



SIGGRAPH 1994

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On Computer Graphics and
Interactive Techniques*

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Course Notes

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**INTRODUCTION TO
PERCEPTION-BASED
VISUALIZATION**

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Introduction to Perception-based Visualization

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Summary

Visualization is an emerging discipline in its infancy. As such, it is based more on examples and anecdotes that are often detached from scientific theory. As researchers and practitioners address the increasing demands for visualization, they find the need to tie the theory to human perception. This is becoming perhaps *the major requirement* for producing effective visualizations.

This course introduces the foundations of perception as related to visualization, and prepares researchers and practitioners to develop perception-based visualizations and thus to improve their effectiveness. It provides visualization professionals with the necessary tools to create visualizations that take advantage of, and thus enhance, users' perception of the data.

The focus of this course is the design of effective visual displays of quantitative information and the validation of visualization techniques through psychophysical methods.

Course Objectives

The objective of the course is:

1. To teach visualization researchers and practitioners the basics of visual, auditory, and tactile perception.
2. To tie this general perception understanding to the task of developing more effective static and dynamic visualizations.

The specific objective of this introduction course is to teach the basics of perceptual theory necessary to produce more effective static visualizations.

Prerequisites

Basic understanding of computer graphics and imaging concepts.

Who Should Attend?

Visualization researchers, visualization systems developers, and users will learn the mechanisms of human perception and how they can improve visualizations.

Course Organizers and Instructors

Organizers

Haim Levkowitz is an Assistant Professor of Computer Science and a founding faculty member of the *Institute for Visualization and Perception Research* at the University of Massachusetts Lowell, in Lowell, MA. Since 1982, he has been studying multidimensional, multiparametric imaging and visualization. He has developed new color methods for computer graphics representation of parameter distributions and methods for evaluation. He is the developer of the Generalized Lightness, Hue, and Saturation (GLHS) family of color models, the Linearized Optimal Color Scale (LOCS), and the Color Icon. He has also developed and implemented tools for automated psychometric evaluation of the developed display methods and has used these tools to conduct observer performance evaluations of some of his methods. Dr. Levkowitz is the author of over 25 publications on color, visualization, and imaging. His panel at Visualization '91, "Color vs. Black-and-White in Visualization" won the Best Panel award. He has organized and taught several tutorials at conferences. Dr. Levkowitz was on the conference committees of Visualization '91, '92, and '93; on the program committee of the 46th IS&T meeting; Co-chair of the 1992 Boston Workshop on Volume Visualization; and Co-Chair of the IFIP 93 Workshop on Perceptual Issues in Visualization.

Penny Rheingans is a visualization specialist for Martin Marietta at the US Environmental Protection Agency Scientific Visualization Center. She is actively involved in developing visualization tools and techniques for the more effective display of environmental data to scientists, policy-makers, and citizens. She has developed systems for the dynamic design and manipulation of color mappings for bivariate data, the design of opacity-modulating textures for molecular surfaces, and the display of high-dimensional statistical data. Her current research interests include multivariate visualization, dynamic manipulation, the design of effective color mappings, perceptual issues in visualization, the application of texture mapping to data visualization, and the experimental validation of visualization techniques. Dr. Rheingans received a BA in Computer Science from Harvard University in 1985 and a PhD in Computer Science from the University of North Carolina, Chapel Hill in 1993.

Instructors

Stephen G. Eick received his Ph.D. in Statistics from the University of Minnesota (1985). In 1985 he joined AT&T Bell Laboratories as a Member of the Technical Staff and has been involved in research in software engineering, visualization, statistical graphics, and networking. He developed the *Seenet* system for displaying network data and the *SeeSoft* software visualization system. He has published over 25 refereed

research papers, holds four software patents, and is currently a member of a National Academy of Sciences Panel on Software Engineering.

Ronald Pickett is a cognitive psychologist with extensive experience in research on the visual analysis of complex optical images. He has conducted basic and applied research on visual texture perception and has worked for many years on the evaluation and enhancement of visual image analysis, principally in areas of image-based medical diagnosis. Dr. Pickett is the co-author of a leading text on methods for the evaluation of diagnostic systems. He is a Professor of Psychology at the University of Massachusetts Lowell and has been working closely for several year with colleagues in the Computer Science Department to bring his knowledge of visual perception and image processing to bear on the development of systems for the visualization of scientific data. He is a founding member of the University's Institute for Visualization and Perception Research.

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