

# Daniel Quigley

Linguistics and Mathematics PhD Candidate | [dquigleydev@gmail.com](mailto:dquigleydev@gmail.com) | (414) 335-2754  
[dquigley.dev](https://dquigley.dev) | [github.com/deltaquebec](https://github.com/deltaquebec) | [linkedin.com/in/quigley-daniel](https://linkedin.com/in/quigley-daniel)

## Education

### University of Wisconsin-Milwaukee

Milwaukee, WI | 2025

*PhD: Linguistics | Artificial Intelligence | Computer Science*

- Interdisciplinary PhD research across linguistics, mathematics, philosophy, and logic
- **Advisors:** Nicholas Fleisher, Hamid Ouali (linguistics) | Jeb Willenbring (mathematics) | Matthew Knachel (philosophy and logic)

### University of Wisconsin-Milwaukee

Milwaukee, WI | 2023

*MA: Linguistics*

- Interdisciplinary MA research across linguistics, computer science, logic, and mathematics
- **Advisors:** Nicholas Fleisher, Hamid Ouali (linguistics) | Susan McRoy (computer science)

### Universiteit Utrecht

Utrecht, The Netherlands | 2019

*MSc Certificate: Theoretical Physics*

- Interdisciplinary Graduate Honors recipient
- Completed Master's coursework in Theoretical Physics and Mathematics

### University of Wisconsin-Madison

Madison, WI | 2018

*BSc: Anthropology | Astronomy | Linguistics | Mathematics | Physics*

- Record holder for number of majors
- **Advisors:** Stefan Westerhoff (physics, astronomy, mathematics) | Monica Macaulay (linguistics) | J. Mark Kenoyer (anthropology)

## PhD Research

### University of Wisconsin-Milwaukee

Milwaukee, WI | Aug 2020 – Current

*Theoretical Linguistics | Mathematics | Artificial Intelligence | Natural Language Processing*

- Conducting research in interpretable neuro-symbolic artificial intelligence and natural language processing on problems in natural language understanding, knowledge representations, and semantic representations.
- Developing mathematical models for computably tractable neuro-symbolic architectures for formal semantics and vector space semantics for logical reasoning tasks.
- Proving morphisms between intensional semantics and vector space semantics using model-theoretic, group-theoretic, and category-theoretic frameworks.
- Developing first- and second-order logic representations for intensional semantics in the context of category theory.
- Designing algorithms and computing their space and time complexities to facilitate interpretable language processing for logical reasoning tasks.
- Exploring theoretical foundations in the context of graph and group theory to explain model architectures for deep neural networks.

## MA Research

### University of Wisconsin-Milwaukee

Milwaukee, WI | Aug 2020 – May 2023

*Theoretical Linguistics | Mathematics | Artificial Intelligence | Natural Language Processing*

- Designed and proved PSPACE-hard algorithms for language processing based on extensional and intensional semantics.
- Proved homomorphism between discrete intensional semantics models and vector space semantics.
- Derived tensor forms for semantic representations of various linguistic phrasal types and constructions in hyperbolic spaces.

## MSc Research

### Universiteit Utrecht

Utrecht, The Netherlands | Aug 2018 – Jul 2019

*Theoretical Physics: Graduate Interdisciplinary Honors*

- Completed coursework in Theoretical Physics, with a focus on high energy physics, cosmology, and gravitational physics.
- Completed coursework in Mathematics, with a focus on differential geometry, geometric partial differential equations, and geometric flows.
- Applied scientific expertise to interdisciplinary applications across multiple departments, including presenting independent research on geography and climate science to colleagues in the honors seminar.

<b>University of Wisconsin-Madison</b> <i>Indus Valley Civilization Undergraduate Researcher</i> <ul style="list-style-type: none"><li>Reconstructed broken strings of written data from the Indus Valley Script using <math>n</math>-gram Markov chains and conditional entropy, and applied statistical analysis techniques to analyze the data using Python.</li><li>Collaborated with international colleagues to analyze the Indus Valley Script data, resulting in the creation of sign frequency scores that showed the context in which different symbols were used.</li><li>Presented results at an international academic conference.</li></ul>	Madison, WI   Oct 2015 – May 2018
<b>University of Wisconsin-Madison</b> <i>Wisconsin Baldwin Idea Grant Project Assistant</i> <ul style="list-style-type: none"><li>Coordinated with team of students and academic advisors to work with Menominee elders with Menominee language data elicitation and transcription.</li><li>Recorded and documented language data for preservation and revitalization, and prepared teaching materials for language preservation and revitalization efforts.</li><li>Results of work integrated into Menominee reference grammar (to be published).</li></ul>	Madison, WI   Oct 2014 – May 2018
<b>Wisconsin IceCube Particle Astrophysics Center</b> <i>High Energy Astroparticle Physics Research Assistant</i> <ul style="list-style-type: none"><li>Designed and implemented simulations, data acquisition systems, and visualizations for HAWC (High-Altitude Water Cherenkov) gamma-ray detector.</li><li>Resolved discrepancies in gamma-ray results across four international experiments; wrote GPS data system using ZeroMQ in C++.</li><li>Communicated results of simulations and technical developments with international teams, demonstrating strong collaboration and communication skills.</li></ul>	Madison, WI   Oct 2014 – May 2018

Internship Experience

<b>Fujitsu Limited</b> <i>Visiting Scientist</i> <ul style="list-style-type: none"><li>Collaborated on an 8-week project with Graduate-level Research in Industrial Projects for Students (G-RIPS), UCLA Institute for Pure and Applied Mathematics (IPAM) and Fujitsu Limited, focusing on explanatory and interpretable AI in causal modeling.</li><li>Reverse-engineered underlying mathematics of Fujitsu's "Wide Learning" classification machine learning model for causal AI.</li><li>Developed a logical framework for feature relationships in Pearlean causal models.</li><li>Developed a classifier model for causal graph structures using graph-theoretic hierarchical metrics.</li><li>Designed an interactive, accessible interface for causal graph representation, incorporating language, vision-based, and machine-readable features for explanatory and interpretable AI in causal modeling.</li></ul>	Sendai, Japan   Jun 2024 – Aug 2024
<b>Apple</b> <i>Career Experience: Production Engineer</i> <ul style="list-style-type: none"><li>Tested and deployed demo content to channel stores across iOS, tvOS, watchOS, and macOS platforms from development to production.</li><li>Developed, maintained, and documented sophisticated automation frameworks, using Python scripting to enhance operational efficiency.</li><li>Resolved failing Wi-Fi connectivity across demo devices by investigating plist data structures for discrepancies; resolved publishing content issues for by region and device.</li><li>Validated content in twenty-one languages across twenty-five locales sensitive to local content and language requirements while crafting comprehensive test plans and technical documentation for new features and internal tools.</li></ul>	Cupertino, CA   Jul 2023 – Nov 2023

Presentations and Publications

<b>Presentations</b> <ul style="list-style-type: none"><li>Forde, John and Mendez, Gaspar and Okubo, Akane and <b>Quigley, Daniel</b> and Sakamoto, Renji (2024). <i>Fujitsu Causal Discovery: a novel interactive platform for conditional causal discovery</i>. Fujitsu Limited.</li><li><b>Quigley, Daniel</b> (2024). <i>Be Reasonable! Relating Logical Models and Vector Spaces for NLP Interpretability</i>. Workshop in General Linguistics.</li><li><b>Quigley, Daniel</b> (2024). <i>Getting Started with <math>\LaTeX</math></i>. Workshop in General Linguistics.</li><li><b>Quigley, Daniel</b> (2024). <i>Merge: Syntax-Semantics as a Hopf Algebra</i>. Algebraic Structures Seminar.</li><li><b>Quigley, Daniel</b> (2024). <i>Natural Language Understanding as Tensor Product Models</i>. Algebraic Structures Seminar.</li><li><b>Quigley, Daniel</b> (2024). <i>A Primer on the Mathematics of Artificial Neural Networks</i>. Graduate Student Colloquium.</li><li><b>Quigley, Daniel</b> (2023). <i>Tensor Space and Category-Theoretic Semantics for Resolving Long-Distance Linguistic Expressions in Natural Language Processing</i>. PhD preliminary paper and presentation.</li><li><b>Quigley, Daniel</b> (2023). <i>Decoding Authorial Style, Tone, and Mood in Poetic Translations through Natural Language Processing: An Analysis of Beowulf</i>. Workshop in General Linguistics.</li></ul>	
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- **Quigley, Daniel** (2023). *L<sup>A</sup>T<sub>E</sub>X for Linguists*. Summer Workshop.

## Publications

- Forde, John and Mendez, Gaspar and Okubo, Akane and **Quigley, Daniel** and Sakamoto, Renji (2024). *Fujitsu Causal Discovery: a novel interactive platform for conditional causal discovery*. Fujitsu Limited.
- **Quigley, Daniel** (2024). *Categorical Framework for Typed Extensional and Intensional Models in Formal Semantics*. Manuscript submitted for review. arXiv.
- **Quigley, Daniel** (2024). *Be Reasonable! Relating Logical Models and Vector Spaces for NLP Interpretability*. In Proceedings: Workshop in General Linguistics.
- **Quigley, Daniel** (2023). *Exploring Category-Theoretic Morphisms for Model-Theoretic Semantics*. Manuscript submitted for review.
- **Quigley, Daniel** (2023). *Decoding Authorial Style, Tone, and Mood in Poetic Translations through Natural Language Processing: An Analysis of Beowulf*. In Proceedings: Workshop in General Linguistics.

## Project Experience

### University of Wisconsin-Milwaukee

Milwaukee, WI | Aug 2020 – Present

#### L<sup>A</sup>T<sub>E</sub>X Developer

- Designed L<sup>A</sup>T<sub>E</sub>X document templates, accepted by university as official resources for graduate school.
- Created document tagging and readability methods to improve designs of accessible PDF documents.
- Developing intelligent UIs for improved accessibility of PDF documents, improving usability for users with accessibility needs and machine readability.

### University of Wisconsin-Madison

Milwaukee, WI | May 2021

#### Data Visualization and Sentiment Analysis of Movie Reviews across Four Neural Network Models

- Conducted a comprehensive comparison of performance metrics for polarity sentiment analysis of movie reviews using deep learning techniques, including the design of four different machine learning architectures (CNN, RNN, RCNN, LSTM).
- Compared the performance of the different model architectures across ten epochs, with a cutoff for validation loss, and achieved an accuracy rate of greater than 83% for each model.
- Demonstrated expertise in the application of deep learning techniques to natural language processing tasks through the successful execution and analysis of this research project.

### University of Wisconsin-Madison

Milwaukee, WI | May 2021

#### ML Optimization: No Free Lunch

- Optimized, evaluated, and compared performance scores for classification machine learning tasks: Decision Tree Classifier; K-Nearest Neighbor; Multinomial Naive Bayes; Logistic Regression; SVC; Dummy Classifier; Neural Network.
- Optimized, evaluated, and compared performance scores for regression machine learning tasks: Decision Tree Regressor; Linear Regression; SVR; Dummy Regressor; Neural Network.
- Evaluated CNN architectures of image classification task using the Fashion-MNIST dataset.

### University of Wisconsin-Madison

Milwaukee, WI | Jul 2020

#### Linux from Scratch

- Completed *Linux from Scratch* project, building a fully functional Linux distribution from scratch using source code and following project documentation, demonstrating strong problem-solving and troubleshooting skills to resolve issues during build process.
- Developed deep understanding of Linux operating system, including kernel, system libraries, and userland utilities, and improved skills in working with source code and building software from ground up.
- Created a customized Linux distribution that met specific needs and preferences, showcasing ability to tailor a system to meet unique requirements.

## Work Experience

### Apple

Glendale, WI | Oct 2021 – March 2024

#### Genius Technician

- Demonstrated leadership while also mentoring Technical Specialists and Technical Experts | developed and implemented new processes to improve efficiency and effectiveness of Genius Bar team.
- Exceeded expectations for customer satisfaction: attained performance review scores of 88 TMS and 74 NPS, excelling in metrics for technical expertise (89) and empathy (80).
- Certified for iPhone and Mac repair, maintaining 95% repair rate on devices.

### University of Wisconsin-Milwaukee

Milwaukee, WI | Aug 2020 – Present

#### Instructor of Record

- Responsible for class sizes of 20-30 students per semester, providing comprehensive support and guidance.
- Designed course content to include topics in natural language processing, such as introductory concepts and artificial intelligence ethics.
- Providing effective feedback and communication to improve performance, demonstrating commitment to student success and learning.

## Graduate Teaching Experience

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<b>Linguistics 100:</b> <i>Instructor of Record</i>	Fall 2024
<b>Linguistics 100:</b> <i>Instructor of Record</i>	Spring 2024
<b>Linguistics 100:</b> <i>Instructor of Record</i>	Fall 2023
<b>Linguistics 210:</b> <i>Instructor of Record</i>	Spring 2023
<b>Linguistics 100:</b> <i>Instructor of Record</i>	Fall 2022
<b>Linguistics 210:</b> <i>Instructor of Record</i>	Spring 2022
<b>Linguistics 210:</b> <i>Instructor of Record</i>	Fall 2021
<b>Linguistics 210:</b> <i>Teaching Assistant</i>	Spring 2021
<b>Linguistics 210:</b> <i>Teaching Assistant</i>	Fall 2020

## Graduate Coursework

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**Linguistics:** Phonetics | Phonology | Morphology | Syntax | Semantics | 2nd Language Acquisition | Seminar: Ellipsis | Typology and Universals | Historical and Comparative Linguistics | Seminar: Research Methods | Seminar: Double Object Constructions | Advanced Phonetics | Advanced Phonology | Advanced Syntax | Advanced Semantics | Foundations of Formal Logic | Advanced Independent Study

**Computer Science:** Machine Learning and Applications | Introduction to Natural Language Processing | Introduction to Artificial Intelligence | Artificial Intelligence in Business | Advanced Independent Study | Advanced Machine Learning | Algorithm Design and Analysis

**Physics:** Quantum Field Theory | Statistical Field Theory | General Relativity | String Theory | Field Theory in Particle Physics | Cosmology | Radiative Processes | High Energy Astrophysics

**Mathematics:** Differential Geometry | Geometric Partial Differential Equations | Mathematical Methods in Theoretical Physics | Algebraic Structures

## Professional Interests

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**Linguistics:** formal logic | mathematical models | model theory | ellipsis | double object constructions | transitivity mismatches | case stacking | construction grammar | scope | binding | degree and comparison | typology | language change

**Computer Science:** algorithm design | complexity | formal logic | mathematical models | model theory | machine learning methods for language processing | human language technologies | human-computer interaction

**Artificial Intelligence:** neural networks | natural language processing | explainable artificial intelligence | geometric neural networks | graph neural networks

**Physics:** gravitational physics | black hole physics | early universe physics | topological defects | quantum field theory in curved spacetime | inverse problem for Lagrangians

**Mathematics:** category theory | group theory | differential geometry | geometric PDEs | geometric flows | Ricci flow | operator theory | formal logic | model theory | inverse problems

**Anthropology:** writing | calendrical systems | power and social relations | gender | ethnoarchaeology | archaeoastronomy

## Professional Affiliations

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**American Mathematical Society (AMS)**  
**American Physical Society (APS)**  
**Association for Computational Linguistics (ACL)**  
**Association for the Advancement of Artificial Intelligence (AAAI)**  
**Language Creation Society (LCS)**  
**Linguistic Society of America (LSA)**

## Honors and Awards

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<b>University of Wisconsin-Milwaukee:</b> <i>Graduate Teaching Assistantship</i>	Aug 2020 – Current
<b>University of Wisconsin-Milwaukee:</b> <i>Chancellor's Graduate Student Award</i>	2020, 2023
<b>Universiteit Utrecht:</b> <i>Graduate Honors</i>	2019
<b>University of Wisconsin-Madison:</b> <i>Record - Number of Majors (5)</i>	2018

## Skills

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**Data skills:** Technical writing | Data collection, annotation, processing, visualization, statistical analysis, machine learning (Python: NumPy, Keras, Scikit-Learn, NLTK, Pandas, Matplotlib, TensorFlow, Mathematica, LiNGAM) | Technical documentation

**Project skills:** Written and oral presentation and communication | Qualitative and quantitative research methods | Problem solving | Experiment design | Language data collection and analysis | Team work and team leadership

**Technical skills:** Python |  $\LaTeX$  | Excel | Praat | R | SPSS | regex | SQL (basic) | HTML (basic) | Jekyll (basic)

**Operating Systems and Software:** Linux | Windows | MacOS | Conda | CUDA (GPU Programming) | MS Office Suite

# Languages

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**Native:** English  
**Conversational:** German  
**Elementary:** Dutch | Finnish | Japanese  
**Some Study:** Menominee | Arabic (MSA) | Sanskrit | Georgian