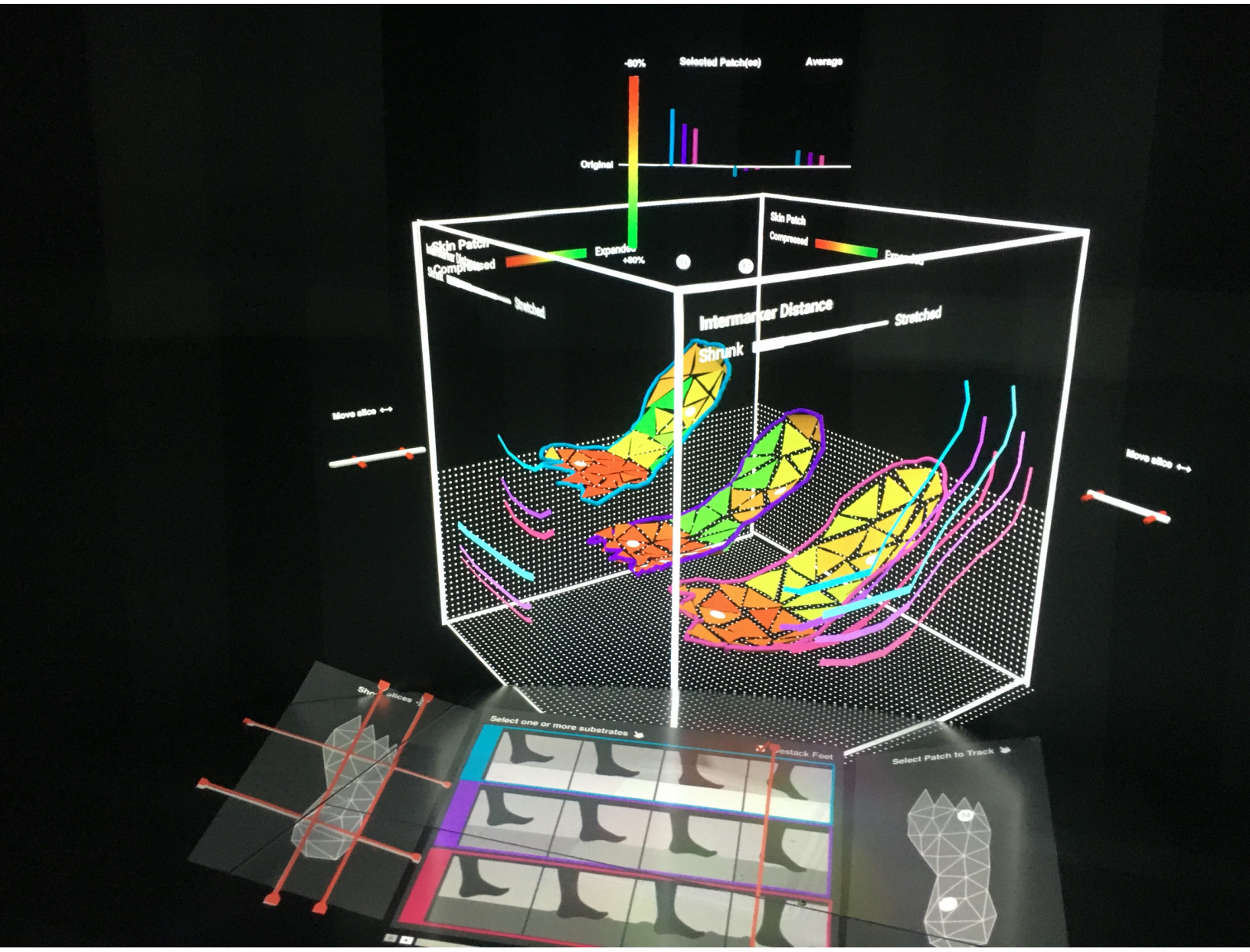

Interactive Visualization in VR:

Plantar Skin Deformation on Different Substrates

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Abstract

Research problem: how different substrate types impact skin deformation during gait motion?

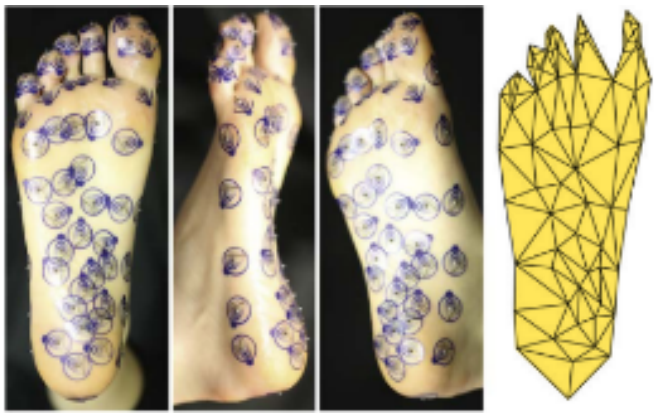
When walking on different substrates, human load their feet and propel their body differently – on hydrated mud, one's foot sinks deep into the ground, while on firmer surfaces, it compresses at the surface of contact. Leveraging of the existing plantar tracking technology and the multifaceted flexibility of the virtual reality environment, I present an interactive application that anatomizes the problem across time and scale.

The design goals of my application are:

- Users will be able to compare plantar deformation on different substrate surfaces at different points in time and establish correlations.
- Users will be able to understand plantar deformation from both a macro (movement) level and a granular (skin patch) level.
- Users will be able to highlight and track progression of specific areas or segments of interest on the plantar surface throughout the gait cycle.

Design

1) Leverage of Existing Model



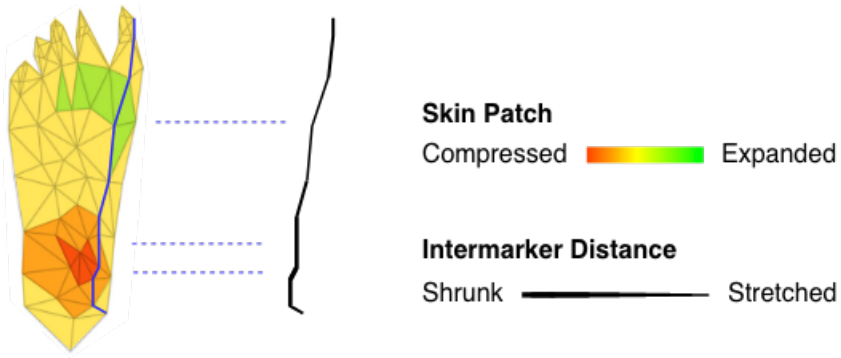
At the center of the box is the plantar surface of a walking foot reconstructed by externally attached markers. This model sets a perfect base for understanding the high-level gait motion and provides possibilities to look into muscle and skin deformation.

2) Gait Cycle

A full gait cycle is shown through four major frames; users can play, pause, or move the play head on the panel to inspect into specific points or sequences in time.

3) Visualization

The changing color shows how the skin patches compress or expand during the gait cycle; users can also toggle with selected slices to view/hide potentially interesting inter-marker segments.



4) Ease & Flexibility to Compare Among Substrates

As comparison among substrates is the focus of the problem, the application makes it easy and flexible through color coding. Users are able to explore in various angles - show the foot under all substrate contexts at one time for parallel comparison, cycle through frames to examine motion-level implications, opt in for selected segments to gain deeper correlations.

Discussion

The immersive VR environment provides rich possibilities for tackling complex visualization goals. What I found helpful in my design process was to I. leverage the scalability (users' intent to scale to learn more) and full spatiality (intent to walk around the space and view from all angles) of the system, and II. keep the user flow & key visuals as straightforward as possible to avoid cognitive overload and the sense of lack in guidance that can come easily from the immersive environment.