

Richard Paul Gabriel

Address:

3636 Altamont Way
Redwood City, CA 94062

Telephone:

Voice: (650)298-8735
Fax: (650)216-6755

E-Mail:

rpg@dreamsongs.com

Web:

<http://www.dreamsongs.com>

Educational Background

Warren Wilson College 1995–1998 M.F.A. in Creative Writing (Poetry)

Stanford University 1975–1981 Ph.D. in Computer Science

University of Illinois 1973–1975 M.S. in Mathematics

MIT 1972–1973 Graduate studies in Mathematics

Northeastern University 1967–1972 B.A. in Mathematics

Recent Experience

Distinguished Engineer, IBM Research, February 2007–

Distinguished Engineer, Sun Microsystems, November 1998–January 2007

President, Hillside Group, February 2002–November 2006

Member of the Steering OOPSLA Committee, January 2006–

Notable Experience

Principal Investigator, Sun Microsystems Laboratories July 2004–September 2006

Chief Scientist, Laboratory for Self-Sustaining Systems, July 2000–July 2004

Consultant, Aspen Smallworks, Sun Microsystems, February 1997–November 1998

Distinguished Computer Scientist, ParcPlace-Digitalk, Inc, Dec. 1993–Oct. 1996

Vice President of Development, ParcPlace Systems, Inc, June 1994–August 1995

Lucid Fellow, Lucid Inc, October 1992–November 1993

Chairman of the Board, Lucid Inc, October 1992–December 1994

Chief Technical Officer, Lucid Inc, August 1984–November 1993

Consulting Full Professor of Computer Science, Stanford University, April 1991–August 2001

Founding Joint Editor-in-Chief, “Lisp and Symbolic Computation: An International Journal,” October 1986–1992

President and Chief Technical Officer, Lucid Inc, August 1984–October 1987

Founder, Lucid, Inc, August 1984

Noteworthy Accomplishments

Wrote and promulgated the so-called “Gabriel Benchmarks” for the performance measurement of a variety of Lisp and Lisp-like systems. This work culminated in the book, “Performance and Evaluation of Lisp Systems.”

Conceived of Common Lisp, set its early technical directions, and was the original and primary organizer for the Common Lisp Community, which accomplished the first language design done over the Internet.

Designed and implemented Qlisp, a parallel dialect of Common Lisp.

Was one of six primary designers of the Common Lisp Object System; wrote its specification.

Was one of the primary introducers of and commentators on the concepts of Patterns and Pattern Languages to the software community.

Wrote an essay informally called “Worse is Better,” which has been called by some one of the most important business essays of the 20th century.

Adapted and introduced the writers workshop to the software community; this method is now widely used wherever software patterns are in use.

Conceived of the Jini Community and is its principal architect; its method of organization (pattern-based) and voting mechanisms are considered innovations in democracy.

Acted as advisor for the business models, license models, and community-building activities of the NetBeans, OpenOffice, and other similar efforts at Sun Microsystems. Wrote a book on the lesson learned with Ron Goldman.

Began and led the Feyerabend Project which is examining alternative principles for computing. Held workshops in Arizona, Germany, Tampa, Oxford, Santa Fe, Poland, and Spain.

Introduced the Onward! track to OOPSLA in 2002. Ran it as a full subconference in 2002 and 2003, including publishing the proceedings (Dreamsongs Press). Many attribute the revitalization of OOPSLA in 2004 to Onward!.

Led three successful workshops (in 2002, 2004, 2005) on the relationship between the methods of artists and scientists. These workshops were called Extravagaria, Extravagaria II, and Extravagaria III.

Designed a Masters program for the design and construction of software, based on the teaching methods used in MFA programs. Designed and ran a trial of the program at the University of Illinois in January 2004 with Ralph Johnson and Brian Marick.

Promulgated the collection of software source code to create a teaching and learning literature.

As Program Chair, redesigned OOPSLA for 2005 along with Ralph Johnson. Changes include moving Onward! into the regular technical program, adding Essays, adding Lightning Talks, adding shepherding, and reformulating the Program Committee structure.

Was a major contributor to the Ultra-Large-Scale Systems study led by the Software Engineering Institute. The report and the ideas in it represent a new way to look at large-scale software production and operation.

Have written a poem a day since March 2000.

Publications

Books

Innovation Happens Elsewhere: Open Source as Business Strategy, (with Ron Goldman), Morgan-Kauffman. San Francisco, 2005.

Drive On, Hollyridge Press, Venice, California, 2005.

Writers' Workshops and The Work of Making Things, Addison-Wesley-Longman, New York, June 2002.

Patterns of Software: Tales from the Software Community, Oxford University Press, New York, New York, 1996 (trade paperback edition, 1998).

Performance and Evaluation of Lisp Systems, MIT Press, Cambridge, Massachusetts, 1985 (in print).

Papers

The Road: Reinventing Education (with Joseph Bergin, Robert Duvall, Rick Mercer, Eugene Wallingford, David West, and Pamela Rostal), Rebooting Computing: The Magic and Beauty of Computer Science, a summit organized by Peter Denning for the Great Principles of Computing Project, January 2009.

Designed as Designer, ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications, (OOPSLA), Nashville, Tennessee, October 2008.

A Snapshot of Studio Based Learning: Code Reviews as a means of Community Building (with Joseph Bergin, Robert Duvall, Rick Mercer, Eugene Wallingford, David West, and Pamela Rostal), Educators' Symposium, ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications, (OOPSLA), Nashville, Tennessee, October 2008.

Autopoietic Companions and Correctness Helpers, Second International Workshop on Ultra-Large-Scale Software-Intensive Systems (ULSSIS 2008), at ICSE 2008, May 2008.

Virtual World Runtimes for Autopoiesis and the Control of Runaway Abstraction, Second International Workshop on Ultra-Large-Scale Software-Intensive Systems (ULSSIS 2008), at ICSE 2008, May 2008.

Conscientious Software (with Ron Goldman), ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications, (oopSLA), Onward!, Portland, Oregon, October 2006.

The Software Challenge of the Future: Ultra-Large-Scale Systems (with Peter Feiler, John Goodenough, Rick Linger, Tom Longstaff, Rick Kazman, Mark Klein, Linda Northrop, Douglas Schmidt, Kevin Sullivan, and Kurt Wallnau), The Software Engineering Institute, June, 2006.

Nervous Eyes: An Introduction to the Theory of Centers, 88, A Journal of Contemporary Poetry, Issue 3, October 2003.

Open Source: Beyond the Fairy Tales (with Ron Goldman), Perspectives on Business Innovation, Ernst & Young, Issue 8, May 2002.

Netbeans Open Source Experiences (with Evan Adams and Ron Goldman), SSG Technical Conference, March 2001.

Jini Community Pattern Language (with Ron Goldman), Pattern Languages of Programs Conference VI, Allerton Park, IL, August 1999.

Jini Connection Technology: An Experiment in Technology, Business Strategy, and Community Building, Symposium on Object-Oriented Techniques. Tokyo Japan, July 1999.

The Failure of Pattern Languages, “The Patterns Handbook: Techniques, Strategies, and Applications,” Collected and Introduced by Linda Rising, Cambridge University Press, 1998.

Repetition, Generativity, and Patterns, the introduction to “Pattern Languages of Program Design, 2,” Vlissides, John M., Coplien, James O., and Kerth, Norman L. (eds), Addison-Wesley, 1996.

Book Review of “The Art of the Metaobject Protocol,” Artificial Intelligence, Volume 61, Number 2, Elsevier, June 1993.

Habitability, Piecemeal Growth, Compression, and Abstraction in Programming Languages, Workshop on Object-Oriented Programming Languages: The Next Generation, ACM Conference on Object-oriented Programming Systems, Languages, and Applications (OOPSLA), Vancouver, BC, Canada October, 1992.

The Evolution of Lisp (with Guy L. Steele Jr.), ACM Conference on the History of Programming Languages, II, published in ACM SIGPLAN Notices, Volume 28, Number 3, March 1993.

CLOS in Context: The Shape of the Design Space (with Jon L. White and Daniel G. Bobrow), “Object-Oriented Programming: The CLOS Perspective,” Andreas Paepcke, Editor, MIT Press 1992.

The Design of Parallel Programming Languages, “Artificial Intelligence and Mathematical Theory of Computation,” edited by Vladimir Lifschitz, Academic Press, 1991.

CLOS: Integrating Object-Oriented and Functional Programming (with Jon L. White and Daniel G. Bobrow), Communications of the ACM, September 1991.

An Open Architecture for Programming Environments, Programming Environment Workshop at the ACM Conference on Object-oriented Programming Systems, Languages, and Applications, Ottawa (OOPSLA), Ontario Canada, October 1990.

Foundation for a C++ Programming Environment (with Nickieben Bourbaki, Matthieu Devin, Patrick Dussud, David Gray, and Harlan Sexton), Proceedings of C++ at Work, September 1990.

Qlisp: An Interim Report (with Ron Goldman and Carol Sexton), “Parallel Lisp: Languages and Systems,” edited by Takayasu Ito and Robert H. Halstead, Jr., Lecture Notes in Computer Science, Springer-Verlag, 1990.

Using CLOS-like Concepts in a Prototyping System, Common Lisp Object System Workshop, ACM Conference on Object-oriented Programming Systems, Languages, and Applications (OOPSLA), October 1989.

Object-Oriented Programming and the Common Lisp Object System, Computer Language, August 1989.

Qlisp: Parallel Processing in Lisp (with Ron Goldman), Hawaii International Conference on Systems Sciences, Kailua-Kona, Hawaii, 1989.

Requirements for a Common Prototyping System, primary author as Editor of the Common Prototyping Working Group, November, 1988, Sigplan Notices, March 1989 Volume 24, Number 3.

Technical Issues of Separation in Function Cells and Value Cells (with Kent Pitman), *Lisp and Symbolic Computation*, Volume 1, Number 1, 1988.

Preliminary Results with an Initial Implementation of Qlisp (with Ron Goldman), Conference on Lisp and Functional Programming, Snowbird, Utah, 1988.

Qlisp: Experience and New Directions (with Ron Goldman), ACM Symposium on Parallel Programming: Experience with Applications, Languages, and Systems, New Haven, Connecticut, 1988.

Qlisp (with John McCarthy), "Parallel Computation and Computers for Artificial Intelligence," J. S. Kowalik, editor, 1988.

The Common Lisp Object System Specification (primary author, with Daniel Bobrow, Linda G. DeMichiel, Sonya Keene, Gregor Kiczales, and David Moon), Technical Document 88-002R of X3J13, LASC and SIGPLAN Notices, June 1988.

Deliberate Writing, "Natural Language Generation Systems," Leonard Bolc, editor, Springer-Verlag, 1988

The Common Lisp Object System: An Overview (with Linda DeMichiel), European Conference on Object-Oriented Programming, Springer-Verlag, 1987.

Lisp, an article in the *Encyclopedia of Artificial Intelligence*, Stuart C. Shapiro, Editor-in-Chief, 1987.

Used Software, Aerospace Applications of Artificial Intelligence Conference, Dayton, Ohio, October 1986.

Design of an Optimizing, Dynamically Retargetable Compiler, (with Rodney Brooks, David Posner, James McDonald, Jon L. White, and Eric Benson), ACM Conference on Lisp and Functional Programming, Cambridge, Massachusetts, August 1986.

Massively Parallel Machines: The Connection Machine and NON-VON, *Science*, Volume 231, pages 975–978, February 28, 1986.

Common Lisp: Its History, Its Uses, and Its Future, AI-85 Conference, Long Beach, California, May 1985.

Queue-based Multi-processing Lisp (with John McCarthy), Symposium on Lisp and Functional Programming, August 1984.

A Critique of Common Lisp (with Rodney Brooks), Symposium on Lisp and Functional Programming, August 1984.

A Programming Environment for a Timeshared System (with Martin Frost), Software Engineering Symposium on Practical Software Development Environments, 1984.

Lisp-in-Lisp: High Performance and Portability (with Rodney A. Brooks and Guy L. Steele Jr.), International Joint Conference on Artificial Intelligence, August 1983.

An Optimizing Compiler for Lexically-Scoped Lisp (with Rodney A. Brooks and Guy L. Steele Jr.), Symposium on Compiler Construction, Boston, Massachusetts, June 1982.

Lisp Evaluation and Timing (with Larry M. Masinter), Symposium on Lisp and Functional Programming, Pittsburgh, Pennsylvania, August 1982.

S-1 Common Lisp Implementation (with Rodney A. Brooks and Guy L. Steele Jr.), Symposium on Lisp and Functional Programming, Pittsburgh, Pennsylvania, August 1982.

An Organization for Programs in Fluid Domains (dissertation) Computer Science Department, STAN-CS-81-856, AIM-342 Stanford University, 1981.

Results in Knowledge-based Program Synthesis, (Green, Gabriel, et al), 6th IJCAI, 1979.

Computer-Assisted Diagnosis of Orthopedic Gait Disorders (with Kathleen B. Tracy et al), Physical Therapy March 1979.

Natural Language-based Information Retrieval (with David L. Waltz), Twelfth Annual Allerton Conference, October 1974.

Structured Descriptions, MIT AI Lab Working Paper, August 1973.

Miscellanea: Approximately three dozen popular articles on Lisp, programming languages, and programming environments. 1985–present.

Poems

God Is the Final Eigenvector, 88, A Journal of Contemporary Poetry, Issue 5, October 2005.

Sudden Snap and **Trying Language**, Printed Matter (forthcoming)

Lesson and **The Essence of Memory**, 88, A Journal of Contemporary Poetry, Issue 2, December 2002.

Good Evening, Bitter and **Unnormalized Models**, 88, A Journal of Contemporary Poetry, Issue 1, December 2001.

The Source of It All, Puerto Del Sol, Volume 34 #2, August 1999.

Leaf of my Puzzled Desire and **Jimmy, Jimmy, Oh Jimmy Mack**, Ploughshares, December 1998.

The Death of Sheriff William Brady, Crania, October 1998.

Night Patterns, "Pattern Languages of Program Design," Coplien, James O., and Schmidt, Douglas C. (eds), Addison-Wesley, 1995.

Websites

<http://www.dreamsongs.com>: almost all written material and presentations have been available at this site since 2001. Averaged over 18,000 visitors (about 90,000 hits) a month in 2005.

<http://www.wally-alumni.org>, website and wiki for the alumni of the Warren Wilson MFA program.

<http://www.MapsOfTheImagination.com>, website for the launch of Maps of The Imagination, by Peter Turchi.

<http://www.dreamsongspress.com>, website for Dreamsongs Press.

Invited Papers and Talks

Christopher Alexander: The Search for Beauty (keynote), First Joint IBM / Hillside Patterns Conference, Bangalore, India, June 2008.

50 in 50 (with Guy L. Steele Jr.), the Christopher Strachey Distinguished Lecture, Oxford, June 2007.

On Sustaining Self, at the Workshop on Self Sustaining Systems (keynote), Hasso-Plattner-Institut Potsdam, Germany, May 2008.

Design Beyond Human Abilities, at the Chinese University of Hong Kong (Wei Lun Visiting Professor public lecture), November 2007.

50 in 50 (abridged), at QCON SF 2007 (keynote), San Francisco, CA, November 2007.

The Architecture of Extraordinarily Large, Self-Sustaining Systems, at QCON SF 2007, San Francisco, CA, November 2007.

50 in 50 (with Guy L. Steele Jr.), at ooPSLA 2007 (keynote), Montréal, Québec, Canada, October 2007.

50 in 50 (with Guy L. Steele Jr.), at HOPL III (keynote), San Diego, CA, June 2007.

Design Beyond Human Abilities, at PLoP 2007 (keynote), Allerton Park, Monticello, IL, October 2007.

Design Beyond Human Abilities, at SugarLoaf PLoP 2007 (keynote), Porto de Galinhas, Pernambuco, Brazil, May 2007.

Beyond Large; Beyond Human Abilities; Beyond Mechanism, at ROOTS 2006 (keynote), Bergen, Norway, April 2006.

Breathturn: Design Beyond Human Abilities, at AOSD 2006 (keynote), Bonn, Germany, March 2006.

Impossible Design / Ultra-Large-Scale Systems, at OOP 2006 (keynote), Munich, Germany, January 2006.

...come from the artists themselves, comments on “Creating a Culture of Gift,” an essay by Frederick Turner in “Conversations on Philanthropy, an Interdisciplinary Series of Reflections and Research,” Lenore T. Ealy, editor, Volume II, 2005.

Self-Sustaining Systems, at the DARPA Workshop on Self-Aware Computer Systems, April 2004.

The Science of Design, at the NSF Science of Design Workshop, November, 2003.

Form and Function in Software, at the Form and Function workshop, co-sponsored by the Santa Fe Institute and Collegium Budapest, November 2003.

Software Preservation, at the Workshop on Preserving Classic Software at the Computer History Museum, October 2003.

The Art of Lisp & Writing, a Foreword to “Successful Lisp,” David B. Lamkins, 2003.

The Road Not Taken (expanded), (invited presentation), Software Development Forum, Palo Alto, CA, January 2003.

The Road Not Taken, (keynote), Java Technology and Object-Oriented Software Engineering 2002 (JAOO 2002), Aarhus, Denmark, September 2002; Maersk Institute, University of Southern Denmark, September 2002; Lisp Users Group Meeting, October 2002.

Fine Points of Pattern Writing, (invited talk), Pattern Languages of Programs, Monticello, Illinois, September 2002.

Creative Writing (invited talk), Pattern Languages of Programs, Monticello, Illinois, September 2002.

Triggers & Practice, (keynote), XP/Agile Universe, Chicago, Illinois, August 2002; Java Technology and Object-Oriented Software Engineering 2002 (JAOO 2002), Aarhus, Denmark, September 2002.

Whither Computing, (invited talk), OT2002, Oxford, UK, April 2002.

Redefining Computing, (invited talk, prepared with Ron Goldman), Almaden Institute on Automatic Computing, April, 2002.

Whither Software, (invited talk), Santa Fe Institute Business Network, Santa Clara, CA, March, 2002.

Lessons from the Science of Nothing At All (keynote), PDMA 2001, Santa Clara, CA, October 2001.

Mob Software: The Erotic Life of Code (invited talk, prepared with Ron Goldman), OOPSLA, Minneapolis, MN, October 2000.

Organizing for Mob Software, (prepared with Ron Goldman) O'Reilly Open Source Software Convention, Monterey, CA, July 2000.

Uncontrolled Success (keynote), Lisp Users Group Meeting, San Francisco, CA, October 1999.

Jini Connection Technology: An Experiment in Technology, Business Strategy, and Community Building (keynote), Symposium on Object-Oriented Techniques. Tokyo Japan, July 1999.

The Nature of Poetic Order, Warren Wilson Alumni Conference, Mount Holyoke, MA, June 1998.

The Nature of Order: The Post-Pattern World, Brown University, May 1998.

Models of Technology Acceptance (keynote), Object World, Boston, May 1996.

Christopher Alexander: The Search for Beauty (keynote), Current Object Practice and Experience, St. Paul, MN, May 1996.

Models of Technology Acceptance (keynote), Object World, Tokyo, October 1996.

Ten Ideas for Programming Language Design (keynote address & paper), High Performance and Parallel Computing in Lisp Conference, Twickenham, England, November 1990.

Lisp: Good News, Bad News, How to Win Big, (keynote), European Conference on the Practical Applications of Lisp, Cambridge University, Cambridge, England, March 1990 (reprinted in *AI Expert*, June 1991, pp. 31–39; excerpted in “The Unix-Haters Handbook,” by Simson Garfinkel, Daniel Weise, and Steven Strassman, IDG Books, San Mateo, California, 1994; this paper is colloquially known as *Worse is Better*).

Languages for Parallel Machines: Built for Speed or Built for Comfort? Workshop on Programming Languages and Compilers for Parallel Computing, Champaign-Urbana, August, 1989.

The Common Lisp Object System: An Overview (with Linda G. DeMichiel), European Conference of Object-Oriented Programming, June 1987 (see Publications).

Deliberate Writing, Workshop on Natural Language Generation, Burg Stettenfels, West Germany, 1983

Conference Chairs and Notable Service

Member of the Editorial Board, Transactions on Pattern Languages of Programs, September 2007–

Founding Steering Committee Chair, Onward! 2008–

General Chair, OOPSLA 2007. October 2007.

Chair, Essays Committee, OOPSLA 2006.

Chair, Corporate Support, OOPSLA 2006.

Chair, Program Committee, OOPSLA 2005, October 2005.

Chair, Sun Engineering Conference (designed and executed the first internal conference at Sun Microsystems to operate like a standard external conference), February 2005.

Member, Software Collection Committee, Computer History Museum, November 2003–November 2004.

Chair, Onward! Forum, OOPSLA 2003, October 2003.

Chair, Onward! Forum, OOPSLA 2002, November 2002.

Chair, Lisp 40th Anniversary Conference, Berkeley, CA, November 16–18, 1998

Conferences Chair, Hillside Group, 1996–1999

Chair, 1986 ACM Conference on Lisp and Functional Programming, Cambridge, MA, June 1986.

Founder and Workshop Designer, Pattern Languages of Programs (I), Allerton Park, IL, September 1994.

Chair, Pattern Languages of Programs II, Allerton Park, IL, September 1995.

Awards

Invited to the Squaw Valley Community of Writers Poetry Workshop, July 2008.

2007 Wei Lun Visiting Professor, the Chinese University of Hong Kong.

2004 AAAI/ACM Allen Newell Award, March 2005: “For innovations not only on fundamental issues in programming languages and software design but also on the interaction between computer science and other disciplines, notably architecture and poetry.”

Invited to the Squaw Valley Community of Writers Poetry Workshop, July 2004.

Honorable Mention, Sawtooth Poetry Prize for a first book of poetry, January 2002.

Finalist, National Poetry Series book prize for a first book of poetry, June 1998.

Finalist, Snake Nation Press book prize for a first book of poetry, September 1999.

ACM Fellow, 1998.

Northeastern University **Outstanding Alumni Award**, 1995.

Invited to the Breadloaf Writers’ Workshop, August 1993; August 1994.

ACM SIGPLAN Distinguished Service Award, 1988.

Texas Instruments **Excellence in Technical Communications Award**, 1985.

Columns

The following appeared in the Journal of Object-oriented Programming (JOOP):

Reuse Versus Compression

Habitability and Piecemeal Growth

Abstraction Descant (Part 1)

Abstraction Descant (Part 2)

Language Size

The End of History and the Last Programming Language

The Quality Without a Name

Writing Broadside

What We Do

Pattern Languages

The Failure of Pattern Languages

Productivity: Is There a Silver Bullet?

A Personal Narrative

The Bead Game, Rugs, and Beauty (Part 1)

The Bead Game, Rugs, and Beauty (Part 2)

The following appeared in the JOOP under the pseudonym Nickieben Bourbaki:

Toward a Definition of Object-oriented Languages (Part 1)

Toward a Definition of Object-oriented Languages (Part 2)

Toward a Definition of Object-oriented Languages (Part 3)

The following appeared in AI Expert under the pseudonym Nickieben Bourbaki:

Lisp: The Quick and the Dead

The Why of Y

Simple Lessons from Simple Problems

Simple Problems with Complex Solutions

Pattern Matching

Pattern Matching: Compilation

Simulation

Scheme

Dynamic Programming

Turing, Searle, and Thought

Initialization Protocol

Metaobject Protocol (Part 1: Classes)

Metaobject Protocol (Part 2: Generic Functions and Methods)

Reuse is not Inheritance

Common Lisp Interface Manager

Worse is Better is Worse

Some Fun Puzzles

Building a Class Browser using CLIM

Editorials

Is Worse Really Better?, The Journal of Object-oriented Programming (JOOP), October 1992.

The following appeared in *Lisp and Symbolic Computation: An International Journal* and were written with Guy L. Steele Jr.:

Standardizing the Exotic
User Interface Copyrights
What Computers Can't Do (And Why)
Technical Writing: The Vivid and Continuous Dream
Is Computer Science Science; Are Computer Scientists Scientists?
Paradise
The Failure of Abstraction
The Art of Computer Programming

Other publications include reports on programs and research performed for ONR at Parke Mathematical Laboratories in the field of underwater acoustics and are no longer available. Most magazine and newspaper articles and features are not listed.

Research Interests

Self-sustaining systems, the relationship between the practice of art and the practices of science and engineering, emergent software architecture, development methodologies, organizations (including chaotic organizations), business models, and licensing arrangements; patterns and pattern languages, programming languages, programming systems, Lisp systems, and object-oriented programming; the philosophy of programming language, organization, and environment design, and software development methodologies—all from the viewpoint of the design and construction theories of Architect Christopher Alexander.

Personal Interests

I am a poet and a lead guitarist in a rock 'n' roll band.