Two-Handed Interaction

Based on previous work by the authors [5], this case study is centered around an interaction scheme that overloads a 6-DOF Space Navigator (3D Connexion, Inc) via:

1. **Context sensitivy:** Mouse position determines high-DOF input mapping

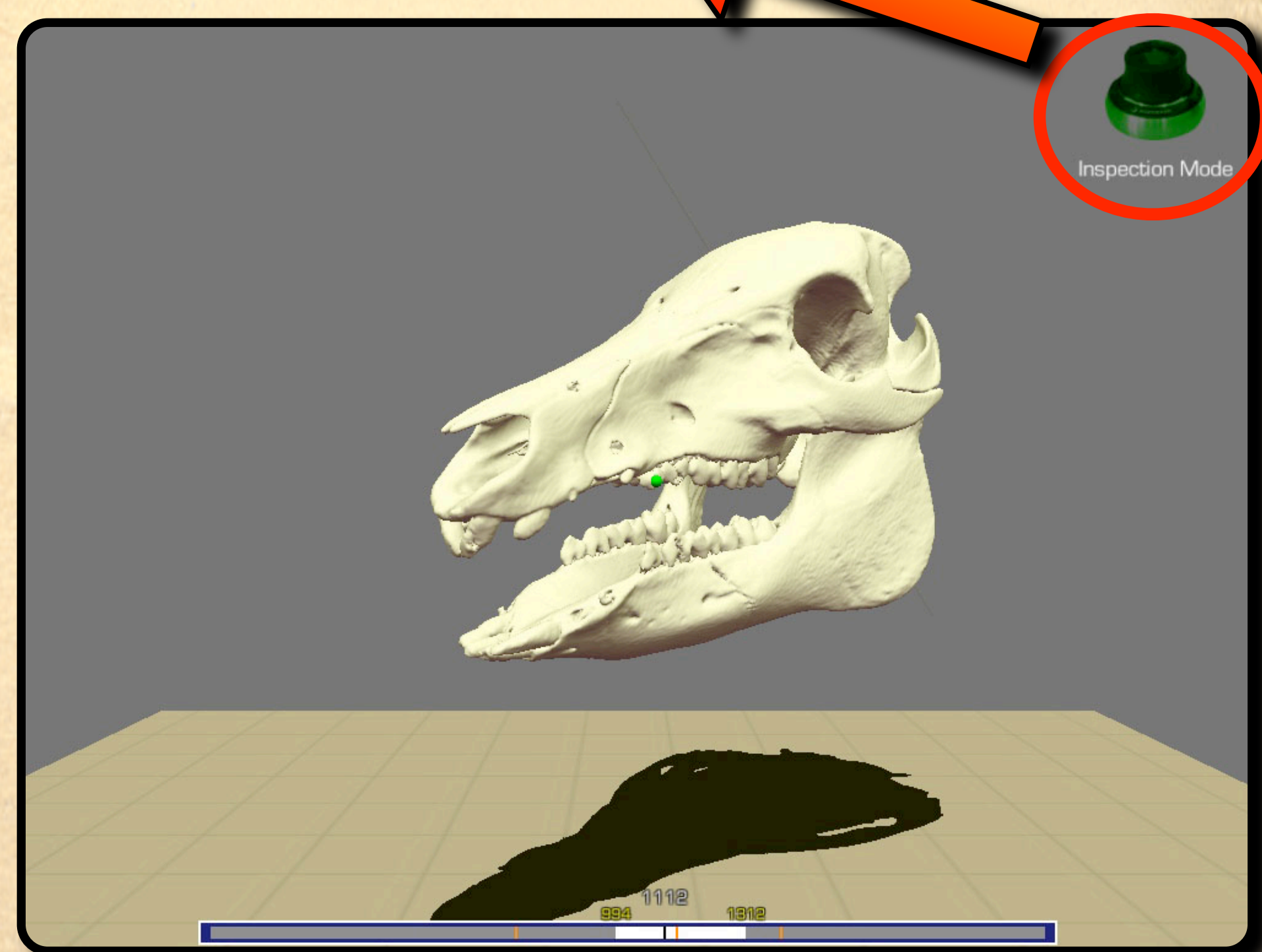2. **High-Dof Gestures:**

Pump: Twist:

Mode Switches

To make input mapping-switches transparent to the user:

- **Display color-coded HUD icons to indicate current input state.**
- **Animate icon to signify a switch.**

(ANIMATE ON SWITCH)

Inspection Mode

Observation Mode

Playback Mode

Inspection Mode

Two-Handed Visualization: Bimanual Interaction Techniques for Exploring Time-Varying 3D Data

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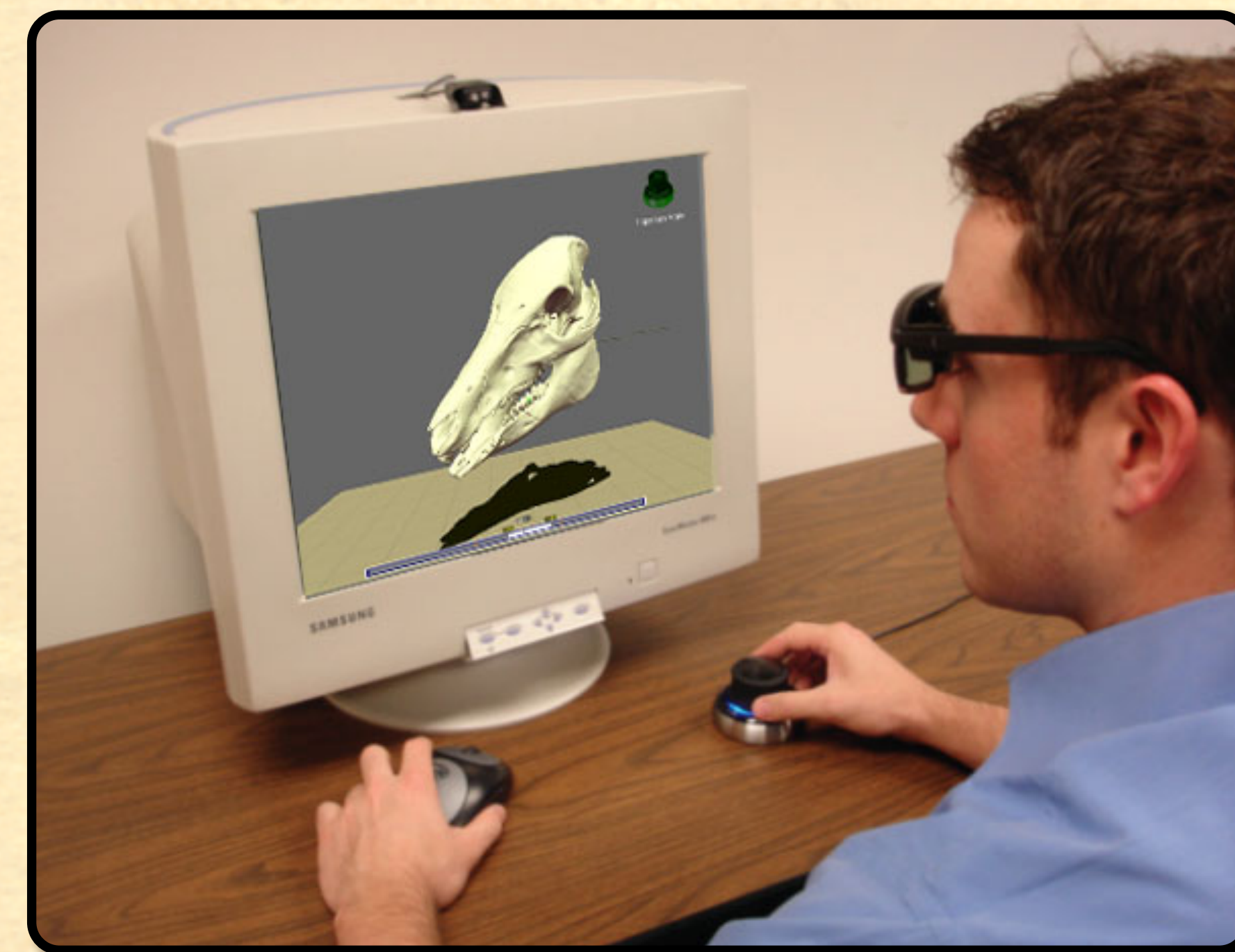
An example of a user navigating a time-varying 3D visualization of animal kinematics with bimanual techniques.

Interaction & Vis

In this demonstration, we examine a set of interaction design principles aimed toward increasing efficiency and usability in time-varying 3D scientific applications. Building on a two-handed input technique developed in [5], we propose two means of improvement: 1. to make mode-switches in the input mapping transparent to users without diverting their primary focus; and 2. to allow users the ability to revisit and replay their interactive explorations and share them with others.

With respect to the first aim, we employ perceptual and cognitive design principles explored in [6, 2] -- centered on motion perception -- within a heads-up display (HUD). By animating icons in the HUD to depict switches, we hypothesize that users will make use of their peripheral vision to detect changes in the input mapping without swaying their full attention.

Toward the second aim, we build on recent work in [3] to automatically generate and visualize editable interaction histories. History objects serve as landmarks throughout both the space and time of the visualization, and are stored in a tree-like, branching structure, supporting iterative exploration.

Conclusions

- **Motion perception can be exploited for conveying secondary information.**

- **Interaction histories:**
  - **Aid in 3D navigation and overall usability.**
  - **Support collaborative visualization and facilitate explanatory presentation.**
  - **Provide training data to "learn" suggested sequences of interaction.**

References:

[1] W. Buxton and B. Myers. A study in two-handed input. SIGCHI Bull.,17(4):321–326, 1986.
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[5] T. M. O'Brien, D. F. Keefe, and D. H. Laidlaw. A case study in using gestures and bimanual interaction to extend a high-dof input device. In SI3D '08: Proceedings of the 2008 symposium on Interactive 3D graphics and games, pages 1–1, New York, NY, USA, 2008. ACM.
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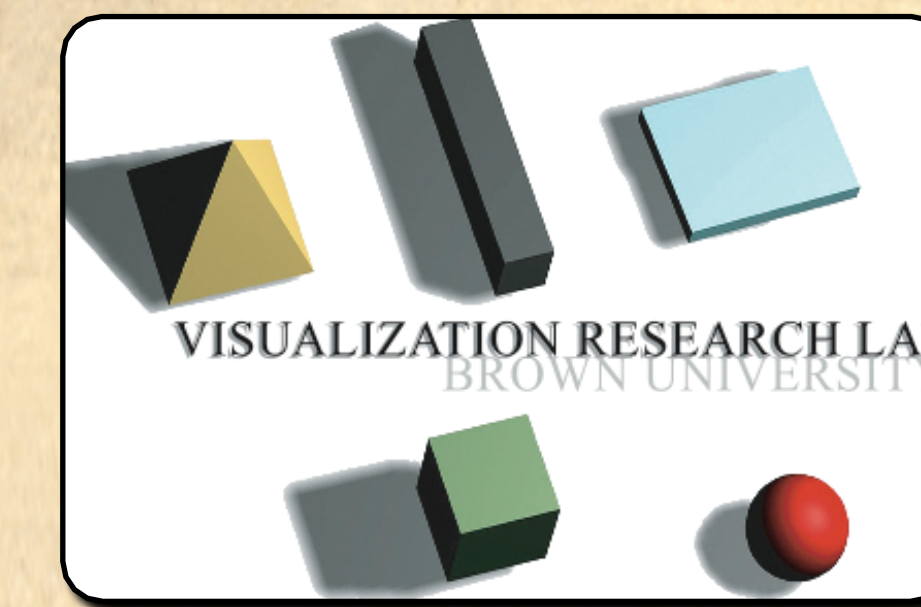
Interaction Histories
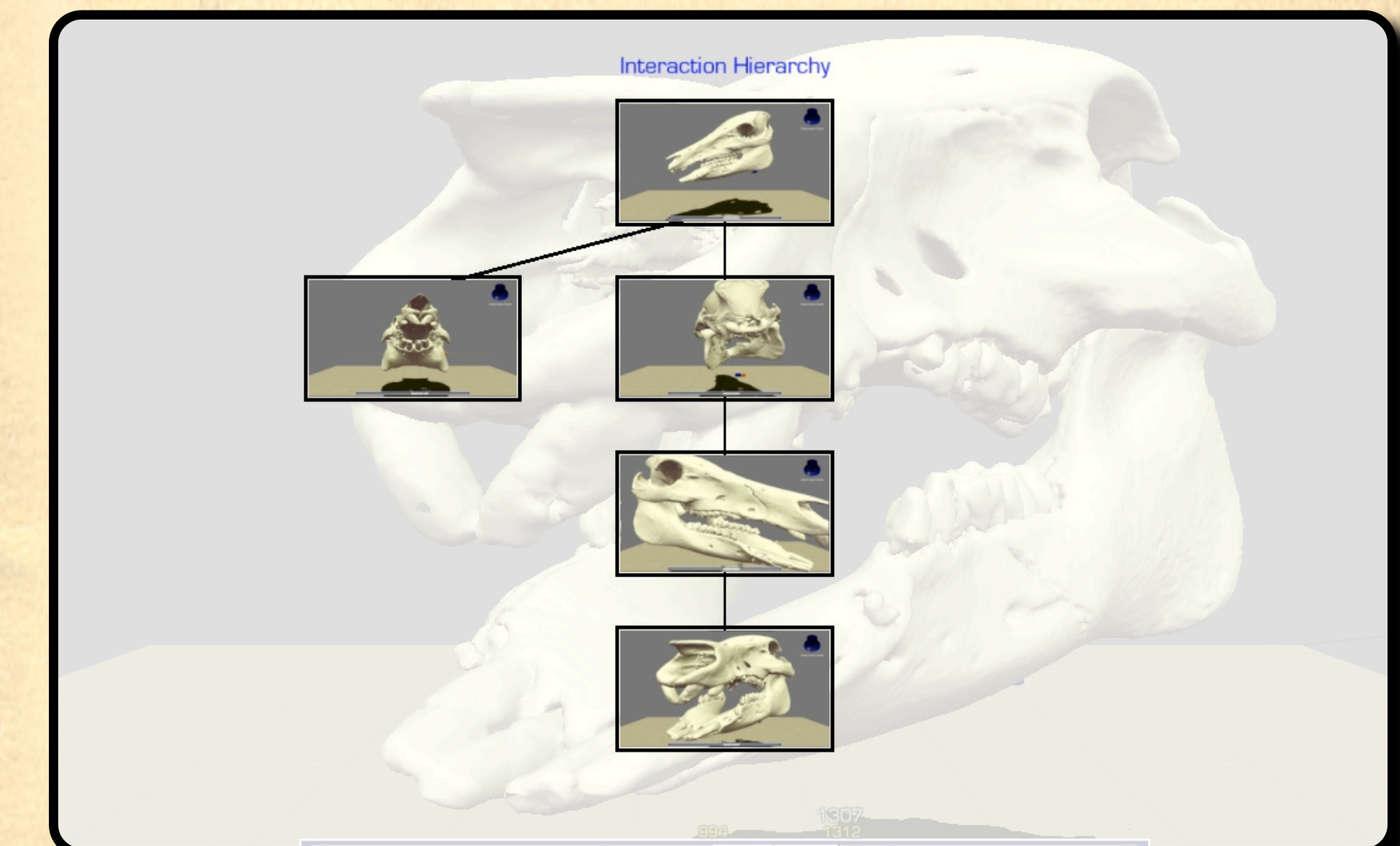
Histories are automatically generated during user interaction. Branches are formed after "undo" operations but may also be triggered manually.

Design Principles

For generating history objects:

- **When the visualization "state" changes, create a history object.**
- **If no interaction events arrive over a set period of time, create a history object.**
- **To maintain manageability, filter consecutive events according to a similarity metric.**

Users may select paths through their interaction history to generate a presentation-like replay of their exploration.

For visualizing histories:

- **Display thumbnails atop global view to establish context.**
- **Allow for manual edit, branching.**
- **Maintain lightweight save/load to promote sharing, collaboration.**