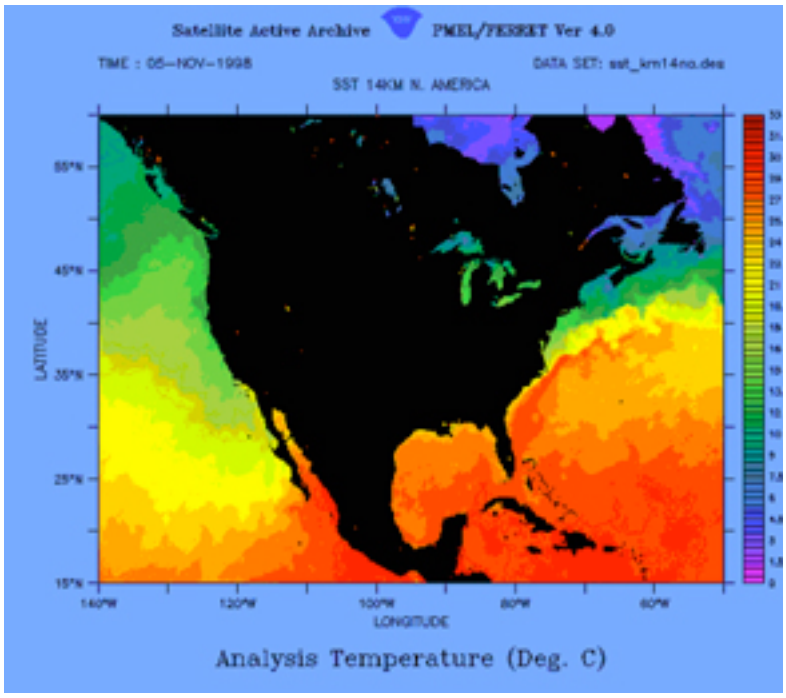

UNIT 1 Communications Technology: Introduction to Visualization

Unit Overview

I. Introduction

Every day graphics are being used to guide decision-making. These decisions may concern interpreting the results of basic research studies in high-energy physics, developing an understanding of trends in global warming, the structural safety of a new bridge design, or identification of potentially hostile aircraft during war. In all of these cases, graphics are being used to communicate information to one or more people who are attempting to solve problems. These problems may be ones that concern the immediate safety of people or it may be issues that can affect the quality of our life 100 years from now.

This unit introduces students to how graphics can be used as a tool to communicate technical and scientific information. In doing so, this unit shows how the design process can be applied to creation of graphics used to communicate data-driven information (e.g., charts and graphs) or conceptual information about technological and scientific systems. This unit focuses on the design and creation of two-dimensional (2D) graphics while another unit will focus on three-dimensional (3D) graphics.

Why not just use words or numbers to communicate this information? Words and numbers are powerful ways of communicating. However, they are not the optimal method of communicating all types of information. Especially in cases where individuals are being asked to synthesize large amounts of data and to understand trends or identify unusual conditions, graphics can be a powerful tool. As powerful as graphics can be, they are a language and have to be crafted in the same way that words needs to be constructed into sentences and paragraphs. This unit will introduce you to how problem-solving heuristics can be applied to the design of graphics to communicate technical and scientific information. Later activities will apply these tools to the communication of

different areas of technology. Let's start this unit by looking at an example from business and manufacturing.

You work for a biotechnology firm manufacturing pharmaceutical compounds used in a revolutionary new class of cancer-fighting drugs. Demand is so high that your company needs to expand its operations. Building a new facility offers the possibility of greatly expanding your production capacity. However, it could also sink your young company if you end up not being able turn a profit on your new facility. The bottom line: a lot rests on making the right decisions concerning this new manufacturing facility. Part of the decision-making process is determining where to locate the plant. Factors such as the quality of the labor force, transportation of raw materials and finished product, and the climactic conditions all come into play in making this decision.

What role does climactic conditions play? Weather will impact the efficiency and effectiveness of transportation systems. How often is the weather extreme enough that workers can't drive their cars to work or shipments of raw material can't make it to the plant? Maybe a bigger long-term factor is going to be how much is it going to cost to heat or cool your facility? If you are engaged in bioprocess manufacturing, temperature control of your facility is critical not only for the comfort of your workers, but for management of your manufacturing processes. These heating and cooling costs may be a key factor in determining your overall cost of operations of your new facility. In this unit, you will look at how graphic visualization technology might be used to help make these crucial decisions. You will also be introduced to a problem-solving method that can be used to help decide on optimal graphic designs.

II. Unit Learning Goals

- You will develop an understanding of the historical perspective of graphics as a communications technology.
- You will learn about a design process for graphic communication of technical and scientific information.
- You will develop an awareness of both inadvertent and purposeful misrepresentation of information with graphics.

III. Unit Connections to ITEA's Standards for Technological Literacy

This unit is centered on Information and Communication Technologies of the Designed World, Standard 17. The following matrix identifies the Standards for Technological Literacy that are addressed by the projects within the unit. Project extensions and advanced level projects may cover additional standards.

Unit 1	Communications Technology: Introduction to Visualization																			
Target Standards for Technological Literacy																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Introductory Level Projects																				
Project 1-Interpreting graphics		X	X	X		X	X	X			X									
Project 2-Graphing max and min temperatures											X	X				X	X		X	
Prroject 3-Data-driven graphics											X	X				X	X		X	
Project 4-Conceptual graphics											X	X								X
Intermediate Level Projects																				
Project 5-Animating insulation principles			X		X						X	X				X	X			
Project 6-Multimedia presentation of insulation properties			X		X						X	X				X	X			

IV. Navigating the Unit

This unit is meant to provide foundation experiences and support the use of all of the other units. In particular, this unit supports 2D graphical techniques and a basic overview of animation. You should complete this unit at least through the introductory level before you teach any of the other units.

You can complete the historical overview and misrepresentation of graphics (Project 1) at any time within either the Introductory or Intermediate level. Project 1 does, however, provide a nice warm-up to the remaining Introductory level activities. Also, cover and regularly refer to the introduction to visualization design when you complete the remaining projects.

Projects 2 and 3 form a pair of projects focused on data-driven visualizations. Depending on the level of your students, you can move through Project 2 rapidly and focus on Project 3. Conversely, you can focus on Project 2, skip Project 3, and move on to Project 4. Project 4 covers concept-driven visualizations and should be covered.

However, you can expand or contract this activity by having students create more or fewer design variations.

The Intermediate level projects focuses on 2D animation techniques to represent change over time. You may skip this level and return to it at a later time if you desire to focus exclusively on 2D static graphics for a time. If you plan on moving into 3D animation techniques, it would be best to at least review the material in this level and complete the 3D introductory unit before attempting projects using 3D animation.

V. Projects

Introductory Projects

Project 1: Interpreting Graphics

This project will provide students with the opportunity to explore how graphics are currently being used to convey technical and scientific information. It also allows students to rehearse the analytic process of decomposing graphics into their component parts and identifying the role of each component. This analytic process also allows students to critique the effectiveness of the graphics and how they might be redesigned. Through teacher-led activities, students will also be exposed to how graphic communication has evolved, its current practice, and its societal implications.

Project 2: Data-Driven Graphics—Graphing Maximum and Minimum Temperatures

In this project, students will create data-driven visualizations (line graphs and bar charts) using climatic data. These visualizations compare and contrast the climatic conditions in three different parts of the country. This information visualization is designed to help make decisions concerning the heating and cooling costs in different parts of the country. Students will create these visualizations by transforming numeric data found on the Web—interpreting how the data is organized into variables, and creating different types of data-driven charts and graphs that serve different communication needs.

Project 3: Data Driven Graphics—Graphing Degree-Day Data

In this project, students will create data-driven visualizations (line graphs and bar charts) using climatic data. These visualizations build on the work done in Project 2 of this unit by creating charts and graphs that can be used to compare the heating and cooling costs in three different parts of the country. Students will create these visualizations by transforming numeric data found on the Web—interpreting how the data is organized into variables and creating different types of data-driven charts and graphs that serve different communication needs.

Project 4: Conceptual Graphics—The Value of Insulation

In this project, students will create a static, 2D concept-driven visualization about how building insulation works. This will involve exploring different ways of representing the key conceptual elements of the visualization.

Intermediate Projects

Project 5: Animating Insulation Principles

Students will create a 2D animation of how insulation retards the flow of heat energy. Starting with the 2D static graphics created as part of the introductory level, they will represent the changes in the insulation system over time using 2D animation techniques.

Project 6: Multimedia Presentation of Insulation Properties

Students will build on the animation created in Project 5 by demonstrating the heating costs related to different levels of insulation. These animations will explore alternate ways of representing the flow of heat across the insulation barrier. In addition, these animations will be merged with graphs showing how insulation values and the difference in inside and outside temperatures translate into cost to heat a space.

Advanced Projects

Students will complete an independent project through the use of visualization tools by researching a new topic dealing with insulation technology, climatic data, or by expanding on topics covered in this unit. The objective of the advanced level is for students to further their skills in integrating research, problem solving through the design brief approach, and presentation. It is up to the teacher to work with students to negotiate the topic, time allocated to the project, and design constraints.

VI. Unit Resources

The Resource index document contains a listing of all resources associated with the Unit. Included are relevant web site links, books and other publications. Listed in the document are additional files found in the Resources folder under each Unit folder on the CD-ROM. Also included are the Glossary, Evaluation rubric, Lecture PowerPoint slides, and Unit test questions.