

Vita

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DEGREES

Ph.D. in mathematical physics, Indiana University, 1981.
M.S. in physics, Indiana University, 1977.
A.B. *summa cum laude* in physics, Harvard University, 1976.

PROFESSIONAL POSITIONS

Senior Principal Researcher, Microsoft Research Artificial Intelligence, Redmond WA, Dec. 2016–present.
Krieger-Eisenhower Professor of Cognitive Science, Johns Hopkins University, 2006–present.
Full Professor, Department of Cognitive Science, Johns Hopkins University, 1994–2006.
Chair, Department of Cognitive Science, Johns Hopkins University, Jan. 1997–June 1998 (Acting), July 1998–June 2000
Professor, Department of Computer Science, University of Colorado at Boulder:
 Full Professor, 1994–95 (on leave, 1994–95).
 Associate Professor, 1990–94.
 Assistant Professor, 1985–90.
Assistant Research Cognitive Scientist (Assistant Professor – Research), Institute for Cognitive Science, University of California at San Diego, 1982–85.
Visiting Scholar, Program in Cognitive Science, University of California at San Diego, 1981–82.

Adjunct Professor, Department of Linguistics, University of Maryland at College Park, 1994–2010.
Assistant Director, Center for Language and Speech Processing, Johns Hopkins University, 1995–2008.
Director, NSF IGERT Training Program, Unifying the Science of Language, 2006–2015.
Director, NSF IGERT Training Program in the Cognitive Science of Language, 1999–2006.

International Chair, Inria Paris (National Institute for Research in Computer Science and Automation), 2017–2021.
Visiting Scientist, Inserm-CEA Cognitive Neuroimaging Unit, NeuroSpin Center, Paris, France, 2016.
Visiting Professor, Department of Cognitive Studies, École Normale Supérieure, Paris, 2016.
Visiting Researcher, Laboratory for Speech and Language, Aix-Marseille University, Aix-en-Provence, France, 2016.
Visiting Researcher, Deep Learning Group, Microsoft Research, Redmond, WA, 2015.
Sapir Professor, Linguistic Society of America (LSA) Summer Linguistic Institute, University of Chicago, 2015.
Faculty, 15th Summer School in Cognitive Science, New Bulgarian University, Sofia, 2008.
Faculty, LSA Summer Linguistic Institute, MIT, 2005.
Visiting faculty, Department of Cognitive Studies, École Normale Supérieure, Paris, 2005.

Visiting lecturer, Linguistics Department, Tromsø University, Norway, 2004.
 Faculty, First International Summer Institute in Cognitive Science, SUNY Buffalo, 1994.
 Faculty, Linguistic Institute, University of California at Santa Cruz, 1991.
 Faculty, Connectionist Models Summer School; Carnegie-Mellon University, 1986, 1988; University of California, San Diego, 1990; University of Colorado, Boulder, 1993.
 Faculty, Advanced Course in Artificial Intelligence, Neuchâtel, Switzerland, 1989.
 Visiting Scholar, Linguistic Institute, Stanford University, 1987.

Visiting Researcher, Microsoft Research, Redmond, WA, Aug.–Dec. 2015.
 Consultant, Johns Hopkins Applied Physics Laboratory, Laurel, MD, July–Dec. 2014.
 Consultant, Xerox Palo Alto Research Center, Intelligent Systems Laboratory, 1987.

National Science Foundation, John H. Edwards, and Indiana University Graduate Fellow, 1976–81.
 Associate Instructor, Department of Physics, Indiana University, 1976–81.
 Project Specialist, Institute for Research on Poverty, University of Wisconsin, 1978.
 Consultant, California Planning and Conservation Foundation, 1975.
 Undergraduate Teaching Assistant, Committee on Natural Sciences, Harvard University, 1974–75.

PROFESSIONAL AWARDS

International Chair, Inria Paris Research Center, 2017–2021.
 Association Lecture, Workshop and Master Class, Linguistics Association of Great Britain, York, UK 2016.
 Sapir Professorship, Linguistic Society of America Summer Linguistic Institute, Chicago, 2015.
 Chaire Internationale de Recherche Blaise Pascal, l'Etat et la Région d'Ile-de-France, 2008–2009.
 David E. Rumelhart Prize for Outstanding Contributions to the Formal Analysis of Human Cognition, 2005.
 Fellow, Cognitive Science Society, elected 2005.
 Scheduled Fellow, Center for Advanced Study in the Behavioral Sciences, Stanford, 2003.
 Guggenheim Foundation Fellowship, 1995–96.
 Faculty Fellowship, University of Colorado, 1991–92.

John H. Edwards Fellowship (“the most highly prized graduate fellowship awarded directly by Indiana University”), 1980–81.
 Lieber Associate Instructor Award (6 awarded annually system-wide), Indiana University, 1979.
 Associate Instructor Teaching Award, Physics Department, Indiana University, 1978.
 National Science Foundation Graduate Fellowship in Mathematical Physics, 1977–80.
 Indiana University Department of Physics Graduate Fellowship, 1976–80.

A.B. with honors in physics, Harvard University; among top five Harvard College graduates of 1976.
 Master’s Award, Dudley House, Harvard University, 1976.
 Detur Prize, Harvard University, 1975.
 Phi Beta Kappa membership, Harvard College chapter, 1975.
 John Harvard Scholarship, Harvard University, 1973–74, 1974–75.
 Edwards Whitaker Scholarship, Harvard University, 1974.

PROFESSIONAL SERVICE

Cognitive Science Society Fellows Selection Committee, 2014–17.
 Selection Committee, David E. Rumelhart Prize for Contributions to the Theoretical Foundations of Human Cognition, 2007–10.
 President, Society for Philosophy and Psychology. 2000–01.

President, Cognitive Science Society. 1995–96, 1996–97.
 Annual Conference Oversight Committee, Cognitive Science Society. 1995–98.
 Governing Board, Cognitive Science Society. 1992–98.
 Executive Board, Society for Philosophy and Psychology. 1988–91, 1994–97.
 International Advisory Board, Cognitive Science Department, New Bulgarian University. 1993–present.
 Editorial Board, *Minds and Machines: Journal for Artificial Intelligence, Philosophy, and Cognitive Science*. 1990–present.
 Editorial Board, *Cognitive Science*. 1988–present.
 Editorial Board, *Connection Science: A Journal of Neural Computing, Artificial Intelligence, and Cognitive Research*. 1988–present.
 Advisory Board, Neural Network Series, MIT Press. 1990–present.
 Advisory Editorial Board, *Network: Computation in Neural Systems*. 1989–91.

Organizer, IGERT Conference: Interdisciplinary Training and Cognitive Science. Baltimore, February 2012.
 Co-organizer, Second IGERT Workshop: The Cognitive Science of Language. Baltimore, January 2004.
 Program Committee, Cognitive Science Society Conference, Boston, August 2003.
 Co-organizer, First IGERT Workshop: The Cognitive Science of Language. Baltimore, January 2003.
 Organizer, Symposium on the Mathematics of Optimality Theory, Annual Meeting of the American Association for the Advancement of Science, San Francisco, CA, February 2001.
 Program Committee, Cognitive Science Society Conference, University of Pennsylvania, August 2000.
 Organizing Committee, Cognitive Science Society Conference, Stanford, CA, July 1997.
 Organizer, Symposium on Connectionism and Language, Annual Meeting of the American Association for the Advancement of Science, Baltimore, MD, February 1996.
 Program Committee, Association for Computational Linguistics Conference, Cambridge, MA, June 1995.
 Organizer, Symposium on Connectionism and Cognitive Science, First International Summer Institute in Cognitive Science, Buffalo, NY, July 1994.
 Organizing Committee, Cognitive Science Society Conference, Boulder, CO, June 1993.
 Organizing Committee, Connectionist Models Summer School, Boulder, CO, June 1993.
 Honorary Organizing Committee, Neural Networks Symposium, International Symposia on Information Sciences, Iizuka, Kyushu, Japan, July, 1992.

BOOKS

- [1] Smolensky, P., & Legendre, G. 2006. *The Harmonic Mind: From Neural Computation to Optimality-Theoretic Grammar*. Vol. 1: *Cognitive Architecture*; vol. 2: *Linguistic and Philosophical Implications*. Cambridge, MA: MIT Press.
- [2] Prince, A. & Smolensky, P. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, MA: Blackwell.
 Excerpted in:
 McCarthy, John J. ed. 2003. *Optimality Theory in Phonology: A Reader*, 3-71. Malden, MA: Blackwell.
 [Chapter 6 reprinted in [1], Chapter 13, Vol. 2, 3–25.
 Japanese translation: Haruka Fukazawa and Mafuyu Kitahara, 2008, Iwanami Shoten Publishers, Tokyo
- [3] Tesar, B. & Smolensky, P. 2000. *Learnability in Optimality Theory*. MIT Press.
- [4] Smolensky, P., Mozer, M. C., & Rumelhart, D. E. (Eds.). 1996. *Mathematical Perspectives on Neural Networks*. Mahwah, NJ: Lawrence Erlbaum Publishers [Contributed 4 of 20 chapters].
- [5] Macdonald, C. & Macdonald, G. (Eds.). 1995. *Connectionism: Debates on Psychological Explanation, Volume Two*. Oxford: Basil Blackwell. [Contributed 4 of 11 chapters].
- [6] Mozer, M.C., Smolensky, P., Touretzky, D., Elman, J., & Weigend, A. (Eds.). 1993. *Proceedings of the Connectionist Models Summer School 1993*. Hillsdale, NJ: Lawrence Erlbaum Publishers.

- [7] Smolensky, P. 1992. *Il Connessionismo: tra simboli e neuroni*. Translation of the entire treatment, including peer commentary: On the proper treatment of connectionism, *The Behavioral and Brain Sciences*, **11**, 1-74 ([168] below); with introduction by Marcello Frixione. Genova: Marietti/Cambridge University Press.

PAPERS (by general topic area)

Computation

- [1] Y Deng, K Prasad, R Fernandez, P Smolensky, V Chaudhary, S Shieber. 2023. [Implicit Chain of Thought Reasoning via Knowledge Distillation](#). arXiv preprint arXiv:2311.01460.
- [2] R. Thomas McCoy, Paul Smolensky, Tal Linzen, Jianfeng Gao, Asli Celikyilmaz. 2023. Do Language Models Copy From Their Training Data? Evaluating Linguistic Novelty in Text Generation Using RAVEN. *Transactions of the Association for Computational Linguistics* 2023; 11 652-670. doi: https://doi.org/10.1162/tacl_a_00567.
- [3] Soulos, P., Hu, E., McCurdy, K., Chen, Y., Fernandez, R., Smolensky, P., & Gao, J. (2023). Differentiable Tree Operations Promote Compositional Generalization. In *Proceedings of the 40th International Conference on Machine Learning*, pages 32499-32520. PMLR, 23-29 Jul 2023.
- [4] Paul Smolensky, R. Thomas McCoy, Roland Fernandez, Matthew Goldrick, Jianfeng Gao. 2022. Neurocompositional computing: From the Central Paradox of Cognition to a new generation of AI systems. *AI Magazine*, Fall 43:308-322. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/aaai.12065> and <http://arxiv.org/abs/2205.01128>
- [5] Smolensky, Paul and McCoy, R. Thomas and Fernandez, Roland and Goldrick, Matthew and Gao, Jianfeng. 2022. Neurocompositional computing in human and machine intelligence: A tutorial. Microsoft Technical Report MSR-TR-2022-5, https://www.microsoft.com/en-us/research/uploads/prod/2022/04/Neurocompositional_computing_tutorial.pdf
- [6] Laurel Brehm, Pyeong Whan Cho, Paul Smolensky, Matthew A. Goldrick. 2022. PIPS: A Parallel Planning Model of Sentence Production. *Cognitive Science*, 46:2, e13079 <http://doi.org/10.1111/cogs.13079>
- [7] Yichen Jiang, Asli Celikyilmaz, Paul Smolensky, Paul Soulos, Sudha Rao, Hamid Palangi, Roland Fernandez, Caitlin Smith, Mohit Bansal, Jianfeng Gao. 2021. Enriching Transformers with Structured Tensor-Product Representations for Abstractive Summarization. *North American Chapter of the Association for Computational Linguistics: Human Language Technologies*. <https://aclanthology.org/2021.naacl-main.381.pdf>
- [8] R. Thomas McCoy, Paul Smolensky, Tal Linzen, Jianfeng Gao, Asli Celikyilmaz. 2021. How much do language models copy from their training data? Evaluating linguistic novelty in text generation using RAVEN. <https://arxiv.org/abs/2111.09509>
- [9] Paul Soulos, Sudha Rao, Caitlin Smith, Eric Rosen, Asli Celikyilmaz, R. Thomas McCoy, Yichen Jiang, Coleman Haley, Roland Fernandez, Hamid Palangi, Jianfeng Gao, Paul Smolensky. 2021. Structural Biases for Improving Transformers on Translation into Morphologically Rich Languages. *18th Biennial Machine Translation Summit, 4th Workshop on Low-Resource Machine Translation*, 52-67. <https://aclanthology.org/2021.mtsummit-loresmt.6.pdf>
- [10] Jacob Russin, Roland Fernandez, Hamid Palangi, Eric Rosen, Nebojsa Jojic, Paul Smolensky, and Jianfeng Gao. 2021. Compositional processing emerges in neural networks solving math problems. In *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society*, 1767-1773. <https://arXiv.org/abs/2105.08961> .
- [11] Najoung Kim, Paul Smolensky. 2021. Testing for Grammatical Category Abstraction in Neural Language Models. *SCiL*.
- [12] Caitlin Smith, Charlie O'Hara, Eric Rosen, Paul Smolensky. 2021. Emergent Gestural Scores in a Recurrent Neural Network Model of Vowel Harmony. *SCiL*.

- [13] Kezhen Chen, Qiuyuan Huang, Hamid Palangi, Paul Smolensky, Kenneth D. Forbus, Jianfeng Gao. 2020. Mapping natural-language problems to formal-language solutions using structured neural representations. *37th ICML; Journal of Machine Learning Research* 119:1566–1575.
- [14] Kezhen Chen, Qiuyuan Huang, Paul Smolensky, Kenneth Forbus, Jianfeng Gao. 2020. Learning Inference Rules with Neural TP-Reasoner. *NeurIPS BabyMind Workshop: How Babies Learn and How Machines Can Imitate*.
- [15] Coleman Haley and Paul Smolensky. 2020. Invertible Tree Embeddings using a Cryptographic Role Embedding Scheme. *Proceedings of the 28th International Conference on Computational Linguistics (COLING-2020)*. 3671–3683. <https://www.aclweb.org/anthology/2020.coling-main.328.pdf>
- [16] Paul Soulos, R. Thomas McCoy, Tal Linzen, Paul Smolensky. 2020. Discovering the compositional structure of vector representations with role learning networks. *EMNLP BlackboxNLP Workshop*. <https://arxiv.org/abs/1910.09113>
- [17] R. Thomas McCoy, Erin Grant, Paul Smolensky, Thomas L. Griffiths, and Tal Linzen. 2020. Universal linguistic inductive biases via meta-learning. *Proceedings of the 42nd Annual Conference of the Cognitive Science Society*.
- [18] Cho, P. W., Goldrick, M., & Smolensky, P. 2020 (April 23). Parallel parsing in a Gradient Symbolic Computation parser. Retrieved from psyarxiv.com/utcv. DOI 10.31234/osf.io/utcv.
- [19] McCoy, Richard Thomas, Linzen, Tal, Dunbar, Ewan & Smolensky, Paul. 2020. Tensor Product Decomposition Networks: Uncovering Representations of Structure Learned by Neural Networks. *Proceedings of the Society for Computation in Linguistics 3, (SCiL-2020)* 474-475. <https://aclanthology.org/2020.scil-1.34/>
- [20] McCoy, RT, Grant, E, Smolensky, P, Griffiths, T, Linzen, T. Discovering universal linguistic inductive biases via meta-learning. In review for the Cognitive Science Society 2020 conference.
- [21] Lalis, M, Rosen, E, Smolensky, P. Scalable knowledge base completion with superposition memories. In review for the Association for Computational Linguistics 2020 conference.
- [22] HUBERT Untangles BERT to Improve Transfer across NLP Tasks. 2019. M Moradshahi, H Palangi, MS Lam, P Smolensky, J Gao. arXiv:1910.12647.
- [23] Paul Soulos, R Thomas McCoy, Tal Linzen, Ewan Dunbar, Paul Smolensky. 2019. Discovering the compositional structure of vector representations with role learning networks. *NeurIPS Workshop on Context and Composition in Biological and Artificial Neural Systems*. arXiv:1910.09113.
- [24] I Schlag, P Smolensky, R Fernandez, N Jojic, J Schmidhuber, J Gao. Enhancing the Transformer with Explicit Relational Encoding for Math Problem Solving. 2019. *NeurIPS Workshop on Context and Composition in Biological and Artificial Neural Systems*. <http://arXiv.com/abs/1910.06611> .
- [25] K Chen, Q Huang, H Palangi, P Smolensky, KD Forbus, J Gao. Natural-to formal-language generation using Tensor Product Representations. *NeurIPS Workshop on Knowledge Representation meets Deep Learning (Best Paper Award)*. arXiv:1910.02339.
- [26] Wiebe, Nathan, Bocharov, Alex, Smolensky, Paul, Troyer, Matthias & Svore, Krysta M. Quantum Language Processing. arXiv:1902.05162
- [27] McCoy, Richard Thomas, Linzen, Tal, Dunbar, Ewan & Smolensky, Paul. 2019. RNNs implicitly implement tensor-product representations. *Proceedings of ICLR-2019*. arXiv:1812.08718
- [28] Kim, Najoung, Rawlins, Kyle, Van Durme, Benjamin & Smolensky, Paul. 2019. Predicting the Argumenthood of English Prepositional Phrases. *AAAI-2019*.
- [29] Goldrick, Matthew, Brehm, Laurel, Cho, Pyeong Whan & Smolensky, Paul. 2019. Transient blend states and discrete agreement-driven errors in sentence production (poster). *Society for Computation in Linguistics (SCiL-2019)*.
- [30] Lalis, Matthias & Smolensky, Paul. 2019. Augmenting compositional models for knowledge base completion using gradient representations. *Society for Computation in Linguistics (SCiL-2019)*, 257–266. arXiv:1811.01062

- [31] Tang, Shuai, Smolensky, Paul, de Sa, Virginia R. 2018. Learning distributed representations of symbolic structure using binding and unbinding operations. *Workshops of NeurIPS-2018*. arXiv:1810.12456
- [32] Tupper, Paul, Smolensky, Paul & Cho, Pyeong Whan. 2018. Discrete symbolic optimization and Boltzmann sampling by continuous neural dynamics: Gradient Symbolic Computation. arXiv:1801.03562.
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- [34] Huang, Qiuyuan, Smolensky, Paul, He, Xiaodong, Deng, Li & Wu, Dapeng. 2018. Tensor Product Generation Networks for deep NLP learning. *Proceedings of the North American Association for Computational Linguistics (NAACL-2018)* arXiv:1709.09118
- [35] Dynamic encoding of structural uncertainty in gradient symbols. Pyeong Whan Cho, Matthew Goldrick, Richard L Lewis, Paul Smolensky. 2018. *Proceedings of the 8th Workshop on Cognitive Modeling and Computational Linguistics (CMCL 2018)*.
- [36] Grammatically-interpretable learned representations in deep NLP models. Hamid Palangi, Qiuyuan Huang, Paul Smolensky, Xiaodong He & Li Deng. 2017. *Proceedings of the NIPS Workshop on Interpreting, Explaining and Visualizing Deep Learning ... now what?*
- [37] Cho, Pyeong Whan & Smolensky, Paul. 2016. Bifurcation analysis of a Gradient Symbolic Computation model of incremental processing. *Proceedings of the 38th Annual Conference of the Cognitive Science Society*. 1487–1492. Philadelphia, PA, Aug.
- [38] Smolensky, Paul, Lee, Moontae, He, Xiaodong, Yih, Wen-tao, Gao, Jianfeng & Deng, Li. 2016. Basic reasoning with Tensor Product Representations. arXiv:1601.02745.
- [39] Lee, Moontae, He, Xiaodong, Yih, Wen-tao, Gao, Jianfeng, Deng, Li. & Smolensky, Paul. 2016. Reasoning in vector space: An exploratory study of question answering. *Proceedings of the International Conference on Learning Representations (ICLR-2016)*. arXiv:1511.06426.
- [40] Smolensky, Paul, Goldrick, Matthew & Mathis, Donald. 2014. Optimization and quantization in gradient symbol systems: A framework for integrating the continuous and the discrete in cognition. *Cognitive Science*, 38, 1102–1138. DOI: 10.1111/cogs.120472013. Online publication: June 26, 2013, DOI: 10.1111/cogs.12047. (ROA 1103)
- [41] Smolensky, Paul. 2012. Subsymbolic computation theory for the human intuitive processor. In *How the world computes: Turing Centenary Conference and 8th Conference on Computability in Europe*, CiE 2012, Lecture Notes in Computer Science, vol. 7318, 676–686, eds. S. B. Cooper, A. Dawar, B. Löwe. Springer.
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- [45] Smolensky, Paul. 2006. Tensor product representations: Formal foundations. In [1]. Chapter 8. Vol. 1, 271–344.
- [46] Smolensky, Paul. 2006. Constraints and optimization: Harmony maximization. In [1]. Chapter 9. Vol. 1, 345–392.
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- [51] Smolensky, P. 1996. Dynamical perspectives on neural networks. In [4]. 245–270.
- [52] Smolensky, P. 1996. Statistical perspectives on neural networks. In [4]. 453–496.
- [53] Tesar, B. & Smolensky, P. 1994. Synchronous-firing variable binding is spatio-temporal tensor product representation. *Proceedings of the 16th Annual Conference of the Cognitive Science Society*. 870–875. Atlanta, GA. August.
- [54] Smolensky, P. 1993. Harmonic Grammars for formal languages. In S. Hanson, J. D. Cowan, & C. L. Giles, (Eds.), *Advances in Neural Information Processing Systems 5*, San Mateo, CA: Morgan Kaufmann. [Collected papers of the IEEE Conference on Neural Information Processing Systems—Natural and Synthetic, Denver, Nov. 1992.] 847–854.
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- [60] Smolensky, P. 1991. Connectionism. In W. Bright (Ed.) *The International Encyclopedia of Linguistics*. Oxford University Press. 294–297.
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- [62] McMillan, C., Mozer, M. C., & Smolensky, P. 1991. The connectionist scientist game: Rule extraction and refinement in a neural network. *Proceedings of the Thirteenth Annual Conference of the Cognitive Science Society*, Chicago, IL. July.
- [63] McMillan, C., Mozer, M., & Smolensky, P. 1991. Learning explicit rules in a neural network. *Proceedings of the International Joint Conference on Neural Networks*. Seattle, WA. July.
- [64] Smolensky, P. 1990. Tensor product variable binding and the representation of symbolic structures in connectionist systems. *Artificial Intelligence*, 46(1), 159–216. [Reprinted in G. Hinton, (Ed.), 1990, *Connectionist symbol processing*, Elsevier/MIT Press.] P. Smolensky. Tensor product variable binding and the representation of symbolic structures. ISSN 0004-3702. doi: [https://doi.org/10.1016/0004-3702\(90\)90007-M](https://doi.org/10.1016/0004-3702(90)90007-M). URL <https://www.sciencedirect.com/science/article/pii/000437029090007M>
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- [66] Smolensky, P. 1990. Representation in connectionist networks. *Intellectica: The Journal of the French Association for Cognitive Research*, 9–10, 127–165.
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- [76] Smolensky, P. 1987. On variable binding and the representation of symbolic structures in connectionist systems. Technical Report CU-CS-355-87, Department of Computer Science, University of Colorado at Boulder. February.
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GRANTS

- Paul Smolensky, P.I., Najoung Kim, Geraldine Legendre, Tal Linzen, co-PIs. Compositional Linguistic Generalization in Human and Machine Learning. NSF Doctoral Dissertation Research Improvement Grant. 1/15/21 – 12/31/2022. \$12,771.
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- Smolensky, P., P.I.; Legendre, G., co-P.I. Towards an Integrated Connectionist/Symbolic Theory of Higher Cognition: Research Experiences for Undergraduates Supplement. 1993.
- Mozer, M. C., P.I.; Smolensky, P., co-P.I. Connectionist Models Summer School. Cognitive Science Initiative and Knowledge Models and Cognitive Systems Program, NSF. 4/93 – 3/94. \$30,000.
- Prince, A., Smolensky, P., P.I.s. Universal phonology through harmony theory. Small Grant for Exploratory Research, Linguistics Program, NSF. 8/90 – 7/91. \$20,000.
- Smolensky, P., recipient. Gift for support development of the EUCLID system. Apple Computer, Inc. 9/90 – 9/91. \$30,000.

- Schnabel, R., P.I.; King, R., Lewis, C., Main, M., Nutt, G., Smolensky, P., co-P.I.s Effective use of parallel and distributed computing. Institutional Infrastructure Program, NSF. 9/90 – 8/95. \$1,800,000.
- Smolensky, P. P.I.; Fox, B., King, R., Lewis, C., co-P.I.s. Computer-aided reasoned discourse: the EUCLID system. Interactive Systems Program, Computer and Information Science and Engineering Directorate, NSF. 4/87 – 9/90. \$490,458.
- Smolensky, P. Investigator, Optical Connectionist Machine Program. NSF Engineering Research Center for Optoelectronic Computing Systems. 5/87 – 4/92. \$14,500,000.
- McNaughton, B., Nadel, L., O’Keefe, J., & Smolensky, P., co-P.I.s. Spatial computation in the mammalian hippocampal formation. Computational Neuroscience Program, Sloan Foundation. 2/87 – 2/90. \$200,000.
- Smolensky, P., P.I. Inference in massively parallel artificial intelligence systems. Information Science Program, Information Science and Technology Division, NSF. 8/86 – 7/89. \$136,660.
- Smolensky, P., P.I.; Anderson, D. Z., Cohen, M., Feinberg, J., co-P.I.s. Distributed processing in continuous optical media. Lightwave Technology Program, Engineering Division, NSF. 9/87 – 2/89. \$88,625.
- Smolensky, P., P.I. Support for research on connectionism and the EUCLID system. Symbolics, Inc. 9/86 – 8/89. \$18,000.

PATENTS

- Nathan O Wiebe, Alexei Bocharov, Paul Smolensky, Matthias Troyer, Krysta Svore. Quantum algorithms for supervised training of quantum Boltzmann machines. US Patent 11783222.
- Computational-model operation using multiple subject representations. Microsoft Technology Licensing LLC. US Patent 10,592,519
- Recursive Function Computation by Linear Transformations of Vectorial Representation. Johns Hopkins University.
- Neural Network Computation of Gradient and Discrete Symbolic Representations. Johns Hopkins University.
- Grammars Defined over Gradient Symbolic Representations. Johns Hopkins University.

ONLINE RECORDINGS

Presentation in the online panel, “Why Compositionality Matters for Artificial Intelligence” (June 29–30, 2022; <https://compositionalityintelligence.github.io/>) <https://youtu.be/9tH9Qz1nH3k> (starts at 40 minute mark)

Audio of 1988 debate at MIT with Jerry Fodor and Zenon Pylyshyn, showing my slides:
<https://www.youtube.com/watch?v=EdWZpuXB5eA>

What kind of computation is human cognition? A brief history of thought:

Episode 1 of 2 (July 28, 2020):

<https://www.microsoft.com/en-us/research/video/what-kind-of-computation-is-human-cognition-a-brief-history-of-thought-episode-1-2/>

Episode 2 of 2 (August 4, 2020):

<https://www.microsoft.com/en-us/research/video/what-kind-of-computation-is-human-cognition-a-brief-history-of-thought-episode-2-2/>

NeurIPS 2019 Workshop on Context and Compositionality in Biological and Artificial Neural Systems (<https://context-composition.github.io/>):

<https://slideslive.com/38922743/panel-discussion> (this talk: first 12.5 minutes; panel discussion from 28:50)

Embedding symbolic computation within neural computation for AI & NLP – keynote, High-Level AI, Prague, August 2018:

<https://www.youtube.com/watch?v=yFuEQleX7VQ>

SCiL 2018/Perceptrons and Syntactic Structures at 60; Salt Lake City:

<https://www.youtube.com/watch?v=yJuvEw-Rt3U&t=110s>

Budapest 2016 Hungarian Academy of Sciences:

http://videotorium.hu/hu/recordings/details/12562,Paul_Smolensky_-_Grammatical_Theory_with_Gradient_Symbol_Structures

At Microsoft Research

Deep Learning Research Group talk on interpreting the TPT(Math) model, 05/21/20:

<https://msit.microsoftstream.com/video/fc68a1ff-0400-96d0-2272-f1ea9b986d97>

Fall 2015:

#1: <http://research.microsoft.com/apps/video/default.aspx?id=256335>

#2: <http://research.microsoft.com/apps/video/default.aspx?id=258552>

#3: <http://research.microsoft.com/apps/video/default.aspx?id=258546>

#4: <http://research.microsoft.com/apps/video/default.aspx?id=258545>

#5: <http://research.microsoft.com/apps/video/default.aspx?id=258551>

#6: <http://research.microsoft.com/apps/video/default.aspx?id=258550>

#7: <http://research.microsoft.com/apps/video/default.aspx?id=258866>

PROFESSIONAL ACTIVITIES

Invited Presentations

2024

Keynote speaker, Weinberg Symposium on Cognitive Science, University of Michigan
Linguistics Department Colloquium, Yale University

2023

Invited speaker, NeurIPS Workshop on AI and Mathematical Reasoning

2022

Invited speaker, Why Compositionality Matters for Artificial Intelligence online workshop

2020

AI Speaker Series, Microsoft Research, Redmond, 2 lectures.
Cognitive Science Colloquium, Princeton University.

2019

Physics \cap Machine Learning Workshop, Microsoft Research AI, Redmond, WA.

Understanding Human and Machine Intelligence: A Workshop on Cognitive Science and AI, Facebook AI Research, New York, NY.

Invited Speaker, Princeton Phonology Forum, Princeton University.

2018

Plenary Speaker, AI and Cognition Symposium, 'Springboard for Artificial Intelligence' conference, Inria Sophia Antipolis, France.

Invited speaker, Parallel Distributed Processing Symposium in Honor of Jay McClelland, Princeton University, Princeton, NJ.

Plenary Speaker, Conference on Neural Symbolic Learning & Reasoning (NeSy)/Human-Level AI Multi-conference (HLAI), Prague, Czech Republic.

Invited Speaker, DeepMind, London, UK.

Invited Speaker, Conference on Symbolic-Neural Learning, Nagoya, Japan.

Plenary Speaker, Syntactic Structure and Perceptrons at 60 Symposium, Meeting on Computation in Linguistics, Salt Lake City, UT.

2017

Colloquium, Department of Linguistics, University of California at Los Angeles.

Tutorial on Gradient Symbolic Computation, Leipzig University.

Invited speaker, Meeting on Strength in Grammar, Leipzig University.

Colloquium, Natural Language Processing, Department of Computer Science, University of Washington

Colloquium, Department of Computer Science, Portland State University.

Workshop on Logic, Rationality, and Intelligent Interaction, Center for the Study of Language and Information, Stanford University.

2016

Workshop on Complexity in Language, Brain-Language Research Institute, Aix-Marseille Université.

Colloquium, Linguistics and English Language Department, University of Edinburgh, Scotland

Tensor Product Representations tutorial, Microsoft CCP Bellevue.

Invited Lecture, University of Strasbourg, France.

Laboratoire de Sciences Cognitives et Psycholinguistique: Language Group Seminar (2 lectures), Paris.

Laboratoire de Sciences Cognitives et Psycholinguistique: Modeling Group Seminar (2 lectures), Paris.

Laboratoire de Sciences Cognitives et Psycholinguistique: Linguistics and vector space representations workshop.

Atelier de Phonologie, Laboratoire Structures Formelles du Langage, Université de Paris 8/CNRS.

Invited speaker, Computational and Systems Neuroscience Conference (Cosyne), Salt Lake City.

Keynote speaker, Computational Neuroscience Workshop, Geneva.

Workshop on Liaison, Brain-Language Research Institute, Aix-Marseille University.

Tutorial on Optimality Theory, Brain-Language Research Institute, Aix-Marseille University.

Invited Lecture, Research Institute for Linguistics, the Hungarian Academy of Sciences, Budapest, Hungary.

2015

Invited speaker, 2-day Workshop on Cognitive Computation: Integrating neural and symbolic approaches, Neural Information Processing Systems (NIPS), Montreal, Canada.

Colloquium, Cognitive Science series: Mind, Technology, Society; UC-Merced.

Colloquium, Linguistics Department, Stanford University.

Extended tutorial (series of seven 1½-hour lectures) on Gradient Symbolic Computation, Microsoft Research, Redmond, WA.

Lecture, State Key Laboratory of Brain and Cognitive Science, Institute of Biophysics, Chinese Academy of Sciences, Beijing.

Keynote speaker, Conference on Computational Natural Language Learning, Beijing, China.
Invited lecture, Toyota Technological Institute at Chicago.
Invited speaker, Computational Phonology Workshop, LSA Summer Linguistic Institute, University of Chicago.
Sapir Lecture, LSA Summer Linguistic Institute, University of Chicago.
Keynote speaker, Rutgers University Linguistics Conference RULing-X, New Brunswick, NJ.
Invited speaker, Advances in Distributional Semantics Workshop, International Conference on Computational Semantics, Queen Mary University, London, UK.

2014

Invited public lecture, Faculty of Human Sciences, Macquarie University, Sydney, Australia.
Plenary speaker, Australian Linguistic Society, Newcastle, Australia.
Invited speaker, Workshop on the Role of Prosody in Language Learning: Stress, Tone and Intonation, Macquarie University Sydney, Australia.
Colloquium, Institute of Cognitive and Brain Sciences, University of California at Berkeley.
Invited commentator, Deep Learning Panel, Microsoft Research Faculty Summit, Redmond, WA.
Invited speaker, Deep Learning Technology Center, Microsoft Research, Redmond, WA.
Invited public lecture, Johns Hopkins Brain and Cognition Speaker Series.

2013

Invited speaker, 'The Cognitive Revolution 60 Years On', British Academy for the Humanities and Social Sciences, London.
Invited participant, 'Linking language and cognition to neuroscience via computation', NSF Workshop.
Invited speaker, MIT Intelligence Initiative Speaker Series.

2012

Colloquium, Department of Linguistics, University of Massachusetts at Amherst.
Advances in Optimality Theory: Syntax and Semantics, Johns Hopkins University Workshop, Baltimore. (With Matthew Goldrick.)
Cognitive Science Program Inaugural Conference, Tufts University.
Turing Centenary Conference, Computability in Europe 2012, Cambridge University.
Defining Cognitive Science speaker series, Simon Fraser University, Vancouver, Canada.

2011

Speaker, 'Optimality Theory as a General Cognitive Architecture' Workshop, Annual Meeting of the Cognitive Science Society, Boston.
Colloquium, Psychology Department, Stanford University.
Colloquium, Cognitive Science Program, University of Maryland at College Park.

2010

Two talks, Tandem Workshop on Optimality in Language and Geometric Approaches to Cognition, Berlin.
Colloquium, School of Philosophy, Psychology and Language Studies Interdisciplinary Seminar Series, University of Edinburgh.
Colloquium, School of Informatics, University of Edinburgh.
Speaker and panelist, '10 years of the Rumelhart Prize' Symposium, Annual Meeting of the Cognitive Science Society, Portland.
Conférence de clôture, Chaire Blaise Pascal, Paris.
Colloquium, Cognitive Science Program, University of Arizona.
Colloquium, Cognitive Science Program, Yale University.

Workshop on Language, Cognition, and Computation, University of Chicago (With M. Goldrick & Don Mathis.)

2009

Master class, Royal Netherlands Academy of Arts and Science. (With Géraldine Legendre.)

Master class, Royal Netherlands Academy of Arts and Science.

Royal Netherlands Academy of Arts and Science Workshop on Language Acquisition and Optimality Theory, Amsterdam. (With Géraldine Legendre.)

Royal Netherlands Academy of Arts and Science Workshop on Language Acquisition and Optimality Theory, Amsterdam.

Colloquium, Max Planck Institute for Psycholinguistics, Nijmegen.

Plenary speaker, Generative Linguistics in the Old World Conference, Nantes.

Colloquium, Linguistics Society, Cambridge University.

Colloquium, Department of Experimental Psychology, Oxford University.

Laboratory of Cognitive Science and Psycholinguistics, Ecole Normale Supérieure, Paris.

2008

'Author meets critic' session on *The Harmonic Mind* (Smolensky & Legendre, MIT Press, 2006), American Philosophical Association Eastern Division Annual Conference, Philadelphia.

Colloquium, Département d'Etudes Cognitives, Ecole Normale Supérieure, Paris.

Laboratory for Language and Speech, University of Provence, Aix-en-Provence. Ecole d'Automne de Linguistique, Ecole Normale Supérieure, Paris.

Workshop on Dynamical Systems in Language, Reading, UK.

Connecting probabilistic models of cognition and neural networks, Berkeley.

Language Production Workshop, Annapolis.

Language and Neurons -Theoretical Approaches, Ramat-Gan, Israel.

Workshop on Building Integrated Models of Linguistic Change, Santa Fe Institute.

2007

Workshop on Variation, Gradience and Frequency in Phonology, Stanford University.

Keynote Address, 25th anniversary celebration of the official founding of the Cognitive Science Program, Vassar College.

Linguistics Colloquium, Northwestern University.

2006

Workshop on Gaps in Paradigms, Oslo.

Inaugural Glushko Distinguished Visitor in Cognitive Science Program, UCSD.

Workshop on Language and the Origins of Humans, San Diego.

Linguistics Colloquium, Stanford University.

2005

Rumelhart Prize Lecture, Cognitive Science Society, Stresa.

Plenary speaker, Chicago Linguistic Society, Chicago.

Workshop on Perception in Phonology, Köln.

2004

Amsterdam Colloquium.

Amsterdam Fall Master Classes.

Linguistics Symposium, University of North Carolina.

Linguistics Colloquium, University of Southern California.

2003

Semantics Colloquium. Nijmegen, Netherlands.
Plenary speaker, Southwestern Optimality Theory Conference.
Workshop on Neural Networks, Logic, and Optimality Theory, Berlin.
Distinguished speaker series, University of Amsterdam.
Workshop on Markedness and the Lexicon. MIT.

2002

Seoul National University (two lectures).
Korean Phonological Society, Seoul.
North American Summer School for Logic, Language, and Information. Stanford University.
Plenary speaker, Annual Meeting of the Linguistic Society of America, San Francisco.
Linguistics Colloquium, Rutgers University.

2001

Phonology Forum, Tokyo.
Optimality Theory Workshop, Tokyo.
Plenary speaker, International Cognitive Science Conference, Beijing.
Presidential Address, Annual Meeting of the Society for Philosophy and Psychology, Cincinnati.
Invited organizer and speaker, Symposium on the Mathematics of Optimality Theory, Annual Meeting of the American Association for the Advancement of Science. San Francisco.
Cognitive Science Distinguished Speaker Series, Rochester University (two lectures).
Workshop on Language and Evolution, Institute for Advanced Study, Princeton.
Plenary speaker, International Conference on Cognitive and Neural Systems, Boston University.

2000

Workshop on the Optimization of Interpretation. Utrecht, The Netherlands.
Linguistics Colloquium, UCLA.

1999

Invited speaker, Symposium on Optimality Theory. Annual Conference of the Cognitive Science Society, Vancouver.
Workshop on Neuronal Assemblies, International Joint Conference on Neural Networks, Washington, D.C.
Workshop on Phonology and the Lexicon, University of Alberta, Edmonton.
Plenary speaker, Inaugural Conference for the Program in Cognitive Science, University College Dublin.
Plenary speaker, 35th Annual Meeting of the Chicago Linguistics Society, Chicago.
Ida Cordelia Beam Distinguished Lecture, University of Iowa.
Linguistics Colloquium, University of Massachusetts at Amherst.
Physics Colloquium, Rutgers University.

1998

Is syntax different? Common cognitive structure for syntax and phonology in Optimality Theory, Stanford University.
Cognitive Science Round Table, Stanford University.
Linguistics Colloquium, Stanford University.
Linguistics Colloquium, New York University.
Linguistics Colloquium, Yale University.
Applied Physics Laboratory Colloquium, Johns Hopkins University.
Philosophy Colloquium, Johns Hopkins University.

1997

Plenary speaker, Computational Psycholinguistics Conference, Berkeley, CA.
Plenary speaker, Hopkins Optimality Theory Workshop/University of Maryland Mayfest.
Tutorial in Optimality Theory (for syntacticians and others), Hopkins Optimality Theory Workshop/ University of Maryland Mayfest.
Plenary speaker, GALA Conference on Language Acquisition: Knowledge Representation and Processing, Edinburgh.
Center for Cognitive Science Colloquium, Rutgers University.
Optimality Theory Research Seminar, Rutgers University.

1996

Workshop on Optimality Theory and Cognition, Stanford University.
Invited organizer/moderator, Symposium on Controversies in Cognitive Science: The Case of Language. Cognitive Science Society, San Diego.
Plenary speaker, Celebration of the 10th anniversary of publication of the PDP books, Cognitive Science Society, San Diego.
Invited organizer, discussant and speaker, Symposium on Non-symbolic Computation, Society for Philosophy and Psychology, San Francisco.
University of California at San Diego Cognitive Science Distinguished Speaker Series.
Vassar College Cognitive Science Speaker Series.
Linguistics Colloquium, Stanford University.
Language Acquisition Seminar, Stanford University.

1995

Plenary speaker, Conference of the Computational Linguistics Special Interest Group of the German Linguistics Society, Düsseldorf.
Plenary speaker, Conference on Current Trends in Phonology: Models and Methods, Royaumont/Paris.
Plenary speaker, Conference on Optimality in Syntactic Theory, MIT .
Cognitive Studies Speaker Series, Cornell University.
Linguistics Colloquium, Cornell University.
Computer Science Colloquium, Rutgers University.
Colloquium, Program in Cognitive Science and Linguistics, MIT.
Linguistics Colloquium, University of Arizona.
Linguistics Colloquium, University of Southern California.
Linguistics Colloquium, University of Maryland.
Colloquium, Institute for Research in Cognitive Science, University of Pennsylvania.
Linguistics Colloquium, University of California, Los Angeles.
Linguistics Colloquium, University of Delaware.

1994

Invited speaker, Annual Conference of the Cognitive Science Society, Atlanta.
Plenary speaker, First International Summer Institute in Cognitive Science, Buffalo, NY.
Plenary speaker, Annual Conference of the Association for Computational Linguistics.
Invited speaker, Annual Conference of the Society for Philosophy and Psychology, Memphis.
Workshop on Cognitive Models of Language Acquisition, Tilburg, The Netherlands.
Plenary speaker, CUNY Sentence Processing Conference, New York.
Colloquium, Department of Cognitive and Linguistic Sciences, Brown University.
Psychology Colloquium, Yale University.
Linguistics Colloquium, University of California, Santa Cruz.

Cognitive Science Colloquium, Georgia Institute of Technology.

1993

Keynote Address, Rutgers Optimality Workshop-1, New Brunswick, NJ.

Plenary speaker, Annual Conference of the Cognitive Science Society, Boulder, CO.

Cognitive Science Colloquium, University of Massachusetts at Amherst.

Cognitive Science Colloquium, University of Minnesota, Twin Cities.

Cognitive Science Colloquium, New York University.

Phonology Workshop, Stanford University.

1992

NSF Workshop on Approaches to AI, Santa Fe, NM.

Plenary speaker, International Symposia on Information Sciences, Fukuoka, Japan.

Plenary speaker, Conference on Cognition and Representation, Buffalo, NY.

Keynote address, West Coast Conference on Formal Linguistics XI, Los Angeles.

Rutgers Center for Cognitive Science Colloquium, Rutgers University.

International Computer Science Institute, Berkeley, CA.

Colloquium, Phonology Laboratory, Linguistics Department, University of California, Berkeley.

Department of Computer and Cognitive Sciences, Chukyo University, Toyota, Japan.

Electro-Technical Laboratory, Tsukuba, Japan.

Nippon Telephone and Telegraph, Yokosuka, Japan.

Colloquium, Cognitive Science Program, University of Rochester.

Colloquium, Department of Computer Science, State University of New York at Buffalo.

Colloquium, Institute for Research in Cognitive Science, University of Pennsylvania.

Colloquium, Cognitive Science Program, University of California at Berkeley.

1991

Plenary speaker, Royal Society Conference on Hybrid Models of Cognition: The Problems of, and Requirements for, Combining the Use of Subsymbolic and Symbolic Computing, London.

Plenary speaker, Scandinavian Conference on Artificial Intelligence, Roskilde, Denmark.

Plenary speaker, CUNY Sentence Processing Conference, Rochester, NY.

Connectionism and cognitive science workshop, Cognitive Science Program, Vassar College.

Interdisciplinary Workshop on Compositionality in Cognition and Neural Models, Royaumont/Paris.

Plenary speaker, Arizona Phonology Conference, Tucson.

Harmonic phonology workshop, Cognitive Science Program, University of Arizona, Tucson.

Parallel Distributed Processing Seminar, Stanford University.

Colloquium, Center for the Study of Language and Information, Xerox PARC/Stanford University.

1990

Plenary speaker, Symposium on Neural Networks, Linz, Austria.

Artificial Intelligence and Cybernetics Speaker Series, University of Vienna.

Workshop on Language: With or without rules? Questions from Universal Grammar, Cognitive Grammar, and Connectionism, Durham, NH.

Workshop on Iconic and Symbolic Representations in Mental Models, MIT.

University Lecture Series, Memphis State University.

Program in Cognitive Science Speaker Series, University of North Carolina, Chapel Hill.

Colloquium, Institute of Cognitive Science, University of Colorado at Boulder.

Colloquium, Center for Research on Language, UCSD.

1989

Colloquium, Center for Complex Cognitive, Neural, and Computational Systems, Brandeis University.
International Symposium on Synergetics of Cognition, Elmau, West Germany.
Cognitive Science Speaker Series, Indiana University, Bloomington.
Colloquium, International Computer Science Institute, Berkeley.
Seminar in Connectionist and Neural Models, University of Chicago.

1988

Workshop: Connectionism in Perspective, Zurich.
Colloquium, International Computer Science Institute, Berkeley.
Parallel Distributed Processing Seminar, University of Pennsylvania.
Colloquium, Optoelectronic Computing Systems Center, University of Colorado, Boulder.
Plenary speaker, Neuro-Image Conference, Bordeaux.
Invited speaker, Symposium on Connectionism and Psychological Explanation, Society for Philosophy and Psychology Conference, Chapel Hill, NC.
Invited speaker, Symposium on Parallel Distributed Processing in Man and Machine, European Meeting on Cybernetics and Systems Research, Vienna.
Workshop on Parallel Distributed Processing of Language, Vienna.
Invited debater, Program in Cognitive Science, MIT.
Sloan Cognitive Science Speaker Series, University of Pennsylvania.

1987

Plenary speaker, Spindel Philosophy Conference on Connectionism and the Philosophy of Mind, Memphis, TN.
Plenary speaker, Annual Meeting of the Society for Mathematical Psychology, Berkeley, CA.
Plenary speaker, Symposium on Cognitive Science, Cerisy-la-Salle, France.
New Directions in the Philosophy of Cognitive Science Speaker Series, University of Minnesota.
Plenary speaker, Symposium on Connectionism, University of Toronto.
Panel Speaker, Human Factors in Computing Systems and Graphics Interfaces Conference, Toronto.
Colloquium, Program in Cognitive Science, Princeton University.
Colloquium, Department of Brain and Cognitive Sciences, MIT.
Cognitive Science Colloquium, University of Illinois.
Colloquium, Department of Computer Sciences, University of Pennsylvania.
Colloquium, Center for Research in Learning, Cognition, and Perception, University of Minnesota.
Seminar in Mathematical Approaches to Language, Linguistic Institute, Stanford University.
Parallel Distributed Processing Research Group, Stanford University.

1986

Colloquium, Program in Cognitive Science, University of California at Berkeley.
Invited speaker, Symposium on Connectionist Models and Neural Networks, Society for Philosophy and Psychology Conference, Baltimore, MD.
Invited speaker, Symposium on Cognitive Science: Theory, Methodology, and Applications, American Association for the Advancement of Science, Southwest and Rocky Mountain Division Annual Meeting, Boulder, CO.
Plenary speaker, Neural Connections/Mental Computation: Conference on Biological Computation, Tucson, AZ.
Colloquium, Max Planck Institute for Psychiatry, Munich.
Computer Science Colloquium, University of Arizona.
Colloquium, Computing Research Laboratory, New Mexico State University.
Seminar in Expert Systems, University of California at Berkeley.

University of California at Berkeley, Seminar in Neural Nets and Parallel Computation.
 University of California at Berkeley, Seminar in Cognitive Modeling.
 Xerox Palo Alto Research Center, Intelligent Systems Laboratory.

1985

Computer Science Colloquium, UCSD.
 Colloquium, MCC, Austin, TX.
 Information and Computer Sciences Colloquium, University of California at Irvine.
 Colloquium, Division of Education in Mathematics, Technology and Science, University of California at Berkeley.
 Computer Science Colloquium, University of Colorado, Boulder.
 Colloquium, Philips Laboratories, New York.

1984

Invited speaker, Symposium on Ethical Issues in New Computing Technologies, National Conference of the Association for Computing Machinery, San Francisco.
 Workshop on Parallel Distributed Processing, La Jolla, CA.
 Workshop on Stochastic Parallel Computation, Boston.
 Colloquium, Brown University Applied Mathematics Department.
 Colloquium, MIT Artificial Intelligence Laboratory.
 Seminar, Carnegie-Mellon Boltzmann Machine Research Group.
 Colloquium, University of Pittsburgh Learning Research and Development Center.
 Seminar, University of Massachusetts Adaptive Systems Research Group.
 Colloquium, Max Planck Institute for Psychiatry, Munich.
 Colloquium, European Centre for Research in Computing, Munich.

Other International Invitations (declined)

Invited speaker, Workshop on Hyper-Dimensional Computing and Vector Symbolic Architectures, Heidelberg, Germany, March 2020
 Keynote speaker, International Society of Experimental Linguistics. Athens, Greece, October 2020
 Invited lecturer, International Summer School on Deep Learning, DeepLearn 2020. León, Mexico, July 2020.
 Invited conference speaker, Introducing QNLP: embracing the NISQ era, Oxford University, November, 2019
 Keynote speaker, Artificial Intelligence and Machine Learning Conference, Jeddah, Saudi Arabia, January, 2019
 Invited lecturer, International Summer School on Deep Learning (DeepLearn 2017), Bilbao, Spain, July, 2017
 Invited lecturer, Jiaotong University Global Summer School, Beijing, July – August, 2016.
 Invited Workshop Participant, Neural-Symbolic Learning and Reasoning, Schloss Dagstuhl - Leibniz Center for Informatics, Germany, September 2014.
 Newton Institute lecture, John Moores University; Liverpool, England, June 2012.
 Professor, Eastern European Generative Grammar summer school; Constanza, Romania, July – August, 2010.
 Invited speaker, Workshop: What Should Psychology as a Basic Science Aim For? Strengths and Limitations of Theoretical Explanations in Psychology; Nierstein, Germany, December, 2009.
 Invited speaker, Eighth International Tbilisi Symposium on Language, Logic and Computation, Bakuriani, Georgia, September, 2009.
 Invited speaker, Interdisciplinary Seminar Series of the School of Philosophy, Psychology and Language Sciences, Edinburgh University, May, 2009.
 Invited speaker, Workshop on learning about vocal structure, Leiden, Netherlands, April, 2009.
 Invited speaker, Seventh International Tbilisi Symposium on Language, Logic and Computation, Tbilisi, Georgia, October, 2007.
 Invited speaker, 45th Annual Meeting of the Association for Computational Linguistics, Prague, June, 2007.

- Invited speaker, Sixth International Tbilisi Symposium on Language, Logic and Computation, Batumi, Georgia, September, 2005.
- Invited instructor, Summer School on Complex Networks in Brain Dynamics, International Helmholtz Institute for Supercomputational Physics, Potsdam, September, 2005.
- Invited speaker, Réseau Français de Phonologie, Aix-en-Provence, June 2004.
- Invited speaker, Sixth Workshop on Optimality Theory Syntax. Potsdam. October, 2002.
- Invited speaker, GLOW Workshop on First and Second Language Acquisition, Utrecht, 12–13 April, 2002.
- Invited speaker, First Salzburg Workshop on Paradigms of Cognition, Salzburg University, Salzburg, Austria, July, 2002.
- Keynote speaker, Cognitive Linguistics Conference, Graduate Institute of Linguistics, National Chengchi University, Taiwan, January, 2002.
- Invited speaker, Cognitive Science Conference, California State University, Long Beach, April, 2002.
- Invited speaker, Fifth International Conference on Computational Intelligence, Symposium on New Frontiers for Recurrent Neural Networks, Research Triangle Park, NC, March 2002.
- Invited speaker, Scuola Superiore G. Reiss Romoli Winter Conference, L'Aquila, Italy, January, 2002.
- Invited lecturer (3 lectures), Vilem Mathesius Lecture Series 17, Prague, March 2002.
- Invited speaker, International Symposium on Foundations and the Ontological Quest, Rome, Jan. 2002.
- Invited speaker, Early phonological acquisition Workshop, Vacancier La Calanque, Carry-le-Rouet, France, Oct. 2001
- Invited speaker, Language, Abduction, And Computation Workshop, Canadian Philosophical Association Meeting, Québec, May 2001
- Faculty, Summer School in Linguistics, Girona, Spain, 2000
- Invited speaker, Workshop on conflicting rules, Potsdam University, Dec. 1999.
- Invited speaker, Economy in the Structure and Computation of Natural Language. Lyon, France. Oct. 1999.
- Invited speaker, Computationalism – The next generation. Vienna, May 1999.
- Invited speaker, Cognitive Science Tutorial Speaker Series, University of Delaware. 1998
- Invited speaker, Cognitive Science Distinguished Lecture Series, Carleton University, Ottawa. 1998.
- Invited speaker, Cognitive Science of Natural Language Processing. Dublin, August 1998.
- Organizing committee, Workshop on Computing Constraints, Annual Conference on Computational Linguistics, Montreal. August 1998.
- Invited speaker, Conference on Memory and Linguistics Processing, Utrecht, Holland. May 1998.
- Invited speaker, International Workshop on Approaches to Phonology, Abbaye de Royaumont, France. June 1998.
- Invited speaker, Conference on Connectionism and the Philosophy of Psychology, Ljubljana, Slovenia. August 1997.
- Invited speaker, Korean Conference on Cognitive Science. Seoul, August 1997.
- Invited speaker, Language and Cognition in Language Acquisition, Odense. Denmark, Aug. 1997.
- Invited speaker, Carnegie Symposium on Cognition. Pittsburgh, May 1997.
- Invited speaker, Workshop on Conflicting Constraints, Groningen, The Netherlands. July, 1996.
- Faculty, Behavioral and Cognitive Neurosciences International Summer School, Groningen, The Netherlands. July, 1996.
- Invited speaker, Workshop on Dynamics, Computation, and Cognition, Santa Fe Institute. May, 1996.
- Faculty, Summer School in Cognitive Science, New Bulgarian University, Sofia, Bulgaria. July, 1996, 1995.
- Invited speaker, Conference on Recent Developments in Connectionism, Ottawa, June 1996.
- Invited contributor, Special Issue on Cognitive Science, *il cannocchiale: rivista di studi filosofici*, 1996.
- Editorial Board, *Cognition*, 1995–.
- Invited speaker, Workshop on Derivations and Constraints in Phonology, Colchester, England, September, 1995.
- Invited speaker, Linguistic Society of Korea; Korean Society for Cognitive Science. July 1995.

- International Program Committee, World Conference on the Fundamentals of Artificial Intelligence. Paris. July, 1995.
- Invited speaker, Fourth International Conference on Cognitive Science. San Sebastián, Spain. May, 1995.
- Optimality and processing in phonology. *Processing Consequences of Phonological Diversity*. Trieste, Italy. April, 1995.
- Invited speaker, Second Swedish Conference on Connectionism. March, 1995.
- International board of consulting editors, *Human Cognitive Processing: An Interdisciplinary Series on Language and Other Mental Faculties*, John Benjamins Publishing Co. February 1995.
- Advisory Board, *Handbook of Neural Computation*. Oxford/Institute of Physics Publishing. April, 1994.
- Invited speaker, Weizmann Institute Workshop on Immunology as a Cognitive Science, Rehovot, Israel. April 1994.
- Chair of session on Optimality Theory, Annual Meeting of the Linguistics Society of America, Boston, MA. January 1994.
- Invited talk and tutorial, International Conference on Neural Networks, Nagoya, Japan. October, 1993.
- Invited Speaker, Ludwig Wittgenstein Symposium: Philosophy and the Cognitive Sciences. Kirchberg/Wechsel, Austria. August 1993.
- Invited Speaker, Models of Cognition. Salernes, France. May, 1993.
- Invited Speaker, Perceptual Multistability and Semantic Ambiguity Workshop, Bremen, Germany. March 1993.
- Program Committee Member, IEEE International Conference on Neural Networks. San Francisco. March, 1993.
- Invited Speaker, Conference on Brain and Cognitive Processes. San Marino. December, 1992.
- Invited Speaker, Linguistics Society of Belgium. Antwerp, Belgium. November, 1992.
- Invited Speaker, First Swedish Conference on Connectionism. Skovde, Sweden. September, 1992.
- Invited Speaker, Workshop on Integrating Speech and Natural Language. Dublin, Ireland. July 1992.
- Invited Speaker, International Conference on the Holonomic Theory of Perception. Australia. July, 1992.
- Invited Speaker, Irish Neural Networks Conference. Belfast, Northern Ireland. June, 1992.
- Invited Speaker, Round-table on the continuum in Linguistic Semantics. Caen, France. June, 1992.
- Invited Speaker, Second Interdisciplinary Workshop on Compositionality in Cognition and Neural Models. Royaumont/Paris. June, 1992.
- Invited Speaker, 9th International Congress of Logic, Methodology and Philosophy of Science; Cognitive Science, Artificial Intelligence and Computational Psychology Section. Uppsala, Sweden. August, 1991.
- Invited speaker, Conference on Adaptive Learning and Neural Networks. Ulm, Germany. July, 1991.
- Invited Speaker, 2nd International Conference on Cognitive Science. San Sebastian, Spain. May, 1991.
- Keynote speaker, TEC-COMP 91, International Congress on New Horizons of Artificial Intelligence. Mexico City. April, 1991.
- Invited Speaker, Congress on Linguistic Engineering 91. Paris. January, 1991.
- Invited Speaker, Conference on Emergence, Supervenience, and Non-reductive Materialism. Zentrum für interdisziplinäre Forschung, Universität Bielefeld, Germany. October, 1990.
- Program Committee, Tutorial Speaker, and Invited Speaker, Cognitiva meeting. Madrid. October, 1990.
- Invited Speaker, Colloquium on Continuous Mathematics. Cerisy-la-Salle, France. September, 1990.
- Colloquium Speaker, Forschungsinstitut für anwendungsorientierte Wissensverarbeitung. Ulm, Germany. July, 1990
- Instructor, International Summer School in Philosophy and Artificial Intelligence. Bolzano, Italy. July, 1990.
- Invited Speaker, Turing Colloquium. University of Sussex, Brighton, England. April, 1990.
- Invited Participant, Mind and Brain symposium. Zentrum für intedisziplinäre Forschung, Universität Bielefeld, West Germany. December, 1989.
- Invited Speaker, Connectionism and language. The New University, San Marino, Italy. October, 1989.

Invited Speaker, European Mathematical Psychology Meeting. Nijmegen, The Netherlands. August 1989.

Invited Participant, Workshop on Connectionism. Birkbeck College, London. July 1989.

Instructor, Eurotra Machine Translation Advanced Course Programme. Barcelona, Spain.

Visiting Lecturer, University of Vienna.

Visiting Lecturer, Institute of Cognitive Science, Beijing.

Contributed Conference Presentations (without proceedings)

Pyeong Whan Cho, Matthew Goldrick, Paul Smolensky. A Gradient Symbolic Computation parser: Parallel parsing in a continuous dynamical system. CUNY Sentence Processing Workshop, UMass Amherst, March 2020.

Linguistically informed tasks for evaluating structure encoded by sentence representations. Najoung Kim, Benjamin Van Durme, Ellie Pavlick & Paul Smolensky. WeCNLP Summit, Facebook HQ, Menlo Park, CA, Sept. 2018.

A gradient blend analysis of English PP verbal dependents. Najoung Kim, Kyle Rawlins, & Paul Smolensky. Conference on Interdisciplinary Approaches to Linguistic Theory (CiALT) 2, Humboldt-Universität zu Berlin, Oct. 2018.

A gradient blend analysis of English PP verbal dependents. Najoung Kim, Kyle Rawlins, & Paul Smolensky. Acceptability judgments in current linguistic theory, Universitat Autònoma de Barcelona, Oct. 2018.

Learning and analyzing vector encoding of symbolic representations. Roland Fernandez, Asli Celikyilmaz, Rishabh Singh, Paul Smolensky. ICLR 2018 Workshop. arXiv:1803.03834. May 1, 2018.

A neural-symbolic approach to design in CAPTCHA. Qiuyuan Huang, Paul Smolensky, Xiaodong He, Li Deng, Dapeng Wu. Poster, NIPS Workshop on Security Dec. 8, 2017.

Bifurcation analysis of a Gradient Symbolic Computation model of incremental processing. Cho, Pyeong Whan & Smolensky, Paul. Poster presented at the 38th Annual Conference of the Cognitive Science Society. Aug., 2016.

Optimal control in a Gradient Symbolic Computation model of incremental processing. Cho, Pyeong Whan, Goldrick, Matthew & Smolensky, Paul. Poster presented at the 15th Neural Computation and Psychology Workshop (NCPW15). Aug., 2016

A Gradient Symbolic Computation model of incremental processing. Cho, Pyeong Whan, Goldrick, Matthew & Smolensky, Paul. Poster presented at the 29th Annual CUNY Conference on Human Sentence Processing, Gainesville, FL. Mar., 2016.

Reasoning in Vector Space: An Exploratory Study of Question Answering. Moontae Lee, Xiaodong He, Wen-tau Yih, Jianfeng Gao, Li Deng, and Paul Smolensky. Poster presented at International Conference on Learning Representations (ICLR2016) poster, May 4, 2016.

Gradient symbol processing for phonological production. Talk presented at the North-East Computational Phonology Workshop (NECPhon), Yale. October 6, 2012.

Statistical learning constrained by syntactic biases in an artificial language learning task. Jennifer Culbertson, Paul Smolensky and Géraldine Legendre. Talk given at Boston University Conference on Language Development 36, November 2011.

Positive-overlapping letter position representation in reading: An axiomatic analysis of transposition priming. Simon Fischer-Baum and Paul Smolensky. Talk given at the 44th annual meeting of the Society for Mathematical Psychology, Boston, MA. July, 2011.

Bayesian modeling of substantive biases for word order in an artificial language learning paradigm. Jennifer Culbertson and Paul Smolensky. Poster presented at the 29th West Coast Conference on Formal Linguistics, Tucson, AZ. April, 2011.

Can neural-network-parsing complexity explain a word-order universal? Paul Smolensky, Jennifer Culbertson, Donald Mathis, Colin Wilson, Matt Goldrick, and Géraldine Legendre. Poster presented at the CUNY Conference on Sentence Processing. Stanford, CA. March, 2011.

Learning biases and constraints on syntactic typology: an artificial language learning approach. Jennifer Culbertson, Paul Smolensky and Géraldine Legendre. 85th Annual Meeting of the Linguistic Society of America, Pittsburgh, PA. February, 2011.

- Disharmony in the nominal domain: An artificial language learning approach. Jennifer Culbertson and Paul Smolensky. Linguistics Association of Great Britain Annual Meeting, Leeds, UK. September, 2010.
- Testing Greenberg's Universal 18 using the Mixture Shift Paradigm for artificial language learning. Jennifer Culbertson and Paul Smolensky. 40th meeting of the North East Linguistic Society, Cambridge, MA, November, 2009.
- Replicator dynamics of speech perception and categorization. Michael Wolmetz, Colin Wilson and Paul Smolensky. Poster presented at Laboratory Phonology 11, Wellington, New Zealand, June, 2008.
- Speakers' knowledge of phonological universals: Evidence from nasal clusters. Iris Berent, Tracy Lennertz, & Paul Smolensky. CUNY Conference on the Syllable. New York. January, 2008.
- Recoverability Optimality Theory: Discourse anaphora in a bidirectional framework. Paper presented at EDILOG, 6th Workshop on the Semantics and Pragmatics of Dialog, Edinburgh, UK. August 2002.
- Typological consequences of local constraint conjunction. 21st West Coast Conference on Formal Linguistics. April, 2002.
- A criterion for causal efficacy derived from Optimality Theory. American Philosophical Association Meeting, Midwest Division. May, 2001.
- Syntactic Influences in Relative Clause Attachment: An Optimality Theory Account. CUNY Sentence Processing Conference. Philadelphia, PA. March, 2001.
- Phonological processing deficits in aphasia. Cognitive Science Society. Philadelphia, PA. August, 2000.
- Implementing the dual route in a single route. Cognitive Science Society. Vancouver. August, 1999.
- Optimality in sentence processing. Computational Psycholinguistics. Berkeley, CA. August, 1997.
- Optimal sentence processing. Hopkins Optimality Theory Workshop/University of Maryland Mayfest. May, 1997.
- The learnability of Optimality Theory. West Coast Conference on Formal Linguistics. San Diego, CA. February, 1994.
- Analytic typology of case marking and grammatical voice based on hierarchies of universal constraints. Berkeley Linguistics Society. Berkeley, CA. February, 1993.
- Harmonic Grammars for formal languages. Neural Information Processing Systems. Denver, CO. December, 1992.
- Harmonic Grammar: A progress report on connectionist mathematical linguistics. Third Conference on the Mathematics of Language. Austin, TX. November, 1992.
- Rule induction through integrated symbolic and subsymbolic processing. Neural Information Processing Systems. Denver, CO. December, 1991.
- The connectionist scientist game: Rule extraction and refinement in a neural network. Cognitive Science Society. Chicago, IL. July, 1991.
- Learning explicit rules in a neural network. International Joint Conference on Neural Networks. Seattle, WA. July, 1991.
- Unifying syntactic and semantic accounts of unaccusativity: A connectionist approach. Berkeley Linguistics Society. Berkeley, CA. February, 1991.
- Recursive structure processing and Harmonic Grammar. Neural Information Processing Systems. Denver, CO. November, 1990.
- Harmonic Grammar – A formal multi-level connectionist theory of linguistic well-formedness: An application. Cognitive Science Society. Cambridge, MA. July, 1990.
- Harmonic Grammar – A formal multi-level connectionist theory of linguistic well-formedness: Theoretical foundations. Cognitive Science Society. Cambridge, MA. July, 1990.
- Can connectionism contribute to syntax? Chicago Linguistics Society. Chicago, IL. April, 1990.
- Virtual memories and massive generalization in connectionist combinatorial learning. Cognitive Science Society. Ann Arbor, MI. August, 1989.
- Skeletonization: Trimming the fat from a network via relevance assessment. Neural Information Processing Systems. Denver, CO. November, 1988.

- Application of the interactive activation model to document retrieval. Neuro-Nîmes: Neural networks and their applications. Nîmes, France. November, 1988.
- Analyzing a connectionist model as a system of soft rules. Cognitive Science Society. Montreal, Canada. August, 1988.
- Analysis of distributed representation of constituent structure in connectionist systems. IEEE Conference on Neural Information Processing Systems: Natural and Synthetic. Denver, CO. November, 1987.
- On the connectionist reduction of conscious rule interpretation. Cognitive Science Society. Seattle, WA. July, 1987.
- Statistical mechanics and parallel computation. La Jolla Institute Center for Studies of Nonlinear Physics Dynamics Days. La Jolla, CA. January, 1985.
- Parallel computation: The brain and artificial intelligence. Southern California Artificial Intelligence Society. Los Angeles, CA. October, 1984.
- Formalizing task descriptions. International Federation for Information Processing Conference on Human-Computer Interaction. London, England. September, 1984.
- A parallel model of problem solving. Cognitive Science Society. Boulder, CO. June, 1984.
- The mathematical role of self-consistency in parallel computation. Cognitive Science Society. Boulder, CO. June, 1984.
- User-centered system documentation. Human Factors in Computer Systems. Boston, MA. December, 1983.
- Schema selection and stochastic inference in modular environments. National Conference on Artificial Intelligence. Washington, DC. August, 1983.
- Cognitive temperature and learning in connectionist models. Cognitive Science Society. Rochester, NY. May, 1983.

Service to National Scientific Organizations

- NSF Workshop on Linking Language and Cognition to Neuroscience via Computation, 2013
- NIH Training Grant Panel, Cognitive Neuroscience, 2003, 2004
- National Academy of Sciences/Institute of Medicine Workshop, Opportunities for Interdisciplinary Training, Invited Speaker, 1999
- NSF Science and Technology Center Program site visit team member, 1996
- NSF Workshop on Learning and Intelligent Systems Initiative Team Leader, 1995
- NSF Young Investigator Award Panel, 1993
- NSF Workshop on Approaches to AI, 1993
- NSF Cognitive Science Initiative Workshop, 1991
- NSF Science and Technology Center Program panel member and site visit team chairman, 1990
- NSF Institutional Infrastructure Program site visit team member, 1989
- NSF Workshop on Connectionism and Cognitive Science, 1986

University Service

- Bloomberg Distinguished Professorship Search Committee Co-Chair, Computational Cognitive Science
- Bloomberg Distinguished Professorship Search Committee Co-Chair, Philosophy & Cognitive Science
- Online Learning working group
- Science of Learning Initiative (university-wide): Man-Machine Learning working group; Molecules to Minds working group
- Brain and Behavioral Sciences Advisory Committee
- Krieger-Eisenhower Chair Selection Committee
- Anthropology Department Senior Search Committee
- Undergraduate Writing Requirement Evaluation Committee
- Ad hoc promotion/appointment committees: Computer Science, Electrical and Computer Engineering, Anthropology, Psychology

Courses Developed

Deep Learning Seminar. Fall 2016.
 Gradient Symbolic Computation (Sapir Lecturer Course, Linguistics Society of America Summer Linguistic Institute). July 2015.
 Cognition (Introduction to Cognitive Science). Fall 2014.
 Integrative Research Methods in Cognitive Science. Spring 2013.
 Introduction to the Itô calculus (short course). Fall 2009.
 Axiomatic Linguistics: Exemplars and compositionality (with Robert Frank). Spring 2008.
 Professional Seminar in Cognitive Science. Spring 2008 (with Barbara Landau).
 Learning Theory (with Robert Frank). Spring 2007.
 Seminar in Experimental and Processing Linguistics. Fall 2006.
 Multidisciplinary seminar in phonology. Fall 2005.
 Universals and nativism in linguistics (Linguistics Society of America Summer Linguistic Institute). July 2005.
 Foundations of cognitive science B. Spring 2004.
 Introduction to cognitive science for mathematical scientists. Fall 2003.
 Phonology III. Spring 2003.
 Intermediate formal methods in cognitive science: neural networks. Fall 2002.
 Seminar: Competence and performance in cognitive science. Spring 2001.
 Formal methods in cognitive science: Neural networks. Fall 1998.
 Phonology II. Spring 1997.
 Phonology I. Fall 1996; Fall 2004.
 Minds, brains, and computers. Spring 1996.
 Seminar in Optimality Theoretic phonology. Spring 1995.
 Seminar in Optimality Theory and connectionism in linguistics. Spring 1994.
 Computation for cognitive scientists (for non-computer-science graduate students). Spring 1993.
 Mathematical perspectives on neural networks. Spring 1991.
 Connectionism and Harmony Theory in linguistics. (Linguistics Society of America Summer Linguistic Institute). July 1991.
 Modules for Introduction to AI: Logic; Cognitive Modeling; Machine Learning. Fall 1990.
 Foundations of cognitive science. Fall 1989.
 Advanced seminar in connectionist modeling. Spring 1988.
 Topics in cognitive science: Connectionism; Formal Syntax. Spring 1988.
 Survey of cognitive science. Fall 1987.
 Introduction to connectionist AI. Spring 1986.
 Advanced AI programming. Fall 1985.

Doctoral Thesis Supervision [*&* current position]

Primary advising (all Department of Cognitive Science, Johns Hopkins University except where noted)

Soulos, Paul. Expected: 2025.

McCoy, Richard Thomas. *Implicit compositional structure in artificial neural networks*. 2022. (Co-advisor: Tal Linzen) [Postdoc, Princeton University Psychology; Asst. Prof., Yale Linguistics]

Kim, Najoung. *Compositional linguistic generalization in artificial neural networks*. 2021. (Co-advisors: Tal Linzen, Kyle Rawlins) [Faculty Fellow, NYU Data Science; Asst. Prof., Boston University Linguistics]

Lalisse, Matthias Rémy. *Structure assembly in knowledge base representation*. 2021.

Ramadoss, Deepti. *The phonology and phonetics of tone perception*. Department of Cognitive Science, Johns Hopkins University. 2011. (Co-advisor: Luigi Burzio)

Culbertson, Jennifer. *Learning biases, regularization, and the emergence of typological universals in syntax*. Department of Cognitive Science, Johns Hopkins University. 2010. (Co-advisor: Géraldine Legendre)

- Finley, Sara. *Formal and Cognitive Restrictions on Vowel Harmony*. Department of Cognitive Science, Johns Hopkins University. 2008.
- Morley, Rebecca L. *Generalization, lexical statistics, and typologically rare systems*. Department of Cognitive Science, Johns Hopkins University. 2008.
- Jarosz, Gaja. *Rich Lexicons and Restrictive Grammars – Maximum Likelihood Learning in Optimality Theory*. Department of Cognitive Science, Johns Hopkins University. 2006.
- Buchwald, Adam. *Sound Structure Representation, Repair and Well-Formedness: Grammar in Spoken Language Production*. Department of Cognitive Science, Johns Hopkins University. 2005. (Co-advisor: Brenda Rapp)
- Hale, John. *Grammar, Uncertainty and Sentence Processing*. Department of Cognitive Science, Johns Hopkins University. 2003.
- Davidson, Lisa. *The Interaction of Articulatory, Perceptual, and Temporal Elements in Consonant Cluster Production*. Department of Cognitive Science, Johns Hopkins University. 2003.
- Tesar, Bruce. *Computational Optimality Theory*. Department of Computer Science, University of Colorado. 1995.
- Lynn, Patrick. *System Interaction in Human Memory and Amnesia: Theoretical Analysis and Connectionist Modeling*. Department of Computer Science, University of Colorado. 1994.
- Bernstein, Bernard. *EUCLID Supports Informal Argumentation with Hypertext*. Department of Computer Science, University of Colorado. 1993.
- Brousse, Olivier. *Systematicity and Generativity in Neural Network Combinatorial Learning*. Department of Computer Science, University of Colorado. 1991.
- Sanger, Dennis. *Contribution Analysis: A Technique for Assigning Responsibilities to Hidden Units in Connectionist Networks*. Department of Computer Science, University of Colorado. 1990.

Secondary advising

- Nicol, Tamara. *Learning Which Verbs Allow Object Omission: Verb Semantic Selectivity and the Implicit Object Construction*. Department of Cognitive Science, Johns Hopkins University. 2007. (Primary advisors: Barbara Landau, Géraldine Legendre)
- Goldrick, Matthew. *Patterns in Sound, Patterns in Mind: Phonological Regularities in Speech Production*. Department of Cognitive Science, Johns Hopkins University. 2002. (Primary advisor: Brenda Rapp)
- Wilson, Colin. *Targeted Constraints: An Approach to Positional Neutralization in Optimality Theory*. Department of Cognitive Science, Johns Hopkins University. 2000. (Primary advisor: Luigi Burzio)
- Gafos, Diamandis. *The Articulatory Basis of Locality in Phonology*. Department of Cognitive Science, Johns Hopkins University. 1996. (Primary advisor: Luigi Burzio)
- McMillan, Clayton. *Rule Induction in a Neural Network through Symbolically Constrained Subsymbolic Processing*. Department of Computer Science, University of Colorado. 1992. (Primary advisor: Michael Mozer)