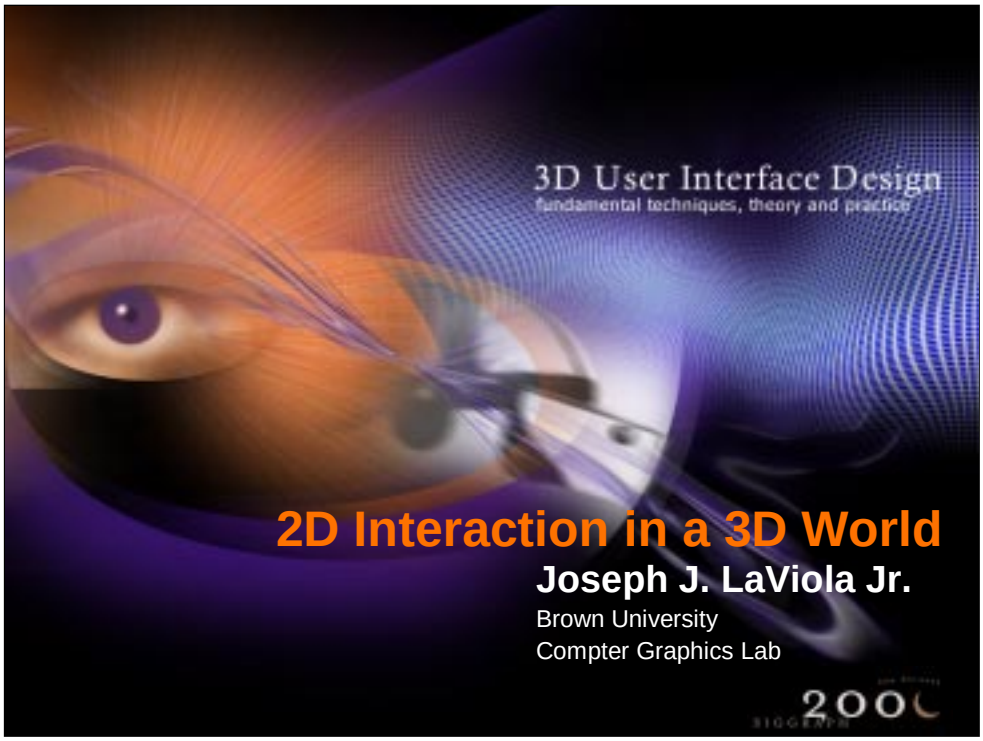

2D Interaction in a 3D World

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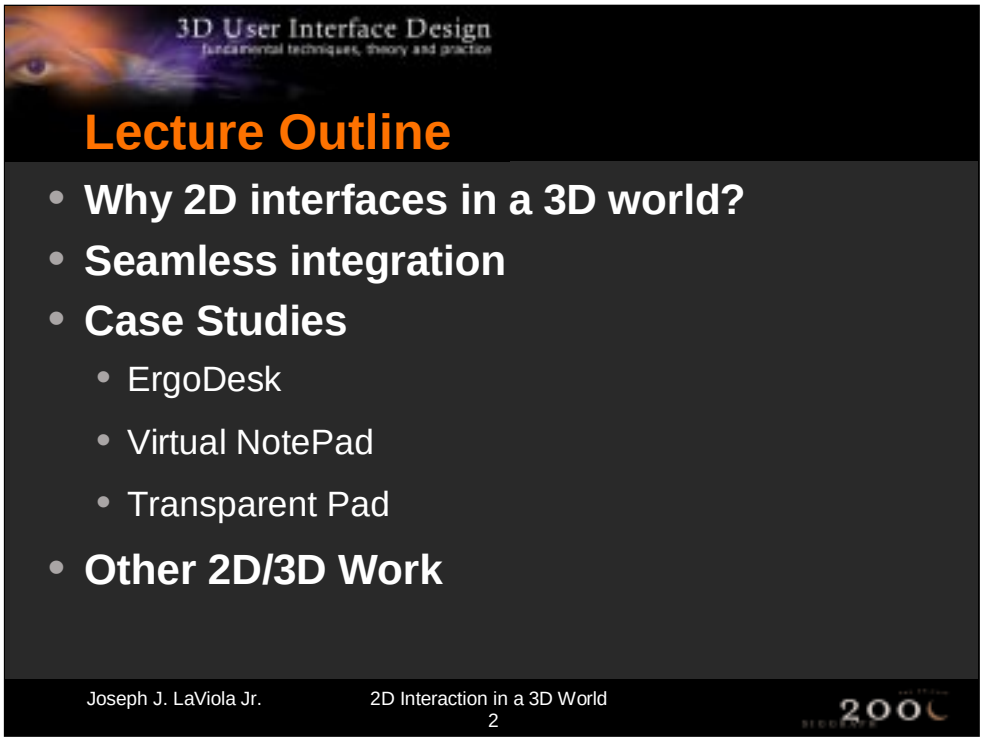
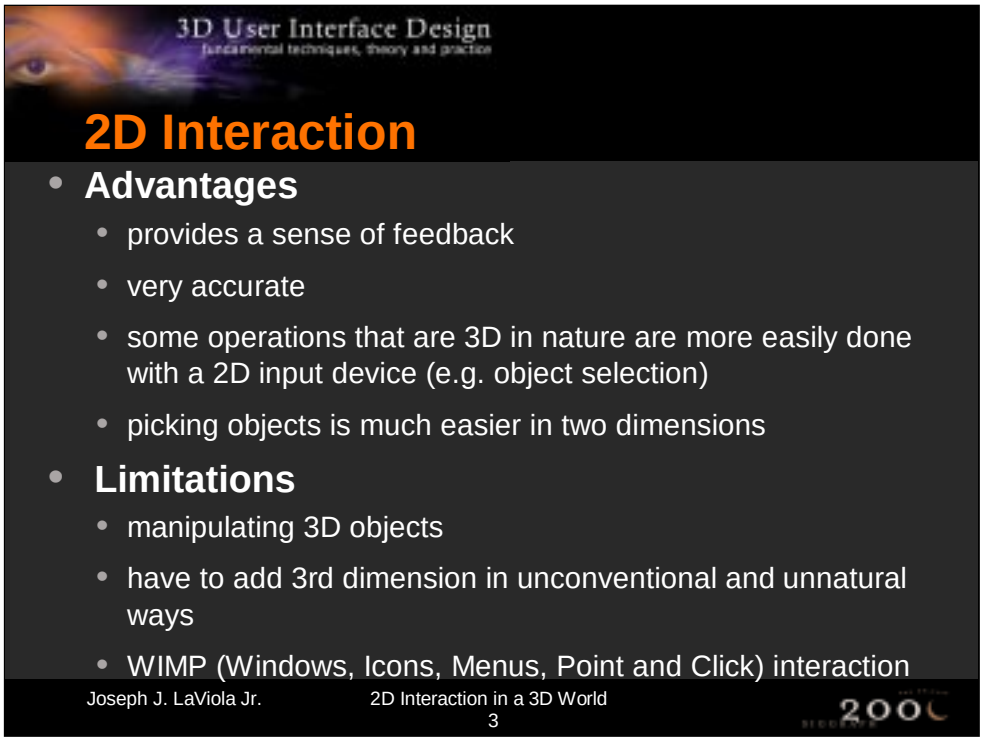
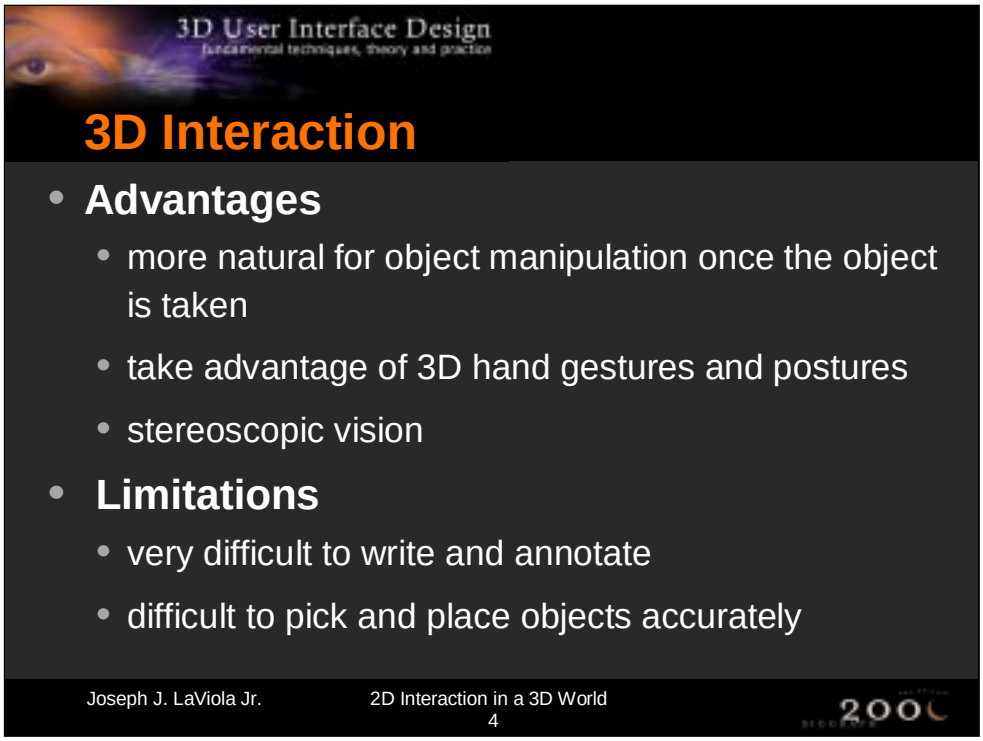


In this lecture, we will discuss how and when 2D interfaces can be used in 3D applications.



2D interaction techniques have both advantages and disadvantages as shown in the slide.



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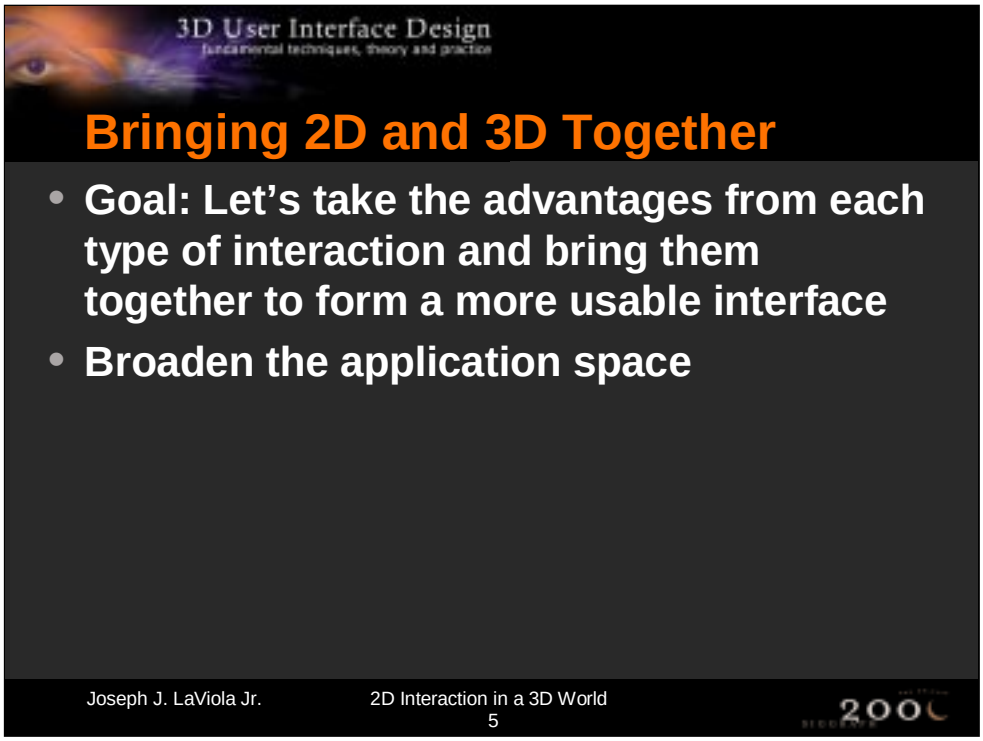
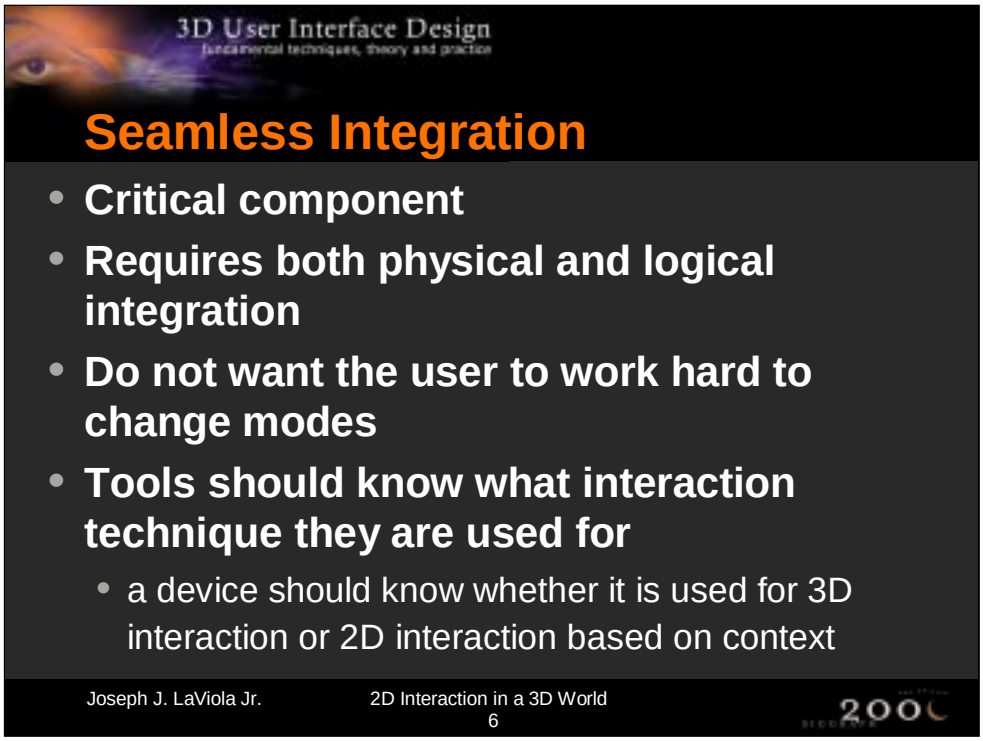


By taking advantage of the benefits of both 2D and 3D interaction techniques and metaphors, we can create interfaces for 3D applications that are easier to use and more intuitive for the user. The key research issue is how to combine these two input styles in a seamless manner and to determine whether a particular task is better suited for either 2D or 3D interaction so we can maximize user performance.



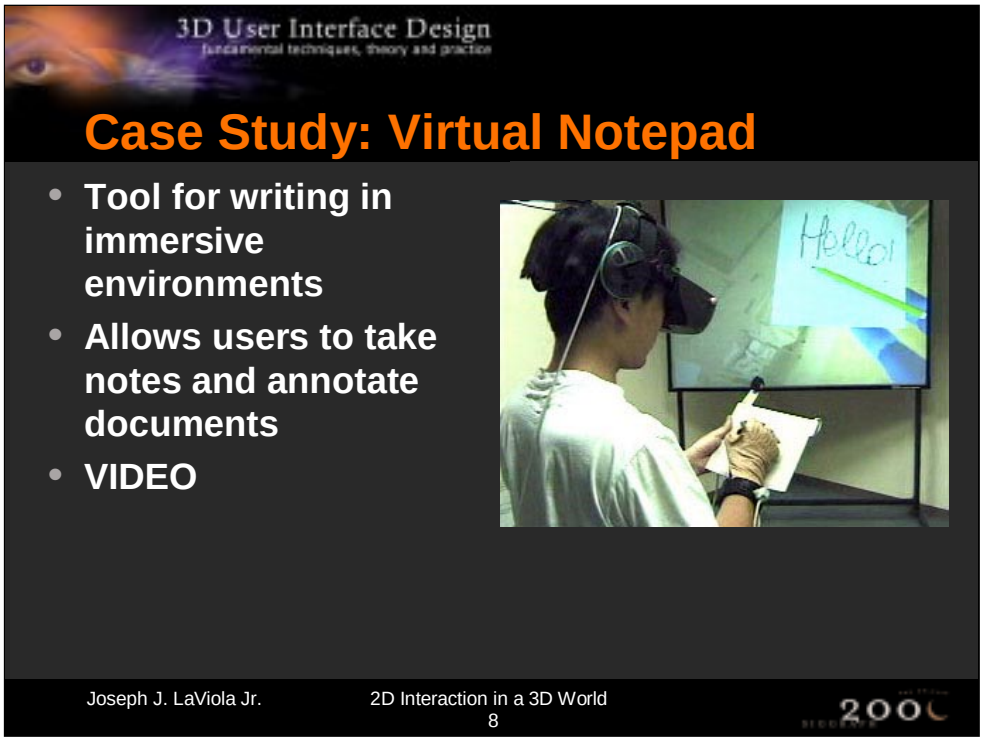
The seamless integration of the 2D and 3D interface techniques in a 3D application is a critical design consideration from both a logical and a physical perspective. Physical integration is important because we do not want to make it difficult for the user to switch between 2D and 3D devices. Logical integration is also important because we want the devices used in the application to know whether they are used for either 2D or 3D interaction. This knowledge helps to reduce the user's cognitive load.

ErgoDesk in a example of a 2D/3D interface where the user interacts in 2D directly on the display surface. The 2D component of the ErgoDesk application is based on the Sketch conceptual modeling system which uses only a three button stylus (no menus or 2D interface widgets are used). Sketch interprets lines drawn by the user on the image plane of a 3D view as operations and parameters. These operations include primitive creation, primitive manipulation, and camera manipulation. Gestures that create primitives provide enough information to select which primitive to create, its dimensions and its place in 3D. Creating a cube, for example, requires the user to draw 3 gesture lines one for each of the principle axes, each line meeting at a single point. The cube is generated with it's length, width, and height corresponding to the three gesture lines and its place in 3D based on the intersection point. Primitives such as cylinders, cones, pyramids, and extrusions can also be instantiated. The primitive manipulation interface allows for automatic object constraint by gesturally drawing a motion constraint over the object before manipulating it. For example, to constrain an object's movement to a given axis, a straight line is drawn indicating what axis to constrain the object to, and when the user moves the object it will only move along that axis. Other gestures constrain objects to move along surfaces, rotate around a given principle axis, or scale and deform to fit a new gesture contour.

References:

Forsberg, A., LaViola J., and Zeleznik, R. "ErgoDesk: A Framework For Two and Three Dimensional Interaction at the ActiveDesk." In the Proceedings of the Second International Immersive Projection Technology Workshop, Ames, Iowa, May 11-12, 1998.

Zeleznik, R.C., Herndon, K., Hughes, J. (1996) "Sketch: An Interface for Sketching 3D Scenes." Proceedings of SIGGRAPH'96, 163-170.



The Virtual Notepad is an example of a 2D/3D interface where users cannot physically see the 2D device since they are wearing an HMD. The 2D device is tracked so a graphical representation of it is present in the virtual environment.

References:

Poupyrev, I., Tomokazu, N., Weghorst, S., “Virtual Notepad: Handwriting in Immersive VR”. IEEE VRAIS'98, 126-132, 1998.

The Transparent Pad is an example of a 2D/3D interface where a transparent prop is used for 2D interaction. The pad is tracked and graphics are projected on the primary display but appear as if they are on the surface and even above the pad.

References:

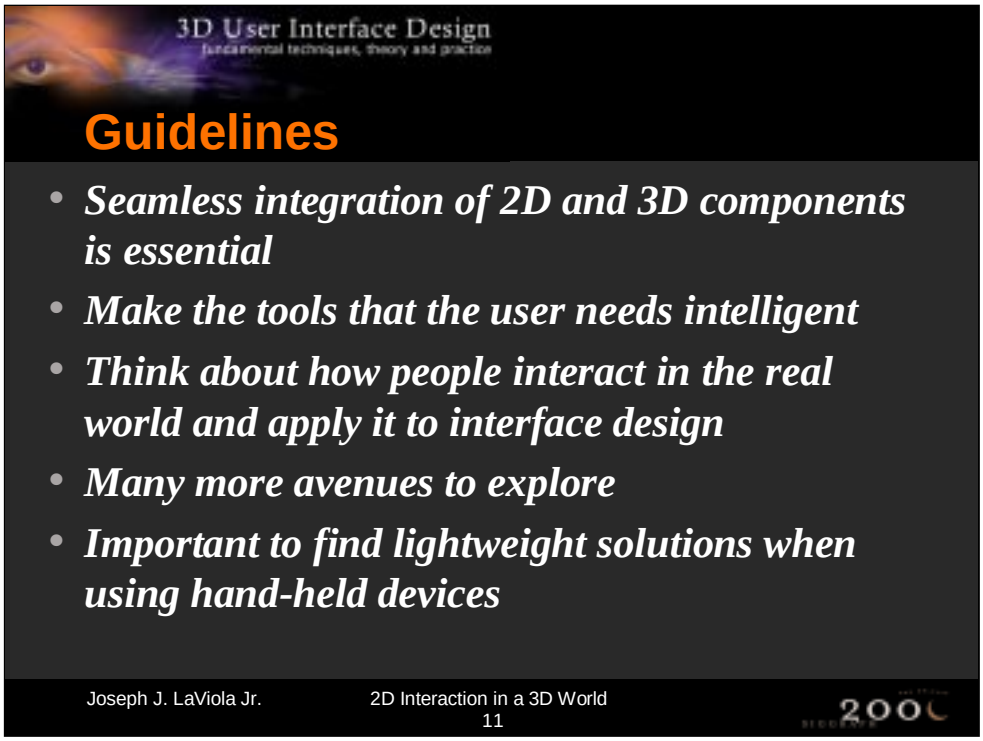
Schmalsteig, Dieter, L. Miguel Encarcacao, Zsolt Szalavari. “Using Transparent Props For Interaction with The Virtual Table.”, In Proceedings of the 1999 ACM Symposium on Interactive 3D Graphics, 147-154, 1999.

This slide shows other work that has been done with 2D/3D interfaces.

References:

Watsen, Kent, Rudy Darken, and Michael Capps. "A Handheld Computer as an Interaction Device to a Virtual Environment." Proceedings of the Immersive Projection Technology Workshop, Stuttgart, Germany, May 1999.

Coquillart, S. and G. Wesche. "The Virtual Palette and the Virtual Remote Control Panel: A Device and Interaction Paradigm for the Responsive Workbench." IEEE VR'99, 213-217, 1999.


3D User Interface Design
fundamental techniques, theory and practice
Guidelines
Seamless integration of 2D and 3D components is essential
Make the tools that the user needs intelligent
Think about how people interact in the real world and apply it to interface design
Many more avenues to explore
Important to find lightweight solutions when using hand-held devices
Joseph J. LaViola Jr.
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2006