

I focus on developing tools and processes for designers of games and instructional technologies to work reflectively with their products. I leverage knowledge across the disciplines of learning science, human-computer interaction, and game design to build theory around the relationship between learners and their experiences.

*Research Interests:* Educational Games, Educational Data Mining, Learning Science, Game User Research, Usable Analytics

## Employment

2017 – present Systems Scientist, Human-Computer Interaction Institute, Carnegie Mellon University

## Education

### **Carnegie Mellon University, 2011 – 2017**

MS / PhD Human-Computer Interaction

Advisor: Vincent Aleven

Committee: Jodi Forlizzi, Jessica Hammer, Sharon Carver, Jesse Schell

### **Illinois Institute of Technology, 2007 – 2011**

BS Psychology, minor Computer Science

### **Temple University Japan Campus, 2010**

Exchange Student

## Selected Honors, Awards, and Fellowships

- 2019 LAK Nomination for Best Paper (top 5) – P15
- 2016 EDM Exemplary Paper Designation (top 15%) – P10
- 2015 CHIPLAY Best Paper Honorable Mention (top 5%) – P8
- 2013 CHI Best Paper Honorable Mention (top 5%) – P2
- 2011 Program for Interdisciplinary Education Research (PIER) Fellowship, Carnegie Mellon University

## Grants

- 2019 Assisted with *NSF AISL* Grant entitled "Player-Programmed Partner Games (P3G) for Low-Resource Learners" (PI: Ross Higashi) [worth \$2,616,054]  
Assisted with *NSF SL* Grant entitled "Learning Depends on Knowledge: Using Interaction Designs and Machine Learning to Contrast the Testing and Worked Example Effects" (PI: Kenneth Koedinger, CO-PI: Paulo Carvalho) [worth \$712,416]

## Academic Publications

*Google Scholar:* <http://scholar.google.com/citations?user=9twQhlwAAAAJ>

## Thesis

Projective Replay Analysis: A Reflective Approach for Aligning Educational Games to their Goals,  
Tech Report: CMU-HCII-17-107, Defended August 4, 2017.

## Conference and Journal Papers

- [P22] Daniel Weitekamp III, Zihuiwen Ye, Napol Rachatasumrit, **Erik Harpstead** and Kenneth Koedinger. Investigating Differential Error Types between Human and Simulated Learners. *Proceedings of the 21st International Conference on Artificial Intelligence in Education – AIED '20*, Iframe, Morocco, July 6-10, 2020. (to appear).
- [P21] Kenneth Holstein, **Erik Harpstead**, Rebecca Gulotta, and Jodi Forlizzi. Replay Enactments: Exploring Possible Futures through Historical Data. *Proceedings of the 2020 on Designing Interactive Systems Conference - DIS '20*, Eindhoven, Netherlands, July 6-10, 2020. (to appear).
- [P20] Daniel Weitekamp III, **Erik Harpstead**, and Kenneth R. Koedinger. An Interaction Design for Machine Teaching to Develop AI Tutors. *Proceedings of the 2020 SIGCHI Conference on Human Factors in Computing Systems – CHI '20*, Honolulu, Hawai'i USA, April 25-30, 2020. paper 99.
- [P19] Joseph Seering, Ray Mayol, **Erik Harpstead**, Tianying Chen, Amy Cook, and Jessica Hammer. Peer Feedback Processes in the Game Industry. *Proceedings of the 2019 Annual Symposium on Computer-Human Interaction in Play - CHI PLAY '19*, Barcelona, Spain, October 22-25, 2019. pp. 427-438.
- [P18] **Erik Harpstead**, Juan Sebastian Rios, Joseph Seering, and Jessica Hammer. Toward a Twitch Research Toolkit: A Systematic Review of Approaches to Research on Game Streaming. *Proceedings of the 2019 Annual Symposium on Computer-Human Interaction in Play - CHI PLAY '19*, Barcelona, Spain, October 22-25, 2019. pp. 111-119.
- [P17] Daniel Weitekamp III, **Erik Harpstead**, Napol Rachatasumrit, Christopher J. Maclellan, and Kenneth R. Koedinger, Toward Near Zero-Parameter Prediction Using a Computational Model of Student Learning. *Proceedings of the 12th International Conference on Educational Data Mining – EDM '19*, Montreal, Canada, June 27-July 6, 2019. pp. 456-461.
- [P16] Yeyu Wang, Huy Nguyen, **Erik Harpstead**, John Stamper, and Bruce M. McLaren, How Does Order of Gameplay Impact Learning and Enjoyment in a Digital Learning Game? *Proceedings of the 20th International Conference on Artificial Intelligence in Education – AIED '19*, Chicago, IL USA, June 25-29. pp. 518-531.
- [P15] **Erik Harpstead**, J. Elizabeth Richey, Huy Nguyen, and Bruce M. McLaren, Exploring the Subtleties of Agency and Indirect Control in Digital Learning Games. *Proceedings of the International Conference on Learning Analytics and Knowledge – LAK '19*, Tempe, Arizona USA, March 2019 pp. 121-129. **Nominated for Best Paper**
- [P14] Christopher J. MacLellan, **Erik Harpstead**, Robert P. Marinier III, and Kenneth R. Koedinger, A Framework for Natural Cognitive System Training Interactions. *Advances in Cognitive Systems*, 6, 2018. pp. 177-192.
- [P13] Huy Nguyen, **Erik Harpstead**, Yeyu Wang, Bruce M. McLaren, Student Agency and Game-Based Learning: A Study Comparing Low and High Agency. *Proceedings of the 19th International Conference on Artificial Intelligence in Education – AIED '18*, London, UK, June 25-30, 2018.
- [P12] Kelly Rivers, **Erik Harpstead**, and Kenneth R. Koedinger, Learning Curve Analysis for Programming: Which Concepts do Students Struggle With? *Proceedings of the International Computing Education Research Workshop – ICER '16*, Melbourne, Australia, September 8-12, 2016. pp. 143-151.
- [P11] Catherine Chase, **Erik Harpstead**, and Vincent Alevan, Inciting out-of-game transfer: Adapting contrast-based instruction for educational games. *Proceedings of the Games+Learning+Society Conference 12.0 – GLS 12.0*. Madison, WI, August 17-19, 2016.
- [P10] Christopher J. MacLellan, **Erik Harpstead**, Rony Patel, and Kenneth R. Koedinger, The Apprentice Learner Architecture: Closing the loop between learning theory and educational data. *Proceedings of the 9th International Conference on Educational Data Mining – EDM '16*, Raleigh, NC, June 29-July 2, 2016. pp. 151-158. **Exemplary Paper Designation**

- [P9] Christopher J. MacLellan, **Erik Harpstead**, Vincent Aleven, and Kenneth R. Koedinger, TRESTLE: A Model of Concept Formation in Structured Domains, *Advances in Cognitive Systems*, 4, 2016. pp. 131-150.
- [P8] **Erik Harpstead**, and Vincent Aleven, Using Empirical Learning Curve Analysis to Inform Design in an Educational Game, *Proceedings of the ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play – CHIPLAY '15*, London, UK, October 3-5, 2015. pp. 197-207. **Best Paper Honorable Mention Award**
- [P7] **Erik Harpstead**, Thomas Zimmermann, Nachiappan Nagapan, Jose Guajardo, Ryan Cooper, Tyson Solberg, and Dan Greenawalt, What Drives People: Creating Engagement Profiles of Players from Game Log Data, *Proceedings of the ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play – CHIPLAY '15*, London, UK, October 3-5, 2015. pp. 369-379.
- [P6] Christopher J. MacLellan, **Erik Harpstead**, Vincent Aleven, and Kenneth R. Koedinger, TRESTLE: Incremental Learning in Structured Domains using Partial Matching and Categorization, *Proceedings of the 3rd Annual Conference on Advances in Cognitive Systems – ACS '15*, Atlanta, Georgia, May 28-31, 2015. p. 13.
- [P5] **Erik Harpstead**, Christopher J. MacLellan, Vincent Aleven, Brad A. Myers, Using Extracted Features to Inform Alignment-Driven Design Ideas in an Educational Game, *Proceedings of the 32nd SIGCHI Conference on Human Factors in Computing Systems – CHI '14*, Toronto Canada, April 26-May 1, 2014. pp. 3329-3338.
- [P4] **Erik Harpstead**, Christopher J. MacLellan, Kenneth R. Koedinger, Vincent Aleven, Steven P. Dow, and Brad A. Myers, Investigating the Solution Space of an Open-Ended Educational Game Using Conceptual Feature Extraction, *Proceedings of the 6th International Conference on Educational Data Mining – EDM '13*, Memphis, Tennessee, July 6-9, 2013. pp. 51-58.
- [P3] Vincent Aleven, Steven Dow, Michael Christel, Scott Stevens, Carolyn Rosé, Kenneth Koedinger, Brad Myers, Julia Brynn Flynn, Zane Hintzman, **Erik Harpstead**, Soyeon Hwang, Derek Lomas, Chris Reid, Mitra Fathollahpour, Amos Glenn, Jonathan Sewall, John Balash, Nora Bastida, Chandana Bhargava, Sean Brice, Matt Champer, Samantha Collier, Jingyi Feng, Danny Hausmann, Meng Hui Koh, Weiwei Huo, Qianru Ma, Bryan Maher, Weichuan Tian, and Xun Zhang, Supporting Social-Emotional Development in Collaborative Inquiry Games for K-3 Science Learning, *Proceedings of the Games+Learning+Society Conference 9.0 – GLS 9.0*, Madison, WI, June 12-14, 2013. pp. 53-60.
- [P2] **Erik Harpstead**, Brad A. Myers, and Vincent Aleven, In Search of Learning: Facilitating Data Analysis in Educational Games, *Proceedings of the 31st SIGCHI Conference on Human Factors in Computing Systems – CHI '13*, Paris, France, April 27-May 2, 2013. pp. 79-88. **Best Paper Honorable Mention Award**
- [P1] Mike G. Christel, Scott M. Stevens, Bryan S. Maher, Sean Brice, Matthew Champer, Luke Jayapalan, Qiaosi Chen, Jing Jin, Daniel Hausmann, Nora Bastida, Xun Zhang, Vincent Aleven, Kenneth R. Koedinger, Catherine Chase, **Erik Harpstead**, and Derek Lomas. RumbleBlocks: Teaching Science Concepts to Young Children through a Unity Game, *Proceedings of the 17th International Conference on Computer Games – CGames '12*, Louisville, Kentucky, July 30-August 1, 2012. pp. 162-166.

## Book Chapters

- [B1] **Erik Harpstead**, Christopher J. MacLellan, Vincent Aleven, Brad A. Myers, Replay analysis in open-ended educational games, *Serious Game Analytics: Methodologies for Performance Measurement, Assessment, and Improvement*. Christian S. Loh, Yanyan Sheng, and Dirk Ifenthaler (Eds.) 2015. pp. 381-399.

## Teaching Experience

Design of Educational Games, Carnegie Mellon University – 05-418/818  
 Spring Semester 2020, Instructor of Record

Interactive Data Science, Carnegie Mellon University – 05-839

*Fall Semester 2019, Co-Instructor of Record*

Design of Educational Games, Carnegie Mellon University – 05-418/818

*Spring Semester 2019, Instructor of Record*

Design of Educational Games, Carnegie Mellon University – 05-418/818

*Spring Semester 2018, Instructor of Record*

User Interface Lab – GUI Development, Carnegie Mellon University – 05-433/633-B

*Fall Semester 2014, TAsupervised by: Anind Dey*

Educational Game Design Track, IPTSE Winter School, Bangalore, India

*2 Week Winter Workshop 2013, Co-Instructors: Amy Ogan (CMU), and Erin Walker (ASU)*

User Centered Research and Evaluation, Carnegie Mellon University – 05-410/610

*Fall Semester 2013, TAsupervised by Robert Kraut, and James Morris*

Introduction to Computer Programming with Media, Carnegie Mellon University

*Online Preparatory Course Summer 2013, Instructor*

## Professional Experience

2014.	<b>Microsoft Research</b> Redmond, WA, USA Research Internship <i>Mentors:</i> Thomas Zimmermann & Nachiappan Nagappan	Analyzed a large-scale dataset of gameplay data to understand common types of players in a popular racing game.
2010 – 2011	<b>Carnegie Mellon University</b> Pittsburgh, PA, USA Research Programmer <i>Mentor:</i> Vincent Aleven	Contributed to the Cognitive Tutor Authoring Tools (CTAT) project including a full re-architecting of its Flash UI toolkit.
2009.	<b>Museum of Science and Industry</b> Chicago, IL, USA Floor Presentations Intern	Ran interactive floor presentation carts for guests

## Professional Service

### Conference Organizing Committees

2020 ACM CHI Play (Co-Chair Student Game Design Competition)

2017 ACM CHI Play (Co-Chair of Student Volunteering)

2016 ACM CHI Play (Co-Chair of Student Volunteering)

### Judging, Review Panels, and Program Committees

2020 ACM CHI (Associate Chair; Learning, Education, & Families subcommittee)

ACM CHI Play (Associate Chair; Program Committee)

EDM (Member; Program Committee)

NSF Panelist

2019 ACM CHI (Associate Chair; Learning, Education, & Families subcommittee)

EDM (Member; Program Committee)

LEAP Innovations Edtech Curation Panel (Expert Panelist)

2018 ACM CHI Play (Associate Chair; Program Committee)

LEAP Innovations Edtech Curation Panel (Expert Panelist)

2015 ACM CHI Works-in-Progress (Program Committee Member)

## External Reviewer

2019 Journal of Learning Analytics, Transactions on Learning Technology  
2018 Journal of Human-Computer Studies  
2016+ Journal of Information Visualization, Journal of Computers and Education  
2015+ ACM CHI Play, Journal Entertainment Computing, ACM TOCHI, GLS  
2014+ ACM CHI  
2013 FDG

## Extended Honors, Awards, and Fellowships

2019 Best Use of Theme, PIGDA Pittsburgh Board Game Jam 2019  
2016 First Place among Carnegie Mellon University teams, Microsoft College Puzzle Challenge  
2014 First Place among Carnegie Mellon University teams, Microsoft College Puzzle Challenge  
2010 Commendation of Merit in Collaboration & Co-Creation, as part of IIT Empowering Haiti IPRO Team, Society for New Communications Research  
2009 College of Science and Letters Undergraduate Research Award, Researching and Redesigning IIT's CS General Education Requirements, Illinois Institute of Technology

## Other Publications

- [O13] Erik Harpstead, and Jessica Hammer, Toward Game Aware Streaming Interfaces, *CHI '20 Workshop on Be Part Of It: Spectator Experience in Gaming and eSports*, Online, April 27, 2020.
- [O12] David Gagnon, **Erik Harpstead**, Vishesh Kumar, Elizabeth Owen, Dennis Ramirez, and Stefan Slater, Game Data Analysis to Understand Players, Design, and Learning, *Symposium at the Connected Learning Summit – CLS 2019*, Irvine, CA, October 2-5, 2019.
- [O11] David Gagnon, **Erik Harpstead**, and Stefan Slater, Comparison of Off the Shelf Data Mining Methodologies in Educational Game Analytics, *EDM '19 Workshop on EDM & Games: Levelling Up Engaged Learning with Data-Rich Analytics*, Montreal, Canada, July 2, 2019.
- [O10] **Erik Harpstead**, Christopher J. MacLellan, Daniel Weitekamp, and Kenneth R. Koedinger, The Use of Simulated Learners in Adaptive Education, *3rd International Conference on AI + Adaptive Education*, Beijing, China, May 24-25, 2019.
- [O9] Benjamin Xie, **Erik Harpstead**, Betsy DiSalvo, Petr Slovak, Ahmed Kharrufa, Michael J. Lee, Viktoria Pammer-Schindler, Amy Ogan, and Joseph Jay Williams. 2019. Learning, Education, and HCI. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems - CHI EA '19*. Galsgow, UK Paper SIG09, 4 pages.
- [O8] **Erik Harpstead** and Christopher J. MacLellan, Visualizing the Solution Space of Educational Games using TRESTLE, *Companion Proceedings 9th International Conference on Learning Analytics & Knowledge – LAK '19*, Tempe, Arizona USA, March 2019
- [O7] **Erik Harpstead**, Christopher J. MacLellan, Robert P. Marinier III, and Kenneth R. Koedinger, Towards Natural Cognitive System Training Interactions: A Preliminary Framework, *Designing the User Experience of Artificial Intelligence as part of the 2018 AAAI Spring Symposium*. Stanford, CA, March 26, 2018.

- [O6] **Erik Harpstead** Projective Replay Analysis: Using Cognitive Systems to Drive Evaluation of Educational Games, *2nd Annual Students of Cognitive Systems Workshop at the Advances in Cognitive Systems Conference – SOCS '16*, Evanston, IL, June 23, 2016.
- [O5] **Erik Harpstead**, Christopher J. MacLellan, and Vincent Aleven, Discovering Knowledge Models in an Open-ended Educational Game using Concept Formation, *6th International Workshop on Intelligent Support in Exploratory and Open-Ended Learning Environments at the 17th International Conference on Artificial Intelligence in Education – AIED '15*, Madrid, Spain, June 22, 2015.
- [O4] Christopher J. MacLellan, **Erik Harpstead**, Eliane Stampfer Wiese, Mengfan Zou, Noboru Matsuda, Vincent Aleven, and Kenneth R. Koedinger, Authoring Tutors with Complex Solutions: A Comparative Analysis of Example Tracing and SimStudent, *Workshop on Simulated Learners at the 17th International Conference on Artificial Intelligence in Education – AIED '15*, Madrid, Spain, June 26, 2015.
- [O3] **Erik Harpstead**, Christopher J. MacLellan, Vincent Aleven, & Kenneth R. Koedinger, Using Data to Explore the Differences between Instructional Vision and Student Performance, *Workshop on Learning Innovation at Scale at the 32<sup>nd</sup> SIGCHI Conference on Human Factors in Computing Systems – CHI '14*, Toronto, Canada, April 27, 2014.
- [O2] **Erik Harpstead**, A Potential Future for Games: Appropriated Interfaces, *Game Jam at the 31st SIGCHI Conference on Human Factors in Computing Systems – CHI '13*, Paris, France, May 27-28, 2013.
- [O1] Derek Lomas and **Erik Harpstead**, Design Space Sampling for the Optimization of Online Educational Games, *Workshop on Game User Research at the 30th SIGCHI Conference on Human Factors in Computing Systems – CHI '12*, Austin, Texas, May 5-6, 2012

## Invited Talks

- [T7] Seeing Experience from Many Angles: Educational Game Design as a Data-Informed Craft. *University of California, Santa Cruz, February 2019.*
- [T6] Seeing Experience from Many Angles: Educational Game Design as a Data-Informed Craft. *University of Saskatchewan, November 2018.*
- [T5] An AI That Learns Like Students Do: Developing a Computational Theory of Human Learning in Tutoring Environments. *Simon Initiative LearnLab Summer School, August 2018.*
- [T4] Seeing Experience from Many Angles: Educational Game Design as a Data-Informed Craft. *Microsoft Research, April 2017.* <https://www.youtube.com/watch?v=D6zGEdb8z0>
- [T3] Projective Replay Analysis in Educational Games. *Soar Technology, Inc., March 2017.*
- [T2] Computational Theory and Educational Game Design. *Northwestern University, March 2017.*
- [T1] Seeing Experience from Many Angles: Educational Game Design as a Data-Informed Craft. *Virginia Polytechnic Institute and State University Department of Computer Science, February 2017.*

**Updated: April 30, 2020**