Ned Hall (optional) (by 4/20)
12a	The Future of the Future	4-27	Final Discussions + featured student videos		4-29	Stuart Firestein, Agustin Rayo (optional) (by 4/27)

Thursday—
Resolution & Uncertainty, Games

Simulation Games

Publish

Preview...

In class on April 8, we'll discuss Games and/or Curricula focused on teaching modern prediction concepts to 10-year olds. Reference material is available at a Canvas Page called "Modern Predictions & AI, which includes links to three Google Docs one each on Weather , Genomics/Personal Health , and Mobile Health .

We asked you in class to think about strategies for teaching Weather, Genomics/Personal Health, and Mobile Health predictions to kids by considering the following questions:

- What do you want students to learn?
- What do you think they already know?
- Can you think of a way to make a good learning game out of this topic?
- What questions do you have to answer for yourself to finish this curriculum/game?

This assignment asks you to expand on the discussions started in-class, as follows:

1. Choose one, or more, of the three topic areas covered in the Weather , Genomics/Personal Health , and Mobile Health Google Docs. (A curriculum you propose can include >1 topical area, but it does not have to.)
2. Read the Google Docs material you & your peers already created.
3. **Sketch out, in outline and/or graphical form:**
    1. which ideas you think would be most important to convey to 10-year-olds
    2. the relative importance of those ideas; and
    3. how you suggest conveying those ideas (game, reading material, interactive

City Building Games—Expertise & Tech

To complete the survey, go to pollev.com/prediction

0 done

1 underway

SimCity 2000

I'm an expert

Played a little

Not me!

I have Steam on my computer, and can play City Skylines

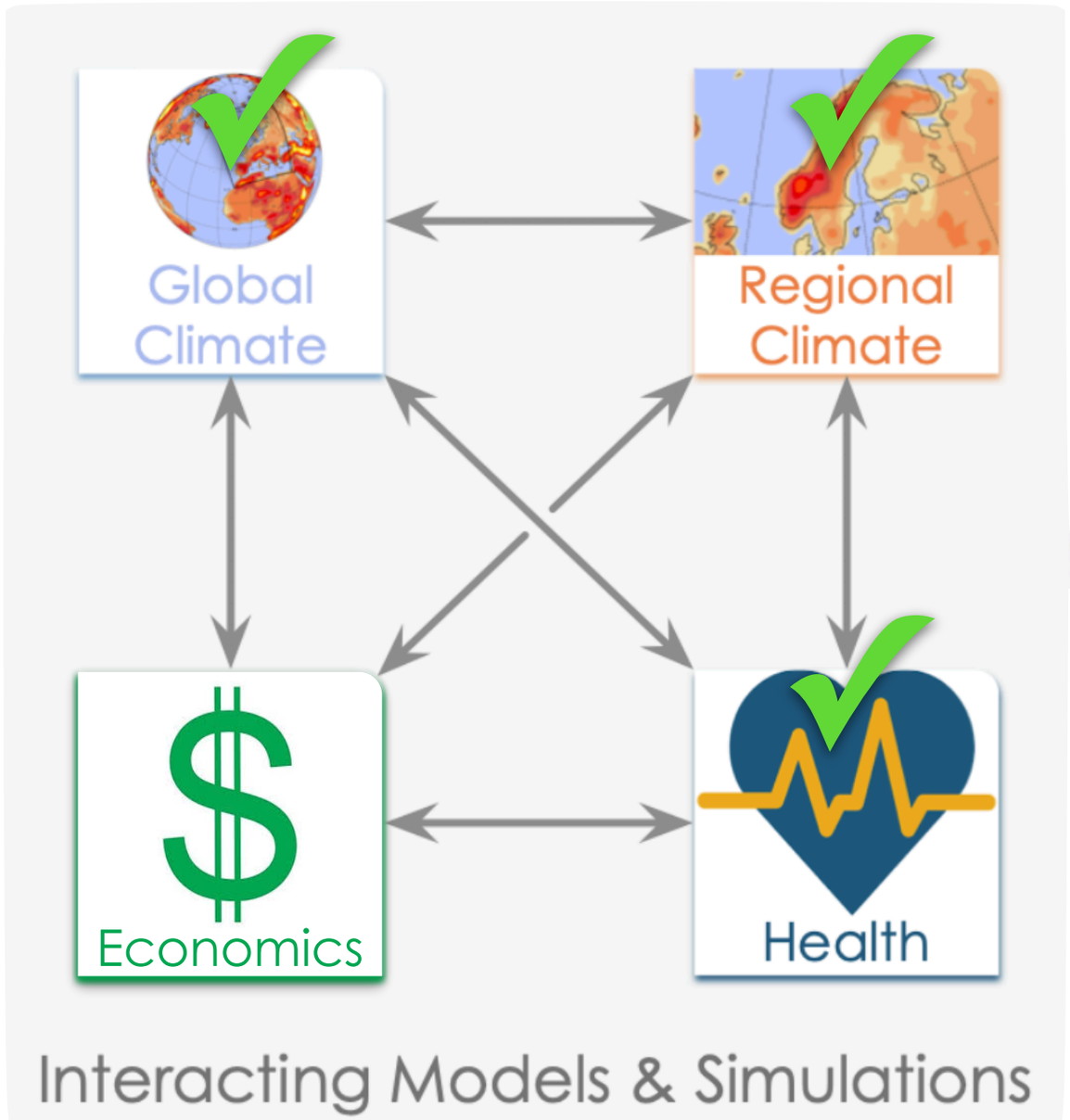
Yes

No

Where are we? We need money.

PRESENT

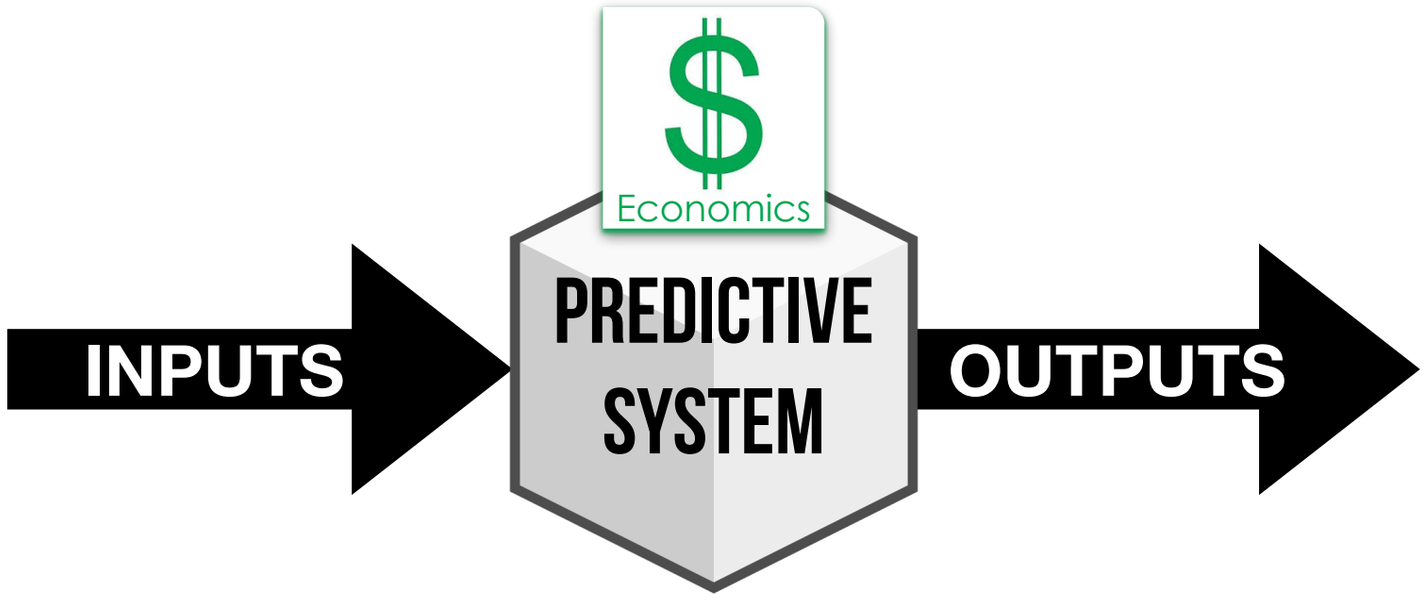
- Temperature
- Pressure
- Chemical Abundances
- Opacity
- Ice Depth, Coverage
- Economic Indicators
- Political System Features
- Social Indicators
- …



FUTURE

- Temperature
- Pressure
- Chemical Abundances
- Opacity
- Ice Depth, Coverage
- Economic Indicators
- Political System Features
- Social Indicators
- …

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



“HUMAN”

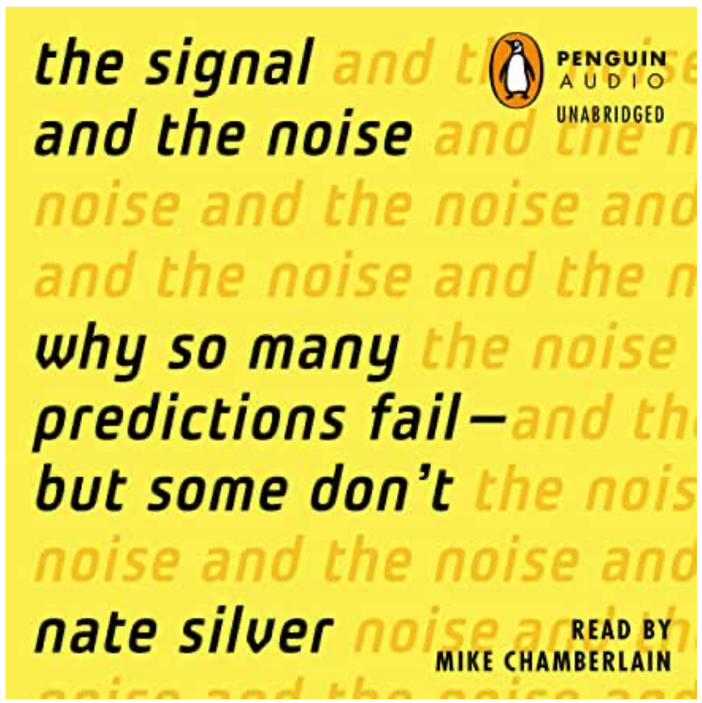
STATISTICAL

SIMULATION

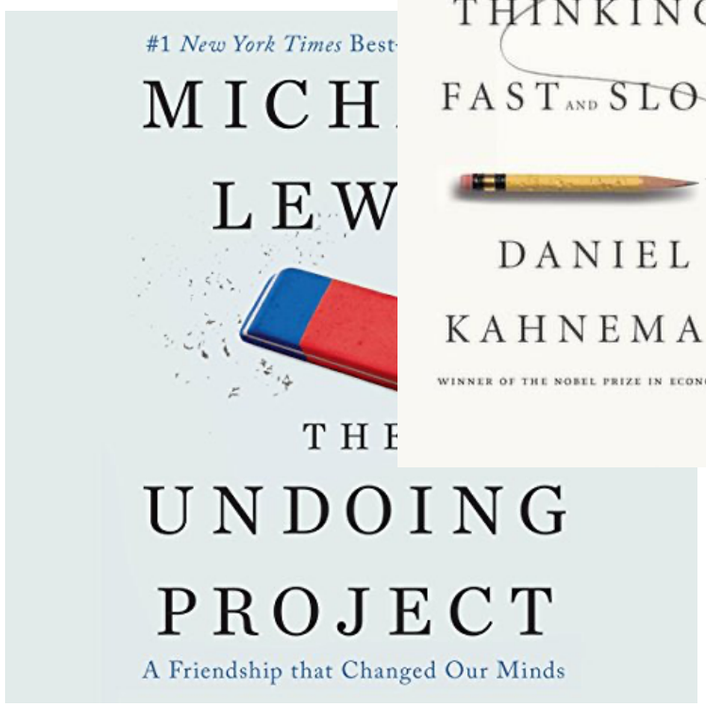
COMBINATIONS

om/mental-models/, https://www.bbc.com/news/av/health-30996506/3d-printed-heart-helps-to-save-girl-s-life

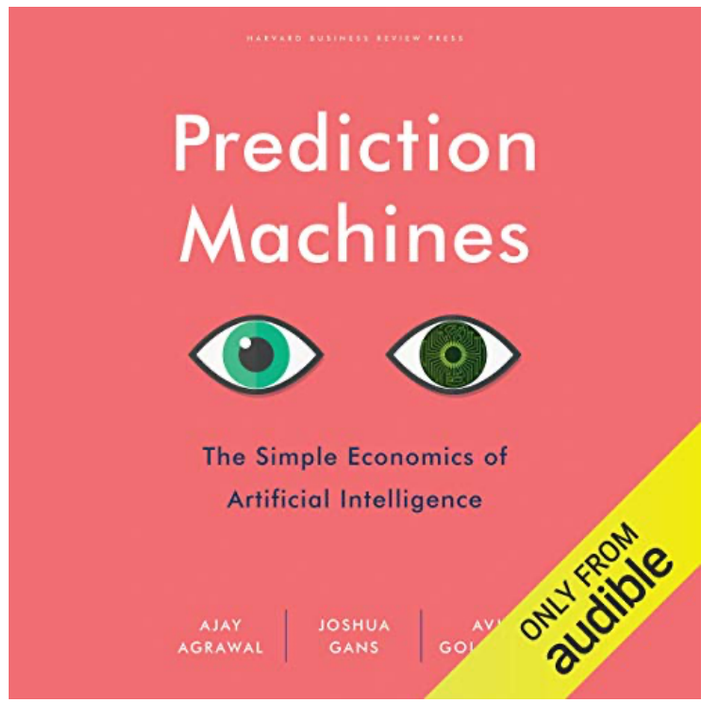
Highly recommended books on



(your textbook)



Behavioral Economics



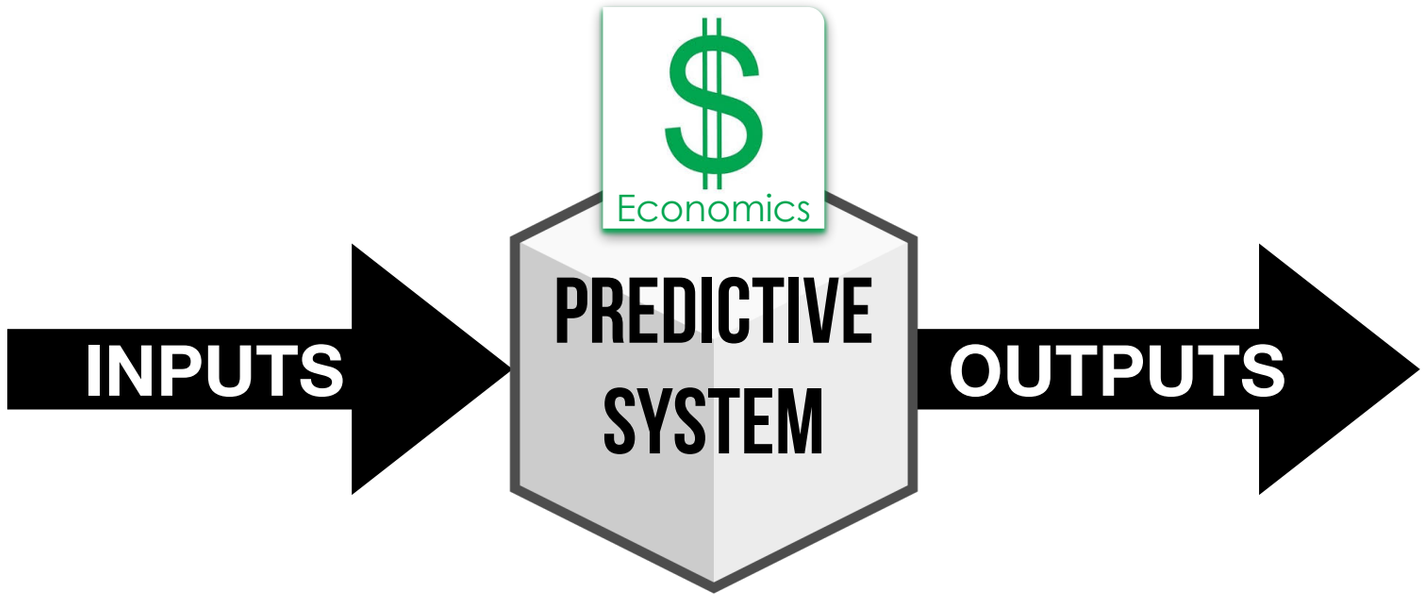
AI & Economics

pollev.com/Prediction

How much do you know about Economics?

It's my major	**A**
Ec10	**B**
Next to nothing...	**C**

Today's goal: How does prediction work in the world of wealth, today?



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Economics as a Predictive "Science"

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

"Classical Economics"

Rational Choice Theory

Prisoner's Dilemma

Cooperation Games

Behavioral Economics [Laibson]

SimCity
(Cities Skylines)

Economics in Everyday Life

(when, during the day, are you affected directly by predictions related to economics?)

Economics in Business

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

Economics in Government

How can rules lead to better economic futures?
For whom?

And what about AI?

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

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[Laibson (at home)]

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PREDICTIVE SYSTEMS

Classical Economics

"HUMAN"	
STATISTICAL	*mostly regression*
SIMULATION	*economic theory*
COMBINATIONS	

Regression

"HUMAN"	
STATISTICAL	*"semantic" variables*
SIMULATION	
COMBINATIONS	

Behavioral Economics

"HUMAN"	*behavioral inputs key*
STATISTICAL	*regression or AI*
SIMULATION	*behavioral inputs key*
COMBINATIONS	*almost always*

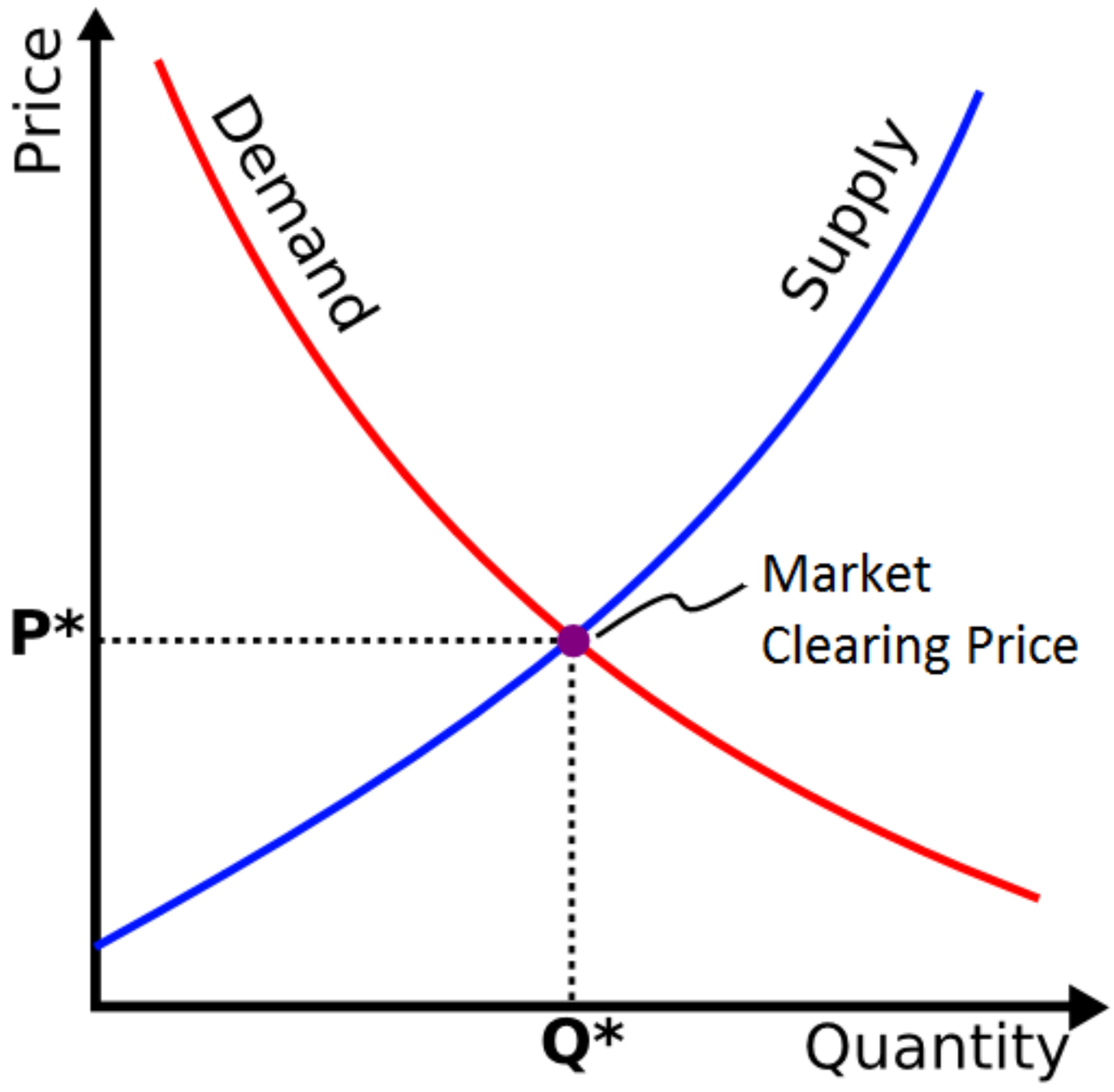
Artificial Intelligence

"HUMAN"	
STATISTICAL	*not-necessarily semantic "features"*
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"

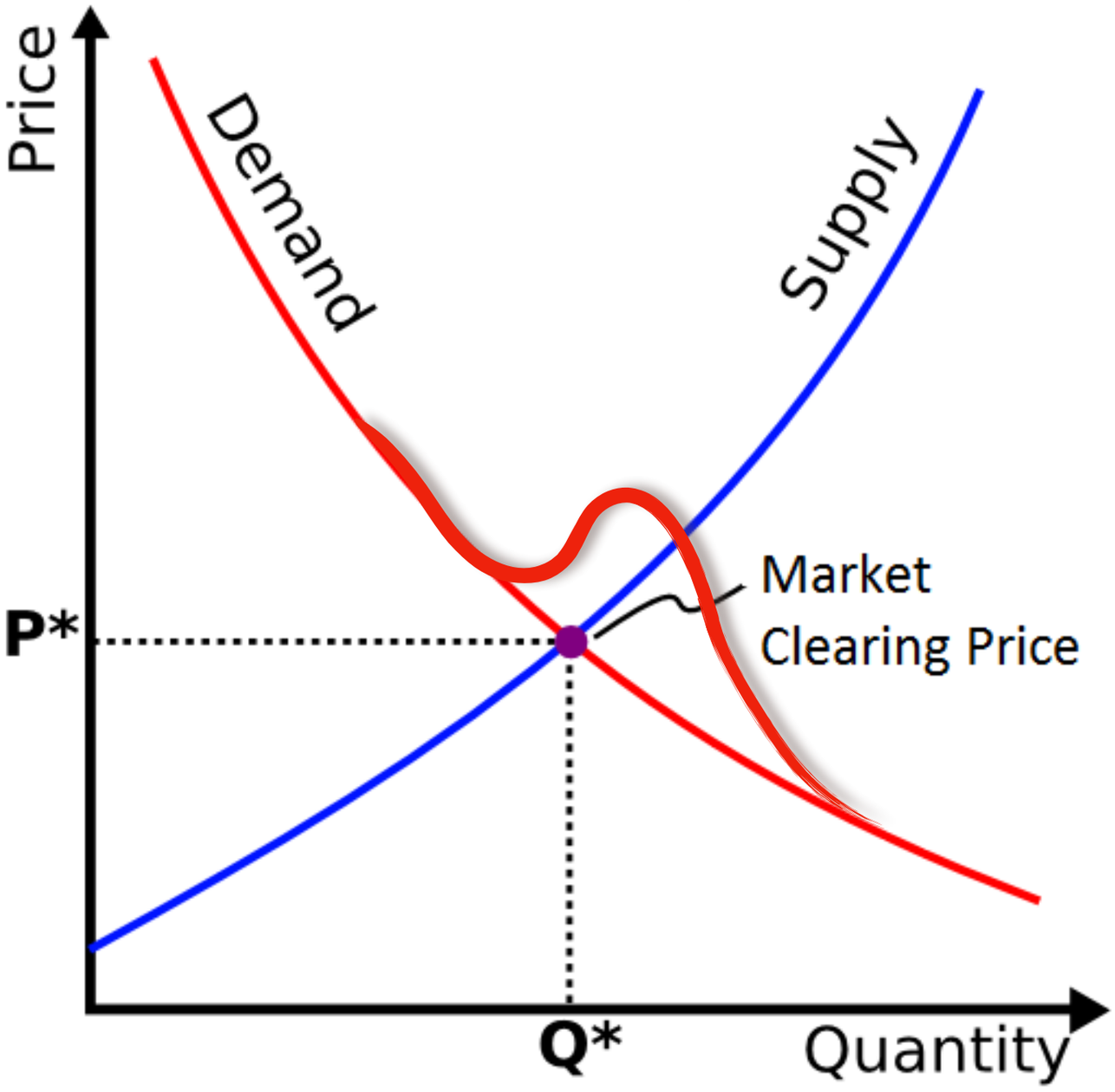


popularized by Adam Smith, 1776

ADAM SMITH: THE FATHER OF ECONOMICS

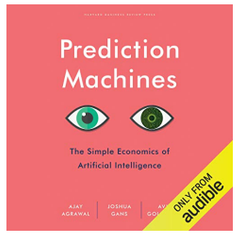
The "Law" of Supply and Demand

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



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)*

Margot Robbie explains in “The Big Short”

And then…

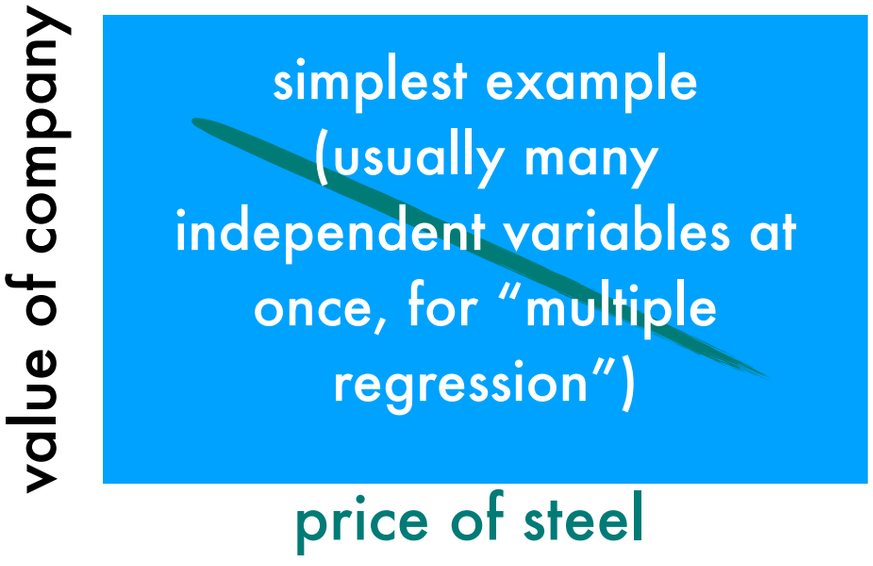
Selena Gomez & Richard Thaler explain in “The Big Short”

Regression

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)

…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

BREAKOUT ROOMS

tinyurl.com/GenEd1112-Money-Humans

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COMBINATIONS	

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The IllustrisTNG Project

"The next generation of cosmological hydrodynamical simulations."

tng-project.org

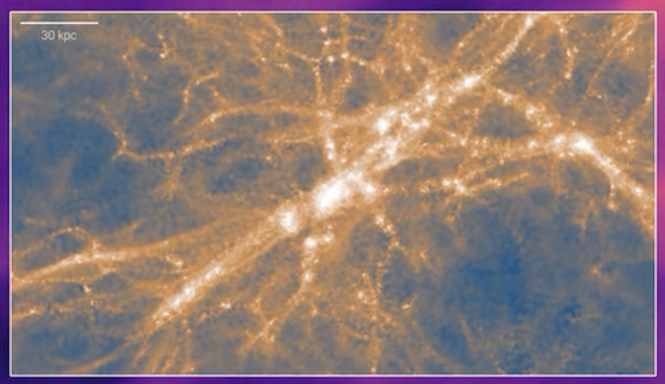
10 kpc

z = 8.3

log $M_\star$ = 7.94

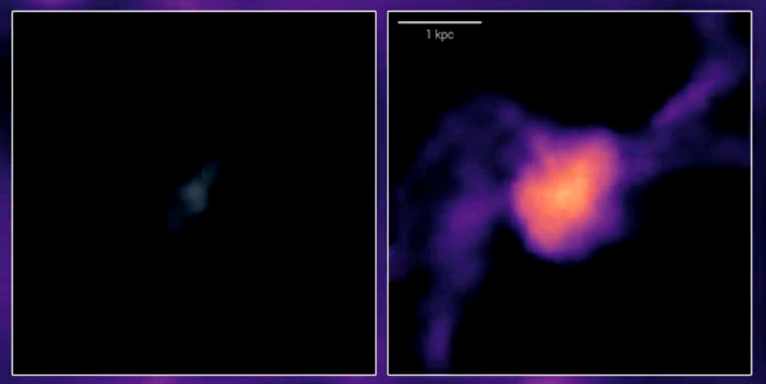
SFR = 0.2 $M_\odot$ yr^{-1}

TNG50



large-scale dark matter, then gas

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



small-scale stellar & gaseous distributions

Prediction: Week 10 (part 2)

understanding & simulating wealth & humans

Logistics: Forum (thanks!), Evaluations, Overall Plan

Economics & Prediction

Breakout Room Showdown Rational Choice, Behavioral Economics, Regression, AI

Today

RESOLUTION

The Plan

1. Play/Demo (notice how resolution and algorithms matter)
2. Breakout Discussions

   What would YOU would like to TEACH using a game designed for 10-and-up? Discuss your ideas within your group. Be sure to take (your own) notes, as fleshing out your game design idea will become your assignment for 4/13.

Your interests

Specific Topic	Student 1 (Lastname, Firstname)	Student 2 (Lastname, Firstname)
personal genomics kits	Alarifi,Julie	
Nor'easters	Avallone, Aurora	
movie popularity	Axelsen, Emily	Foulkes, Will
football team rankings	Bowlby, Henry	
water supplies	Duarte Moreira, Pedro	
traffic forecasting	Elliott, Eric	
baseball player ratings (moneyball)	Furey, Chase	Lee, Jordan
Asset Pricing	Gaurang Goel	
war/battle outcomes	Gordan, Andrew	
March Madness (basketball)	Jordan, Luke	Foley, Ben
online dating	Khurana, Neil	Kuchibhotla, Sravya
mental health	Li, Vincent	
music popularity (e.g. of a specific artist/genre)	Marshall, Lauren	
election outcomes	Minsky-Primus, Zev	
jury decision outcomes	Schimelpfenig, Elijah	
online poker	Son, Daniel	
auction pricing	Uberti, Gavin	
galaxy collisions	Vazquez, Oswaldo	
horse racing	Williams, Cici	
earthquakes	Wilson, Jaida	
language modeling (predictive text)	Yang, Tristan	
Ebola in Africa	Yeboah-Kodie, Grace	
human height	Zhou, Jaron	

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.

PREDICTIONX

Favorites
0

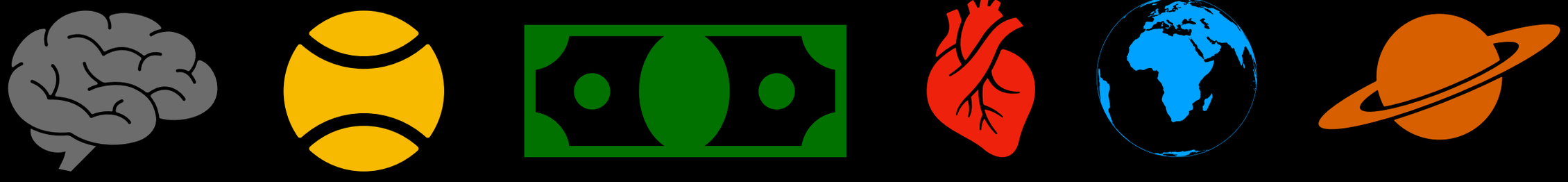
Subject
Biological Sciences
+5

Language
English

Background Knowledge
None

License
LabXchange Standard License

Which *can* we simulate?

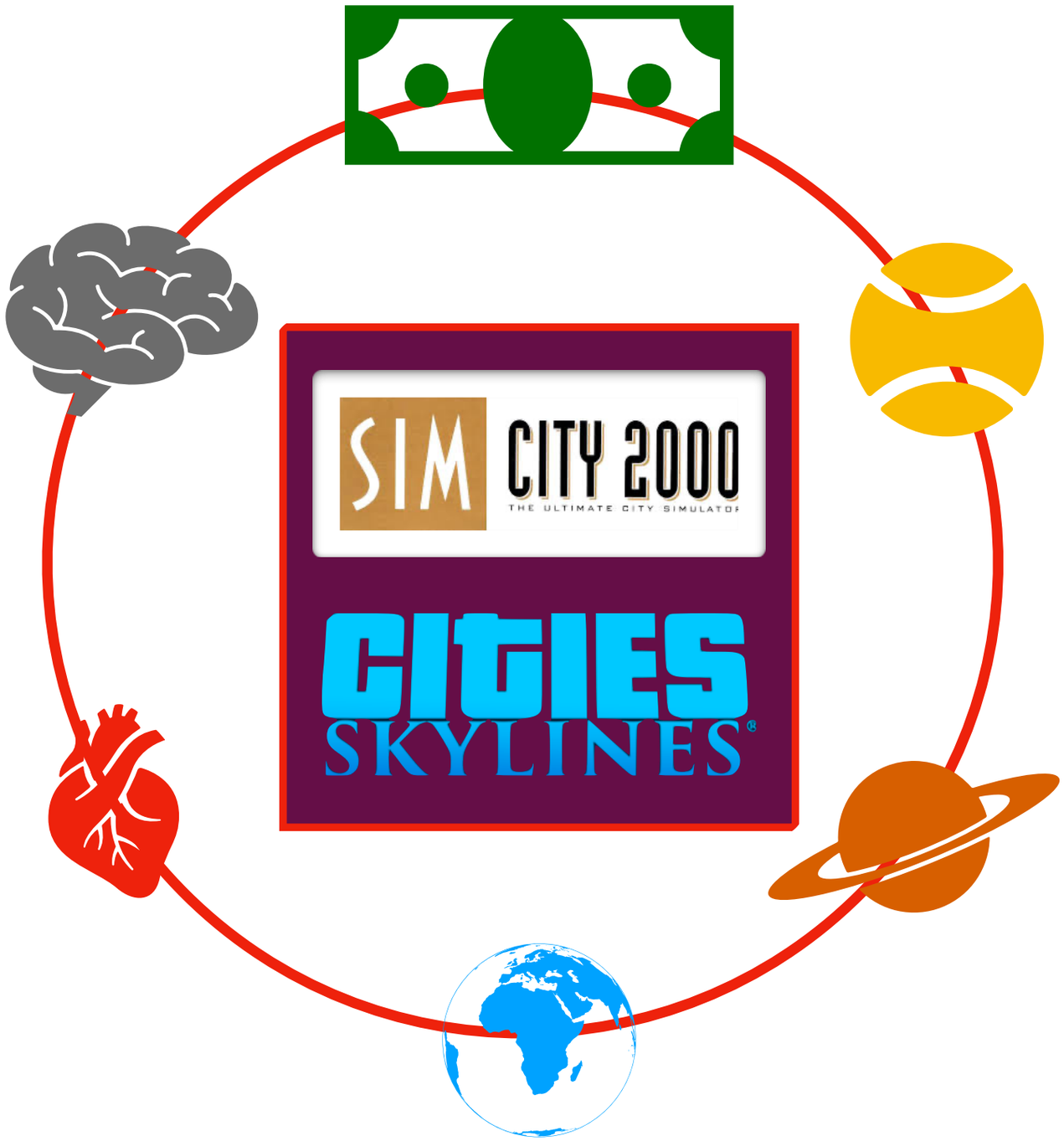


With… Rules? Theory? Data?

20th century

21st century?

Which *can* we simulate?



Considering…

Prediction X: Modern Simulations—THEMES/TAGS used on LabXchange

#simulation_or_model
#theoretical_empirical (c.f. Rainbow diagram)
#framework_model_inputs
#framework_testing
#biases
#uncertainty (c.f. document, puck simulation (link), Take a Sweater)
#approximation (c.f. Ten questions) #Heuristic
#public_reaction
#predictability
(predictability, determinism, randomness and uncertainty--use sand on shuffleboard analogy, includes #convergence, #divergence, #feedback #chaos)
#unknown_unknowns
#bayes_theorem
#deterministic_vs_probabilistic (probabilistic vs. deterministic prediction…when is uncertainty small enough to call it "deterministic"?)
#machine_learning (c.f. list)
#artificial_intelligence(c.f. list, Derek's Day)
#prediction_vs_decision
#explanation_vs_prediction (c.f. rainbow diagram)
#technology_theoretical_computation_and_math
#technology_observational_experimental_devices_and_sensors (c.f. PtN)
#future_of_the_future
#personal_or_societal
#samplesize
#resolution
#rainbow_diagram

Economics as a Predictive "Science"

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

Refresher

"Classical Economics"

Rational Choice Theory

Prisoner's Dilemma

Cooperation Games

Behavioral Economics

[Laibson (at home)]

SimCity (Cities Skylines)

Economics in Everyday Life

(when, during the day, are you affected directly by predictions related to economics?)

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How can rules lead to better economic futures?

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?

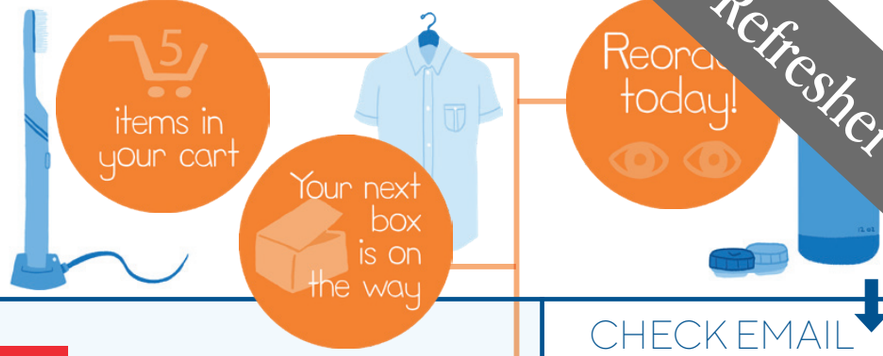
Morning

START

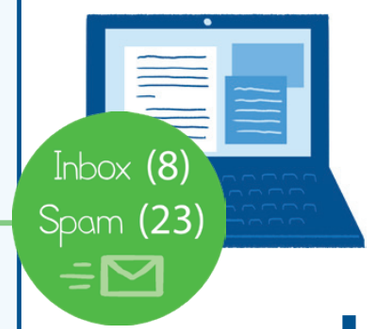
FINISH

WAKE UP

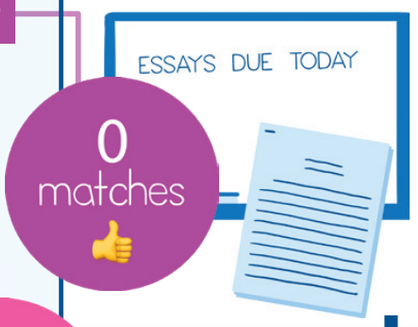
PERFORM MORNING ROUTINE



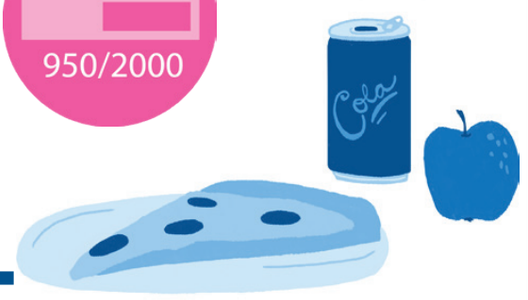
CHECK EMAIL



GO TO CLASS



EAT LUNCH



ATTEND SEMINAR

GET COFFEE

PERFORM CIVIC DUTY

FLY HOME

Evening

Afternoon

Refresher

AI and Algorithms

The Adpocalypse

Landing optimization

Bayesian theory in juries

Mental health

Sales forecasting

Spam filtering

Plagiarism checker

Longevity assessment

The board game

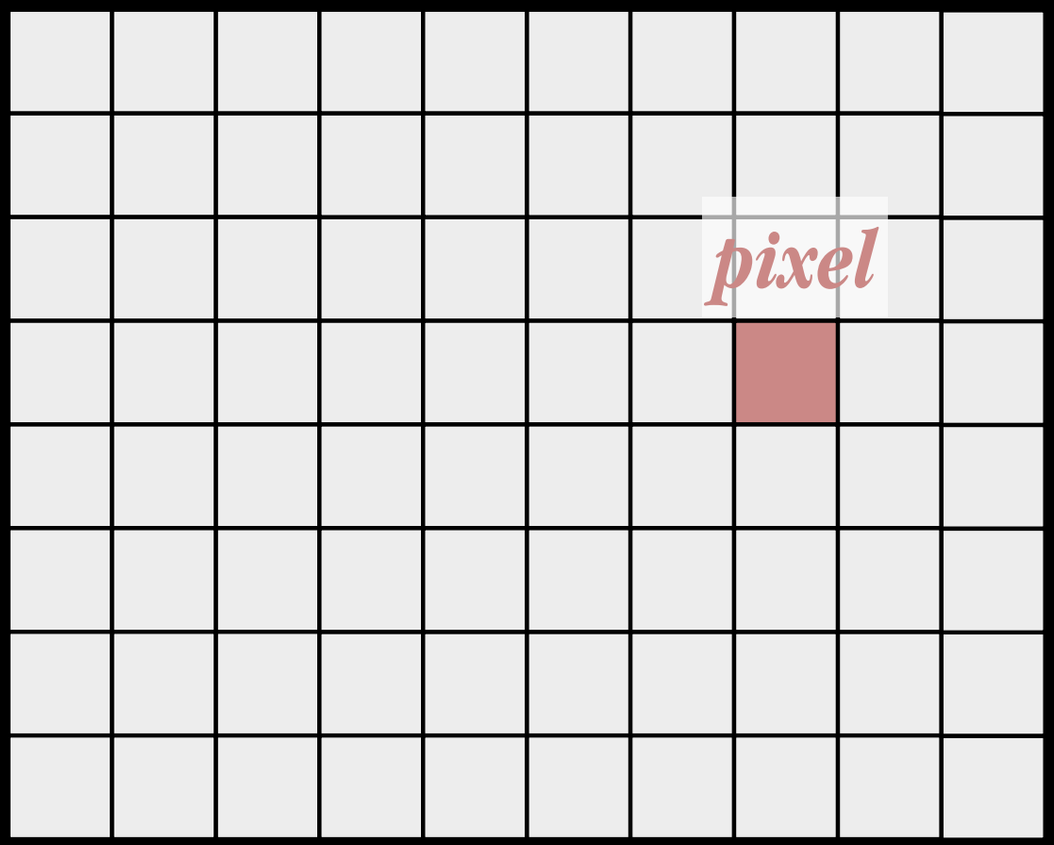
DEREK'S DAY

Algorithmic Forecasting in Everyday Life

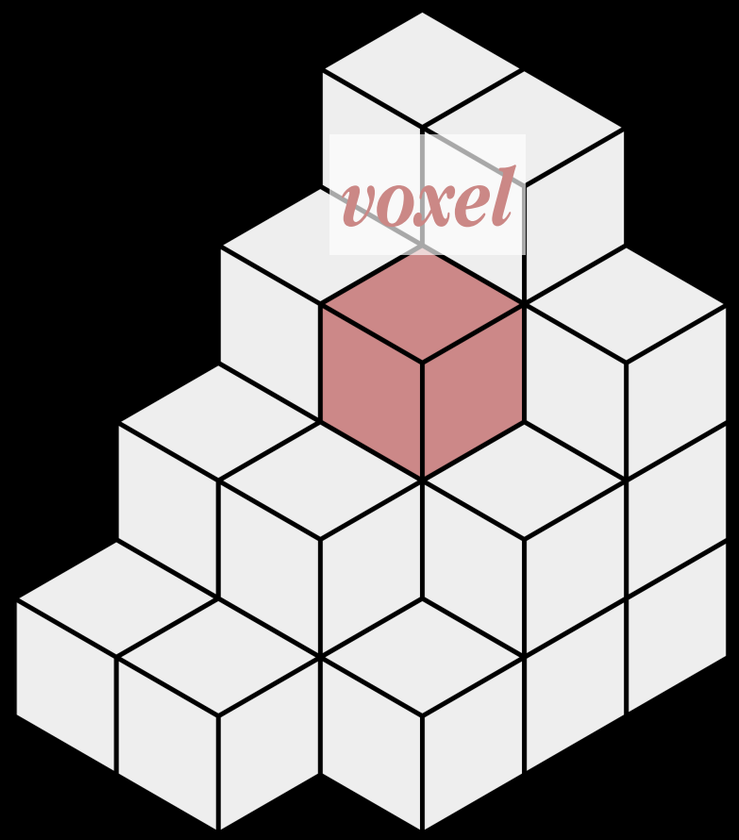
Simulated Economics in “SimCity 2013”

RESOLUTION

2D computational zones are called “pixels” or “grid cells”

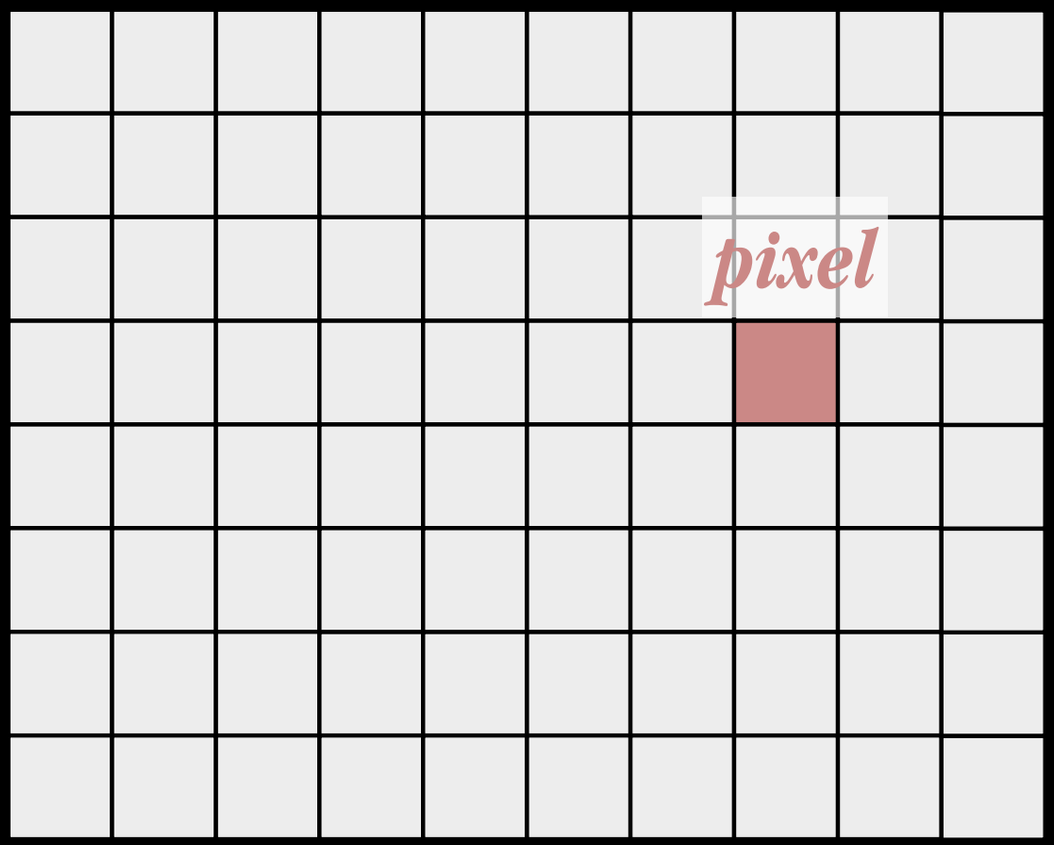


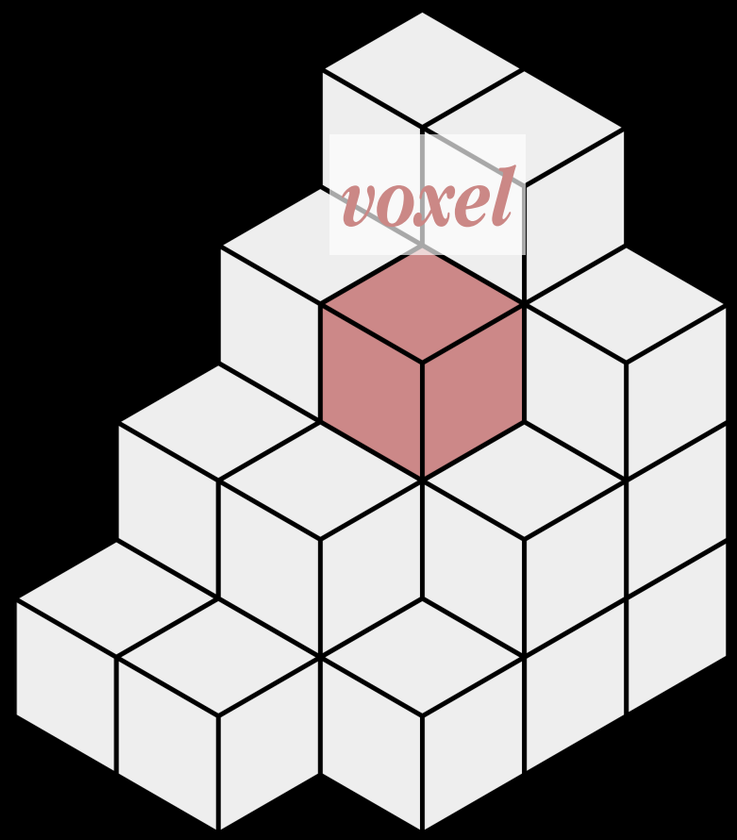
3D computational zones are called “voxels” or “grid cells”



#resolution #simulation_or_model #technology_theoretical_computation_and_math

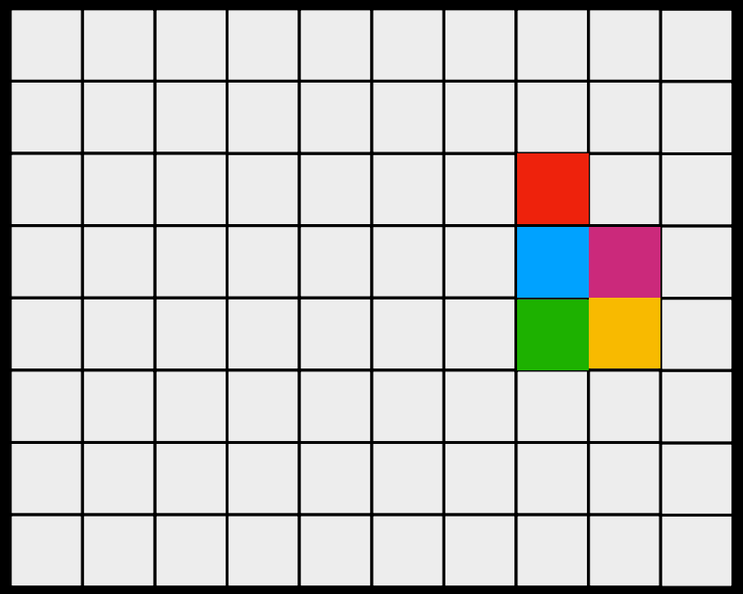
The rules applied in a simulation give an “update” for what happens in each “pixel” or “voxel” depending on what happens in neighboring cells.





The resolution in any simulation cannot be finer, in space, than the size of the smallest grid cell, or in time than the smallest time step.

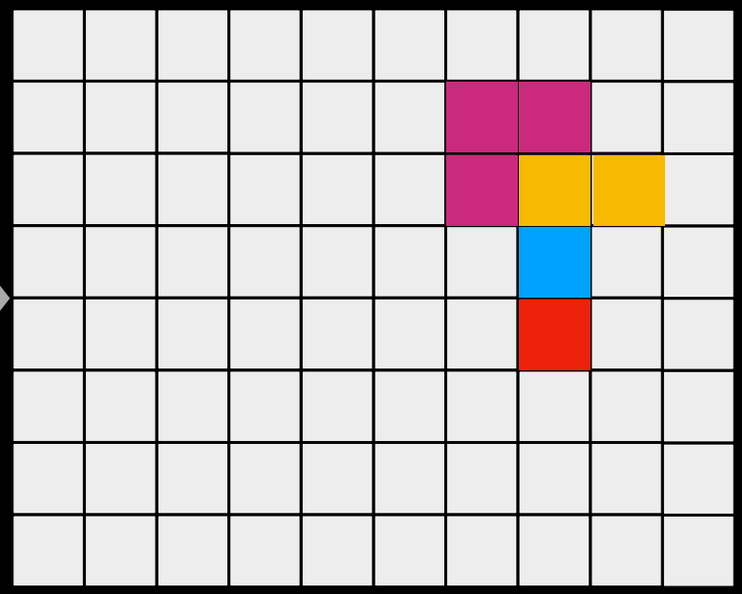
“Time Step n”



System is in some “state” shown by the arrangement of colors in the pixels

PREDICTIVE SYSTEM

“Time Step n+1”



System is in new “state” shown by the new arrangement of colors in the pixels

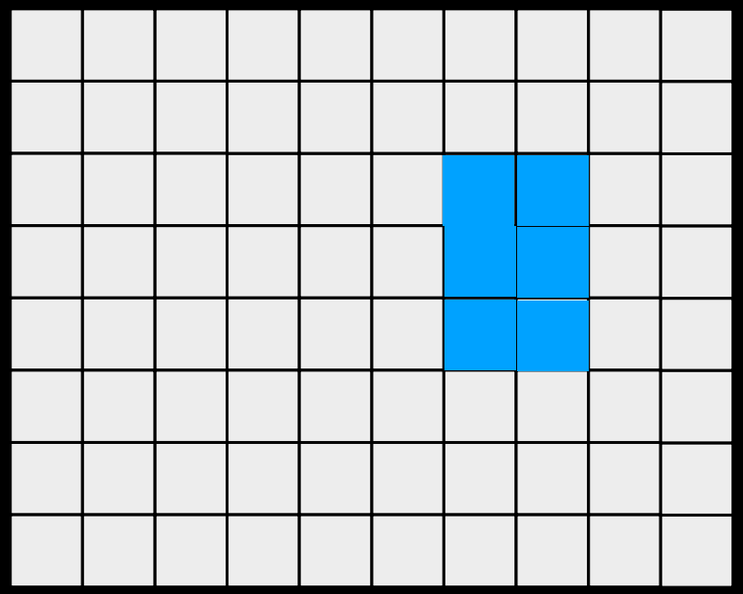
The resolution in any simulation cannot be finer, in space, than the size of the smallest grid cell, or in time than the smallest time step.

INPUTS

PREDICTIVE SYSTEM

OUTPUTS

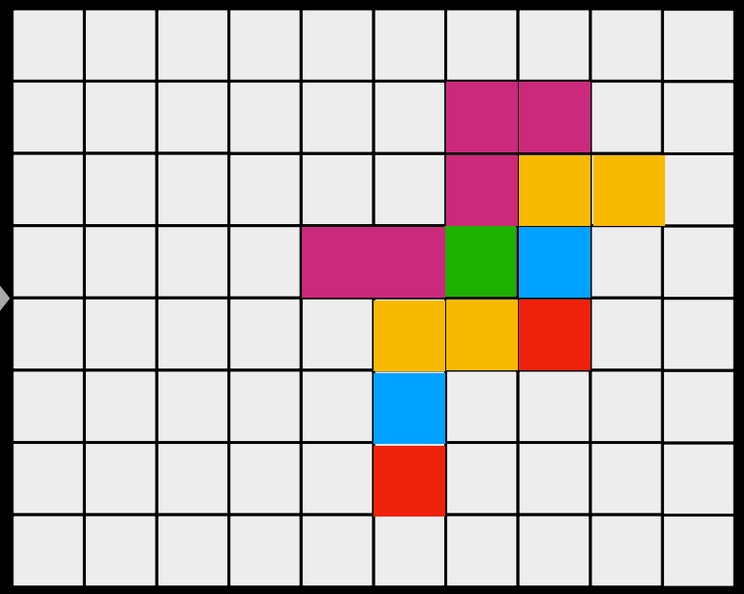
Initial Conditions



This starting state is determined by **INPUTS** to the predictive system.

after total # of steps…

Final Conditions

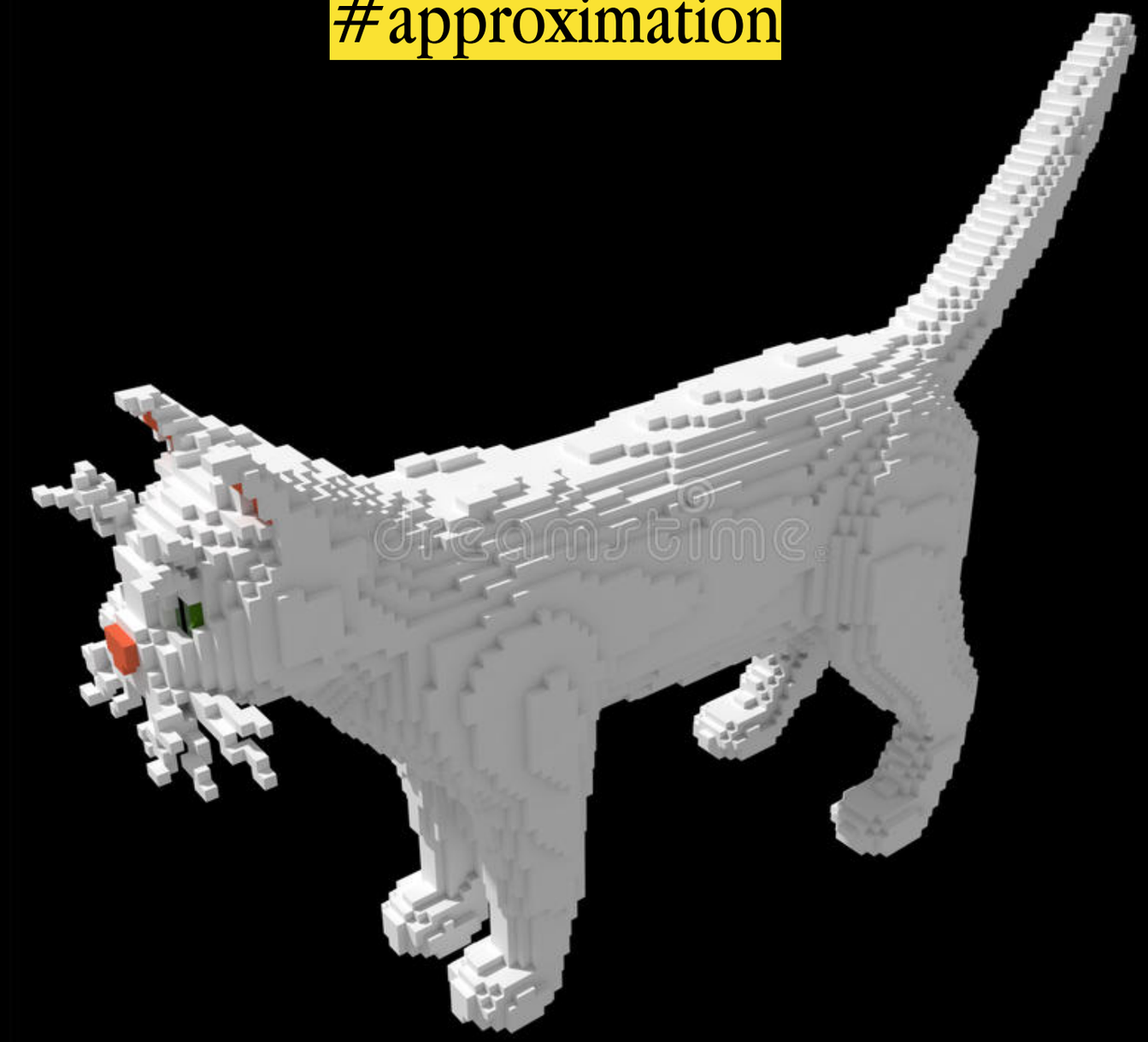


At the last time step, the state of the simulation is the **OUTPUT**.

The resolution in any simulation cannot be finer, in space, than the size of the smallest grid cell, or in time than the smallest time step.

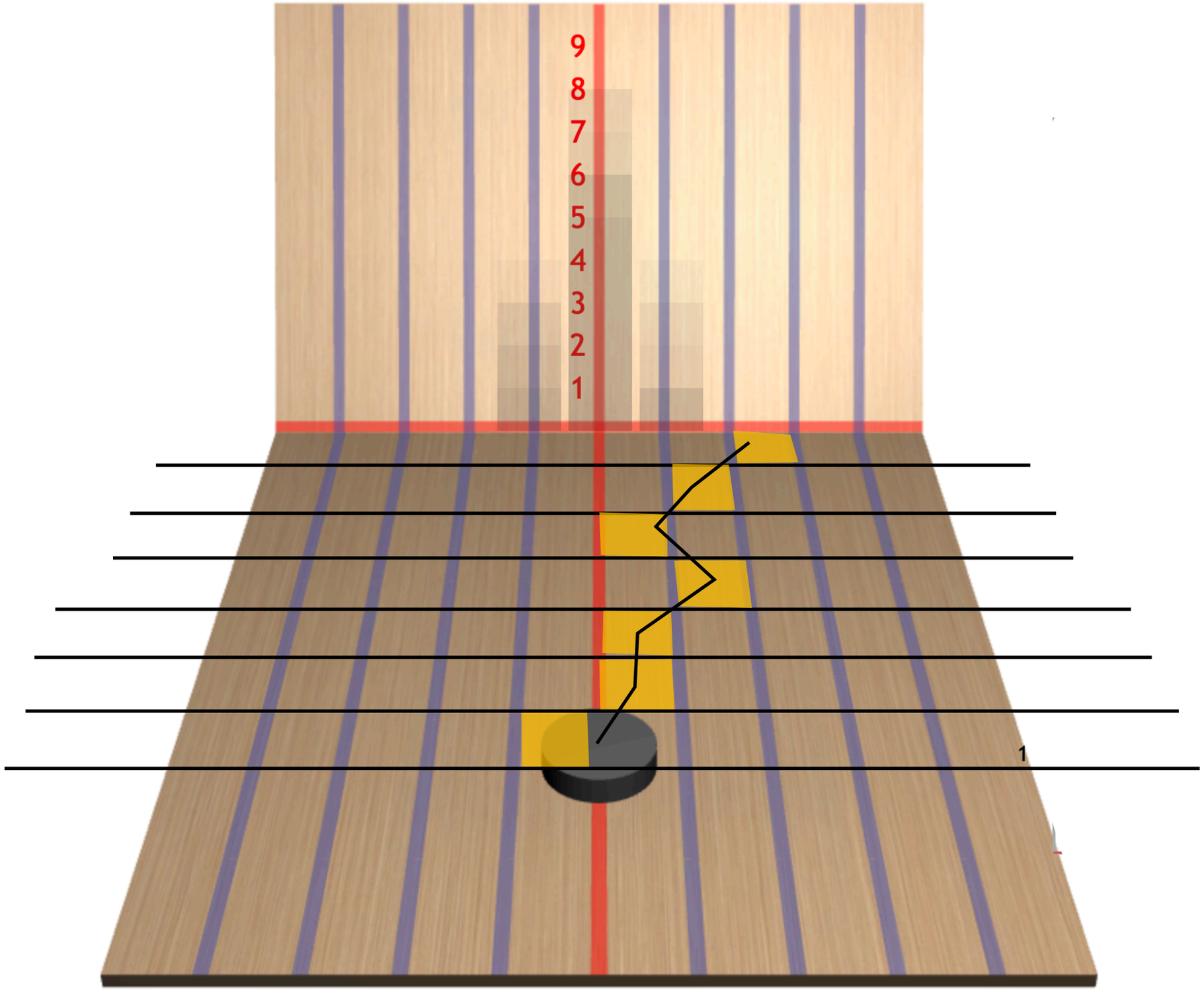
#resolution (and #approximation

#approximation

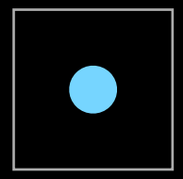


https://www.dreamstime.com/stock-illustration-d-voxel-cat-image-white-made-blocks-voxels-side-view-isolated-black-background-image76450879

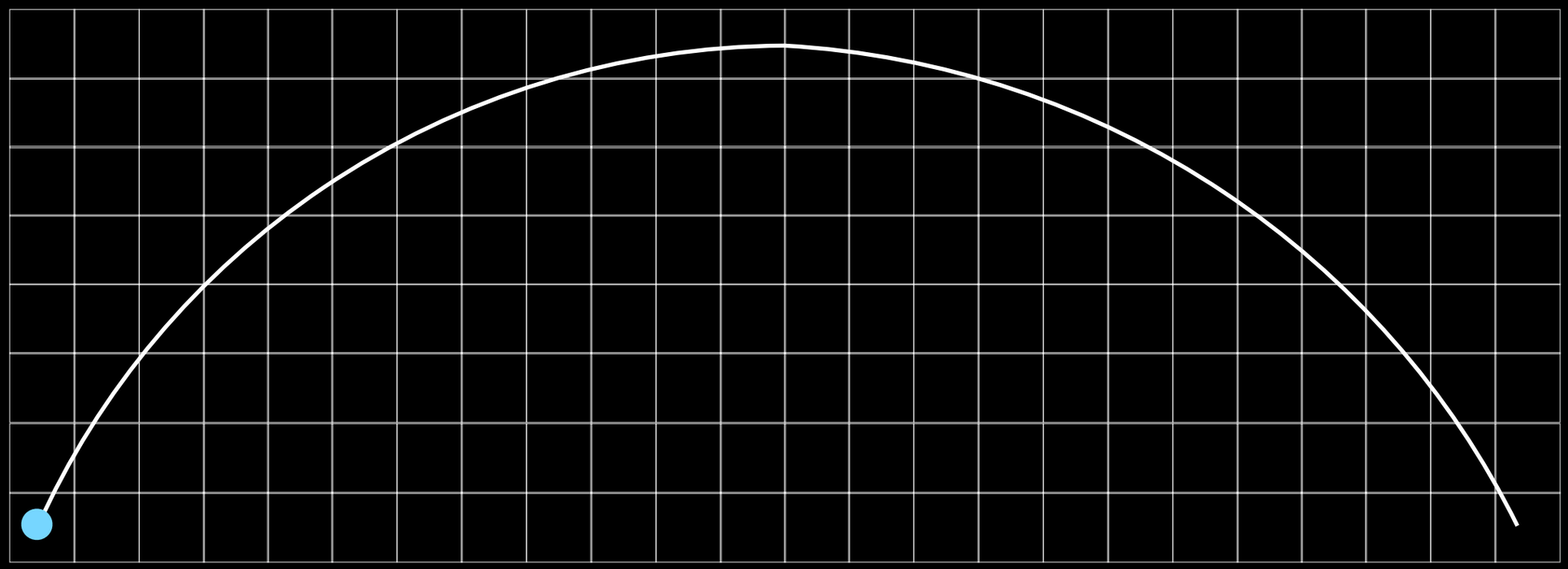
The path of the puck looks jerky when you play because the **temporal** and/or **spatial** #resolution of the situation is low (not very good).



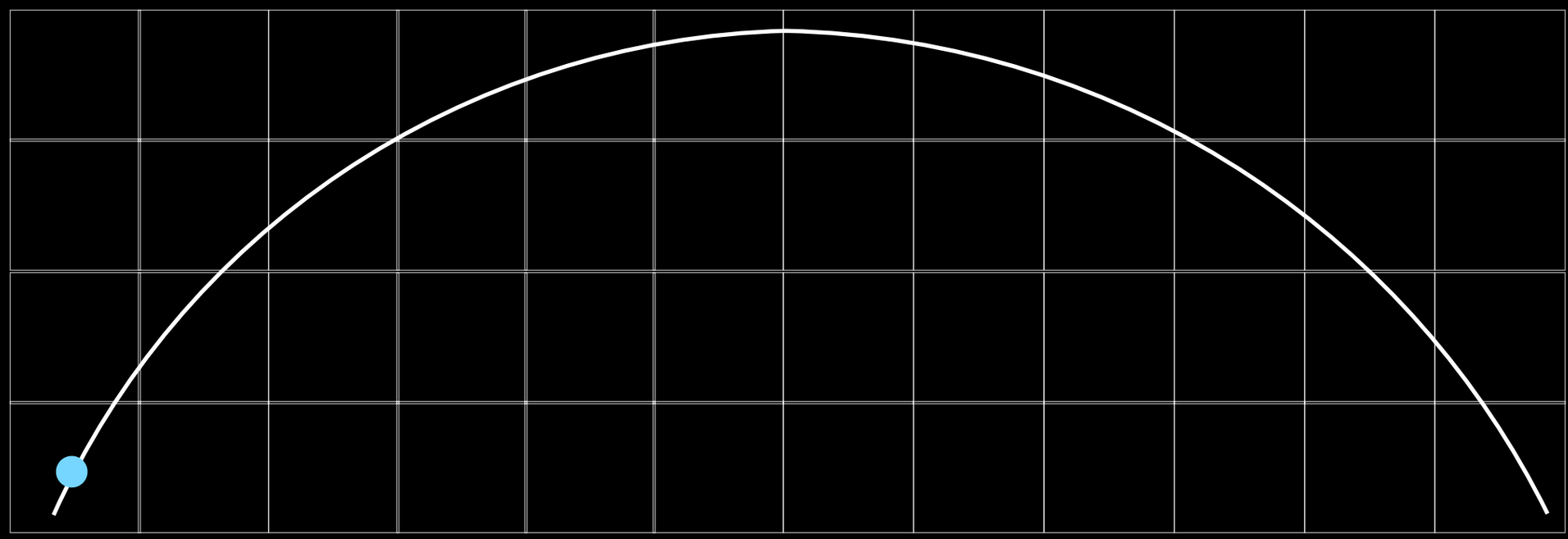
#resolution #approximation



at each time step, the blue dot will be in the exact CENTER of one "grid" cell

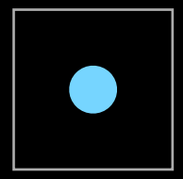


horizontal speed = 23 box-units in 26 (0.05 sec) steps = 18 box-units/second

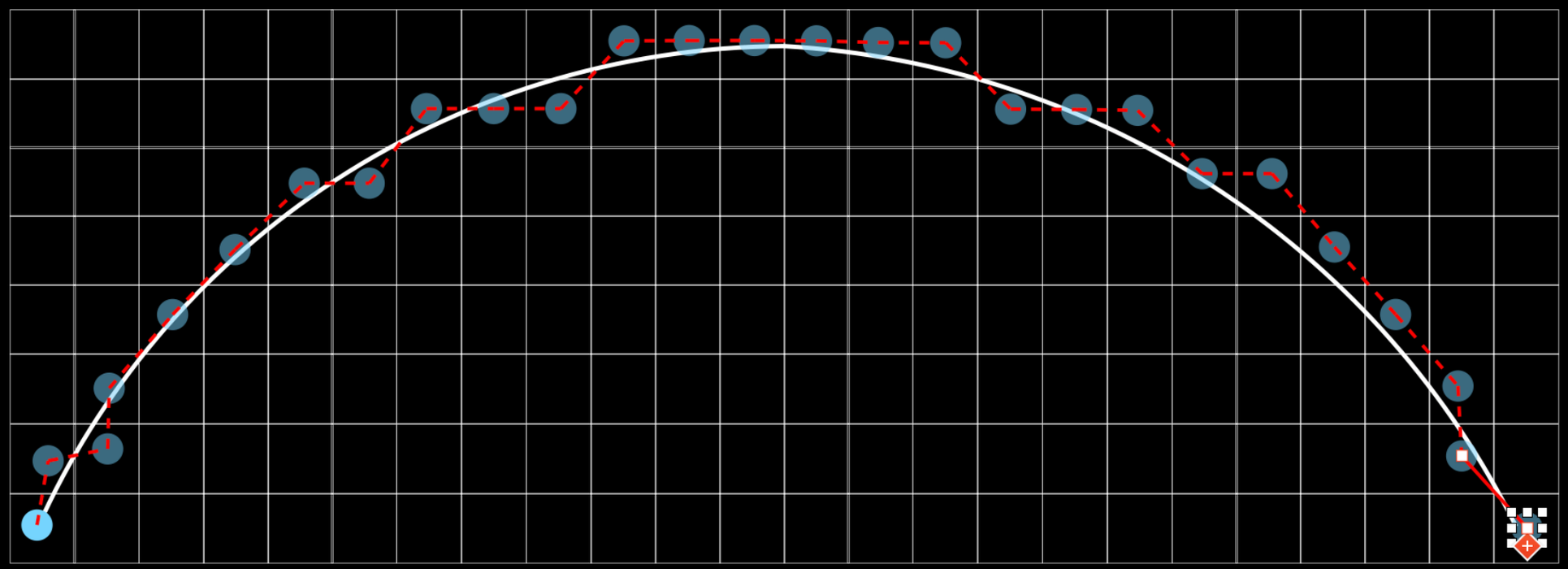


horizontal speed = 11 boxes in 13 (0.05 sec) steps = 17 box-units/second

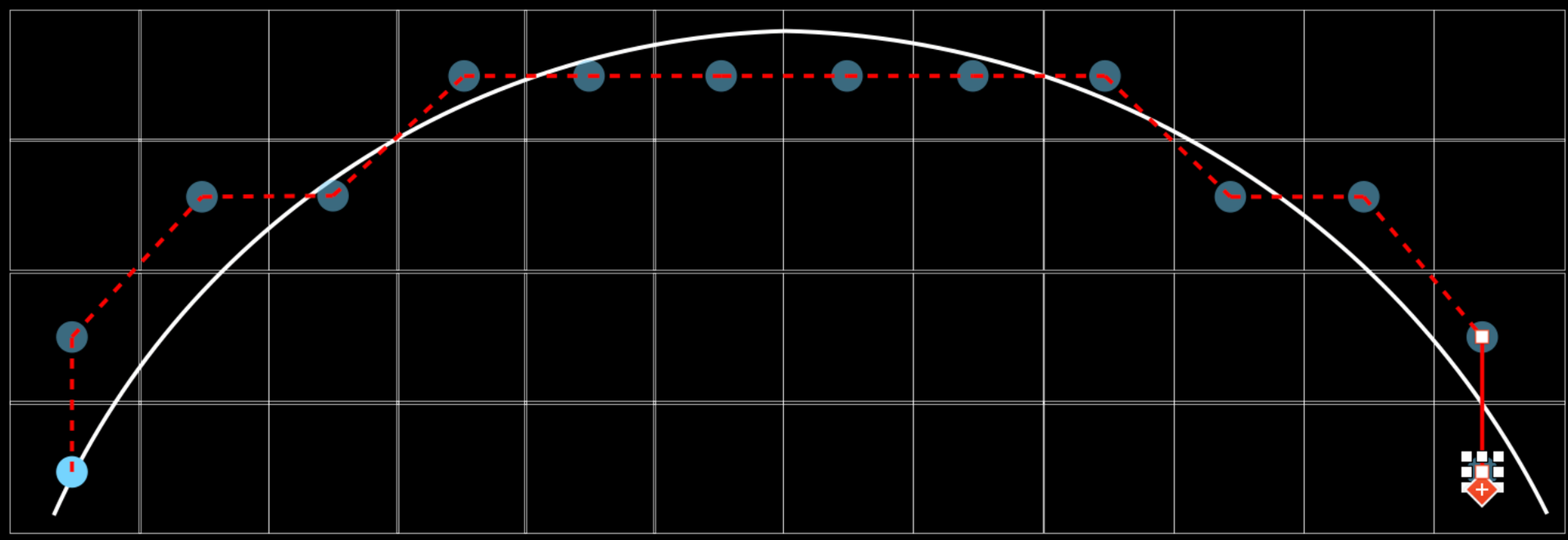
#resolution #approximation



at each time step, the blue dot was in the exact CENTER of one "grid" cell

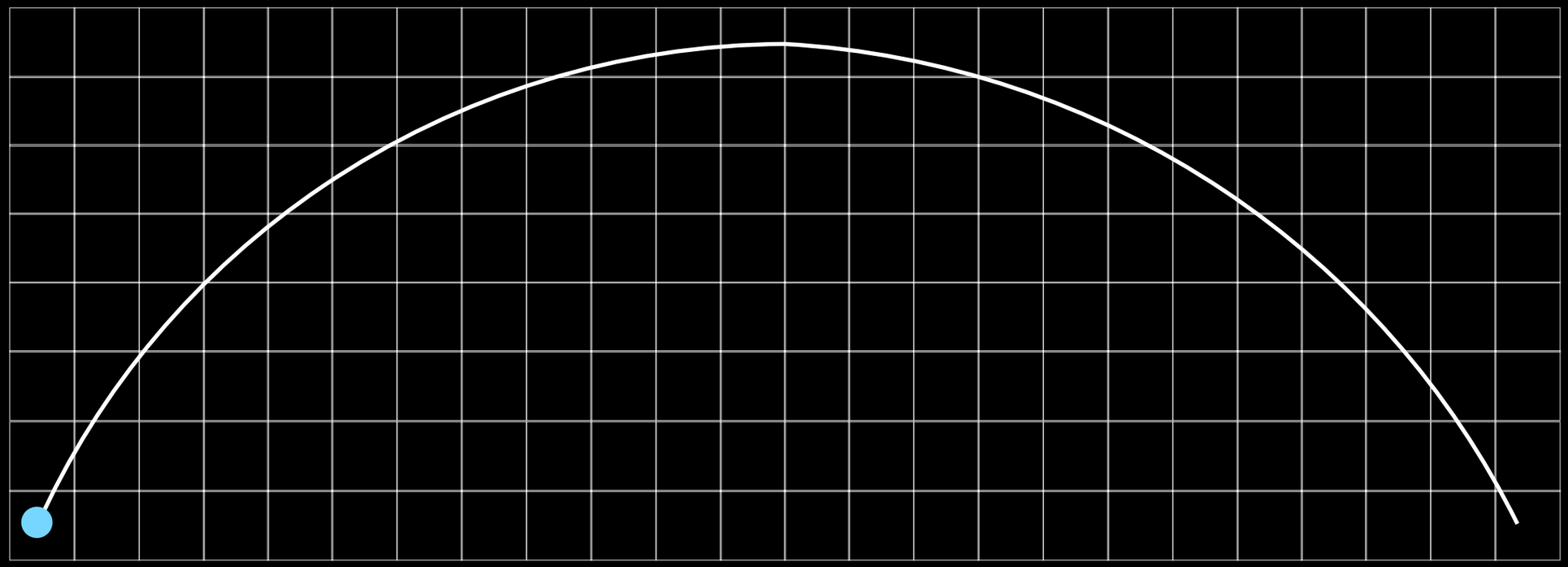


horizontal speed= 23 box-units in 26 (0.05 sec) steps=18 box-units/second

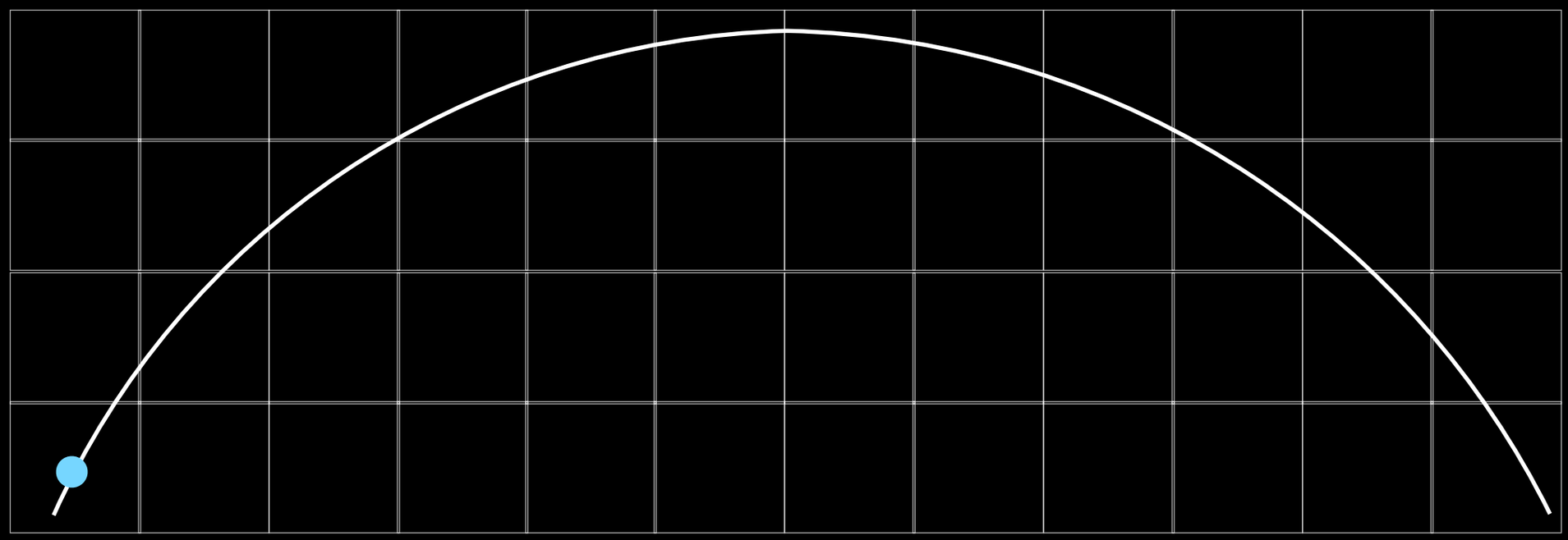


horizontal speed= 11 boxes in 13 (0.05 sec) steps=17 box-units/second

#resolution #approximation

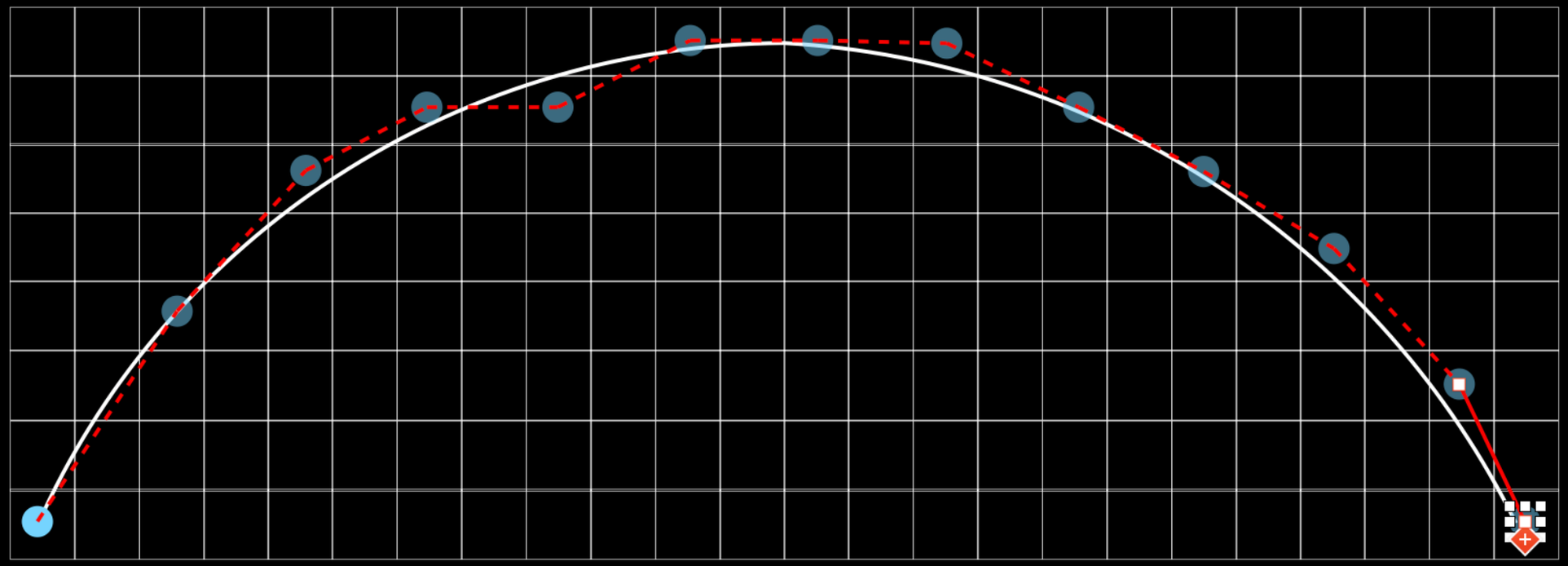


horizontal speed= 23 box-units in 13 (0.05 sec) steps=35 box-units/second

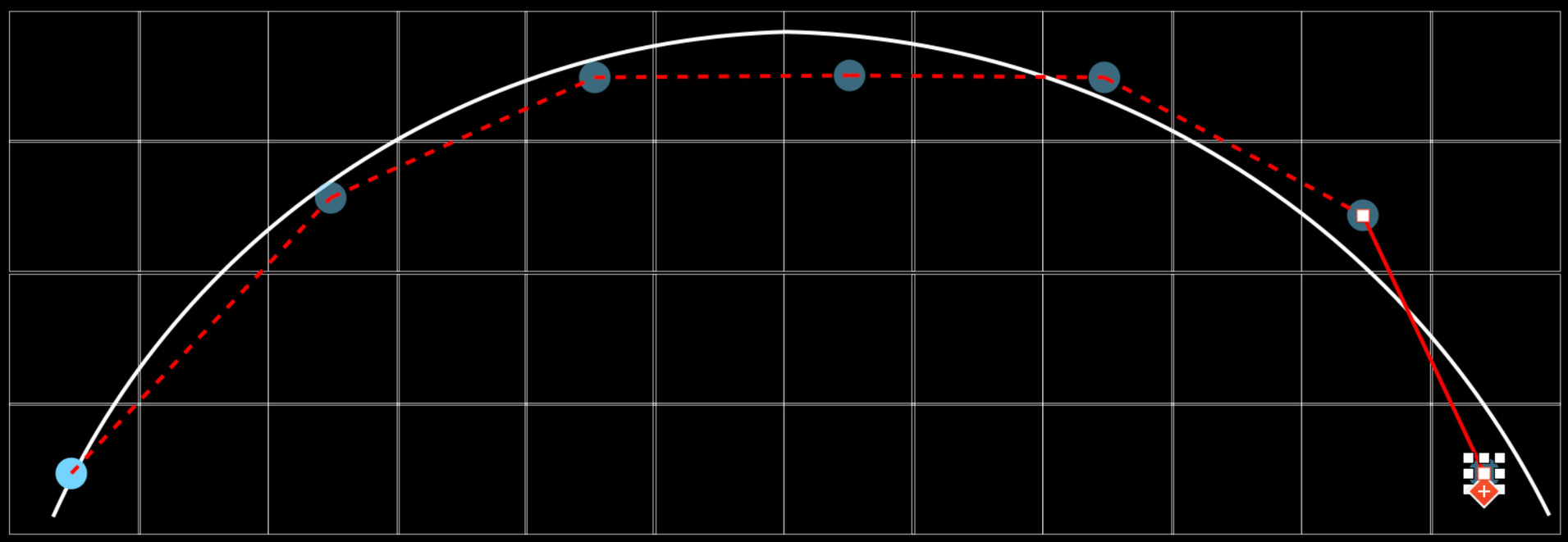


horizontal speed= 11 boxes in 6 (0.05 sec) steps=37 box-units/second

#resolution #approximation



horizontal speed= 23 box-units in 13 (0.05 sec) steps=35 box-units/second



horizontal speed= 11 boxes in 6 (0.05 sec) steps=37 box-units/second

#approximation

Approximations resulting from choices of spatial and temporal resolution

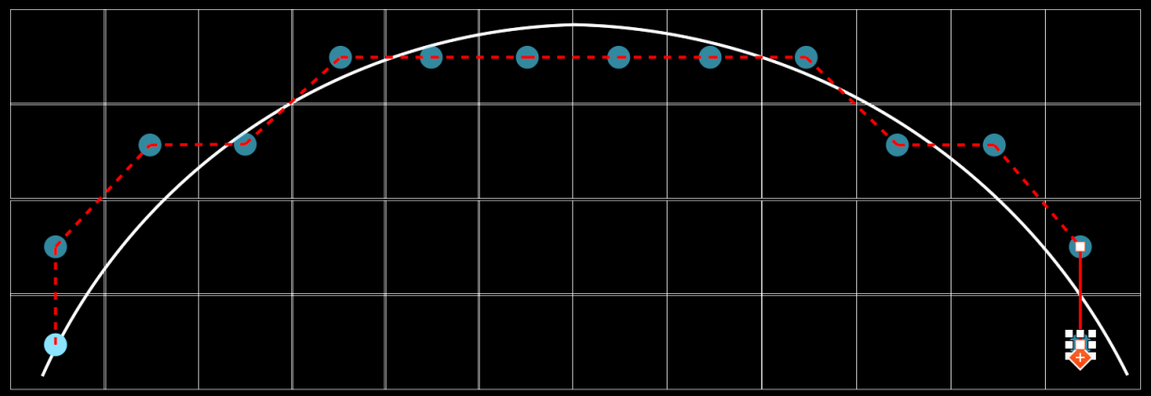
#resolution

#simulation_or_model

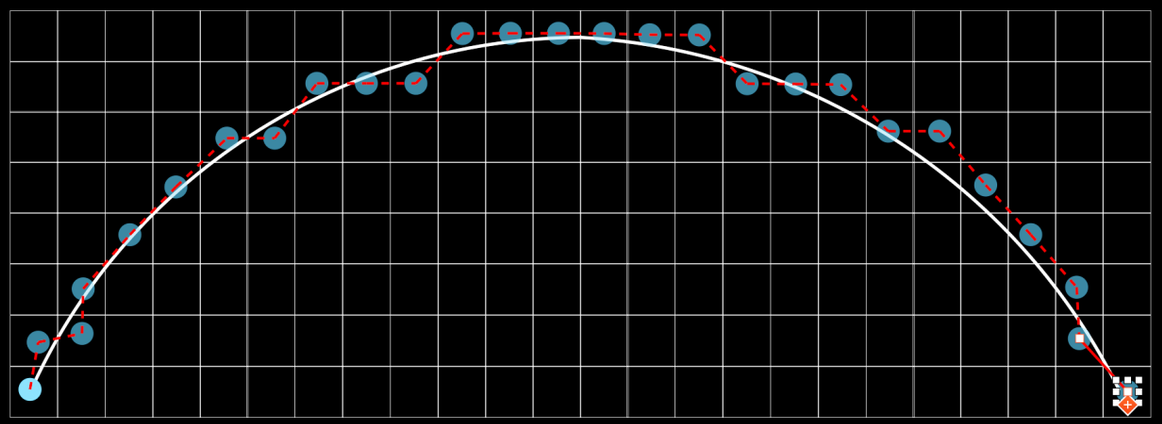
#technology_theoretical_computation_and_math

at each time step, the blue dot was the exact CENTER of one "grid" cell

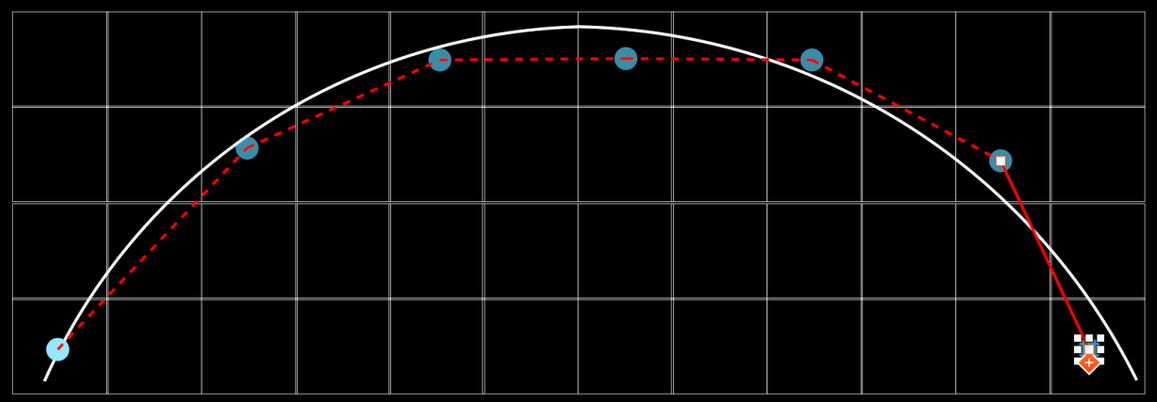
"better" temporal resolution



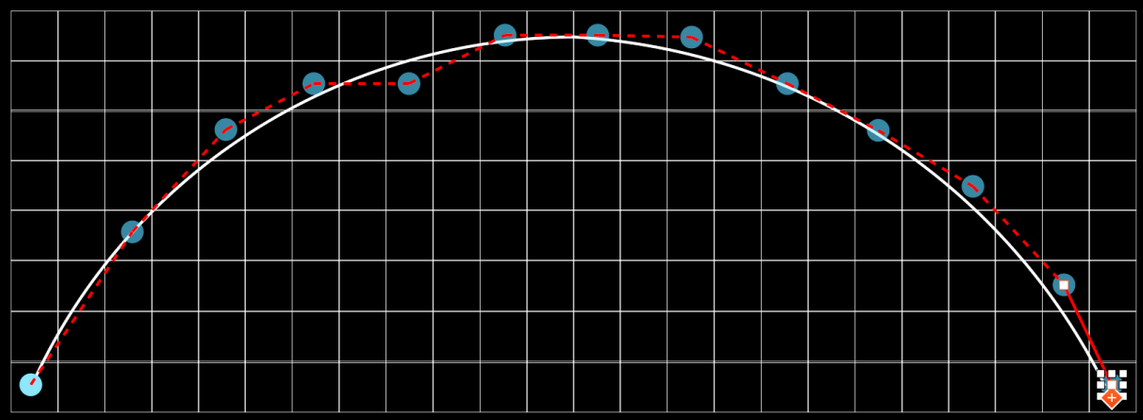
horizontal speed = 11 boxes in 13 (0.05 sec) steps = 17 box-units/second



horizontal speed = 23 box-units in 26 (0.05 sec) steps = 18 box-units/second



horizontal speed = 11 boxes in 6 (0.05 sec) steps = ~37 box-units/second



horizontal speed = 23 box-units in 13 (0.05 sec) steps = 35 box-units/second

finer spatial resolution

Very clever modern simulation "meshes" *move* and *adjust* with what's happening in the simulation.

(e.g. Arepo "moving mesh" code, using Voronoi tessellation)

#resolution

#approximation

FYI—same "Vornoi" idea gives the curved line on the "original" cholera map.

MORE ON TUESDAY

Image credit: Volker Springel, wwwmpa.mpa-garching.mpg.de/~volker/arepo/

Recall…

"Simulation" vs. "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?
  (Note Marianna Linz' simple global temperature model…)
  SimCity 2000 vs. The Sims…

The Plan

1. Play/Demo (notice how resolution and algorithms matter)
2. Breakout Discussions

   What would YOU would like to TEACH using a game designed for 10-and-up? Discuss your ideas within your group. Be sure to take (your own) notes, as fleshing out your game design idea will become your assignment for 4/13.

File Speed Options Disasters Windows Newspaper

Jul 2236 <Darwin City> $61,909

Query Tool

SIM CITY 2000

THE ULTIMATE CITY SIMULATOR

https://playclassic.games/games/city-building-dos-games-online/play-simcity-2000-online/play

File Speed Options Disasters Windows Newspaper

Centering Tool
Citizens Demand Road & Rail

Groundwork Laid For GenEd 1112-2021

GenEd 1112-2021 Chronicle

Just A Dollar

Sunday 7, January 2050

Weather with Merle
Chilly Weather
50F 10mph 15mm

Locals Want Transit

Struggle Over Land Rights

Health Care Battle

Tornado Twirls Manchester

Survey

https://playclassic.games/games/city-building-dos-games-online/play-simcity-2000-online/play/

https://playclassic.games/games/city-building-dos-games-online/play-simcity-2000-online/play/


Economy
Taxes
Budget
Loans
100%
100%
₵262.56
₵0.00
₵0.00
Money Panel
You can manage your city's taxes, budget and loans here. The majority of your city's income comes from taxes. Tax income is based on the size and level of the buildings in each of the zones. High taxation will make people unhappy and might cause them to move away.
A bigger budget for a service means its facilities work more efficiently but it also becomes more expensive to maintain. City service budgets can be adjusted separately for day and nighttime from the sliders in the budget view.
You can take loans from different banks. The loan amount and interest rates differ from bank to bank and there is a limited number of loans that can be taken simultaneously.
EXPENSES
₵130.88
₵262.56
TOTAL
₵3.04
TOTAL
₵393.44
16/04/2020
Springfield
₵34,237
-₵390
16
+16
CITIES
SKYLINES