

CAITLIN SUSAN TENISON

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BIO

Dr. Caitlin Tenison has over 10 years' experience in Cognitive Neuroscience studying the neural underpinnings of higher-order cognition. Her research focuses on identifying the learning mechanisms and cognitive changes that underlie the acquisition of cognitive skill. She has experience analysing EEG, MEG, and fMRI brain imaging modalities both using traditional signal processing approaches and extending machine learning methods to detect latent cognitive states and cope with rich time-series data. Her work is characterized by the use of multi-modal data to provide convergent evidence of the state of an individual. She also has experience designing research studies, using cognitive behavioral test-batteries, and working with diverse patient populations.

Keywords: Cognitive Modeling, Skill Acquisition, Problem Solving, Science of Learning, Data-mining

EDUCATION

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| 2016- 2017 | Postdoctoral Researcher
Carnegie Mellon University , Pittsburgh, PA
<i>Supervisor:</i> Dr. John R. Anderson |
| 2011- 2016 | Ph.D. in Psychology
Carnegie Mellon University , Pittsburgh, PA
<i>Affiliations:</i> Program for Interdisciplinary Education Research,
Pittsburgh Science of Learning Center
<i>Advisor:</i> Dr. John R. Anderson
<i>Committee:</i> Dr. Robert Siegler & Dr. Marcel Just |
| 2005-2009 | B.A. in Psychology and Plan II Honors
University of Texas , Austin, TX
GPA 4.0 Cum Laude Ampla et Magna |

PUBLICATIONS

Journal Articles

Tenison, C., Fincham, J., & Anderson, J. (2016). Phases of learning: How skill acquisition impacts cognitive processing. *Cognitive Psychology*. 87,1-28.

Jolles, D., Supekar, K., Richardson, J., Tenison, C., Ashkenazi, S., Rosenberg-Lee, M., Fuchs, L., & Menon, V. (2016). Reconfiguration of parietal circuits with cognitive tutoring in elementary school children. *Cortex*. 83, 231-245.

- Jolles, D., Wassermann D., Chokani, R., Richardson, J., Tenison, C., Bammer, R., Supekar, K., Menon, V. (2016). Plasticity of left perisylvian white-matter tracts is associated with individual differences in math learning. *Brain Structure and Function*. 221(3), 1337-1351.
- Tenison, C., & Anderson, J. (2015). Modeling the distinct phases of skill acquisition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 42(5), 749-767.
- Iuculano, T., Rosenberg-Lee, M., Richardson, J., Tenison, C., Fuchs, L., Supekar, K., & Menon, V. (2015). Cognitive tutoring induces widespread neuroplasticity and remediates brain function in children with mathematical learning disabilities. *Nature Communications*, 6.
- Tenison, C., Fincham, J., & Anderson, J. (2014). Detecting math problem solving strategies. An investigation into the use of retrospective self-reports, latency and fMRI data. *Neuropsychologia*, 54, 41-52.
- Supekar, K., Swigart, A., Tenison, C., Jolles, D., Rosenberg-Lee, M., Fuchs, L., & Menon, V. (2013). Neural predictors of individual differences in response to math tutoring in primary-grade school children. *PNAS*. 11(20), 8230-8235.
- White, M. P., Shirer, W. R., Molfino, M. J., Tenison, C., Damoiseaux, J. S., & Greicius, M. D. (2013). Disordered reward processing and functional connectivity in trichotillomania: a pilot study. *Journal of Psychiatric Research*, 47(9), 1264-1272.
- Ashkenazi, S., Rosenberg-Lee, M., Tenison, C., & Menon, V. (2012). Weak task-related modulation and stimulus representations during arithmetic problem solving in children with developmental dyscalculia. *Developmental Cognitive Neuroscience*, 2(1), 152-166.

Peer-Reviewed Conference Papers

- Tenison, C., & Anderson, J. (2017, July). *Impact of practice frequency on learning and retention*. Presented at the 39th Conference of the Cognitive Science Society, London, UK
- Popov, V., Ostarek, M. & Tenison, C. (2017, July). *Inferential pitfalls in decoding neural representations*. Presented at the 39th Conference of the Cognitive Science Society, London, UK
- Tenison, C. (2016, June). *Modeling the phases of skill acquisition*. Presented at the 4th annual Advances in Cognitive Systems: Students of Cognitive Systems Workshop, Evanston, IL.

Tenison, C., & MacLellan, C. J. (2015, June). *The Impact of Instructional Intervention and Practice on Help-Seeking Strategies within an ITS*. In Proceedings of the 8th International Conference on Educational Data Mining, Madrid, Spain.

Tenison, C. & Anderson, J. (2014, July). *Detecting Changes in Math Strategy During Learning*. In Proceedings of the 36th Conference of the Cognitive Science Society, Quebec City, Canada.

Tenison, C., & MacLellan, C. J. (2014, June). *Modeling Strategy Use in an Intelligent Tutoring System: Implications for Strategic Flexibility*. In Proceedings of the 12th International Intelligent Tutoring Systems, Honolulu, HI.

Tenison, C., & Anderson, J. (2014, June). *An Exploration of Two Methods for using fMRI to identify Student Problem Solving Strategies*. In Proceedings of Workshop "Utilizing EEG Input in Intelligent Tutoring Systems" at the 12th International Intelligent Tutoring Systems, Honolulu, HI.

Conference Presentations

Tenison, C., & Anderson, J. (2016, August). *From computation to automatization: How practice alters initial neural response to familiar arithmetic problems*. Presented at the 38th Conference of the Cognitive Science Society, Philadelphia, PA.

Tenison, C., & Anderson, J. (2015, May). *Exploring skill acquisition with cognitive and brain-based models*. Paper presented at the 8th annual Inter-Science of Learning Center Student and Post-Doc Conference, San Diego, CA.

Tenison, C., & Anderson, J. (2013, June). *Detecting math problem solving strategies using retrospective self-reports, latency, and fMRI data*. Presented at the Organization for Human Brain Mapping, Seattle, WA.

Tenison, C., & Anderson, J. (2013, February). *Assessing strategy use in a fMRI study of arithmetic training*. Presented at the Inter-Science of Learning Center Student and Post-Doc Conference, Philadelphia, PA.

Rosenberg-Lee, M., Escovar, E., Tenison, C., Khouzam, A., & Menon, V. (2012, October). *Dynamic changes in brain response and connectivity associated with arithmetic fact learning in children*. Presented at Society for Neuroscience, New Orleans, LA.

Jolles, D., Rosenberg-Lee, M., Ashkenazi, S., Supekar, K., Tenison, C., Duan, X., Uddin, L., Fuchs, L., & Menon, V. (2012, October). *Math training strengthens intrinsic connectivity of parietal cortex in children*. Presented at Society for Neuroscience, New Orleans, LA.

- Rosenberg-Lee, M., Escovar, E., Tenison, C., Khouzam, A., & Menon, V. (2012, August). *How do children learn math facts?* Presented at EARLI SIG Neuroscience and Education, London, UK.
- Jolles, D., Rosenberg-Lee, M., Supekar, K., Tenison, C., Ashkenazi, S., Duan, X., & Menon, V. (2012, August). Math training changes intrinsic brain connectivity of the intraparietal sulcus. Presented at EARLI SIG Neuroscience and Education, London, UK.
- Rosenberg-Lee, M., Young, C., Tenison, C., Geary, D., & Menon, V. (2010, June). *Neural Correlates of Developmental Dyscalculia in Children: Univariate and Multivariate Analysis*. Presented at Human Brain Mapping Annual Meeting, Barcelona, SP.
- Pacheco, J., Dailey, N., Olivares, M., Tenison, C., & Schnyer, D. (2009, March) *An fMRI examination of the Effects of Aging on Memory Monitoring for Source and Item Recognition*. Presented at Cognitive Neuroscience Society Meeting, San Francisco, CA.
- Trujillo, L., Tenison, C., Dailey, D., & Schnyer, D. (2009, March). An ERP Examination of the *Differential Effects of Sleep Deprivation on Endogenously Cued and Exogenously Cued Attention*. Presented at Cognitive Neuroscience Society Meeting, San Francisco, CA.
- Goldwater, M., Schnyer, D., Markman, A., Williams, V., Tenison, C., & Dailey, N. (2008, April) *An Event Related Potential Analysis of Novel Denominal Verb Interpretation*. Presented at Cognitive Neuroscience Society Meeting, San Francisco, CA.

Manuscripts in Progress

- Tenison, C., Fincham, J., & Anderson, J. (In prep). From computation to automatization: How practice alters initial neural response to familiar arithmetic problems.
- Anderson, J., Borst, J., Fincham, J., Ghuman, A., Tenison, C., & Qiong, Z. (In prep). The temporal structure of memory retrieval.

GRANTS RECEIVED

- 2014-2015 National Science Foundation, Science of Learning Centers. Award No. SMA-1430662. (Co-Author with Chris MacLellan and Audrey Kittredge) *Conference: A Proposal to the National Science Foundation for Support of the Seventh Annual Inter-Science of Learning Centers (iSLC) Student / Postdoctoral Scholar Conference*

RESEARCH EXPERIENCE

- 2011-2017 ACT-R Laboratory
Carnegie Mellon University
 Dr. John R. Anderson, Principal Investigator
 Researching methods for modeling cognition by combining multiple sources of data with specific focus on detecting cognitive changes due to skill acquisition using brain and behavioral data
- 2013-2015 Interdisciplinary Independent Project
Carnegie Mellon University
 Collaboration with Christopher MacLellan, PhD student
 Developing a domain general data-mining technique that can identify strategy use and strategic flexibility using student interactions with intelligent tutoring system software
- 2009-2011 Social Science Research Assistant
 Stanford Cognitive and Systems Neuroscience Laboratory
Stanford University
 Dr. Vinod Menon, Principal Investigator
 Designed and conducted an NIH-funded study of the neural effects of math remediation on children with math learning disabilities
- 2008-2009 Undergraduate Research
 Undergraduate Honors Program
University of Texas at Austin
 Dr. Charles Holahan and Dr. David Schnyer, Advisors
 Designed and implemented experiment investigating the interdependence between the neural networks of music and language through priming word recognition using familiar songs
- 2007-2009 Research Assistant
 Schnyer Lab
University of Texas at Austin
 Working with Dr. David Schnyer and Jennifer Pacheco
 Studied the effects of aging on memory monitoring using fMRI
- Working with Dr. David Schnyer and Dr. Logan Trujillo
 Studied the differential effects of sleep deprivation on cued attention using Electrophysiology (EEG)
- Working with Dr. David Schnyer and Micah Goldwater
 Used EEG to study how people interpret and understand novel denominal verbs

SKILLS

Analysis Packages	Matlab, R, and SPSS.
Statistical Skills	Data mining techniques (e.g., hidden Markov modeling, linear discriminant analysis, principal components analysis), regression, hierarchical linear modeling, Bayesian modeling
Research Methods	Designing experiments, administering and scoring neuropsychological evaluations, working with participants between ages 7 – 80 years old, recruiting and scheduling subjects, cognitive task analysis, managing lab, overseeing and mentoring research assistants
Brain Imaging Methods	Collecting functional, structural and diffusion tensor imaging (DTI) scans using a G.E. 3.0-tesla MRI magnet Collecting magnetoencephalography (MEG) data Analyzing fMRI data using software packages: AFNI and FSL and SPM Analyzing MEG data using MNE 72-channel electrophysiology (EEG) recording with the BioSemi System

HONORS AND AWARDS

2016	Conference Travel Grant <i>National Science Foundation</i> For attendance of the 4 th annual Advances in Cognitive Systems Conference
2016	Bobby Klatzky Graduate Student Publication Award <i>Carnegie Mellon University</i> Given annually for outstanding performance in scholarly research and writing.
2015	Latin American School for Education, Cognitive, and Neural Sciences <i>The James S. McDonnell Foundation</i> Selected to attend a two-week international meeting of students and faculty to discuss bridging between education and brain sciences.
2015	Dick Hayes Graduate Student Service Award <i>Carnegie Mellon University</i> Given annually to the graduate student who contributes time and service to the department
2011	San Francisco Regional MENSA Scholarship <i>San Francisco Regional MENSA</i>

2008-2009 Funding provided for attending graduate school
The Undergraduate Research Fellowship & Undergraduate Honors Research Grant
University of Texas at Austin
Provides research funding for undergraduate research projects

2005-2009 Terry Scholar
University of Texas at Austin
Full academic scholarship for four years of college

SERVICE

2015-2016 PIER Graduate Student Representative
Program for Interdisciplinary Education Research
Represented the graduate students at the Steering Committee meetings

2013-2014 Conference Organizer
Inter-Science of Learning Center Student and Postdoc Conference
Organized and hosted the 7th Annual iSLC conference in Pittsburgh bringing together students from Science of Learning Centers from across the United States

2013-2014 Organizer of Brain and Machine Learning Meetings
Collaboration between Psychology and Machine Learning
Organized series of talks to foster dialogue between Machine Learning and Psychology Departments

2013-2014 PIER Speaker Series Organizer
Program for Interdisciplinary Education Research
Invited and organized guest speakers series

2012-2013 President
Pittsburgh Science of Learning Center Student Group
Organized meetings, professional development, and attended executive committee meetings as representative for graduate students of the PSLC

2011-2012 Student Committee Member
Carnegie Mellon University - Human Computer Interaction Institute
Involved in planning curricula and requirements for the Masters in Educational Technology and Applied Learning Science program