Integrating Interactive Graphics Techniques with Future Technologies

Chair
Theresa Marie Rhyne, Lockheed Martin / U.S. EPA Scientific Visualization Center

Panelists
Eric Gidney, College of Fine Arts/University of New South Wales, Australia
Tomasz Imielinski, Rutgers University
Pattie Maes, MIT Media Laboratory
Ronald Vetter, North Dakota State University

This panel examines the need to integrate computer graphics techniques with other methodologies and technologies such as mobile and wireless personal assistants, intelligent agents, cartography, human perception, voice recognition, interactive television, cooperative computing, and high speed networking. The need to develop new interfaces and displays which reflect the social changes associated with the way people will interact with integrated computer systems and the information highway is addressed.

Theresa Marie Rhyne: Cartography, Visualization, & Decision Support

Interactive computer graphics techniques are just one component of integrated decision support systems. For comprehensive interpretation of geographically referenced data, visualization environments need to be merged with large remotely distributed and networked spatial data bases. Three dimensional isosurface and volume rendered images must be referenced against cartographic, statistical and plotting displays for effective interpretation of scientific results. The requirements of research, policy analysis, and science education are not necessarily the same. Therefore, user interfaces need to be flexible in their design to support these different viewpoints and interpretations of data. Decision making is rarely done in a vacuum but rather is a collaborative process. To support these collaborative efforts, interactive computer graphics techniques will need to merge with multi-media tools for desktop and wireless videoconferencing, cooperative computing technologies, mobile ways for collecting and accessing data, and high speed networking.

A geographic decision support system which is comprehensively integrated will alter the perceptual thinking of individuals and communities. This will result in differing interpretations of information and the need to build computing tools which visually display these discerning viewpoints and the paths taken for arriving at the results.

Tomasz Imielinski: The Challenge — User Interfaces for Mobile Users

Palmtops such as the Newton or HP 100LX are equipped with very small screens. Keyboards with these machines will likely be of little use. This requires a new approach to user interface design. There will be a growing role for pens and speech recognition. Additionally a few companies are exploring "magnifying technology." This allows the user to magnify the size of the screen with little effect on resolution through some form of headmounted display. Voice activated input will be very useful in the car, while less likely in public places where visual interfaces will still remain dominant.

What is the nature of applications which will be run on palmtop computers? Many such applications will be location dependent and deal with the area immediately surrounding the user such as a local supermarket (shopping), restaurant and movie theater (entertainment), and local yellow pages (business). Thus, we define the metaphor of a map centric interface. At any location, the user sees a local map, as a background on his mobile computer screen. This display plays the role of a "magnified eye" which sees further than the real eye and provides labels and interpretations of "whats around." Additionally, the interface will allow rotation and repositioning of images on the screen to reflect the current location of the user. A user standing in front of a building will readjust the mobile computer image to his own unique position, This feature will use information positioning devices such as global positioning systems (GPS).

Summarizing: new hardware restrictions and developments as well as new applications call for revolutionary approaches to user interfaces on small battery powered terminals. Due to battery power limitations and bandwidth restrictions, especially outdoors, CPU intensive visual interfaces will have to be ruled out. There is a need for new solutions, which are attractive to the naive users, while not overly resource consuming.

Ronald Vetter: High Speed Networking

Recent advances in communication networks, computer hardware, software, and visualization are generating interest in the cross- fertilization of application areas . Interaction with massive amounts of three dimensional images, generated in real-time, requires communication networks with high data rates and low latency. The sheer volume of data that must be transmitted in these short periods of time requires networks running at multimegabit speeds. The deployment of high speed networks will allow the integration of computer-generated and real-world imagery to finally reach the desktop.

An example of this kind of interaction is exemplified by an application called TerraVision. In TerraVision, the integration of remote databases, including massive amounts of heterogeneous data (e.g., aerial photography, satellite imagery, digital elevation models) on mass-storage systems, and temporal data from a real-time global positioning satellite system were transmitted over a high speed network. This enabled a U.S. Army commander to "drive through" and "see the battlefield" from a remote workstation. Global positioning sensors were used to track vehicles which were then integrated as 3-D objects in real-time into the terrain image display. TerraVision was developed over a wide-area, switched asynchronous transfer mode (ATM) network of supercomputer systems, gigabit LANs, graphics workstations, mass storage systems, and multimedia facilities.

The impact of network and display technology is also seen by the rapid growth of graphical-based browsing tools on the Internet. NCSA Mosaic type browsers allow wide-area distrib-

uted asynchronous collaboration and hypermedia-based information discovery and retrieval. One concern users have with existing Internet browser tools involves the overwhelming number of possible links (choices) to select from. It is also difficult to recall where a particular piece of information is located. In the future, intelligent interface agents will be able to learn particular interests, habits, and preferences of individual users and help them obtain information when they need it. This will add much more flexibility to many of today's closed hypermedia- based systems.

Eric Gidney - Collaboration in Media & Design Pre-Production

Real-time communications presents a different, more urgent and more sociable paradigm then the human-computer interaction we normally associate with computing. Asynchronous collaboration does not provide the benefits of rapid contextualisation and decision- making that are achievable in real time.

Distributed work environments are now common, but the technology of sharing favourite applications in real time is not readily accessible. Companies need to be able to integrate application sharing into their current work and social contexts. This includes requirements for mobile computing, which may impose constraints on what can be shared.

Media and design companies that work visually need to share images over distance in real time. However, they will have to rationalise bandwidth utilisation versus cost. It may be better, for example, to provide good, fast shared graphics rather than poor videoconferencing.

Pattie Maes: Intelligent Agents & Personal Assistants

Computers are becoming the vehicle for an increasing range of everyday activities. Acquisition of news, information, and mail, as well as social interactions and entertainment, are becoming more computer-based. Simultaneously, more untrained users are interacting with computers. This number will rise as technologies like hand-held computers and interactive TV increase in popularity. Unfortunately, these technological developments are not going hand in hand with changes in the way people interact with computers. The currently dominant interaction metaphor of direct manipulation requires the user to initiate all tasks explicitly and to monitor all events. This metaphor will need to change if untrained users are to make effective use of the computers and networks of tomorrow.

Techniques from the field of Artificial Intelligence, in particular "autonomous agents," can be used to implement a complementary style of interaction. Instead of user-initiated interaction via commands and/or direct manipulation, the user is engaged in a cooperative process in which human and computer agents both initiate communication, monitor events and perform tasks. The metaphor used is that of a "personal assistant" who is collaborating with the user in the same work environment. The assistant becomes gradually more effective as it learns the user's interests, habits and preferences (as well as those of his or her community). Notice that the agent is not necessarily an interface between the computer and the user. In fact, the most successful software agents are those that do not prohibit the user from taking actions and fulfilling tasks personally.

The premise of the talk is that the ideal interface for agent-human collaboration consists of a virtual graphical world in which the agents are depicted as life-like computer characters. I will demonstrate such a system, called ALIVE, which allows a user and an agent (or agents) to co-inhabit a semi-real, semi-virtual 3D environment. In contrast with traditional virtual reality systems (goggles and gloves systems), the ALIVE system allows wireless, full-body interaction. We use a single CCD camera to obtain a color image of a person, which we composite into a 3D graphical world. The resulting image is projected onto a large screen which faces the user and acts as a type of "magic mirror": the user sees herself surrounded by objects and agents (real as well as virtual ones). Computer vision techniques are used to extract information about the person, such as her 3D location, the position of various body parts as well as simple gestures performed. In addition, simple audio and speech processing allows the user to complement the communication with verbal and sound- based cues. Because of the presence of agents, the system does more than the obvious direct-manipulation style of interaction. It provides for a powerful, indirect style of interaction in which gestures can have more complex meanings, which may vary according to the situation the agents and user find themselves in.

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