

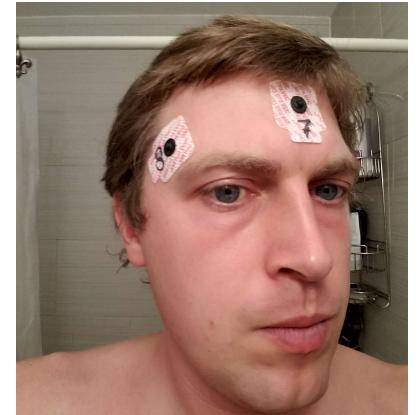
Visualizing time

Benjamin Smarr

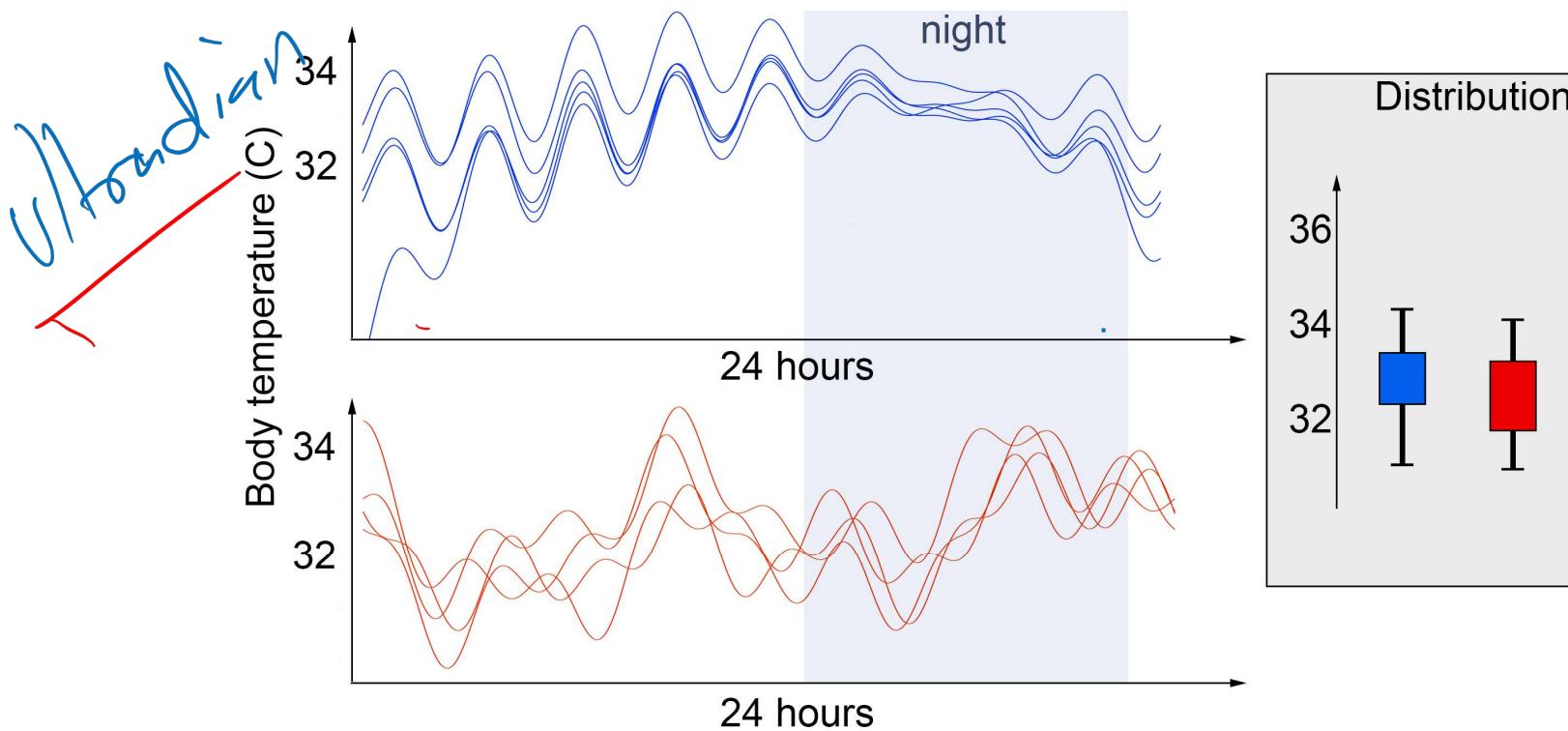
Asst. Prof. Halicioglu Data Science Institute

Shu Chien - Gene Lay Department of Bioengineering

DSC 106 W25



Why does visualizing time series matter?



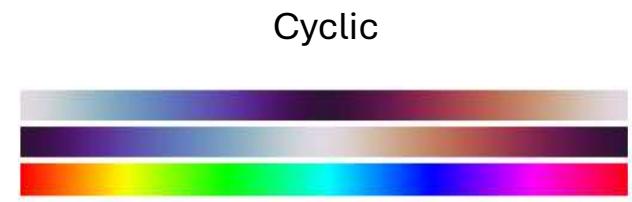
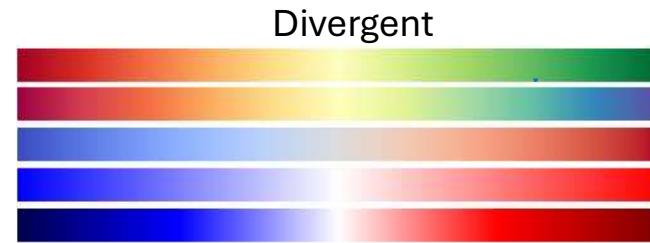
1. BIG IDEAs Lab Glycemic Variability and Wearable Device Data
2. VitalDB Korean Surgery Dataset
3. Physionet – collection datasets
4. Mouse Data (you'll see today!)

Questions to ask about a good visualization

1) What do you want to compare (windows, individuals, trends)?



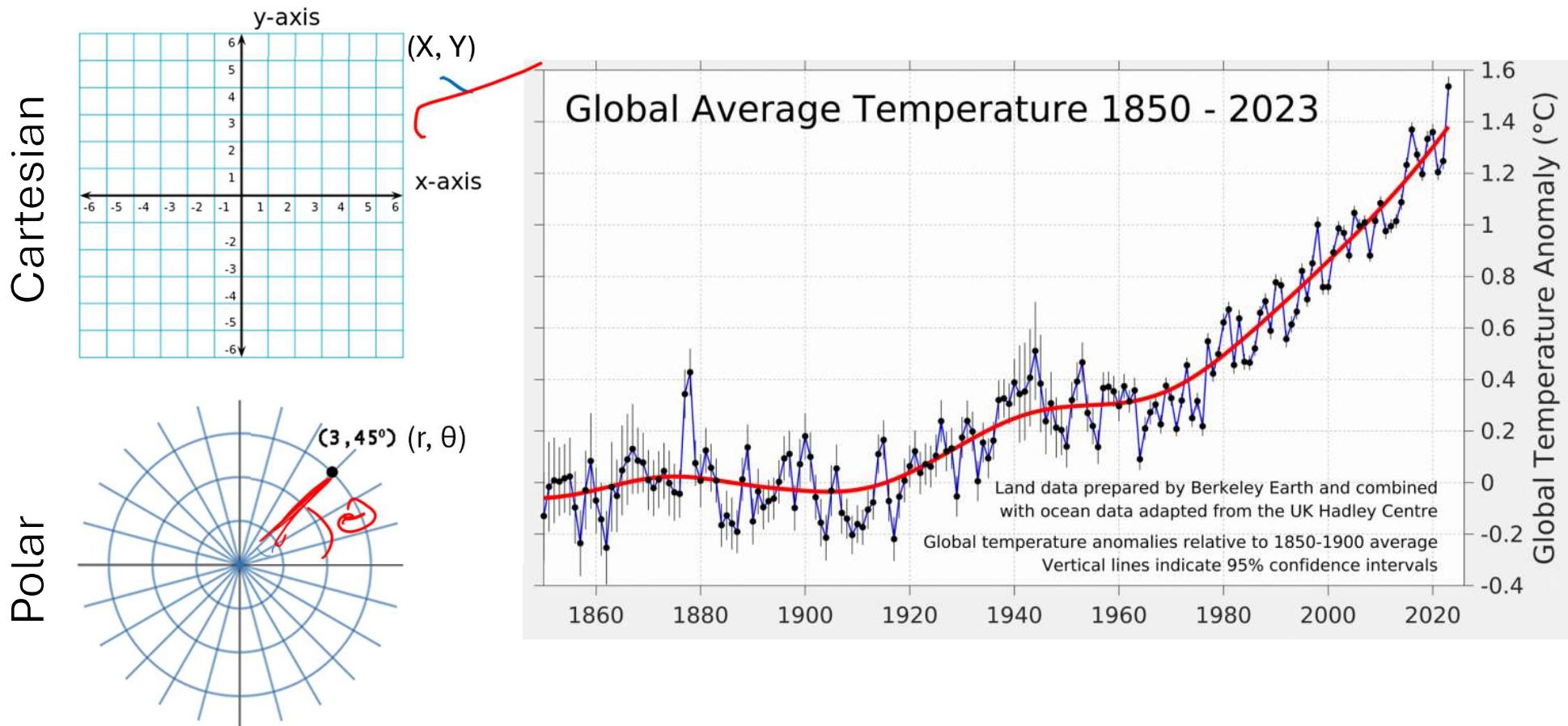
2) What do you want to highlight (Distance, Sign, Label)?



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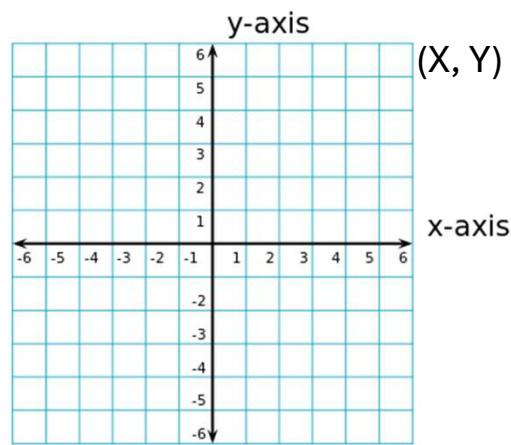
3) What aspect of time matters (linear, modules, phase, frequency)?

Radial plots

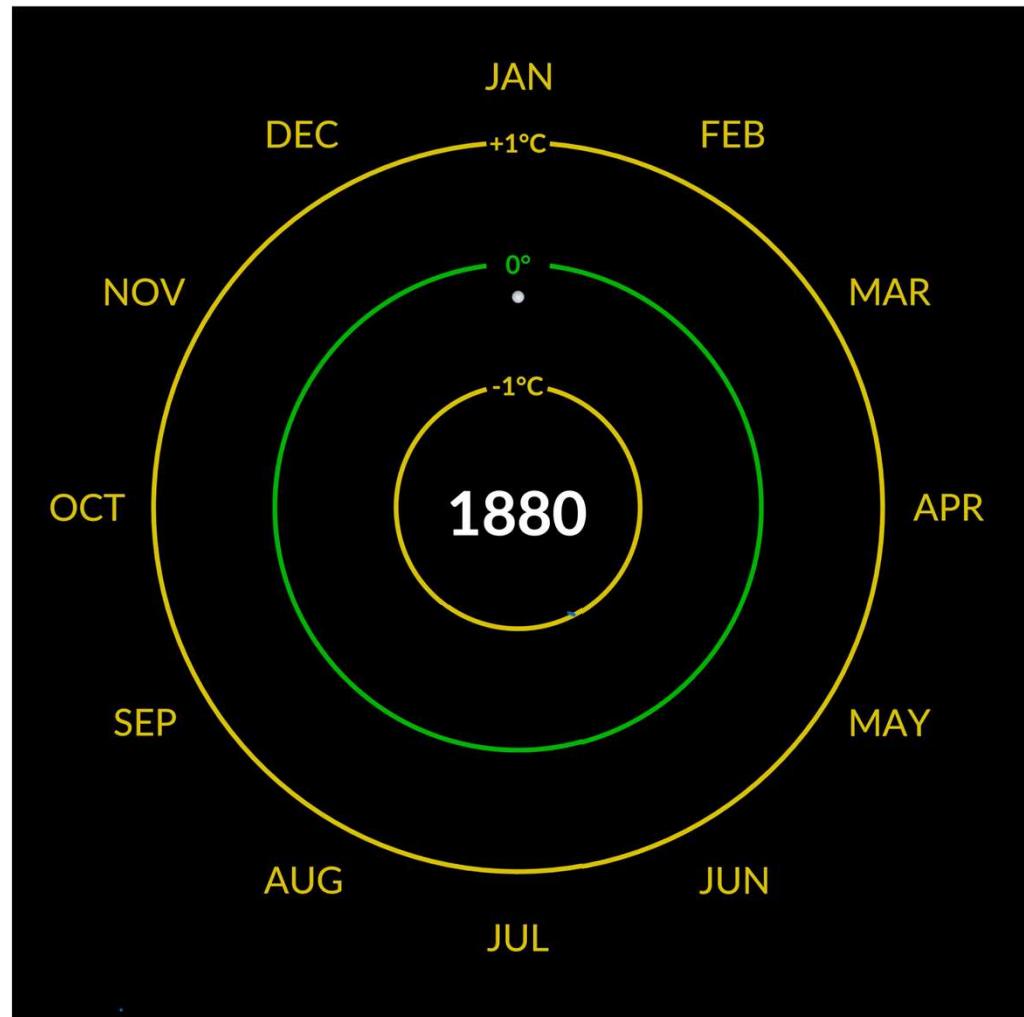
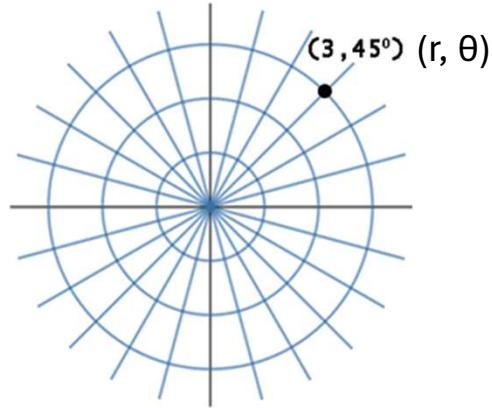


Radial plots

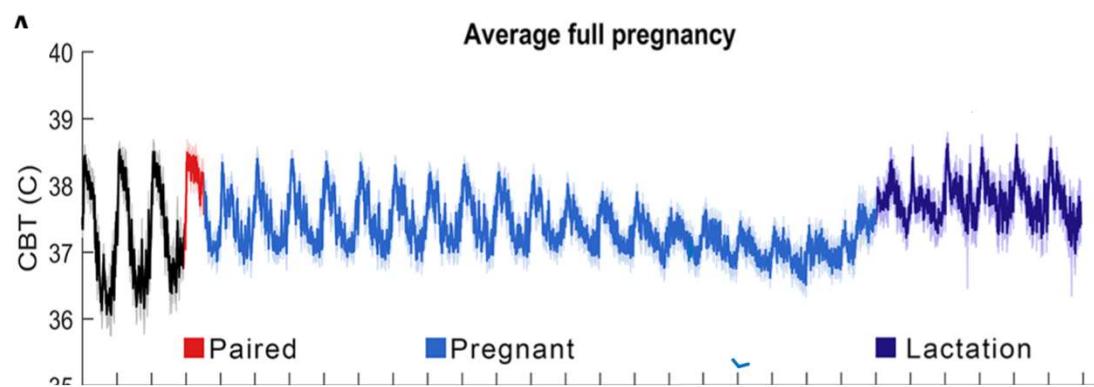
Cartesian



Polar

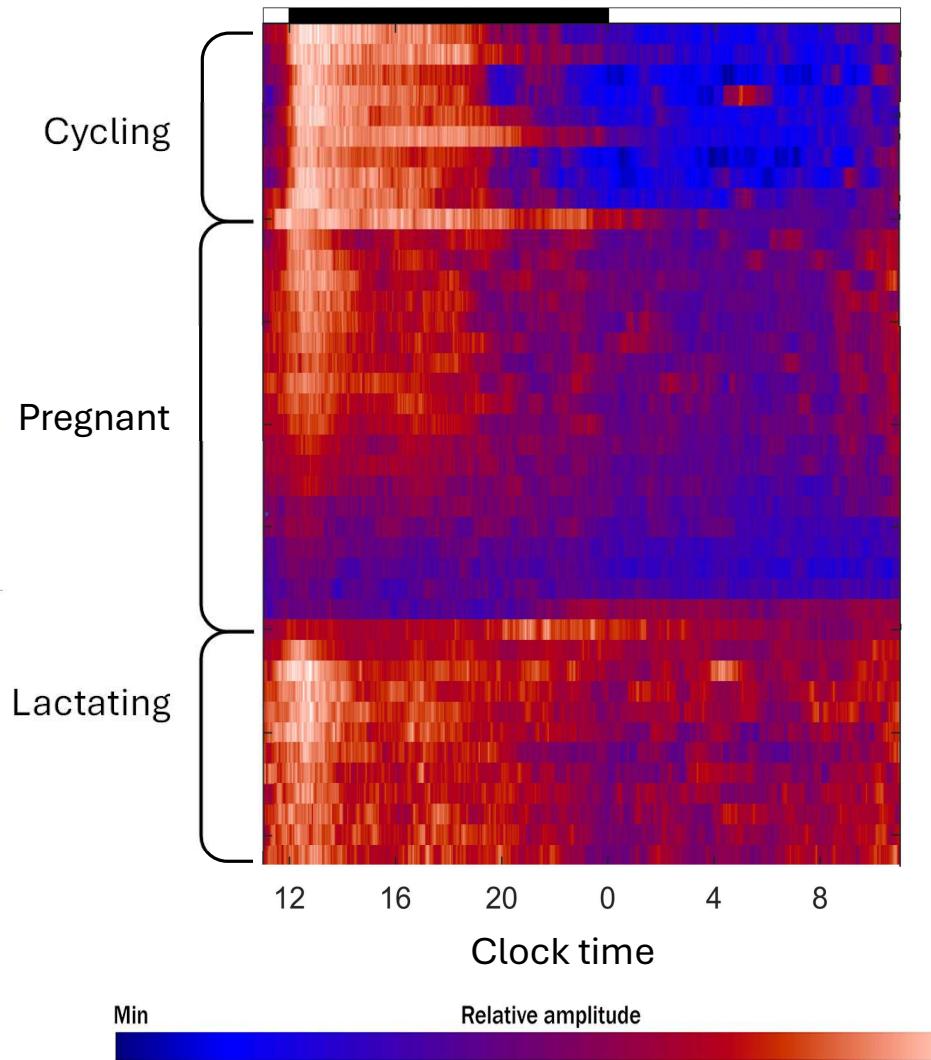


Heatmaps and aggregation

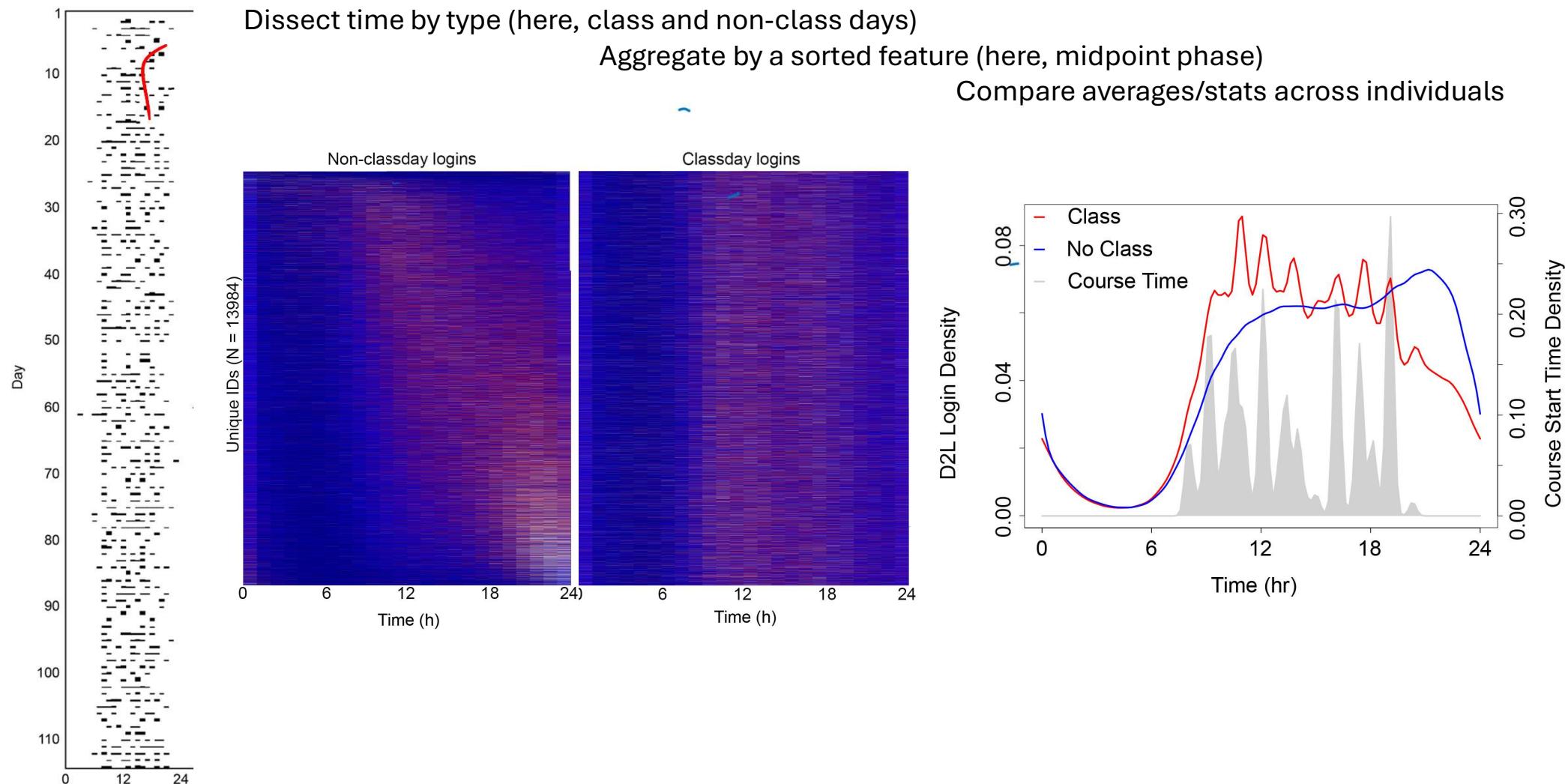


Remapping a line into a matrix:

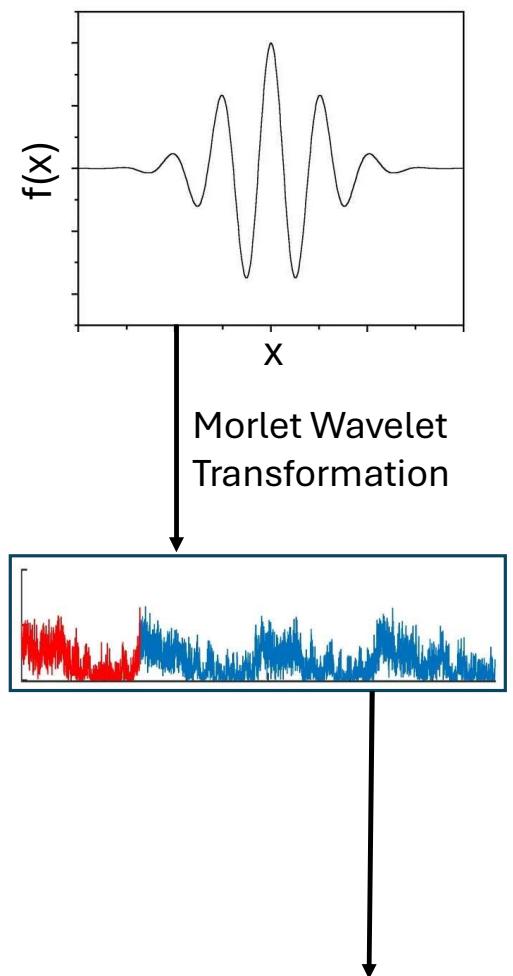
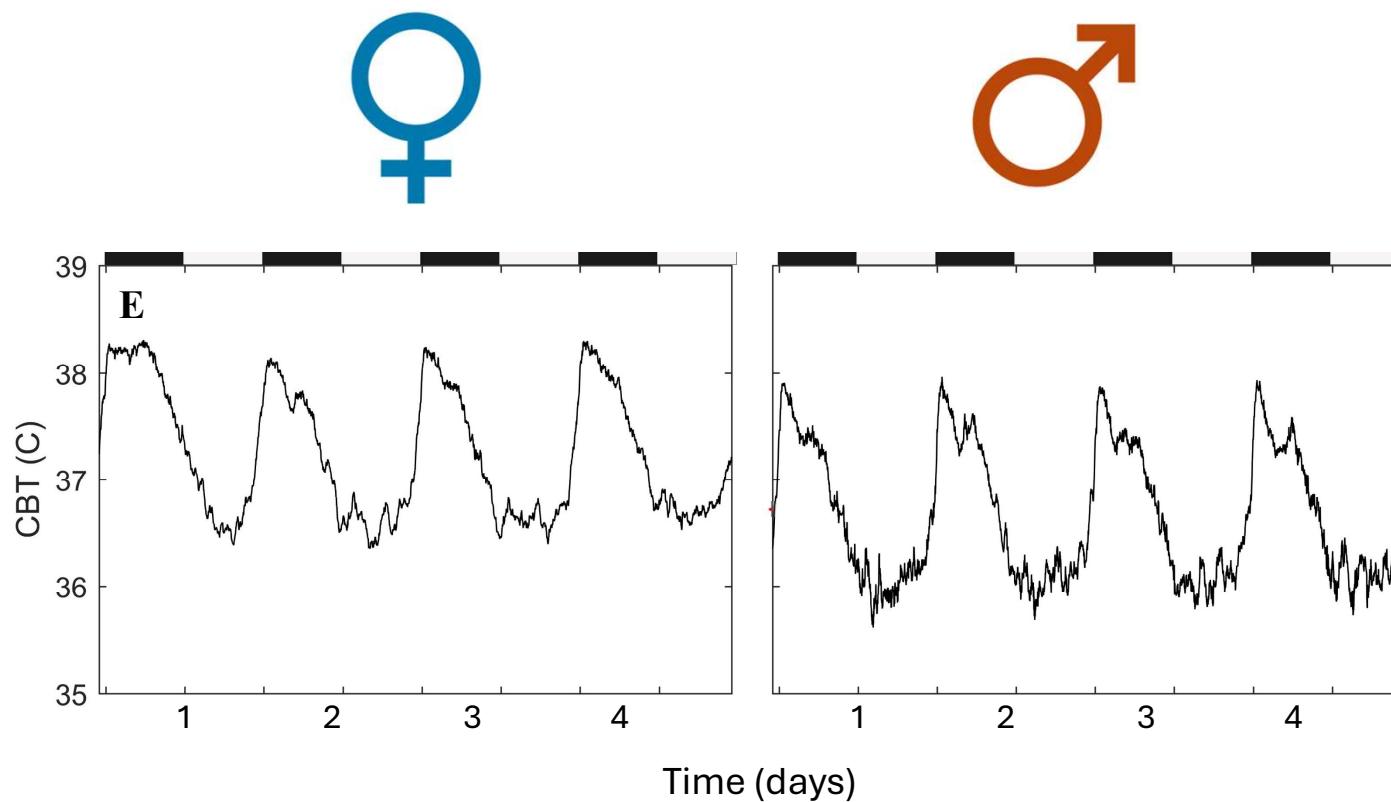
- 1) Assess alignment by mode/unit
- 2) See more time resolution
- 3) Takes more space
- 4) Difficult to compare replicates



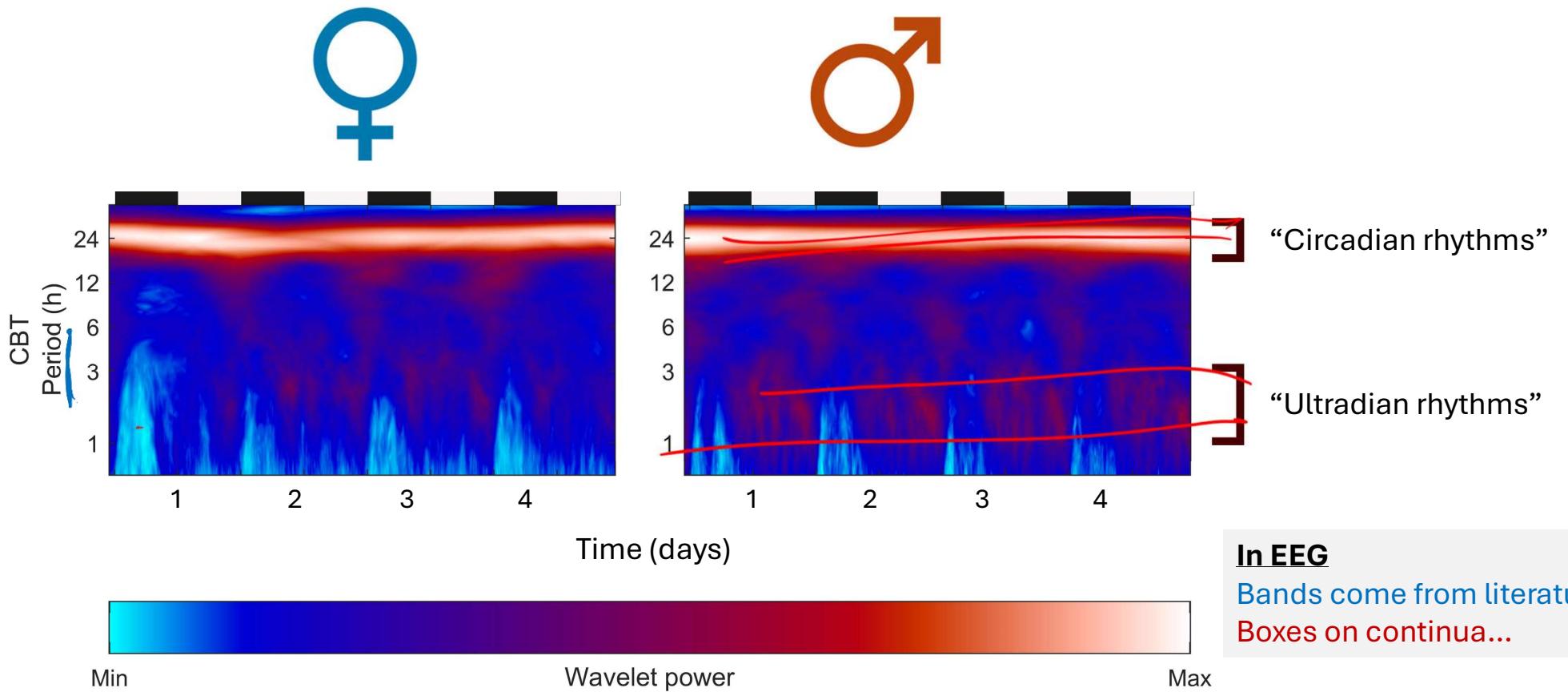
Heatmaps and aggregation



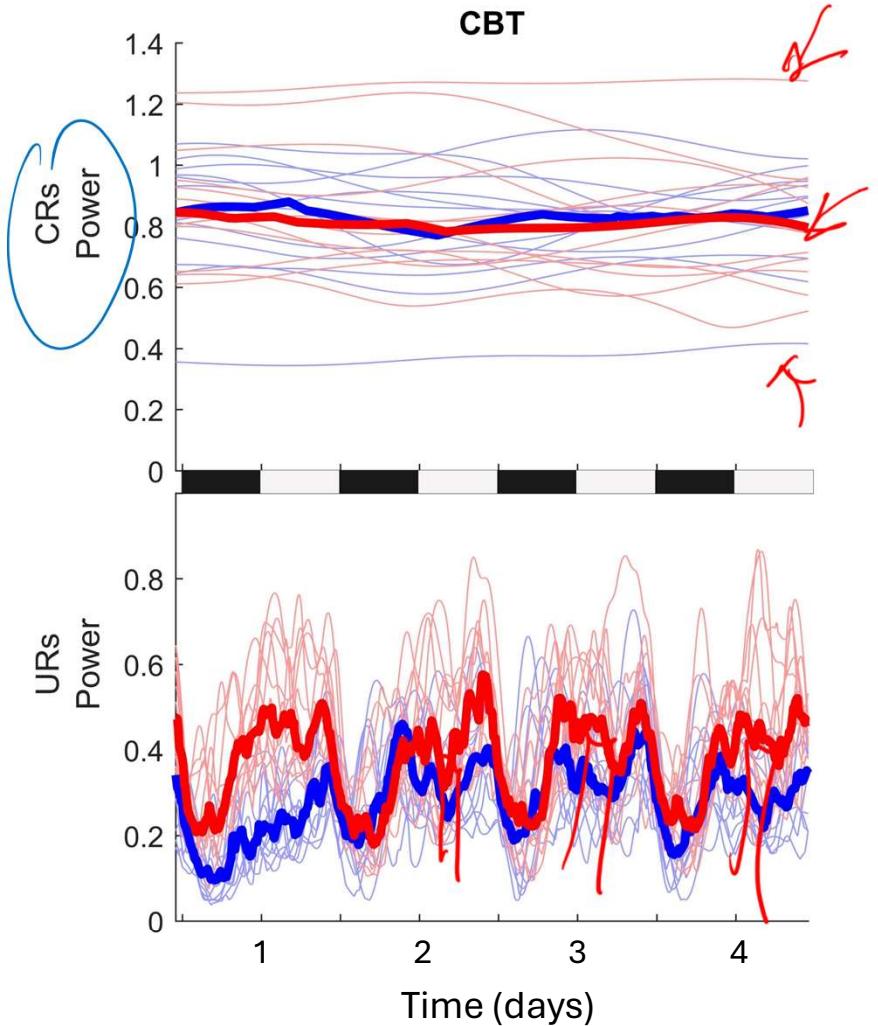
Frequency transformations



Spectrogram 3D “surface” from 2D lines

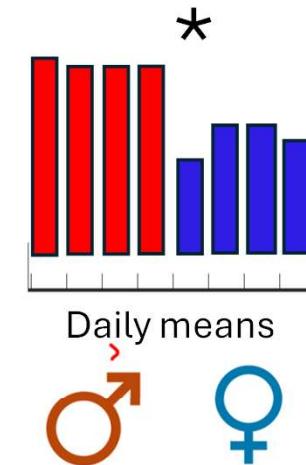
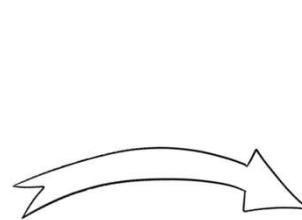


Frequency can be treated just like other data

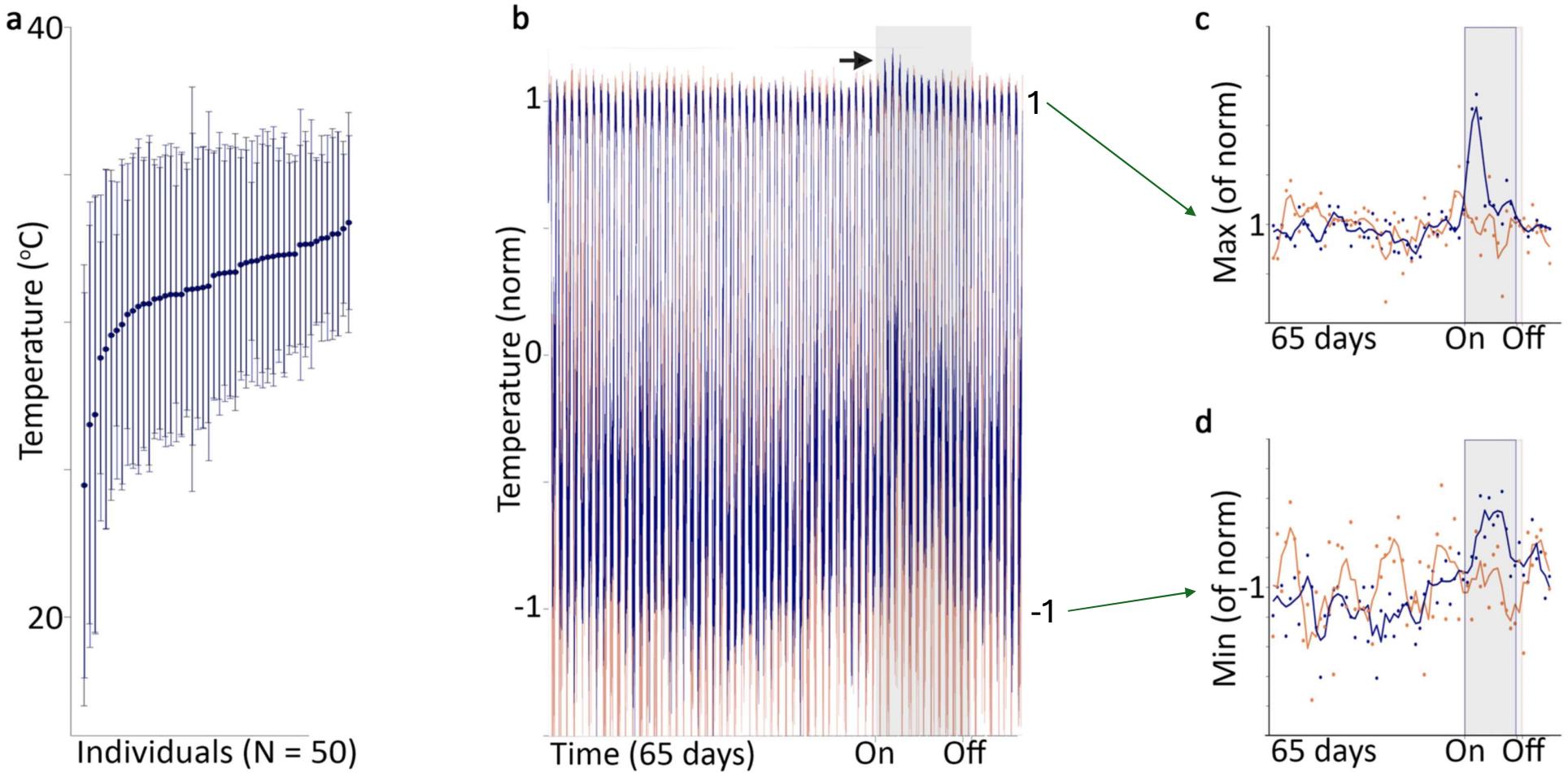


- Frequency transformations:**
- 1) Compare band by band
 - 2) Quantify dynamics
 - 3) Takes more compute
 - 4) Infinite ways to transform

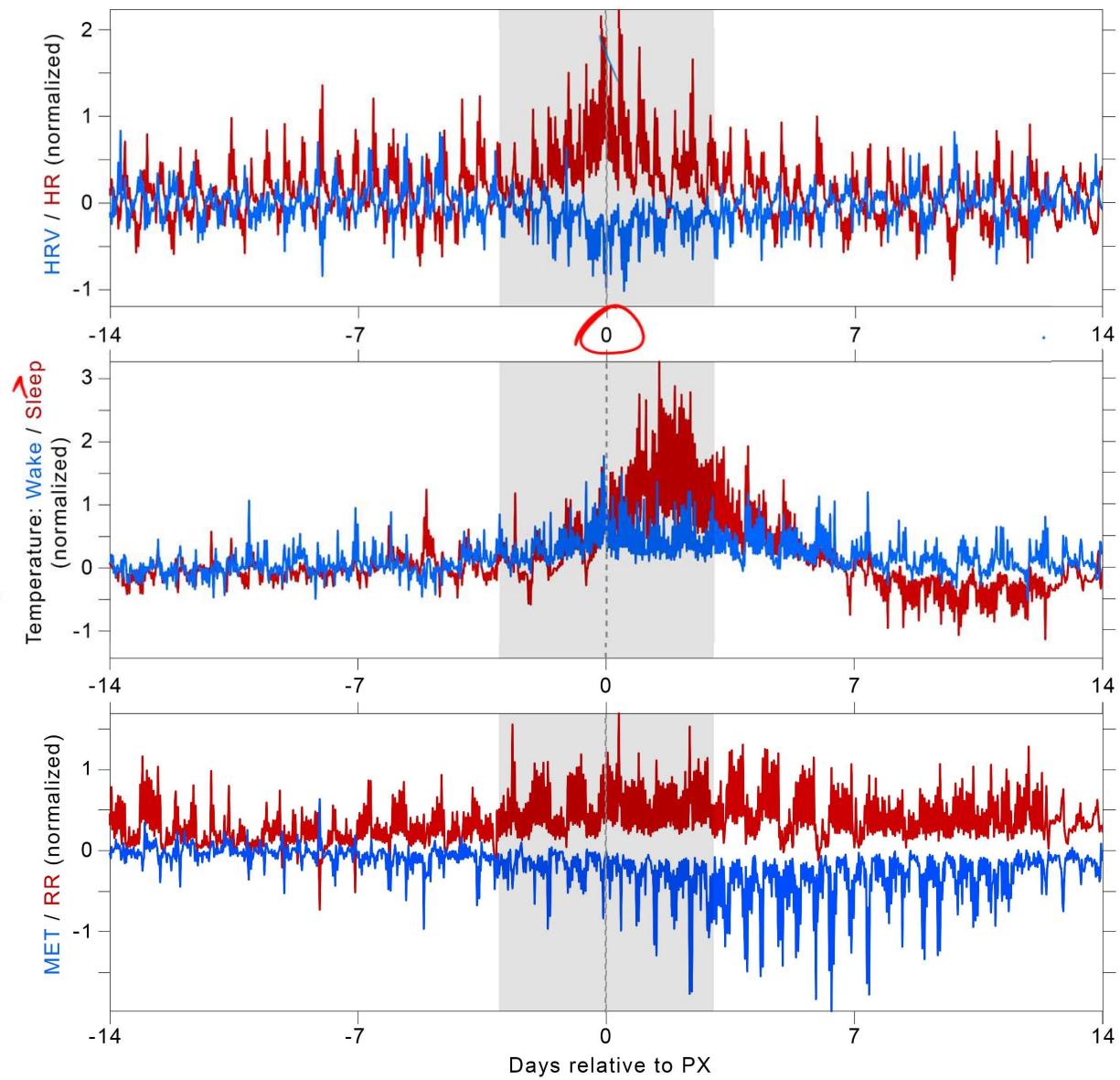
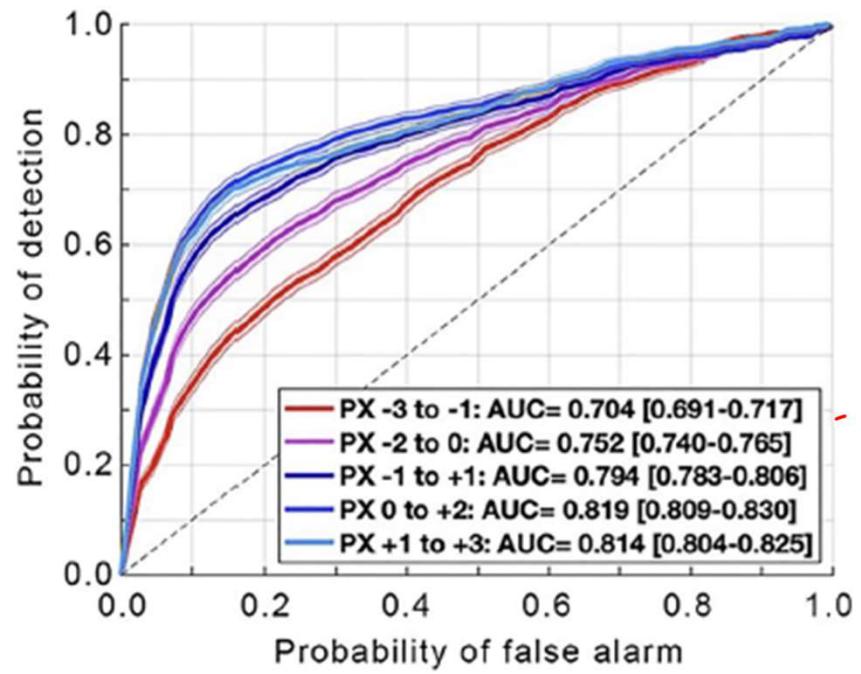
— Males
— Females



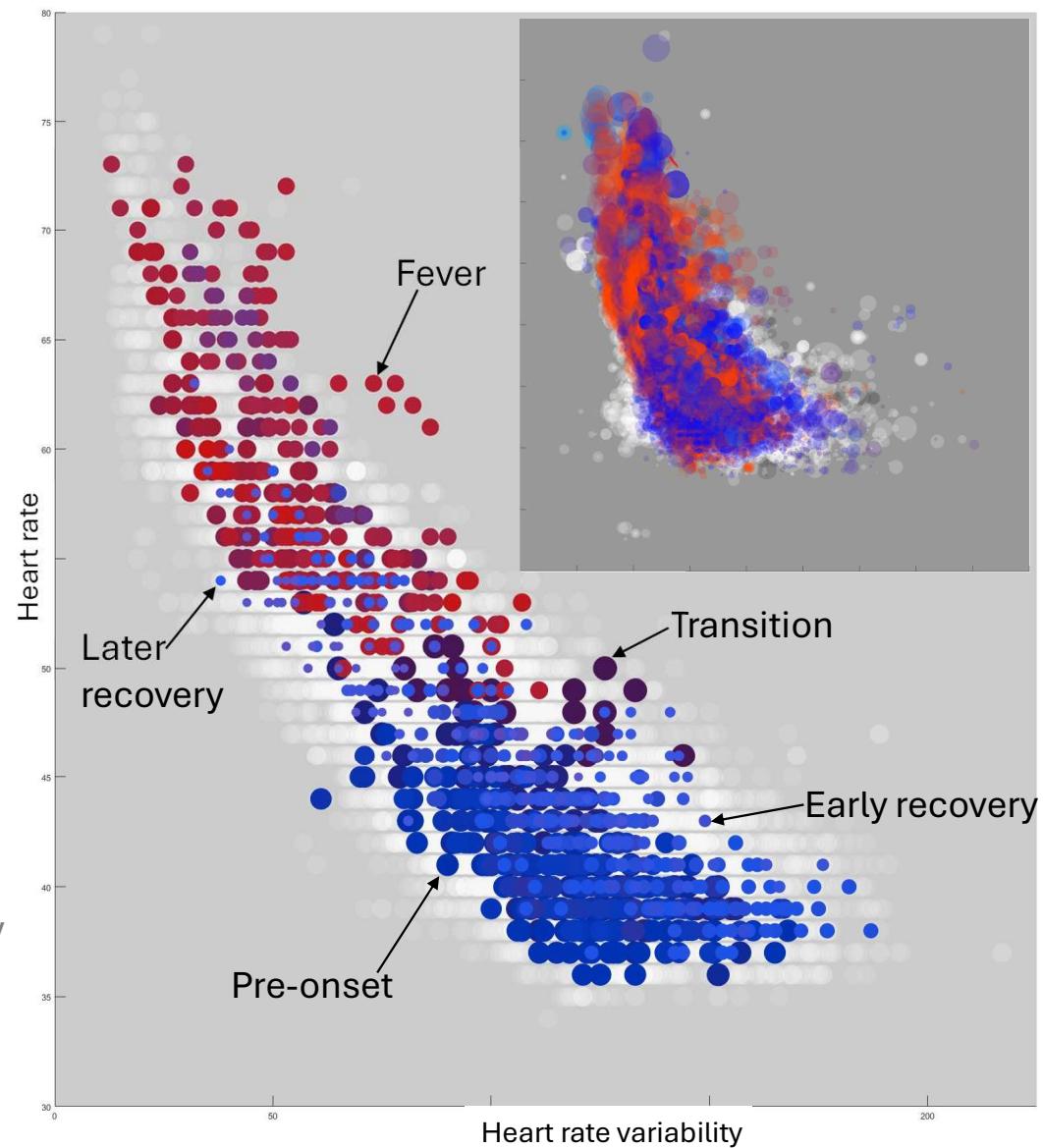
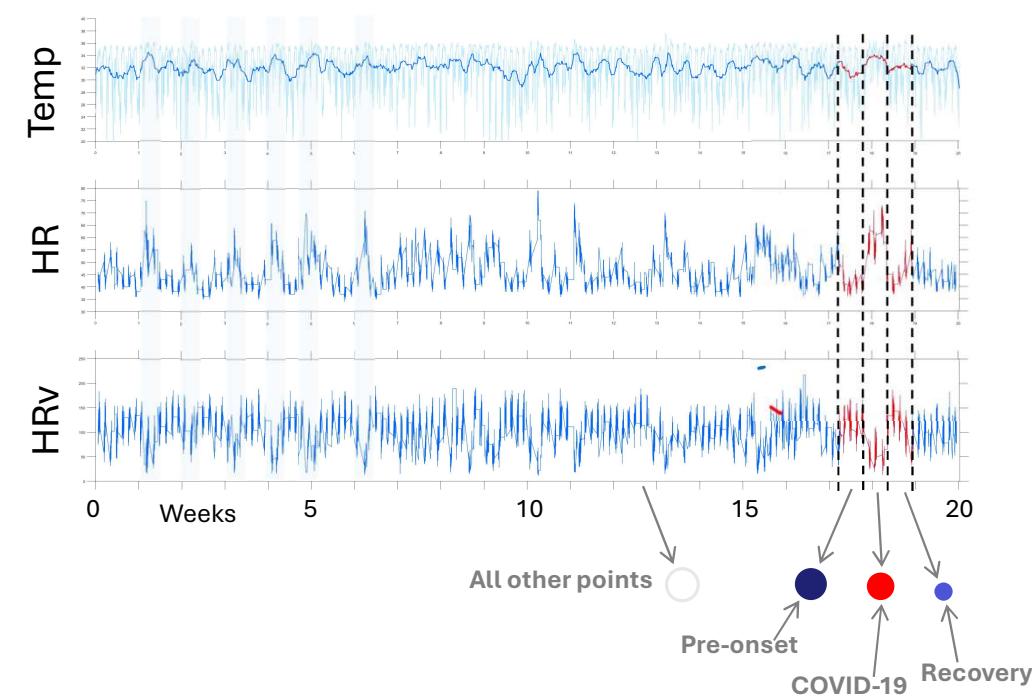
Visual exploration supports feature engineering



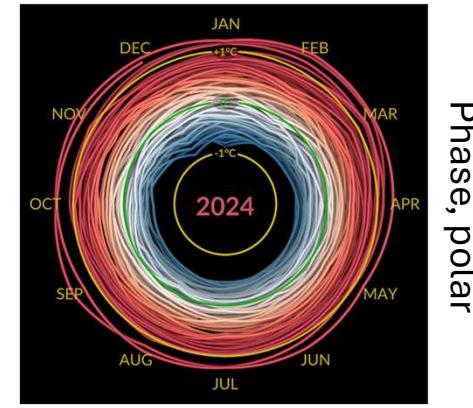
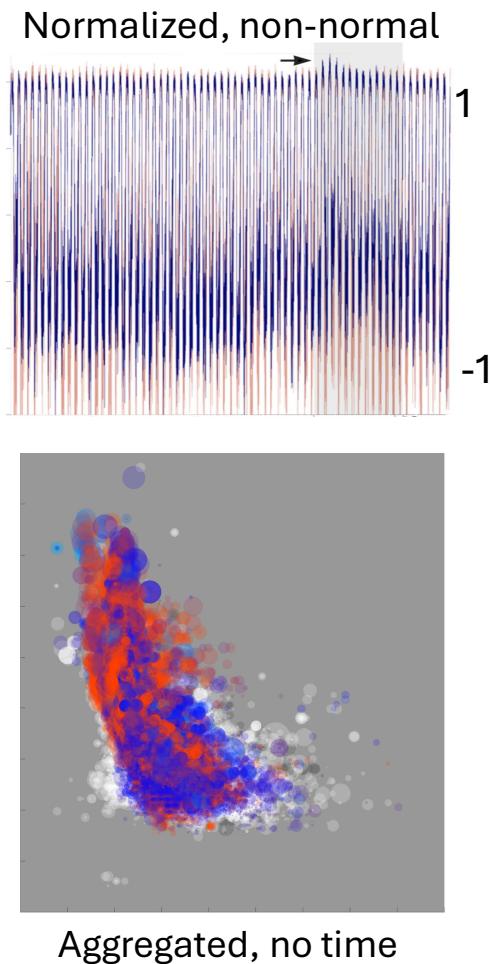
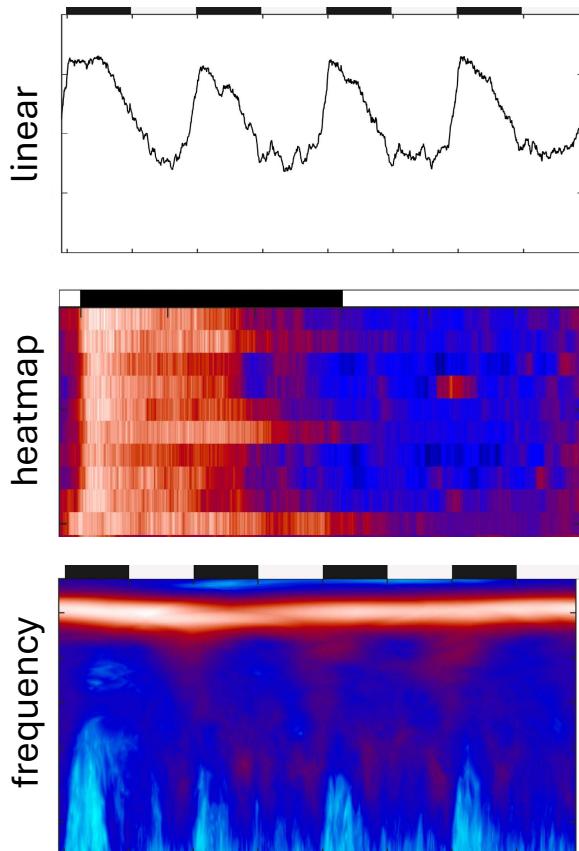
Classification in time



Time without time



Conclusion: lots of options/trade offs to consider



Iterate unsupervised and supervised learning

Different time series visualizations:

1. Build your intuition for what matters
2. Improve feature selection
3. Allow comparison at different scales
4. Allow comparison of dynamics by group
5. Support a more compelling story/argument