Benjamin Neal Conrad, PhD
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Google Scholar
CV date: August 9th, 2021

Summary

Recently completed a doctoral degree in Neuroscience (Cognitive and Systems track) at Vanderbilt University. Interested in leveraging neuroimaging, data science, and machine learning techniques for clinical and scientific insight. Expertise in image analysis, statistics and machine learning, scientific programming, data visualization, and cognitive-behavioral research methods.

Education

- Ph.D. in Neuroscience, Cognitive and Systems Track (GPA: 4.0) Aug 2016-Aug 2021
  Neuroscience Graduate Program
  Vanderbilt University, Nashville, TN
  Dissertation: **Conrad, BN**. "Numerals in the Ventral Stream: Brain Architecture and Development"

- B.S. in Pre-Graduate Psychology, Magna Cum Laude (GPA: 3.8) Aug 2009-Dec 2012
  Graduate of Honors College
  Minors in Neuroscience and Philosophy
  Middle Tennessee State University, Murfreesboro, TN
  Honors Thesis: **Conrad, BN**. "Electrophysiological Correlates of Morpho-Syntactic Processing in Spoken English."

- High School Degree 2005-2009
  Franklin High School, Franklin, TN

Research Experience

- **Research Scientist** Sep 2021-Present
  - Numerical Brain Lab, Psychology and Human Development, Vanderbilt University, Advisor: Dr. Gavin Price (80%)
  - Stress and Early Adversity Lab, Psychology and Human Development, Vanderbilt University, Advisor: Dr. Kathryn Humphreys (20%)
- **Graduate Research Assistant** Aug 2017-Aug 2021
  - Numerical Brain Lab, Psychology and Human Development, Vanderbilt University
  - Independent and collaborative research on number processing in children and adults
  - Management of lab MRI collection, data servers, and data processing
  - Mentorship and training of multiple undergraduate, masters, and staff research assistants
  - Advisor: Dr. Gavin Price
- **Graduate Teaching Assistant** Jan 2020-May 2020
  - Computational Neuroscience (NSC3270-S20) grader
  - Project-based neural networks and machine learning course using Python
  - Advisor: Dr. Sean Polyn

- **Graduate Research Assistant** Feb 2019-Nov 2019
    - Hourly position (part-time) with the Stress and Early Adversity Lab, Psychology and Human Development, Vanderbilt University
    - Infant and pregnant mother MRI protocol development and analysis
    - Advisor: Dr. Kathryn Humphreys
- **Graduate Research Assistant** Aug 2016-Aug 2017
    - Independent projects involving spinal cord fMRI in healthy and multiple sclerosis populations
    - Advisors: Dr. John Gore and Dr. Seth Smith
- **Research Assistant II**, Vanderbilt University Institute of Imaging Science Mar 2015-Aug 2016
    - Increased emphasis on independent analyses and scientific writing
    - Responsibilities in teaching and managing undergraduates/new staff members
- **Research Assistant I**, Vanderbilt University Institute of Imaging Science Dec 2013-Mar 2015
    - Involved with multiple MRI research projects looking at function and structure of both brain and spinal cord in patients and healthy controls
    - Including multiple sclerosis, epilepsy, and concussion populations
    - Organize, schedule, and oversee MRI scanning sessions
    - Manage data processing pipelines, including projects on XNAT system
    - Conduct independent analyses for multiple PI's
    - Report and present scientific findings at seminars and conferences
    - NIRS technician
- **EEG Research Assistant**, Brain and Language Lab, MTSU Jan 2011-Dec 2012
    - EEG/ERP language and music research lab
    - Involved in every aspect of research from experiment design and coding, to data acquisition and analysis
    - Attended CUNY Conference on Human Sentence Processing. University of South Carolina, Columbia, SC. Mar 2013
- **Programming languages**: full proficiency in MATLAB, working proficiency in Python, Unix
- Experience with most widely-used neuroimaging software including AFNI, FSL, MRtrix3, SPM, CONN, MIPAV, GraphVar, and XNAT. Also Photoshop, EPrime, JASP, Jamovi, PsychToolbox, SPSS, Praat, Netstation.

Outreach

- **Volunteer** – Brain Blast Mar 2019
    - Ran eye-tracking booth for Vanderbilt Brain Institute's annual community outreach event for children K-8th
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    - Ran eye-tracking booth for Vanderbilt Brain Institute's annual community outreach event for children K-8th
- **Instructor** – Summer Academy at Vanderbilt for the Young (SAVY) July 2018
    - Course: "Neuroscience Navigators" – Vanderbilt Programs for Talented Youth
    - Taught gifted students, rising 2nd-3rd graders
    - Designed and developed curriculum covering broad range of neuroscience topics
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Awards/Honors

- Data Science Essentials trainee, course offered by the Vanderbilt's BRET Career Development ASPIRE Program. Sept 2020-May 2021
- Attended the Brain Connectivity Workshop 2018, Stanford, CA, with funds awarded from Department of Psychology and Human Development, Vanderbilt University. June 2018
- Outstanding Poster Award (top rated poster) for **Conrad BN**, Maki S, Watchmaker JM, Box BA, Barry RL, Smith SA, and Gore JC, "Functional MRI of the Cervical Spinal Cord" at Frontiers of Biomedical Imaging Science VI Conference, Nashville TN. May 2017
- Summa Cum Laude (top 5% abstracts) ISMRM merit award for **Conrad BN**, Maki S, Watchmaker JM, Box BA, Barry RL, Smith SA, Gore JC, "BOLD Signal Changes in Spinal Cord with Hypercapnia." ISMRM, Honolulu, HI. April 2017
- Awarded funds by VUIIS Faculty as an RA for travel and registration to:
  - Conference on Resting State/Brain Connectivity and Pre-conference Educational Workshop. Massachusetts Institute of Technology, Boston, MA. Sept 2014
  - International Society of Magnetic Resonance in Medicine (ISMRM) Annual Meeting and Educational Workshop. Toronto, ON, Canada. Jun 2015
- Phi Kappa Phi Honor Society, Member 2011-2012
- Institute of Leadership Excellence, MTSU Jun 2012
  Highly selective (25 students), faculty nominated summer program focused on leadership development for promising students
- The Top Scorer on General Exit Exam, University Honors College Dec 2012
- URECA Undergraduate Research Assistantship Stipend, MTSU Dec 2011
- Scholastic Merit Scholarship 2009-2011

Journal Publications (submitted or in preparation)

1. **Conrad BN**, Pollack C, Price GR (*in prep*). "Connectivity constraints on symbol areas in the occipitotemporal cortex." Analysis of structural and task-evoked functional connectivity of the inferior temporal numeral areas and letter area in neuro-typical adults.
2. **Conrad BN** & Price GR (*in prep*). "Functional development of inferior temporal numeral areas from kindergarten through 2nd grade." Analysis of functional specificity, selectivity, representational geometry, and connectivity of symbol areas in longitudinal sample of neuro-typical children.
3. Yeo DJ, Pollack C, **Conrad BN,** Price GR (*in prep*). "Probing the Hemispheric Asymmetry of Representations in the Bilateral 'Inferior Temporal Numeral Area' During Visual Search". fMRI representational similarity analysis of symbol detection task involving numbers and letters.

Journal Publications (accepted)

1. Barry, RL†, **Conrad BN** †, Maki S†, Watchmaker JM, Mckeithan LJ, Box BA, Weinberg QR, Smith SA, Gore JC. "Multi-shot acquisitions for stimulus-evoked spinal cord BOLD fMRI." (†authors contributed equally). *Magnetic Resonance in Medicine* 2020. 00:1– 11. https://doi.org/10.1002/mrm.28570
2. **Conrad BN**, Wilkey ED, Yeo DJ, Price GR. "Network topology of symbolic and nonsymbolic number comparison." *Network Neuroscience* 2020;1-32. https://doi.org/10.1162/netn_a_00144

3. **Conrad BN**, Barry RL, Rogers BP, Maki S, Thukral S, Sriram S, Bhatia A, Mishra A, Pawate S, Gore JC, Smith SA. "Multiple Sclerosis Lesions Affect Intrinsic Functional Connectivity of the Spinal Cord." *Brain* 2018; 141(6):1650-1664. https://doi.org/10.1093/brain/awy083
4. **Conrad BN**, Rogers BP, Abou-Khalil B, Morgan VL. "Increased MRI Volumetric Correlation Contralateral to Seizure Focus in Temporal Lobe Epilepsy." *Epilepsy Research* 2016; 126:53-61. https://doi.org/10.1016/j.eplepsyres.2016.07.001
5. Cai LY, Yang Q, Kanakaraj P, Nath V, Welch EB, Newton AT, Edmonson HA, Luci J, **Conrad BN**,... Landman, BA. "MASiVar: Multisite, multiscanner, and multisubject acquisitions for studying variability in diffusion weighted MRI." *Magnetic Resonance in Medicine* 2021; 00:1-17. https://doi.org/10.1002/mrm.28926
6. Cai LY, Yang Q, Hansen CB, Nath V, Ramadass K, Johnson GW, **Conrad BN**,... Landman, BA. "PreQual: An automated pipeline for integrated preprocessing and quality assurance of diffusion weighted MRI images." *Magnetic Resonance in Medicine* 2021. 86(1):456-470. https://doi.org/10.1002/mrm.28678
7. Wilkey, ED, **Conrad, BN**, Price GR. "Shared numerosity representations across formats and tasks revealed with 7 Tesla fMRI: decoding, generalization, and individual differences in behavior." *Cerebral Cortex Communications* 2020. 1(1):1-19. https://doi.org/10.1093/texcom/tgaa038
8. Merkley, R, **Conrad, B**, Price, G, & Ansari, D. "Investigating the visual number form area: A replication study." *Royal Society Open Science* 2019; 6(10). https://doi.org/10.1098/rsos.182067
9. McKeithan, LJ, Lyttle, B D, Box, BA, O'Grady, KP, Dortch, RD, **Conrad, BN**,... Smith, SA (2019). "7T quantitative magnetization transfer (qMT) of cortical gray matter in multiple sclerosis correlates with cognitive impairment." *NeuroImage* 2019; 203(September), 116190. https://doi.org/10.1016/j.neuroimage.2019.116190
10. Barry RL, **Conrad BN**, Smith SA, Gore JC. "A practical protocol for clinical translation of measurements of spinal cord functional connectivity." *Scientific Reports* 2018; 8(1):16512. https://doi.org/10.1038/s41598-018-34841-6
11. O'Grady, K.P, Dula, AN, Lyttle, BD, Thompson, LM, Conrad, BN, Box, BA, McKeithan, LJ, Pawate, S, Bagnato, F, Landman, BA, Newhouse, P, Smith, SA. Glutamate-sensitive imaging and evaluation of cognitive impairment in multiple sclerosis. *Multiple Sclerosis Journal* 2019; 25, 1580–1592. https://doi.org/10.1177/1352458518799583
12. Prados F, Ashburner J, Blaiotta C, Brosch T, Carballido-Gamio J, Cardoso MJ, **Conrad BN**,... Cohen-Adad J. "Spinal cord grey matter segmentation challenge." *NeuroImage* 2017;152:312-329. https://doi.org/10.1016/j.neuroimage.2017.03.010
13. Xu Z, **Conrad BN**, Baucom RB, Smith SA, Poulose BK, Landman BA. "Abdomen and spinal cord segmentation with augmented active shape models." *Journal of Medical Imaging* 2016; 3(3):036002. https://doi.org/10.1117/1.JMI.3.3.036002
14. Banks SD, Coronado RA, Clemons L, Abraham CM, Pruthi S, **Conrad BN**, Morgan VL, Guillamondegui OD, Archer KR. "Thalamic functional connectivity in mild traumatic brain injury: Longitudinal associations with patient-reported outcomes and neuropsychological tests." *Archives of Physical Medicine and Rehabilitation* 2016;97(8):1254-61. https://doi.org/10.1016/j.apmr.2016.03.013
15. Barry RL, Rogers BP, **Conrad BN**, Smith SA, Gore JC. "Reproducibility of resting state spinal cord networks in healthy volunteers at 7 Tesla." *NeuroImage* 2016;133:31-40. https://doi.org/10.1016/j.neuroimage.2016.02.058
16. Dula AN, Pawate S, Dethrage LM, **Conrad BN**, Barry RL, Smith SA. "Chemical exchange saturation transfer of the cervical spinal cord at 7T." *NMR in Biomedicine* 2016;29(9):1249-57. https://doi.org/10.1002/nbm.3581

17. Harrigan RL, Yvernault BC, Boyd BD, Damon SM, Gibney KD, **Conrad BN**, Phillips NS, Rogers BP, Gao Y, Landman BA. "Vanderbilt University Institute of Imaging Science Center for Computational Imaging XNAT: A multimodal data archive and processing environment." *NeuroImage* 2016;124:1097-1101. https://doi.org/10.1016/j.neuroimage.2015.05.021
18. Morgan VL, **Conrad BN**, Abou-Khalil B, Rogers BP, Kang H. "Increasing structural atrophy and functional isolation of the temporal lobe with duration of disease in temporal lobe epilepsy." *Epilepsy Research* 2015;110:171-178. https://doi.org/10.1016/j.eplepsyres.2014.12.006

Oral Presentations

1. **Conrad BN**. "Numerals in the Ventral Stream: Brain Architecture and Development." Vanderbilt Neuroscience Graduate Program. July 29th, 2021. Nashville, TN. Dissertation Defense
2. **Conrad BN**, Price GR. "Distinct connectivity profiles underlie digit and letter preference in the ventral visual stream." Vanderbilt Brain Institute Research Forum. October 30th, 2020. Nashville, TN. Oral Presentation
3. **Conrad BN**, Price GR. "Functional Coupling of the Inferior Temporal Gyrus During Digit Processing." Vanderbilt Brain Institute Research Forum. December 6th, 2019. Nashville, TN. Oral Presentation
4. **Conrad BN**, Price GR. "Neural mechanisms of digit processing in kindergartners – An fMRI study." Cognitive Science of Learning and Development, Flash Talk. September 6th, 2019. Nashville, TN. Oral Presentation
5. **Conrad BN**, Price GR. "Neural mechanisms of digit processing in kindergartners – An fMRI study." FLUX Congress Annual Meeting, Flash Talk. August 30th, 2019. New York, NY. Oral Presentation
6. **Conrad BN**, Price GR. "Digit Processing in Typically-Developing Kindergartners." Vanderbilt Brain Institute Nano-Symposium. March 20th, 2019. Nasvhille, TN. Oral Presentation
7. **Conrad BN**, Wilkey ED, Price GR. "Network Topology of Symbolic and Nonsymbolic Number Processing: A 7T fMRI Study." Cognitive Neuroscience Society Annual Meeting, DataBlitz Session 3. March 24th, 2018. Boston, MA. Oral presentation
8. **Conrad BN**, Maki S, Watchmaker JM, Box BA, Barry RL, Smith SA, Gore JC. "Functional MRI of the Cervical Spinal Cord." 14th Annual VUIIS Retreat, 2017. Nashville, TN. Oral Presentation
9. **Conrad BN**. "Structural Covariance analysis using standard T1's: Methods and application in temporal lobe epilepsy." Vanderbilt Psychiatric Neuroimaging Program Seminar. March 30th 2015. Nashville, TN. Oral Presentation
10. **Conrad BN**, Merkle K, Morgan VL. "Morphometric analysis in TLE." 11th Annual VUIIS Retreat, 2014. Nashville, TN. Oral Presentation

Conference/Poster Presentations

1. **Conrad BN**, Price GR. "The development of numeral processing in the ventral visual stream: A longitudinal fMRI study." FLUX Congress Annual Meeting, Virtual. September 2021. Traditional Poster
2. **Conrad BN**, Price GR. "Connectivity profiles of numeral-preferring areas in the inferior temporal cortex. Annual meeting of the Organization for Human Brain Mapping, Virtual. June 2021. Traditional Poster
3. **Conrad BN**, Price GR. "Does selective coupling precede selective activity? A study of numeral processing in kindergartners." Annual meeting of the Organization for Human Brain Mapping, Virtual. June 2020. Traditional Poster

4. **Conrad BN**, Price GR. "Does the pITG demonstrate selective coupling during numeral processing in kindergartners? - An fMRI study of task-evoked connectivity." Annual meeting of the Vision Sciences Society, Virtual. June 2020. Traditional Poster https://doi.org/10.1167/jov.20.11.1710
5. **Conrad BN**, Price GR. "Neural mechanisms of digit processing in kindergartners – An fMRI study." FLUX Congress Annual Meeting. August 30th, 2019. New York, NY. Traditional Poster. *Selected for oral presentation (Flash Talk), one of only 18 of 296 posters with this distinction
6. **Conrad BN**, Price GR. "Task-evoked connectivity of the putative number form area in typically developing kindergartners." Mathematical Cognition and Learning Society annual meeting. Ottawa, ON. June 16th 2019. Traditional Poster
7. **Conrad BN**, Wilkey ED, Price GR. "Frontoparietal reorganization during symbolic and nonsymbolic number processing." Society for Neuroscience Annual Meeting, Poster Session. November 2018. San Diego, CA. Dynamic Poster. *Selected for Dynamic Poster, one of only 135 abstracts with this distinction.
8. **Conrad BN**, Yeo DJ, Pigg RA, Kaminski AM, Venanzi LD, Price GR. "Symbol processing in healthy kindergartners: An event-related fMRI study." International Mind, Brain, and Education Society biennial conference. Los Angeles, CA. September 2018. Traditional Poster
9. **Conrad, BN**, Wilkey ED, Price GR. "Network Topology of Symbolic and Nonsymbolic Number Processing: A 7T fMRI Study." Cognitive Neuroscience Society Annual Meeting. Traditional Poster, March 2018. *Selected for DataBlitz
10. **Conrad BN**, Maki S, Watchmaker JM, Box BA, Barry RL, Smith SA, and Gore JC, "Functional MRI of the Cervical Spinal Cord." Frontiers of Biomedical Imaging Science VI, Nashville TN. Traditional poster, May 2017. *Outstanding Poster award
11. **Conrad BN,** Maki S, Watchmaker JM, Box BA, Barry RL, Smith SA, Gore JC. "BOLD Signal Changes in Spinal Cord with Hypercapnia." ISMRM, Honolulu, HI. E-Poster (5319), April 2017. *Summa Cum Laude merit award
12. **Conrad BN,** Lyttle BD, Pawate S, Smith SA. "Functional Reorganization in Multiple Sclerosis at 7T: Altered Connectivity and Relationships to Cognitive Impairment." American Academy of Neurology 68th Annual Meeting, Vancouver, BC. Selected for Dual Presentation, Integrative Neuroscience Session. Posters (010 and 134), April 2016. http://n.neurology.org/content/86/16_Supplement/P4.134.abstract
13. **Conrad BN**, Lyttle BD, Pawate S, Barry RL, Landman BA, Smith SA. "Measuring Cross Sectional Area of the Spinal Cord at 7T: Validating Fully Automated Segmentation." ISMRM, Toronto, ON. E-Poster (4436), June 2015.
14. **Conrad BN**, Dethrage LM, Pawate S, Smith SA. "Alterations of Resting State Functional Connectivity in Multiple Sclerosis at 7T." 12th Annual VUIIS Retreat, Nashville, TN. Traditional poster, June 2015.
15. Wilkey, ED, **Conrad, BN**, Price, GR. "Shared Representation of Symbolic and Nonsymbolic Number, But Overlap Negatively Predicts Math." Annual conference of the Organization of Human Brain Mapping, Montreal, Canada (virtual event). Symposium talk and traditional poster, June 2020.
16. Wilkey, ED, **Conrad, BN**, Price, GR. "Individual Differences in Shared Representation of Symbolic and Nonsymbolic Number at 7T fMRI." Annual conference of the Association for Psychological Science, Chicago, Illinois (virtual event). Traditional poster, May 2020.
17. Maki S, **Conrad BN**, Barry RL, McKeithan LJ, Gore JC, Smith SA. "Motor-task based fMRI of the spinal cord reveals neural activity in gray matter horns." ISMRM, Honolulu, HI. E-Poster (4674), April 2017.
18. O'Grady KP, Dula AN, Lyttle BD, **Conrad BN**, Box BA, Pawate S, Bagnato FR, Smith SA. "Glutamate-sensitive CEST in cortical gray matter: Application to cognitive impairment in multiple sclerosis." ISMRM, Honolulu, HI. Oral (0215), April 2017. *Magna Cum Laude merit award

19. McKeithan LJ, Lyttle BD, Box BA, O'Grady KP, Dortch RD, **Conrad BN**, Smith SA. "7T quantitative magnetization transfer (qMT) of cortical gray matter in multiple sclerosis correlates with cognitive disability." ISMRM, Honolulu, HI. Power Pitch (0019), April 2017.
20. Barry RL, **Conrad BN**, Smith SA, Gore JC. "Functional connectivity in spinal cord for clinical translation." ISMRM, Singapore. E-Poster (963), May 2016.
21. Morgan VL, Cakir A, **Conrad BN**, Abou-Khalil B, Anderson AW, Ding Z, Landman BA. "Similarity in structural and functional network connectivity evolution over duration of TLE." ISMRM, Singapore. Poster (2422), May 2016.
22. Buck AW, Severence LM, **Conrad BN**, Landman BA, Anderson AW, Abou-Khalil B, Jacobs ML, Morgan VL. "Relationship between hippocampal volume, white matter and cognition in temporal lobe epilepsy." ISMRM, Singapore. Poster (2890), May 2016.
23. Dula AN, Pawate S, Lyttle BD, **Conrad BN,** Smith SA. "Measures of Glutamate using Chemical Exchange Saturation Transfer (CEST) MRI Related to Cognition." American Academy of Neurology 68th Annual Meeting, Vancouver, BC. Poster (135) April 2016.
24. Morgan VL, **Conrad BN**, Abou-Khalil B, Rogers BP. "Volumetric Network Reorganization in Temporal Lobe Epilepsy." American Epilepsy Society. Traditional poster, 2015 (2.201).
25. Banks SD, Coronado RA, Haislip LR, Abraham CM, **Conrad BN**, Morgan VL, Archer KR. "Thalamic Functional Connectivity in Mild Traumatic Brain Injury." *Archives of Physical Medicine and Rehabilitation* 2015;96:e51-e52. https://doi.org/10.1016/j.apmr.2015.08.171
26. Coronado RA, Banks SD, Haislip L, Abraham CM, **Conrad BN**, Morgan VL, Archer KR. "Thalamic functional connectivity in mild traumatic brain injury." Poster presentation at the Postdoctoral Association and Shared Resource Symposium, Nashville, TN, April 28, 2015.
27. Severance L, **Conrad BN**, Jacobs M, Morgan VL. "The relationship between regional brain volume and IQ in temporal lobe epilepsy." Vanderbilt Undergraduate Research Fair 2015. Top poster award.
28. Dula AN, Pawate S, Dethrage LM, **Conrad BN**, Smith SA. "CEST MRI of Cortical Gray Matter in Multiple Sclerosis." ISMRM, Toronto, ON. E-poster (3372), June 2015.
29. Lyttle BD, Dula AN, **Conrad BN**, Dortch R, Barry M, Sriram S, Reddy S, Smith SA, Pawate S. "High-Field Characterization of Spinal Cord Damage in Multiple Sclerosis." ISMRM, Toronto, ON. E-poster (4363), June 2015.
30. Dula AN, Pawate S, Dethrage LM, **Conrad BN**, Barry RL, Smith SA. "CEST of the Cervical Spinal Cord at 7 Tesla." ISMRM, Toronto, ON. E-poster (4432), June 2015.