

# Stephen Bannasch

Learn Make Teach Share

[stepheneb.github.io](http://stepheneb.github.io)

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[stepheneb.github.io/resume.html](http://stepheneb.github.io/resume.html), pdf

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## Overview

Over 30 years of experience working with diverse teams of researchers, teachers, and students developing deeply interactive software and hardware for all kinds of learners. Extensive full-stack experience developing interactive collaborative web applications as well as high-performance web-based computational simulations and visualizations. Helped found the Concord Consortium, an educational non-profit focused on math and science education. As Director of Technology led the development of re-usable open source architectures/frameworks for education and managed and hired a team of programmers. Am an enthusiastic public speaker and deeply committed to helping teams of people make, teach, and share what matters to them.

Extensive experience with web-based application/visualization technologies (JavaScript, HTML, CSS, SVG, Canvas) and related open source frameworks (D3.js, jQuery, JQueryUI, CoffeeScript, Cherrio, Pixi.js, Underscore, Modernizr, MathJax, ...) as well as back-end server programming in Ruby, Java, and Node.js and Amazon cloud-based server setup and administration.

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## Professional Experience

### [Art & Logic](#), 2016-2018

Created web application for managing and facilitating in-person collaborative brainstorming and planning for: [Maverick and Boutique](#), a consulting firm that helps organizations and teams discover and implement the most effective ways to think, act and collaborate to achieve their goals. The web application was inspired by and derived from functionality in their legacy Java application.

Maverick and Boutique have not yet released the web application publicly. If you are interested in more information or a demonstration contact them.

### Technical Elements

- Rails v5.1.6 with PostgreSQL and Redis backend data stores.
- Extensive use of [ActionCable](#) websocket framework to support interactive real-time visual and textual collaboration among participants.
- Interactive collaborative visualizations using [D3.js](#).
- Administrative, authoring, participant collaboration, and reporting systems.
- Scripted deployment using Capistrano to AWS development, staging, and production AWS servers.
- Integrated with [Bootstrap](#) styling and components.

## **Concord Consortium, Concord MA, 1995-2013** [concord.org](http://concord.org)

In 1995 helped Bob Tinker, internationally recognized as a pioneer in [developing and adapting technology for constructivist education](#), create the Concord Consortium, a 501(c)(3) non-profit educational research and development organization focusing on math and science education.

### **Director of Technology, 1995-2013**

Directed technology development for the Concord Consortium. My responsibilities included hiring, budgeting, technology acquisition and development, developing licensing strategies, reviewing contracts, assisting with proposal development, and management of software and hardware development.

### **Architect and technical lead for the Lab Framework, 2011-2013** [lab.concord.org](http://lab.concord.org)

Code: [github.com/concord-consortium/lab](https://github.com/concord-consortium/lab)

In November 2011 the Google Foundation awarded Concord Consortium a grant to develop an HTML5 version of [Molecular Workbench](#), an award-winning Java-based physics simulation. We extended the initial scope and created a more general framework for authoring and deploying interactives integrating simulations running in multiple modeling engines, data collection from sensors and probes, real-time graphing, and data tables.

Lab Interactives are sharable, embeddable, and authorable components defined in JSON that wrap a model with additional inquiry-oriented user interface components such as buttons, checkboxes, sliders, graphs etc.

### **Co-Principal Investigator**

The Enhancing Engineering Education with Computational Thinking, ([DRL-0918449](#)); 2009-2013; focuses on studying how computational thinking, primarily through numerical simulation and computer-aided design tools, can enhance engineering education in high schools (see <http://energy.concord.org> for more information). Project developed Energy2D: a computational simulation modeling conduction, convection, and radiation and Energy3D: an application for designing buildings using a WYSIWYG 3D user interface.

The GENIQUEST (GENomics Inquiry through QuAntitative Trait Loci Exploration with SAIL Technology): Bringing STEM Data to High School Classrooms ([DRL-0733264](#)); 2007-2010; centered on the dragons and related organisms that previously served as genetic models in the previous Concord Consortium projects. Students were further supported in seeking out gene locations through the bioinformatics technique of Quantitative Trait Loci (QTL) analysis. Results demonstrated increased student understanding of concepts such as genetic recombination and inbred strains, and that the software helped.

## **TERC; Cambridge, MA; 1982-1994** [terc.edu](http://terc.edu)

### **Co-Project Director**

The Global Laboratory Project. Directed the technical and telecommunication efforts of the project. Responsible for setting technical directions, hiring, budgets, management, and project reports. The project supported 150 middle schools and high schools in 22 countries collaborating on investigations into local and global environmental change, sharing text, data, graphs, instrumentation for measuring and monitoring the environment.

### **Software and Hardware Designer**

Adapted instrumentation for measuring various environmental characteristics including total-column-ozone, ground-level ozone, soil moisture, air flow, relative humidity, temperature, and visible light. Developed stand-alone data-logging systems probeware interfaces, and many types of specific

## Publications

Bannasch, S. (2010). [Innovator interview: Stephen Bannasch](#). @Concord, 14(2). The Concord Consortium.

Staudt C., & Bannasch S., [Using sensors and models to answer discovery questions](#). (2006). @Concord, 10 (2). The Concord Consortium.

Tinker R., Bannasch S., [Future technology in unexpected places](#). (2005). @Concord, 9(1). The Concord Consortium.

Bannasch, S. (2002). [Probing the unseen world: Advanced probe captures subtle changes in temperature](#). @Concord, 6(2). The Concord Consortium.

Bannasch, S., & Tinker, R. (2002). [Probeware takes a seat in the classroom: Educational impact of probes improves with time and innovation](#). @Concord, 6(1). The Concord Consortium.

Bannasch, S. (2001). [Wireless Computers and Probeware Support a New Science Curriculum: Using iPAQ Pocket PCs to study science fundamentals](#) . @Concord, 5(1). The Concord Consortium.

Bannasch S. (2001). [Educational Innovations in Portable Technology](#). In Tinker R., & Krajcik, J. (eds.), Portable Technologies: Science Learning in Context (121-141). Kluwer Academic/Plenum Publishers

Bannasch, S. (2000). [Beam me up, Scottie! Handheld computers extend the range of wireless communication in schools](#). @Concord, 4(3). The Concord Consortium.

Bannasch, S. (1999). [The electronic curator: Using a handheld computer at the Exploratorium](#). @Concord, 3(3). The Concord Consortium.

Bannasch, S. (1998). [Making smarter probes](#). @Concord, 2(2). The Concord Consortium.

Bannasch S., & Berenfeld B. (1996). [Global Lab: From Classroom Labs to Real-World Research Labs](#). In Tinker B., Microcomputer-based Labs Educational Research and Standards (247-258). Springer-Verlag New York, Inc.

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## Software Technical Skills

### Ruby, JRuby, Rails, RubyGems

- Extensive work with Ruby, JRuby, Ruby Gems, and Rails. Developed several large Rails applications (see: [github.com/concord-consortium/rigse](https://github.com/concord-consortium/rigse)).
- Author of Jnlp Ruby Gem: [rubygems.org/gems/jnlp](https://rubygems.org/gems/jnlp); contributed commits to over 30 external Ruby Gems.
- Regular use of RVM, Bundler, HAML, Capistrano, Rake, Compass, Sass, Devise, and behavior-driven development and testing with Capaybara, Cucumber, RSpec.

### JavaScript

- JavaScript: extensive experience in high-performance scientific computation, visualization, and the D3.js framework. See: [lab.concord.org/](https://lab.concord.org/) and the code: [github.com/concord-consortium/lab](https://github.com/concord-consortium/lab): a large JavaScript codebase and using RequireJS for module and dependency management.
- Used Node.js, CoffeeScript, jQuery, JQueryUI, Cherrio, Pixi.js, Underscore, Modernizr MathJax, and a number of other JavaScript tools and frameworks.

## HTML5, CSS, Canvas, and SVG

- Extensive experience using HTML5 and CSS. Created dynamic visualizations using HTML5 Canvas and SVG.

## Cross-browser performance and functional web application testing

- The Lab framework was designed to run on all HTML5-compatible browsers and as such created a framework for performance testing the simulations that separately measured the performance of JavaScript computation, JavaScript graphics, and browser rendering.
- Developed an integration of Mocha and PhantomJS to enable basic functional testing of the Lab framework on a developers computer as well as further tests that ran in multiple virtual OS/browser setups on the [saucelabs.com](https://saucelabs.com) service.

## WebGL and 3D visualization

- 3-D visualization for learning about seasons: [stepheneb.github.io/seasons/index.html](https://stepheneb.github.io/seasons/index.html). Used [sceneJS](#) an open-source WebGL-based 3D visualization engine.
- Benchmarking speed of different WebGL-enabled JavaScript matrix libraries [stepheneb.github.io/webgl-matrix-benchmarks/matrix\\_benchmark.html](https://stepheneb.github.io/webgl-matrix-benchmarks/matrix_benchmark.html)
- Currently learning C# and developing a 3D visualization using [Unity](#).

## Web video transcoding and deployment

- Video integrated with digital map: [stepheneb.github.io/simple-orange-map](https://stepheneb.github.io/simple-orange-map).
- Scripted FFmpeg to transcode original video into multiple formats, sizes and bitrates for web delivery.
- Subtitling videos using [WebVTT](#) (Web Video Text Tracks Format). Example: [Spanish subtitles for detroit interviews](#).

## Additional dynamically-typed languages: PHP, Python

- Moderate experience with PHP and Python.

## Statically-typed languages: Java, C++, C#, Pascal

- Moderate experience with Java and Pascal. Less experience with C++ and C#.
- Experience re-writing high-performance Java programs in JavaScript. Example: [github.com/concord-consortium/energy2d-js](https://github.com/concord-consortium/energy2d-js) a port of the 2-D Java computational fluid dynamics thermal simulation program Energy2D.
- Built multiple branches of the open-source Java codebase including the MLVM branch that explores extending Java to improve implementation and performance of dynamic languages.
- Debugged a USB driver written in C++.
- Learning C# as part of developing a 3D Unity application.
- Debugged and extended a large Pascal program for an video-based interactive art installation.

## IDEs: Xcode, Eclipse, Visual Studio

- Moderate experience with a number of IDEs.

## Source code management systems

- Experienced git and github user, additional experience with Subversion, Mercurial, and CVS.

## Learning management platforms

- Setup and administered Moodle servers.
- Setup prototype edX server.
- Experience using both Moodle and Blackboard as a course instructor.

## Web servers: Apache, NGINX, Node, Tomcat

- Setup, configuring, administering, and customizing Apache, NGINX, Node, and Java Tomcat-based web servers including performance testing with HTTPPerf.

## Linux server: setup, security, monitoring, administration, and optimization

- Setup stand-alone and cloud-based Linux servers.
- Experience with security, database setup, design, and administration.
- Created scripts using Chef and Fog to automate the generation of complete functional cloud-based Amazon servers.

## Databases

- Setup, architected and administered MySQL, PostgreSQL and Redis databases.
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## Hardware technical skills

- Digital, analog, and sensor electronic design, prototyping, debugging and manufacturing.
  - Arduino and Microchip microcontroller development.
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## Contributions to external open source projects

Over 200 commits to more than 50 external open source projects. Projects include: JRuby (Java implementation of Ruby), Rails framework and 30 more Ruby gems, 12 JavaScript projects and a number of miscellaneous projects.

For more detail: [open-source-contributions.html](https://github.com/mtclair/open-source-contributions.html)

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## Teaching experience

**Lesley College, Cambridge, MA, 1983-1984.**

**Co-Instructor: Fundamentals of Computer Architecture.**

Students were in a masters program focused on using computers in education.

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## Older independent projects

**CMDA320: TransMedia Projects: Montclair State University, Spring 2015**



Consultant working with professor Beverly Peterson's Transmedia class.

Adapted mapping and video code from Cosmopolis: 49 Waltzes for the World project to create map of Orange NJ with clickable hotspots showing video and audio narratives:

[stepheneb.github.io/simple-orange-map](http://stepheneb.github.io/simple-orange-map).

## Cosmopolis: 49 Waltzes for the World, Fall 2013

<http://bacnyc.org/performances/performance/cosmopolis>

Architect, and Programmer.

Code: [github.com/stepheneb/49waltzes-detroit](https://github.com/stepheneb/49waltzes-detroit) and [github.com/stepheneb/detroit-interviews](https://github.com/stepheneb/detroit-interviews)

Architected and implemented the software for NYC-based video artists Roberta Friedman and Daniel Loewenthal's interactive video installation. Roberta and Dan shot short videos at 147 different locations in Detroit. The installation has a map of Detroit displayed on a large touch screen monitor. Tapping the map brings up the closest video in a separate monitor. Visible hotspots on the map representing viewed location slowly fade out over time. Implemented using browser technology and WebVTT for Spanish subtitling.

## The Erl King, 1986

<http://www.guggenheim.org/new-york/membership/photo-gallery/album/674/414>

Programmer.

Worked with NYC-based video artists Graham Weinbren and Roberta Friedman to complete the design and programming of the editing and run-time software for an interactive video art piece in which viewers explore non-linear narratives by touching areas on the video screen. The run-time software controls the queuing and playing of video and audio from three videodisk players as well as reading viewer input from the touch screen. The editing software was designed to enable the film maker to easily specify the non-linear interactions. The software was written in Pascal and Z80 assembly language. 12/86-2/87 Museum of Contemporary Art, Los Angeles, CA; 4/87-7/87 Whitney Museum of American Art, New York, NY.

## Video Write, 1987

Creator/Programmer.

Design and programming of educational software which integrates a prompted editor with a videodisk display system for the Apple//e. Written entirely in 6502 assembly language. Done for and distributed by SERESC Inc., 11 Peabody Rd., Derry, NH 03038.

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## Education

### Hampshire College; BA 1982

Thesis Project: Monitoring and Analysis of an Experimental Passive Solar Envelope House.

Implemented a microcomputer-based monitoring system for measuring the performance of an experimental passive solar 'envelope' house built in Leverett MA. Extended a small single board computer (KIM-1) with an analog interface for measuring multiple temperature sensors and solar insolation using a pyranometer installed on the peak of the roof. The single-board computer saved sensor data every 15 minutes on magnetic tape. Brought the magnetic tapes back to Hampshire and read the stored data using an Apple II computer. Wrote programs on the Apple II in BASIC and machine language to do solar performance analyses of the house and display and print graphs. Finished writing thesis on the IMSAI 8080 running CPM in the basement of the library using Emacs

and saving the work on 8" floppies.