

LAURA R. NOVICK

VITA

**Personal Information**

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Citizenship: USA

**Education**

Postdoctoral fellowship, University of California at Los Angeles, 1986-1988  
 Ph.D., Stanford University, Cognitive Psychology, 1986  
 B.S., The University of Iowa, Psychology, 1981

**Employment History**

Associate Professor of Psychology, Vanderbilt University Peabody College	1996-present
College of Arts and Science (secondary appointment)	1996-present
Assistant Professor of Psychology, Vanderbilt University Peabody College	1988-1996
College of Arts and Science (secondary appointment)	1991-1996
NRSA Postdoctoral Fellow, University of California, Los Angeles	1986-1988
Instructor, University of California, Los Angeles	winter 1987
Instructor, Stanford University	spring 1985
Member of Technical Staff, AT&T Bell Laboratories	summer 1984

**Honors and Awards**

"Highly Accessed" designation from Springer Publications for Novick et al. (2014). Depicting the Tree of Life in museums: Guiding principles from psychological research. <i>Evolution: Education and Outreach</i> , 7:25.	2014
Fellow of the Psychonomic Society	2014
Fellow of the Association for Psychological Science	2011
Catalyst for Creativity, Curb Center for Creativity, Vanderbilt University	2011

"Outstanding Professor" Recognition by Vanderbilt Undergraduate Honor Societies, Greek Societies, and other Student Groups	2016, 2009, 2004, 2003, 2002, 2001, 1999, 1998, 1997, 1994
National Academy of Education Spencer Fellowship	1990-1992
National Science Foundation Graduate Fellowship	1981-1984
Sanxay Prize for Graduate Study from The University of Iowa (given to a senior graduating from the College of Liberal Arts)	1981-1982
Phi Beta Kappa, The University of Iowa	1981

### Professional Affiliations

Association for Psychological Science, Fellow and Charter Member  
 Cognitive Science Society, Member  
 Psychonomic Society, Fellow  
 Society for the Advancement of Biology Education Research, Charter Member  
 Women in Cognitive Science, Member

### Research Interests

Thinking with diagrams  
 Problem solving and reasoning  
 Expertise and ability  
 Knowledge representation and misconceptions  
 Phylogenetics (a topic in macroevolution) education

### Publications

#### *Publications*

Novick, L. R., & Fuselier, L. C. (2019). Perception and conception in understanding evolutionary trees. *Cognition*, 192. <https://doi.org/10.1016/j.cognition.2019.06.013>

Novick, L. R., & Catley, K. M. (2018). Teaching tree thinking in an upper level organismal biology course: Testing the effectiveness of a multifaceted curriculum. *Journal of Biological Education*, 52, 66-78.

Novick, L. R., & Catley, K. M. (2016). Fostering 21st-century evolutionary reasoning: Teaching tree thinking to introductory biology students. *CBE—Life Sciences Education*, 16 (4), ar66.

Novick, L. R., Pickering, J., MacDonald, T., Diamond, J., et al. (2014). Depicting the Tree of Life in museums: Guiding principles from psychological research. *Evolution: Education and Outreach*, 7:25. doi:10.1186/s12052-014-0025-0.

This article received the "Highly Accessed" designation from Springer Publications.

Novick, L. R., Schreiber, E. G., & Catley, K. M. (2014). Deconstructing evolution education: The relationship between micro- and macroevolution. *Journal of Research in Science Teaching*, 51, 759-788. [Special issue on Discipline-Centered Post-Secondary Education Research]

- Novick, L. R., & Catley, K. M. (2014). When relationships depicted diagrammatically conflict with prior knowledge: An investigation of students' interpretations of evolutionary trees. *Science Education, 98*, 269-304.
- Catley, K. M., Phillips, B. C., & Novick, L. R. (2013). Snakes and eels and dogs! Oh, my! Evaluating high school students' tree-thinking skills: An entry point to understanding evolution. *Research in Science Education, 43*, 2327-2348.
- Novick, L. R., & Catley, K. M. (2013). Reasoning about evolution's grand patterns: College students' understanding of the tree of life. *American Educational Research Journal, 50*, 138-177.
- Novick, L. R., & Catley, K. M. (2012). Assessing students' understanding of macroevolution: Concerns regarding the validity of the MUM. *International Journal of Science Education, 34*, 2679-2703.
- Phillips, B. C., Novick, L. R., Catley, K. M., & Funk, D. J. (2012). Teaching tree thinking to college students: It's not as easy as you think. *Evolution: Education and Outreach, 5*, 595-602.
- Singer, S. R., Nielsen, N. R., & Schweingruber, H. A., (Eds.); Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research (Novick, L. R., member). (2012). *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*. Washington, DC: National Academies Press.
- Novick, L. R., Stull, A. T., & Catley, K. M. (2012). Reading phylogenetic trees: Effects of tree orientation and text processing on comprehension. *BioScience, 62*, 757-764.
- Catley, K. M., Novick, L. R., & Funk, D. J. (2012). The promise and challenges of introducing tree thinking into evolution education. In K. Rosengren, E. M. Evans, S. Brem, & G. Sinatra (Eds.), *Evolution challenges: Integrating research and practice in teaching and learning about evolution* (Ch. 5, pp. 93-118). New York, NY: Oxford University Press.
- Bassok, M., & Novick, L. R. (2012). Problem solving. In K. J. Holyoak & R. G. Morrison (Eds.), *Oxford handbook of thinking and reasoning* (Ch. 21, pp. 413-432). New York, NY: Oxford University Press.
- Novick, L. R., Shade, C. K., & Catley, K. M. (2011). Linear versus branching depictions of evolutionary history: Implications for diagram design. *Topics in Cognitive Science, 3*, 536-559.
- Novick, L. R., Catley, K. M., & Funk, D. J. (2011). Inference is bliss: Using evolutionary relationship to guide categorical inferences. *Cognitive Science, 35*, 712-743.
- Novick, L. R., Catley, K. M., & Funk, D. J. (2010). Characters are key: The effect of synapomorphies on cladogram comprehension. *Evolution: Education and Outreach, 3*, 539-547.
- Morabito, N., Catley, K. M., & Novick, L. R. (2010). Reasoning about evolutionary history: The effects of biology background on post-secondary students' knowledge of most recent common ancestry and homoplasy. *Journal of Biological Education, 44*, 166-174.

- Catley, K. M., Novick, L. R., & Shade, C. K. (2010). Interpreting evolutionary diagrams: When topology and process conflict. *Journal of Research in Science Teaching, 47*, 861-882.
- Hurley, S. M., & Novick, L. R. (2010). Solving problems using matrix, network, and hierarchy diagrams: The consequences of violating construction conventions. *The Quarterly Journal of Experimental Psychology, 63*, 275-290.
- Catley, K. M., & Novick, L. R. (2009). Digging deep: Exploring college students' knowledge of macroevolutionary time. *Journal of Research in Science Teaching, 46*, 311-332.
- Catley, K. M., & Novick, L. R. (2008). Seeing the wood for the trees: An analysis of evolutionary diagrams in biology textbooks. *BioScience, 58*, 976-987.
- Novick, L. R., & Sherman, S. J. (2008). The effects of superficial and structural information on on-line problem solving for good versus poor anagram solvers. *The Quarterly Journal of Experimental Psychology, 61*, 1098-1120.
- Novick, L. R., & Catley, K. M. (2007). Understanding phylogenies in biology: The influence of a Gestalt perceptual principle. *Journal of Experimental Psychology: Applied, 13*, 197-223.
- Cheng, P. W., Novick, L. R., Liljeholm, M., & Ford, C. (2007). Explaining four psychological asymmetries in causal reasoning: Implications of causal assumptions for coherence. In J. K. Campbell, M. O'Rourke, & H. S. Silverstein (Eds.), *Causation and explanation* (Ch. 1, pp. 1-32). MIT Press.
- Novick, L. R. (2006). Understanding spatial diagram structure: An analysis of hierarchies, matrices, and networks. *The Quarterly Journal of Experimental Psychology, 59*, 1826-1856.
- Hurley, S. M., & Novick, L. R. (2006). Context and structure: The nature of students' knowledge about three spatial diagram representations. *Thinking & Reasoning, 12*, 281-308.
- Novick, L. R. (2006). The importance of both diagrammatic conventions and domain-specific knowledge for diagram literacy in science: The hierarchy as an illustrative case. In D. Barker-Plummer, R. Cox, & N. Swoboda (Eds.), *Diagrammatic representation and inference (Diagrams 2006)*, LNAI 4045 (pp. 1-11). Berlin: Springer-Verlag.
- Whitley, K. N., Novick, L. R., & Fisher, D. (2006). Evidence in favor of visual representation for the dataflow paradigm: An Experiment Testing LabVIEW's Comprehensibility. *International Journal of Human-Computer Studies, 64*, 281-303.
- Cheng, P. W., & Novick, L. R. (2005). Constraints and nonconstraints in causal reasoning: Reply to White (2005) and to Luhmann & Ahn (2005). *Psychological Review, 112*, 694-707.
- Novick, L. R., & Bassok, M. (2005). Problem solving. In K. J. Holyoak & R. G. Morrison (Eds.), *Cambridge handbook of thinking and reasoning* (Ch. 14, pp. 321-349). New York, NY: Cambridge University Press.
- Novick, L. R., & Sherman, S. J. (2004). Type-based bigram frequencies for five-letter words. *Behavior Research Methods, Instruments, & Computers, 36*, 397-401.

The norms described in this article are available from the Psychonomic Society Web Archive: <http://www.psychonomic.org/archive/>.

- Novick, L. R. (2004). Diagram literacy in pre-service math teachers, computer science majors, and typical undergraduates: The case of matrices, networks, and hierarchies. *Mathematical Thinking and Learning, 6*, 307-342.
- Novick, L. R., & Cheng, P. W. (2004). Assessing interactive causal influence. *Psychological Review, 111*, 455-485.
- Novick, L. R. (2003). At the forefront of thought: The effect of media exposure on airplane typicality. *Psychonomic Bulletin & Review, 10*, 971-974.
- Ahn, W-k., Novick, L. R., & Kim, N. (2003). Understanding behavior makes it more normal. *Psychonomic Bulletin & Review, 10*, 746-752.
- Novick, L. R. (2003). Problem solving, Psychology of. In L. Nadel (Ed.), *Encyclopedia of cognitive science* (Vol. 3, pp. 734-740). London: Nature Publishing Group.
- Novick, L. R., & Sherman, S. J. (2003). On the nature of insight solutions: Evidence from skill differences in anagram solution. *The Quarterly Journal of Experimental Psychology, 56A*, 351-382.
- Novick, L. R., & Hurley, S. M. (2001). To matrix, network, or hierarchy: That is the question. *Cognitive Psychology, 42*, 158-216.
- Novick, L. R. (2001). Spatial diagrams: Key instruments in the toolbox for thought. In D. L. Medin (Ed.), *The psychology of learning and motivation* (Vol. 40, pp. 279-325). San Diego, CA: Academic Press.
- Novick, L. R., & Morse, D. L. (2000). Folding a fish, making a mushroom: The role of diagrams in executing assembly procedures. *Memory & Cognition, 28*, 1242-1256.
- Novick, L. R., Hurley, S. M., & Francis, M. (1999). Evidence for abstract, schematic knowledge of three spatial diagram representations. *Memory & Cognition, 27*, 288-308.
- Novick, L. R. (1996). Darmok and Jalad at Tenagra? [Review of the book *Mental leaps*]. *Applied Cognitive Psychology, 10*, 541-542.
- Novick, L. R. (1995). Some determinants of successful analogical transfer in the solution of algebra word problems. *Thinking & Reasoning, 1*, 5-30.
- Novick, L. R., & Hmelo, C. E. (1994). Transferring symbolic representations across nonisomorphic problems. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*, 1296-1321.
- Holyoak, K. J., Novick, L. R., & Melz, E. (1994). Component processes in analogical transfer: Mapping, pattern completion, and adaptation. In K. J. Holyoak & J. A. Barnden (Eds.), *Advances in connectionist and neural computation theory, Vol. 2: Analogical connections* (pp. 113-180). Norwood, NJ: Ablex.

Novick, L. R., Fratianne, A., & Cheng, P. W. (1992). Knowledge-based assumptions in causal attribution. *Social Cognition, 10*, 299-333.

Cheng, P. W., & Novick, L. R. (1992). Covariation in natural causal induction. *Psychological Review, 99*, 365-382.

This paper has been reprinted in:

Goldstein, W. M., & Hogarth, R.M. (Eds.). (1997). *Research on judgment and decision making: Currents, connections, and controversies* (pp. 285-321). Cambridge, UK: Cambridge University Press.

Novick, L. R. (1992). The role of expertise in solving arithmetic and algebra word problems by analogy. In J. I. D. Campbell (Ed.), *The nature and origins of mathematical skills* (pp. 155-188). Amsterdam: Elsevier.

Novick, L. R., & Coté, N. (1992). The nature of expertise in anagram solution. *Proceedings of the Fourteenth Annual Conference of the Cognitive Science Society* (pp. 450-455). Hillsdale, NJ: Erlbaum.

Cheng, P. W., & Novick, L. R. (1991). Causes versus enabling conditions. *Cognition, 40*, 83-120.

Novick, L. R., & Holyoak, K. J. (1991). Mathematical problem solving by analogy. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17*, 398-415.

Novick, L. R. (1990). Representational transfer in problem solving. *Psychological Science, 1*, 128-132.

Cheng, P. W., & Novick, L. R. (1990). A probabilistic contrast model of causal induction. *Journal of Personality and Social Psychology, 58*, 545-567.

Cheng, P. W., & Novick, L. R. (1990). Where is the bias in causal attribution? In K. J. Gilhooly, M. T. G. Keane, R. H. Logie, & G. Erdos (Eds.), *Lines of thinking: Reflections on the psychology of thought* (Vol. 1, pp. 181-197). Chichester, England: Wiley.

Novick, L. R. (1990). The complexity of problem solving and analogical transfer [Review of the book *Analogical problem solving*]. *Contemporary Psychology, 35*, 22-24.

Novick, L. R. (1988). Analogical transfer, problem similarity, and expertise. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14*, 510-520.

Novick, L. R. (1988). Analogical transfer: Processes and individual differences. In D. H. Helman (Ed.), *Analogical reasoning* (pp. 125-145). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Novick, L. R., & Tversky, B. (1987). Cognitive constraints on ordering operations: The case of geometric analogies. *Journal of Experimental Psychology: General, 116*, 50-67.

Hinrichs, J. V., & Novick, L. R. (1982). Memory for numbers: Nominal versus magnitude information. *Memory & Cognition, 10*, 479-486.

*Technical Reports, Workshop Papers, and Unpublished Manuscripts*

- Novick, L. R. (2012). Extreme variability and forward telescoping in university students' estimates of macroevolutionary deep time. *On the Cutting Edge Workshop: Rates, dates and geologic time: Teaching about the temporal aspects of deep time*. Sponsored by the Science Education Resource Center (SERC) at Carleton College.  
<http://serc.carleton.edu/NAGTWorkshops/time/workshop2012/essays/novick.html>
- Novick, L. R. (1981). *The use of minimum competency tests for granting/denying high school diplomas: Social and political considerations*. Evaluation and Examination Service Report Series No. 81-100, The University of Iowa.
- Novick, M. R., Turner, N. J., & Novick, L. R. (1981). *Experimental studies of CADA-based utility assessment procedures*. ONR Technical Report 81-2.

### Curriculum Materials

These materials are available for download from the lessons and resources for teachers section of the *Understanding Evolution* web site maintained by the University of California Museum of Paleontology:

[http://evolution.berkeley.edu/evolibrary/search/lessonsummary.php?topic\\_id=&keywords=&type\\_id=&sort\\_by=resource\\_title&Submit=Search&thisaudience=13-16&resource\\_id=511](http://evolution.berkeley.edu/evolibrary/search/lessonsummary.php?topic_id=&keywords=&type_id=&sort_by=resource_title&Submit=Search&thisaudience=13-16&resource_id=511)

[http://evolution.berkeley.edu/evolibrary/search/lessonsummary.php?topic\\_id=&keywords=&type\\_id=&sort\\_by=resource\\_title&Submit=Search&thisaudience=13-16&resource\\_id=525](http://evolution.berkeley.edu/evolibrary/search/lessonsummary.php?topic_id=&keywords=&type_id=&sort_by=resource_title&Submit=Search&thisaudience=13-16&resource_id=525)

Novick, L. R., Catley, K. M., & Schreiber, E. G. (2012, August). *Understanding Evolutionary History: An Introduction to Tree Thinking (Version 3.2)*. Unpublished instructional booklet, Department of Psychology and Human Development, Vanderbilt University, Nashville, TN.

Catley, K. M., & Novick, L. R. (2016, June). *Phylogenetics Laboratory: Reconstructing Evolutionary History (Version 3.3)*. Unpublished student laboratory booklet, Department of Psychology and Human Development, Vanderbilt University, Nashville, TN.

Catley, K. M., & Novick, L. R. (2016, June). *Phylogenetics Laboratory: Reconstructing Evolutionary History. Instructors' Guide and Answer Key (Version 2.3)*. Unpublished instructor's laboratory guide, Department of Psychology and Human Development, Vanderbilt University, Nashville, TN.

### Research Support

*Funded*

Principal Investigator: Peabody College Small Grant (Vanderbilt University). *Influences of Gestalt Perceptual Principles on Students' Interpretations of Evolutionary Trees*, 1/1/17-12/31/18; \$6,487.

Principal Investigator (Kefyn M. Catley, Co-Investigator): Department of Education, Institute of Education Sciences (IES), Cognition and Student Learning section. *A Cognitive Approach to Implementing Tree Thinking in High School and College Biology Curricula*, 7/1/08-6/30/12; \$665,247.

Co-Principal Investigator: Peabody College Small Grant (Vanderbilt University). Catley, K. & Novick, L. R., *Investigating the Role of Hierarchical Diagrams in Biology Education*, 11/15/04-6/30/06; \$6,486.

Investigator: National Institutes of Health. *Natural Causal Discovery: Learning Simple and Complex Causes* (Patricia Cheng, Principal Investigator, UCLA), 9/1/02-7/31/05; \$122,000 (total cost of subcontract to Vanderbilt University).

Principal Investigator: Peabody College Small Grant (Vanderbilt University). *To Matrix, Network, or Hierarchy, That is the Question: Understanding Three Spatial Diagram Representations*, 6/1/99-6/30/00; \$3,310.

Principal Investigator: University Research Council Grant (Vanderbilt University). *Expert Knowledge and Expert Processing*, 5/1/92-6/30/93; \$3,360.

Principal Investigator: University Research Council Grant (Vanderbilt University). *Problem Representations*, 5/1/91-6/30/92; \$3,700.

Principal Investigator: National Academy of Education Spencer Fellowship. *The Role of Representations in Problem-Solving Transfer*, 9/1/90-5/31/92; \$30,000 (salary).

Principal Investigator: University Research Council Grant (Vanderbilt University). *Problem-Solving Expertise*, 4/1/90-6/30/91; \$7,565.

Principal Investigator: The Spencer Foundation Small Grants Program. *Representationally Mediated Transfer in Mathematical and Logical Problem-Solving*, 10/1/89-9/30/90; \$5,230.

Principal Investigator: University Research Council Grant (Vanderbilt University). *Representational Transfer*, 4/1/89-6/30/90; \$1,619.

Principal Investigator: Peabody College Dean's Office (Vanderbilt University). *Mathematical and Logical Problem-Solving*, 10/18/88-4/30/89; \$1,500.

Principal Investigator: University Research Council Small Grant (Vanderbilt University). *Mathematical and Logical Problem-Solving*, 10/18/88-12/31/88; \$700.

Principal Investigator: NIMH Individual Postdoctoral Fellowship (NRSA). *Analogical Transfer*, 9/1/86-8/31/88.

## Presentations

### *Invited*

Novick, L. R. (2021, April). Using cognitive/perceptual psychology to improve students' understanding of evolutionary trees. Keynote address at the conference on *Integrating*



*Psychology and STEM Education Research to Promote Innovative Teaching*. Washington University, St. Louis, MO.

Novick, L. R. (2021, June). *A psychological perspective on tree-thinking difficulty*. Society for the Study of Evolution annual meeting. Cleveland, OH.

Novick, L. R., & Fuselier, L. (2017, December). *Sexual selection and gender role stereotyping*. NSF-funded, invitation-only conference to jump-start new research collaborations between cognitive scientists and discipline-based education researchers from the natural sciences and engineering, Washington University, St. Louis, MO.

Novick, L. R., & Catley, K. M. (2015, July). *Solving problems in nature and at home: Unleashing the power of tree thinking in your classroom*. Think Evolution VII Institute. University of California, Berkeley, Museum of Paleontology. Berkeley, CA.

[This was a five-day institute (continuing education) for science educators, primarily high school biology teachers. We were responsible for leading the first day of the institute.]

Novick, L. R. (2013, May). *The importance of diagram design in biology education*. National Conference on Improving Middle School Science Instruction Using Cognitive Science. Washington, DC.

Novick, L. R. (2013, March). *Effects of diagram design on students' understanding of evolutionary trees: Implications for biology education*. School of Education, Iowa State University, Ames, IA.

Novick, L. R. (2012, November). *Effects of perceptual and reading processes on understanding tree-of-life diagrams: A cognitive psychologist's journey into biology education research*. Undergraduate science education research group seminar, Michigan State University, East Lansing, MI.

Novick, L. R. (2011, November). *Effects of perceptual and reading processes on comprehension of tree-of-life diagrams from biology*. Department of Psychology, University of Washington, Seattle, WA.

Novick, L. R. (2011, May). *Understanding the tree of life: A cognitive psychologist's journey into evolutionary biology*. Carleton College colloquium, Northfield, MN. Sponsored by the Elizabeth Nason Distinguished Women Visitors Fund and the Departments of Cognitive Science and Biology.

Novick, L. R. (2009, October). *Hamsters and parrots and snakes oh my: Using evolutionary relationship to guide categorical inferences*. Department of Psychology colloquium, University of California, Santa Barbara, CA.

Novick, L. R. (2008, October). *Understanding the tree of life: Effects of cognitive, perceptual, and knowledge factors on tree thinking*. Combined Program in Education and Psychology, 50<sup>th</sup> anniversary colloquium series, University of Michigan, Ann Arbor, MI.

Novick, L. R. (2008, October). *Tree thinking in college students: Effects of biology background and cladogram format*. Department of Biological Sciences colloquium, Vanderbilt University, Nashville, TN.

- Novick, L. R. (2008, January). *Tree thinking in evolution education: Understanding the tree of life*. Educational Psychology colloquium, University of Minnesota, Minneapolis, MN.
- Novick, L. R. (2007, November). Featured participant at the *Evolution Challenges* conference, an interdisciplinary meeting funded through an NSF grant designed to produce a comprehensive framework for integrating what we know about the teaching and learning of evolution across the life span. Phoenix, AZ.
- Novick, L. R. (2007, February). *The effects of diagram format and biology background on students' understanding of evolutionary diagrams*. Tennessee Mathematics and Science Education Research Conference, Murfreesboro, TN.
- Novick, L. R. (2006, June). *The importance of both diagrammatic conventions and domain-specific knowledge for diagram literacy in science: The hierarchy as an illustrative case*. Keynote address at The Fourth International Conference on the Theory and Application of Diagrams, Stanford, CA.
- Cheng, P. W., & Novick, L. R. (2001, August). *The explicit representation of causal hypotheses in the assessment of causal influence: The case of interactive causal influence*. Conference of Causality and Statistics, Snowbird, Utah.
- Novick, L. R. (1999, October). *To matrix, network, or hierarchy, that is the question*. Cognitive Science Colloquium, Georgia Institute of Technology, Atlanta, GA.
- Novick, L. R. (1998, April). *Highly skilled problem solvers use example-based reasoning to support their superior performance*. In E. R. Rothkopf (Chair), *What do experts know: General principles or specific problems?* Symposium conducted at the annual meeting of the American Educational Research Association, San Diego, CA.
- Cheng, P. W., & Novick, L. R. (1995, September). *Explaining probabilistic contrasts as estimates of causal power*. In F. Van Overwalle & M. W. Morris (Chairs), *Attribution processes*. Symposium conducted at the 1995 Joint EAESP/SESP (European Association of Experimental Social Psychology, Society for Experimental Social Psychologists) Meeting, Washington, D.C.
- Novick, L. R. (1993, February). *On the possibility of parallel processing in expert anagram solution*. Cognitive Science Colloquium, Indiana University, Bloomington, IN.
- Novick, L. R. (1992, May). *Transferring diagrammatic representations in math and logic problem solving*. In A. L. Brown (Chair), *Spencer Fellows Forum: Group B*. Spring Meeting of the National Academy of Education, Chicago, IL.
- Novick, L. R. (1992, May). *Transferring diagrammatic representations*. In B. Ross (Chair), *The role of prior experience in problem solving*. Symposium conducted at the Sixty-Fourth Annual Meeting of the Midwestern Psychological Association, Chicago, IL.
- Novick, L. R. (1991, April). *The role of expertise in analogical problem solving*. In J. Gallini (Chair), *Analogical problem solving: The mechanisms underlying what develops*. Symposium conducted at the Annual Meeting of the Society for Research in Child Development, Seattle, WA.

Novick, L. R. (1990, April). *The influence of problem structure and world knowledge on causal inference*. In D. D. Cummins (Chair), *Content effects in human reasoning*. Symposium conducted at the Annual Meeting of the Rocky Mountain Psychological Association, Tucson, AZ.

Novick, L. R. (1988, January). *Analogical problem solving*. Bell Communications Research, Morristown, NJ.

#### *Refereed*

Novick, L. R., & Liu, J. (2020, July). *Perceptual grouping affects students' propensity to make inferences consistent with their misconceptions*. Tenth Annual Meeting of the Society for the Advancement of Biology Education Research, online.

Spaulding, S., Fuselier, L., & Novick, L. R. (2020, March). *Sexual selection instruction: An evaluation of relationships between theory pedagogy, gender self-stereotyping, and student misconceptions*. 2020 Annual Meeting of the National Association of Research in Science Teaching. Portland, OR.

Fuselier, L., Spaulding, S., & Novick, L. R. (2019, June). *Gender stereotypes emerge in student explanations of sexual selection*. Gordon Research Conference on Undergraduate Biology Education Research. Bates College, Lewiston, ME.

Novick, L. R., & Fuselier, L. (2018, July). *Biology students use Gestalt grouping to evaluate evolutionary relatedness*. Fortieth Annual Meeting of the Cognitive Science Society, Madison, WI.

Fuselier, L., & Novick, L. R. (2018, March). *The Gestalt of it: Do Gestalt grouping principles influence college student interpretation of phylogenetic trees?* 2018 Annual Meeting of the National Association of Research in Science Teaching, Atlanta, GA.

Novick, L. R., & Fuselier, L. (2017, November). *Reasoning about relationships in evolutionary trees is influenced by Gestalt grouping*. Fifty-Eighth Annual Meeting of the Psychonomic Society, Vancouver, BC, Canada.

Novick, L. R., & Fuselier, L. (2017, July). *Perceptual grouping affects biology students' understanding of evolutionary relatedness*. Seventh Annual Meeting of the Society for the Advancement of Biology Education Research, Minneapolis, MN.

Novick, L. R. (2016, August). *Interpreting evolutionary trees: Biological reasoning at the interface of cognition and perception*. In L. R. Novick & M. Hegarty (Chairs), *Research at the Interface of Cognition, Education, and Disciplinary Science*. Symposium conducted at the annual meeting of the Cognitive Science Society, Philadelphia, PA.

Novick, L. R., & Hegarty, M. (Chairs) (2016, August). *Research at the Interface of Cognition, Education, and Disciplinary Science*. Symposium conducted at the annual meeting of the Cognitive Science Society, Philadelphia, PA.

Novick, L. R. (2016, July). *Tree thinking meets perceptual psychology: Toward an explanation of students' difficulty understanding evolutionary relatedness*. Sixth Annual Meeting of the Society for the Advancement of Biology Education Research, Minneapolis, MN.

- Halmo, S., Sensibaugh, C., Novick, L. R., & Lemons, P. (2016, July). *Using comparison to frame conditional knowledge in biochemistry problem-solving*. Sixth Annual Meeting of the Society for the Advancement of Biology Education Research, Minneapolis, MN.
- Novick, L. R., & Catley, K. M. (2014, March/April). *Students' interpretations of evolutionary trees: When relationships contradict prior knowledge*. 2014 Annual Meeting of the National Association of Research in Science Teaching, Pittsburgh, PA.
- Novick, L. R. (2012, November). *Discipline-Based Education Research: Understanding and improving learning in undergraduate science and engineering*. Fifty-Third Annual Meeting of the Psychonomic Society, Minneapolis, MN.
- Novick, L. R., Catley, K. M., & Schreiber, E. G. (2012, July). *A research based tree-thinking (macroevolution) curriculum for college students*. Second Annual Meeting of the Society for the Advancement of Biology Education Research, Minneapolis, MN.
- Novick, L. R., Stull, A. T., & Catley, K. M. (2011, November). *Diagram orientation affects interpretation of evolutionary diagrams: Evidence from eye movements*. Fifty-Second Annual Meeting of the Psychonomic Society, Seattle, WA.
- Catley, K. M., & Novick, L. R. (2011, July). *Towards a full-service evolution curriculum: Microevolution PLUS macroevolution*. First Annual Meeting of the Society for the Advancement of Biology Education Research, Minneapolis, MN.
- Phillips, B. C., Novick, L. R., & Catley, K. M. (2011, June). *Form, function, and habitat: Similarity of responses among college students and primary school children to questions about evolutionary relatedness*. Forty-first Annual Meeting of the Jean Piaget Society, Berkeley, CA.
- Catley, K. M., & Novick, L. R. (2011, April). *Microevolution and macroevolution: Ne'er the twain shall meet?* 2011 Annual Meeting of the National Association of Research in Science Teaching, Orlando, FL.
- Phillips, B. C., Novick, L. R., Catley, K. M., & Funk, D. J. (2010, August). *Interactive effects of teleological beliefs and diagrammatic format on tree thinking*. Thirty-second Annual Meeting of the Cognitive Science Society, Portland, OR.
- Phillips, B. C., Novick, L. R., & Catley, K. M. (2010, July). *How high school students reason about the tree of life: A developmental perspective*. In S. Ainsworth, C. Matuk, & D. Uttal (Chairs), *Learning to Understand the Tree of Life*. Symposium conducted at the annual meeting of the International Conference of the Learning Sciences, Chicago, IL.
- Novick, L. R., & Catley, K. M. (2010, May). *The Role of good continuation in understanding ladder cladograms: Implications for education*. In C. O'Donnell & E. Albro (Chairs), *Perceptual Characteristics and Concept Mastery: What Makes a Difference?* Symposium conducted at the 22<sup>nd</sup> annual meeting of the Association for Psychological Science, Boston, MA.
- Novick, L. R., Shade, C. K., & Catley, K. M. (2010, March). *The effect of linear versus branching depictions of evolutionary history on students' interpretations of evolution as an anagenic*

*process*. 2010 Annual Meeting of the National Association of Research in Science Teaching, Philadelphia, PA.

- Novick, L. R., & Catley, K. M. (2009, July). *Inference is bliss: Using evolutionary relationship to guide inferences about biological categories*. Thirty-first Annual Meeting of the Cognitive Science Society, Amsterdam, The Netherlands.
- Novick, L. R., Catley, K. M., & Funk, D. J. (2009, June). *Inference is bliss: Using evolutionary relationship to guide inferences about biological categories*. Fourth Annual IES (Institute of Education Sciences) Research Conference, Washington, DC.
- Catley, K. M., Novick, L. R., & Shade, C. (2009, April). *Reinforcing macroevolutionary misconceptions: Students' interpretations of textbook diagrams*. 2009 Annual Meeting of the National Association of Research in Science Teaching, Anaheim, CA.
- Novick, L. R., & Catley, K. M. (2009, April). *Understanding the tree of life: Effects of biology background and cladogram format on tree thinking*. 2009 Annual Meeting of the American Educational Research Association, San Diego, CA.
- Novick, L. R., & Catley, K. M. (2008, November). *Understanding the tree of life: Reasoning from evolutionary hierarchies*. Forty-Ninth Annual Meeting of the Psychonomic Society, Chicago, IL.
- Catley, K. M., & Novick, L. R. (2008, April). *Seeing the wood for the trees: An analysis of evolutionary diagrams in biology textbooks*. 2008 Annual Meeting of the National Association of Research in Science Teaching, Baltimore, MD.
- Novick, L. R., & Catley, K. M. (2008, March). *Assessing students' understanding of cladograms*. 2008 Annual Meeting of the National Association of Research in Science Teaching, Baltimore, MD.
- Morabito, N. P., Catley, K. M., & Novick, L. R. (2008, March). *Lizards and frogs or lizards and mammals: University students' understanding of most recent common ancestry*. 2008 Annual Meeting of the National Association of Research in Science Teaching, Baltimore, MD.
- Novick, L. R., & Catley, K. M. (2007, August). *The effects of diagram format on college students' understanding of evolutionary hierarchies*. Twenty-Ninth Annual Meeting of the Cognitive Science Society, Nashville, TN.
- Catley, K. M., & Novick, L. R. (2007, April). *Digging deep: exploring college students' understanding of macroevolutionary time*. 2007 Annual Meeting of the National Association of Research in Science Teaching, New Orleans, LA.
- Novick, L. R., & Catley, K. M. (2006, November). *Extracting hierarchical structure from biological diagrams: An analysis across knowledge levels*. Forty-Seventh Annual Meeting of the Psychonomic Society, Houston, TX.
- Novick, L. R., & Catley, K. M. (2006, June). *Interpreting hierarchical structure: Evidence from cladograms in biology*. The Fourth International Conference on the Theory and Application of Diagrams, Stanford, CA.

- Catley, K. M., Novick, L. R., & Traynham, B. (2006, April). *Assessing students' understanding of evolutionary diagrams*. 2006 Annual Meeting of the National Association of Research in Science Teaching, San Francisco, CA.
- Catley, K. M., & Novick, L. R. (2006, January). *Assessing undergraduate students' understanding of evolutionary concepts*. Fourth Annual Hawaii International Conference on Education, Honolulu, HI.
- Novick, L. R., & Sherman, S. J. (2005, November). *Predicting expert and novice anagram solution*. Forty-Sixth Annual Meeting of the Psychonomic Society, Toronto, Canada.
- Hurley, S. M., & Novick, L. R. (2003, November). *Diagram construction conventions and their effects on diagram use*. Forty-Fourth Annual Meeting of the Psychonomic Society, Vancouver, BC, Canada.
- Novick, L. R. (2001, November). *Property diagnosticity and representation applicability ratings for hierarchies, matrices, and networks*. Forty-Second Annual Meeting of the Psychonomic Society, Orlando, FL.
- Ahn, W-k., Novick, L. R., & Kim, N. (2001, November). *Understanding makes it normal: Causal explanations affect the perception of psychological symptoms*. Forty-Second Annual Meeting of the Psychonomic Society, Orlando, FL.
- Whitley, K. N., Novick, L. R., & Fisher, D. (2001, August). *Advantages of a visual representation for computer programming*. Twenty-third Annual Meeting of the Cognitive Science Society, Edinburgh, Scotland.
- Novick, L. R., & Cheng, P. W. (1999, November). *Estimating conjunctive causal power*. Fortieth Annual Meeting of the Psychonomic Society, Los Angeles, CA.
- Hurley, S. M., Novick, L. R., & Brackin, A. (1998, November). *Students possess abstract schemas for hierarchy, matrix, and network representations*. Thirty-Ninth Annual Meeting of the Psychonomic Society, Dallas, TX.
- Novick, L. R., & Hurley, S. M. (1997, November). *College students' knowledge about three spatial diagram representations*. Thirty-Eighth Annual Meeting of the Psychonomic Society, Philadelphia, PA.
- Novick, L. R., & Hurley, S. M. (1996, November). *A theoretical analysis of three spatial diagram representations*. Thirty-Seventh Annual Meeting of the Psychonomic Society, Chicago, IL.
- Novick, L. R. (1996, August). *On the nature of college students' knowledge about spatial diagram representations*. Third International Conference on Thinking, London, UK.
- Novick, L. R., & Hurley, S. M. (1996, July). *A preliminary test of a theory of the applicability conditions for three spatial diagram representations*. Eighteenth Annual Conference of the Cognitive Science Society, San Diego, CA.
- Novick, L. R., Sherman, S. J., & McKinley, M. O. (1995, November). *Effects of letter order and expertise on solving double-solution anagrams*. Thirty-Sixth Annual Meeting of the Psychonomic Society, Los Angeles, CA.

- Novick, L. R. (1994, November). *Parallel processing may underlie expert anagram solution*. Thirty-Fifth Annual Meeting of the Psychonomic Society, St. Louis, MO.
- Novick, L. R., & Francis, M. D. (1993, November). *Assessing students' knowledge and use of symbolic representations*. Thirty-Fourth Annual Meeting of the Psychonomic Society, Washington, DC.
- Novick, L. R., & Coté, N. (1992, July). *The nature of expertise in anagram solution*. Fourteenth Annual Conference of the Cognitive Science Society, Bloomington, IN.
- Novick, L. R., & Hmelo, C. E. (1991, November). *Representational transfer in math and logic problem solving*. Thirty-Second Annual Meeting of the Psychonomic Society, San Francisco, CA.
- Hmelo, C. E., & Novick, L. R. (1991, June). *Retrieval and mapping as processes in representational transfer*. Third Annual Convention of the American Psychological Society, Washington, DC.
- Novick, L. R., & Holyoak, K. J. (1990, November). *Mathematical problem solving by analogy*. Thirty-First Annual Meeting of the Psychonomic Society, New Orleans, LA.
- Novick, L. R., Fratianne, A., & Cheng, P. W. (1989, November). *Covariation-based causal inference computed over a focal set of events*. Thirtieth Annual Meeting of the Psychonomic Society, Atlanta, GA.
- Novick, L. R. (1988, November). *Transfer of a problem representation across non-isomorphic problems*. Twenty-Ninth Annual Meeting of the Psychonomic Society, Chicago, IL.
- Cheng, P. W., & Novick, L. R. (1988, November). *Causes versus mere conditions*. Twenty-Ninth Annual Meeting of the Psychonomic Society, Chicago, IL.
- Cheng, P. W., & Novick, L. R. (1988, August). *Explaining causal inference by covariation: A new look at an old idea*. International Conference on Thinking, Aberdeen, Scotland.
- Novick, L. R. & Tversky, B. (1984, August). *Mental drawing processes in the solution of geometric analogies*. Ninety-Second Annual Convention of the American Psychological Association, Toronto, Ontario, Canada.
- Novick, L. R. & Tversky, B. (1983, November). *Transforming our knowledge of geometric analogies*. Twenty-Fourth Annual Meeting of the Psychonomic Society, San Diego, CA.

### Teaching (course numbers refer to Vanderbilt University)

#### *Undergraduate*

- PSY 2200: Psychology of Thinking  
 PSY 1601: Psychology of Thinking Laboratory  
 PSY 3650: Advanced Topical Seminar: Creativity  
 PSY 3650: Advanced Topical Seminar: Creativity and Genius  
 PSY 3650: Advanced Topical Seminar: Thinking with Diagrams  
 PSY 2110: Introduction to Statistical Analysis

PSY 2120: Statistical Analysis  
 PSY 2901: Research Methods (honors section)  
 PSY 3860: Directed Research for Undergraduates

*Graduate*

PSY 301P: Methods of Psychological Research  
 PSY 302P: Proseminar in Psychology: Cognition  
 PSY 311P: Experimental Design (ANOVA)  
 PSY 352P: Human Cognition  
 PSY 353P: Seminar: Thinking with Diagrams, Graphs, and Pictures  
 PSY 353P: Seminar: Representation: Diagrams and Mental Models  
 PSY 353P: Seminar: The Nature and Acquisition of Expertise  
 PSY 359P: Seminar: Methods for Studying Thinking and Problem Solving

**Service**

*National*

Invited participant, interdisciplinary conversation on creating a more unified and coherent discipline-based education research community. Convened by the American Association for the Advancement of Science (AAAS) and the Association of Public and Land-grant Universities (APLU), Washington, DC, November 2016.

Invited participant, NSF-funded conference to promote collaboration and communication between cognitive science researchers and discipline-based education researchers from the natural sciences and engineering, National Science Foundation, Washington, DC, September 2016.

Member, Primary review committee for the *Next Generation Science Standards* for K-12 education, a collaborative project of the National Research Council, Achieve, Inc., the American Association for the Advancement of Science, and the National Science Teachers Association, 2011-2013.

Member, National Research Council (NRC) consensus study on Discipline Based Education Research (DBER), a comprehensive examination of learning and teaching in physics, the biological sciences, geosciences, and chemistry at the undergraduate level, 2010-2012.

Editorial board memberships:

Associate editor, *Journal of Experimental Psychology: Learning, Memory, and Cognition* (2012-2017)

Consulting editor, *Journal of Experimental Psychology: Learning, Memory, and Cognition* (1992-2000; 2006-2011)

Consulting editor, *Memory & Cognition* (1990-1996; 2006-2011)

Consulting editor, *Journal of Experimental Psychology: General* (2004-2010)

Advisory boards:

Advisory Board Member for *Exploring the Spatial Alignment Hypothesis in STEM*

*Learning Environments*, an IES-funded project that explores how to optimize the spatial arrangement of visuals in middle school. PIs: Bryan Matlen (WestEd), Dedre



Gentner (Northwestern University), and Benjamin Jee (Worcester State University). 8/1/17-7/31/21.

Advisory Board Member for *Problem Solving Through Practice: Identifying Common Student Struggles in Solving Complex Biology Problems and Developing Tools to Drive Improvement*, an NSF-funded higher-education research and curriculum project. PI: Jennifer Knight, Molecular, Cellular, and Developmental Biology, University of Colorado, Boulder. 2017-2020.

Project Advisor for *The Tree Room: Teaching and Learning About Evolutionary Relationships*, an IMLS-funded National Leadership Project to develop a free, online resource for science teachers and informal science institution professionals. PI: Judy Scotchmoor, Assistant Director for Education and Public Programs, University of California Museum of Paleontology. 2012-2015.

Advisory Board Member for *SLIDER: Science Learning - Integrating Design, Engineering, and Robotics*, an NSF-funded K-12 research and curriculum project. PI: Richard Millman, Director, Center for Education Integrating Science, Mathematics, and Computing (CEISMC) and Professor of Mathematics, Georgia Institute of Technology. 2010-2014.

#### Consulting activities:

Consultant to Julie Fick, Science Education Specialist at the Michigan State University Museum, on a virtual outreach lesson for third graders on modern scientific classification. 2012.

Consultant to Jane Pickering, Deputy Director & Assistant Director for Public Programs of the Yale Peabody Museum of Natural History, on the presentation of the succulent plants tree of life exhibit at the Museum. 2010.

Consultant to Elisabeth Werby, Executive Director of the Harvard Museum of Natural History, on the presentation of the echinoderms tree of life exhibit at the Museum. 2009.

Consultant for *Understanding the Tree of Life*, an interdisciplinary project funded by an NSF Informal Science Education grant to (a) investigate how museum visitors understand the tree of life and (b) improve museum exhibits to more effectively teach about the tree of life. PI: Teresa MacDonald, Director of Education, Natural History Museum & Biodiversity Research Center, Kansas University. 2009-2010.

Consultant for Kim Quillin, designer of illustrations for *Biological Science* by Scott Freeman (Benjamin Cummings, publisher), on how to draw the cladograms, a hierarchical branching diagram used to depict evolutionary relationships. 2008.

Consultant on a project investigating primary school children's knowledge of spatial diagrams. PI: Carmel Diezmann, School of Maths, Science & Technology Education, Centre for Learning Innovation, Queensland University of Technology, Queensland, Australia. 2000-2004.

External examiner, student Ph.D. thesis, Queensland University of Technology, 1998.

Consultant on a project investigating expertise in troubleshooting digital circuit designs. Co-PIs: Gautam Biswas, Department of Electrical Engineering and Computer Science, and Susan Goldman, Department of Psychology and Human Development, Vanderbilt University. 1992-1995.

## Grant study sections:

IES, Basic Processes panel, rotating committee member, October 2009  
 NIH, Cognition and Perception panel, ad-hoc committee member, February 2009

## Professional societies:

Psychonomic Society, Early Career Awards selection committee, 2013, 2014  
 Second International Analogy Conference, Program committee member, 2009  
 Cognitive Science Society, Award selection committee, ad-hoc member, 2009 annual conference  
 Cognitive Science Society, Program committee member, 2007 annual conference

## Ad hoc reviewer for journals in cognitive/experimental/perceptual psychology:

*Applied Cognitive Psychology; Cognition; Cognitive Psychology; Discourse Processes; European Journal of Cognitive Psychology; Journal of Experimental Psychology: Applied; Journal of Experimental Psychology: General; Journal of Experimental Psychology: Human Perception and Performance; Journal of Experimental Psychology: Learning, Memory, and Cognition; Journal of Memory and Language; Memory & Cognition; Psychonomic Bulletin & Review; Quarterly Journal of Experimental Psychology; Thinking and Reasoning*

## Ad hoc reviewer for journals in cognitive science:

*Cognitive Science; Cognitive Science Quarterly; Topics in Cognitive Science; Trends in Cognitive Science*

## Ad hoc reviewer for journals in educational and developmental psychology:

*Child Development; Cognition and Instruction; Developmental Psychology; Journal of Educational Psychology; Journal of Experimental Child Psychology; Mathematical Thinking and Learning; Merrill-Palmer Quarterly*

## Ad hoc reviewer for other psychology journals:

*American Journal of Psychology; Contemporary Psychology; International Journal of Psychology; Journal of Personality and Social Psychology: Attitudes and Social Cognition; Personality and Social Psychology Bulletin; Psychological Bulletin; Psychological Methods; Psychological Review; Psychological Science; Psychology and Aging; Social Cognition*

## Ad hoc reviewer for funding agencies, conferences, and publishers:

Air Force Office of Scientific Research; Austrian Science Fund; Cambridge University Press; Cognitive Science Society (annual meeting submissions); Lawrence Erlbaum Associates, Inc.; The MIT Press; National Science Foundation, Human Cognition and Perception Unit; National Science Foundation, Social Psychology Unit

*University*

Central Neighborhood Planning Study Advisory Committee	2019-present
Vanderbilt Juggling and Physical Arts Club, Faculty Advisor	2003-present
Graduate Faculty Delegate Assembly, Member	2015-2016, 2010-2012
Graduate School Honor Fellowships Awards Committee, Member	2007-2009
Vanderbilt University Religious Affairs Committee	1999-2002

Provost's Initiative for Integrating Technology and Instruction, Member of the Instructional Team	1997-2001
Vanderbilt University Behavioral Sciences Committee for the Protection of Human Subjects (IRB)	1999-2001, 1993-1997

*College*

Peabody College Teaching Committee	2019-present
Peabody College Faculty Affairs Committee	2016-2017, 2001-2014
Peabody College Small Grant and Instructional Improvement Award Selection Committee	2010-2015, 2001-2002
Peabody College Web Site Coordinating Committee	2003-2005
Peabody College Library Advisory Committee	2000-2003
Ad Hoc Committee on Gifted Education (GATEWAY)	1996-2000, Chair 1999-2000
Peabody College Curriculum and Educational Programs Committee	1992-1999
Peabody College Technology Committee	1992-1994
Peabody College Academic Standards and Procedures Committee	1991-1992
Peabody College Computer Committee	1988-1990

*Department*

Faculty Review Committee	2017-2018, 2013, 2003- 2004, 1998
Cognition in Context Steering Committee (graduate)	2016-2018
Cognitive Science of Learning and Development Search Committee	2014-2015
Graduate Student Award Selection Committee	2011
Distinguished Alumnus/Alumna Award Selection Committee	2009
Coordinator, Prospective Graduate Student Visitation Weekend	2009
Departmental Space Committee	2008-2013
Inter-Departmental Web Site Development Committee	2004-2008
Mayborn Chair of Cognitive Studies Search Committee	2001-2004
Cognitive Studies Faculty Search Committee (2 positions)	2001-2003
Quantitative Methods Faculty Search Committee, Co-Chair	1996-1997
Conducted an In-Depth Analysis of the Undergraduate Cognitive Studies Curriculum; Wrote a Report Documenting My Findings	1995
Developmental and Cognitive Lunch Bunch Seminar, Co-Organizer	1993-1998
Developmental Psychology Faculty Search Committee	1993-1994
Ad Hoc Committee for Selecting a New Department Chair	Fall 1992
Cognitive Studies Faculty Search Committee	1991-1992
Cognitive Studies Training Committee (graduate)	1990-2004
Cognitive Studies Training Committee (undergraduate)	1988-2002
Developmental Psychology Graduate Training Committee	1988-1995