

Usability of Integrated Eye-Tracking HMDs for Real-Time Unreal Engine Applications

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Background

- Eye-tracking is used across many domains [Adhanom et al., 2023]
- Researchers often use custom solutions, even though HMDs with integrated eye-trackers exist
- Existing literature focuses on data accuracy and quality or the scientific outcomes (e.g., [Hou et al., 2024]); pitfalls and reliability during setup are rarely mentioned
- Reasearch gap: Do HMDs with integrated eye-trackers offer a reliable alternative to custom solutions? What issues should researchers expect?

Evaluation Dimensions & Tested HMDs

- Dimensions:**
 - Software Setup
 - Documentation
 - Engine Integration
 - Data Frequency
 - Reliability
- Tested HMDs:**
 - HTC Focus Vision
 - HTC Vive Pro Eye
 - Pico 4 Enterprise
 - HP Reverb G2 Omnicept
 - (BigScreen Beyond 2e) - excluded due to missing pupillometry

Findings

Headset	Software Setup	Documentation	Engine Integration	Data Frequency	Reliability
HTC Focus Vision	Vive Hub; Built-in calibration app; not callable from code	Sufficient; website unstable	Outdated plugin (UE 5.4); manual upgrade required	90 Hz achieved (120 Hz beta, unreported)	Unreliable; frequent calibration failures, random freezes, inaccurate data
HTC Vive Pro Eye	Vive Console + SRanipal; Built-in calibration app; callable from code	Poorly documented; SDK only available via unofficial archives	SRanipal SDK outdated; manual UE upgrade required	Up to 120 Hz (theoretical, via SRanipal, Tobii)	Unstable; non-functional on Windows 11, no valid data even on Windows 10
Pico 4 Enterprise	Pico Business Streaming; Built-in Calibration	Well-documented	Up-to-date, well-documented plugin	90 Hz	N/A — excluded (no eye tracking in Live Preview)
HP Reverb G2 Omnicept	Oasis driver + Omnicept runtime; calibration streamed from PC; workaround required	Registration is well-documented; SDK functions are poorly documented	Outdated plugin (UE4.27); manual upgrade required, minimal effort	120 Hz (Tobii)	Reliable; rarely crashes, continuous data delivery

Fig. 1: Summary of evaluation criteria across tested eye-tracking HMDs

System Limitations:

- **Focus Vision:**
Relies on the Vive OpenXR plugin, which is tied to the frame rate - as a consequence, tracker sampling rate = frame rate; the tracker freezes frequently, requiring application and HMD restart
- **Vive Pro Eye:**
Original SRanipal SDK is deprecated and hard to obtain (did not run on Windows 11); Vive OpenXR replaced it (also limits sampling rate)
- **Pico 4 Enterprise:**
No eye tracking in live preview; App must run packaged as standalone --> HMD was excluded from testing
- **HP Reverb G2 Omnicept:**
Relied on Windows Mixed Reality (deprecated); Oasis driver does not support streaming the calibration app to the HMD, requiring a workaround that limits accuracy. Runs well on Windows 10

Observed Data Quality:

- **Vive Pro Eye:** reported exclusively invalid data, including during calibration
- **Focus Vision and HP Reverb G2 Omnicept:** were tested on multiple colleagues with the task to - after an initial calibration - subjectively rate the gaze direction accuracy, which was displayed using debug rays
 - The calibration of the **Focus Vision** (Fig. 2) failed frequently, and the accuracy was highly susceptible to positional shifts of the HMD; it seems to favor the left eye across persons, reports exceptionally high pupil dilations, and exhibits plateaus
 - The **Reverb G2 Omnicept** (Fig. 3), while not perfect, tracked more reliably even after positional changes; it continuously reports feasible pupil dilation and marks invalid data with -1 (blinks)

Sample Pupil Dilation Over Time:

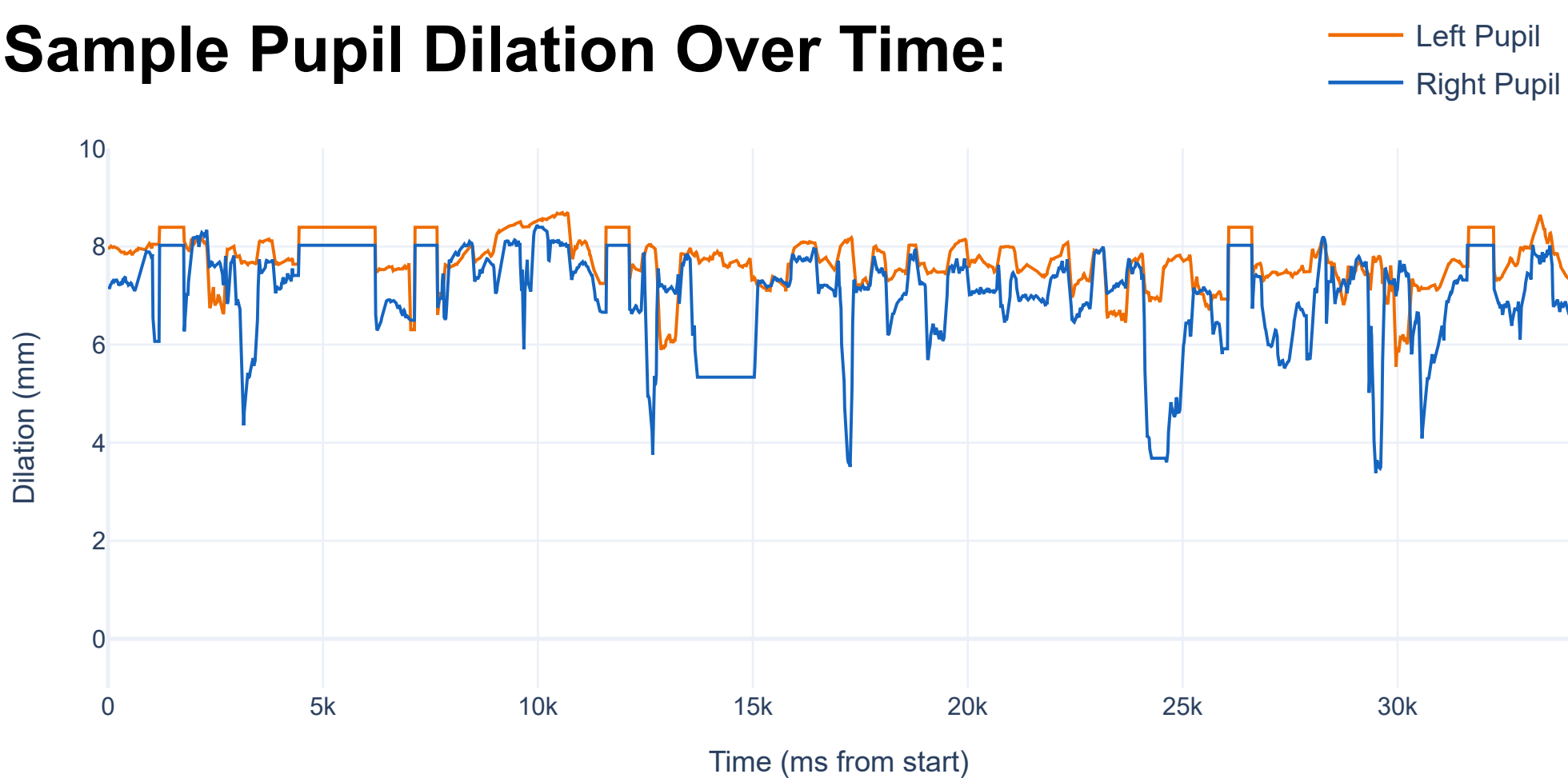


Fig. 2: HTC Focus Vision

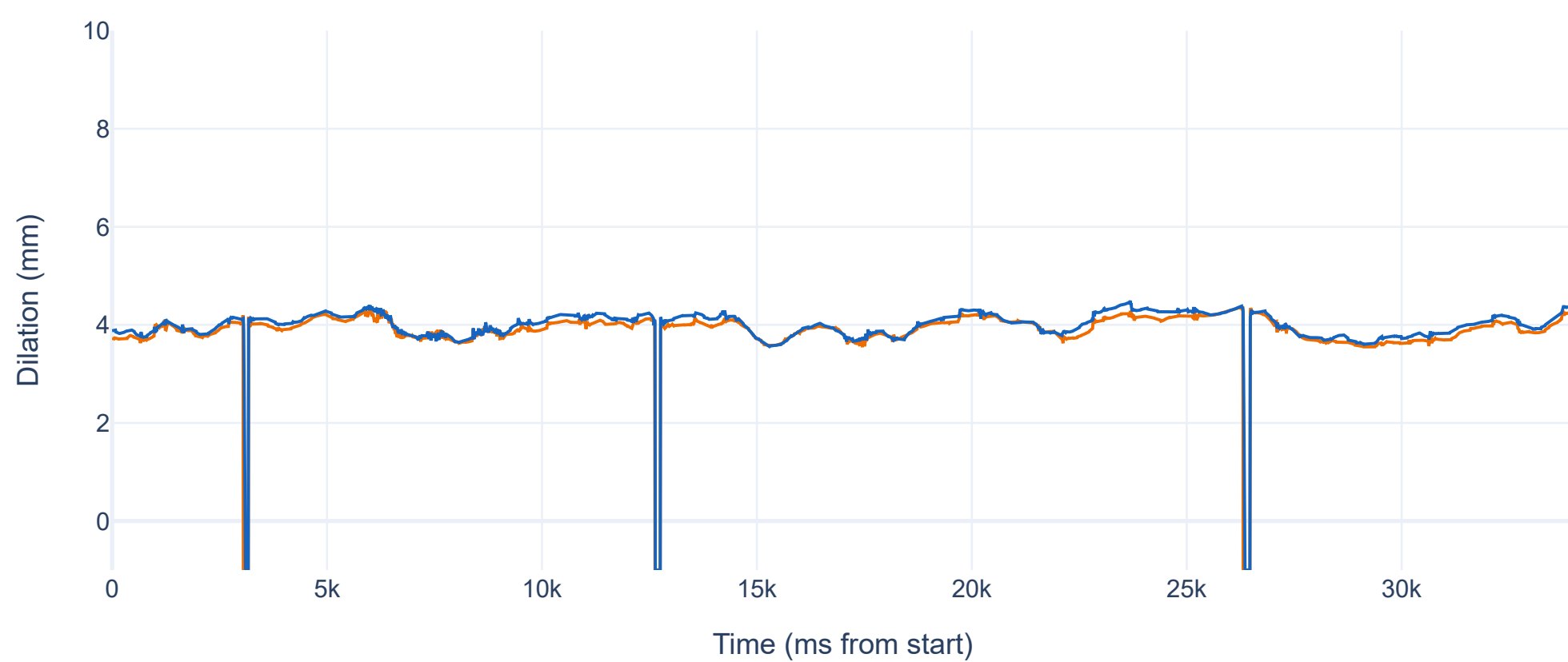


Fig. 3: HP Reverb G2 Omnicept

Takeaways

- None of the tested HMDs provides a reliable, out-of-the-box experience
- **HTC HMDs:** current software state performs poorly despite the Vive Pro Eye's good track record [Schuetz and Fiehler, 2022]
- **Pico 4 Enterprise:** solid documentation, but "stand-alone-only" design; the lack of a live preview hinders rapid testing
- **HP Reverb G2 Omnicept:** most reliable hardware, but relies on reverse-engineered drivers and outdated software
- Practical advice: budget extra time for driver/SDK validation, compatibility checks, and potential work-arounds before starting data collection.

Literature

- Adhanom et al., 2023**
Eye Tracking in Virtual Reality: A Broad Review of Applications and Challenges.
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Unveiling Variations: A Comparative Study of VR Headsets Regarding Eye Tracking Volume, Gaze Accuracy, and Precision. In *IEEE Conf. Virtual Real. 3D User Interfaces Abstr. Workshops (VRW)*.
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