Virtual Volcano 2.0

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What is Virtual Volcano?

Virtual Volcano is a data-based interactive model of an active volcanic system, which enables students to observe the system as well as to directly control its mechanics to conduct authentic scientific investigations.

Using keyboard controls, students are able to navigate around the volcano as well as observe subsurface features and processes.

Students actively control the physical processes driving two active volcanoes: Mount St. Helens and Piton de la Fournaise.

Preliminary User Survey

In 2006 the Interactive Visualizations for Earth Science Teaching (InVEST) team developed the Volcanic Concept Survey (VCS) to diagnose student-held misconceptions of how volcanic systems evolve and operate. The most poorly misunderstood concepts included:

- Where volcanoes form, and their relation to plate tectonics theory
- Why volcanoes erupt in different styles and the specific hazards a given volcano is likely to produce
- The physical and chronological scales on which volcanic processes opreate
- The nature of internal structures and "hidden" subsurface processes

Virtual Volcano was developed to specifically address these difficult concepts (Fig 1, 2).

Proposed User Study

A user study will be conducted by late October 2011. The user study will examine usability of the Virtual Volcano interface for both content experts (geology graduate students) and content novice users (undergrdaute students). Field testing will occur at Iowa State and partner schools nationwide.

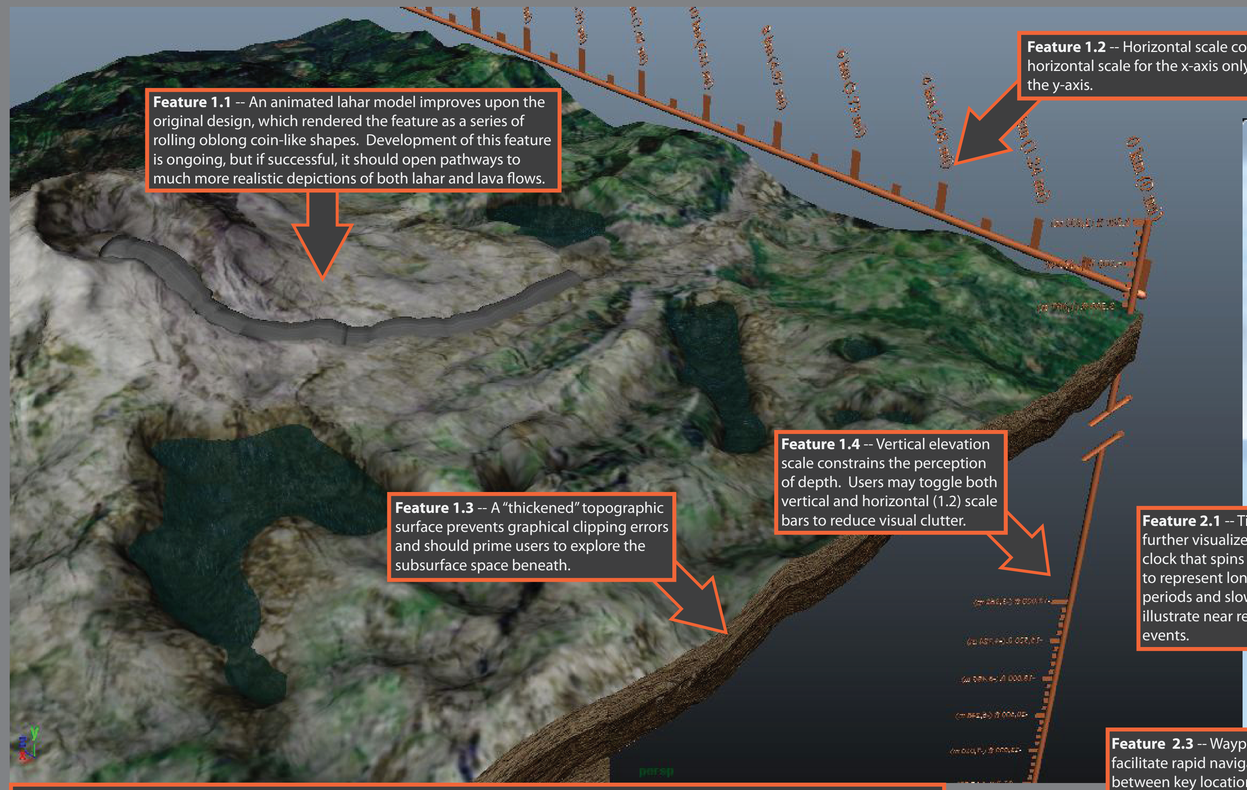

Figure 1 ---- The model viewer provides a full 3D space in which users may explore the structure of each volcano as well as make qualitative observations of eruption events. The Mount St. Helens model is shown with updated topography, lahar model prototype, and physical scale bars.

Rationale for 2.0 Re-Design

Recent user study with Iowa State students during the Fall 2010 semester (n = 65) showed that student users spent as much as 40% of their time with Virtual Volcano 1.0 rebooting or recovering from program instabilities and less than 10% of their time actively exploring the volcano models. Analysis of learning gains showed only marginal gains in understanding of eruptive mechanics and that the model may actually have misinformed students as to the 3D structure of volcanic systems. Student conceptualizations of both the physical scale of volcanic phenomena and the rates of volcanic processes were highly skewed. Moreover, qualitative user ratings of both graphical fidelity of the models and usability of the interface were highly unfavorable.

A full-scale redesign of the platform addressed numerous stability issues while also greatly expanding functionality. The 2.0 interface highlights key information through effective use of color, streamlines navigation tasks (2.3, 2.2), and allows for the implementation of much-needed timescale visualizations (2.2, 2.1). Text has been reduced throughout to reduce cognitive load (2.4). The volcano models have been updated to improve graphical fidelity (1.3, 1.1), prime subsurface exploration (1.3), and allow detailed investigation of volcano structure and scale (1.4, 1.2). Illustration of physical scale also supports navigation tasks and comparison of the extent of various volcanic hazards.

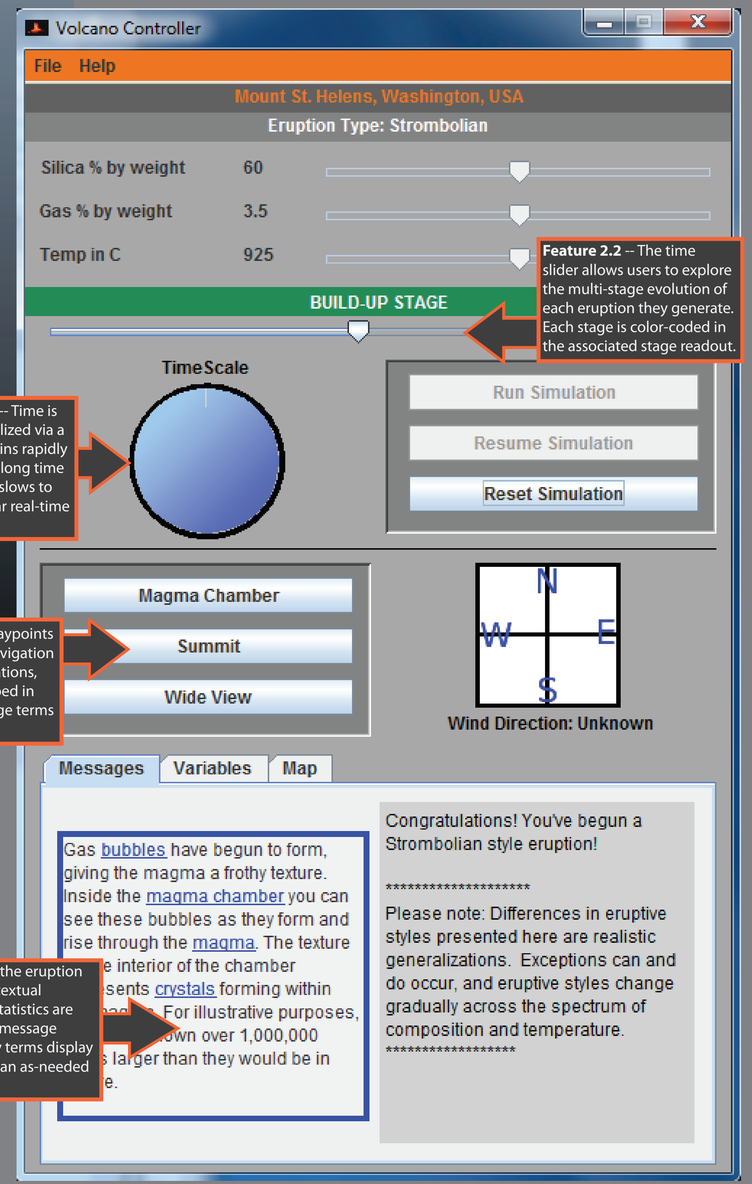

Figure 2 -- The Graphical User Interface (GUI) is the control panel through which the user manipulates the physical factors driving the volcano, makes quantitative observations, and learns more about individual phenomena.