**Supplementary File 1:** Features of visual display software

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **BonVision** | **PsychToolBox** | **PsychoPy** | **ViRMEn** | **ratCAVE** | **FreemoVR** | **Unity** |
| Free and Open-Source (FOSS) | ✓✓ | ✓# | ✓✓ | ✓# | ✓ | ✓✓ | ✓ |
| Rendering of 3D environments | ✓✓ | ✓ | ✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| Dynamic rendering based on observer viewpoint | ✓✓ |  |  | ✓ | ✓✓ | ✓✓ | ✓ |
| GUI for designing 3D scenes |  |  |  | ✓✓ |  |  | ✓✓ |
| Import 3rd party 3D scenes | ✓✓ | ✓ | ✓ |  |  |  | ✓✓ |
| Real-time interactive in 3D scenes | ✓✓ | ✓ |  | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| Web-based deployment |  |  | ✓✓ |  |  |  | ✓✓ |
| Interfacing with cameras, sensors, and effectors | ✓✓ | ✓✓ | ~ | ✓✓ |  | ~ | ~ |
| Real-time hardware control | ✓✓ | ~ | ~ | ✓ | ✓✓ | ✓ | ✓ |
| Traditional visual stimuli | ✓✓ | ✓✓ | ✓✓ |  |  |  |  |
| Auto-calibration of display position and pose | ✓✓ |  |  |  |  |  |  |
| Integration with deep learning pose estimation | ✓✓ |  |  |  |  |  |  |

✓✓ easy and well-supported

✓ possible or not well-supported

~ difficult to implement

# based on MATLAB (requires a license)