

Curriculum Vitae

Alexander A. Petrov

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Research Interests

- **perceptual learning**, vision models, psychophysics
- **computational cognitive neuroscience**, neural networks
- **cognitive architectures**, Leabra, ACT-R
- relational reasoning in neural networks, analogy making
- memory-based scaling and categorization, prototypes, ANCHOR model

Employment

Assistant Professor. 2006 – present
Department of Psychology, Ohio State University, Columbus, OH, USA

Degrees

Ph.D. & M.S. in Cognitive Science. 1998. Central and East-European Center for Cognitive Science, New Bulgarian University. Thesis: *A dynamic emergent computational model of analogy-making based on decentralized representations*. Advisor: Boicho N. Kokinov.

M.S. & B.S. in Computer Science. 1995. Sofia University, Sofia, Bulgaria. *Cum laude*.

Additional Education

Post-doctoral Fellow. 2005 – 2006. Supervisor: Randall C. O'Reilly.
Department of Psychology, University of Colorado, Boulder, CO, USA.

Post-doctoral Fellow. 2001 – 2005. Supervisor: Barbara A. Doshier.
Department of Cognitive Science, University of California, Irvine, CA, USA.

Post-doctoral Fellow. 1998 – 2001. Supervisor: John R. Anderson.
Department of Psychology, Carnegie Mellon University, Pittsburgh, PA, USA.

Data mining and machine learning for professionals. 1999. Summer school at the Center for Automated Learning and Discovery, Carnegie Mellon University.

TEMPUS mobility grant. May–July 1996. Study period at Hamburg University, Germany. Financed by the TEMPUS program of the European Union.

Funding

Biologically-Inspired Cognitive Architectures, Co-Investigator on DARPA Grant 05185052, Oct 2005–Oct 2006, \$229,532 direct costs.

Journal Articles

Petrov, A. A. (in press). Category rating is based on prototypes and not instances: Evidence from feedback-dependent context effects. *Journal of Experimental Psychology: Human Perception and Performance*.

Petrov, A. A., Jilk, D. J., & O'Reilly, R. C. (in press). The *Leabra* architecture: Specialization without modularity. *Behavioral and Brain Sciences*.

Petrov, A. A. (2009). Symmetry-based methodology for decision-rule identification in same–different experiments. *Psychonomic Bulletin & Review*, 16 (6), 1011–1025.

Jeter, P. E., Doshier, B. A., **Petrov, A.**, & Lu, Z.-L. (2009). Task precision at transfer determines specificity of perceptual learning. *Journal of Vision*, 9 (3): 1, 1–13, <http://www.journalofvision.org/9/3/1/>

Petrov, A. A. (2008a). Additive or multiplicative perceptual noise? Two equivalent forms of the ANCHOR model. *Journal of Social & Psychological Sciences*, 1 (2), 123–143.

Petrov, A. A. (2008b). Relational priming plays a supporting but not leading role in adult analogy-making. *Behavioral and Brain Sciences*, 31 (4), 392–393.

Petrov, A. A., Doshier, B. A., & Lu, Z.-L. (2006). Perceptual learning without feedback in non-stationary contexts: Data and model. *Vision Research*, 46 (19), 3177–3197.

Petrov, A. A., Doshier, B. A., & Lu, Z.-L. (2005). The dynamics of perceptual learning: An incremental reweighting model. *Psychological Review*, 112 (4), 715–743.

Petrov, A. A. & Anderson, J. R. (2005). The dynamics of scaling: A memory-based anchor model of category rating and absolute identification. *Psychological Review*, 112 (2), 383–416.

Alexandrova, B., Terzieva, M., **Petrov, A. A.**, Tarnev, I. & Mavlov, L. (1996). [A study on visuo-perceptive and imagery abilities—I. Assessment of visuo-perceptive abilities.] (In Bulgarian). *Bulgarian Journal of Psychology*, 3, 76–91.

Terzieva, M., Alexandrova, B., **Petrov, A. A.**, Tarnev, I. & Mavlov, L. (1996). [A study on visuo-perceptive and imagery abilities—II. Assessment of visual mental image generation and transformation.] (In Bulgarian). *Bulgarian Journal of Psychology*, 4.

Book Chapters (Peer Reviewed)

Kokinov, B. & **Petrov, A. A.** (2001). Integrating memory and reasoning in analogy-making: The AMBR model. In D. Gentner, K. Holyoak, & B. Kokinov (Eds.), *The analogical mind: Perspectives from cognitive science* (pp. 59–124). Cambridge, MA: MIT Press.

Petrov, A. A. & Kokinov, B. (1998). Mapping and access in analogy-making: Independent or interactive? A Simulation Experiment with AMBR. In K. Holyoak, D. Gentner, & B.

Kokinov (Eds.), *Advances in analogy research: Integration of theory and data from the cognitive, computational, and neural sciences* (pp. 124–134). Sofia: NBU Press.

Kokinov, B., Nikolov, V. & **Petrov, A. A.** (1996). Dynamics of emergent computation in DUAL. In A. Ramsay (Ed.), *Artificial Intelligence: Methodology, Systems, Applications* (pp. 303–311). Amsterdam: IOS Press.

Conference Proceedings (Peer Reviewed)

Petrov, A. A. (2006). Computationally efficient approximation of the base-level learning equation in ACT-R. In D. Fum, F. del Missier, & A. Stocco (Eds.) *Proceedings of the Seventh International Conference on Cognitive Modeling* (pp. 391–392). Trieste, Italy: Edizioni Goliardiche.

Petrov, A. A. (2003). Additive or multiplicative perceptual noise? Two equivalent forms of the ANCHOR model. In *Proceedings of the Twenty-Fifth Annual Conference of the Cognitive Science Society* (pp. 922–927). Hillsdale, NJ: LEA.

Petrov, A. A. (2001). Fitting the ANCHOR model to individual data: A case study in Bayesian methodology. In *Proceedings of the Fourth International Conference on Cognitive Modeling* (pp. 175–180). Mahwah, NJ: LEA.

Petrov, A. A. & Anderson, J. R. (2000). ANCHOR: A memory-based model of category rating. In *Proceedings of the Twenty-Second Annual Conference of the Cognitive Science Society* (pp. 369–374). Hillsdale, NJ: LEA.

Kokinov, B. & **Petrov, A. A.** (2000). Dynamic extension of episode representation in analogy-making in AMBR. In *Proceedings of the Twenty-Second Annual Conference of the Cognitive Science Society* (pp. 274–279). Hillsdale, NJ: LEA.

Petrov, A. A. & Kokinov, B. (1999). Processing symbols at variable speed in DUAL: Connectionist activation as power supply. In *Proceedings of the Sixteenth International Joint Conference on Artificial Intelligence* (vol. 2, pp. 846–851).

Manuscripts under Review or in Preparation

Petrov, A. A. & Hayes, T. (resubmitted). Asymmetric transfer of perceptual learning of luminance- and contrast-modulation motion. *Journal of Vision*.

Petrov, A., Van Horn, N. M. & Ratcliff, R. (submitted). Dissociable perceptual learning mechanisms revealed by diffusion-model analysis of the patterns of specificity. *Psychonomic Bulletin & Review*.

Petrov, A. A. (in preparation). The stimulus specificity of motion perceptual learning does not arise from stimulus-specific improvements in visual memory or changes of decision strategy.

Petrov, A. A. (in preparation). The stimulus specificity of motion perceptual learning does not depend on the difficulty of the training task.

Petrov, A. & Van Horn, N. M. (in preparation). Motion aftereffect duration is not changed by perceptual learning: Evidence against the representation-modification hypothesis.

Abstracts, Posters, and Technical Reports

- Petrov, A. A.** (2010). The stimulus specificity of motion perceptual learning does not arise from stimulus-specific improvements in visual memory or changes of decision strategy. [Abstract]. *Journal of Vision*, 10(7): 1141, <http://www.journalofvision.org/10/7/1141/>
- Petrov, A. A.** (2010). Symmetry-based methodology for decision-rule identification in Same-Different experiments. [Abstract]. In *Proceedings of the 43rd Annual Meeting of the Society for Mathematical Psychology*.
- Petrov, A. A.** (2009). The stimulus specificity of motion perceptual learning depends on the difficulty during post-test rather than training. [Abstract]. *Journal of Vision*, 9(8), 885a, <http://www.journalofvision.org/9/8/885/>
- Petrov, A. A.** (2009). The stimulus specificity of motion perceptual learning depends on the difficulty during post-test rather than training. [Abstract]. *Abstracts of the Psychonomic Society*, 14, 5093.
- Hayes, T. & **Petrov, A. A.** (2009). Asymmetrical transfer of perceptual learning from luminance- to contrast-modulation motion: Evidence for shared and distinct processing. [Abstract]. *Abstracts of the Psychonomic Society*, 14, 5095.
- Hayes, T. & **Petrov, A. A.** (2009). Perceptual learning transfers from luminance- to contrast-defined motion. [Abstract]. *Journal of Vision*, 9(8), 884a, <http://www.journalofvision.org/9/8/884/>
- Van Horn, N. & **Petrov, A. A.** (2009). Motion aftereffect duration is not changed by perceptual learning: Evidence against the representation-modification hypothesis. [Abstract]. *Abstracts of the Psychonomic Society*, 14, 5094.
- Van Horn, N. & **Petrov, A. A.** (2009). Perceptual learning of visual motion: The role of the spatial frequency of the carrier. [Abstract]. *Journal of Vision*, 9(8), 886a, <http://www.journalofvision.org/9/8/886/>
- Petrov, A. A.** (2008). Single-interval and Same/Different discrimination tasks yield consistent estimates of perceptual learning of visual motion. [Abstract]. *Abstracts of the Psychonomic Society*, 13, 289.
- Petrov, A. A.** (2008). The dynamics of perceptual learning in non-stationary contexts: Data and model [Abstract]. In *Proceedings of the 33rd Annual Interdisciplinary Conference*.
- Petrov, A. A.** & O'Reilly, R. (2006). Generalization and interference in perceptual learning: A selective-reweighting model. [Abstract]. In *Proceedings of the 2006 Computational Cognitive Neuroscience Conference*, V-29.
- Petrov, A. A.** (2006). Bayesian method for repeated threshold estimation. [Abstract]. *Journal of Vision*, 6(6), 167, <http://www.journalofvision.org/6/6/167/>
- Petrov, A. A.** (2005). Bayesian method for repeated threshold estimation. [Abstract]. In *Proceedings of the 38th Annual Meeting of the Society for Mathematical Psychology*.
- Jeter, P., Doshier, B. A., **Petrov, A. A.**, & Lu, Z.-L. (2005). Identical transfer of perceptual learning following easy and difficult task training [Abstract]. *Journal of Vision*, 5(8), 710a, <http://www.journalofvision.org/5/8/710/>

- Petrov, A. A., Doshier, B. A., & Lu, Z.-L.** (2005). Perceptual learning through Hebbian reweighting: Data and model [Abstract]. In *Proceedings of the 2005 Computational Neuroscience Conference*.
- Petrov, A. A.** (2004). Nonstationary response distribution: A telltale sign of the dynamics of category rating. [Abstract]. *Abstracts of the Psychonomic Society*, 9, 4097.
- Petrov, A. A., Doshier, B. A., & Lu, Z.-L.** (2004). Comparable perceptual learning with and without feedback in non-stationary contexts: Data and model [Abstract]. *Journal of Vision*, 4(8), 306a, <http://journalofvision.org/4/8/306/>
- Petrov, A. A.** (2004). The Dynamics of Direct Psychophysical Scaling: A Memory-Based Model. [Abstract]. In *Proceedings of the 37th Annual Meeting of the Society for Mathematical Psychology*.
- Petrov, A. A.** (2003). ANCHOR: A dynamic, memory-based model of psychophysical scaling. [Abstract]. *Abstracts of the Psychonomic Society*, 8, 4111.
- Petrov, A. A., Doshier, B. A., & Lu, Z.-L.** (2003). A computational model of perceptual learning through incremental channel re-weighting predicts switch costs in non-stationary contexts [Abstract]. *Journal of Vision*, 3(9), 670a, <http://journalofvision.org/3/9/670/>
- Petrov, A. A., Doshier, B. A., & Lu, Z.-L.** (2003). A computational model of perceptual learning through incremental channel re-weighting predicts switch costs in non-stationary contexts [Abstract]. In *Proceedings of the Fifth UCI Neuroscience Symposium* (abstract 25). University of California, Irvine.
- Petrov, A. A.** (1998). *A dynamic emergent computational model of analogy-making based on decentralized representations*. Doctoral dissertation, New Bulgarian University, Sofia.
[Doctoral committee: B. Kokinov (chair), E. Gerganov, D. Gentner, K. Forbus, J. Hummel, P. Kanerva, Z. Markov]
- Andonova, E., Gerganov, E., **Petrov, A. A.** & Misheva, A. (1996). *Sentence interpretation in Bulgarian*. (Tech. Rep. No. NBU-COG-96-1). Sofia: New Bulgarian University, Cognitive Science Department.

Scholarships and Awards

- “Extraordinary Ability” status by the U.S. Citizenship and Immigration Services (2002).
 Conference presentation grants from Carnegie Mellon University (1999, 2000).
 Grigor Parlichev Award for outstanding achievements at New Bulgarian Univ. (1997).
 Open Society Fund Scholarship covering tuition at New Bulgarian University (1992-97).
 TEMPUS Mobility Grant supporting a visit to Hamburg University, Germany (1996).
 Merit-based scholarship from Sofia University (1989-94).
 Golden medal from the National High School of Mathematics and Science, Sofia (1987).

Teaching Experience

- Analogy and Relational Reasoning: Data and Models (PSY 811)*. Instructor. 2010–present. Graduate course, Ohio State University, Columbus, OH.
- Introduction to Cognitive Science (PSY 612)*. Instructor. Multiple sections, 2007–present. Graduate/advanced undergraduate course, Ohio State University, Columbus, OH.

Learning, Memory, and Cognition (PSY 312). Instructor. Multiple sections, 2007–present. Undergraduate course, Ohio State University, Columbus, OH.

Introduction to Computational Cognitive Neuroscience (PSY 618). Instructor. 2010–present. Graduate/advanced undergrad. course, Ohio State University, Columbus, OH.

Human Learning I/II (PSY 877/878). [Precursor of Psych 618.] Instructor. Multiple sections, 2007–2009. Graduate course, Ohio State University, Columbus, OH.

Introduction to Computational Cognitive Neuroscience. Instructor. July 2007. Intensive graduate course, 14th International Summer School in Cognitive Science, New Bulgarian University, Sofia, Bulgaria.

Introduction to the Leabra Framework for Computational Cognitive Neuroscience. February 2006. Three-day tutorial, Carnegie Mellon University, Pittsburgh, PA.

Perceptual Learning from a Connectionist Perspective. March 2004. Invited lecture for a graduate course, University of Southern California, Los Angeles, CA.

Behavior-Based Robotics. July 2002. Invited lecture for a graduate course, New Bulgarian University, Sofia, Bulgaria.

Principles of Learning in Humans and Machines. Instructor. July 2000. Intensive graduate course, Seventh International Summer School in Cognitive Science, New Bulgarian University, Sofia, Bulgaria.

Computer Skills and Text Processing. Instructor. 1996–1998. Undergraduate course, New Bulgarian University, Sofia, Bulgaria.

Experiment Design and Programming in PsyScope. Instructor. Spring 1997. Undergraduate course, New Bulgarian University, Sofia, Bulgaria.

Computer and Technical Experience

Programming languages: Matlab, C++, Lisp, Prolog, Python.

Software development: cognitive architecture DUAL (10,000+ lines of Lisp code); Matlab implementation of several complex mathematical models and psychophysical experiments with controlled stimulus presentations (PsychToolbox).

Research Programmer. 1994–1998, part time. Central and East-European Center for Cognitive Science, New Bulgarian University, Sofia, Bulgaria.

Research Programmer. 1991–1994, part time. Institute of Mathematics and Informatics, Bulgarian Academy of Science, Sofia, Bulgaria.

Radio and Telegraph Operator. 1987–1989. Mandatory service in the Bulgarian Army.

Invited Lectures and Colloquia

Indiana University, Bloomington, IN, Dept. of Psychological and Brain Sci, March 2008.

Ohio State University, Neural Mechanisms of Decision Making Workshop, Sep 2007.

Ohio State University, Center for Cognitive Sciences. COGFEST Lecture, May 2007.

Perceptual Expertise Network (PEN) Workshop XII, May 2006.

Rensselaer Polytechnic Institute, Troy, NY, Cognitive Science Department, Jan 2006.

Ohio State University, Columbus, OH, Department of Psychology, Dec 2005.
Ohio University, Athens, OH, Department of Psychology, Dec 2005.
University of Memphis, Memphis, TN, Department of Psychology, Dec 2005.
University of Colorado, Boulder, Computational Cognitive Neuroscience Lab, Oct 2005.
University of Colorado, Boulder, Computational Cognitive Neuroscience Lab, Sep 2005.
Carnegie Mellon University, Center for the Neural Basis of Cognition, Sep 2005.
University of California Irvine, Department of Psychology, June 2005.
University of Arizona, Tucson, Department of Psychology, Jan 2005.
University of Colorado, Boulder, Department of Psychology, Dec 2004.
University of California Irvine, Department of Psychology, Feb 2003.
Bulgarian Society for Cognitive Science, Research colloquium, Sep 2002.
Carnegie Mellon University, Seminar of the ACT-R research group, May 2001.
Carnegie Mellon University, Center for the Neural Basis of Cognition, Feb 2001.
New Bulgarian University, Department of Cognitive Science, July 2000.
University of Liège, Belgium, Cognitive science seminar, July 1996.
Hamburg University, Knowledge and Language Processing Research Group, June 1996.

Professional Service

Program Committee member for *Cognitive Science Conference (2008, 2010)*.
Ad hoc reviewer for *Behavioral and Brain Sciences, Cognitive Science, European Journal of Neuroscience, Journal of Experimental Psychology: General, Journal of Experimental Psychology: Human Perception and Performance, Journal of Vision, Journal of Cognitive Science Research, National Science Foundation, Oxford University Press, Perception & Psychophysics, Psychological Review, Psychonomic Bulletin & Review, Science, Vision Research, Cognitive Science Conference, and International Conference on Cognitive Modeling*.
Ph.D. Thesis Committee Member for Danelle Wilbraham, June 2010, Ohio State Univ.
Ph.D. Thesis Committee Member for Corey White, May 2010, Ohio State University
M.Sc. Thesis Committee Member for Kevin Guckes, Aug 2009, Ohio State University
General Exam Committee Member for Corey White, Dec 2008, Ohio State University
Ph.D. Thesis Committee Member for James Christensen, Aug 2008, Ohio State University
M.Sc. Thesis Committee Member for Jeffrey DeVries, Nov 2007, Ohio State University
M.Sc. Thesis Committee Member for Mariya M. Popova, July 2007, New Bulgarian Univ.
M.Sc. Thesis Committee Member for Radu Luchianov, July 2000, New Bulgarian Univ.
I developed, installed, and currently maintain (with Aaron Seitz from UC Riverside) the Perceptual Learning Wiki (<http://cogmod.osu.edu/wiki/>) serving scholars worldwide.

Professional Affiliations

Cognitive Science Society	Vision Sciences Society
The Psychonomic Society	Society for Mathematical Psychology