Daniel Quigley

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Education

University of Wisconsin-Milwaukee Milwaukee, WI | 2025

PhD: Linguistics | Mathematics | 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.

BSc Research

University of Wisconsin-Madison Madison, WI | Oct 2015 – May 2018

Indus Valley Civilization Undergraduate Researcher

- Reconstructed broken strings of written data from the Indus Valley Script using n-gram Markov chains and conditional entropy, and applied statistical analysis techniques to analyze the data using Python.
- 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.
- Presented results at an international academic conference.

University of Wisconsin-Madison Madison, WI | Oct 2014 – May 2018

Wisconsin Baldwin Idea Grant Project Assistant

- Coordinated with team of students and academic advisors to work with Menominee elders with Menominee language data elicitation and transcription.
- Recorded and documented language data for preservation and revitalization, and prepared teaching materials for language preservation and revitalization efforts.
- Results of work integrated into Menominee reference grammar (to be published).

Wisconsin IceCube Particle Astrophysics Center Madison, WI | Oct 2014 – May 2018

High Energy Astroparticle Physics Research Assistant

- Designed and implemented simulations, data acquisition systems, and visualizations for HAWC (High-Altitude Water Cherenkov) gamma-ray detector.
- Resolved discrepancies in gamma-ray results across four international experiments; wrote GPS data system using ZeroMQ in C++.
- Communicated results of simulations and technical developments with international teams, demonstrating strong collaboration and communication skills.

Internship Experience

Fujitsu Limited Sendai, Japan | Jun 2024 – Aug 2024

Visiting Scientist

- 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.
- Reverse-engineered underlying mathematics of Fujitsu's "Wide Learning" classification machine learning model for causal AI.
- Developed a logical framework for feature relationships in Pearlean causal models.
- Developed a classifier model for causal graph structures using graph-theoretic hierarchical metrics.
- 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.

Apple Cupertino, CA | Jul 2023 – Nov 2023

Career Experience: Production Engineer

- Tested and deployed demo content to channel stores across iOS, tvOS, watchOS, and macOS platforms from development to production.
- Developed, maintained, and documented sophisticated automation frameworks, using Python scripting to enhance operational efficiency.
- Resolved failing Wi-Fi connectivity across demo devices by investigating plist data structures for discrepancies; resolved publishing content issues for by region and device.
- 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.

Presentations and Publications

Presentations

- 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). *Be Reasonable! Relating Logical Models and Vector Spaces for NLP Interpretability*. Workshop in General Linguistics.
- **Quigley, Daniel** (2024). *Getting Started with LaTeX*. Workshop in General Linguistics.
- **Quigley, Daniel** (2024). *Merge: Syntax-Semantics as a Hopf Algebra*. Algebraic Structures Seminar.
- **Quigley, Daniel** (2024). *Natural Language Understanding as Tensor Product Models*. Algebraic Structures Seminar.
- **Quigley, Daniel** (2024). *A Primer on the Mathematics of Artificial Neural Networks*. Graduate Student Colloquium.
- **Quigley, Daniel** (2023). *Tensor Space and Category-Theoretic Semantics for Resolving Long-Distance Linguistic Expressions in Natural Language Processing*. PhD preliminary paper and presentation.
- **Quigley, Daniel** (2023). *Decoding Authorial Style, Tone, and Mood in Poetic Translations through Natural Language Processing: An Analysis of Beowulf*. Workshop in General Linguistics.

- **Quigley, Daniel** (2023). *LaTeX 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

LaTeX Developer

- Designed LaTeX 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

University of Wisconsin-Milwaukee Milwaukee, WI | Aug 2024 – Present

Research Assistant

- Designing AI causal models for battery health and failure in collaboration with Clarios.
- Developing algorithms for data explanation and interpretability of causal relationships for battery health and failure, using LiNGAM models and classification machine learning.
- Developing visual representations for data, causality, and explainability for battery health and failure.

Eruditis Milwaukee, WI | Jun 2024 – Present

Contract: Machine Learning Scientist

- Developing mathematical models for AI-enhanced algorithmic trading systems intended for non-institutional investors.
- Derived mathematical model and representation for financial metrics adaptable to investor profile parameters.
- Wrote documentation and instruction for Python code and underlying mathematics for internal app development.

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

Linguistics 100: *Instructor of Record* Fall 2024
Linguistics 100: *Instructor of Record* Spring 2024
Linguistics 100: *Instructor of Record* Fall 2023
Linguistics 210: *Instructor of Record* Spring 2023
Linguistics 100: *Instructor of Record* Fall 2022
Linguistics 210: *Instructor of Record* Spring 2022
Linguistics 210: *Instructor of Record* Fall 2021
Linguistics 210: *Teaching Assistant* Spring 2021
Linguistics 210: *Teaching Assistant* Fall 2020

Graduate Coursework

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

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

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

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

Skills

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 | regexp | SQL (basic) | HTML (basic) | Jekyll (basic)
Operating Systems and Software: Linux | Windows | MacOS | Conda | CUDA (GPU Programming) | MS Office Suite

Languages

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