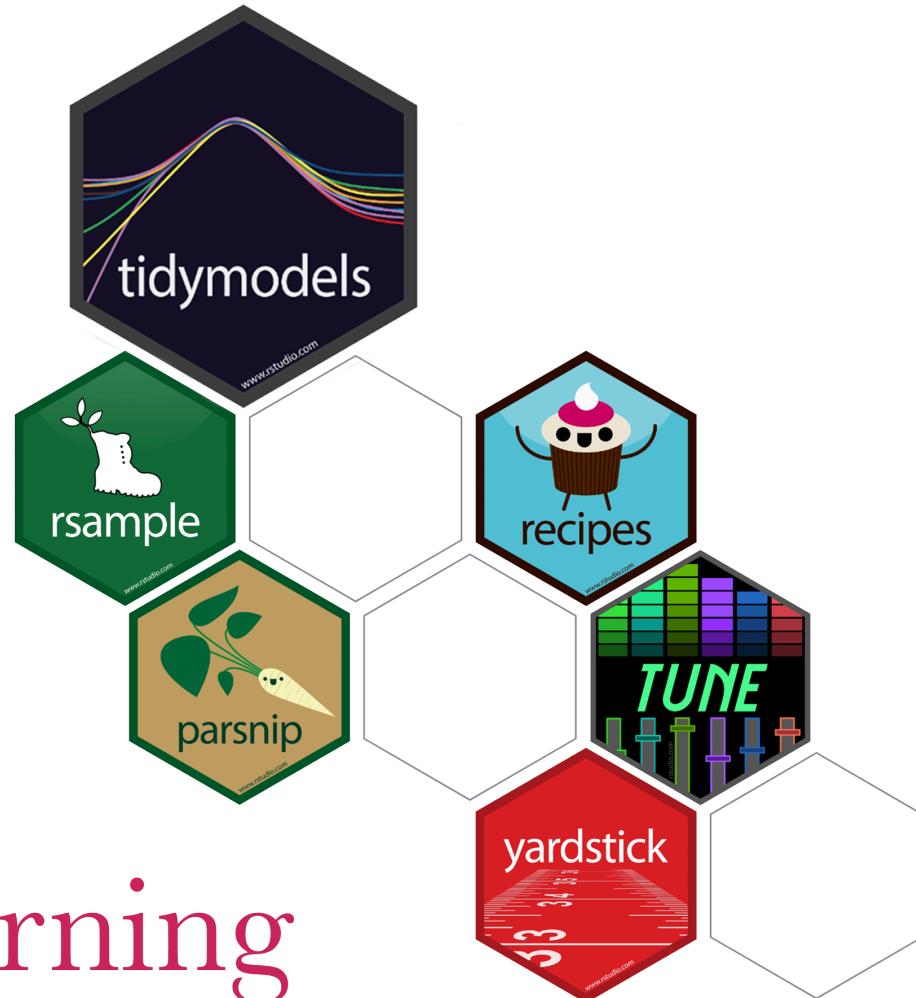


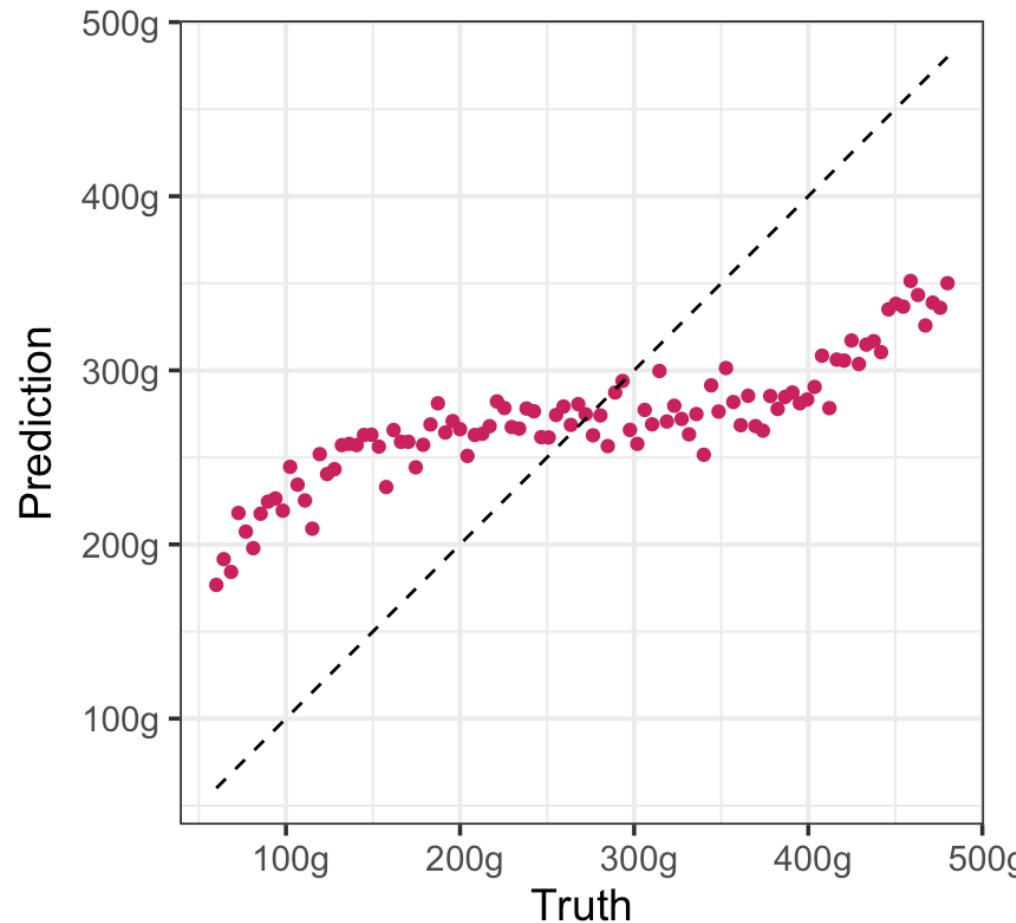
Simon P. Couch  
[simonpcouch.com](http://simonpcouch.com)  
Posit, PBC

# Fair machine learning



## Predicted vs. Actual Vase Weight

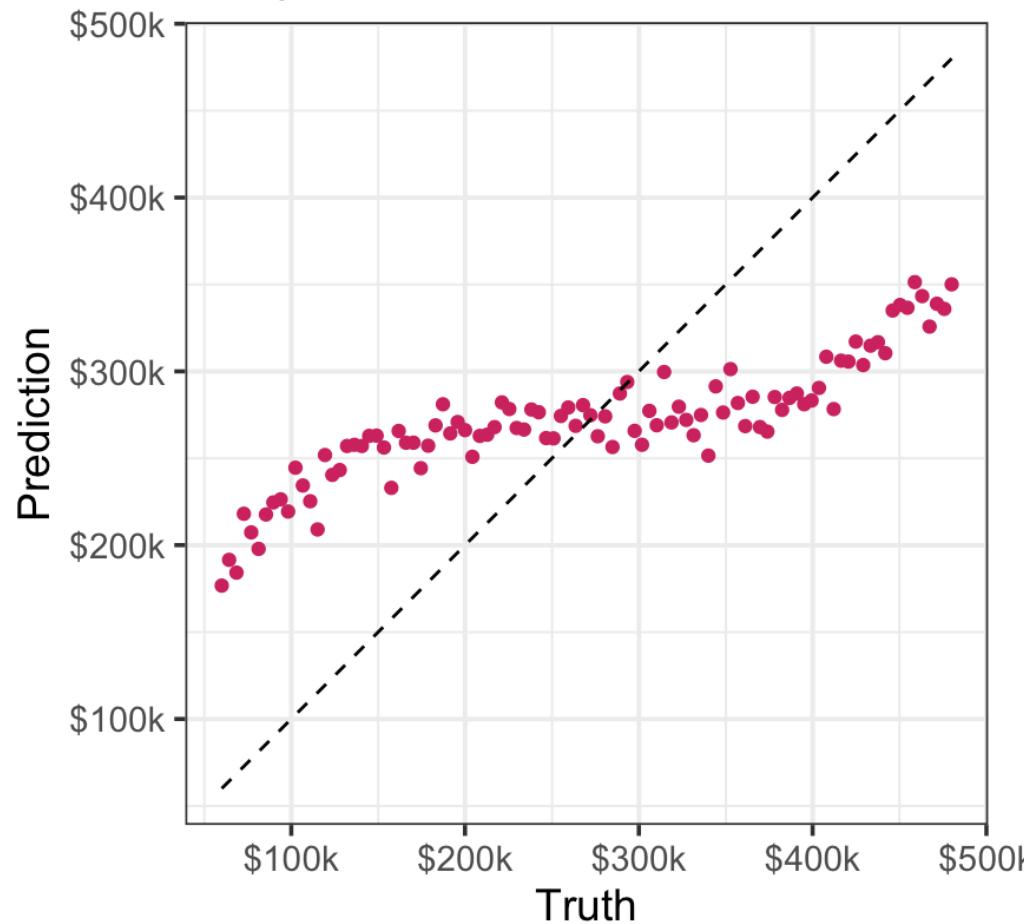
*Machine learning model predicts lighter vases are too heavy, and vice versa.*



Is this fair?

## Predicted vs. Actual Home Value

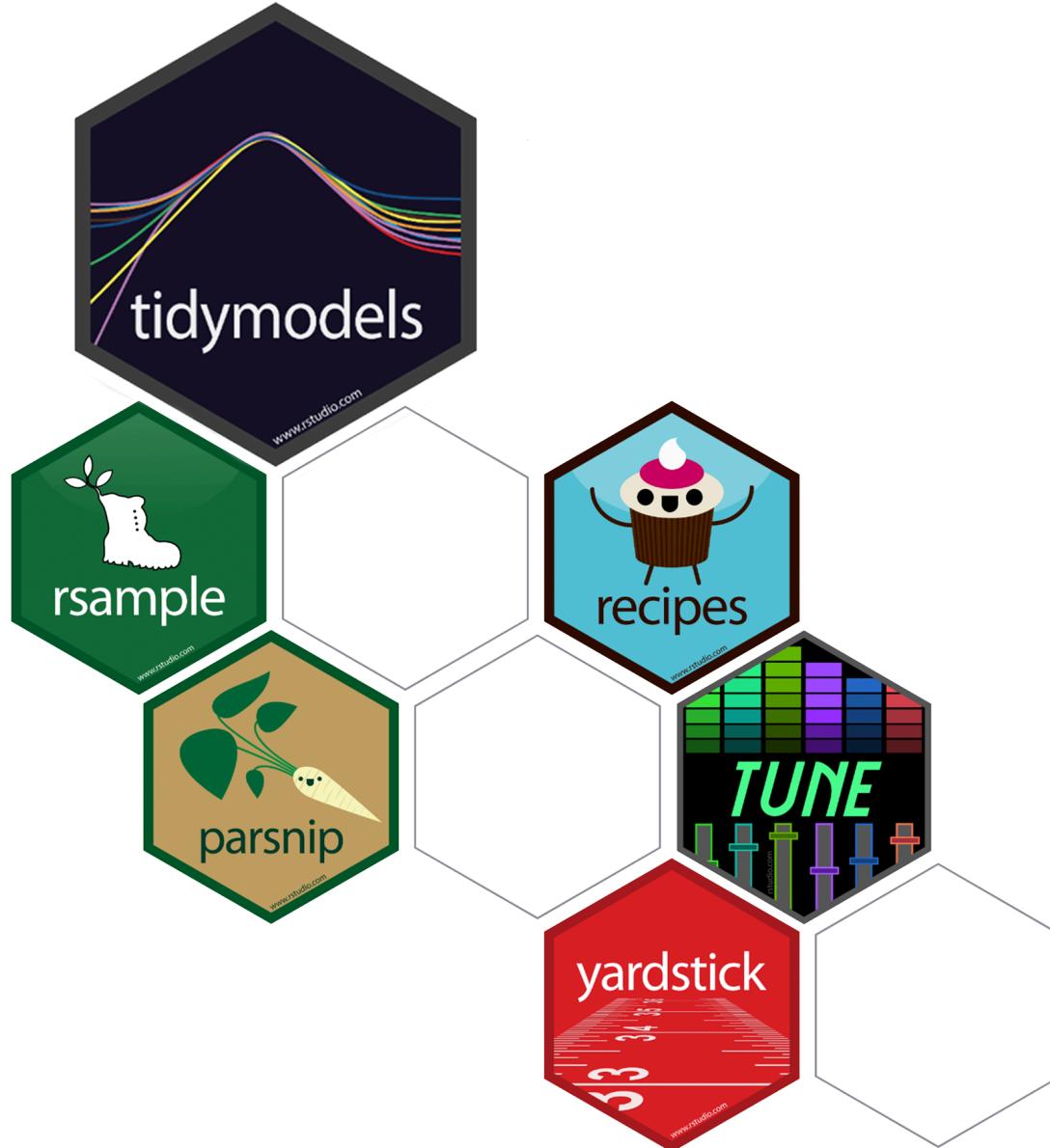
*Tax assessment model overvalues cheaper homes, and vice versa.*



*Is this fair?*

# Fairness is about our beliefs

*The same model parameters can result in behavior that feels totally benign when situated in one context and deeply unjust in another.*



[github.com/simonpcouch/cascadia-24](https://github.com/simonpcouch/cascadia-24)

The Tax Divide -- Chicago Tribune

apps.chicagotribune.com/news/watchdog/cook-county-property-tax-divide/assessments.html

Part 1 | An unfair burden

Chicago Tribune

TRIBUNE WATCHDOG: THE TAX DIVIDE

Pause

# AN UNFAIR BURDEN

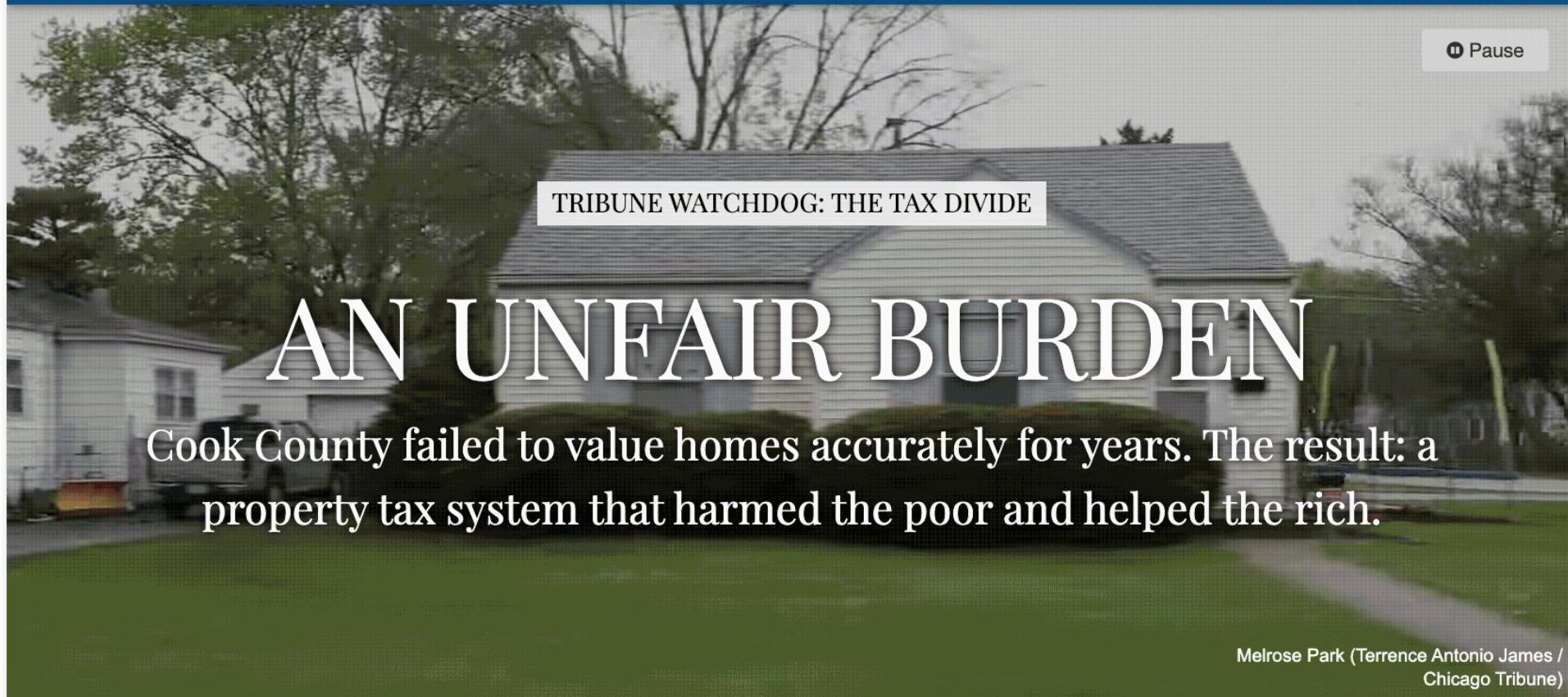
Cook County failed to value homes accurately for years. The result: a property tax system that harmed the poor and helped the rich.

Melrose Park (Terrence Antonio James / Chicago Tribune)

By Jason Grotto  
Chicago Tribune

PUBLISHED: JUNE 10, 2017

[github.com/ccao-data/public](https://github.com/ccao-data/public)



# Defining fairness

## Predicted vs. Actual Home Value

*Tax assessment model overvalues cheaper homes, and vice versa.*



Proposal: The most performant model is the most fair model.

# Proposal: Performant models are fair

Apply calibration to correct for correlated errors.

# Proposal: Performant models are fair

*Tax assessment model predicts with a high R-squared, errors i.i.d.*



Perhaps this is better?

# Proposal: Performant models are fair

Let's plot the errors:



...let's not forget those y-axis units.

# Proposal: Performant models are fair

Let's plot the errors:



...let's not forget those y-axis units.

# Proposal: Similar percentage error is most fair

*Tax assessment model that predicts with similar percentage error across distribution.*



# Defining fairness

# Defining fairness

*Definitions of fairness “are not mathematically or morally compatible in general.”<sup>1</sup>*

# The whole system

# The whole system

How will these predictions even be used, though?

- **Fixed Percentage:** All properties taxed at .9% assessed value
- **Homeowner Exemption:** For those that live in the home they own, first xyz not taxed, then .9% assessed value
- **Transitioning from regressivity:** Is a rapid change in assessment unfair?

# The whole system

*Metrics evaluate the model, but the model is one part of a larger system.*

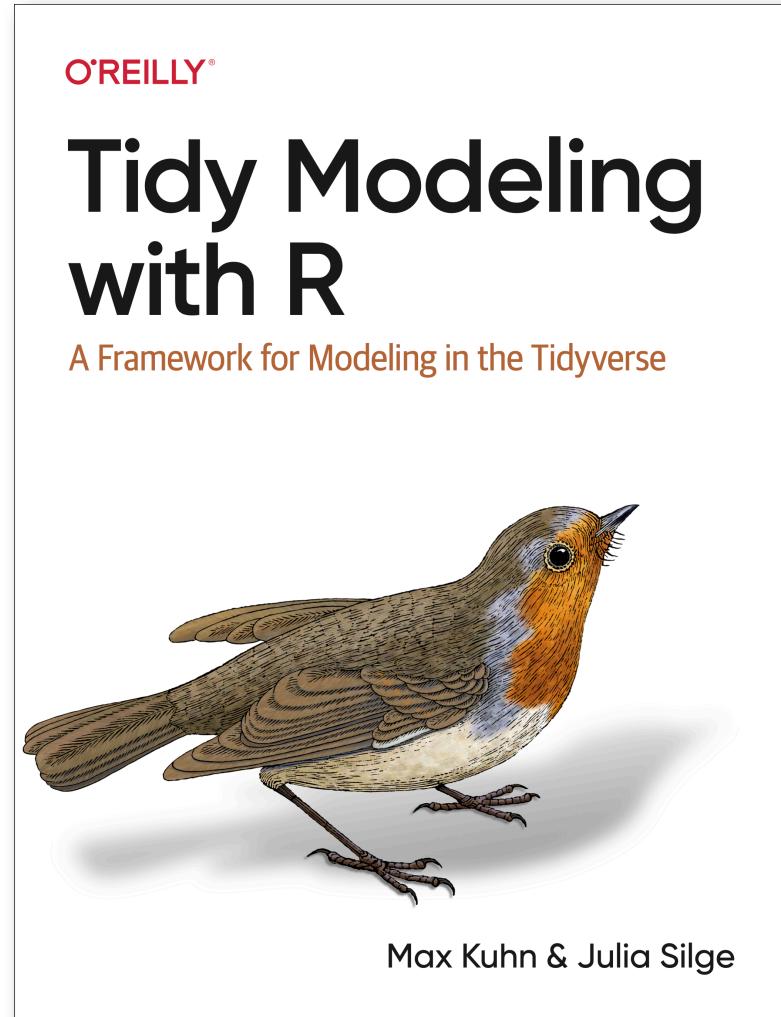
# The hard parts

- Articulating what fairness means to you (or stakeholders) in a problem context
- Choosing a mathematical measure of fairness that speaks to that meaning
- Situating the resulting measure in the whole system

*Choose tools that support thinking  
about the hard parts.*

# Resources

- [tmwr.org](http://tmwr.org)



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- [tmwr.org](http://tmwr.org)
- [tidymodels.org](http://tidymodels.org)



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# Resources

- [tmwr.org](http://tmwr.org)
- [tidymodels.org](http://tidymodels.org)
- Slides and example notebooks:

[github.com/simonpcouch/cascadia-24](https://github.com/simonpcouch/cascadia-24)