

# Selena Wang

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*Network Science, Brain Imaging, Bayesian Analysis, Psychometrics.*

## MAJOR RESEARCH INTERESTS

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### Methodology

- Social network analysis, network neuroscience
- High dimensional data analysis, clustering
- Neuroimaging, connectome-behavior linking
- Imaging genetics, imaging-genetics linking
- Psychometrics, item response theory, latent factor models
- Data integration
- Statistical machine learning, statistical philosophy

### Application

- Children psychopathology and disorders
- Neurodegeneration through aging and Alzheimer's disease
- Social factor of learning, racial homophily
- International politics, networked military mobility, terrorist recruitment

## ACADEMIC APPOINTMENT

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### Yale University

Postdoctoral Associate, Department of Biostatistics

Current

– Advisor: [Yize Zhao](#)

## EDUCATION

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### The Ohio State University

Ph.D. in Quantitative Psychology, Department of Psychology

2022

– Thesis: “Modeling dependence between a network and item responses.”

– Advisor: [Paul De Boeck](#)

M.S. in Statistics

– Thesis: “Joint analysis of social and item response networks with latent space models.”

M.A. in Quantitative Psychology

– Thesis: “When reliability does not signal reliable detection of experimental effects.”

### University of Minnesota, Twin Cities

2017

B.S. in Psychology, Summa cum Laude with Highest Distinction

### University of Amsterdam

2016

Visiting student

## PUBLICATIONS

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15 total, 8 accepted, 2 revision, 5 methodology innovations, 10 first-author.

### 2023+

1. Xu, W., **Wang, S.**, Shen, L., & Zhao, Y. (n.d.). Collaborative survival analysis on predicting alzheimer's disease progression. *Under Review*.
2. Qiu, W., Chu, H., **Wang, S.**, Zuo, H., Li, X., Zhao, Y., & Ying, Z. (n.d.). Learning high-order relationships of brain regions. *Under Review*.
3. **Wang, S.**, Paul, S., & Sweet, S. (n.d.). The co-varying dynamics between networks and item responses via latent vectors. *In Revision*.
4. **Wang, S.**, Li, Z., De Boeck, P., & Cho, S. (n.d.). Precision and accuracy of parameter estimates from binary time series analysis of eye fixations. *In Revision*.
5. Tian, X., Wang, Y., **Wang, S.**, Zhao, Y., & Zhao, Y. (n.d.). Bayesian mixed model inference for genetic association under related samples with brain network phenotype. *Biostatistics (Revision)*. ([arXiv](#))
6. **Wang, S.**, Liu, Y., Xu, W., Tian, X., & Zhao, Y. (n.d.). Inference-based statistical network analysis uncovers star-like brain functional architectures for internalizing psychopathology in children. *In Revision*. ([arXiv](#))
7. **Wang, S.**, Wang, Y., Xu, F. H., Shen, L., & Zhao, Y. (n.d.). Establishing group-level brain structural connectivity incorporating anatomical knowledge under latent space modeling. *Medical Image Analysis (Revision)*. ([arXiv](#))

### 2023

8. **Wang, S.**, Paul, S., & De Boeck, P. (2023). Joint latent space model for social networks with multivariate attributes. *Psychometrika*, 1–31. ( [paper](#), [code](#) )
9. **Wang, S.**, De Boeck, P., & Yotobieng, M. (2023). Heywood cases in unidimensional factor models and item response models for binary data. *Applied Psychological Measurement*, 47(2), 141–154. ([paper](#), [arXiv](#))
10. Mishra, N. K., Kwan, P., Tanaka, T., Sunnerhagen, K. S., Dawson, J., Zhao, Y., ... others (2023). Clinical characteristics and outcomes of patients with post-stroke epilepsy: protocol for an individual patient data meta-analysis from the international post-stroke epilepsy research repository (ipserr). *BMJ open*, 13(11), e078684. ([paper](#))

### 2022

11. **Wang, S.** & Edgerton, J. (2022). Resilience to stress in bipartite networks: application to the islamic state recruitment network. *Journal of Complex Networks*, 10(4), cnac017. ([paper](#))
12. **Wang, S.** & De Boeck, P. (2022). Understanding the role of subpopulations and reliability in between-group studies. *Behavior Research Methods*, 1–16. ([paper](#))
13. **Wang, S.**, Wu, H., & Pek, J. (2022). Performance of alternative regression weights in the context of prediction versus inference (abstract). *Multivariate Behavioral Research*, 57(1), 163–163. ([abstract](#), [poster](#))

## 2021-2019

14. **Wang, S.** (2021). Recent integrations of latent variable network modeling with psychometric models. *Frontiers in Psychology*, 12. ([paper](#))
15. Jamrozik, A., Clements, N., Hasan, S. S., Zhao, J., Zhang, R., Campanella, C., ... others (2019). Access to daylight and view in an office improves cognitive performance and satisfaction and reduces eyestrain: A controlled crossover study. *Building and Environment*, 165, 106379. ([paper](#))

## GRANT EXPERIENCES

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- **Trajectory-based Multimodality Brain-age Delta AD Prediction across Life Span (2023)**  
Agency: National Institute of Aging  
Status: Pending  
Role: Principle Investigator
- **Gender and racial measurement bias in vocational interest assessment (2016-2017)**  
Agency: UROP Grant, University of Minnesota  
Amount: 2,100  
Status: Completed  
Role: Principle Investigator

## TEACHING

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- **Lead instructor of the course** at the Ohio State University (SEI available) Fall 2020, Spring 2021  
*Introduction to Psychology (PSYCH 1100)*
  - Lead online courses during pandemic
  - Develop syllabus
  - Design course assignments
  - Deliver live lectures
- **Teaching Assistant** at the Ohio State University Fall 2018 –Spring 2020  
*Quantitative and Statistical Methods in Psychology (PSYCH 3321)*  
*Data Analysis in Psychology (PSYCH 2220)*
  - Design and grade course assignments
  - Quest lecture at weekly lab and review sessions
  - Tutor students and hold office hours

## STUDENT MENTEES (GRADUATE)

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### **Yunhe Liu**

Master student, Biostatistics, Yale University

- Training in high speed computing, coding, statistics methodology and paper writing

### **Yiting Wang**

Master student, Biostatistics, Yale University

- Training in coding, simulation and paper writing
- Now PhD student of Statistics at University of Virginia

## SOFTWARES

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- **jlsm**: An R package estimating joint latent space models for social networks and multivariate attributes using a fast inference approach.  
Link: <https://cran.r-project.org/web/packages/jlsm/jlsm.pdf>
- **jnirm**: An R package estimating the joint network and item response model accompanying the dissertation.  
Available upon request

## HONOURS, AWARDS AND FELLOWSHIPS

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- DETxDigital Harbor Fellowship in Computational Psychometrics, Duolingo English Test 2021
- Finalist, Student Paper Competition, IISA 2021
  - Project: Joint latent space model for social networks with high-dimensional multivariate attributes.
- Ray Travel Award (for Service and Scholarship), Graduate Student Council, Ohio State 2020
- Graduate Student Conference Presentation Award, Ohio State 2018, 2019
- The International Meeting of the Psychometric Society Travel Award 2019
  - Project: The integration of social network analysis with psychometric models.
- Algorithms for Threat Detection (ATD) Travel Award 2018
  - Project: Joint Analysis of Social and Item Response Networks with Latent Space Models.
- College of Arts and Sciences Division of Social and Behavioral Sciences (SBS) Fellowship, Ohio State 2018
- Distinguished University Fellowship, Ohio State 2017, 2022
- Donald G. Paterson Award, Minnesota Psychological Association 2017
- Innovative Community Building Grants Award, University of Minnesota 2016
- Undergraduate Research Opportunities Program Grant, University of Minnesota 2016
  - Project: Gender and racial measurement bias in vocational interest assessment.
- Global Excellence Scholarship, University of Minnesota (4-years of in-state tuition) 2013

## TALKS

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### Invited Presentations

1. **S. Wang** “The integration of psychometric and network models for behavior and neuroscience research”, *University of Maryland, College Park, April, 2023*.
2. **S. Wang** “The integration of psychometric and network models for educational research”, *Michigan State University, February, 2023*.
3. **S. Wang** “The integration of psychometric and network models for educational research”, *University of Nebraska, Lincoln, January, 2023*.
4. **S. Wang**, J.R. Lockwood, and Y. Attali, “Fitting psychometric models to digital-first assessment”, *Duolingo English Test, August, 2021*.
5. **S. Wang**, S. Paul, and P. De Boeck, “Joint latent space model for social networks with high-dimensional multivariate attributes.”, *International Indian Statistical Association Conference, May, 2021*.
6. **S. Wang**, S. Paul, J. Logan, and P. De Boeck, “Joint modeling of network and psychometric data”, *International Meeting of Psychometric Society, July, 2019*.

## National & Regional Conferences

7. **S. Wang**, Y. Wang, F. Xu, L. Shen and Y. Zhao, “Establishing group-level brain structural connectivity incorporating anatomical knowledge under latent space modeling”, *Statistical Methods in Imaging Conference 2023*, May, 2023.
8. W. Qiu, **S. Wang**, X. Li, Y. Zhao, R. Ying “, Understanding Interactions of ROIs via Learnable Hyperedges (Poster)”, *Organization for Human Brain Mapping*, July, 2023.
9. **S. Wang**, Y. Wang, F. Xu, L. Shen and Y. Zhao, “Identifying Gender based Neuromarkers of Alzheimer’s Disease Using ABC Network Model” (Poster), *Organization for Human Brain Mapping*, July, 2023.
10. P. De Boeck **S. Wang** and S. Cho, “Binary Time Series for Eye Fixations: The Quality of Parameter Estimates”, *National Council on Measurement in Education Conference*, April, 2023.
11. P. De Boeck and **S. Wang**, “Pervasive measurement bias”, *Quantitative Methodology Center 2022 Conference*, June, 2022.
12. **S. Wang**, J.R. Lockwood, and Y. Attali, “Fitting psychometric models to digital-first assessment”, *National Council on Measurement in Education*, April, 2022.
13. **S. Wang**, S. Paul, and P. De Boeck, “Modeling classroom outcome with network analysis”, *National Council on Measurement in Education*, April, 2022, cancelled.
14. **S. Wang**, S. Paul, and P. De Boeck, “Joint latent space model for social networks with high-dimensional multivariate attributes”, *International Meeting of Psychometric Society*, July, 2021.
15. **S. Wang**, S. Paul, J. Logan, and P. De Boeck, “Joint modeling with network analysis and psychometrics”, *Geometry and Topology meet Data Analysis and Machine Learning*, May, 2019.
16. **S. Wang**, S. Paul, J. Logan, P. De Boeck, “Joint Analysis of Social and Item Response Networks with Latent Space Models”, *Algorithms for Threat Detection (ATD)*, November, 2018.
17. **S. Wang** and P. De Boeck, “Does low reliability lead to low replication rates?”, *International Meeting of Psychometric Society*, July, 2018.
18. **S. Wang**, B. Wiernik and B. Morgan, “Gender measurement bias versus trait differences in vocational interest assessment.”, *Society for Industrial and Organizational Psychology conference*, April, 2017
19. C.D. Nye, J. J. Prasad, J.C.Bradburn, F.Elizondo, W.M.J.Phan, R.Amrhein, S.Cho, J.Rounds, B.M.Wiernik, **S.Wang**, B.Morgan, C.J.M.We, E.Wetzel, D.Ispas, “New directions for vocational interest research in organizations.”, *Society for Industrial and Organizational Psychology conference*, April, 2017

## Colloquiums & Symposiums

20. **S. Wang** and J. Edgerton, “Disrupting terrorist recruitment: Network knockouts of Islamic State recruiters.”, *OSU Psychological Studies Quantitative Colloquium*, 2021.
21. **S. Wang** and J. Edgerton, “Disrupting terrorist recruitment: Network knockouts of Islamic State recruiters.”, *OSU Political Science Studies Methodological Colloquium*, 2021.
22. **S. Wang** and P. De Boeck, “Understand reliability with the reliability paradox.”, *OSU Psychological Studies Quantitative Colloquium*, 2020.
23. **S. Wang**, S. Paul, J. Logan, and P. De Boeck, “A joint modeling framework for social network analysis and psychometrics”, *OSU Psychological Studies Quantitative Colloquium*, 2019.
24. **S. Wang** and P. De Boeck, “The role of reliability in the replication crisis.”, *OSU Psychological Studies Quantitative Colloquium*, 2018.
25. **S. Wang**, “Applications of differential item functioning analysis with item response theory.”, *Undergraduate Research Symposium*, April, 2016.

## RELEVANT EXPERIENCES

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### Department of Biostatistics/Yale University

Postdoctoral Associate

Current

- Predictive Bayesian methods for fMRI, behavior and genetics data
- Write scientific publications with strong methodology components.
- Mentor master students of biostatistics to conduct scientific research.
- Present in professional statistical conferences.
- Manage multiple statistical projects and coordinate collaborations.

### Assessment Team/Duolingo English Test

Computational Psychometrics fellow

Summer 2021

- Estimation of IRT parameters for AI-generated test items.
- Perform simulations with multidimensional IRT models.
- Write a proposal accepted and presented at NCME.
- Give a company-wide presentation.

### Well Living Lab/Mayo Clinic & Delos Research Company

Data Analyst Intern

Summer 2017

- Wellness in the workspace.
- Collect and clean the Stroop Test data and record Inhibition Reaction Time Data.
- Liaise between behavioral scientists and administrative staff to ensure success of the studies.

## SKILLS

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- **Software:** R, Python, SAS, Github, FLEXMirt, Mplus, SPSS
- **Statistical Frameworks:** Network Analysis, Bayesian Inference, Latent Variable Models, Generalized Linear Models, Variational Inference, Statistical Machine learning
- **Psychometrics:** Classical Test Theory, Item Response Theory, Item and Test analyses, Differential Item Functioning, Multidimensional Item Response Theory, Covariance Structure Models, Factor Analysis
- **Soft Skills:** Communication, Project Management, Documentation, Public Speaking, Team Collaboration

## SERVICES

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- Ad Hoc Review
  - Developmental Science*
  - Big Data Mining*
  - President's Research Excellence (PRE) program Catalyst concept papers*
  - National Council on Measurement in Education*
- Conference
  - Organize session on Statistical Methods for Brain Connectomes, SMI 2023 (Speakers include Dr. Yi Zhao (Indiana) and Dr. R.J. Liu (Florida))*
  - Chair for parallel sessions, International Meeting of Psychometric Society (2018,2021)*
  - Planning committee, Translational Data Analytics Institute Fall Forum (2021)*
- Consulting
  - Consultation for a COVID and mobility research project at the College of Public Health, Ohio State University*
  - Consultation for a network project at the College of Medicine, Ohio State University*
- School/Departmental

*Graduate Student Diversity, Equality and Inclusivity Committee, Ohio State University (2021)*  
*Quantitative Psychology Group, Ohio State University (2019)*  
*Discussion Panel, the Office of Diversity and Inclusion, Ohio State University (2019)*  
*Psychology Diversity Council, University of Minnesota (2016)*  
*International and LGBT+ A Panel Discussion, University of Minnesota (2015)*  
*Orientation committee, International Student and Scholar Services, University of Minnesota (2015)*

- Professional Organizations

*Columbus Metropolitan Library (2020)*  
*American Statistical Association, the Caucus for Women in Statistics (2019)*  
*State Science Day (2019)*

## CURRENT/PAST COLLABORATORS

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### **Tracy Sweet**

Associate Professor, QMMS, University of Maryland

– Collaborations: Network Methodology

### **J.R. Lockwood**

Principal Assessment Scientist, Assessment Team, Duolingo English Test

– Collaborations: Psychometric models

### **Hao Wu**

Associate Professor, Peabody College, Vanderbilt University

– Collaborations: Machine learning, statistical philosophy

### **Jolynn Pek**

Associate Professor, Quantitative Psychology, Ohio State University

– Collaborations: Unit weight, statistical philosophy

### **Jared Edgerton**

Assistant Professor, Political Science, University of Texas at Dallas

– Collaborations: Networked military mobility, terrorist recruitment

### **Carolyn Fredericks**

Assistant Professor, Neurology, Yale University

– Collaborations: Alzheimer's research

### **Subhadeep Paul**

Associate Professor, Statistics, Ohio State University

– Collaborations: Network/Psychometric Methodology

### **Ryan O'Dell**

Assistant Professor, Psychiatry, Yale University

– Collaborations: ADNI Hearing Loss

### **Nishant Mishra**

Assistant Professor, Neurology, Yale University

– Collaborations: Stroke

### **Todd Constable**

Professor, Radiology and Biomedical Imaging, Yale University

– Collaborations: fMRI computational modeling

**Li Shen**

Professor, Informatics and Radiology, University of Pennsylvania

- Collaborations: medical image computing, bioinformatics and machine learning

**Xiaoxiao Li**

Assistant Professor, Electrical and Computer Engineering, University of British Columbia

- Collaborations: Hypergraph

**Rex Ying**

Assistant Professor, Computer Science, Yale University

- Collaborations: Hypergraph

**Jessica Logan**

Associate Professor, Special Education, Vanderbilt University

- Collaborations: Children social networks and learning outcomes

## REFERENCES

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**Yize Zhao**

Associate Professor, Biostatistics, Yale University

- Email: [yize.zhao@yale.edu](mailto:yize.zhao@yale.edu)

**Paul De Boeck**

Professor, Quantitative Psychology, Ohio State University

- Phone: 614-292-4131
- Email: [deboeck.2@osu.edu](mailto:deboeck.2@osu.edu)
- Career Award for Lifetime Achievement, Psychometric Society

**Hao Wu**

Associate Professor, Peabody College, Vanderbilt University

- Phone: 615-343-0364
- Email: [hao.wu.1@Vanderbilt.Edu](mailto:hao.wu.1@Vanderbilt.Edu)
- Associate Editor of British Journal of Mathematical and Statistical Psychology

**Subhadeep Paul**

Associate Professor, Department of Statistics, Ohio State University

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- Email: [paul.963@osu.edu](mailto:paul.963@osu.edu)

**J.R. Lockwood**

Principal Assessment Scientist, Assessment Team, Duolingo English Test

- Email: [jr@duolingo.com](mailto:jr@duolingo.com)

**Melissa Beers (teaching)**

Program Director, Ohio State University

- Phone: 614-292-7143
- Email: [beers.3@osu.edu](mailto:beers.3@osu.edu)
- Mentorship of Teachers Award, Society for the Teaching of Psychology (APA Div. 2)