

# MATTHEW BREHMER, PHD

DATA VISUALIZATION RESEARCHER



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I am a **postdoctoral researcher at Microsoft Research** in Redmond, Washington, where I specialize in expressive information visualization design for storytelling and journalism as well as data visualization on mobile devices. I am a member of the EPIC Research Group, Project Steller, and the Microsoft Data Journalism Team.

## EXPERTISE

### VISUALIZATION AND INTERFACE DESIGN

I design, develop, and deploy visualization tools and techniques for data analysis and communication.

→ **EXAMPLES PROJECTS:** *Timeline Storyteller*, *Portfolio Sandbox*, *SoundConsensus*, *ShinyFork*

→ **RELATED PUBLICATIONS:** J6, J5, T3

### QUANTITATIVE HUMAN FACTORS RESEARCH

I conduct controlled experiments as a way to understand human capabilities with respect to perception and attention with the objective of deriving actionable implications for interface design.

→ **RELATED PUBLICATIONS:** C6, C4, T2, C3, T1

### QUALITATIVE HUMAN FACTORS RESEARCH

I evaluate current data analysis and communication processes, work-in-progress designs, and deployed visualization tools by means of work domain analyses, interviews, chauffeured walkthroughs, and field studies.

→ **RELATED PUBLICATIONS:** J5, J2, W3, W2, TR1, T2

## APPLICATION DOMAINS

### DATA JOURNALISM AND STORYTELLING

I aim to provide journalists and storytellers with usable and expressive tools for presenting information visually to their audience, such as with tools like *Timeline Storyteller*, *TimeLineCurator*, and *ChartAccent*.

→ **RELATED PUBLICATIONS:** J4, J6

As part of my PhD, I conducted case studies of journalists who used *Overview* to investigate and report on large text document collections. Our findings provided transferable lessons for visualizing analyzing document collections and hierarchical data.

→ **RELATED PUBLICATION:** J2

## APPLICATION DOMAINS (CONT.)

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### ENERGY MANAGEMENT AND CONSERVATION

As part of my PhD, I designed and developed visualization prototypes for analyzing and monitoring energy usage in portfolios of commercial buildings. I consulted with various stakeholders and prospective users, envisioning and implementing designs for interactively locating patterns and anomalies.

→ RELATED PUBLICATION: J5

### HEALTH AND FITNESS

My MSc research pertained to the design and evaluation of *C-TOC*, a computerized cognitive assessment tool intended for early detection of dementia. I studied the use of *C-TOC* prototypes by healthy older adults and by adults with diagnosed mild cognitive impairments.

→ RELATED PUBLICATIONS: C4, J3, T2, W1

Prior to my MSc, I worked in the area of exercise video games (aka active games): I studied the role of physical exertion on cognitive task performance. I also developed *GAIM*, an XNA/C# toolkit which allowed players with different input peripherals to play active games together.

→ RELATED PUBLICATIONS: C2, C1, T1

## EDUCATION

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### DOCTOR OF PHILOSOPHY, COMPUTER SCIENCE

2011 - 2016

University of British Columbia (UBC), Vancouver, Canada

→ THESIS: *Why Visualization? Task Abstraction for Analysis and Design*

→ SUPERVISORY COMMITTEE: Tamara Munzner (UBC Computer Science), Joanna McGrenere (UBC Computer Science), and Ronald A. Rensink (UBC Psychology)

→ EXAMINATION COMMITTEE: Jason Dykes (giCentre, City University London), Alfred Hermida (UBC Journalism), and Giuseppe Carenini (UBC Computer Science)

→ RELATED PUBLICATIONS: T3, J1, J2, J5, TR1, W2

### MASTER OF SCIENCE, COMPUTER SCIENCE

2009 - 2011

Specialization in Human-Computer Interaction

University of British Columbia (UBC), Vancouver, Canada

→ THESIS: *Usability and the Effects of Interruption in C-TOC: Self-Administered Cognitive Testing on a Computer*

→ SUPERVISED BY: Joanna McGrenere (UBC Computer Science) and Claudia Jacova (UBC Medicine)

→ THESIS READER: Peter Graf (UBC Psychology)

→ RELATED PUBLICATIONS: C4, J3, W1, T2

## EDUCATION (CONT.)

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### BACHELOR OF COMPUTING

2004 - 2009

Specialization in Cognitive Science with Professional Internship  
Queen's University, Kingston, Canada

→ THESIS: *Assessing the Effect of Exercise Intensity on Cognitive Task Performance in an Exercise Video Game*

→ THESIS ADVISER: T.C. Nicholas Graham (Queen's School of Computing)

→ RELATED PUBLICATION: T1

## EMPLOYMENT HISTORY

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### Microsoft Research

2016 - PRESENT

Postdoctoral Researcher  
Redmond, USA

### University of British Columbia Department of Computer Science

2009 - 2016

Graduate Research Assistant  
Vancouver, Canada

### Microsoft Research

2015

Graduate Research Intern  
Redmond, USA

### Pulse Energy (now a division of EnerNOC)

2013 - 2014

Mitacs Graduate Research Intern  
Vancouver, Canada

### University of British Columbia Department of Computer Science

2009 - 2011

Graduate Teaching Assistant  
Vancouver, Canada

### Queen's University School of Computing

2009

Research Assistant  
Kingston, Canada

### EMC Corporation (now Dell EMC)

2007 - 2008

User Interface Design Intern  
Toronto, Canada

### Killam Properties, Inc.

2006

Information Technology Staff and Web Developer  
Halifax, Canada

## INVITED TALKS

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*Slides and videos from these talks are available at [mattbrehmer.github.io/#talks](https://mattbrehmer.github.io/#talks)*

- Timeline Storyteller, from Visualization Design Space to Deployment*** 2018 / 06 / 18  
The University of Calgary Data Empowerment Speaker Series (Calgary, Canada)
- Data-Driven Storytelling at Microsoft: Introducing Timeline Storyteller and ChartAccent for Microsoft Power BI*** 2017 / 10 / 24  
UBC School of Journalism Course on Special Topics in Contemporary Journalism: Data Viz (JRNL 520H) (Vancouver, Canada)
- Timelines Revisited: A Design Space and Considerations for Expressive Storytelling*** 2017 / 10 / 03  
IEEE InfoVis 2017 (Phoenix, USA)  
→ RELATED PUBLICATION: J6
- Expressive Storytelling With Timelines*** 2017 / 08 / 31  
Uber Visualization Night: A Journey Through Space and Time (Seattle, USA)
- Timelines Revisited: Considerations for Expressive Storytelling*** 2017 / 07 / 11  
King's College London Department of Informatics (London, UK)
- Timelines Revisited: Considerations for Expressive Storytelling*** 2017 / 07 / 10  
City University London giCentre (London, UK)
- The Timeline Storyteller Custom Visual for Power BI*** 2017 / 06 / 13  
Microsoft Data Insights Summit BI Power Hour (Seattle, USA)
- Timelines Revisited: Considerations for Expressive Storytelling*** 2017 / 04 / 28  
Northeastern University NUVis Visualization Consortium (Boston, USA)
- Timelines Revisited: Considerations for Expressive Storytelling*** 2017 / 04 / 27  
Bentley University RealViz talk series (Waltham, USA)
- What Story Does Your Timeline Tell?*** 2017 / 04 / 24  
OpenVisConf 2017 (Boston, USA)
- Timelines Revisited: Considerations for Expressive Storytelling*** 2016 / 12 / 08  
Radcliffe Institute at Harvard University (Cambridge, USA)
- Why Visualization? Task Abstraction for Analysis and Design*** 2016 / 03 / 23  
Dissertation Defence (Vancouver, Canada)  
→ RELATED PUBLICATION: T3
- Storytelling with Timeline Data*** 2016 / 02 / 11  
Data-Driven Storytelling Dagstuhl Seminar (Wadern, Germany)

## INVITED TALKS (CONT.)

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- Why Visualization? Task Abstraction for Analysis and Design*** 2016 / 02 / 01  
Microsoft Research (Redmond, USA)
- Matches, Mismatches, and Methods: Multiple-View Workflows for Energy Portfolio Analysis*** 2015 / 10 / 28  
IEEE InfoVis 2015 (Chicago, USA)  
→ RELATED PUBLICATION: J5
- Matches, Mismatches, and Methods: Multiple-View Workflows for Energy Portfolio Analysis*** 2015 / 09 / 04  
University of Washington (Seattle, USA)
- The Future of Data and Design ... In Visualization Research*** 2015 / 05 / 19  
Vancouver Data Visualization Meetup (Vancouver, Canada)
- Overview: The Design, Adoption, and Analysis of a Visual Document Mining Tool For Investigative Journalists*** 2014 / 11 / 14  
IEEE InfoVis 2014 (Paris, France)  
→ RELATED PUBLICATION: J2
- Visualizing Dimensionally-Reduced Data: Interviews with Analysts and a Characterization of Task Sequences*** 2014 / 11 / 10  
ACM BELIV 2014 (Paris, France)  
→ RELATED PUBLICATION: W3
- Pre-Design Empiricism for Information Visualization: Scenarios, Methods, and Challenges*** 2014 / 11 / 10  
ACM BELIV 2014 (Paris, France)  
→ RELATED PUBLICATION: W2
- Visualization Task Abstraction from Multiple Perspectives*** 2014 / 11 / 08  
IEEE VIS Doctoral Colloquium 2014 (Paris, France)
- A Multi-Level Typology of Abstract Visualization Tasks*** 2013 / 10 / 15  
IEEE InfoVis 2013 (Atlanta, USA)  
→ RELATED PUBLICATION: J1
- Investigating Interruptions in the Context of Computerised Cognitive Testing for Older Adults*** 2012 / 05 / 10  
ACM CHI 2012 (Austin, USA)  
→ RELATED PUBLICATION: C4
- A Tale of Two Studies: Investigating the Impact of Interruptions on Task Performance in Older Adults*** 2011 / 05 / 14  
GRAND NCE AGM 2011 (Vancouver, Canada)  
→ RELATED PUBLICATION: W1

## PUBLICATIONS

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Author copies of these publications are available at [mattbrehmer.github.io/#pubs](https://mattbrehmer.github.io/#pubs)

PUBLICATION TYPES: J = journal article, c = conference proceedings, w = workshop paper, bc = book chapter, T = thesis, PO = poster.

### PUBLICATIONS AS PRIMARY AUTHOR

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***Visualizing Ranges over Time on Mobile Phones: A Task-Based Crowdsourced Evaluation*** J8

**Matthew Brehmer**, Bongshin Lee, Petra Isenberg, and Eun Kyoung Choe  
To appear in Volume 25, Issue 1 (Jan. 2019) of *IEEE Transactions on Visualization and Computer Graphics (InfoVis 2018)*.

***Evaluating Data-Driven Stories & Storytelling Tools*** BC1

Fereshteh Amini\*, **Matthew Brehmer\***, Gordon Bolduan, Christina Elmer, and Benjamin Wiederkehr ( \* equal contribution )  
A chapter in *Data-Driven Storytelling*, a book edited by Sheelagh Carpendale, Nicholas Diakopoulos, Christophe Hurter, and Nathalie Henry Riche, 2018.

***Demonstrating the Value of Visualization: Highlights from the 2017 PacificVis Visual Data Storytelling Contest*** Po1

**Matthew Brehmer**, Kyungwon Lee, Ivan Viola, Jinwook Seo, and Bongshin Lee.  
In poster proceedings of the 2017 *IEEE VIS Conference*.

***Timelines Revisited: A Design Space and Considerations for Expressive Storytelling*** J6

**Matthew Brehmer**, Bongshin Lee, Benjamin Bach, Nathalie Henry Riche, and Tamara Munzner  
In Volume 23, Issue 9 (Sept. 2017) of *IEEE Transactions on Visualization and Computer Graphics*.

***Why Visualization? Task Abstraction for Analysis and Design*** T3

**Matthew Brehmer**  
University of British Columbia PhD Dissertation (April, 2016).

***Matches, Mismatches, and Methods: Multiple-View Workflows for Energy Portfolio Analysis*** J5

**Matthew Brehmer**, Jocelyn Ng, Kevin Tate, and Tamara Munzner  
In Volume 22, Issue 1 (Jan. 2016) of *IEEE Transactions on Visualization and Computer Graphics (InfoVis 2015)*.

***Overview: The Design, Adoption, and Analysis of a Visual Document Mining Tool For Investigative Journalists*** J2

**Matthew Brehmer**, Stephen Ingram, Jonathan Stray, and Tamara Munzner.  
In Volume 20, Issue 12 (Dec. 2014) of *IEEE Transactions on Visualization and Computer Graphics (InfoVis 2014)*.

## PUBLICATIONS (CONT.)

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- Visualizing Dimensionally-Reduced Data: Interviews with Analysts and a Characterization of Task Sequences*** W3  
**Matthew Brehmer**, Michael Sedlmair, Stephen Ingram, and Tamara Munzner  
In proceedings of the 2014 *ACM BELIV Workshop (Beyond Time and Errors: Novel Evaluation Methods for Visualization)*.
- Pre-Design Empiricism for Information Visualization: Scenarios, Methods, and Challenges*** W2  
**Matthew Brehmer**, Sheelagh Carpendale, Bongshin Lee, and Melanie Tory.  
In proceedings of the 2014 *ACM BELIV Workshop (Beyond Time and Errors: Novel Evaluation Methods for Visualization)*.
- A Multi-Level Typology of Abstract Visualization Tasks*** J1  
**Matthew Brehmer** and Tamara Munzner  
In Volume 19, Issue 12 (Dec. 2013) of *IEEE Transactions on Visualization and Computer Graphics (InfoVis 2013)*.
- Investigating Interruptions in the Context of Computerised Cognitive Testing for Older Adults*** C4  
**Matthew Brehmer**, Joanna McGrenere, Charlotte Tang, and Claudia Jacova  
In proceedings of the 2012 *ACM Conference on Human Factors in Computing Systems (CHI)*.
- Usability and the Effects of Interruption in C-TOC: Self-Administered Cognitive Testing on a Computer*** T2  
**Matthew Brehmer**  
University of British Columbia MSc Thesis (2011).
- A Tale of Two Studies: Investigating the Impact of Interruptions on Task Performance in Older Adults*** W1  
**Matthew Brehmer**, Charlotte Tang, Joanna McGrenere, and Claudia Jacova  
In the work-in-progress proceedings of the the 2011 *GRAND NCE AGM*.
- Activate Your GAIM: A Toolkit for Input in Active Games*** C2  
**Matthew Brehmer**, T.C. Nicholas Graham, and Tadeusz Stach  
In proceedings of the 2010 *ACM Future Play Conference*.
- Assessing the Effect of Exercise Intensity on Cognitive Task Performance in an Exercise Video Game*** T1  
**Matthew Brehmer**  
Queen's University B.Comp Thesis (2009).

- Charticulator: Interactive Construction of Bespoke Chart Layouts*** J7  
Donghao Ren, Bongshin Lee, and **Matthew Brehmer**  
To appear in Volume 25, Issue 1 (Jan. 2019) of *IEEE Transactions on Visualization and Computer Graphics (InfoVis 2018)*.
- What's the Difference?: Evaluating Variants of Multi-Series Bar Charts for Visual Comparison Tasks*** C6  
Arjun Srinivasan, **Matthew Brehmer**, Bongshin Lee, and Steven Drucker  
In proceedings of the 2018 *ACM Conference on Human Factors in Computing Systems (CHI)*.
- Data Visualization on Mobile Devices*** W4  
Bongshin Lee, **Matthew Brehmer**, Eun Kyoung Choe, Petra Isenberg, Ricardo Langer, and Raimund Dachsel  
In extended abstract proceedings of the 2018 *ACM Conference on Human Factors in Computing Systems (CHI)*.
- ChartAccent: Annotation for Data-Driven Storytelling*** C5  
Donghao Ren, **Matthew Brehmer**, Bongshin Lee, Tobias Höllerer, and Eun Kyoung Choe  
In proceedings of the 2017 *IEEE PacificVis Symposium*.
- TimeLineCurator: Interactive Authoring of Visual Timelines from Unstructured Text*** J4  
Johanna Fulda, **Matthew Brehmer**, and Tamara Munzner  
In Volume 22, Issue 1 (Jan. 2016) of *IEEE Transactions on Visualization and Computer Graphics (VAST 2015)*.
- C-TOC (Cognitive Testing on Computer): Investigating the Usability and Validity of a Novel Self-administered Cognitive Assessment Tool in Aging and Early Dementia*** J3  
Claudia Jacova, Joanna McGrenere, Hyunsoo S. Lee, William Wang, Sarah Le Huray, Emily F. Corenblieth, **Matthew Brehmer**, Charlotte Tang, Sherri Hayden, B. Lynn Beattie, and Ging-Yuek R. Hsiung  
In Volume 29, Issue 3 (July 2015) of *Alzheimer Disease and Associated Disorders*.
- The Haptic Crayola Effect: Exploring the Role of Naming in Learning Haptic Stimuli*** C3  
Inwook Hwang, Karon MacLean, **Matthew Brehmer**, Jeff Hendy, Andreas Sotirkopoulos, and Seungmoon Choi  
In proceedings of the 2011 *IEEE World Haptics Conference*.
- Classifying Input for Active Games*** C1  
Tadeusz Stach, T.C. Nicholas Graham, **Matthew Brehmer**, and Andreas Hollatz  
In proceedings of the 2009 *ACM Advances in Computer Entertainment Technology (ACE) Conference*.



## ACADEMIC SERVICE

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**Organizing Committee:** IEEE VIS 2018 (Co-Chair: Visualization in Practice), the Data Visualization on Mobile Devices Workshop at CHI 2018, IEEE PacificVis 2017-2018 (Co-Chair, Visual Data Storytelling Contest)

**Program Committee:** IEEE InfoVis (2017, 2018), EuroVis State of the Art Reports (2017), IEEE PacificVis (2017, 2018), FAT\*: Conference on Fairness, Accountability, and Transparency (2018), The Art of Networks III (2018), VIS Arts Program (2018), Information+ (2018), Computation + Journalism (2019)

**Conference Session Chair:** IEEE PacificVis 2018

**Reviewer:** IEEE InfoVis (2013 - 2016), IEEE VAST (2015), IEEE PacificVis (2017), IEEE TVCG (2015 - 2018), EuroVis (2014 - 2017), ACM CHI (2013 - 2018), ACM TOCHI (2013), Sage Information Visualization Journal (2015 - 2016), ACM SIGGRAPH Asia (2012), GRAND NCE ACM (2012)

**Student Volunteer:** ACM CHI Conference (2011, 2013, 2015, 2016)

## UNIVERSITY SERVICE

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**University of Washington:** Invited Project Judge for CSE 442 Data Visualization (2017)

**University of British Columbia Department of Computer Science:** Graduate Admissions and Recruitment Committee (2013-2015), Guest Lecturer (CPSC 547: Information Visualization, 2014-2017), Curriculum Development (CPSC 444: Advanced Human Computer Interaction Methods, 2010-2011), Teaching Assistant (CPSC 444: Advanced Human Computer Interaction Methods, 2010; CPSC 344: Introduction to Human Computer Interaction Methods, 2009)

**University of British Columbia Computer Science Graduate Students' Association:** Vice President (Social Affairs) (2010-2011), Graduate Student Orientation Committee (2012), Organizer of the Un-Distinguished Lecture Series (2010-2011, 2012-2013)

**Queen's University Computing Students' Association:** Student Orientation Leader (2005), First Year Representative (2004-2005)

## AWARDS

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**University of British Columbia:** Student Service Award (2016), Volunteering Award (2015), Mitacs-Accelerate Graduate Research Internship Program Award (2013-2014), Natural Sciences & Engineering Research Council of Canada (NSERC) Postgraduate Scholarship (2011-2014), Four Year Doctoral Fellowship (2011-2015), Department of Computer Science Merit Scholarship (2009-2011)

**Queen's University:** Dean's Entrance Scholarship in Computing (2004-2005)

## REFERENCES

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*References are available upon request.*