TU Informatics

Interactive 3D Storytelling for Planetary Exploration

Martin Mautner
Visual Computing

TU Wien Informatics
Institute of Visual Computing & Human-Centered Technology
Research Unit of Computer Graphics
Supervisor: Eduard Gröller, Ao.Univ.Prof. Dipl.-Ing. Dr.techn.
Assistance: Thomas Ortner, Msc Msc

Motivation

The Planetary Robotics 3D Viewer (PRo3D) is an interactive visualization tool that allows for geological analyses of planetary surfaces. Scientists can use PRo3D to measure and annotate geological features on a high-resolution 3D surface model. The primary goal is to support geologists at NASA and ESA in their mission to find signs of life on Mars. While PRo3D facilitates an exploratory workflow to gain new insights, there is a lack of support to communicate new findings to other scientists and broader audiences.

Problem Statement

Communicating results using traditional slide show presentations is time-consuming and limiting in how data can be presented. In particular, relying on embedded screenshots and videos, comes with three major problems:

(1) Creating screenshots and videos is tedious, requiring respective knowledge and skills.

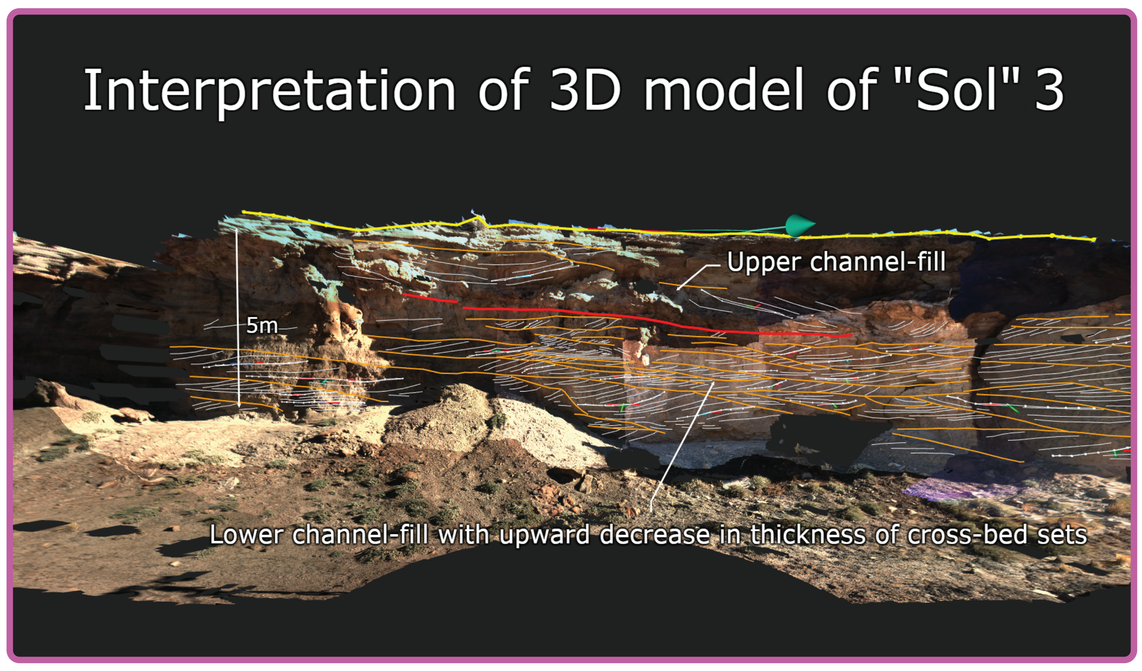
(2) Only a small static portion of the data can be presented.

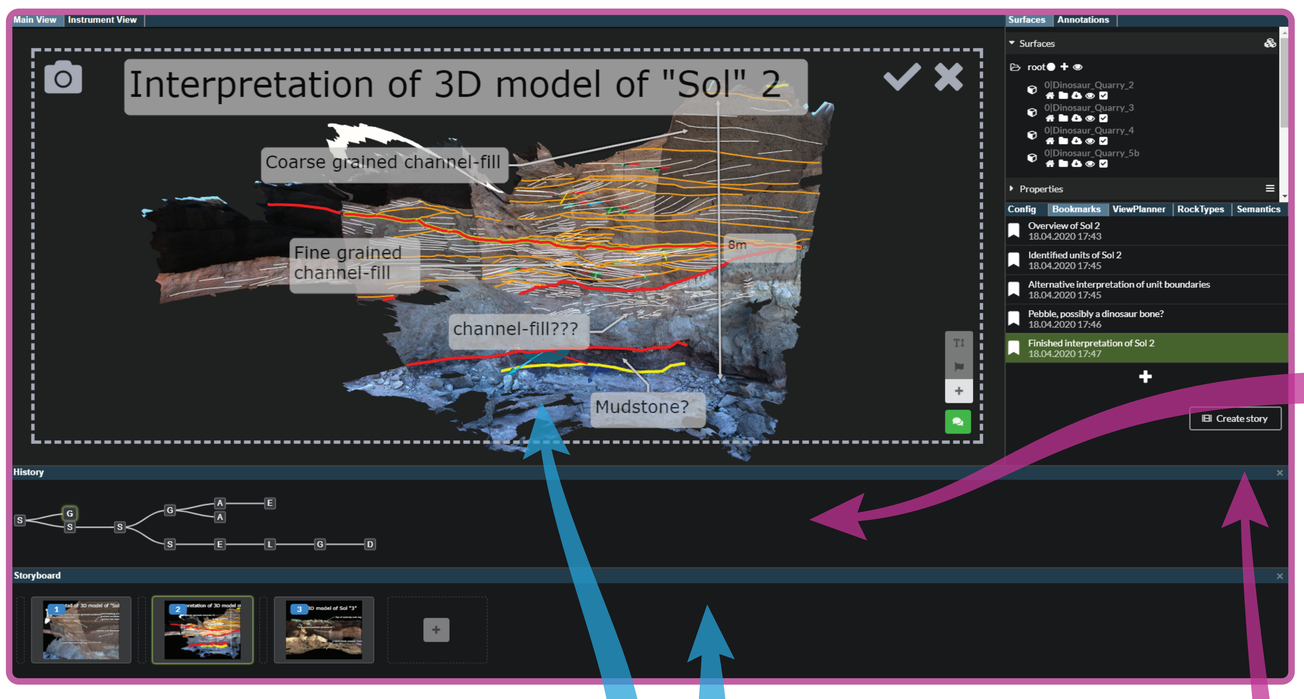
(3) Screenshots do not capture the spatial context of 3D data.

Integrated Storytelling

We extend PRo3D with storytelling functionality allowing users to build interactive presentations directly in PRo3D. Scientists can summarize their discoveries by creating slide shows based on their conducted analysis.

- A slide depicts surface data including geoscientific annotations from a chosen point of view.
- Animated camera transitions between slides help to understand spatial relations.
- Text labels describe the scene in general or specific features.
- Interactive camera controls let the viewer explore the data freely.





Provenance

Our solution adds provenance tracking to PRo3D, capturing the steps and stages of an analysis session automatically. The session is visualized as a tree (node = session state, edge = action).

- Past states can be restored by navigating the tree.
- Alternative geological models can be explored, resulting in a branch in the tree.
- Each slide references a specific node in the tree, making it possible to incorporate different analysis stages in a story.
- Linking slides to provenance facilitates reproducibility and enables an iterative workflow (i.e. presented results can be used as a starting point for further research).

Bookmarks

The provenance tree grows rapidly as the analysis session progresses. Bookmarks let users remember and access important states quickly.

- Users can bookmark milestones and locations with descriptive names.
- Bookmarks may be used as a template for a full story, by converting each one to a slide.

Authoring and Presentation

Users can build their stories using a storyboard interface by adding, duplicating, reordering (via drag and drop), and editing slides.

- Slides are edited in the main render window, selecting a slide enables an overlay for story authoring (indicated by a gray dashed outline and a camera symbol).
- In authoring mode, users may change the camera orientation and add descriptive text labels to the selected slide.
- Finished stories may be presented using the built-in presentation mode. The user controls the story progression, and may manipulate the camera to inspect the contents of a slide.