Perception for visualization: From design to evaluation

Course instructor
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Length
Full day

Level
Intermediate

Goals
To understand perception and its implications on visualization, from front-end design to final efficacy evaluation.

Abstract
What is the smallest sample I can show that will be perceived? What is the smallest sample I can show that will be perceived in color? Can I afford using image compression? If yes, how much and what kind? Should I use a grayscale or another color scale? How many gray levels do I absolutely need? What color scale should I use? How many bits for color do I need to have? Should I use 3D, stereo, texture, motion? If so what kinds? and Has my visualization been successful meeting its goals and needs?

If you have ever designed a visualization, you probably have asked yourself (perhaps others) some of these questions; at least you should have.

Since visualization “consumers” are humans, the answers to these questions can only come from a thorough analysis and understanding of human perceptual capabilities and limitations, combined with the visualization's goals and needs.

This tutorial will teach you the basics of human perception and how to utilize them in the complete process of visualization: from design to evaluation.

Who should attend?
Anyone engaged in the design, implementation, and evaluation of visualizations.
What will you gain?
Understanding of the complete process of visualization, from design to evaluation, and how to incorporate perception into the process to maximize the visualizations impact and results.

Course Organizer and Instructor
Haim Levkowitz is an Associate Professor of Computer Science and Co-Director of the Institute for Visualization and Perception Research at the University of Massachusetts Lowell, in Lowell, MA. Since 1982, he has been studying the mathematical and computer science aspects of multidimensional, multiparametric imaging and visualization. Since 1985, his research efforts have concentrated on the development of methods for multiparametric representation and presentation of information. He has developed new color methods for computer graphics representation of parameter distributions. 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 has published and presented extensively on color and texture in graphics and visualization, and has taught many tutorials on perception and visualization.

Contents and Schedule

Introduction (30 Minutes)
  Motivation and goals
  Outline

The human visual system (1 hour)
  Physical stimulus and perceptual response
  Anatomy of the eye
  Accommodation
  Eye and brain
  Basic vision: fundamental visual functions
    Scotopic and photopic vision
    Adaptation
    Limits
    Acuity
    Eye movements
  Color vision and perception
    Color matching
    Color mixture
    Color perception and modeling
    Color deficiencies

Perception: Selected topics (1 hour)
  Form and shape perception
  Space and depth perception
  Texture
  Motion perception
  Sound perception

Cognitive issues in visual perception (1 hour)
  Illusions (geometrical and otherwise)
  Perceptual grouping
  Feature extraction and texture segmentation
  Visual attention

From theory to implementation
  Human perception and image generation and understanding (1 hour)
  Evaluation (1 hour)
    Is it really necessary?
    Study design
    Study execution
    Analysis and interpretation
    Example/case study

Discussion, questions, examples, and demonstrations (30 minutes)
Bibliography