



1



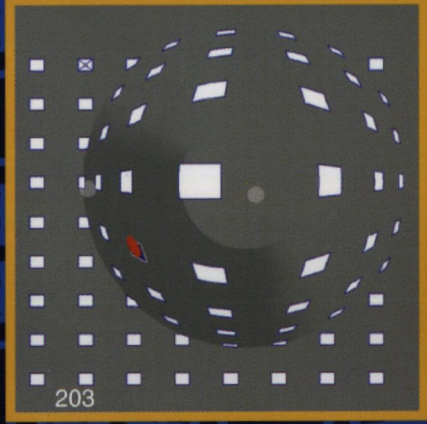
61



153



87



203



9



219



227

```
package com.moby;
import java.util.*;
import org.lwjgl.opengl.*;
import org.lwjgl.opengl.gesometry.*;
import org.lwjgl.opengl.generation.*;
class Pairing {
    int sw1;
    boolean left1;
    int sw2;
    boolean left2;
    Point p1;
    Point p2;
    Point isect;
    double cost;
    Pairing(int sw1, boolean left1, int sw2, boolean left2,
           Point p1, Point p2, Point isect, double cost) {
        this.sw1 = sw1;
        this.left1 = left1;
        this.sw2 = sw2;
        this.left2 = left2;
        this.p1 = p1;
        this.p2 = p2;
        this.isect = isect;
        this.cost = cost;
    }
}

public class BuildRegion {
    private static double getAngle(Point o, Point a, Point b) {
        double dx1 = a.getX() - o.getX();
        double dy1 = a.getY() - o.getY();
        double dx2 = b.getX() - o.getX();
        double dy2 = b.getY() - o.getY();
        double dot = dx1*dx2 + dy1*dy2;
        double len = Math.sqrt(dx1*dx1 + dy1*dy1) * Math.sqrt(dx2*dx2 + dy2*dy2);
        return Math.acos(dot/len);
    }
    public static Point[] getBetterLine(
        Point p1, Point p2, Point q1, Point q2) {
        if (Loose.zero(p2.distToLine(p1, q1)))
            Loose.zero(p2.distToLine(p1, q2))
            return new Point[] { p1, p2 };
        return ret;
    }
}

private static Point getSegment(Point p, Point q,
    double s, double t, boolean left, Point[] ret, double cost) {
    double x1 = p.getX() + (q.getX() - p.getX()) * s;
    double y1 = p.getY() + (q.getY() - p.getY()) * s;
    double x2 = p.getX() + (q.getX() - p.getX()) * t;
    double y2 = p.getY() + (q.getY() - p.getY()) * t;
    Point p1 = new Point(x1, y1);
    Point p2 = new Point(x2, y2);
    Point isect = new Point(0, 0);
    double cost1 = p1.distToLine(p2, q1);
    double cost2 = p2.distToLine(p1, q2);
    if (cost1 < cost2) {
        ret[0] = p1;
        ret[1] = p2;
    } else {
        ret[0] = p2;
        ret[1] = p1;
    }
    return ret;
}

public static Point[] buildFromTiling(Tiling tiling, double sw, double sep,
    boolean two, boolean allContacts) {
    Vector ret = new Vector();
    for (int idx = 0; idx < tiling.numFeatures(); idx++)
        PlacedFeature pf = tiling.getFeature(idx);
        Point[] lines = buildFeature2(
```

# Proceedings Graphics Interface 2005

9-11 May 2005  
Victoria, British Columbia  
Canadian Human-Computer  
Communications Society



```
ret[0] = pf;
ret[1] = pf;

public static Point[] buildFromTiling(Tiling tiling, double sw, double sep,
    boolean two, boolean allContacts) {
    Vector ret = new Vector();
    for (int idx = 0; idx < tiling.numFeatures(); idx++)
        PlacedFeature pf = tiling.getFeature(idx);
        Point[] lines = buildFeature2(
```

Proceedings

# Graphics **Interface** 2005

Kori Inkpen and Michiel van de Panne  
Program Co-Chairs

[www.graphicsinterface.org](http://www.graphicsinterface.org)

Victoria, British Columbia  
9–11 May 2005



Copyright © 2005 by the Canadian Information Processing Society

All rights reserved. No part of the material protected by this copyright notice may be reproduced or utilized in any form, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission from the copyright owner.

Papers are reproduced here from electronic files prepared by the authors.

ISSN 0713-5424  
ISBN 1-56881-265-5

Proceedings Graphics Interface 2005, Kori Inkpen and Michiel van de Panne (Program Co-Chairs), Victoria, British Columbia, 9–11 May 2005. Published by the Canadian Human-Computer Communications Society and A K Peters Ltd.

Graphics Interface is sponsored by:  
The Canadian Human-Computer Communications Society (CHCCS)

Membership Information for CHCCS is available from:  
Canadian Information Processing Society (CIPS)  
2800 Skymark Avenue, Suite 402  
Mississauga, Ontario L4W 5A6  
Canada  
Telephone: (905) 602-1370  
Fax: (905) 602-7884  
Web: <http://www.cips.ca/>

Additional copies of the proceedings are available from:  
A K Peters Ltd.  
888 Worcester Street, Suite 230  
Wellesley, MA 02482  
Web: <http://www.akpeters.com/>

Published by the Canadian Human-Computer Communications Society and A K Peters Ltd.  
Distributed by A K Peters Ltd.  
Printed in Canada by Graphics Services at the University of Waterloo, Waterloo, Ontario.

#### Cover Credits

Wireframes: Craig Kaplan (177). Computer Program: Craig Kaplan (177). Colour images: Left to right (starting on back left): Tom Haber, Tom Mertens, Philippe Bekaert, and Frank Van Reeth (79); Maxime Collomb, Mountaz Hascoët, Patrick Baudisch, and Brian Lee (25); Florence Bertails, Clément Ménier, and Marie-Paule Cani (71); Trần-Quân Luong, Ankush Seth, Allison Klein, and Jason Lawrence (233); Manfred Ernst, Tomas Akenine-Möller, and Henrik Wann Jensen (87); Michael Ashmore, Andrew T. Duchowski, and Garth Shoemaker (203); Martin Hachet, Joachim Pouderoux, Pascal Guitton, and Jean-Christophe Gonzato (9); David Mould (219). Top to bottom on front: Luv Kohli and Mary Whitton (1); Ari Shapiro, Petros Faloutsos, and Victor Ng-Thow-Hing (61); Le-Jeng Shiue and Jörg Peters (153); then, below joint: Steve Zelinka, Hui Fang, Michael Garland, and John C. Hart (227). Design: Christine Goucher and Abby Van Dongen.

# Preface

Kori Inkpen

EDGE Lab

Faculty of Computer Science

Dalhousie University

Michiel van de Panne

IMAGER Lab

Department of Computer Science

The University of British Columbia

Welcome to Graphics Interface 2005. This annual conference, now in its 31<sup>st</sup> year, is devoted to computer graphics, interactive systems, and human-computer interaction. Beginning in 1969 as the “Canadian Man-Computer Communications Seminar” (CMCCS), it is the oldest regularly-scheduled computer graphics and human-computer interaction conference. This year, Graphics Interface was held May 9–11, 2005 in Victoria, British Columbia.

A total of 104 submissions were received, up 20% from 2004, of which 30 papers were accepted. The final program is well balanced between HCI and computer graphics, with both tracks seeing similar acceptance rates: 14/51 for the HCI track, and 16/53 for the graphics track.

The program committee consisted of 20 international experts, 18 of which attended the program committee meeting held in mid February at UBC. The great majority of papers received 5 reviews, two of which were from program committee members, and 3 from external reviewers. The reviewing process was double-blind, with the exception of the primary reviewers, who knew the identity of the authors in order to be able to select conflict-free external reviewers. We thank the program committee for their expertise and time in selecting a very high quality set of papers for this year’s conference. We also thank the many external reviewers for their help in this endeavor.

There are also many others whose efforts were indispensable in making Graphics Interface happen. Michael McCool, together with Graphics Services at the University of Waterloo, consistently does an amazing job at producing the proceedings each year and this year is no exception. The conference would also simply not happen each year were it not for the efforts of Kelly Booth, who orchestrated many important details behind the scenes and acted a liaison between the AI, GI, and CRV trio of conferences. We thank Fred Peet, the treasurer of the Canadian Human-Computer Communication Society, for looking after all financial issues related to the conference. The electronic submission system and the online conference registration system was provided by Precision Conference Systems and we thank James Stewart for his prompt support whenever it was needed. Joseph MacInnes of Saint Mary’s kindly volunteered as this year’s posters chair. Karyn Moffatt was the student volunteer coordinator, yet another important role in making the conference run smoothly. Lastly, we thank this year’s local organizers for their efforts. This list includes Margaret-Anne Storey, Davor Cubranic, Paul Lalonde, Alex Thomo, and Bill Wadge.

We would also like to extend our appreciation to this year’s invited speakers, all of whom are outstanding leaders in their respective fields: Holly Rushmeier, Yale University; Bill Buxton, Buxton Design; and Ramesh Raskar, Mitsubishi Electric Research Labs. Their presentations provide unique insights that will help spark ideas to advance the fields of computer graphics and human-computer interaction during the coming years. We are also pleased to announce that Dr. Ronald M. Baecker has received the 2005 CHCCS Achievement Award for his significant research contributions in computer graphics and human-computer interaction over the past 40 years.

For further information about the conference series we invite you to visit the web site:

<http://www.graphicsinterface.org/>

# Organization

## Conference and Program Chairs

Kori Inkpen, HCI Co-chair, Dalhousie University  
Michiel van de Panne, Graphics Co-chair, The University of British Columbia

## Local Organizers

Paul Lalonde, Electronic Arts  
Davor Cubranic, University of British Columbia  
Margaret-Anne Storey, University of Victoria  
Alex Thomo, University of Victoria  
Bill Wadge, University of Victoria

## Posters and Demos Chair

Joseph MacInnes, Saint Mary's University

## Intersociety Liason and Advisor

Kellogg Booth, University of British Columbia

## Student Volunteer Organizer

Karyn Moffatt, University of British Columbia

## Online Services

James Stewart, Precision Conference Systems and Queen's University

## Proceedings Editor

Michael McCool, University of Waterloo

## Program Committee

Maneesh Agrawala, Microsoft Research  
Kavita Bala, Cornell Univesrity  
Patrick Baudisch, Microsoft Research  
James "Bo" Begole, PARC  
Robert Bridson, The University of British Columbia  
Sheelagh Carpendale, University of Calgary  
Mario Costa Sousa, University of Calgary  
Steven Drucker, Microsoft Research  
Petros Faloutsos, University of California Los Angeles  
Xavier Granier, INRIA Futurs  
Baining Guo, Microsoft Research Asia  
Lars Erik Holmquist, Viktoria Institute  
Scott Klemmer, Stanford University  
Hendrik Lensch, MPI and Stanford University  
Regan Mandryk, Simon Fraser University  
Stephen Mann, University of Waterloo  
Kathy Ryall, Mitsubishi Electric Research Labs  
Alla Sheffer, The University of British Columbia  
Karan Singh, University of Toronto  
Maureen Stone, StoneSoup Consulting

## CHCCS Treasurer

Fred G. Peet, Canadian Forest Service

# Reviewers

Shalini Aggarwal	Hui Fang	Fred Kimberley	Faramarz Samavati
Ergun Akleman	Steven Feiner	Arthur Kirkpatrick	Johan Sanneblad
Pierre Alliez	Leah Findlater	Per-Ola Kristensson	Luis Sarmenta
Ken Anjyo	Brian Fisher	Lucas Kovar	Mirko Sattler
Thomas Annen	Kenneth Fishkin	Hendrik Kueck	Christophe Schlick
Georg Apitz	James Fogarty	Vivek Kwatra	Albrecht Schmidt
Adam Arbrece	Clifton Forlines	Joe LaViola	Pradeep Sen
Michael Ashikhmin	Charless Fowlkes	Jason Lawrence	Hovav Shacham
Norman Badler	James Frankel	Brian Lee	Ariel Shamir
Brian Bailey	Krzysztof Gajos	Jehee Lee	Ari Shapiro
Ravin Balakrishnan	Michael Garland	Sylvain Lefebvre	Chia Shen
Gladimir Baranoski	Lalya Gaye	Bruno Levy	Michael Shilman
Francesca Barrientos	Simon Gibson	Wilmot Li	Garth Shoemaker
Richard Bartels	Andrew Glassner	Yanxi Liu	Tobias Skog
Lyn Bartram	Michael Goesele	Yingbin Liu	Kenneth Sloan
Thomas Baudel	Dan Goldman	Sara Ljungblad	Greg Slabaugh
Bill Baxter	Craig Gotsman	Celine Loscos	Ian E. Smith
Philippe Bekaert	Stephane Grabli	Joe MacInnes	Brian Smits
Bedrich Benes	Eitan Grinspun	Karon MacLean	Henry Sowizral
Kiran Bhat	Eran Guendelman	Jennifer Mankoff	Marc Stamminger
Xuehai Bian	Yves Guiard	Steve Marschner	Josh Steinhurst
Mark Billinghurst	Pascal Guitton	Ignacio Martin	James Stewart
Gary Bishop	Carl Gutwin	Wojciech Matusik	Thomas Strothotte
Kellogg Booth	Eben Haber	Michael McGuffin	Wolfgang Stuerzlinger
Stephen Brewster	Martin Hachet	Barb Meier	Vitaly Surazhsky
David Brogan	Maria Håkansson	Tom Mertens	Colin Swindells
David John Burrowes	Jim Hanan	Jan Meseth	Desney Tan
Xiang Cao	Mark Hancock	Jessica Miller	Peter Tandler
Yong Cao	Simon Harper	Torsten Moeller	Charlotte Tang
Stephen Chenney	John Hart	Matthias Moeller-Fischer	Gabriel Taubin
Chakra Chennubhotla	Björn Hartmann	Meredith Morris	Daniel Thalmann
Ed Chi	Mountaz Hascoët	Jack Muramatsu	Melanie Tory
Bill Chiu	Alejo Hausner	Michael Neff	Joe Tullio
Per H. Christensen	Kirstie Hawkey	Petra Neumann	Matt Uyttendaele
Yiorgos Chrysanthou	Tim Hawkins	Mark Newman	Kristof Van Laerhoven
Jonathan Cohen	Christopher Healey	Victor Ng-Thow-Hing	Roel Vertegaal
Michael Cohen	Aaron Hertzmann	Marc Nienhaus	Oleg Veryovka
Daniel Cohen-Or	Ken Hinckley	James O'Brien	Luis von Ahn
Alex Colburn	Tobias Hollerer	Dan Odell	Ingo Wald
Patrick Coleman	Elaine Huang	Mattias Östergren	Bruce Walter
John Collomosse	Scott Hudson	Miguel Otaduy	Alice Wang
Matt Conway	Dugald Hutchings	Leysia Palen	Lifeng Wang
Greg Coombe	Takeo Igarashi	Rick Parent	Greg Ward
Lorrie Cranor	Victoria Interrante	J. Karen Parker	Chris Weigle
Carolina Cruz-Neira	Tali Ironi	Domingo Martin Perandres	Andreas Wenger
Andrew Csinger	Geoffrey Irving	Ken Perlin	Mikael Wiberg
Davor Cubranic	Tobias Isenberg	Jorg Peters	Alexander Wilkie
Carsten Dachsbacher	Mattias Jacobsson	Doantam Phan	Andy Wilson
Richard Davis	Doug James	Jeffrey Pierce	Michael Wimmer
Sriram Dayanand	Robin Jeffries	Frederic Pighin	Terry Winograd
Doug DeCarlo	Henrik Wann Jensen	Barry Po	Ian Witten
Laurent Denoue	David Johnson	Helmut Pottmann	Albert Wong
Rachna Dhamija	Dan Julius	Thorsten Prante	Peter Wonka
Fabian Di Fiore	Marcelo Kallmann	Simon Premoze	Chris Wyman
John Dill	Eser Kandogan	Przemek Prusinkiewicz	Brian Wyvill
Quynh Dinh	Sing Bing Kang	Saty Raghavachary	Geoff Wyvill
Jean-Michel Dischler	Zachi Karni	Ramesh Raskar	Nicole Yankelevich
George Drettakis	Jan Kautz	Madhu Reddy	Steve Zelinka
Doug Dunham	Melanie Kellar	Tim Regan	Polle Zellweger
Jeff Dyck	Nicky Kern	Derek Reilly	Shengdong Zhao
Xavier Decoret	Drew Kessler	Lionel Reveret	Larry Zitnick
Richard Egli	Dongmin Kim	Daniel Robbins	Victor Zordan
Daniel Fallman	Jiwon Kim	Alyn Rockwood	Torre Zuk

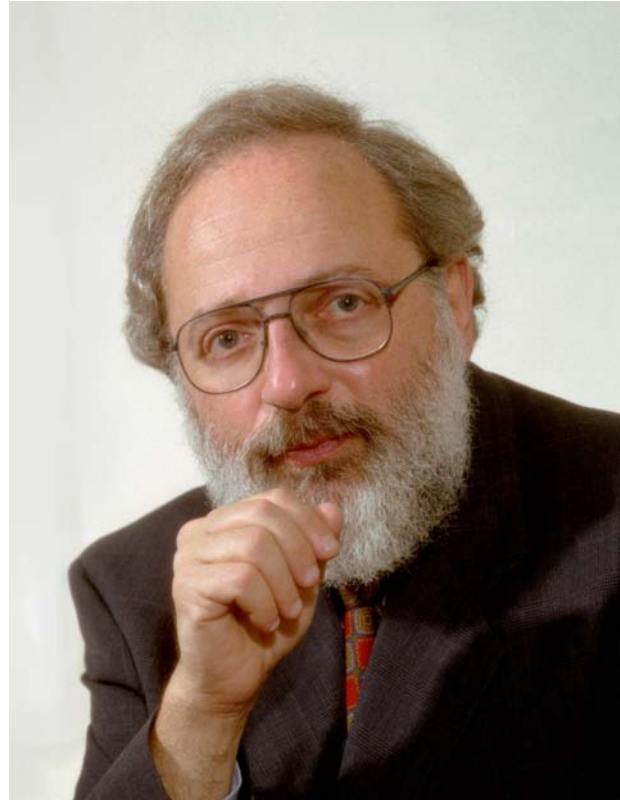
# 2005 CHCCS Achievement Award

Ronald M. Baecker

Ronald Baecker has played a pioneering role in almost every aspect of the community that comprises the Canadian Human-Computer Communications Society. He is internationally recognized for his insights on the importance of interactivity and careful attention to user-centred design. Often he has seen emerging issues well ahead of others and provided leadership by initiating research activity in new areas that have set the agenda for those who followed. The many accomplishments for which he is receiving the CHCCS Achievement Award include: establishing with his colleagues at the University of Toronto the Dynamic Graphics Project as the first (and many would say the foremost) Canadian university research group focused on computer graphics and human-computer interaction; producing in 1981 one of the first and perhaps the most famous animated algorithm visualizations, the computer-generated film *Sorting Out Sorting*; co-chairing and naming Graphics Interface '82, the event that transformed the former CMCCS conference to an annual conference with a wider constituency than just interactive computer graphics; co-founding in 1989 the CAVECAT research project and in 1992 the Ontario Telepresence Project, which were testbeds for many ideas that are now common practice in computer-supported cooperative work; and organizing the Network for Effective Collaboration Technologies through Advanced Research, a new Canadian research network.

The opportunities created by these initiatives, and Dr. Baecker's vision of interactive technology as a key enabler, have been instrumental in establishing and maintaining Canada's position as a world leader in the fields of computer graphics, visualization, human-computer interaction, and computer-supported cooperative work. These and similar initiatives spanning more than four decades have provided inspiration for students, colleagues, and the international research community.

Dr. Baecker is Bell University Laboratories Professor of Human-Computer Interaction, Professor of Computer Science, and founder and Chief Scientist of the Knowledge Media Design Institute at the University of Toronto. He holds cross appointments in the Department of Electrical and Computer Engineering and the Faculty of Man-



Photograph by Louis Fabian Bachrach.

agement. He received his B.Sc., M.Sc., and Ph.D. degrees from M.I.T. His Ph.D. topic led to the first comprehensive conceptual framework for computer animation and the first significant interactive computer animation system. Dr. Baecker joined the University of Toronto in 1972 after working at the National Institutes for Health in the United States.

A partial list of his many research contributions includes the Genesys picture-driven animation system described in his doctoral dissertation (1969), the Shazam interactive animation system developed with researchers at Xerox PARC, the Newswhole interactive newspaper layout system designed with David Tilbrook (1976), a multi-window interactive graphical debugger developed with

Sheila Crossey (1977), the See source code visualization project with Aaron Marcus (1983), the VANNA video annotation tools with Beverly Harrison (1992), research on collaborative writing with Ilona Posner and Alex Mitchell in the early 90s, the MAD movie authoring system for children with Alan Rosenthal, Eric Smith, and Ilona Posner in the mid-90s, and the ePresence open source interactive webcasting and archiving system with Peter Wolf, Gale Moore, and Kelly Rankin in the beginning years of this millenium.

Baecker is an active researcher, lecturer, and consultant on human-computer interaction and user interface design, user support, software visualization, multimedia, computer-supported cooperative work and learning, the Internet, entrepreneurship and strategic planning in the software industry, and the role of information technology in business. He has published over 100 papers and articles on topics in these areas, and is the author or co-author of two published videotapes and four books including three edited collections of readings in human-computer interaction and computer-supported cooperative work. He is co-holder of two patents and one patent pending.

Baecker was the founder, CEO, and Chairman of HCR Corporation, a Toronto-based UNIX contract R&D and technology development and marketing firm, sold in 1990 to the Santa Cruz Operation. He was also the founder of Expresto Software Corp, a firm specializing in structured visual communication explaining software and other complex technology. Expresto Software was sold in 2002 to Caseware International. He has been recognized by ACM SIGGRAPH as a "Graphics Pioneer" for his contributions to interactive computer graphics and he has been inducted into the ACM SIGCHI Academy for his contributions to the field of human-computer interaction.



# Table of Contents

## Two Hands are Better than One

- The Haptic Hand: Providing User Interface Feedback with the Non-Dominant Hand in Virtual Environments* .... 1  
Luv Kohli and Mary Whitton
- TangiMap — A Tangible Interface for Visualization of Large Documents on Handheld Computers* ..... 9  
Martin Hachet, Joachim Pouderoux, Pascal Guitton, and Jean-Christophe Gonzato
- When It Gets More Difficult, Use Both Hands — Exploring Bimanual Curve Manipulation* ..... 17  
Russell Owen, Gordon Kurtenbach, George Fitzmaurice, Thomas Baudel, and Bill Buxton

## Interacting with Walls and Tables

- Improving Drag-and-Drop on Wall-Size Displays* ..... 25  
Maxime Collomb, Mountaz Hascoët, Patrick Baudisch, and Brian Lee
- TractorBeam: Seamless Integration of Local and Remote Pointing for Tabletop Displays* ..... 33  
J. Karen Parker, Regan L. Mandryk, and Kori M. Inkpen
- Exploring Non-Speech Auditory Feedback at an Interactive Multi-User Tabletop* ..... 41  
Mark S. Hancock, Chia Shen, Clifton Forlines, and Kathy Ryall

## Animation

- Controllable Real-Time Locomotion Using Mobility Maps* ..... 51  
Madhusudhanan Srinivasan, Ronald A. Metoyer, and Eric N. Mortensen
- Dynamic Animation and Control Environment* ..... 61  
Ari Shapiro, Petros Faloutsos, and Victor Ng-Thow-Hing

## Rendering

- A Practical Self-Shadowing Algorithm for Interactive Hair Animation* ..... 71  
Florence Bertails, Clément Ménier, and Marie-Paule Cani
- A Computational Approach to Simulate Subsurface Light Diffusion in Arbitrarily Shaped Objects* ..... 79  
Tom Haber, Tom Mertens, Philippe Bekaert, and Frank Van Reeth
- Interactive Rendering of Caustics using Interpolated Warped Volumes* ..... 87  
Manfred Ernst, Tomas Akenine-Möller, and Henrik Wann Jensen
- Reordering for Cache Conscious Photon Mapping* ..... 97  
Joshua Steinhurst, Greg Coombe, and Anselmo Lastra

## Shadows

- Soft Shadows from Extended Light Sources with Penumbra Deep Shadow Maps* ..... 105  
Jean-François St-Amour, Eric Paquette, and Pierre Poulin
- Automatic Generation of Consistent Shadows for Augmented Reality* ..... 113  
Katrien Jacobs, Cameron Angus, Celine Loscos, Jean-Daniel Nahmias, Alex Reche, and Anthony Steed

## Sensing Interaction

- An Empirical Investigation of Capture and Access for Software Requirements Activities* ..... 121  
Heather Richter, Chris Miller, Gregory D. Abowd, and Idris Hsi
- Case Studies in the Use of ROC Curve Analysis for Sensor-Based Estimates in Human Computer Interaction* .. 129  
James Fogarty, Ryan S. Baker, and Scott E. Hudson

**Privacy and Security Awareness**

*Gathering Evidence: Use of Visual Security Cues in Web Browsers* ..... 137  
Tara Whalen and Kori M. Inkpen  
*Using Relationship to Control Disclosure in Awareness Servers* ..... 145  
Scott Davis and Carl Gutwin

**Geometric Modeling**

*A Pattern-Based Data Structure for Manipulating Meshes with Regular Regions* ..... 153  
Le-Jeng Shiue and Jörg Peters  
*Extraction and Remeshing of Ellipsoidal Representations from Mesh Data* ..... 161  
Patricio D. Simari and Karan Singh  
*Distance Extrema for Spline Models Using Tangent Cones* ..... 169  
David E. Johnson and Elaine Cohen  
*Islamic Star Patterns from Polygons in Contact* ..... 177  
Craig S. Kaplan

**Hand/Eye Interaction**

*Evaluation of an On-line Adaptive Gesture Interface with Command Prediction* ..... 187  
Xiang Cao and Ravin Balakrishnan  
*Moving Objects with 2D Input Devices in CAD Systems and Desktop Virtual Environments* ..... 195  
Ji-Young Oh and Wolfgang Stuerzlinger  
*Efficient Eye Pointing with a Fisheye Lens* ..... 203  
Michael Ashmore, Andrew T. Duchowski, and Garth Shoemaker  
*Using Social Geometry to Manage Interruptions and Co-Worker Attention in Office Environments* ..... 211  
Maria Danninger, Roel Vertegaal, Daniel P. Siewiorek, and Aadil Mamuji

**Image-Based Editing and Image-Based Animation**

*Image-Guided Fracture* ..... 219  
David Mould  
*Interactive Material Replacement in Photographs* ..... 227  
Steve Zelinka, Hui Fang, Michael Garland, and John C. Hart  
*Isoluminant Color Picking for Non-Photorealistic Rendering* ..... 233  
Trần-Quân Luong, Ankush Seth, Allison Klein, and Jason Lawrence  
*Interactive Vector Fields for Painterly Rendering* ..... 241  
Sven C. Olsen, Bruce A. Maxwell, and Bruce Gooch

**Invited**

*Forty Years of Human-Computer Interaction and Knowledge Media Design: Twelve Challenges to Meet in Fewer than the Next Forty Years* ..... 249  
Ronald M. Baecker

## Author Index

Abowd, Gregory D. ....	121	Lastra, Anselmo .....	97
Akenine-Möller, Tomas .....	87	Lawrence, Jason .....	233
Angus, Cameron .....	113	Lee, Brian .....	25
Ashmore, Michael .....	203	Loscoc, Celine .....	113
Baecker, Ronald M. ....	249	Luong, Trân-Quân .....	233
Baker, Ryan S. ....	129	Mamuji, Aadil .....	211
Balakrishnan, Ravin .....	187	Mandryk, Regan L. ....	33
Baudel, Thomas .....	17	Maxwell, Bruce A. ....	241
Baudisch, Patrick .....	25	Ménier, Clément .....	71
Bekaert, Philippe .....	79	Mertens, Tom .....	79
Bertails, Florence .....	71	Metoyer, Ronald A. ....	51
Buxton, Bill .....	17	Miller, Chris .....	121
Cani, Marie-Paule .....	71	Mortensen, Eric N. ....	51
Cao, Xiang .....	187	Mould, David .....	219
Collomb, Maxime .....	25	Nahmias, Jean-Daniel .....	113
Cohen, Elaine .....	169	Ng-Thow-Hing, Victor .....	61
Coombe, Greg .....	97	Oh, Ji-Young .....	195
Danninger, Maria .....	211	Olsen, Sven C. ....	241
Davis, Scott .....	145	Owen, Russell .....	17
Duchowski, Andrew T. ....	203	Paquette, Eric .....	105
Ernst, Manfred .....	87	Parker, J. Karen .....	33
Faloutsos, Petros .....	61	Peters, Jörg .....	153
Fang, Hui .....	227	Pouderoux, Joachim .....	9
Fitzmaurice, George .....	17	Poulin, Pierre .....	105
Fogarty, James .....	129	Richter, Heather .....	121
Forlines, Clifton .....	41	Ryall, Kathy .....	41
Garland, Michael .....	227	Seth, Ankush .....	233
Gonzato, Jean-Christophe .....	9	Shapiro, Ari .....	61
Gooch, Bruce .....	241	Shen, Chia .....	41
Guitton, Pascal .....	9	Shiue, Le-Jeng .....	153
Gutwin, Carl .....	145	Shoemaker, Garth .....	203
Haber, Tom .....	79	Siewiorek, Daniel P. ....	211
Hachet, Martin .....	9	Simari, Patricio D. ....	161
Hancock, Mark S. ....	41	Singh, Karan .....	161
Hart, John C. ....	227	Srinivasan, Madhusudhanan .....	51
Hascoët, Mountaz .....	25	St-Amour, Jean-François .....	105
Hsi, Idris .....	121	Steed, Anthony .....	113
Hudson, Scott E. ....	129	Steinhurst, Joshua .....	97
Inkpen, Kori M. ....	33, 137	Stuerzlinger, Wolfgang .....	195
Jacobs, Katrien .....	113	Reche, Alex .....	113
Jensen, Henrik Wann .....	87	Van Reeth, Frank .....	79
Johnson, David E. ....	169	Vertegaal, Roel .....	211
Kaplan, Craig S. ....	177	Whalen, Tara .....	137
Klein, Allison .....	233	Whitton, Mary .....	1
Kohli, Luv .....	1	Zelinka, Steve .....	227
Kurtenbach, Gordon .....	17		



```

    pt.getFeature(), pt.getTransform(), ang,
    all_contacts );
    for( int q = 0; q < lines.length; ++q ) {
        ret.addElement( lines[q] );
    }

    Point[] l = new Point[ ret.size() ];
    ret.copyInto( l );
    return l;
}

public static Point[] buildFeature2(
    Feature feature, Transform T, double ang, double sep, boolean use,
    boolean all_contacts ) {
    Vector ret = new Vector();
    if( feature.isRegular() ) {
        int n = feature.getNumPoints();
        if( n > 6 ) ang = 2.0*Math.PI/(double)n * 60;
        Point[] pts = T.apply( feature.getPoints() );
        for( int v = 0; v < pts.length; ++v ) {
            Point p1 = pts[v];
            Point q1 = pts[(v+1)%n];
            Point[] seg1_right = { null, null };
            getSegment( p1, q1, ang, sep, false, seg1_right, 0.5 );
            Point p2 = pts[(v+2)%n];
            Point q2 = pts[(v+3)%n];
            Point[] seg2_left = { null, null };
            getSegment( p2, q2, ang, sep, true, seg2_left, 0.5 );
            Point[] lse = getBetterLine( seg1_right[0], seg1_right[1],
                seg2_left[0], seg2_left[1] );
            for( int idx = 0; idx < lse.length; ++idx ) {
                ret.addElement( lse[idx] );
            }
        }

        Point[] lret = new Point[ ret.size() ];
        ret.copyInto( lret );
        return lret;
    }

    Polygon pgon = feature.getPolygon();
    pgon.applyTransform( T );
    int n = pgon.getNumVertices();
    double perim = pgon.getPerim();
    for( int v = 0; v < n; ++v ) {
        Point p1 = pgon.getVertex( v );
        Point p2 = pgon.getVertex( (v+1)%n );
        double len = p1.distance( p2 );
        if( len < 0.0001 ) continue;
        int i = 0;
        while( i < len ) {
            double seg = sep;
            if( i < seg ) seg = i;
            if( i > len - seg ) seg = len - i;
            if( len < 2*seg ) seg = len;
            double[] lse = new double[ 2 ];
            if( len < 2*seg ) {
                lse[0] = p1.x + (p2.x - p1.x) * i / len;
                lse[1] = p1.y + (p2.y - p1.y) * i / len;
            } else {
                double det = seg * seg - i * i;
                double x1 = p1.x + (p2.x - p1.x) * i / len;
                double y1 = p1.y + (p2.y - p1.y) * i / len;
                double x2 = p1.x + (p2.x - p1.x) * (len - i) / len;
                double y2 = p1.y + (p2.y - p1.y) * (len - i) / len;
                double dx = x2 - x1;
                double dy = y2 - y1;
                double r = Math.sqrt( dx * dx + dy * dy );
                double a = Math.atan2( dy, dx );
                double x3 = x1 + r * Math.cos( a );
                double y3 = y1 + r * Math.sin( a );
                double x4 = x2 + r * Math.cos( a );
                double y4 = y2 + r * Math.sin( a );
                double[] lse = { x3, y3, x4, y4 };
            }
            ret.addElement( lse );
            i += seg;
        }
    }

    Point[] lret = new Point[ ret.size() ];
    ret.copyInto( lret );
    return lret;
}

```



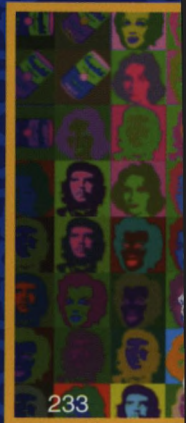
79



25



71



233



A K PETERS LTD.

[www.graphicsinterface.org](http://www.graphicsinterface.org)

[www.akpeters.com](http://www.akpeters.com)

ISSN 0713-5424

ISSN 1-56881-265-5

ISBN 1-56881-265-5



9 781568 812656