

Richard P. Scheines

Bess Family Dean

Mariana Brown College of Humanities and Social Sciences

Carnegie Mellon University

Pittsburgh, PA 15213

412-268-2831

Education

Ph.D. - 1987: History and Philosophy of Science, University of Pittsburgh

B.A. - 1979: History, Hobart College, Geneva, New York

Academic Positions

- *Bess Family Dean*: (7/2014 -), [Mariana Brown Dietrich College of Humanities and Social Sciences](#), Carnegie Mellon University

-*Faculty Director*, [Simon Initiative](#) (1/2015 -), Carnegie Mellon University

-*Department Head* : (7/2005 – 6/2014) Dept. of Philosophy, Carnegie Mellon University

-*Professor*: 7/2004 -

- Dept. of Philosophy, Carnegie Mellon
- Machine Learning Department, Carnegie Mellon
- Human-Computer Interaction Institute, Carnegie Mellon

-*Adjunct Professor*: History and Philosophy of Science, University of Pittsburgh.

-*Distinguished Adjunct Professor of Infometrics*, American University, Washington, DC.

-*Associate Professor*: (7/1998 – 7/2004) Dept. of Philosophy, Carnegie Mellon

-*Associate Head*: 7/1999 - 7/2005 Dept. of Philosophy, Carnegie Mellon

-*Co-Director*: (1997 – 2005) Lab for Symbolic and Educational Computing, CMU

Visiting Positions

-*Visiting Scholar* – Program in Advanced Quantitative Methods in Educational Research, UCLA, Fall 2010.

-*Visiting Professor* – Department of Philosophy, UC Berkeley, Spring, 2011.

-*Visiting Professor* (7/94 - 7/95) - Dept. of Statistics and Measurement Theory, University of Groningen, The Netherlands.

Honors and Awards

- Named Lecture Series: Richard Scheines Distinguished Lecture in the Humanities and Social Sciences

- Sigma Xi – Scientific Research Honor Society (2025 -)

- [Robert E. Doherty Award for Substantial and Sustained Contributions to Education at Carnegie Mellon University](#) -2024.

- *Super Artificial Intelligence Leader (SAIL) award* – for *TETRAD* – awarded at the World Artificial Intelligence Conference, Shanghai, 2020
- *Causality in Statistics Education Award* – honorable mention 2013. Richard Scheines and Steven Klepper.¹
- *Best Paper Award* – 2013 6th International Workshop on Educational Data Mining, Memphis, TN
- *Best Paper Award* – 2008 1st International Workshop on Educational Data Mining, Montreal, Canada.
- *Joe Wyatt Challenge*, awarded to the Carnegie Mellon Proof Tutor, for "exemplary use of educational technology in higher education."

Books

1. *Review of EPA's Integrated Risk Information System (IRIS) Process* (2014), National Research Council, Washington, DC: The National Academies Press, 2014.
2. *Improving the Presumptive Disability Decision-Making Process* (2007). Committee on Evaluation of the Presumptive Disability Decision-Making Process for Veterans, Institute of Medicine of the National Academy of Science, J. Samet, and C. Bodurow, editors. The National Academies Press, Washington, D.C.
3. *Food Marketing to Children and Youth: Threat or Opportunity*, (2006). Committee on Food Marketing and the Diets of Children and Youth, Institute of Medicine of the National Academy of Science, The National Academies Press, Washington, D.C.
4. *Causation, Prediction, and Search* (2000), 2nd edition, P. Spirtes, C. Glymour, and R. Scheines, MIT Press, Boston.
5. *Causation, Prediction, and Search* (1993), P. Spirtes, C. Glymour, and R. Scheines, vol. 81 in Springer-Verlag's Lecture Notes in Statistics Series.
6. *TETRAD II: Tools for Causal Discovery* (1994), R. Scheines, P. Spirtes, C. Glymour, and C. Meek, Lawrence Erlbaum Associates, Hillsdale, N.J.
7. *Discovering Causal Structure: Artificial Intelligence, Philosophy of Science, and Statistical Modeling* (1987), C. Glymour, R. Scheines, P. Spirtes, and K. Kelly. Academic Press, San Diego, CA.

¹ <http://www.amstat.org/education/causalityprize/>

Published Articles – by topic**Philosophy/Methodology**

- Wheeler, G., and Scheines, R. (2013). Coherence and Confirmation Through Causation, *Mind*, 122 (485), 135-170.
- Scheines, R. (2011). Causal Inference in Experimental and Non-Experimental Studies, in *The Philosophy of Social Science Reader*, edited by Daniel Steel and Fancesco Guala, Routledge.
- Glymour, C., Danks, D., Glymour, B., Eberhardt, F., Ramsey, J., Scheines, R. (2010). "Actual Causation: a stone soup essay.", *Synthese*, Volume 175, Issue 2 Page 169-192.
- Wheeler, G., and Scheines, R. (2010). Causation, Association, and Confirmation. in *Explanation, Prediction, and Confirmation. New Trends and Old Ones Reconsidered*, edited by Stephan Hartmann, Marcel Weber, Wenceslao, J. Gonzalez, Dennis Dieks, Thomas Uebe, Springer.
- Scheines, R. (2008). "Causation, Truth, and the Law", *Brooklyn Law Review*, 73, 2,
- Eberhardt, F., and Scheines R., (2007). "Interventions and Causal Inference", in PSA-2006, *Proceedings of the 20th biennial meeting of the Philosophy of Science Association 2006* <http://philsci.org/news/PSA06>
- Scheines, R. (2006). The Similarity of Causal Inference in Experimental and Non-Experimental Studies, *Proceedings of the 2004 Biennial Meetings, Philosophy of Science*, V. 72, N. 5, pp. 927-940.
- Spirtes, P., and Scheines, R. (2004). Causal Inference of Ambiguous Manipulations, *Philosophy of Science* 71 (5):833-845 (2004).
- Scheines, R., Spirtes, P., Glymour, C., Meek, C., and Richardson, T. (1999). "Truth is Among the Best Explanations: Finding Causal Explanations of Conditional Independence and Dependence," in *Computation and Causation*, edited by C. Glymour and G. Cooper, MIT Press, Cambridge, MA, pp. 167-210.
- Scheines, R., (1999). "Estimating Latent Causal Influences: TETRAD II Model Selection and Bayesian Parameter Estimation" in *Computation and Causation*, edited by C. Glymour and G. Cooper, MIT Press, Cambridge, MA, pp. 425 - 440.
- Spirtes, P., Glymour, C., and Scheines, R. (1998). "Reply to Humphrey's and Freedman's Review of Causation, Prediction, and Search," in *British Journal for Philosophy of Science*.
- Spirtes, P. and Scheines, R. (1997), "Reply to David Freedman," in *Causality in Crisis?*, V. McKim and S. Turner (eds.), Univ. of Notre Dame Press, 163-176.
- Spirtes, P., C. Glymour, and R. Scheines, (1991). "From Probability to Causality," in *Philosophical Studies*, Vol. 64. No 1. pp. 1-36

- Glymour, C., P. Spirtes, and R. Scheines, (1991). "Causal Inference," in *Erkenntnis*, Kluwer Academic Publishers, Vol. 35, Nos. 1-3., July, pp. 151-189
- Glymour, C., P. Spirtes, and R. Scheines, (1990). "Causality and Probability," in *Evolving Knowledge in the Natural and Behavioral Sciences*, J.E. Tiles, G.T. Mckee., and G.C. Dean (editors), Pittman Publishing, London
- Glymour, C., Spirtes, P. and Scheines, R. (1990). Independence Relations Produced by Parameter Values in Causal Models," *Philosophical Topics*, Vol. 18, No. 2, pp. 55-70
- Scheines, R., (1988). "Automatically Inventing New Theory," in *The Computers and Philosophy Newsletter*, Issue 3:1, Leslie Burkholder (editor), published by the Center for Design of Educational Computing, Carnegie Mellon Univ., Pgh, PA, pp. 45-59
- Scheines, R., (1988). "Automating Creativity," in *Aspects of Artificial Intelligence*, James Fetzer (editor), Kluwer Academic Publishers, pp. 339-365
- Glymour, C., and R. Scheines, (1986). "Causal Modeling with the TETRAD Program," *Synthese*, Vol. 68, No. 1, July, pp. 37-64.
- Glymour, C., K. Kelly, and R. Scheines, (1983). Two Programs for Testing Hypotheses of Any Logical Form," in the *Proceedings of the Second International Conference on Machine Learning*, Urbana, Illinois.

Statistical Methodology/Machine Learning

- Scheines, R., and Ramsey, J. (2017). Measurement Error and Causal Discovery. *Proceedings of the UAI 2016 Workshop on Causation: Foundation to Application*, pp. 1-7, <http://ceur-ws.org/Vol-1792/>
- Yang, R., Spirtes, P., Scheines, R., Reise, S., Mansoff, M. (2017). Finding Pure Submodels for Improved Differentiation of Bifactor and Second-Order Models. *Structural Equation Modeling*, 24 (3), 402-413.
- Bonifay, W., S. Reise, R. Scheines, R. Meijer (2015). "When are multidimensional data unidimensional enough for structural equation modeling? An evaluation of the DETECT multidimensional index," *Structural Equation Modeling*. 22 (4), 504-516
- Kummerfeld, J Ramsey, R Yang, P Spirtes, R Scheines (2014). Causal Clustering for 2-Factor Measurement Models. *Machine Learning and Knowledge Discovery in Databases*, 34-49
- Reise, S., Scheines, R., Widaman, K., and Haviland, M. (2013). Multidimensionality and Structural Coefficient Bias in Structural Equation Modeling: A Bifactor Perspective, *Educational and Psychological Measurement*, V. 73, Issue 1
- Eberhardt, F., Hoyer, P.O., & Scheines, R. (2010). Combining Experiments to Discover Linear Cyclic Models with Latent Variables. In *Journal of Machine Learning, Workshop and Conference Proceedings (AISTATS 2010)*, 9:185-192.

- Spirtes, P., Glymour, C., Scheines, R., Tillman R. (2010). Automated Search for Causal Relations: Theory and Practice. In *Heuristics, Probability, and Causality: A Tribute to Judea Pearl*, edited by Rina Dechter, Howard Geffner, and Joseph Halpern, College Publications, 467-506.
- Hoyer, P., Hyvarinen, A., Scheines, R., Spirtes, P., Ramsey, J., Lacerda, G., Shimizu, S. (2008). Causal discovery of linear acyclic models with arbitrary distributions. *Proceedings of the 24th Conference on Uncertainty and Artificial Intelligence*, 2008, Helsinki, Finland.
- Silva, R., Scheines, R., (2006). Bayesian Learning of Measurement and Structural Models, in *Proceedings of International Conference on Machine Learning*, 2006.
- Silva, R. and Scheines, R. (2006). Towards association rules with hidden variables. *Proceedings of the 10th European Conference on Principles and Practice of Knowledge Discovery in Databases*, PKDD 2006.
- Silva, R., Glymour, C., Scheines, R. and Spirtes, P. (2006) "Learning the Structure of Linear Latent Structure Models," *Journal of Machine Learning Research*, 7, 191-246.
- Eberhardt, F., Glymour, C., & Scheines, R. (2006). N-1 Experiments Suffice to Determine the Causal Relations Among N Variables, in *Innovations in Machine Learning*, Holmes, Dawn E.; Jain, Lakshmi C. (Eds.), Theory and Applications Series: Studies in Fuzziness and Soft Computing, Vol. 194, Springer-Verlag.
- Eberhardt, F., Glymour, C., & Scheines, R. (2005), On the Number of Experiments Sufficient and in the Worst Case Necessary to Identify All Causal Relations Among N Variables, *Proceedings of the 21st Conference on Uncertainty and Artificial Intelligence*, Fahiem Bacchus and Tommi Jaakkola (editors), AUAI Press, Corvallis, Oregon, pp. 178-184.
- Silva, R. and Scheines, R. (2005). "New d-separation identification results for learning continuous latent variable models." *Proceedings of the International Conference in Machine Learning*, ICML 05.
- Silva, R., Scheines, R., Glymour, C., and Spirtes, P. (2003). Learning Measurement Models for Unobserved Variables, in *Proceedings of the Nineteenth Conference on Uncertainty in Artificial Intelligence*, U. Kjaerulff and C. Meek, eds., Morgan Kaufman.
- Robins, J., Scheines, R., Spirtes, P., and Wasserman, L. (2003). Uniform Consistency in Causal Inference, *Biometrika*, September, 90: 491 – 515.
- Chu, T., Scheines, R., and Spirtes, P. (2001). "Semi-Instrumental Variables: A Test for Instrument Admissibility, in *Proceedings of the 17th Conference on Uncertainty in Artificial Intelligence*, Univ. of Washington, Seattle, 20.
- Scheines, R., Cooper, G., Changwon Yoo, Tianjiao Chu, (2001). Piece-wise Linear Instrumental Variable Estimation of Causal Influence, in *Proceedings of Eighth International Workshop on Artificial Intelligence and Statistics*, Morgan Kaufman.

- Spirtes, P., Glymour, C., Scheines, R., Meek, C., Feinberg, S., and Slate, E. (1999). Prediction and Experimental Design with Graphical Causal Models, in *Computation and Causation*, edited by C. Glymour and G. Cooper, MIT Press, Cambridge, MA, pp. 65-94.
- Scheines, R., Hoijtink, H., & Boomsma, A. (1999), Bayesian Estimation and Testing of Structural Equation Models, *Psychometrika*. 64, 1, pp. 37-52.
- Scheines, R. (1996). Estimating Latent Causal Influences,” in *Proceedings of the 6th International Workshop on Artificial Intelligence and Statistics*, eds. P. Smythe and D. Madigan.
- Scheines, R. (1996). Estimating Under-identified Structural Models, in *Compstat '96: Proceedings in Computational Statistics*, Short Communications and Posters ed., by A. Prat and E. Ripoll, 109-111.
- Glymour, C., P. Spirtes, and R. Scheines, (1994). In Place of Regression, in *Patrick Suppes: Scientific Philosopher*, Paul Humphreys (editor), Vol. 1, Kluwer Academic Publishers, Dordrecht, Holland.
- Glymour, C., P. Spirtes, and R. Scheines (1993). Inferring Causal Structure in *Mixed Populations*, in *Artificial Intelligence Frontiers in Statistics: AI and Statistics III*, D.J. Hand (editor), Chapman & Hall, London, pp. 141-155.
- Scheines, R. and P. Spirtes Finding Latent Variable Models in Large Data Bases," (1992), , in the *International Journal of Intelligent Systems*, edited by G. Piatetski-Shapiro, Vol. 7, No. 7, September, pp. 609-622.
- Scheines, R., Spirtes, P., and C. Glymour (1992). TETRAD II: Finding Causal Models of Statistical Data, in *Sofstat '91: Advances in Statistical Software*, Frank Faulbaum (editor), Gustav Fischer Verlag, pp. 143-152.
- Spirtes, P., C. Glymour, and R. Scheines, (1991). An Algorithm for Fast Recovery of Sparse Causal Graphs. *Social Science Computer Review*, Vol. 9, pp. 62-72.
- Spirtes, P., C. Glymour, and R. Scheines, (1990), From Probability to Causality, *Advanced Computing for the Social Sciences: Conference Proceedings*, Williamsburg, Virginia, §8, pp. 1-21
- Spirtes, P., R. Scheines, and C. Glymour, (1990). Simulation Studies of the Reliability of Computer Aided Model Specification using the TETRAD, EQS, and LISREL Programs,” *Sociological Methods and Research*, Vol. 19, No. 1, pp. 3-66.
- R. Scheines, P. Spirtes and C. Glymour, (1989). A Qualitative Approach to Causal Modeling, in *Qualitative Issues in Simulation Modeling*, Paul Fishwick and Paul Luker (editors), *Advances in Simulation*, Vol. 5, Springer-Verlag, pp. 72-97.

Scheines, R., C. Glymour, K. Kelly, and P. Spirtes (1987). Finding the Causal Structure of a Social System,” in *Proceedings of the IBM Academic Information Systems University Conference*, pp. 469-477.

Causation and Statistics - Reviews/Handbooks/Encyclopedia Articles

Scheines, R. (2018). “A Formal Theory of Causation”, Introduction to Formal Philosophy, edited by Sven Ove Hansson and Vincent F. Hendricks, Springer.

Cooper, G., Bahar, I., Becich, M., Benos, P., Berg, J., Espino Glymour, C., Crowley R., Kienholz, M., Lee, A., Scheines, R., Lu, X., The Center for Causal Discovery of Biomedical Knowledge from Big Data, *JAMA*, (2015)

Scheines, R. (2008). “Causation, Statistics, and the Law”, *Journal of Law and Policy*, 16,

Scheines, R. (2004). Causation, in *New Dictionary of the History of Ideas*. Scribner & Sons.

Feinberg, S., C. Glymour, and R. Scheines (2003). Expert Statistical Testimony and Epidemiological Evidence: The Toxic Effects of Lead Exposure on Children, *Journal of Econometrics*, Volume 113, Issue 1, March, 33-48.

Scheines, R. (2002) “Computation and Causation,” in *MetaPhilosophy*, 33: 1, Blackwell.

Spirtes, P., Richardson, T., Meek, C., Scheines, R., and Glymour, C., (1998). “Using Path Diagrams as a Structural Equation Modeling Tool,” *Sociological Methods & Research*, Vol. 27, N. 2, 182-225.

Scheines, R., Spirtes, P., Glymour, C., Richardson, T., & Meek, C. (1998). “The TETRAD Project : Constraint Based Aids to Model Specification.” *Multivariate Behavioral Research*, Vol. 33, N. 1, 65-118, & "Reply to Commentary," same issue, 165-180.

Scheines, R. (1997). An Introduction to Causal Inference, in *Causality in Crisis?*, V. McKim and S. Turner (eds.), Univ. of Notre Dame Press, pp. 185-200.

Scheines, R., H. Hoijtink, and A. Boomsma, (1996). TETRAD III: Tools for Graphical Models,” in *SoftStat '95, Advances in Statistical Software 5*, edited by Frank Faulbaum and Wolfgang Bandilla, Lucious & Lucious, Stuttgart, Germany, 183-194.

Scheines, R. (2002). Causation, Indistinguishability, and Regression," in *Sofstat '93: Advances in Statistical Software 4*, Frank Faulbaum (editor), Gustav Fischer Verlag, pp. 89-98.

Scheines, R. (2004) Inferring Causal Structure Among Unmeasured Variables, in *Selecting Models from Data: AI and Statistics IV*, P. Chessman and R. W. Oldford (editors), Springer-Verlag, pp. 197-204.

Spirtes, P., Scheines, R., Glymour, C., Richardson, T., and Meek, C. (2004), “Causal Inference,” in *Handbook of Quantitative Methodology in the Social Sciences*, ed. David Kaplan, Sage Publications, 447-478.

- Scheines, R., P. Spirtes, and C. Glymour, (1993). Prediction and Causation," in *Advanced Technology for Developers*, Jane Klimasauskas (editor), Vol. 2, August, High-Tech Communications, Sewickley, PA, pp. 1-12.
- Spirtes, P., R. Scheines, and C. Glymour, (1990). The TETRAD Project," in *Acting and Reflecting*, Wilfried Sieg (editor), Kluwer Academic Publishers, pp. 183-208
- Glymour, C., R. Scheines, and P. Spirtes, (1988). Exploring Causal Structure with the TETRAD Program," *Sociological Methodology*, Clifford Clogg (editor), American Sociological Association, Vol. 18, pp. 411-448.

Causation & Statistics – Applications

- Cryder, C., Loewenstein, G., Scheines, R. (2013). The Donor is in the Details, *Organizational Behavior and Human Decision Processes*, 120 (1), 15-23.
- Livengood, J., Sytsma, Feltz, A., Scheines, R., and Machery, E (2010). *Philosophical Temperament*, chapter 1.3 in *Philosophical Psychology*, 23: 3, 313-330.
- Jackson, A., and Scheines, R. (2005). "Single Mothers' Self-Efficacy, Parenting in the Home Environment, and Children's Development in a Two-Wave Study" in *Social Work Research*, 29, 1, pp. 7-20.
- Chu, T., Glymour, C., Scheines, R., and Spirtes, P (2003). "A Statistical Problem for Inference to Regulatory Structure from Associations of Gene Expression Measurements with Microarrays," *Bioinformatics*, 19: 1147-1152
- Handley, D., Serban, N., Peters, D., O'Doherty, R., Field, M., Wasserman, L., Spirtes, P., Scheines, R., and Glymour, C. (2002) Evidence of systematic Expressed Sequence Tag (EST). I.M.A.G.E. clone cross-hybridization on cDNA microarrays. *Genomics*.Vol 83/6 pp 1169-1175.
- Spirtes, P., Glymour, C., Scheines, R., Kauffman, S., Aimalie, and Wimberly, F. (2001). Constructing Bayesian Network Models of Gene Expression Networks from Microarray Data," in *Proceedings of the Atlantic Symposium on Computational Biology, Genome Information Systems and Technology*, Duke University, March.
- Scheines, R., (2002), Estimating Latent Causal Influences: TETRAD III Variables Selection and Bayesian Parameter Estimation: Lead and IQ" *Handbook of Data Mining and Knowledge Discovery*, Pat Hayes, editor, Oxford University Press, 944-952.
- C. Meek and R. Scheines, (1993). Causal Structure, Neural Networks, and Classification, in *Conference Proceedings: Applications of Artificial Neural Networks and Related Technologies to Manpower, Personnel and Training*, NPRDC-AP-93-10, Navy Personnel Research and Development Center, San Diego, CA, pp. 115-124.

Education / Educational Computing / Educational Data Mining

- Koedinger, K., Scheines, R., and Schaldebrand, P. (2018). "Is the Doer Effect Robust Across Multiple Data Sets?", *Proceedings of the 11th Intl. Conference on Educational Data Mining*, Buffalo, NY.
- Easterday, M., Aleven, V., Scheines, R., Carver, S. (2017). Using Tutors to Improve Educational Games: A Cognitive Game for Policy Argument. *Journal of the Learning Sciences*, 26 (2), 226-276
- Scheines, R., Silver, E., Goldin, I. (2014). Discovering Prerequisite Relationships among Knowledge Components. *Proceedings of the 7th International Conference on Educational Data Mining (EDM 2014)*
- Rau, M., Scheines, R., Aleven, V., and Rummel, N. (2013). Does Representational Understanding Enhance Fluency – or Vice Versa? Searching for Mediation Models. *Proceedings of the 6th International Conference on Educational Data Mining (EDM 2013)*. **Best-Paper Award**
- Carlson, R., Genin, K., Rau, M., and Scheines, R., (2013). Student Profiling from Tutoring System Log Data: When do Multiple Graphical Representations Matter. *Proceedings of the 6th International Conference on Educational Data Mining (EDM 2013)*
- Rau, M., and Scheines, R. (2012). Searching for Variables and Models to Investigate Mediators of Learning from Multiple Representations, in *Proceedings of the 5th International Conference on Educational Data Mining (EDM 2012)*
- Easterday, M., V Aleven, R Scheines, SM Carver. (2011). Using Tutors to Improve Educational Games. *Artificial Intelligence in Education*, 63-71
- Easterday, M. W., Aleven, V., Scheines, R. & Carver, S. M. (2010). Constructing causal diagrams to learn deliberation. *International Journal of Artificial Intelligence in Education*.
- Shih, B., Kenneth R. Koedinger, and Richard Scheines. (2010). "Unsupervised Discovery of Learning Tactics using Hidden Markov Model Clustering." in *Proceedings of the 3rd International Conference on Educational Data Mining*.
- Shih, B., Kenneth R. Koedinger, and Richard Scheines (2010). "A Response Time Model For Bottom-Out Hints as Worked Examples." In *Handbook of Educational Data Mining*, edited by Cristobal Romero, Sebastian Ventura, Silvia Rita Viola, Mykola Pechenizkiy, and Ryan Baker. Boca Raton, FL: CRC Press.
- Easterday, M. W., Aleven, V., Scheines, R., & Carver, S. M. (2009). Will Google destroy western democracy? Bias in policy problem solving. *Proceedings of the 14th International Conference on Artificial Intelligence in Education*.

- Shih, B., Koedinger, K., & Scheines, R. (2008). A Response Time Model for Bottom-Out Hints as Worked Examples. *Proceedings of the First Educational Data Mining Conference*. (**Best Paper Award**).
- Easterday, M. W., Aleven, V., & Scheines, R. (2007). The logic of babel: Causal reasoning from conflicting sources. *Proceedings of the 13th International Conference on Artificial Intelligence in Education*.
- Easterday, M.W., Aleven, V., & Scheines, R. (2007). Tis better to construct than receive: The effects of diagramming tools on learning to analyze social policy. *Proceedings of 13th International Conference on Artificial Intelligence in Education (AIED- 2007)*.
- Shih, B., Koedinger, K., and Scheines, R. (2007) "Optimizing Student Models for Causality." in *Proceedings of the 13th International Conference on Artificial Intelligence in Education*.
- Scheines, R., Easterday, M., Danks, D. (2007). Teaching the Normative Theory of Causal Reasoning, in *Causal learning: Psychology, Philosophy, Computation*, Alison Gopnik and Laura Schultz, editors, New York: Oxford University Press.
- Arnold, A., Beck, J., and Scheines, R. (2006). "Feature Discovery in the Context of Educational Data Mining: An Inductive Approach." *Proceedings of the AAAI2006 Workshop on Educational Data Mining*, Boston, MA.
- Arnold, A., Scheines, R., Beck, J., and Jerome, B. (2005). Time and Attention: Students and Tasks. *AAAI-05: Educational Data Mining*, Technical Report WS-05-02 AAAI Press.
- Scheines, R., Leinhardt, G., Smith, J., and Cho, K. (2005) "Replacing Lecture with Web-Based Course Materials, *Journal of Educational Computing Research*, 32, 1, 1-26.
- Glymour, C. & Scheines, R. (2004) "Accountability, Accessibility and Cost: How the Web Will Change Higher Education," in *The Innovative University*, Carnegie Mellon University Press, 259-270.
- Wheeler, W., D. Danks, J. Ramsey, R. Scheines, J. Smith, A. Thompson, (2001), Developing and Deploying Online Courses with Jcourse” *Proceedings of the Association of the Advancement of Computing in Education (AACE)*.
- Scheines, R. and W. Sieg, (1994). Computer Environments for Proof Construction,” in *Interactive Learning Environments*, Elliot Soloway (editor), Vol. 4, Issue (2), 159-169.
- Sieg, W., and R. Scheines, (1992). Searching for Proofs (in Sentential Logic),” in *Philosophy and the Computer*, L. Burkholder (editor), Westview Press, pp. 137-159.
- Scheines, R., and W. Sieg, (1993), The Carnegie Mellon Proof Tutor,” in *101 Success Stories of Information Technology in Higher Education: The Joe Wyatt Challenge*, Judith V. Boettcher (editor), McGraw-Hill, pp. 74-80.

Scheines, R., and J. Pressler, (1988). An Intelligent Natural Deduction Proof Tutor, *The Bulletin for Computerized Logic Teaching*, Vol.1, Number 1, March.

Commentaries/Reviews

Danks, D., Fancsali, S., Glymour, C., and Scheines, R., (2010). Comorbid Science?, *Behavioral and Brain Sciences*, 33: 2/3, commentary on Comorbidity: A network perspective, by Cramer, A., Waldorp, L., van der Maas, H.L.J., Borsboom, D., 33, 137-193

Op-Eds

“Political slogans about Gaza and Israel simplify and divide,” The Pittsburgh Post-Gazette, October, 2023 <https://www.post-gazette.com/opinion/guest-columns/2023/10/17/richard-scheines-israel-hamas-carnegie-mellon-fence/stories/202310150140>

“Why investment in the social sciences is critical to public health,” *The Hill*, July, 2022 <https://thehill.com/opinion/healthcare/3561363-why-investment-in-the-social-sciences-is-critical-to-public-health/>

Software

1. *TETRAD I* (1987), C. Glymour, R. Scheines, P. Spirtes, and K. Kelly, Academic Press, San Diego, CA.
2. *The Carnegie Mellon Proof Tutor* (1989), R. Scheines, J. Pressler, W. Sieg, and C. Walton, Center of Design of Educational Computing and Dept. of Philosophy, Carnegie Mellon University, Pittsburgh, PA, 15213.
3. *Web based courseware on causal and statistical reasoning* (2000 -): <https://oli.cmu.edu/jcourse/webui/guest/join.do?section=csr>
4. *TETRAD 5-6*: <https://www.ccd.pitt.edu/tools/>
5. *The Causality Lab* www.phil.cmu.edu/projects/causality-lab/
6. Web based courseware on Empirical Research Methods <https://oli.cmu.edu/jcourse/webui/guest/join.do?section=erm>
7. Web based courseware on “Elements of Causal Graphs”

Selected Talks**Talks - 2008**

1. "Data Mining for Latent Variable Models," Symposium, Proctor and Gamble Research, Cincinnati, Ohio.
2. "Causal Diagrams for Policy Analysis," invited symposium "Causation in the Wild," at the American Psychological Association: Eastern Division Meetings, Boston.
3. "Screening Off and Causal Inference," invited talk to University of Alabama at Birmingham, 2008 Conference on Philosophy and Biomedical Science
4. "Causal Discovery as Computation," invited talk at CENTRIA (Center for Artificial Intelligence), New University of Lisbon, Portugal
5. "Causal and Statistical Reasoning: Teaching with the Computer," invited talk at CENTRIA (Center for Artificial Intelligence), New University of Lisbon, Portugal
6. "Evidence for Causation in Public Policy and the Law," invited talk, Workshop on Philosophy of Science & Evidence Relevant for Regulation & Policy, Virginia Tech.
7. "Screening Off, Measurement, and Causal Inference" – contributed paper, Philosophy of Science Bi-annual Meetings, Pittsburgh.
8. "Causal Structure Search: Philosophical Foundations and Future Problems" – Keynote Address at Causality Workshop at NIPS 2008.

Talks - 2009

1. "Data Mining for Latent Variable Models," Symposium, Proctor and Gamble Research, Cincinnati, Ohio.
2. "Causation, Regression, and Educational Research," Symposium, University of Pennsylvania Program in Interdisciplinary Educational Research.
3. "Causal Graphical Models, Applications with Search", University of Pennsylvania, Atlantic Conference on Causal Inference, Invited talk.
4. "Searching for Causal Models, Theory and Practice" Symposium, Penn State Univ. The Methodology Center.
5. Coherence and Confirmation, Symposium on Philosophy and Methodology, Cal Tech, Pasadena, CA

Talks - 2010

1. "To Condition, or Not to Condition, the Problem of M-Structures and Confounders," invited talk at the opening of the Infometrics Institute, American University, Washington, D.C.
2. "Tetrad: Causal Modeling", All day Workshop at the Apollo Group, San Francisco, CA
3. "Online Learning," invited talk to the Council of Scientific Society Presidents, Washington, D.D.
4. "Causal Model Search: Applications, invited for a Tribute to Judea Pearl, UCLA
5. "Graphical Causal Models, Representation and Search", Invited talk, Seminar Series for the Program in Advanced Quantitative Methods, UCLA
6. "Discovering Pure Measurement Models", Invited talk, Seminar Series for the Program in Advanced Quantitative Methods, UCLA
7. "Causal Diagrams and Policy Reasoning," Invited symposium, Cognitive Forum, Department of Psychology, UCLA

Talks - 2011

1. "The Foundations of Causal Inference," March, History and Philosophy of Logic, Mathematics, and Science Colloquia, UC Berkeley Philosophy.
2. "Search Over Latent Variable Models," April, Department of Psychology, UC Davis, Methodology Colloquia
3. "Effective Online Learning," Online Learning Panel, School of Social Sciences, UCLA
4. "Causal Discovery from Sequences of Experiments" May, Biostatistics Seminar, Dept. of Biostatistics, UCLA
5. "Statistics and Causation," ILSI North America, Carbohydrates Committee Meeting

Talks - 2012

1. Tetrad: Machine Learning and Graphical Causal Models, Full day tutorial at the *American Statistical Association Meetings*, Chicago, March.
2. Searching for Causal Models: Full day summer school at Infometrics Institute, American University, Washington, DC., May
3. Finding the Mechanisms of Learning for Teaching Fractions, 5th International Workshop on Educational Data Mining, June, Crete, Greece.
4. Defining Variables for Causal vs. Predictive Inference, Philosophy of Science Association Biannual Meetings, San Diego, November.
5. Causal Models of Online Educational Data, NIPs workshop on Educational Datamining, December.

Talks - 2013

1. Does Representational Understanding Enhance Fluency – or Vice Versa? Searching for Mediation Models. *6th International Conference on Educational Data Mining*, Memphis, TN
2. Student Profiling from Tutoring System Log Data: When do Multiple Graphical Representations Matter, *6th International Conference on Educational Data Mining*, Memphis, TN
3. Tutorial on Causal Search, *Workshop on Case Studies of Causal Discovery*, Carnegie Mellon, October.
4. Causal Model Search in Educational Research, *Workshop on Case Studies of Causal Discovery*, Carnegie Mellon, October.
5. Historical perspective and overview of causal structure learning from observational and experimental data, Invited lecture for *NIPS 2013 Workshop on Causality: Large-scale Experiment Design and Inference of Causal Mechanisms*

Talks - 2014

1. Online Courseware in Philosophy, *American Philosophical Association*, Western Division.
2. Causal Discovery among Unmeasured Variables, Invited lecture to *Atlantic Causal Inference Conference*, Brown University.
3. Decision Theory and Causal Discovery, Invited lecture, *FIT Colloquia*, Monash University, Melbourne, Australia.

Talks – 2015

1. Computational Causal Discovery, *Center for Philosophy of Science*, University of Pittsburgh, Annual Lecture Series
2. Causal Discovery, Keynote Lecture, *American Statistical Association Annual Banquet*, Pittsburgh Chapter.

Talks – 2016

1. Causal Discovery among Latent Variables: the Measurement Problem, Keynote Lecture, Workshop on Causal Discovery, *Uncertainty in Artificial Intelligence*, 2016, Jersey City.
2. Advances in Causal Discovery, Invited Symposia, University of Puerto Rico, San Juan.
3. Tutorial : Computational Causal Discovery in Biomedicine, *American Medical Informatics Association Annual Meetings*, San Francisco, March.
4. Measurement Error and Causal Discovery, Invited Presentation at the *Infometrics Institute*, American University, Washington, D.C.

Talks – 2017

1. Causal Discovery, National Academies Workshop, Advances in Causal Understanding for Risk Based Decision Making, Washington, D.C.
2. Barriers to Adoption in TEL, Global Learning Council, Berlin, June, 2017

Talks – 2018

1. Center for Causal Discovery, *Health Sciences Colloquium*, University of Pittsburgh
2. Causal Machine Learning: the Measurement Problem, Keynote Lecture, *Foundations of Machine Learning*, UC Irvine.
3. AI & Causation, invited Keynote, *World AI Conference*, Shanghai, China, Oct. 2018
4. Information and the Limits of Causal Discovery, *Infometrics Conference on Causality and Information*, CMU.
5. Computational Causal Discovery in Health Research, Invited Lecture at the *Health Effects Institute Annual Conference*, Chicago.

Talks – 2019

1. Atlantic Causal Inference Conference, ½ day workshop on Tetrad.
2. Grand Challenge Seminars, invited keynote at “Humanistic Perspectives at Technological Universities,” Georgia Tech, April 2019.
3. “Causal Discovery in Educational Research” – invited panel at the Empirical Educators Summit – Carnegie Mellon
4. “Building the Humanities” – invited panel at the ADE-ADFL, Modern Language Association Meetings, held at the University of Pittsburgh
5. “Causal Discovery with Tetrad” – invited tutorial at the Educational Data Mining 2019

Talks – 2020

1. “Causation and Educational Research”, invited panel at Georgia Tech.

Talks – 2021

1. “Causal Discovery with Instrumental Variables – Designed and Discovered” invited Keynote at Educational Datamining 2021 (Virtual).

Talks – 2023

1. “The History of Case Studies of Causal Discovery,” Invited talk at *UAI 2023*, Workshop on the History and Development of Search Methods for Causal Structure.

Talks – 2024

1. “Freedom of Expression on Campus: An Insider’s Perspective”, Hobart and William Smith Colleges (HWS), September, 2024

Talks – 2025

2. “Academic Freedom,” public lecture, Longwood Community, Pittsburgh
3. “The Role of Humanities in a Technical University: Grand Challenge Seminars,” Workshop at Georgia Tech on the Future of Humanities

Talks – 2026

1. “Is a Science of Humans Even Possible” Inaugural Lecture of the *Richard Scheines Lecture In the Humanities and Social Sciences*, CMU-Q, Doha, January 2026

Teaching

- 66-104: Grand Challenge Seminar on Academic Freedom/Freedom of Speech
- 88-252 *Empirical Research Methods: Regression and Causation*
- 85-748: *Research Methods in the Learning Sciences*
- 80-710: *Causal Modeling*.
- 80-210: *Self Paced- Intro to Logic*.
- 80-221: *Philosophy of Social Science*
- 80-321: *Causation, Law and Social Policy*
- 80-110: *The Nature of Mathematical Reasoning*
- *Structural Equation Modeling*: Graduate Course at the University of Groningen, the Netherlands, Fall 1994.
- 80-512/812 *Causation* - Graduate Seminar
- 88-241: *Empirical Research Methods II*:
- 05-571: *Project Course in Human Computer Interaction*
- 80-102: *Freshman Seminar on Causal Discovery*
- HPS611: *Causal and Statistical Reasoning*, Spring 2001, University of Pittsburgh.
- 80-321/621: *Causation, Law, and Social Policy*
- 80-103: *Gun Control, Media Violence, School Vouchers, and Social Science*
- 80-105: *The History and Morality of Arab-Israeli Relations*
- *Graphical Causal Models*: Week long course in the Department of Philosophy’s Summer School in Logic and Formal Epistemology (2012, 2013)
- Causal Discovery in Biomedicine: Week long course for the Center for Causal Discovery (<http://www.ccd.pitt.edu/>): 2015, 2016

Grants**-1988-89. Office of Naval Research.**

"Using Artificial Intelligence to Aid in the Development of Causal Models".

- \$79,017. (Research Programmer)
- 1989-90. Office of Naval Research.**
"Using Artificial Intelligence to Aid in the Development of Causal Models".
\$103,973. (Research Scientist)
- 1990-91. Office of Naval Research.**
"Development of Intelligent, Computerized Aids for Specification of Causal Models from Large Data Bases." \$139,015 (Co - PI)
- 1991-92. National Science Foundation**
"Inferring Causal Structure from Statistical Data",
\$76,000. (Research Scientist)
- 1992-93. National Science Foundation.**
"Automated Proof Search," \$72, 842. (Co - PI)
- 1993-95. Office of Naval Research.**
"TETRAD II and Neural Networks," \$227,769. (PI)
- 1994-96. National Science Foundation.**
"Improving the Cost Effectiveness of Health Care through Machine Learning Applied to Clinical Databases," \$750,000. (Research Scientist)
- 1995-97. Office of Naval Research.**
"Measures of Naval Readiness," \$182,747. (Principal-Investigator)
- 1997-2000. Fund for the Improvement of Post-Secondary Education**
"Web-based Courseware for Causal and Statistical Reasoning" \$387,000 (Project Director)
- 1998. Office of Naval Research.**
"Performance Based Measures of Naval Readiness" \$87,000. (Principal-Investigator)
- 1998. Link-to-Learn (State of Pennsylvania).**
"Montessori Software" \$83,000. (Project Director)
- 2000-2003. Andrew W. Mellon Foundation**
"Teaching Causal Reasoning Online" \$550,000 (Project Director)
- 2001-2002. Office of Technology for Education, Carnegie Mellon**
"Repository of Online Assessments" \$90,000 (Project Director)
- 2002-2003. Carnegie Mellon University Seed Grant**
"Data Driven Course Improvement" \$59,000 (Project Director)
- 2003-2004. James S. McDonnell Foundation**
"Online Courseware in Causal and Statistical Reasoning" \$188,000 (Project Director)
- 2002-2004. William and Flora Hewlett Foundation**
"Carnegie Mellon Online Learning Initiative" \$1,900,000 (Co-PI)
- 2004-2008. William and Flora Hewlett Foundation**
"Carnegie Mellon Online Learning Initiative" \$2,700,000 (Co-PI)
- 2004-2009. Institute for Education Science**
"PhD Training Program in Interdisciplinary Educational Research" \$5,000,000 (Co-PI)
- 2009-20014. Institute for Education Science**

“PhD Training Program in Interdisciplinary Educational Research” \$5,000,000 (Co-PI)

-2012-20013. National Science Foundation

“Case Studies in Causal Inference” \$46,000 (PI)

-2013-2015. National Science Foundation

“Algorithms for Measurement Model Specification” \$494,000 (co-PI)

-2014-2019. Andrew W. Mellon Foundation

“Cultivating Digital Scholarship and Technology-Enhanced Learning in the Humanities” \$2,000,000 (PI)

-2015-2020. National Institute of Health

“Center for Causal Discovery” Joint with the Univ. of Pittsburgh
\$11,000,000 (co-lead on the Training Component)

-2016-2017. Carnegie Corporation

“Understanding the Barriers to TEL Adoption” \$1,000,000 (PI)

-2018-2021. Andrew W. Mellon Foundation

“Teaching Writing via a ‘Sidecar’ Model” \$1,000,000 (PI)

Professional Activity

National Academies of Science Committees

- NRC: Progress Toward Transforming the Integrated Risk Information System (IRIS) Program (2018).
- NRC: Committee to Review the EPA’s IRIS Process (2012-2013)
- IOM: Committee on Evaluation of the VA's Presumptive Disability Decision-Making Process. (2006-7)
- IOM: Committee on the Effects of Food Marketing on the Diets of Children and Youth (2004 – 2005)
- IOM: Workshop on Estimating the Contributions of Lifestyle-Related Factors to Preventable Death. (Dec. 2004)

Policy Panels

- **Health Effects Institute**, Strategic Evaluation of Future Research Panel, Boston, MA
- **ILSI North America**, Carbohydrates Committee Meeting, Washington DC

Professional Associations

- Associate: Center for Philosophy of Science, University of Pittsburgh.
- Member: Philosophy of Science Association
- Member: American Philosophical Association

Program Committees

- 4th International Conference on Computers and Philosophy, CMU, August 1989.
- 8th International Conference on Computers and Philosophy, CMU, August 1993.
- CONald (Conference on Automated Learning and Discovery), CMU, June 1998

- Uncertainty in Artificial Intelligence (Univ. of Wisconsin, Madison, July, 1998)
- Artificial Intelligence & Statistics (Ft. Lauderdale, Jan. 1999)
- Uncertainty in Artificial Intelligence (2002, 2003, 2004, 2006, 2009)
- Formal Epistemology Workshop (2007, 2008)
- International Conference on Educational Data Mining (2014)
- UAI 2023, Workshop: The History and Development of Search Methods for Causal Structure

Journals Refereed

Agricultural Economics, British Journal for Philosophy of Science, Cognitive Science, Epidemiology, Journal of Mathematical Sociology, Philosophy of Science, Publication of the National Academies of Science, Synthese, Studia Logica, Structural Equation Modeling, Journal of Machine Learning Research, Statistics in Medicine, Biometrics, Journal of Machine Learning Research, Artificial Intelligence, PLOS, Erkenntnis, Minds and Machines,

Other Professional Service

Editorial Board: *Minds & Machines*

Nominating Editor, *The Philosopher's Annual*

Host: AAU Deans Annual Meetings – April 2019

Evaluation Panels

- NSF Evaluation Panel for Computerized Science Education, CSLA, 1993,95.
- Evaluator for Allegheny College's Initiative in Educational Computing, 1992.
- Evaluator for Allegheny College's Initiative in Educational Computing, 1994
- Advisory Board for “Human Causal Reasoning: NSF CAREER Award” – Ben Rottman, Learning Research and Development Center, Univ. of Pittsburgh, 2016

University Service

1988 - 90 - *Men's Varsity Tennis Coach*

1989 - Coach of the Year - President's Athletic Conference

1990 - Coach of the Year - President's Athletic Conference

1989 - 1999 - *Athletic Department Advisory Committee*

1992 - 2000 - *H&SS Computing Advisory Committee*

1996 - 2005 - *Undergraduate Advisor of the Major in Human Computer Interaction*

1998 - 1999 *University Strategic Planning Committee on Information and Communication Technology*

1999 - *University Strategic Planning Subcommittee on Information and Communication Technology to support Pedagogy (chair)*

1999 - *Search Committee for Director, Office of Education for Technology, (Co-chair)*
2001 - 2002 - *University Tenure and Promotion Committee*
2001 - 2002 - *Faculty Senate Committee on Computing (Chair)*
2002 *University Strategic Planning Subcommittee on Information Technology for Education*
2003 – *5 Campus Computing Advisory Committee*
2006 – *Research Misconduct Committee of Inquiry – Chair*
2007 - *Research Misconduct Investigation Committee – Chair*
2008- *University Strategic Planning Committee on Education and Student Life*
2008 – 2010 *University Task Force on Assessment*
2009-10 –*Board on Administration, Regulation, and Finance*
2013-14 -- *OSP/ORIC advisory committee*
2014-15 –*University Strategic Planning, Co-lead: Teaching and Learning*
2014-15 – *University Strategic Planning, Technology Enhanced Learning, Chair*
2015 – *Director, Simon Initiative*
2017-2023 – *Chair – Honorary Doctorate Committee*
2018 – *Chair, Provost Search Committee*
2020- *Collaboratory Against Hate Steering Committee*
2021 - *Chair, CMU-Q Dean's Review (Mike Trick)*
2021 – *Academic Freedom/Freedom of Expression Commission*
2021 – *Provost's Committee on the Future of Higher Education*
2023- *Implementation Committee on AF/FOE (co-chair of the Education committee with Wanda Heading-Grant)*
2024 – *Co-chair, Heinz Dean Search Committee*
2024-26 - *Deeper Conversations*

Consulting

- 1989 - *Software Development* for Siegal and Gale, 1185 Avenue of the Americas, NY.
- 1990 - *Statistical Analyses* of Market Research Data, for Market Perspectives, Toronto.
- 1990- *Legal Consulting* on a Statistical Attempt to Establish Causation for O'Melveny & Meyers, NY.
- 2002 - 2004 - Institute for Human and Machine Cognition Pensacola, FL, Data Mining Consultant.
- 2006 – Johnson & Johnson, Alzheimers Caregiver Burden Analysis.
- 2007 – Proctor & Gamble, Causal Discovery with Model Search
- 2010 - Apollo Research Group, Causal Discovery from Educational Data, SF, CA
- 2013 – Pearson Education, Causal Discovery of Skill Pre-requisite Structure

Boards

- Pittsburgh City Theater (<http://www.citytheatrecompany.org/>). 2015 - 2018
- History Makers Project (<http://www.thehistorymakers.com/>) 2017 – 2019