Design Decisions

We chose a radial graph to encode the time series data, since the data occurs over multiple days. Our graph's intended audience is scientists interested in or knowledgeable about activity patterns in mice, especially in relation to their estrus cycles.

Reasons for choosing radar graph

The primary motivation for this visualization is to explore and compare the circadian activity of female mice during estrus and non-estrus periods. The dataset spans two weeks of minute-level activity, capturing the natural 24-hour cycle and how it aligns with the 12-hour dark/light schedule. Because mice are nocturnal, it's crucial to highlight when the lights are off (dark period) versus on (light period), especially given that estrus cycles introduce additional variability in their behavior. A circular, or radar-style, representation was chosen to reflect the cyclic nature of daily activity, where each minute is mapped to a point on the circumference, providing a continuous overview of how activity levels fluctuate over time.

Reason for choosing color palette

We used color to differentiate a couple of different features of the dataset. One of them is time, the background color of the graph is a lighter color on one half, to indicate the light period where the lights are on, and darker on the other half, to indicate the dark period where the lights are turned off. This helps the viewer notice features in the data relating to the time series, particularly that most mice activity is during the dark period. The difference is subtle to not draw the viewers' attention away from the data. Additionally, different colors are used for estrus and non-estrus to make them easily distinguishable. We chose red and blue, which is colorblind accessible, with estrus as red to make it stand out more, since activity during estrus is different from normal periods of activity for mice. This allows for the viewer to easily compare and contrast the patterns of activity for estrus and non-estrus periods.

Reason for choosing transformation

We applied a few main transformations to the raw dataset to ensure the visualization accurately reflected the cyclic nature of the data. First, minute-level activity from across the two weeks was averaged to generate representative time profiles grouped for both estrus and non-estrus conditions. This step allowed us to visualize the underlying trends and allow a more clear comparison. Next, we mapped each minute onto a circular coordinate system by converting time into an angular position. We used an offset so that midnight appeared at the top of the radar chart, aligning the visual with the natural circadian rhythm. Lastly, raw activity values were scaled radially so that

higher energy levels extend farther from the center. Overall, these transformations shaped the noisy data into something more clear and intuitive for the average person to interpret.

Reason for choosing tooltip interactivity

In addition to visual encoding, we implemented data transformation and interactive features to enhance the clarity and usability of the visualization. The dataset was normalized and smoothed to reduce noise, ensuring that meaningful trends remain visible without minor fluctuations obscuring key insights. Outliers were not shown or aggregated to prevent extreme values from distorting the overall pattern. Since radial graphs show broad trends but may obscure fine-grained details, we incorporated tooltip interactivity to allow users to explore specific data points. By hovering over any point in the graph, viewers can see the exact timestamp and activity level, making it possible to pinpoint significant events such as the peak activity for estrus mice, which occurs around 7-8 AM with activity levels reaching approximately 50. This feature enables precise comparisons between estrus and non-estrus states, facilitating deeper analysis of behavioral changes over time. There is also a toggle feature to select only between the estrus and non-estrus data, so that the trends can be analyzed individually. This may also make it easier to hover over some data points in order to use the tooltip.

Development and Contributions

The development of this visualization was a collaborative effort, with tasks divided among all team members. Data processing and cleaning were the initial steps, ensuring the dataset was structured correctly for visualization. The implementation phase involved designing and fine-tuning the radial graph, selecting appropriate visual encodings, and integrating interactive elements such as tooltips and toggle buttons. The total development time was around 7 hours. Despite these challenges, the result is an intuitive and engaging visualization that effectively communicates the relationship between circadian activity and estrus cycles in female mice.

- Angela: Write-up, feedback on data visualization, bug fixes.
- Fred: Created base visualization, legend, and hover tooltip. Assisted on write-up.
- Hunter: Creating GitHub page, developing brush tool, summary statistics, and bug fixes.
- Stephanie: created toggle feature, bug fixes and write up