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Session PSTR446 - Software Tools: Neurophysiology

PSTR446.21 / XX70 - Universal Renderer for Neuroscience: interactive 3D rendering for electrophysiology and neuroimaging in the browser, on desktops, and in virtual reality

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Presenter at Poster
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Disclosures
D. Birman: None. **J. Schoch:** None. **I. Brain Laboratory:** None. **N.A. Steinmetz:** None.

Abstract
Modern large-scale electrophysiology and neuroimaging techniques are generating unprecedented amounts of data. Exploring these data in their original anatomical context depends on the existence of easy-to-use and powerful 3D visualization tools. To solve this problem, we have developed an open-source software package, the Universal Renderer Creating Helpful Images for Neuroscience (Urchin), that can visualize anatomically registered data from a variety of input sources in the space of common reference atlases. Our rendering package is platform-agnostic, working equally well as a standalone desktop application, in a virtual reality headset, or as a website. When running in a web browser, the renderer requires no installation and allows users to build complex 3D renderings in seconds. Users send data to the renderer through an application programming interface (API), using simple commands to pass information about their 2D or 3D scene. The visuals that the renderer can create include: brain regions rendered as opaque or transparent 3D objects, simple or complex 3D models such as spheres to represent neurons, probes, or neuron morphology, videos of neuroimaging data projected onto 3D surfaces, volumetric data such as MRI images, and 2D accents such as lines and text. Visualizations can be exported as high quality static images or videos from one or more camera angles. Unlike existing rendering packages intended for neuroscience, our software is interactive and allows users to explore their data in 3D space using keyboard and mouse interactions, or in virtual reality. This interactivity is not limited to simple scenes: by taking advantage of a powerful existing video game engine (Unity), our 3D renderer can support extraordinarily complex interactive scenes and at 60 hz we are able to display real-time firing rate data from up to 100,000 neurons overlaid on hundreds of individual brain regions. To demonstrate the power of Urchin we have developed several applications using the renderer, including a virtual reality experience in which participants explore a 30,000 neuron electrophysiology dataset, an online data viewer where users can explore 2D and 3D views of the mouse brain with per-region analysis results overlaid, and other interactive data viewers. Urchin makes it possible for neuroscientists to build powerful interactive explorations of their three-dimensional datasets with minimal effort and to share these easily with colleagues over the internet.