

# MATTHEW BREHMER, PHD

## VISUALIZATION RESEARCH AND DEVELOPMENT



### CONTACT

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I am a postdoctoral researcher at Microsoft Research in Redmond, USA, where I specialize in expressive visualization design and data visualization for mobile devices. I am a member of the EPIC (Extended Perception, Interaction & Cognition) and Human Computer Interaction groups.

## EXPERTISE

### VISUALIZATION AND INTERFACE DESIGN

I predominantly develop for the web (JavaScript, HTML, CSS) and uses D3.js for visualization, having previously worked with ActionScript, Processing / P5.js, and R/Shiny.

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

RELATED PUBLICATIONS: J6, J5, T3

### QUANTITATIVE HUMAN FACTORS RESEARCH

I design and conduct experiments as a way to understand human capabilities with respect to perception, attention, and interaction; the findings of these experiments often lead to actionable implications for interface and visualization design.

RELATED PUBLICATIONS: J8, C6, C4, T2, C3, T1

### QUALITATIVE HUMAN FACTORS RESEARCH

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

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

## APPLICATION DOMAINS

### DATA JOURNALISM AND STORYTELLING

Journalists, educators, and storytellers require expressive tools for presenting information to their audience. While at Microsoft, I have designed, developed, and promoted the use of such tools in the journalism community with the help of Microsoft's Data Journalism Program.

RELATED PUBLICATIONS: J4, J6

My PhD research included case studies of journalists who used the Associated Press' Overview Project to investigate large text document collections. Our findings provided transferable lessons for visualizing document collections and hierarchical data.

RELATED PUBLICATION: J2

### ENERGY MANAGEMENT AND CONSERVATION

My PhD research included the design of visualization prototypes for analyzing and monitoring energy usage in portfolios of buildings. I consulted with prospective stakeholders and users, envisioning and implementing designs for interactively locating patterns and anomalies.

RELATED PUBLICATION: J5

## APPLICATION DOMAINS (CONT.)

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### PERSONAL 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: 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

### 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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### Postdoctoral Researcher

2016 - PRESENT

Microsoft Research  
Redmond, USA

### Graduate Research Assistant

2009 - 2016

University of British Columbia Department of Computer Science  
Vancouver, Canada


## EMPLOYMENT HISTORY (CONT.)

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<b>Graduate Research Intern</b> Microsoft Research Redmond, USA	2015
<b>Mitacs Graduate Research Intern</b> Pulse Energy (now a division of EnerNOC) Vancouver, Canada	2013 - 2014
<b>Graduate Teaching Assistant</b> University of British Columbia Department of Computer Science Vancouver, Canada	2009 - 2011
<b>Research Assitant</b> Queen's University School of Computing Kingston, Canada	2009
<b>User Interface Design Intern</b> EMC Corporation (now Dell EMC) Toronto, Canada	2007 - 2008
<b>Information Technology Staff and Web Developer</b> Killam Properties, Inc. Halifax, Canada	2006







## TALKS

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Slides from these talks are available at [mattbrehmer.github.io/#talks](http://mattbrehmer.github.io/#talks).  
Talks with video recordings are indicated with the  icon.

<b>Tools for Expressive Information Visualization Design</b> Microsoft Vancouver Data Visualization Symposium (Vancouver, Canada)	2018 / 08 / 01
<b>Timeline Storyteller, from Visualization Design Space to Deployment</b> The University of Calgary Data Empowerment Speaker Series (Calgary, Canada)	2018 / 06 / 18
<b>Data-Driven Storytelling at Microsoft</b> UBC School of Journalism Course on Special Topics in Contemporary Journalism: Data Viz (JRNL 520H) (Vancouver, Canada)	2017 / 10 / 24
<b>Timelines Revisited: A Design Space and Considerations for Expressive Storytelling</b> IEEE VIS 2017, TVCG Track (Phoenix, USA) RELATED PUBLICATION: J6	2017 / 10 / 03
<b>Expressive Storytelling With Timelines</b> Uber Visualization Night: A Journey Through Space and Time (Seattle, USA)	2017 / 08 / 31
<b>Timelines Revisited: Considerations for Expressive Storytelling</b> King's College London Department of Informatics (London, UK)	2017 / 07 / 11
<b>Timelines Revisited: Considerations for Expressive Storytelling</b> City University London giCentre (London, UK)	2017 / 07 / 10

## TALKS (CONT.)

<a href="#">The Timeline Storyteller Custom Visual for Power BI</a> Microsoft Data Insights Summit BI Power Hour (Seattle, USA) 	2017 / 06 / 13
<a href="#">Timelines Revisited: Considerations for Expressive Storytelling</a> Northeastern University NUVis Visualization Consortium (Boston, USA)	2017 / 04 / 28
<a href="#">Timelines Revisited: Considerations for Expressive Storytelling</a> Bentley University RealViz talk series (Waltham, USA) 	2017 / 04 / 27
<a href="#">What Story Does Your Timeline Tell?</a> OpenVisConf 2017 (Boston, USA) 	2017 / 04 / 24
<a href="#">Timelines Revisited: Considerations for Expressive Storytelling</a> Radcliffe Institute at Harvard University (Cambridge, USA)	2016 / 12 / 08
<a href="#">Why Visualization? Task Abstraction for Analysis and Design</a> Dissertation Defence (Vancouver, Canada) RELATED PUBLICATION: T3	2016 / 03 / 23
<a href="#">Storytelling with Timeline Data</a> Data-Driven Storytelling Dagstuhl Seminar (Wadern, Germany)	2016 / 02 / 11
<a href="#">Why Visualization? Task Abstraction for Analysis and Design</a> Microsoft Research (Redmond, USA) 	2016 / 02 / 01
<a href="#">Matches, Mismatches, and Methods: Multiple-View Workflows for Energy Portfolio Analysis</a> IEEE VIS 2015, InfoVis Track (Chicago, USA) 	2015 / 10 / 28
<a href="#">Matches, Mismatches, and Methods: Multiple-View Workflows for Energy Portfolio Analysis</a> University of Washington (Seattle, USA)	2015 / 09 / 04
<a href="#">The Future of Data and Design ... In Visualization Research</a> Vancouver Data Visualization Meetup (Vancouver, Canada)	2015 / 05 / 19
<a href="#">Overview: The Design, Adoption, and Analysis of a Visual Document Mining Tool For Investigative Journalists</a> IEEE VIS 2014, InfoVis Track (Paris, France) 	2014 / 11 / 14
<a href="#">Visualizing Dimensionally-Reduced Data: Interviews with Analysts and a Characterization of Task Sequences</a> ACM BELIV 2014 (Paris, France) RELATED PUBLICATION: W3	2014 / 11 / 10
<a href="#">Pre-Design Empiricism for Information Visualization</a> ACM BELIV 2014 (Paris, France) RELATED PUBLICATION: W2	2014 / 11 / 10
<a href="#">Visualization Task Abstraction from Multiple Perspectives</a> IEEE VIS Doctoral Colloquium 2014 (Paris, France)	2014 / 11 / 08

## TALKS (CONT.)

- A Multi-Level Typology of Abstract Visualization Tasks** 2013 / 10 / 15  
IEEE VIS 2013, InfoVis Track (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

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, P = poster.

METRICS (journals, conferences): AC = acceptance rate, H = H5 index (GOOGLE SCHOLAR, SEPT. 2018.)

### PUBLICATIONS AS PRIMARY AUTHOR

- Visualizing Ranges over Time on Mobile Phones:  
A Task-Based Crowdsourced Evaluation** J8  
Matthew Brehmer, Bongshin Lee, Petra Isenberg, Eun Kyoung Choe  
To appear in Volume 25, Issue 1 (Jan. 2019) of *IEEE Transactions on Visualization and Computer Graphics* [H: 63] (To appear at IEEE VIS 2018, InfoVis Track) [AC: 25%].
- Evaluating Data-Driven Stories & Storytelling Tools** BC1  
Fereshteh Amini\*, Matthew Brehmer\*, Gordon Bolduan, Christina Elmer, and Benjamin Wiederkehr (\* contributed equally)  
A chapter in *Data-Driven Storytelling*, a book edited by Sheelagh Carpendale, Nicholas Diakopoulos, Christophe Hurter, and Nathalie Riche, CRC Press 2018.
- Demonstrating the Value of Visualization:  
Highlights from the 2017 PacificVis Visual Data Storytelling Contest** P1  
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 Riche, Tamara Munzner  
In Volume 23, Issue 9 (Sept. 2017) of *IEEE Transactions on Visualization and Computer Graphics* [H: 63] (Presented at IEEE VIS 2017, TVCG Track).
- Why Visualization? Task Abstraction for Analysis and Design** T3  
Matthew Brehmer  
University of British Columbia PhD Dissertation (April, 2016).

## PUBLICATIONS AS PRIMARY AUTHOR (CONT.)

- Matches, Mismatches, and Methods:** J5  
**Multiple-View Workflows for Energy Portfolio Analysis**  
Matthew Brehmer, Jocelyn Ng, Kevin Tate, and Tamara Munzner  
In Volume 22, Issue 1 (Jan. 2016) of *IEEE Transactions on Visualization and Computer Graphics* [H: 63] (Presented at IEEE VIS 2015, InfoVis Track) [AC: 21%].
- 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* [H: 63] (Presented at IEEE VIS 2014, InfoVis Track) [AC: 23%].
- Visualizing Dimensionally-Reduced Data:** W3  
**Interviews with Analysts and a Characterization of Task Sequences**  
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:** W2  
**Scenarios, Methods, and Challenges**  
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* [H: 63] (Presented at IEEE VIS 2013, InfoVis Track) [AC: 25%]  
[NOTE: THE MOST CITED INFOVIS PAPER SINCE 2013, WITH >250 CITATIONS - GOOGLE SCHOLAR, SEPT. 2018].
- Investigating Interruptions in the Context of** C4  
**Computerised Cognitive Testing for Older Adults**  
Matthew Brehmer, Joanna McGrenere, Charlotte Tang, and Claudia Jacova  
In *Proceedings of the 2012 ACM Conference on Human Factors in Computing Systems (CHI)* [H: 86] [AC: 23%].
- Usability and the Effects of Interruption in C-TOC:** T2  
**Self-Administered Cognitive Testing on a Computer**  
Matthew Brehmer  
University of British Columbia MSc Thesis (2011).
- A Tale of Two Studies: Investigating the Impact of Interruptions on Task** W1  
**Performance in Older Adults**  
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, 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** T1  
**Exercise Video Game**  
Matthew Brehmer  
Queen's University B.Comp Thesis (2009).

## CO-AUTHORED PUBLICATIONS

- 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* [H: 63] (To appear at IEEE VIS 2018, InfoVis Track) [AC: 25%].  
🏆 BEST PAPER HONORABLE MENTION AWARD
- Reflecting on the Evaluation of Visualization Authoring Systems** W5  
Donghao Ren, Bongshin Lee, Matthew Brehmer, and Nathalie Riche  
To appear the *Workshop Proceedings of BELIV 2018: Evaluation and Beyond - Methodological Approaches for Visualization*.
- 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)* [H: 86] [AC: 26%].
- 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, Eun Kyoung Choe  
In *Proceedings of the 2017 IEEE PacificVis Symposium* [H: 21].
- 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* [H: 63] (Appeared at IEEE VIS 2015, VAST Track).
- 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. Corenblith, Matthew Brehmer, Charlotte Tang, Sherri Hayden, B. Lynn Beattie, and Ging-Yuek R. Hsiung  
In *Alzheimer Disease and Associated Disorders (July 2015)*.
- Dimensionality Reduction in the Wild: Gaps and Guidance** TR1  
Michael Sedlmair, Matthew Brehmer, Stephen Ingram, and Tamara Munzner  
University of British Columbia Technical Report TR-2012-03 (2012).
- 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, Nicholas Graham, Matthew Brehmer, 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), BELIV: Evaluation and Beyond - Methodological Approaches for Visualization (2018), Computation + Journalism (2019)

REVIEWER: IEEE InfoVis (2013 - 2016), IEEE VAST (2015), IEEE PacificVis (2017), IEEE TVCG (2015 - 2018), EuroVis (2014 - 2018), 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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IEEE VIS: Best InfoVis Paper Honorable Mention (2018) for J7 (Charticulator)

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.