# Sleep Study

2025-09-04

Introduction

A student in the Yale School of Medicine is planning a study to compare a promising new iPhone/iTouch App (called SomnoPose) to a customized medical device (called the Embletta) for monitoring sleeping position. She's not actually interested in sleep, but is studying eye health. Her long-term research plan is to explore whether pressure on the eyes (perhaps due to sleeping position) could be related to various aspects of eye health. For example, a patient who sleeps almost exclusively on his/her left side might be placing pressure on his/her left eye that is very different from the right eye. Although sleep position isn't a direct measurement of "pressure on the eye," she believes it might be a helpful indicator. The Embletta is considered to be the "gold standard" for the purpose of this study. However, the SomnoPose solution is far less expensive than the Embletta, and the iPhone/iTouch is less cumbersome to sleep with. This student agreed to conduct a pilot study before moving onto a formal study to compare these two devices.

In this report, we analyze the data from the pilot study to determine how well the SomnoPose data compare to the Embletta data, and whether a formal study is warranted. We plan to evaluate the SomnoPose against the Embletta by visually comparing the sleep angle readings on line graphs. If there is general concordance, we can say that the SomnoPose is a fairly accurate tool, and due to its lower cost, likely a good option to evaluate further.
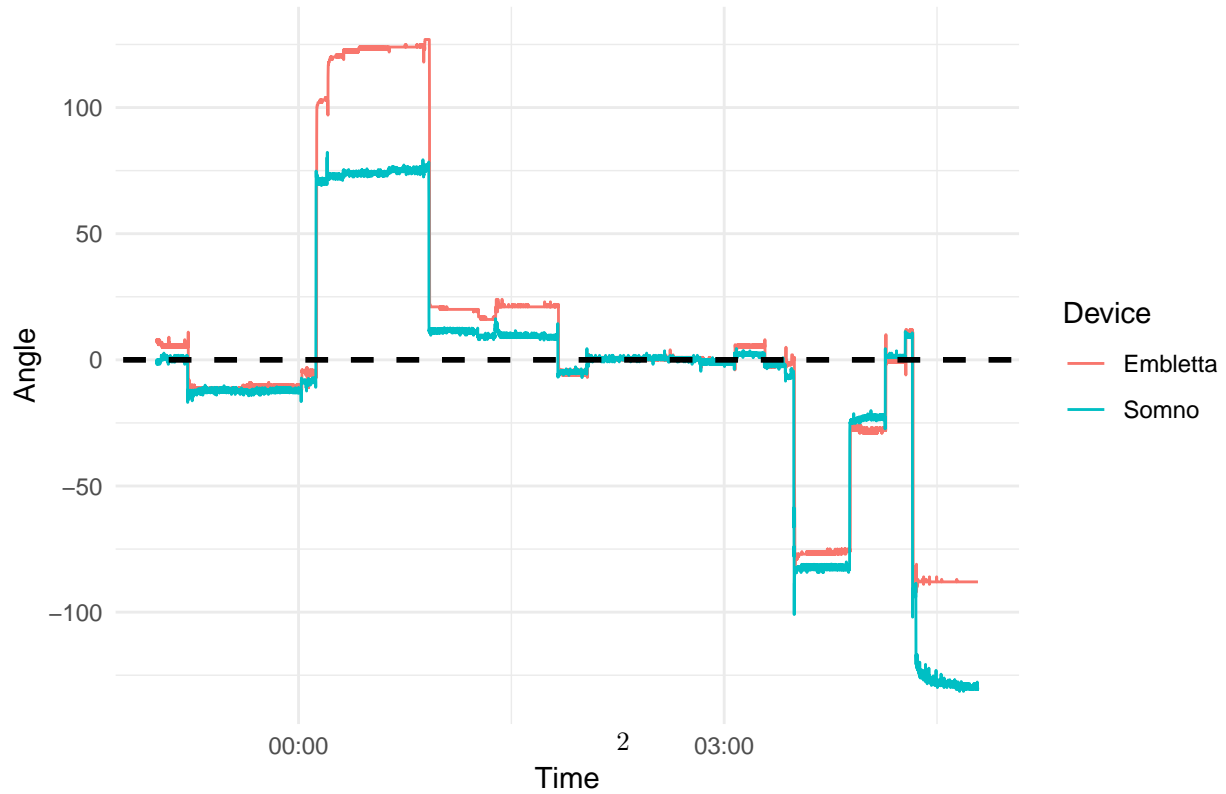
Analysis

November 15
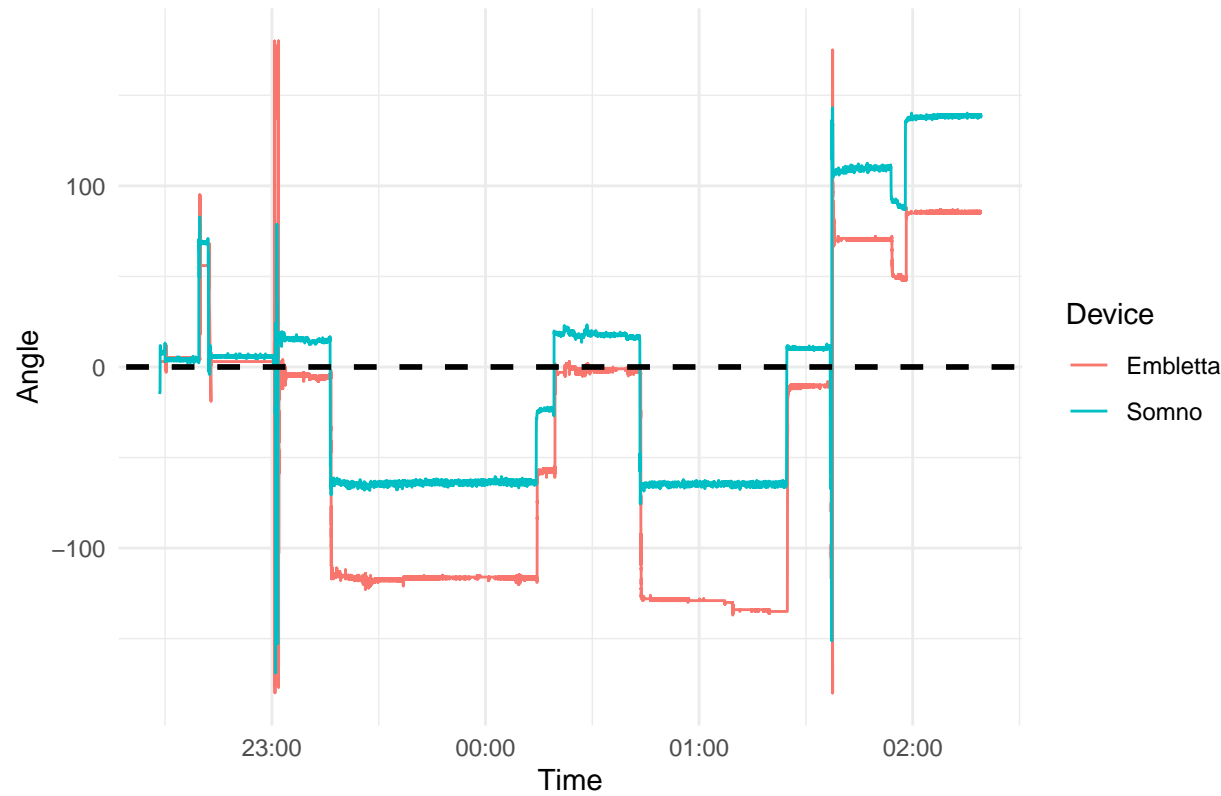
Angle Over Time by Device 11/15
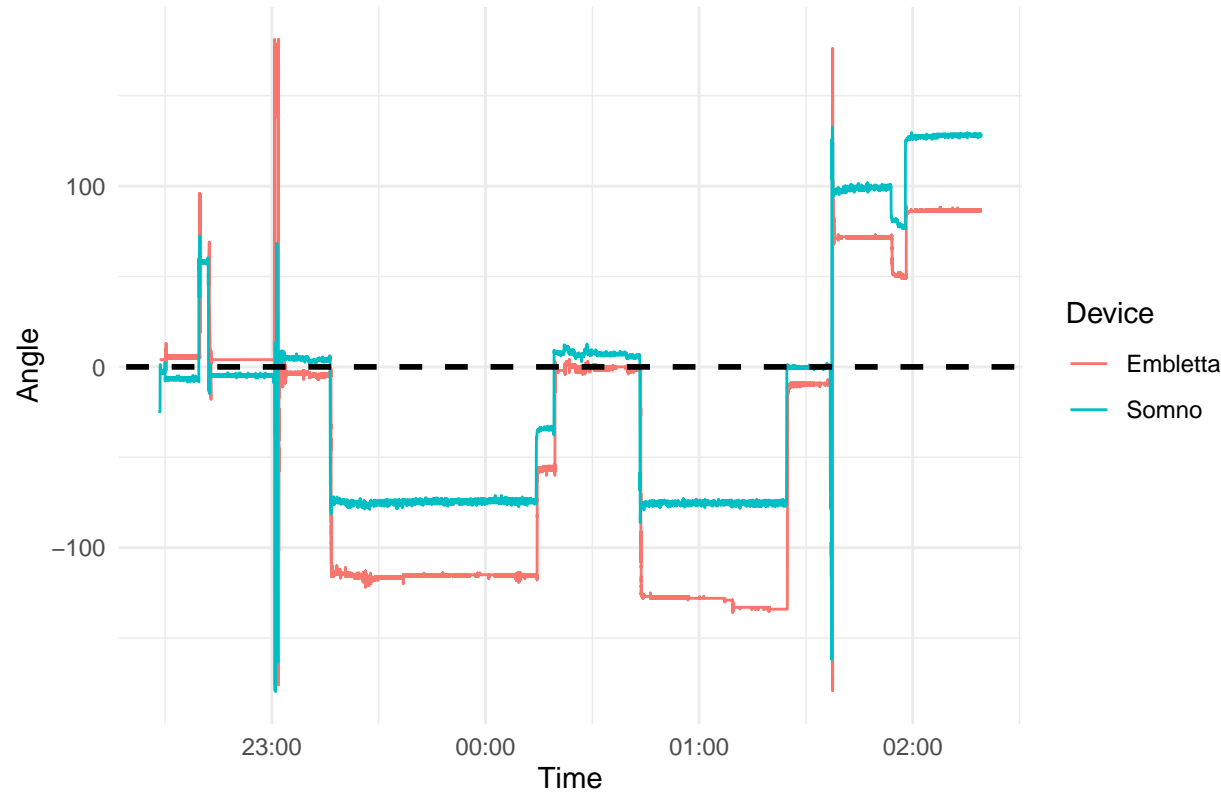

Adjusted Angle Over Time by Device 11/15
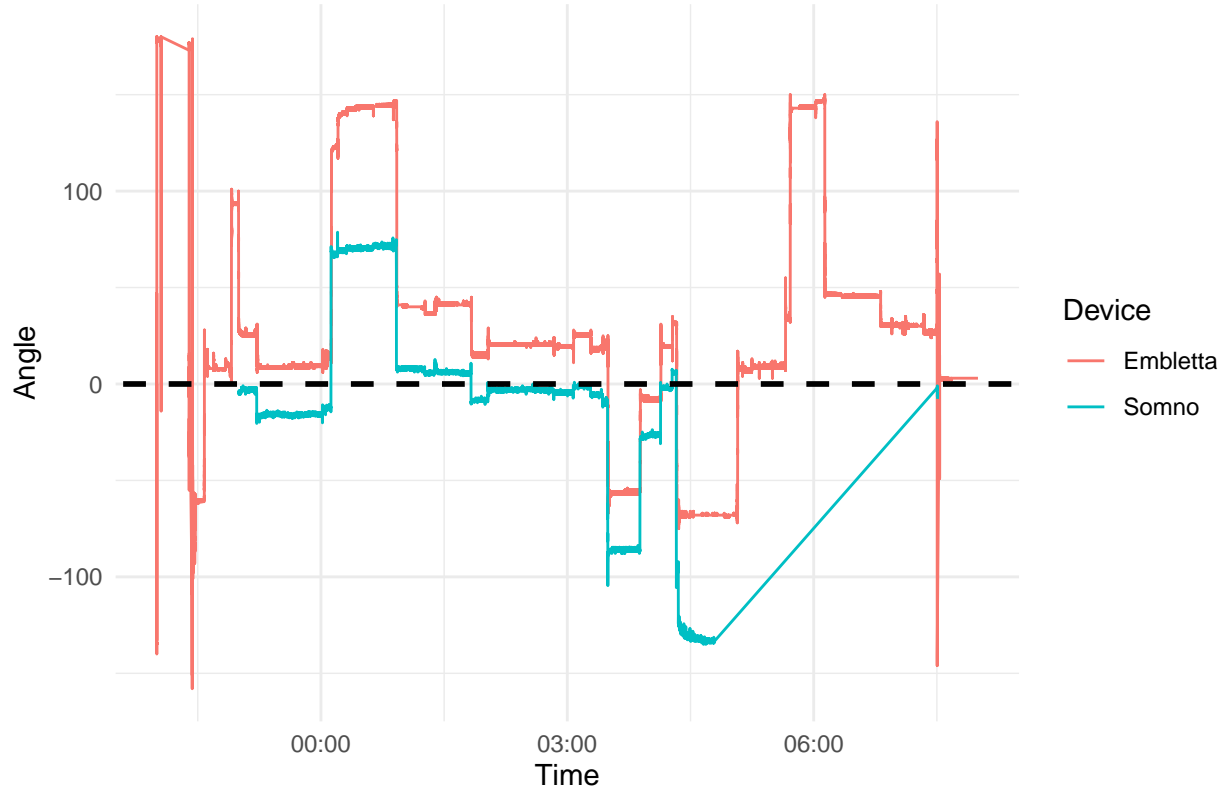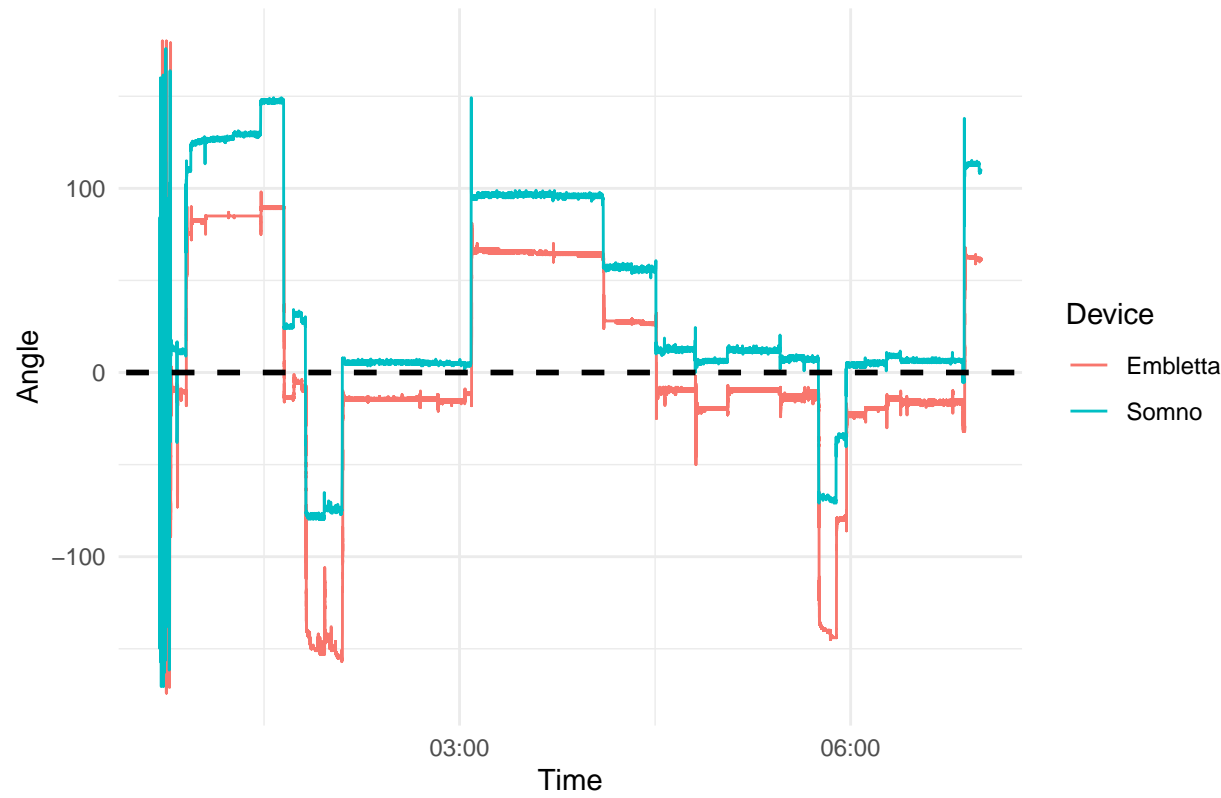
Angle Over Time by Device 11/17

Adjusted Angle Over Time by Device 11/17

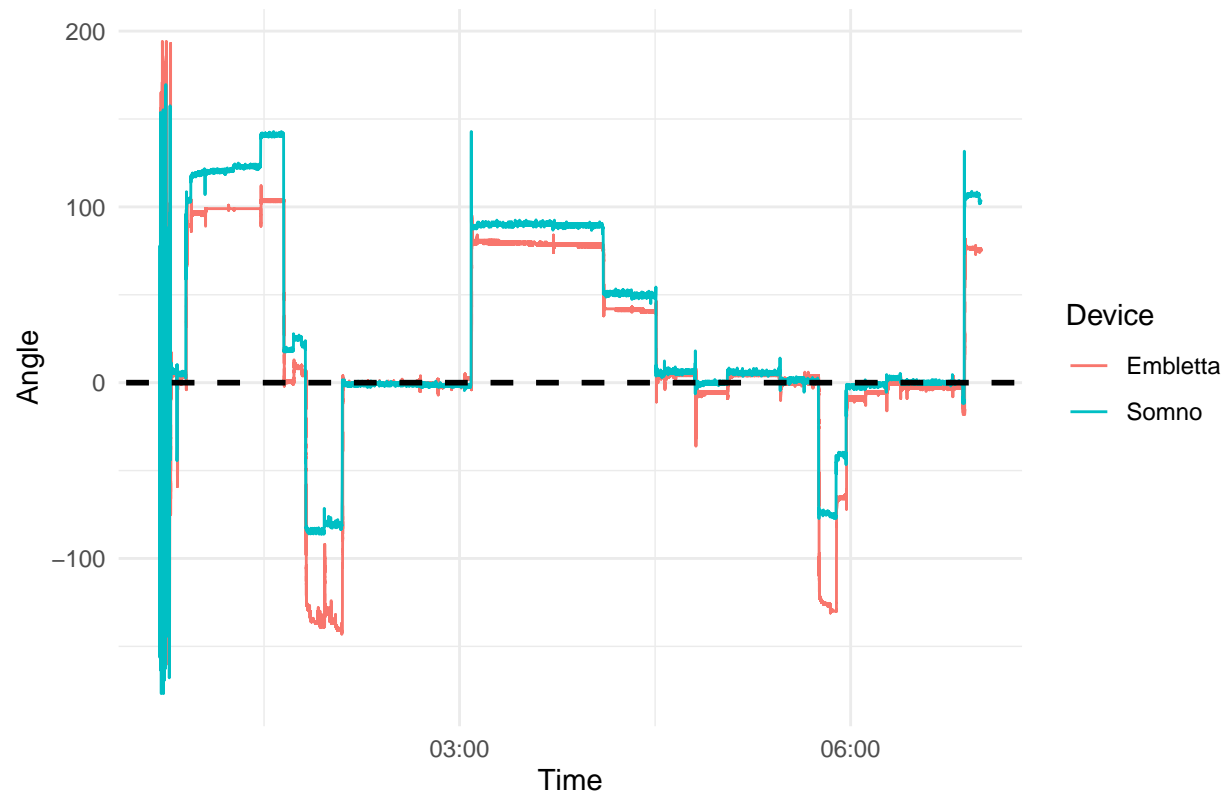## Angle Over Time by Device 11/18

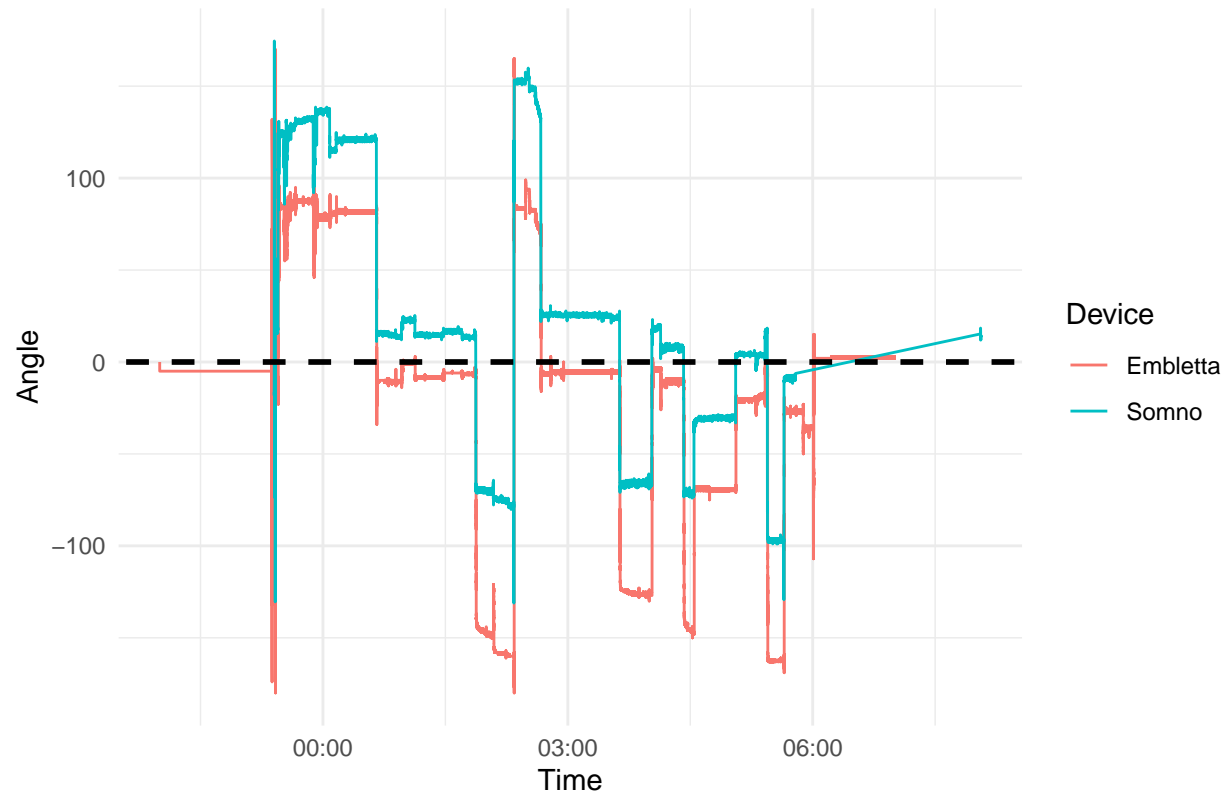## Adjusted Angle Over Time by Device 11/18

Angle Over Time by Device 11/19
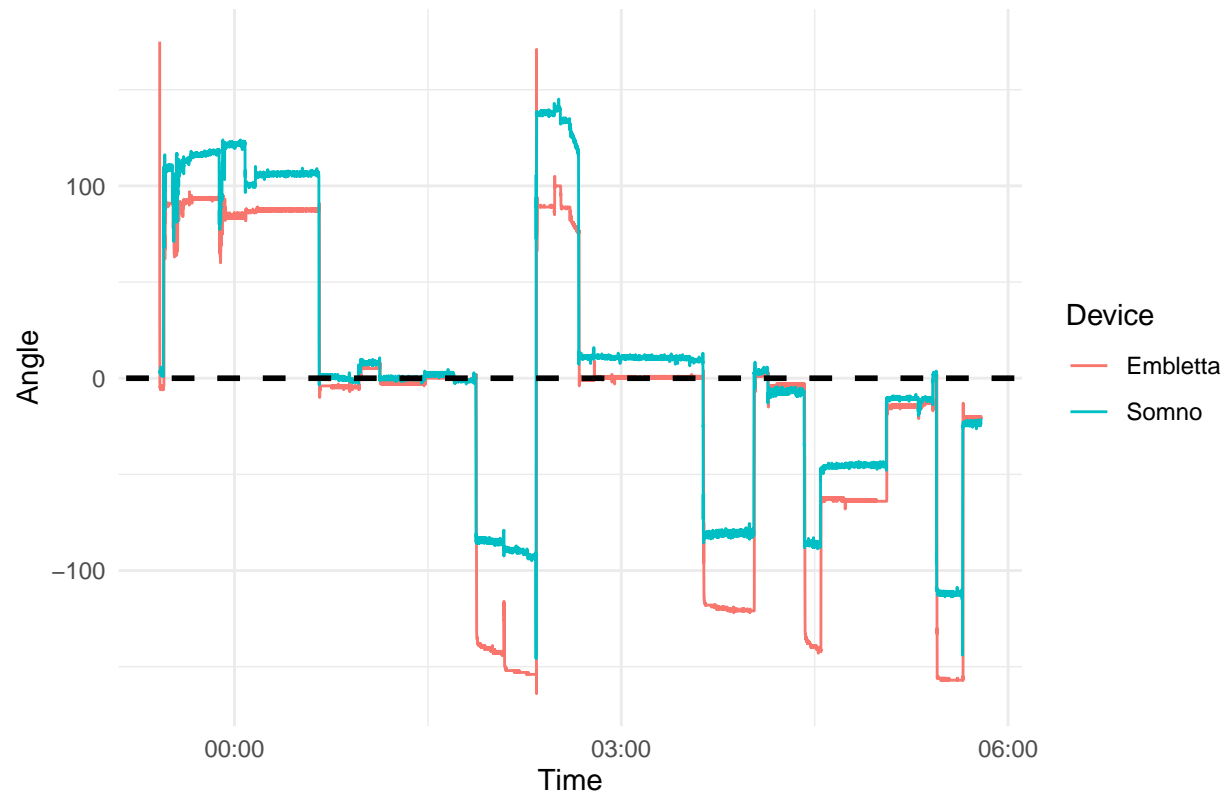

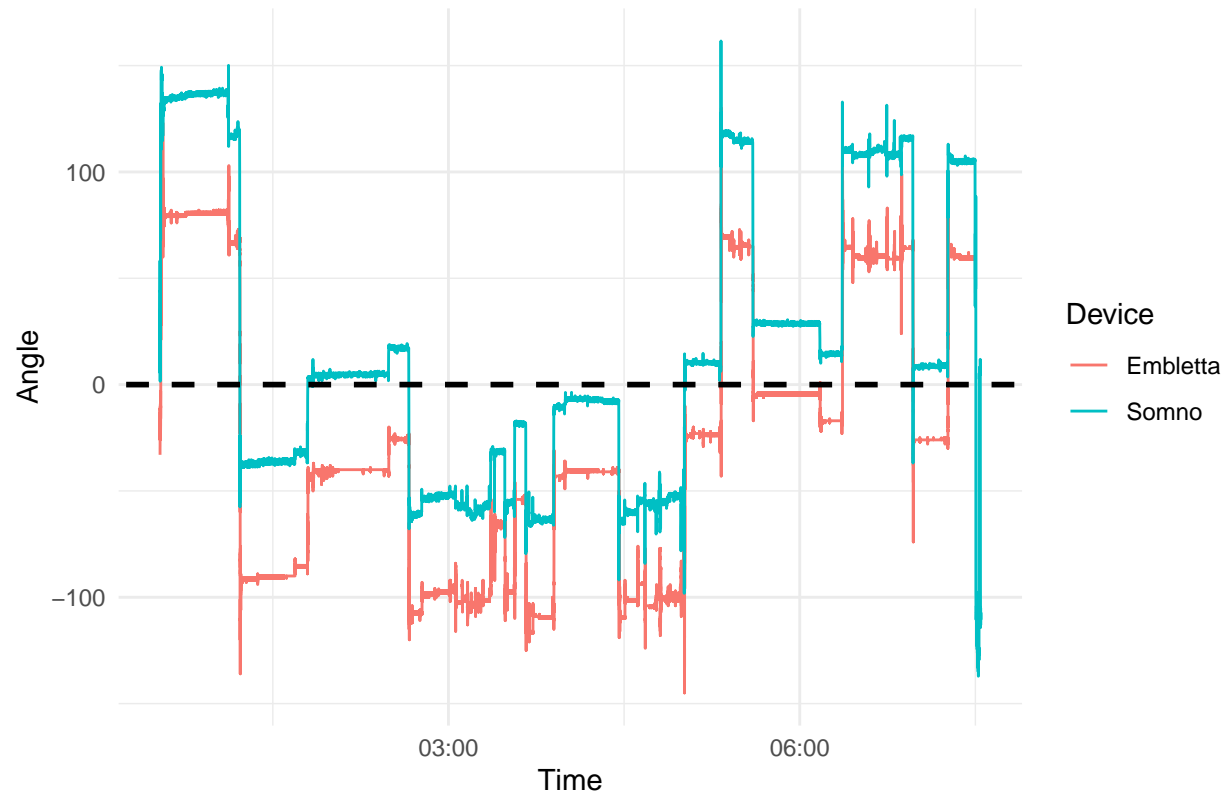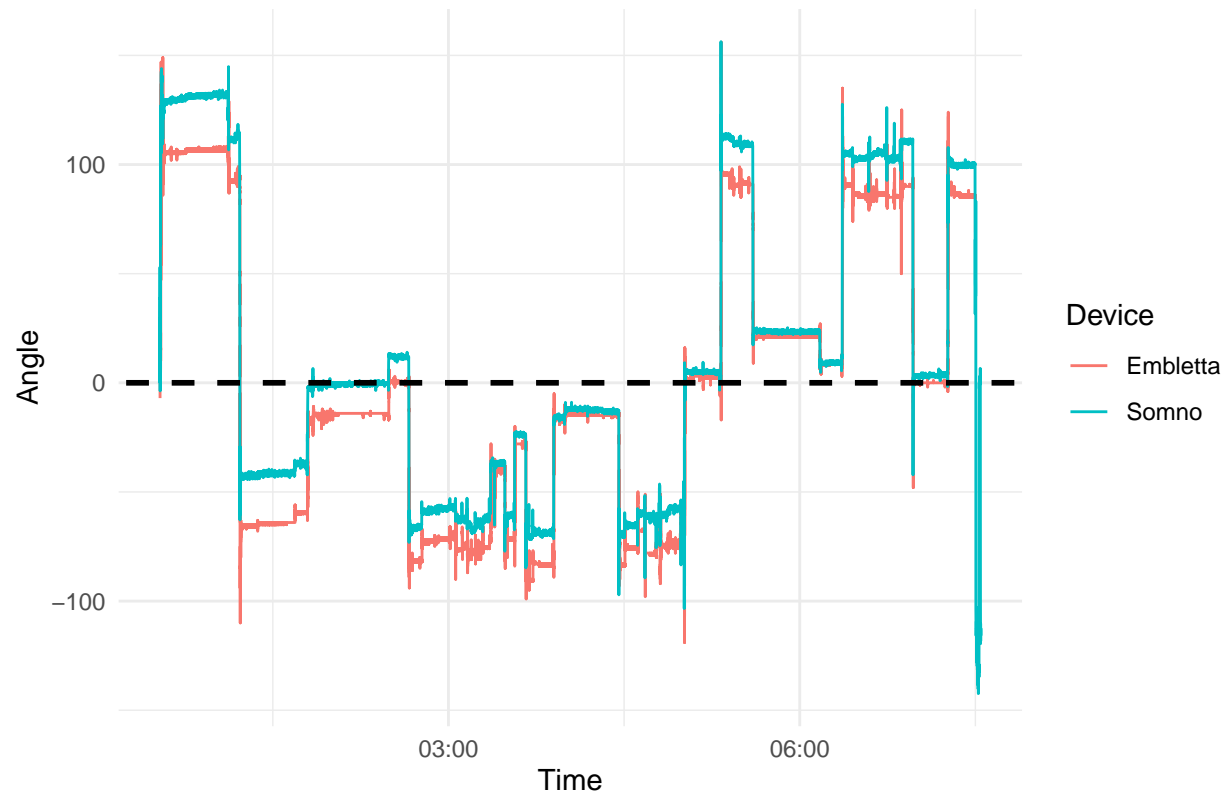## Adjusted Angle Over Time by Device 11/19
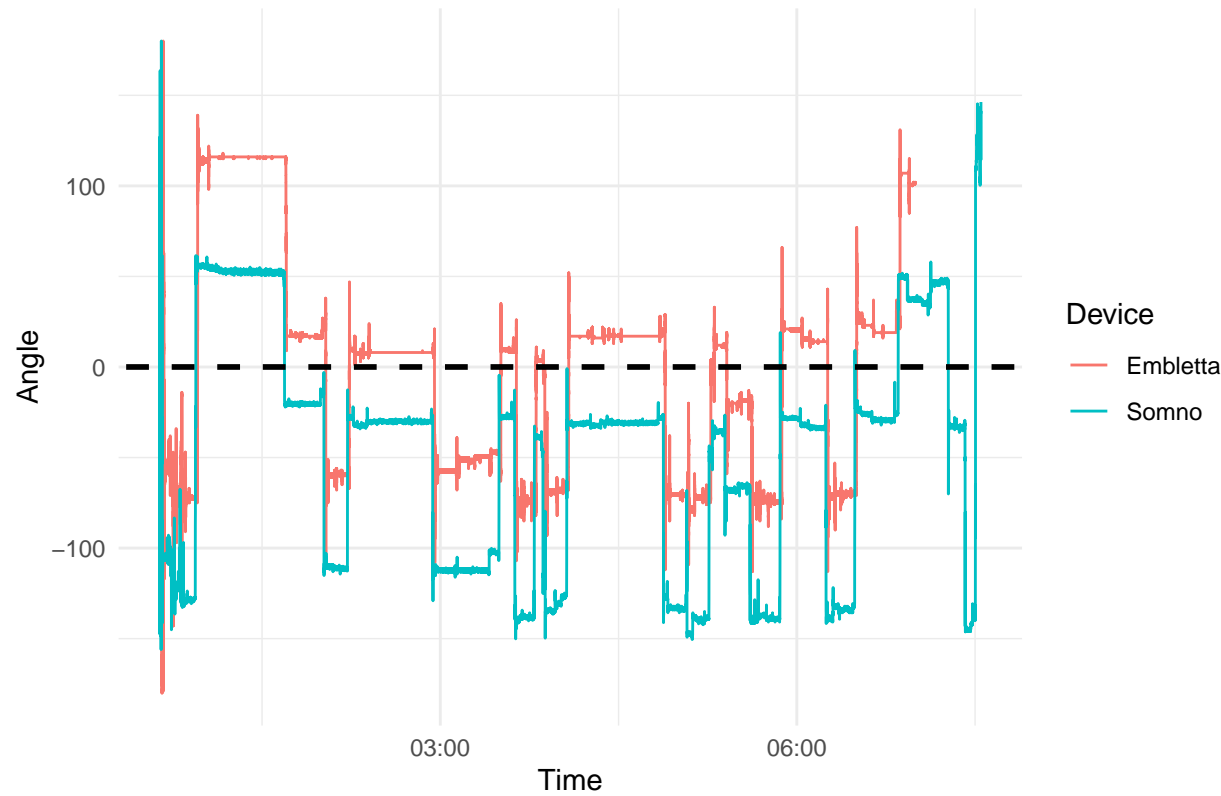
Angle Over Time by Device 11/23

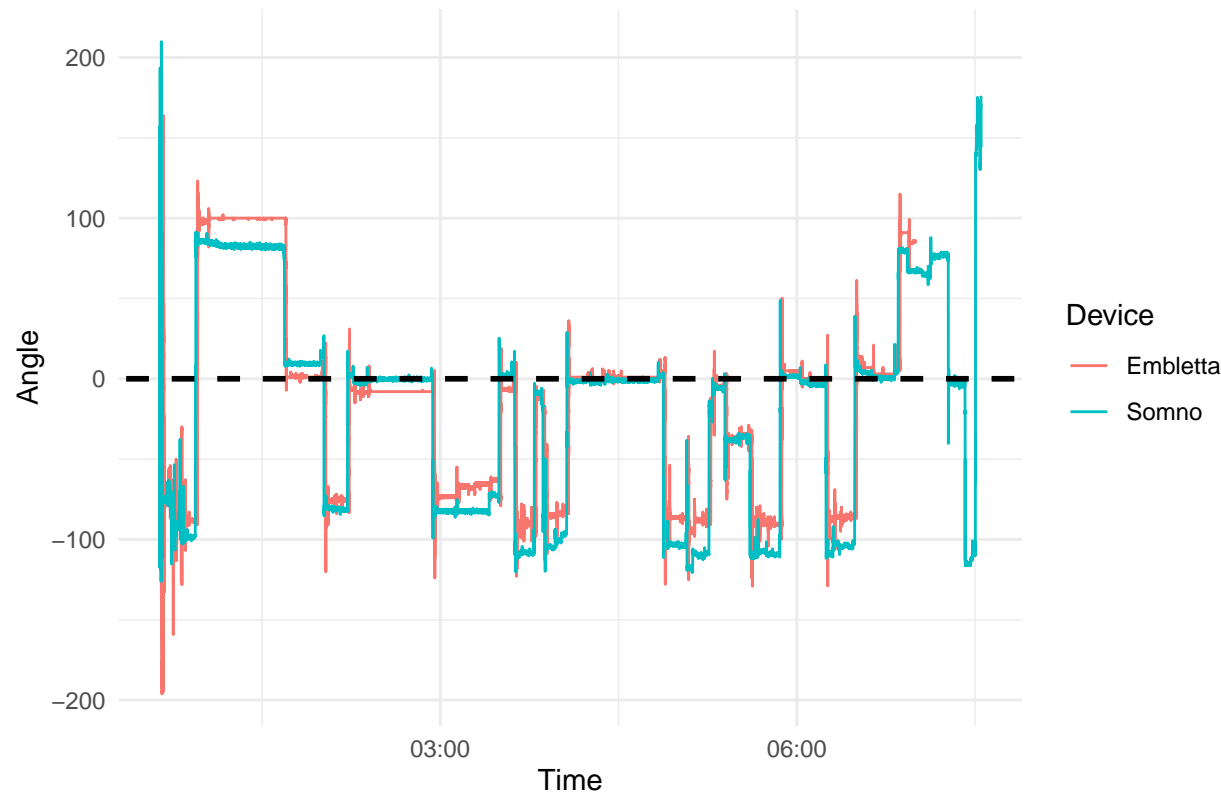## Adjusted Angle Over Time by Device 11/23

November 24

Angle Over Time by Device 11/24

Adjusted Angle Over Time by Device 11/24

Conclusion

Based on the analysis of the pilot study data, the SomnoPose data shows a reasonable level of agreement with the Embletta data, particularly in terms of overall trends and changes in sleeping position. However, they were consistently off by an unknown constant number of degrees (changes by day). Although this was adjusted for in the adjusted angle graphs by calculating the median value of the "baseline" angles (the angles that appear most frequently between -50 and 50 degrees, which was set to be the "zero") and subtracting this value from all SomnoPose angles, the peak angles recorded by each device still did not align perfectly. These discrepancies are likely due to differences in device placement, fit, and size. Also, this could be due to differences in quality of the devices, so further study with more controlled placement is necessary.

Compared to the Embletta, the SomnoPose has several advantages. It provides additional information, including timestamps and inclination data, and is also significantly less expensive. If one device had to be chosen based on the pilot study, the SomnoPose would provide sufficient information.

A larger, standardized study would allow for calibration between devices (such as aligning the definition of 0 degrees), reduce variability introduced by uncontrolled factors such as environment or sleep quality, and ensure consistent and reliable start/stop times (which often had to be inferred for the Embletta by matching the times of "flips" between the subjects left and right sides or changes in sleeping position). We are curious if this standardization and improved calibration would improve the concordance between the SomnoPose data and the Embletta data.

Overall, while the pilot study indicates that the SomnoPose and Embletta yield similar overall patterns, a more formal study is needed to compare the accuracy of the devices and validate the SomnoPose as a reliable alternative