

StereoVista

Concept for an Intuitive Interaction and Navigation System as Open Source Reference Implementation



Abstract

Despite impressive progress in 3D visualization software, most leading industry solutions still lack a unified and intuitive navigation system. Users often encounter fragmented interaction paradigms where camera controls, cursor behavior, and stereo adjustments operate inconsistently. This leads to irritation, breaks immersion, and slows down workflows - especially when working with stereo visualization, where depth perception and precision are critical. StereoVista addresses these limitations by introducing three tightly integrated modules:

- (1) an Advanced Camera Navigation System with distance-aware sensitivity and physics-based interaction, scalable to any scene size
- (2) Comprehensive 3D Cursor Framework with multiple cursor types, adaptive scaling, and modular backend
- (3) Seamless 6DOF Input Support ensuring continuous interaction across devices and dimensions.

By combining these elements with adaptive stereo rendering, StereoVista establishes a coherent interaction model that eliminates friction and enables an immersive, hassle-free stereo experience. In addition, StereoVista will be extended to be usable with external tracking input such as ART IR-Tracking combined with a Flystick, enabling immersive work in front of a Powerwall. As a further development path, distributed rendering for CAVE environments will be supported as well.

Introduction

Although rendering and data processing in 3D visualization have advanced considerably, the interaction layer in many professional tools remains fragmented. Camera controls, cursor usage, and stereo adjustments are often designed independently, producing inconsistent behaviors that frustrate users. In stereo contexts this fragmentation becomes especially problematic, as even small mismatches in navigation logic break immersion and reduce the usefulness of stereo visualization. StereoVista proposes a unified solution. It serves not only as a demonstration of advanced interaction concepts, but also as an open-source reference implementation that other programs can adopt. By combining navigation, cursor, and stereo modules into one consistent system, StereoVista shows how stereo workflows can be intuitive, precise, and transferable.

Advanced Camera Navigation System

StereoVista integrates orbiting, panning, free-look, and 6DOF movement into a coherent model. Orbiting can be performed around the viewport center, around the cursor, or by centering on the cursor before orbiting. Physicsbased scrolling introduces smooth acceleration, momentum carry-over, adaptive speed scaling with respect to object distance, and zoom-to-cursor functionality. Unlike industry-standard tools that separate input systems, StereoVista unifies them: mouse input, multi-device setups, and 6DOF controllers—such as the 3Dconnexion SpaceMouse—share the same logic, eliminating inconsistencies and preserving camera state across devices.

Comprehensive 3D Cursor Framework

A central element of StereoVista is its extensible cursor system, designed to unify how users point, select, and measure in 3D. It supports sphere, fragment, and plane cursors, each with depth-aware scaling options. The framework includes fixed-size, depth-aware fixed-size, and smart depth-scaling modes, ensuring consistent perception across scene scales. Configuration presets and modular backend design make this framework portable. Other programs can adopt the system directly, enabling a consistent cursor interaction model across visualization platforms.

Stereo Rendering and 6DOF Integration

StereoVista employs asymmetric frustum stereo rendering with adaptive convergence. The focus plane adjusts dynamically to object distances, reducing eye strain while maintaining precision. Real-time visualization of frustums and convergence planes further enhances transparency and usability. 6DOF input is fully integrated: switching between devices such as a mouse and the 3Dconnexion SpaceMouse preserves navigation continuity. This closes the gap between traditional input paradigms and immersive stereo control.

Conclusion

StereoVista demonstrates that a coherent interaction model is essential for effective stereo visualization. By unifying advanced camera navigation, an extensible cursor framework, and adaptive stereo rendering, it provides a consistent and intuitive workflow that avoids the frustrations of current fragmented solutions. As an open-source reference implementation, StereoVista goes beyond a single tool: it provides a transferable concept that other visualization systems can adopt. In doing so, it paves the way for a shared industry standard in stereo navigation and interaction.

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Further information and software download:

www.schneider-digital.com/stereovista-3d-mouse-cursor



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StereoVista functions & details

Abstract

StereoVista aims to provide a new industry standard for camera navigation and mouse interaction by combining three core concepts to create an immersive hassle-free stereo experience: (1) **Advanced Camera Navigation System** with distance-aware sensitivity suitable for any scene size; (2) **Comprehensive 3D Cursor Framework** with multiple cursor types, adaptive scaling and modular backend architecture; (3) **Seamless 6DOF Input Support** for continuous interaction across all dimensions and devices. Combining these three modules with adaptive depth-aware stereo, we create an intuitive 3D navigation system that automatically adjusts to scene content of every scale and complexity.

Camera & Orbiting Controls

Adaptive Navigation for Every Environment

Orbiting Modes:

- **Standard Orbit:** Rotates around viewport center at cursor depth
- **Around Cursor:** Rotate around cursor position without centering
- **Around Cursor (Center):** Centers view on cursor before orbiting

Different Navigation Modes

- **Panning:** Move on a 2D plane at the current camera position
- **Free-Look:** Look around with the camera without moving your position
- **Orbit around Point:** Rotate around the set pivot point
- **6DOF Movement:** used by the 3DConnexion Spacemouse around 6 axes with different pivot point options

Movement Processing & Input

Robust Input Handling with Advanced Smoothing and Adaptive Speed Scaling

Physics-Based Scrolling:

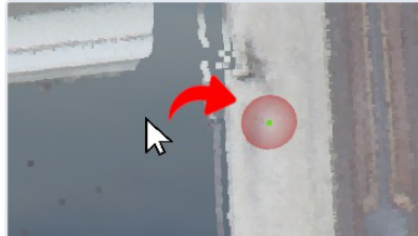
- Momentum system with configurable carry-over
- Adaptive speed scaling with distance to objects
- Smooth deceleration and mouse smoothing
- Zoom to cursor position

Advanced Input Processing:

- Distance-adaptive speed scaling based on scene bounds and object proximity
- Multi-device input support with state management between different cameras
- Momentum accumulation with configurable deceleration curves

3D Cursor System

Advanced Cursor Framework with Automatic Scaling and an Expandable Backend



Sphere Cursor

- 3D sphere with fixed or smart depth-based scaling modes
- Optional inner sphere with independent color and size factor
- Configurable edge softness and center transparency effects

Fragment Cursor

- Circular cursor rendered entirely in fragment shader on geometry
- Configurable outer/inner radius and border thickness
- Independent RGBA color control for outer and inner rings

Plane Cursor

- Camera-facing circular plane
- Adjustable diameter and RGBA color with transparency
- Automatic rotation matrix calculation for camera orientation

Cursor Scaling & Preset Management

Adaptive Scaling System with Configuration Management Cursor Scaling Modes:

- **Fixed Size:** Constant screen size independent of camera distance
- **Depth Aware Fixed Size:** Fixed world radius for maintaining depth perception
- **Depth-Based Smart Scaling:** Radius adjusted by distance factor with configurable min/max difference bounds

Settings and Preset Management System:

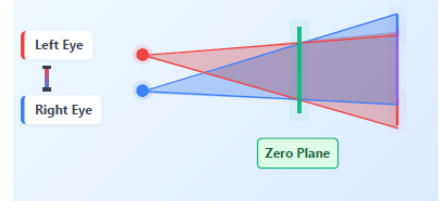
- **Customizability:** Every aspect of the cursor can be customized and combined with other cursor types
- **Configuration Loading:** One-click switching between saved cursor configurations with automatic preference loading on start

6DOF Input Handling

Extended Support for 6DOF Input Devices

- Seamless switching between 6DOF devices and normal input with camera state continuity
- Multiple modes for 6DOF navigation and integration of the 3D cursor
- All depth-aware sensitivity and controls features supported

Stereo Visualization & Controls



Stereo Visualization Features:

- Frustum visualization with zero plane and real-time scene cross-section
- Zero plane visualization showing convergence in 3D space
- Live parameter display for separation and convergence values in automatic mode

Additional Features

Extended Capabilities:

- Custom LOD-based point cloud rendering engine for real-time visualization of 500M+ points
- Voxel cone tracing with real-time scene voxelization supporting transparency, refractions, specular and indirect illumination (WIP)
- Hardware-accelerated shader-based path tracing (WIP)
- Preference manager for automatic settings loading
- Scene management with saving and loading of scenes
- Extended scene manipulation capabilities using the 3D cursor
- Clean and modern user-friendly GUI with in-depth customizability
- Comprehensive system with modular architecture for extensibility

Contact

Project Repository

github.com/Brum2409/StereoVista

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