

# MARGARET J. FOSTER

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## PROFESSIONAL SUMMARY

Scrappy and creative PhD data scientist with 8 years of experience translating hypotheses into data analysis, statistical modeling, machine learning, and quantitative research designs. I excel in uncovering patterns that reveal actionable insights and identifying opportunities to produce new products using existing data resources. A gifted communicator, I am passionate about connecting across diverse audiences and teams.

## SKILLS

**Data Science & Quantitative Research:** Causal Inference, Data Analysis, Data Visualization, Experiments, Machine Learning, Research Design, Network Analysis, Statistical Analysis, Presentations, Teaching, Writing

**Programming Languages & Tools:** R, Python, SQL, Bash, Jupyter Notebook, R Studio, Git, Visual Studio Code

## EDUCATION

### Duke University

August 2014 - May 2020

*PhD, Political Science (Applied Statistics)*

GPA: 3.67

Coursework in: Bayesian Statistics, Network Analysis, Probability and Statistics, Research Design, Quantitative Methodology

### McGill University

August 2008 - February 2011

*MA, Political Science*

GPA: 3.59

### University of Pennsylvania

August 2004 - May 2007

*BA, International Relations*

GPA: 3.33

Honors: Cum Laude with Distinction in International Relations, Dean's List 2006-2007

## PROFESSIONAL EXPERIENCE

### Duke University

Durham, NC, USA

*Postdoctoral Research Fellow*

July 2023 - Present

- Led a team in designing and validating a novel Bayesian Item Response Theory model, enhancing latent dimension estimation and expanding measurement capabilities. Created real and synthetic datasets for model application.
- Scaled the model into a data product by leading a team that refactored code for distribution as an R package and developed 3 novel applications and 4 manuscripts for peer review.
- Developed and applied advanced statistical models in R and Python to analyze 100k+ data points, preparing results for peer review. Presented the results with visualizations (Ggplot, Plotly) and interactive dashboards (Dash)
- Utilized Python (Pandas, Matplotlib, Seaborn) for data analysis and prediction, showcasing regression and decision tree techniques.
- Deployed and validated NLP and LLM models to speed up project bottlenecks, demonstrating advanced analytics and deep learning skills.

### University of North Carolina - Chapel Hill

Chapel Hill, NC, USA

*Postdoctoral Research Fellow*

July 2020 - July 2023

- Utilized machine learning and statistical modeling to analyze large event datasets, identifying changes in 300+ militant groups and developing novel measures of geopolitical risk.
- Created statistical programs to extract, transform, and manage structured and unstructured data using Python and R libraries such as numpy, pandas, scikit-learn, NLTK, and ggplot.
- Developed and implemented custom frameworks to evaluate machine learning models, leading to improved model performance.
- Refactored ETL and NER pipeline from Bash, Python, and Java to Python and R, cutting the workflow and processing time by 200%.
- Delivered virtual workshops on AI and NLP to United Nations DPO and provided technical advice on using machine learning and AI for real-time measurement of initiatives (such as Action4Peace and peace agreements).
- Taught R programming, data science, and causal inference skills to 20+ undergraduates, fostering in-depth engagement with course topics.

### Duke University

Durham, NC, USA

*Doctoral Researcher*

August 2014- May 2020

- Designed and executed analytical hypothesis-testing research using statistical analysis, machine learning, quantitative text analysis, and network methodologies.
- Developed original text datasets of 50,000+ content items from jihadi supporters (scraped from Telegram, Twitter, Ask.fm, and other social network platforms); 1,000 al-Qaeda documents posted online and on social networks; and 125 meeting minutes (8,500 speaker paragraphs) from the World Trade Organization.

- Prepared and delivered presentations to quantitative and non-quantitative stakeholder audiences, distilling complex methods into narrative-focused storytelling; taught research design and statistical analysis to undergraduate and graduate students.

## **SITE Intelligence Group**

*Senior Analyst  
Analyst*

**Bethesda, MD, USA**

*May 2010 - August 2014*

*June 2007 - August 2008*

- Identified and led new organizational competencies in jihadi-supporting and far-right online extremist communities through fast-moving qualitative research on multiple data platforms.
- Produced high-quality strategic analysis and expert-level reports on core areas of expertise, meeting tight deadlines for media and government clients.
- Conducted collaborative threat identification and qualitative research in French and English, training and leading junior analysts on analysis and presentations.

## **PROJECTS**

### **Measurement That Matches Theory**

*Project Lead*

*2020 - 2024*

- Led a team in designing, implementing, and validating a fully Bayesian Item Response Theory model to identify latent factors from 100k survey responses in 50+ countries, resulting in novel insights on political risk and engagement.
- Developed a data pipeline to merge and synthesize datasets on political mobilization, creating a database of 45k events by 2k unique actors spanning 45 years, utilizing statistical modeling (ANOVA, K-S tests, correlation tests, GLM models, Bayesian sampler) in R.
- Executed data visualization in R using ggplot2 tools to communicate complex data findings effectively.
- Main project page: <https://github.com/dasiegel/IRT-M>

### **Subject to Change**

*Creator*

*2021 - 2021*

- Developed a new instrument for predicting geopolitical risks using ML and NLP utilizing open-source data on 100k news reports, estimated for 300+ militant groups.
- Applied machine learning techniques (k-means clustering, random forest, t-SNE, and support vector machines) to quantify temporal patterns in news articles, improving statistical models predicting conflict termination
- Produced an interactive visualization of key metrics, hosted online at <https://stc-visualizer.onrender.com>

### **Dominos**

*Creator*

*2022 - 2022*

- Designed and implemented a bespoke dynamic network simulation in R (using dyplr and igraph) that simulates tie-based recruitment and collapse of a social network. Implemented functionality in which nodes update state according to network typology.
- Simulated social contagion on 10k+ network combinations, varying topology and node attributes; analyzed and interpreted the results of the experiment and presented key conclusions to both technical and non-technical audiences.

### **Developing Gridlock: Frames of Contestation at the World Trade Organization**

*Technical Lead*

*2018 - 2022*

- Led the technical initiative to computationally model 8k+ text exchanges covering 117 meetings of the World Trade Organization
- Engineered an analysis pipeline using Natural Language Processing (NLP), named entity recognition, data mining, and data visualization to model negotiations across 20 years of international organization meetings.
- Collaborated with cross-functional stakeholders to translate abstract questions and unstructured data into statistical tests and summary visualizations, including visualizations of topic frequency, speaker transitions, changes in content sentiment and length, and text reuse.

## **PUBLICATIONS**

- Morucci Marco, **Margaret J. Foster**, So Jin Lee, Kaitlyn Webster, and David Siegel. "Measurement that Matches Theory." Forthcoming, American Political Science Review.
- **Foster, Margaret J.** "Gig Economy Insurgency." Conditionally Accepted (December 2023), Studies in Conflict and Terrorism "Subject to Change." Accepted (May 2024), Political Science Research and Methods
- **Foster, Margaret J.** "Gig Economy Insurgency." Conditionally Accepted (December 2023), Studies in Conflict and Terrorism
- **Foster, Margaret J.** and Tana Johnson. "Power of the Weak." Invitation to Revise & Resubmit. Third World Quarterly
- Minhas, Shahryar, Cassy Dorff, **Margaret J. Foster**, Max Gallop, Juan Tellez, Howard Liu, and Michael Ward. 2021. "Taking Dyads Seriously: A Latent Network Approach for Global Politics." Political Science Research & Methods.
- **Foster, Margaret J.**, and David A Siegel. 2019. "Pink Slips from the Underground: Changes in Terror Leadership." International Studies Quarterly. 63 (2):231-243.