Graham Tierney
319-330-1093 | graham.tierney@duke.edu | g-tierney.github.io

OVERVIEW
- Research agenda focused on causal inference with complex data: how natural language causes political polarization and counterfactual forecasting for multivariate time series.
- Developed novel methodology for text-as-mediator within a randomized experiment.
- Additional work in time series forecasting of multivariate retail sales data.

EDUCATION

Duke University – PhD (expected May 2023)
Work with Alexander Volfovsky (advisor), Chris Bail, and Sunshine Hillygus.
- Designed and analyzed a field experiment to reduce political polarization by randomly pairing Democrats and Republicans to have anonymous conversations. First author on submitted paper.
- Used NLP methods to identify interpretable conversation features that contribute to depolarization. Produced a procedure to benchmark these causal mediation effects in text data. Published at the *First Workshop on Causal Inference & NLP* at EMNLP 2021. ACL Link.
- Extended LDA topic model to analyze Twitter data, jointly clustering users and tweets. Implemented a Gibbs sampler and variational method. Application to US Senators' Twitter activity recovers partisan groupings, especially of infrequent posters. Code and paper.
- Analyzed election polls to identify election-specific bias with a flexible hidden Markov Model. Presented at *JSM* (2021), under review at *Political Analysis*. Code and Paper.

Work with Mike West and 84.51.
- Developed multivariate forecasting models for high-dimensional time series of retail sales at a major grocery chain. Estimated joint distributions of price and quantity across 100 products and multiple geographies. Identified meaningful cross-product relationships wherein discounts for some products materially affect sales of other products. Published in *Applied Stochastic Models in Business and Industry* as a discussion paper.
- Extended models to estimate causal impacts of store-level interventions via synthetic controls, while accounting for dependence among treated units with multivariate forecasting models. Developed methods to generalize estimated effects among treated units to all experimental units and system-level results.

Duke University – MS in Statistical Science (2020)
- Coursework: Bayesian analysis, machine learning, time series, causal inference.
- Final Project: Topic models for short text and partially supervised LDA.

Carleton College – BA in Mathematics/Statistics and Economics (2014)
- Thesis: "Connecting the Dots: High School Exit Exams and the Labor Market" examined the link between high-stakes high school examinations and labor market outcomes. This project was awarded distinction, the highest honor for a thesis project.

PUBLICATIONS

Tierney, Graham and Alexander Volfovsky. "Causal Mediation through Text: an Application to Political Polarization." 2021. In *Proceedings of the First Workshop on Causal Inference and NLP* (pp. 61-73). https://aclanthology.org/2021.cinlp-1.5/

Yanchenko, Anna, **Graham Tierney**, Joseph Lawson, Christoph Hellmayr, Andrew Cron, Mike West. "Multivariate Dynamic Modeling for Bayesian Forecasting of Business Revenue." 2022. Applied Stochastic Models in Business and Industry. doi.org/10.1002/asmb.2704

WORKING PAPERS

Tierney, Graham, Chris Bail, and Alexander Volfovsky. "Clustering and Topic Estimation on Short Texts." 2020. https://arxiv.org/abs/2106.09533 (In submission)

Tierney, Graham and Alexander Volfovsky. "Simultaneous Bias Estimation and Forecasting in Election Polling." 2022. https://arxiv.org/abs/2206.14570 (In submission)

PAPERS IN PROGRESS

Combs, Aidan, **Graham Tierney**, Brian Guay, Friedolin Merhout, Christopher Bail, Sunshine Hillygus, Alexander Volfovsky. "Social Identity and Political Polarization on Social Media: a Field Experiment on a New Chat Platform." (In submission, shared first authorship) Preregistration available at https://osf.io/7xmd8.

Combs, Aidan, **Graham Tierney**, Fatima Alqabandi, Devin Cornell, Gabriel Varela, Andrés Castro Araújo, Lisa P. Argyle, Christopher A. Bail, Alexander Volfovsky. "Perceived Gender and Political Persuasion: A Social Media Field Experiment during the 2020 Democratic National Primary." 2021. (In progress)

PRESENTATIONS

Tierney, Graham. "Bayes at the Ballot Box: Bias and Forecasting in Election Polling." Presented at *Bayesian Young Statisticians Meeting* (2020) and *Joint Statistical Meetings* (2021).

Tierney, Graham and Alexander Volfovsky. "Clustering and Topic Estimation on Short Text: Measuring Echo Chambers in Elite Communication." Presented at ISBA (2022) and BNP (2022).

NONACADMEIC WORK EXPERIENCE
Causal Inference & Experimentation Intern, Netflix – Programing and Audience (Summer 2022)
- Improved lifetime value models used to study price changes by incorporating dependence across subscribers. Previous methods analyzed cohorts of subscribers independently, which underestimated uncertainty in the total effect across all subscribers. I developed a

multivariate forecasting methodology that incorporated dependence across cohorts to resolve the issue.

- Implemented the multivariate models in production code in Python and Metaflow.

Student Technical Assistant, MIT Lincoln Laboratory – AI & Algorithms, (Fall 2021-Present)
- Hired to continue implementing counter-misinformation social media experiment designed and piloted during summer internship.

Summer Research Intern, MIT Lincoln Laboratory – AI & Algorithms, (Summer 2021)
- Designed experiment to test counter-misinformation policies on social media.
- Deployed chat-bot technology in simulated social media environment to discourage sharing of false news stories related to COVID-19 vaccines.
- Analyzed disinformation networks related to QAnon to discover influential accounts on Twitter.

Research Professional, University of Chicago, Professor Steven Levitt (2016-2018)
- Assisted Professor Steven Levitt with conducting research and running field experiments.
- Analyzed results of a large, randomized experiment that provided free early childhood education to residents of a south side Chicago neighborhood and discovered significant gains to cognitive abilities.
- Coded analysis using STATA and R. Built a web scraper in Python to collect data on congressional elections.

Analyst, Cornerstone Research (2014-2016)
- Performed statistical analysis for presentation in expert testimony in civil litigation.
- Worked on cases covering: labor market discrimination, anti-trust issues in computer and communications technology, and the financial impact of regulatory investigations.
- Analysis was performed primarily in STATA, SAS, R, and Excel.

ACADEMIC WORK EXPERIENCE

Teaching Assistant, Summer Institute in Computational Social Science (Summer 2020)
- Taught R programing and analysis to help students understand concepts in text analysis.
- Conducted pilot survey with a student research team to study how a politician's gender affects the response to their messaging about the COVID-19 pandemic.

Research Assistant, Statistical and Mathematical Sciences Institute (SAMSI) Causal Inference Program, (2019-2020)
- Conduct research with Professor Volfovsky on causal inference methods.
- Developed models for causal mediation in text data. Methods were focused on treatments effects potentially mediated by changes in news consumption.

Teaching Assistant, Duke University (Fall 2018, Fall 2020)
- Head TA for Statistics 111 (introductory statistics), Statistics 440 (undergraduate case studies), and Statistics 640 (graduate case studies).
- Created interactive lab assignments to explore expected earnings by college major and forecast the 2020 presidential election.
- Taught causal inference lecture and designed case study to evaluate the effect of the Tennessee STAR experiment.

AWARDS
Duke Rhodes Information Initiative Data Expedition
- Funded to create a module to introduce undergraduates to text analysis at both introductory and advanced levels.
- Materials developed will be posted for use by others as part of the Duke Information Initiative.

Robert E. Will Memorial Prize
- Awarded to the Carleton College economics major who best exemplifies excellent academic achievement and breadth of intellectual interests.

TECHNICAL SKILLS
- **R**: Monte Carlo posterior sampling methods, data visualization, analysis, and cleaning.
- **Python**: web scraping and data analysis.
- **Stata**: data analysis and cleaning.