2008
Volume 5, Number 3

ACM Transactions on

Applied Perception

Association for
Computing Machinery

Advancing Computing as a Science & Profession

ACM Transactions on Applied Perception

2008 • Vol. 5 • No. 3

Articles 13-17

Article 13 (24 pages)	**M. A. Nees** **B. N. Walker**	Data Density and Trend Reversals in Auditory Graphs: Effects on Point-Estimation and Trend-Identification Tasks
Article 14 (21 pages)	**A. Lécuyer** **J.-M. Burkhardt** **C.-H. Tan**	A Study of the Modification of the Speed and Size of the Cursor for Simulating Pseudo-haptic Bumps and Holes
Article 15 (17 pages)	**T. Amemiya** **H. Ando** **T. Maeda**	Lead-Me Interface for a Pulling Sensation from Hand-held Devices
Article 16 (15 pages)	**F. Fontana** **D. Rocchesso**	Auditory Distance Perception in an Acoustic Pipe
Article 17 (11 pages)	**S. A. Kuhl** **S. H. Creem-Regehr** **W. B. Thompson**	Recalibration of Rotational Locomotion in Immersive Virtual Environments

ACM Transactions on
Applied Perception

ACM
2 Penn Plaza, Suite 701
New York, NY 10121-0701
Tel.: (212) 869-7440
Fax: (212) 869-0481

Home Page: http://www.acm.org/pubs/tap

Editors in Chief

Erik Reinhard	University of Bristol and University of Central Florida / Computer Science / Merchant Venturers Building / Woodland Road, Bristol BS8 1UB, United Kingdom / email: reinhard@cs.ucf.edu
Heinrich H. Bülthoff	Max Planck Institute for Biological Cybernetics / Cognitive and Computational Psychophysics Department / 72076 Tübingen / email: heinrich.buelthoff@tuebingen.mpg.de

Associate Editors

Andrew Beall	Department of Psychology / University of California / Santa Barbara, CA 93106 / email: beall@psych.ucsb.edu
Alan Chalmers	Department of Computer Science / University of Bristol / Bristol BS81UB, UK / email: alan.chalmers@brisol.ac.uk
Perry Cook	Department of Computer Science / Princeton University / Princeton, NJ 08544-2087 / email: prc@cs.princeton.edu
Ramani Duraiswami	Institute of Advanced Computer Studies / University of Maryland / College Park, MD 20742 / email: ramani@umiacs.umd.edu
Marc Ernst	Max Planck Institute for Biological Cybernetics / Tübingen, Germany / email: marc.ernst@tuebingen.mpg.de
James Elder	Centre for Vision Research / York University / Toronto, Ontario M3J 1P3, Canada / email: jelder@yorku.ca
James Ferwerda	Program of Computer Graphics / Cornell University / Ithaca, NY 14853 / email: jaf@graphics.cornell.edu
Yves Guiard	Mouvement et Perception / CNRS & Université de la Méditerranée / Faculté des Sciences du Sport Université de la Méditerranée / 13288 Marseille Cedex 9, France / email: guiard@laps.univ-mrs.fr
Matthias Harders	Medical Image Analysis and Visualization Group / Computer Vision Laboratory / ETH Zürich / CH-8092 Zürich, Switzerland / email: mharders@vision.ee.ethz.ch
Vincent Hayward	Centre for Intelligent Machines / McGill University / Montréal, Québec H3A 2A7, Canada / email: hayward@cim.mcgill.ca
Christopher Healey	Department of Computer Science / North Carolina State University / Raleigh, NC / email: healey@csc.ncsu.edu
Ken Hinckley	Microsoft Corporation / Redmond, WA 98052-6399 / email: kenh@microsoft.com
Victoria Interrante	Department of Computer Science and Engineering / University of Minnesota / Minneapolis, MN 55455 / email: interran@cs.umn.edu
Dan Kersten	Computational Vision Lab / Minneapolis, MN 55455 / email: kersten@umn.edu
Roberta Klatzky	Department of Psychology / Carnegie Mellon University / Pittsburgh, Pennsylvania 15213 / email: klatzky@cmu.edu
Michael Langer	School of Computer Science / Center for Intelligent Machines / McGill University / Montreal H3A2P7, Canada / email: langer@cs.mcgill.ca
Anatole Lécuyer	INRIA–Projet BUNRAKU / Campus Universitaire de Beaulieu / F-35042 Rennes Cedex, France / email: anatole.lecuyer@irisa.fr
Katarina Mania	Department of Electronic and Computer Engineering / Technical University of Crete / 73100 Chania / email: k.mania@ced.tuc.gr
Gary Meyer	Department of Computer Science and Engineering / University of Minnesota / Minneapolis, MN 55455 / email: meyer@cs.umn.edu
Karol Myszkowski	Max-Planck-Institut für Informatik / 66123 Saarbrücken, Germany / email: karol@mpi-sb.mpg.de
Carol O'Sullivan	Computer Science Department / Trinity College Dublin / Dublin 2, Ireland / email: carol.osullivan@cs.tcd.ie
Dinesh Pai	Division of Computer and Information Sciences / Rutgers, the State University of New Jersey / Piscataway, NJ 08854-8019 / email: dpai@cs.rutgers.edu
Penny Rheingans	Computer Science and Electrical Engineering Department / University of Maryland Baltimore County / Baltimore, MD 21250 / email: rheingan@cs.umbc.edu
Ruth Rosenholtz	Department of Brain and Cognitive Sciences / Massachusetts Institute of Technology / Cambridge, MA 02139-4307 / email: rruth@mit.edu
Holly Rushmeier	Deparment of Computer Science / Yale University / New Haven, CT 06520-8285 / email: holly@acm.org
Pawan Sinha	MIT Artificial Intelligence Laboratory / Cambridge, MA 02139 / email: sinha@ai.mit.edu
Veronica Sundstedt	Department of Computer Science / University of Bristol / Bristol BS8 1UB, UK / email: veronica@cs.bris.ac.uk
Hong Tan	Electrical Engineering Building / Purdue University / West Lafayette, IN 47907-2035 / email: hongtan@purdue.edu
William B. Thompson	School of Computing / University of Utah / Salt Lake City, UT 84112-9205 / email: thompson@cs.utah.edu
Tom Troscianko	Department of Experimental Psychology / University of Bristol / Bristol, BS8 1TN, UK / email: tom.troscianko@bristol.ac.uk
Colin Ware	Data Visualization Research Lab / Center for Coastal and Ocean Mapping / University of New Hampshire / Durham, NH 03824 / email: colinw@cisunix.unh.edu
Benjamin Watson	Department of Computer Science / North Carolina State University / EBII, 890 Oval Drive, Box 8206 / Raleigh, NC 27695-8206 / email: bwatson@ncsu.edu
Pavel Zahorik	Department of Psychology / University of Louisville / Louisville KY 40292 / email: pavel.zahorik@louisville.edu

On-Line Editor

Roland Fleming	Max Planck Institute for Biological Cybernetics / Tübingen, Germany / email: roland.fleming@tuebingen.mpg.de

Headquarters Journals Staff

Mark Mandelbaum	Director of Publications
Jono Hardjowirogo	Publisher, Associate Director of Publications
Irma Strolia	Editorial Assistant
Media Content Marketing	Production

The *ACM Transactions on Applied Perception* (ISSN: 1544-3558) is published four times a year by the Association for Computing Machinery (ACM), 2 Penn Plaza, Ste. 701, New York, NY 10121-0701. Periodicals class postage paid at New York, NY 10001, and at additional mailing offices. Printed in the U.S.A. POSTMASTER: Send address changes to *ACM Transactions on Applied Perception,* ACM, 2 Penn Plaza, Ste. 701, New York, NY 10121-0701.

Copyright © 2008 by the Association for Computing Machinery (ACM). Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers, or to redistribute to lists, requires prior specific permission and/or a fee. Request permission to republish from: Publications Department, ACM, Inc. Fax +1 212-869-0481 or email permissions@acm.org.

For other copying of articles that carry a code at the bottom of the first or last page or screen display, copying is permitted provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

Association for
Computing Machinery

Advancing Computing as a Science & Profession

Cover image from "Lead-Me Interface for a Pulling Sensation from Hand-held Devices," by T. Amemiya, H. Ando, and T. Maeda, in this issue.

ACM Transactions on Applied Perception

http://www.acm.org/pubs/tap

Guide to Manuscript Submission
Submission to the *ACM Transactions on Applied Perception* is done electronically through http://acm.manuscriptcentral.com. Once you are at that site, you can create an account and password with which you can enter the ACM Manuscript Central manuscript review tracking system. From a drop-down list of journals, choose *Transactions on Applied Perception* and proceed to the Author Center to submit your manuscript and your accompanying files.

You will be asked to create an abstract that will be used throughout the system as a synopsis of your paper. You will also be asked to classify your submission using the ACM Computing Classification System through a link provided at the Author Center. For completeness, please select at least one primary-level classification followed by two secondary-level classifications. To make the process easier, you may cut and paste from the list. Remember, you, the author, know best which area and sub-areas are covered by your paper; in addition to clarifying the area where your paper belongs, classification often helps in quickly identifying suitable reviewers for your paper. So it is important that you provide as thorough a classification of your paper as possible.

The ACM Production Department prefers that your manuscript be prepared in either LaTeX or Ms Word format. Style files for manuscript preparation can be obtained at the following location: http://www.acm.org/pubs/submissions/submission.htm. For editorial review, the manuscript should be submitted as a PDF or Postscript file. Accompanying material can be in any number of text or image formats, as well as software/documentation bundles in zip or tar-gzipped formats.

Questions regarding editorial review process should be directed to the Editor-in-Chief. Questions regarding the post-acceptance production process should be addressed to the Managing Editor, Roma Simon, at simon@hq.acm.org.

Subscription, Single Copy, and Membership Information.

Send orders to:

ACM
P.O. Box 12114
Church Street Station
New York, NY 10257

For information, contact:

Mail: ACM Member Services Dept.
2 Penn Plaza, Suite 701
York, NY 10121-0701
Phone: +1-212-626-0500
Fax: +1-212-944-1318
Email: acmhelp@acm.org
Catalog: http://www.acm.org/catalog

Subscription rates for *ACM Transactions on Applied Perception* are $ 38 per year for ACM members, $33 for students, and $159 for nonmembers. Single copies are $18 each for ACM members and $40 for nonmembers. Your subscription expiration date is coded in four digits at the top of your mailing label; the first two digits show the year, the last two show the month of expiration.

Notice to Past Authors of ACM-Published Articles. ACM intends to create a complete electronic archive of all articles and/or other materials previously published by ACM. If you have written a work that was previously published by ACM in any journal or conference proceedings prior to 1978, or any SIG Newsletter at any time, and you do NOT want this work to appear in the ACM Digital Library, please inform permission@acm.org, stating the title of the work, the author(s), and where and when published.

About ACM. ACM is the world's largest educational and scientific computing society, uniting educators, researchers and professionals to inspire dialogue, share resources and address the field's challenges. ACM strengthens the computing profession's collective voice through strong leadership, promotion of the highest standards, and recognition of technical excellence. ACM supports the professional growth of its members by providing opportunities for life-long learning, career development, and professional networking.

Visit ACM's Website: http://www.acm.org.

Change of Address Notification. To notify ACM of a change of address, use the addresses above or send an email to coa@acm.org.

Please allow 6-8 weeks for new membership or change of name and address to become effective. Send your old label with your new address notification. To avoid interruption of service, notify your local post office before change of residence. For a fee, the post office will forward 2nd- and 3rd-class periodicals.