

EMPOWERING STUDENTS TO FLOURISH



ANDREW CAMPBELL
COMPUTER SCIENCE
DARTMOUTH COLLEGE

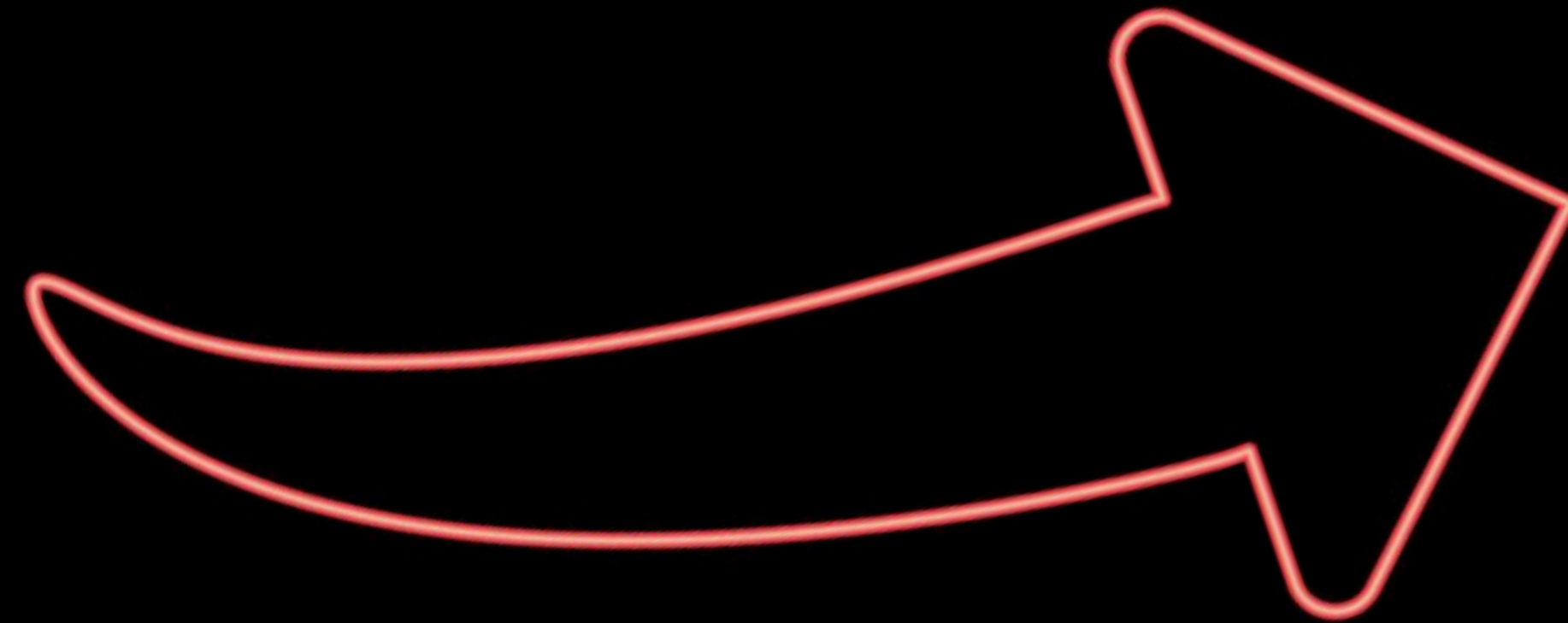
Dartmouth educates the most promising students and prepares them for a lifetime of learning and of responsible leadership through a faculty dedicated to teaching and the creation of knowledge.



mental
Illness



flourishing



MACHINES ARE NEAR TO PREDICTING MENTAL ILLNESS

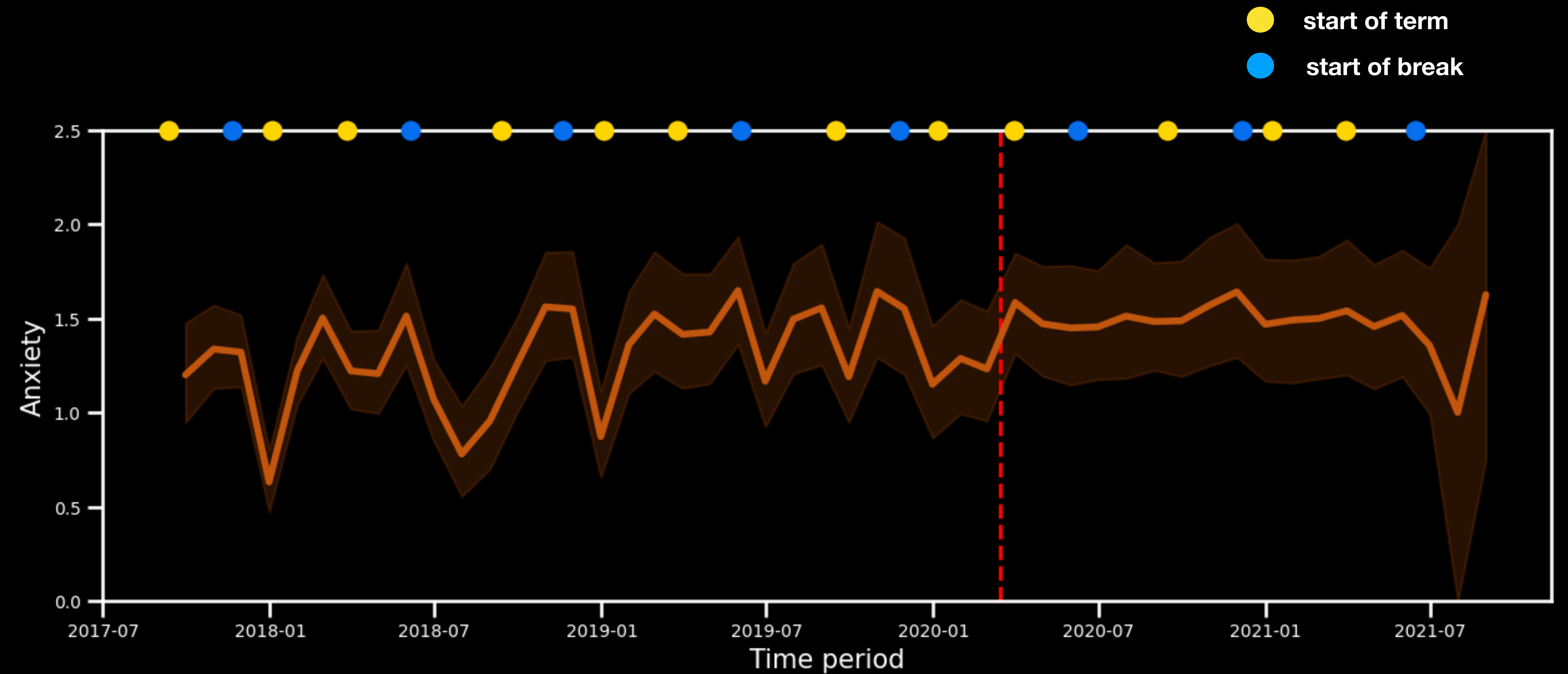




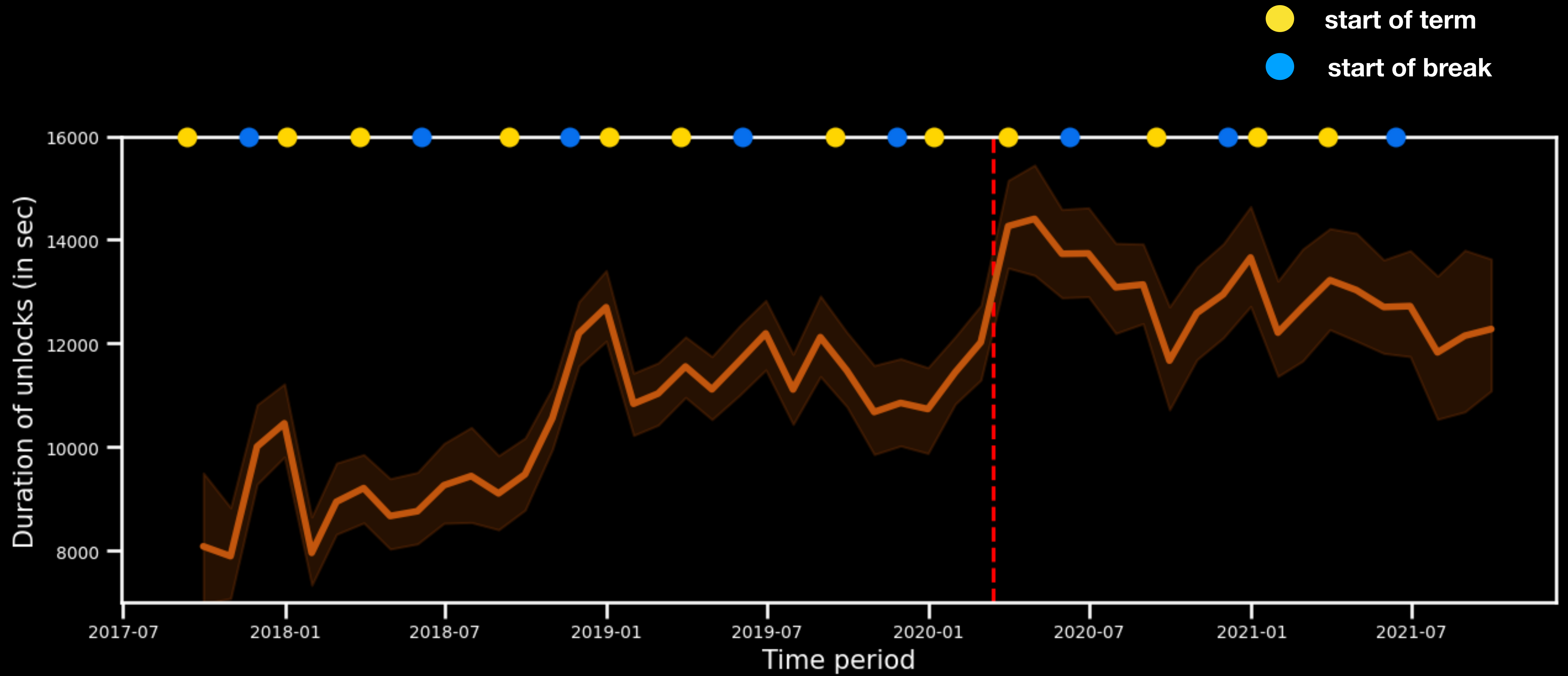
COLLEGE EXPERIENCE STUDY



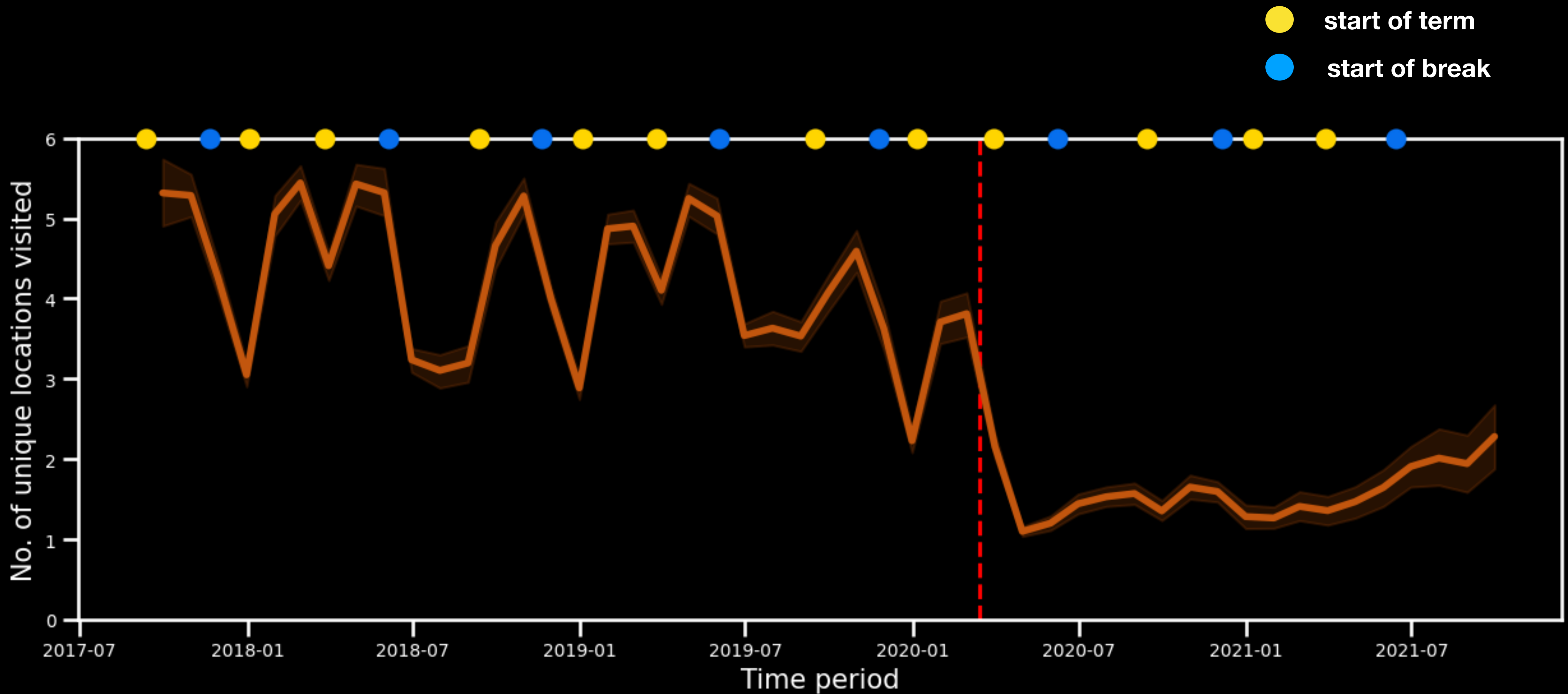
ANXIETY



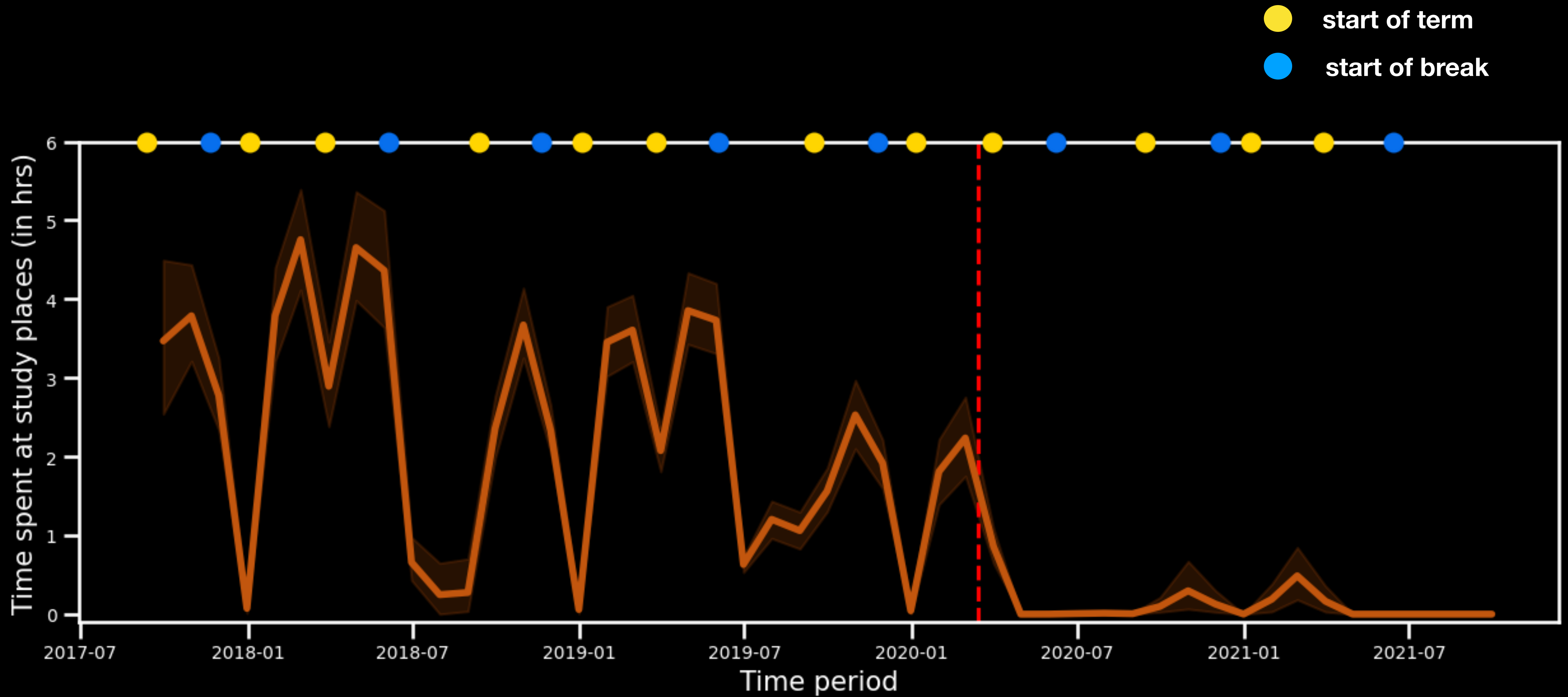
PHONE USAGE



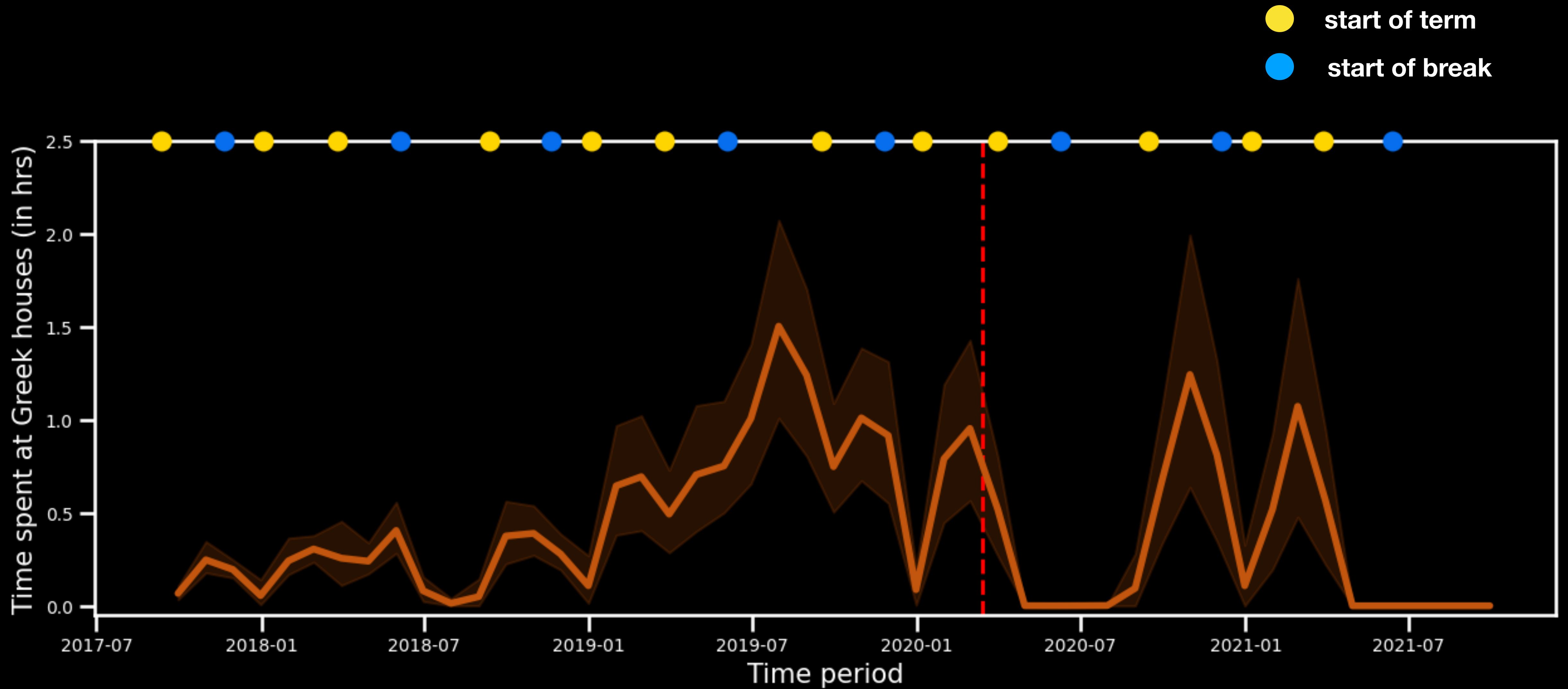
LOCATIONS VISITED

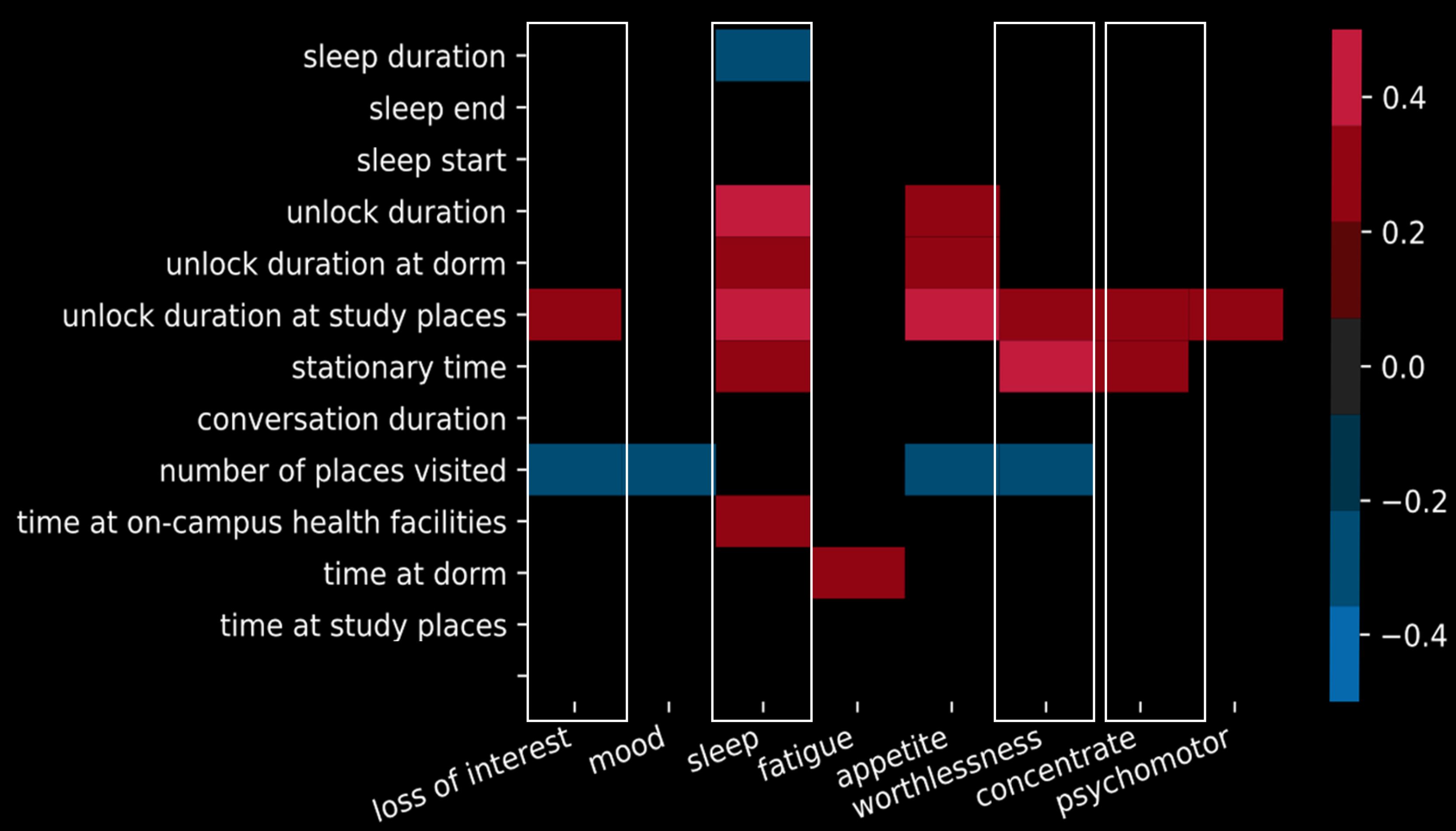


STUDYING

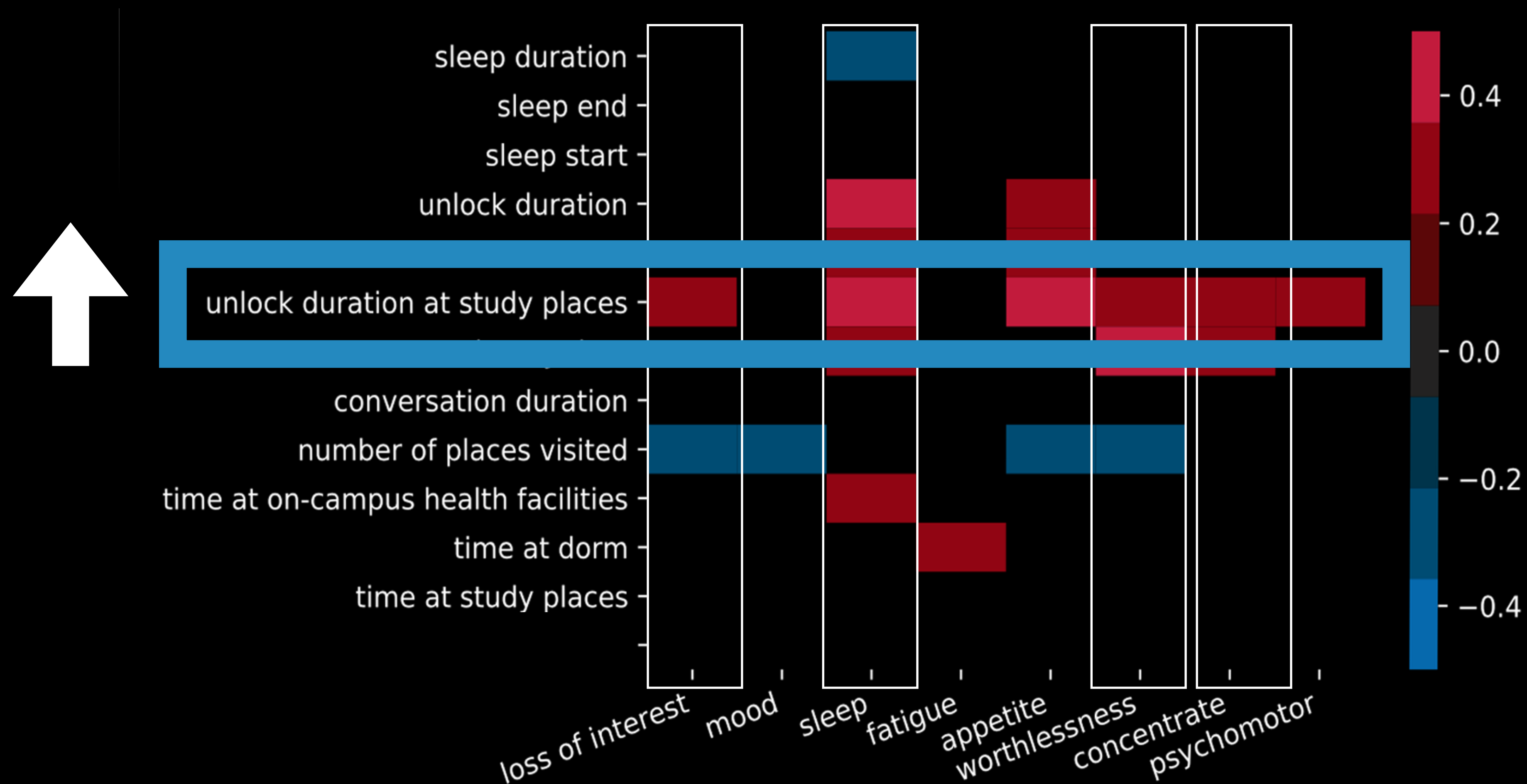


PARTYING

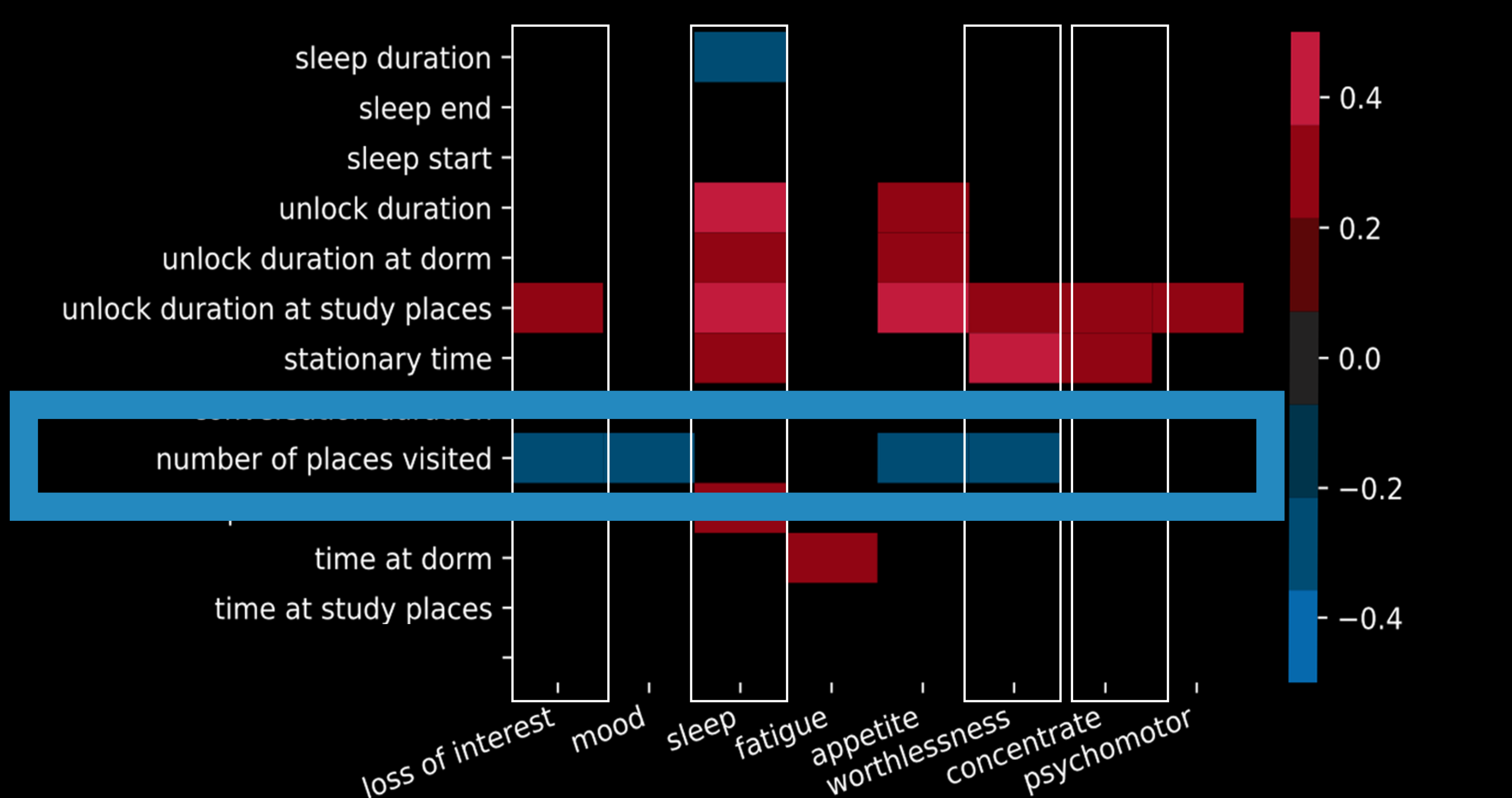
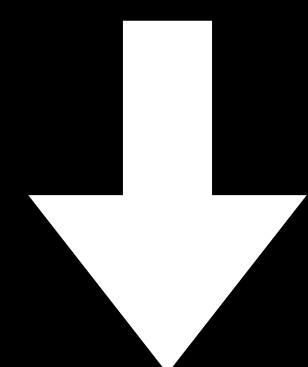




p-value < 0.05



p-value < 0.05



p-value < 0.05

DEPRESSION PREDICTION



unlock

heart rate

sleep duration

...

conversation

distance

time at study

w_1

w_2

w_3

w_{i+1}

w_{i+2}

use l1-norm to regularize training

$$w^* = \arg \min_w \sum_j (y_j - f(x_j))^2 + \lambda \sum_{i=1}^n |w_i|$$

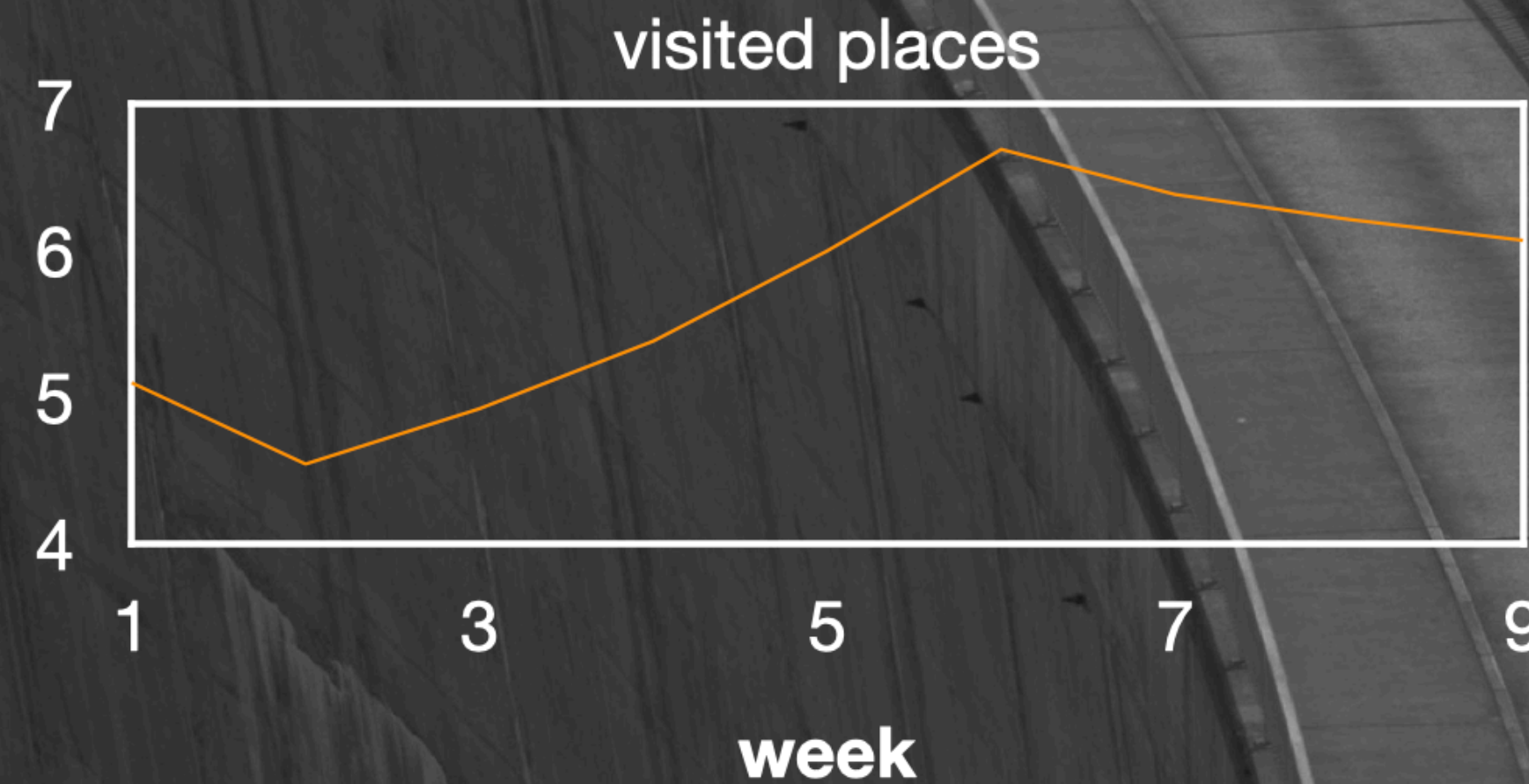
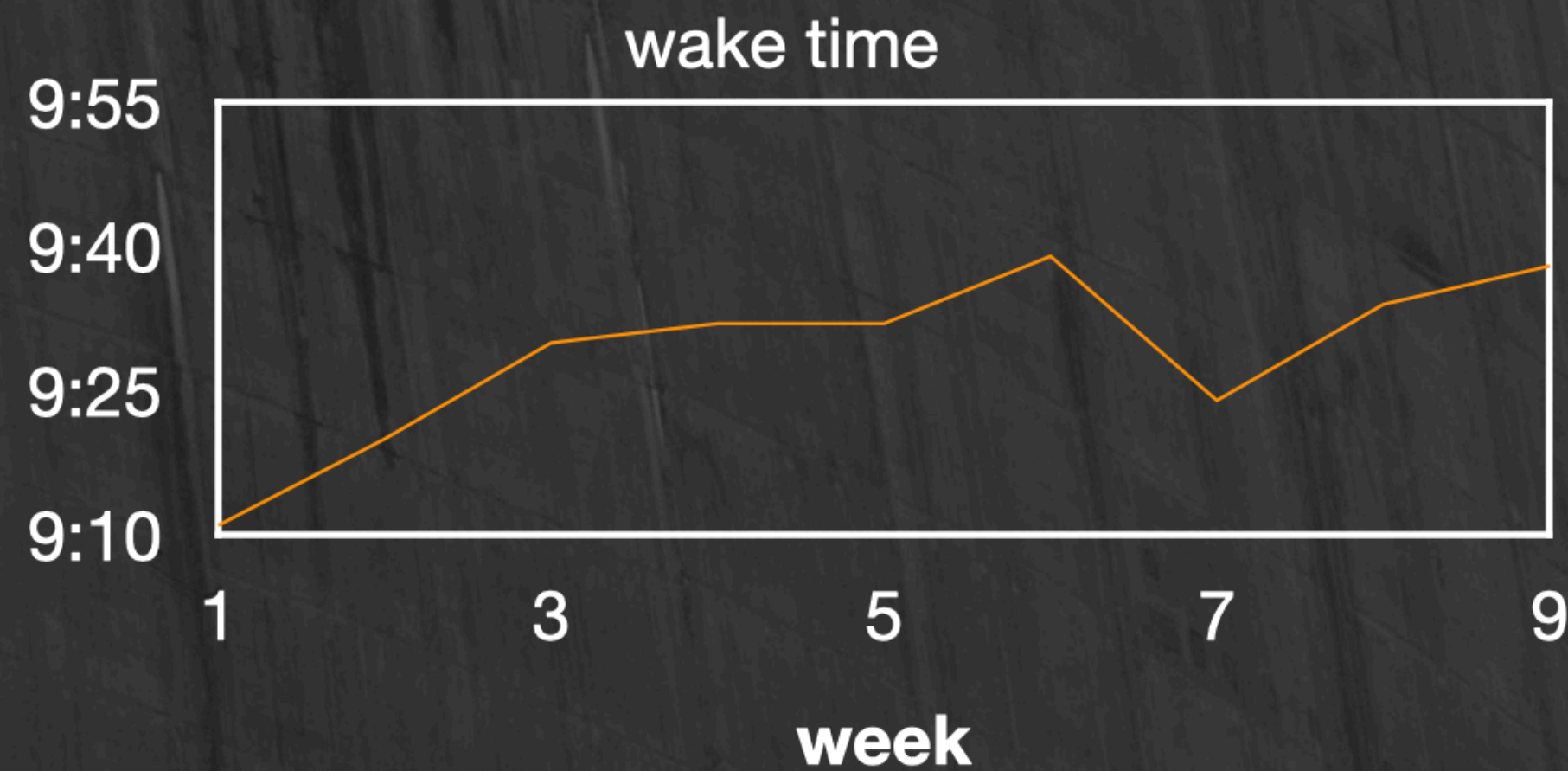
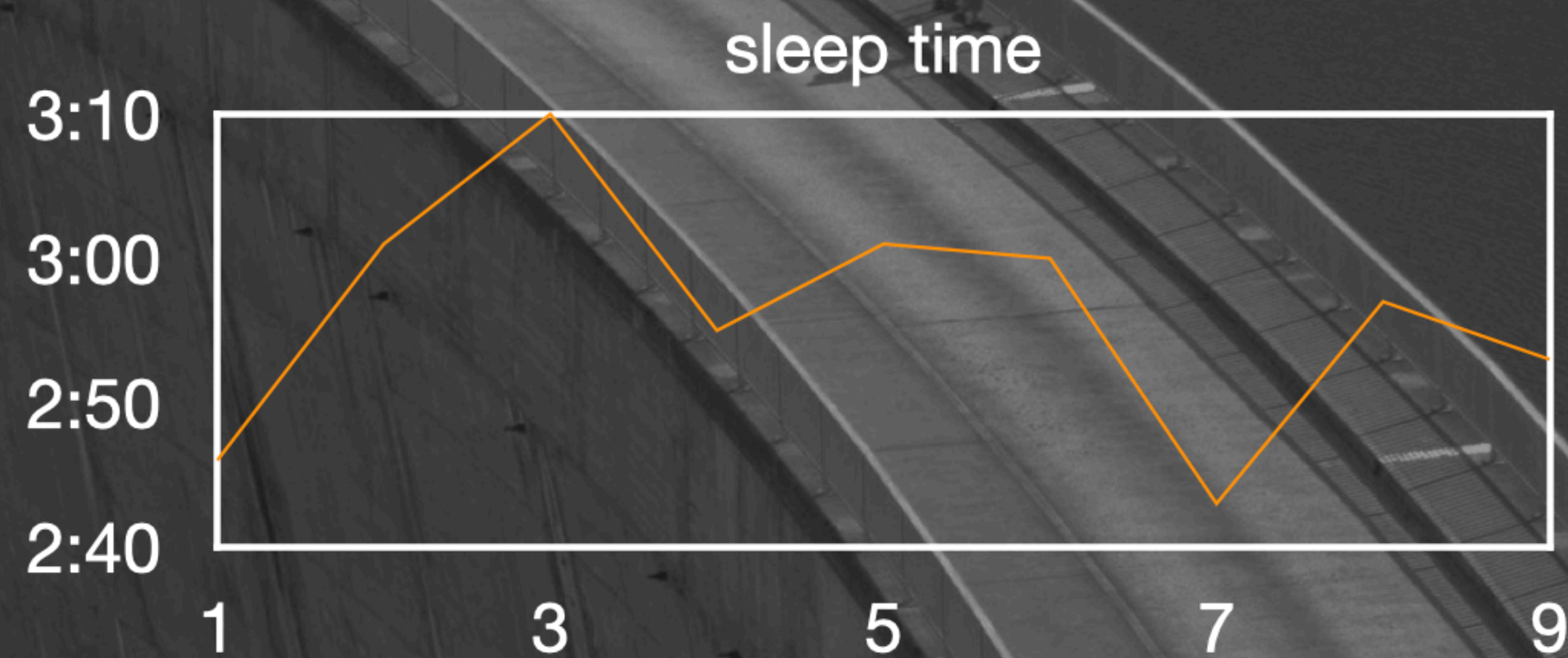
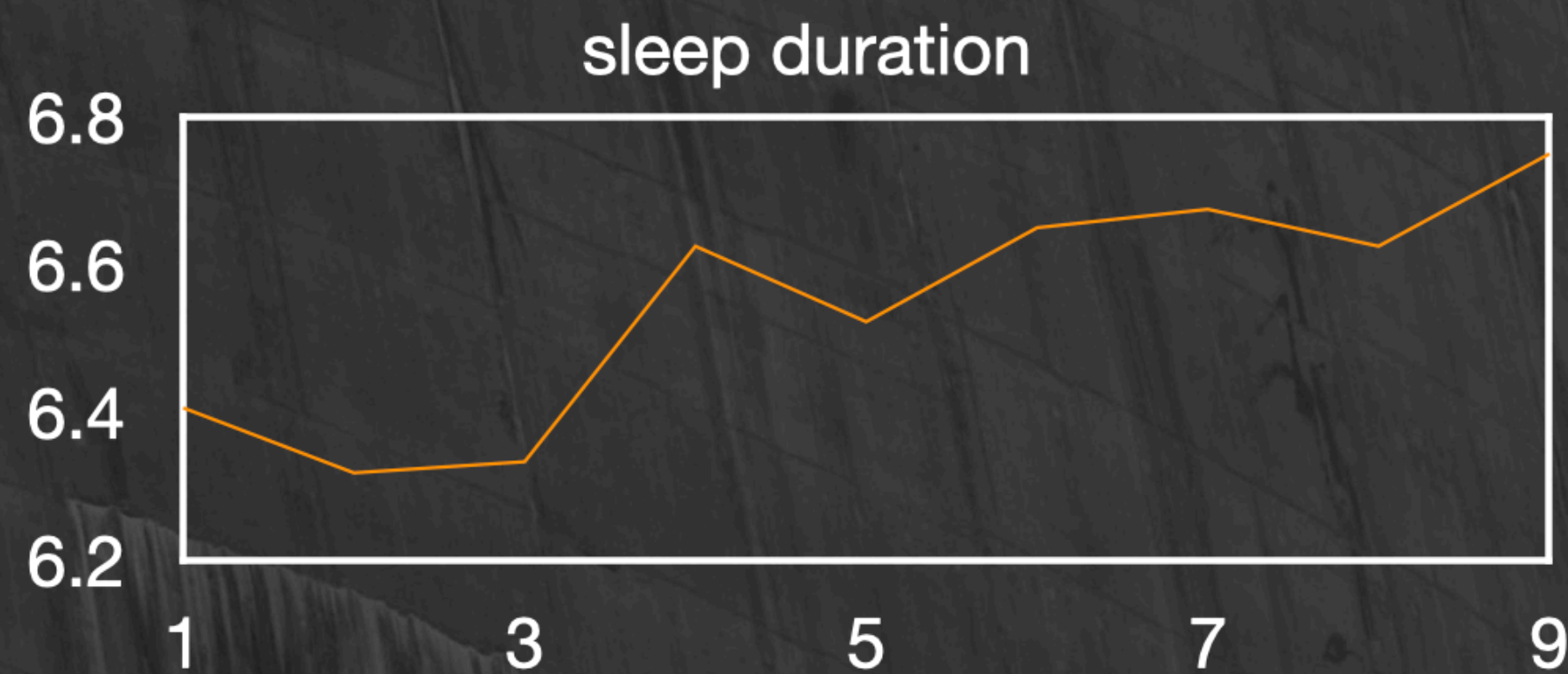
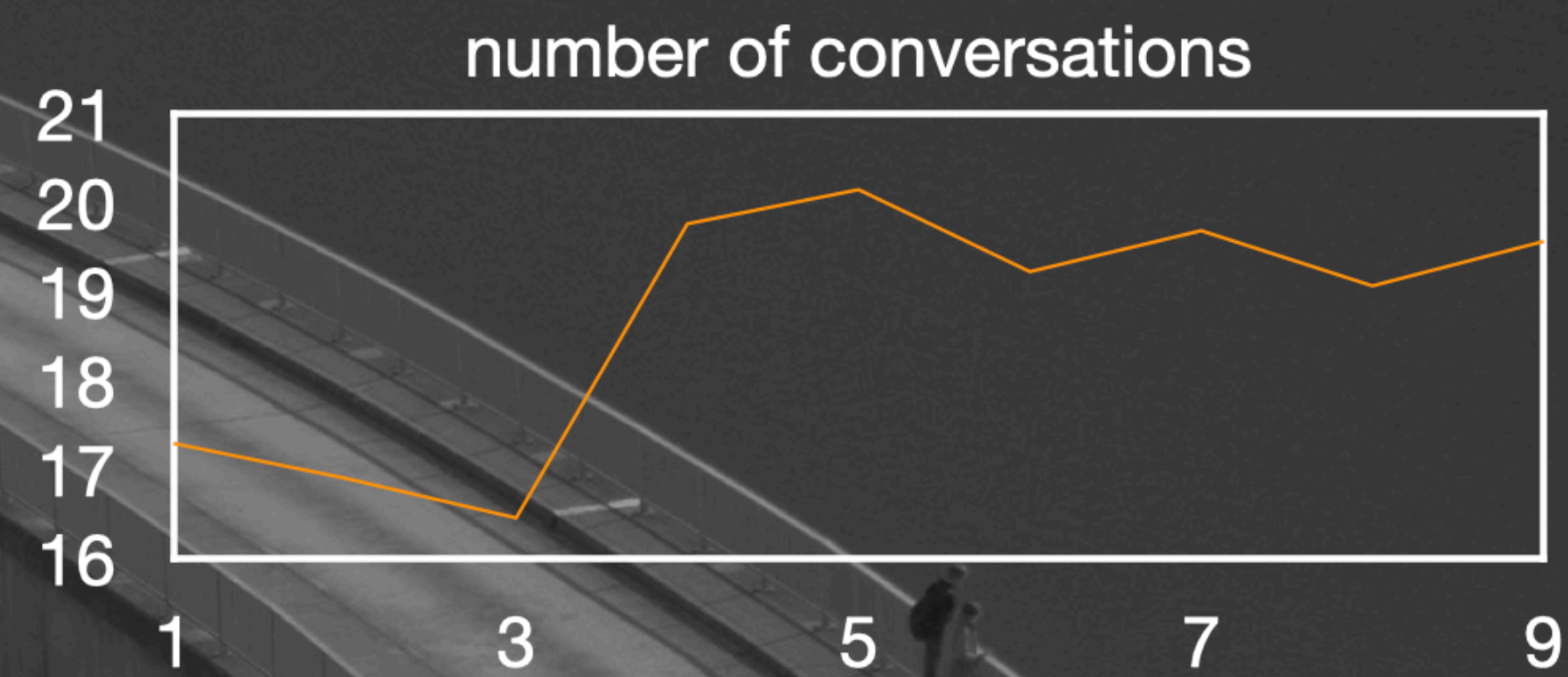
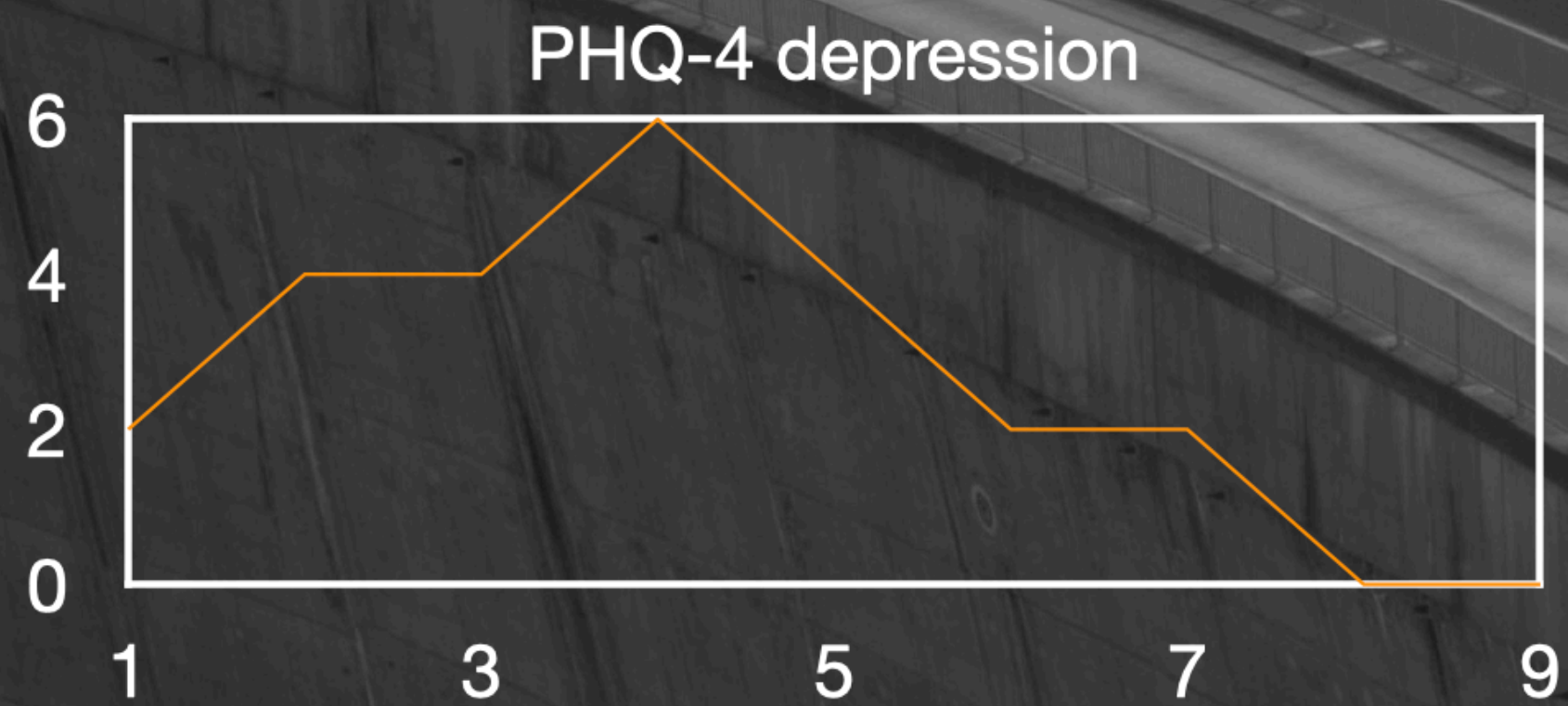
PHQ-8 score

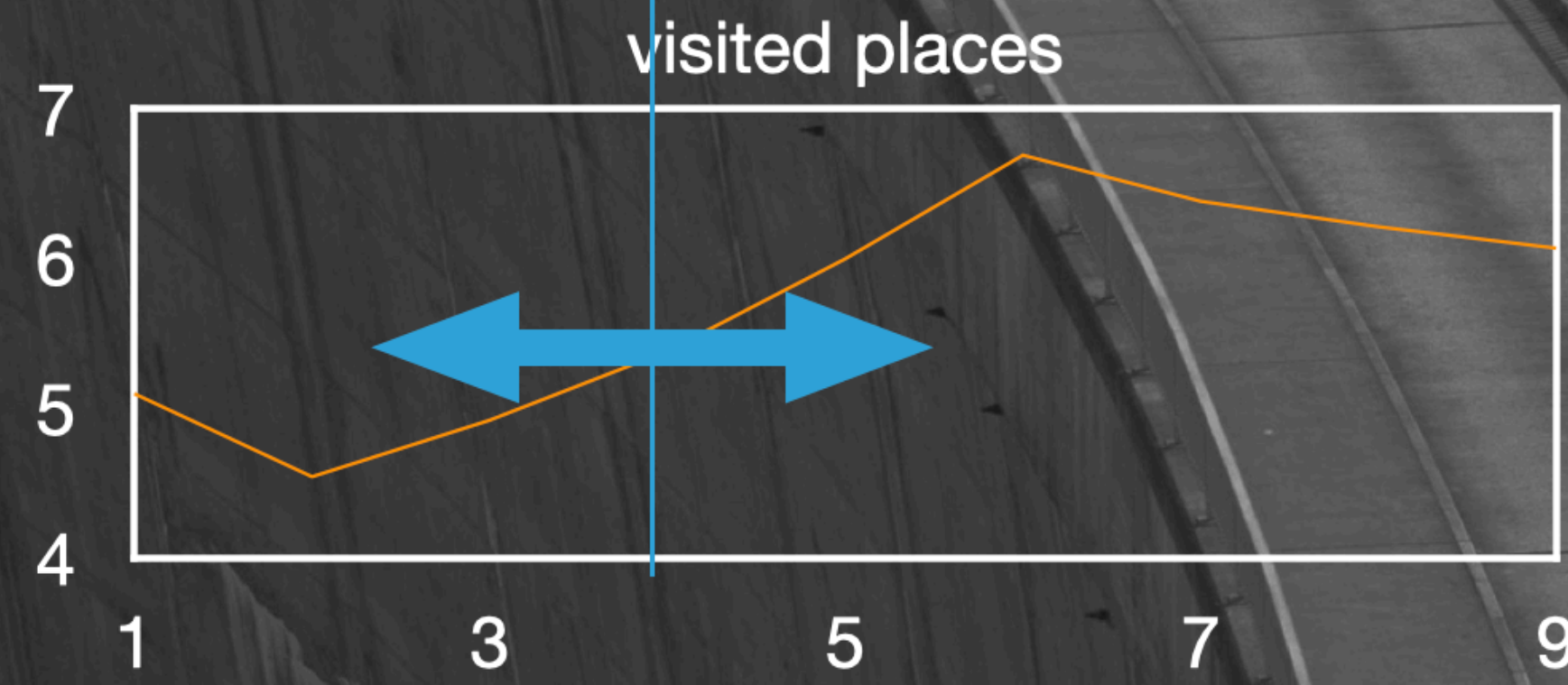
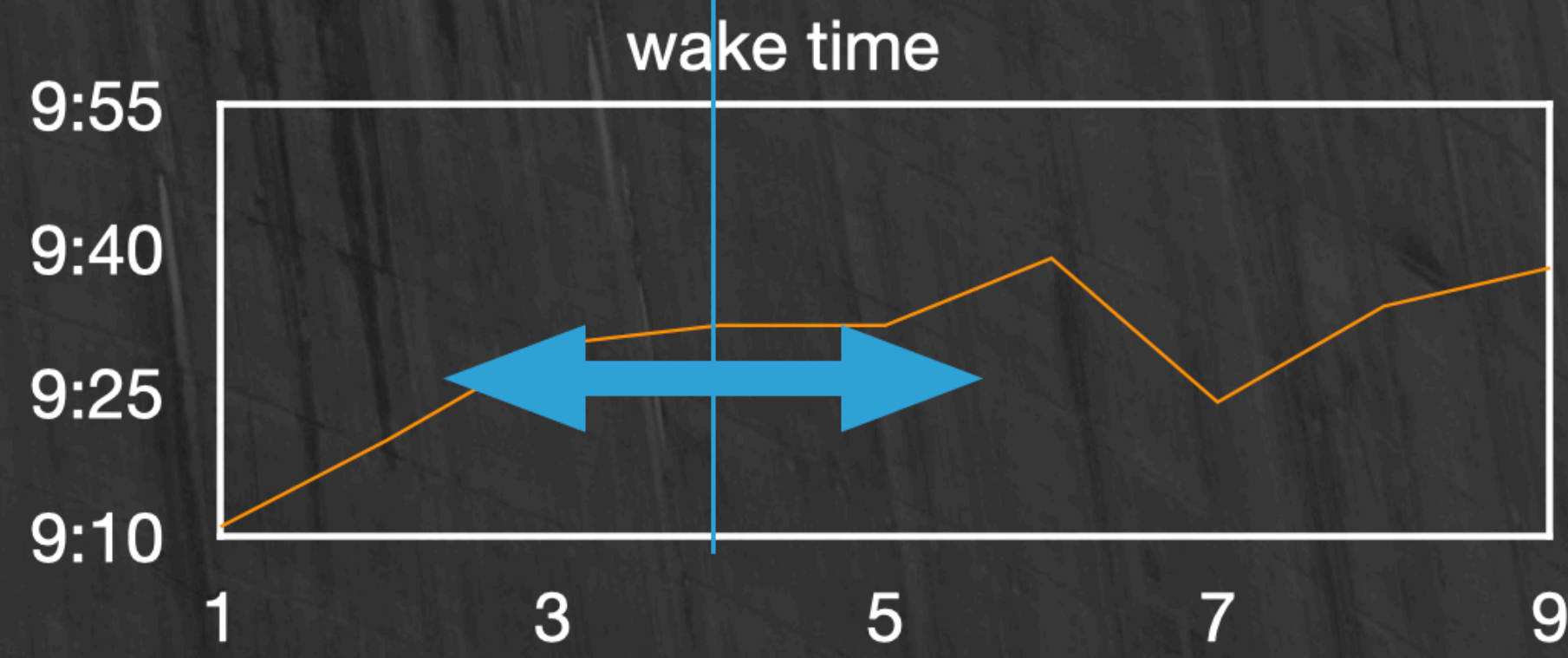
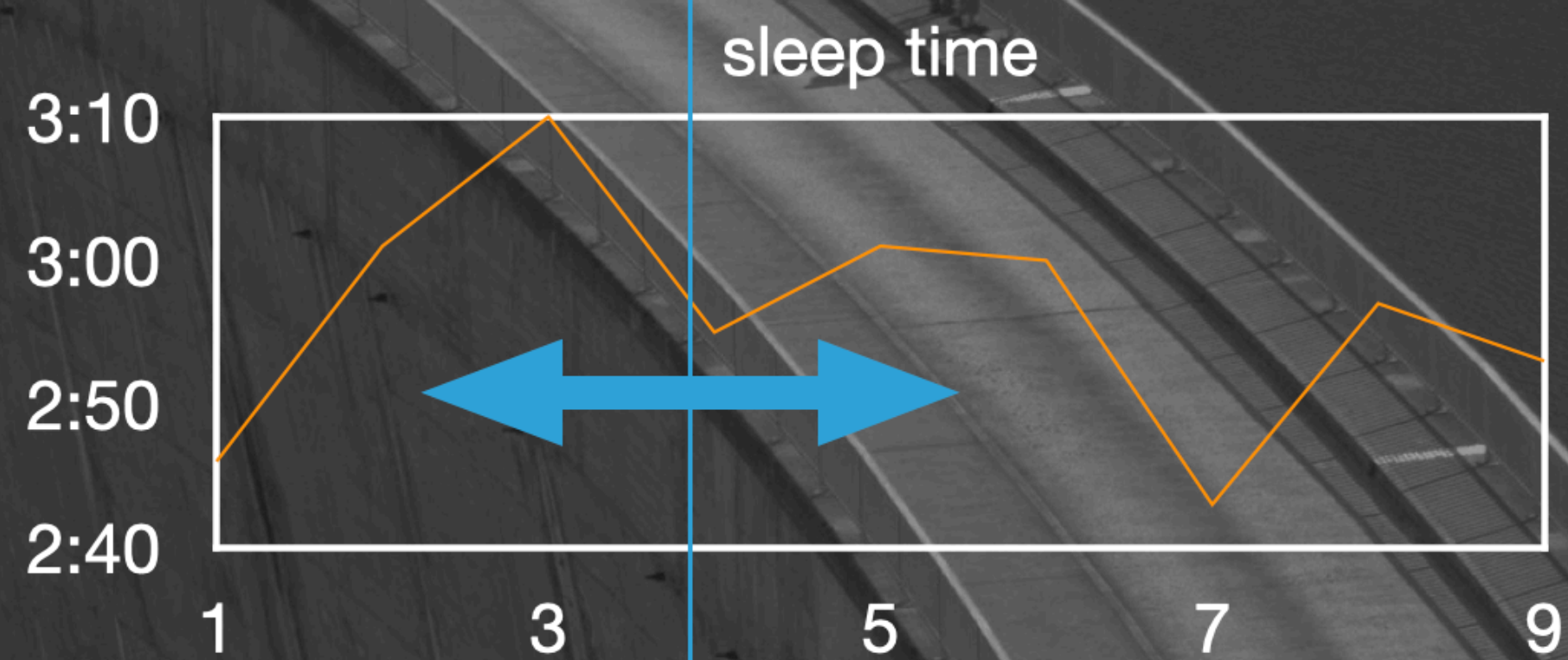
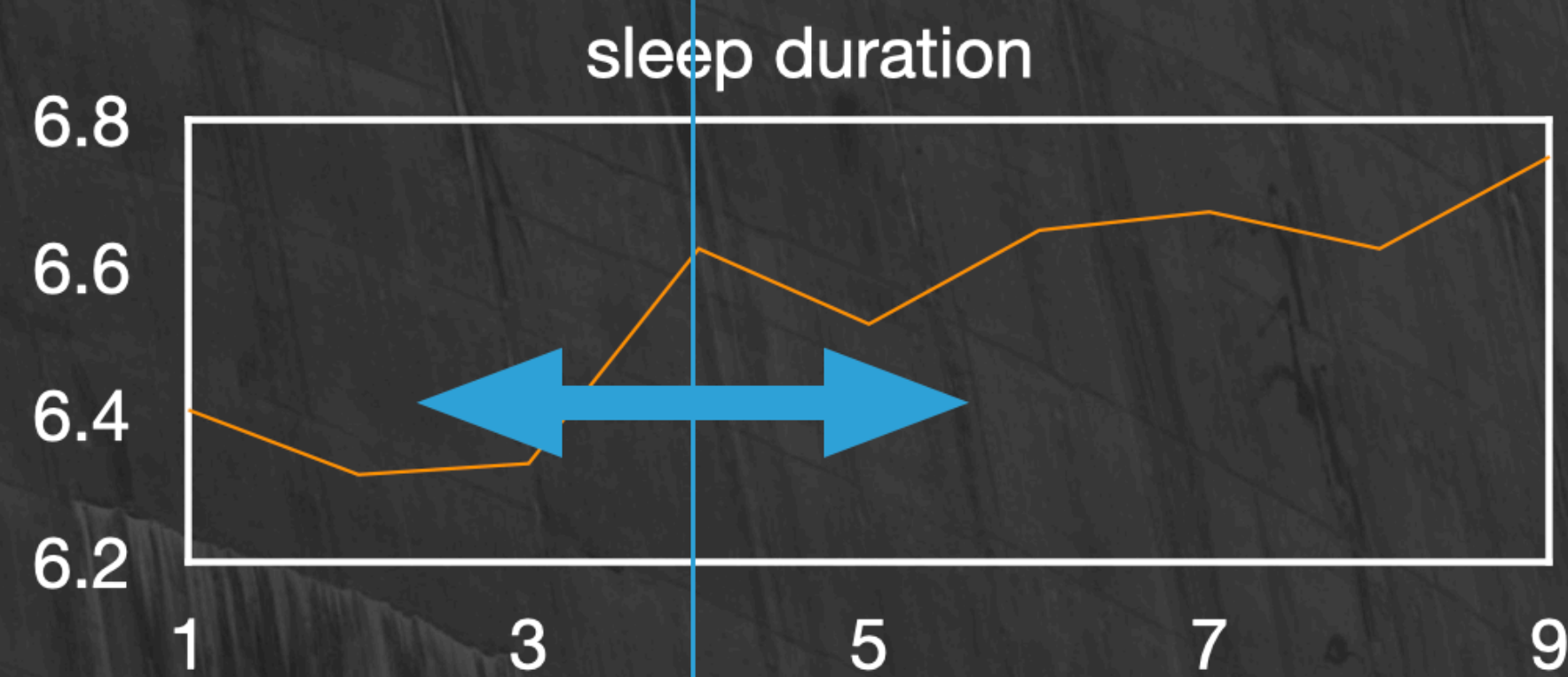
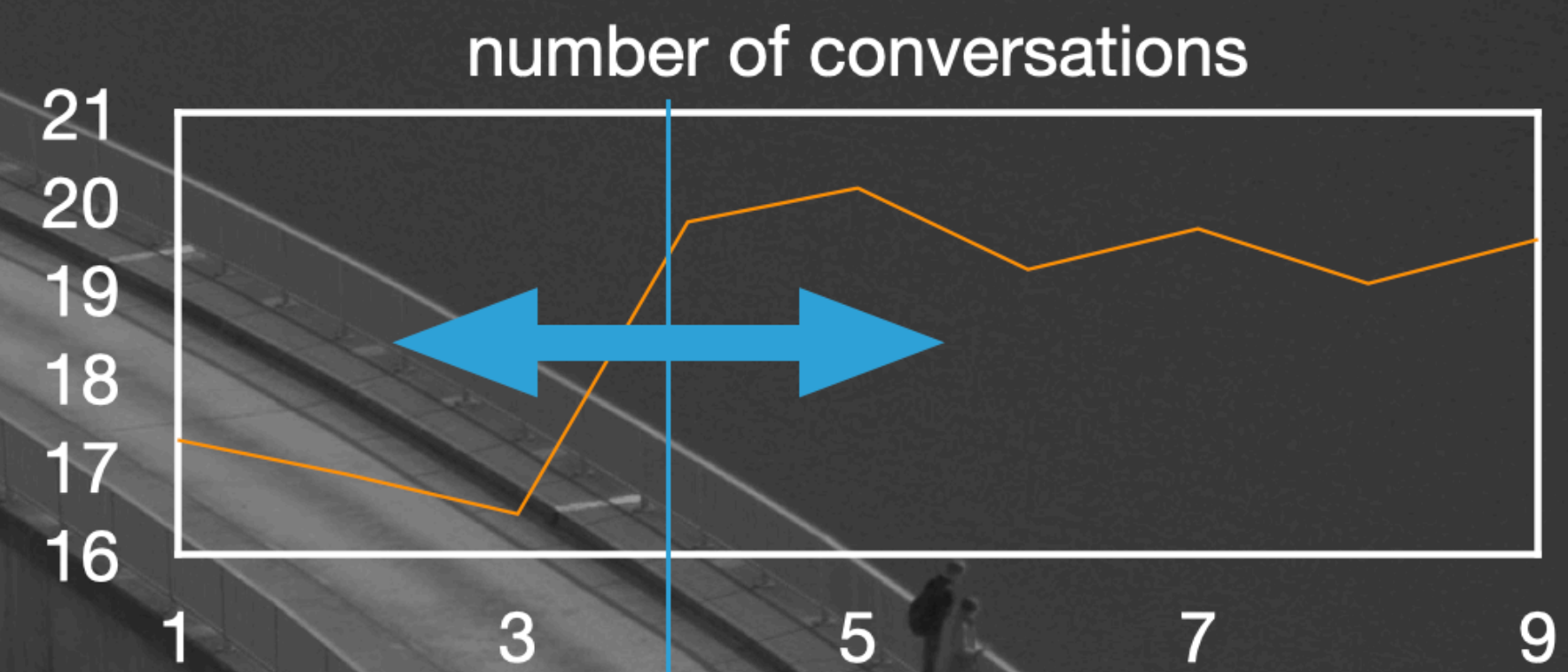
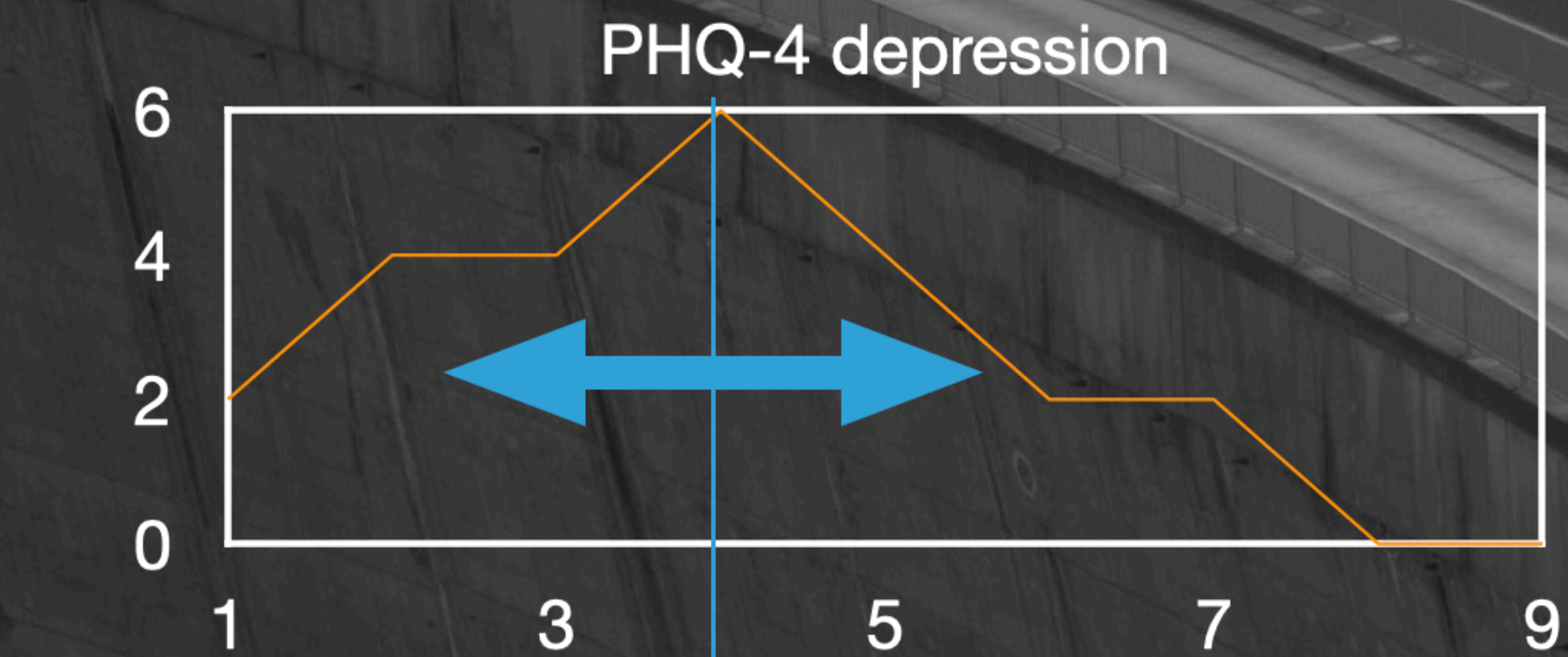
leave-one-out cross validation

$$f(x) = w_0 + \sum_{i=1}^n w_i x_i$$

lasso regularized linear regression to predict pre-post PHQ-8 scores

MAE = 2.4 r = 0.741, p < 0.001





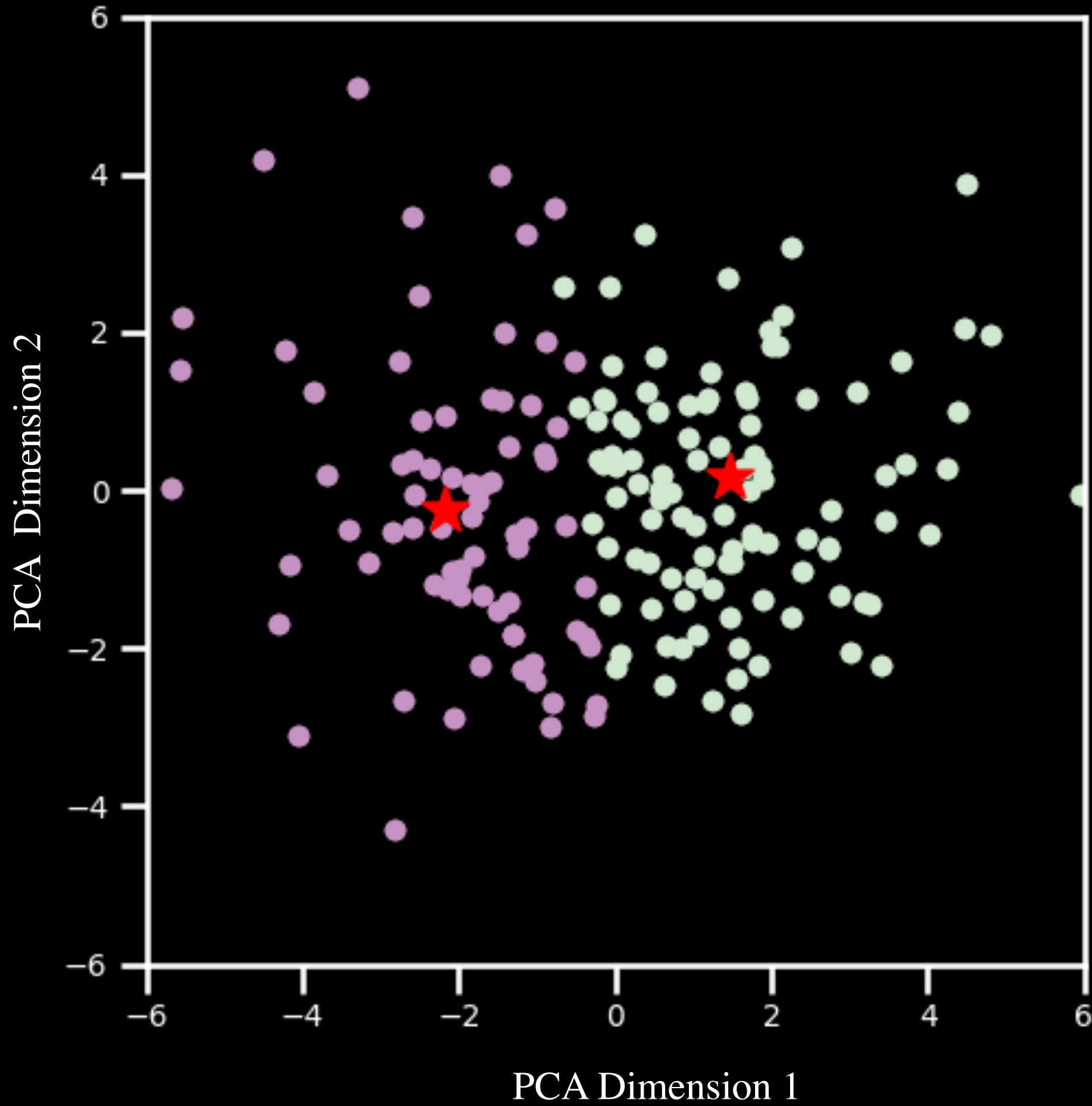
week

week

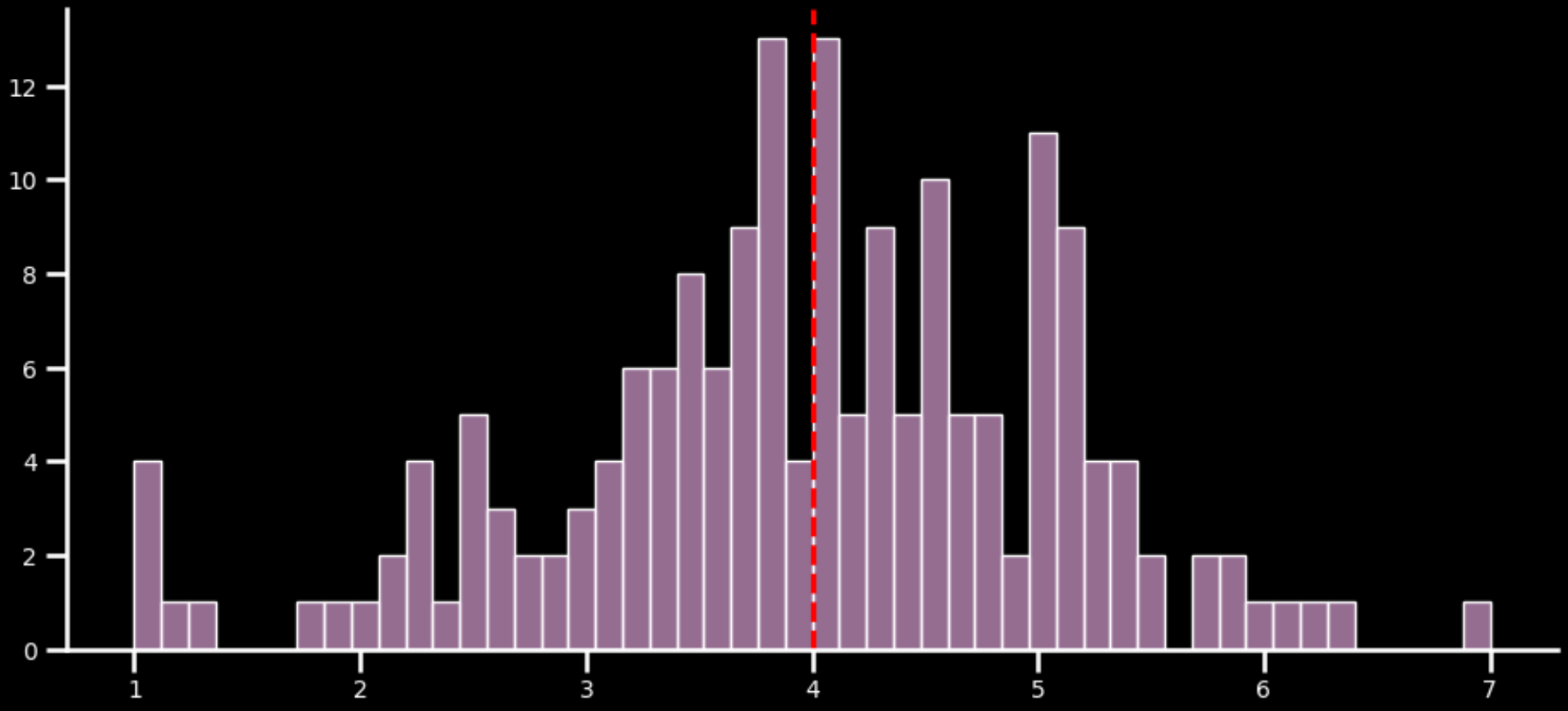


DIFFERENT MENTAL HEALTH GROUPS

POOR MENTAL HEALTH GROUP



How concerned are you about COVID?

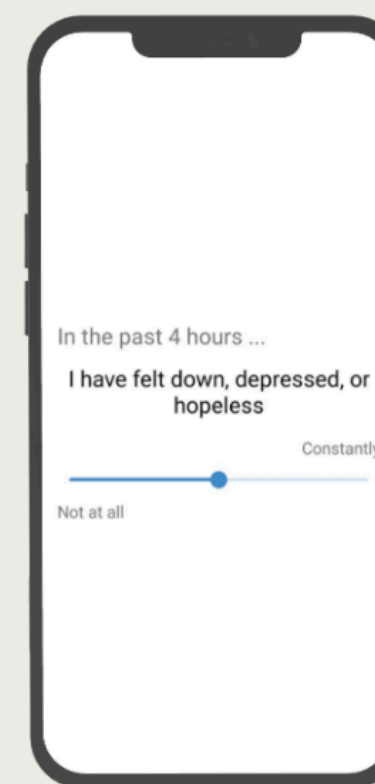
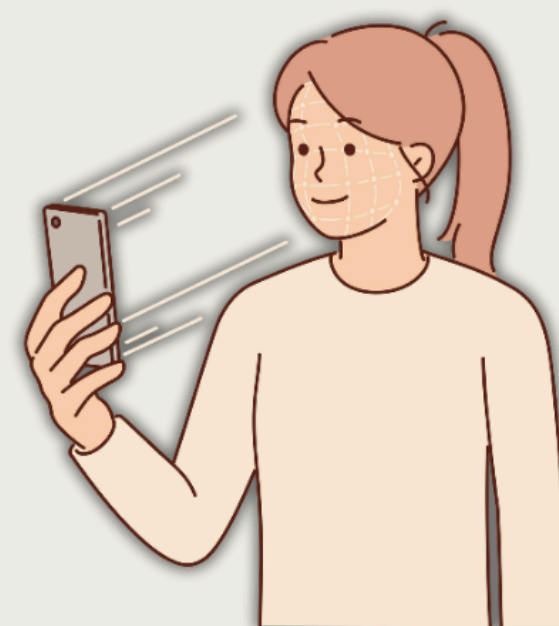


self-reports	c1	c2	mean	H statistic	
phq-4	1.78	4.21	2.91		58.04***
depression	0.94	2.18	1.52		60.76***
anxiety	0.84	2.03	1.40		48.17***
stress	2.42	3.06	2.72		38.95***
self-esteem	12.00	11.16	11.60		8.02***
COVID-1	3.48	4.82	4.1		75.30***

DEPRESSION FROM THE FACE



PHQ-8 survey.



STUDY

177
Users

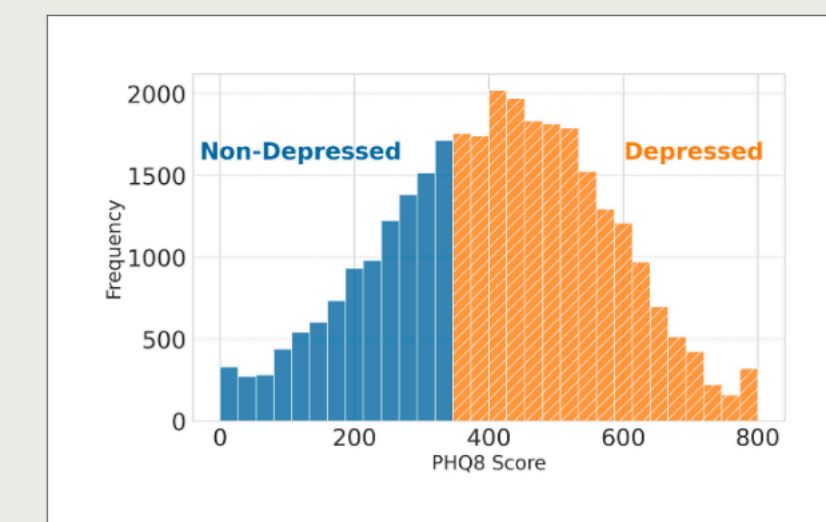
31,215
EMAs

74,347 (67.4%)
Depressed

90
Days

110,272
Photos

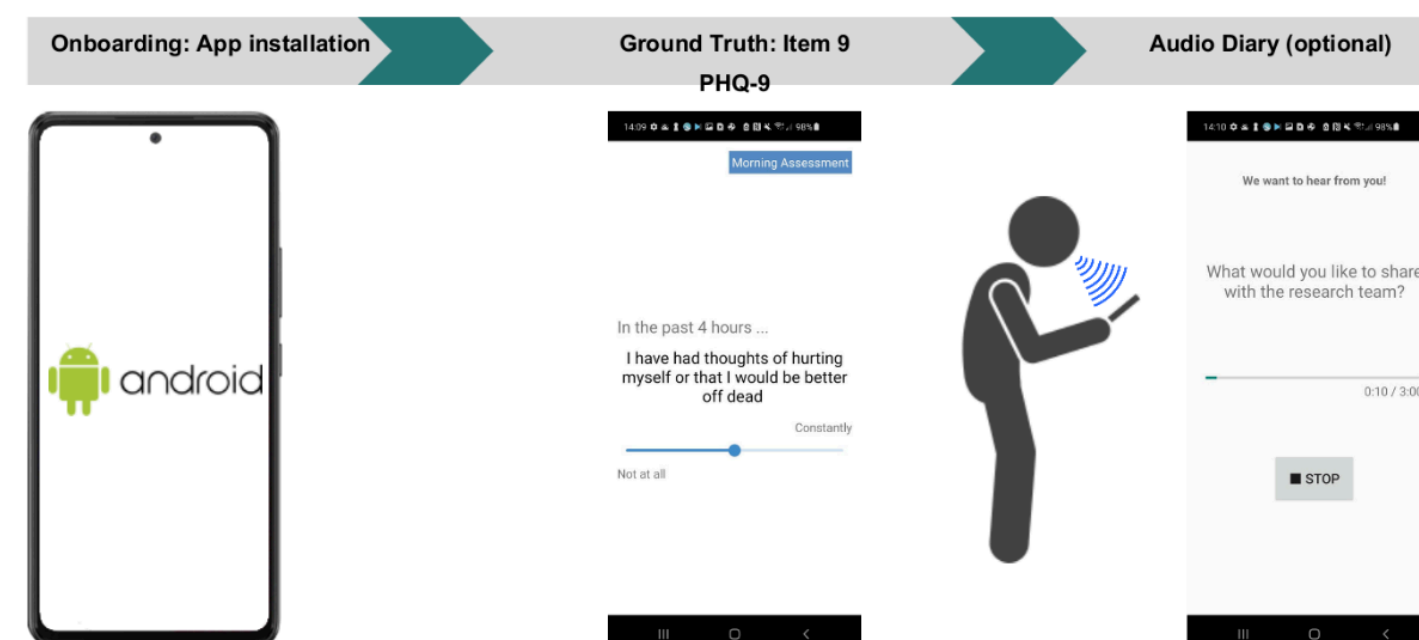
35,925 (32.6%)
Non-depressed



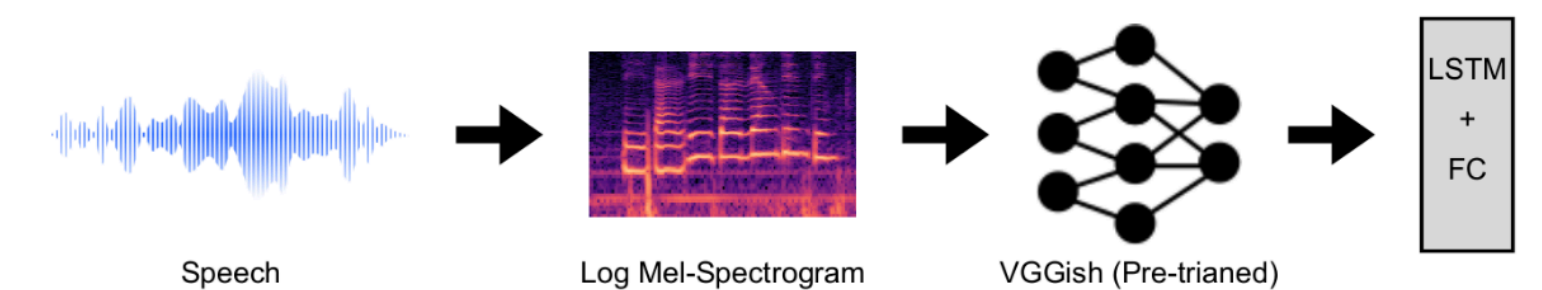
Depression: PHQ-8 (0-800 continuous scale) > 334 (equivalent to 10 on Likert scale)

SUICIDAL IDEATION FROM SPEECH

Three longitudinal studies up to three months



SI detection: Given a speech sample, classify it as SI or not



An aerial photograph of a city at dusk. The city is illuminated with warm lights, and the sky is a mix of blue and orange. In the background, there are mountains and a crescent moon in the sky.

THE POWER OF INTERVENTION

WEEK 7
2024





I haven't been sleeping well; any suggestions?

Show drafts 



Here are some tips to help improve your sleep:

Create a Relaxing Sleep Environment

- **Darkness:** Use blackout curtains or a sleep mask to ensure complete darkness.



- **Quiet:** Use earplugs or a white noise machine to block out noise.



- **Temperature:** Keep your bedroom cool, around 65°F (18°C).



- **Comfort:** Invest in a comfortable mattress, pillows, and bedding.



VISION

WEEK 7
2025





"Good morning, Andrew. Before you start your day, I've noticed your sleep hasn't improved since we last spoke. I know it's week five, and you've stopped going to the gym. But remember, when you go for a run, limit screen time in the evening, and avoid alcohol, your sleep always improves, and you feel more positive. Why don't you try something different today?"



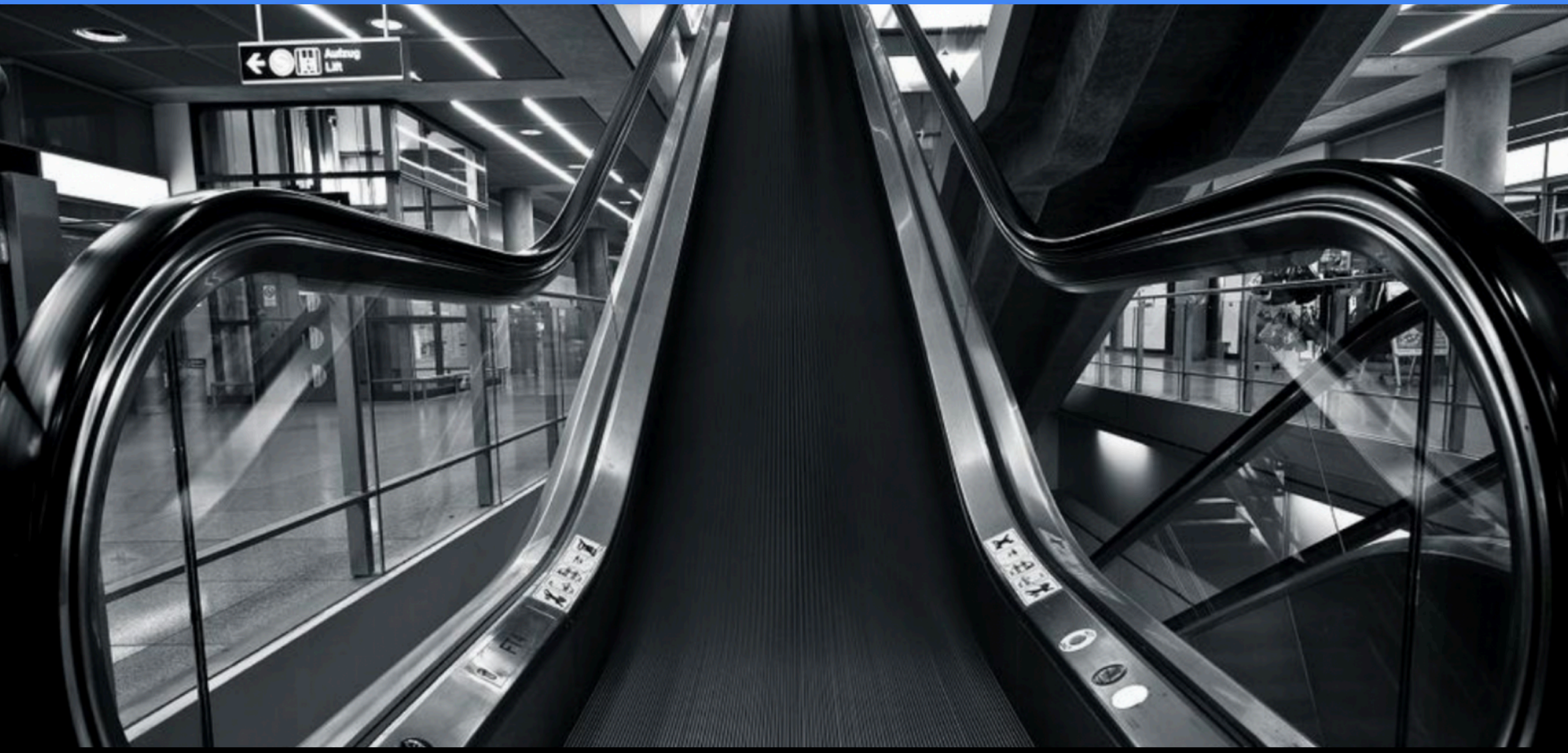
OK I'm going to class now and will try to go for a run and screen off at 11 pm tonight. Thanks dude.

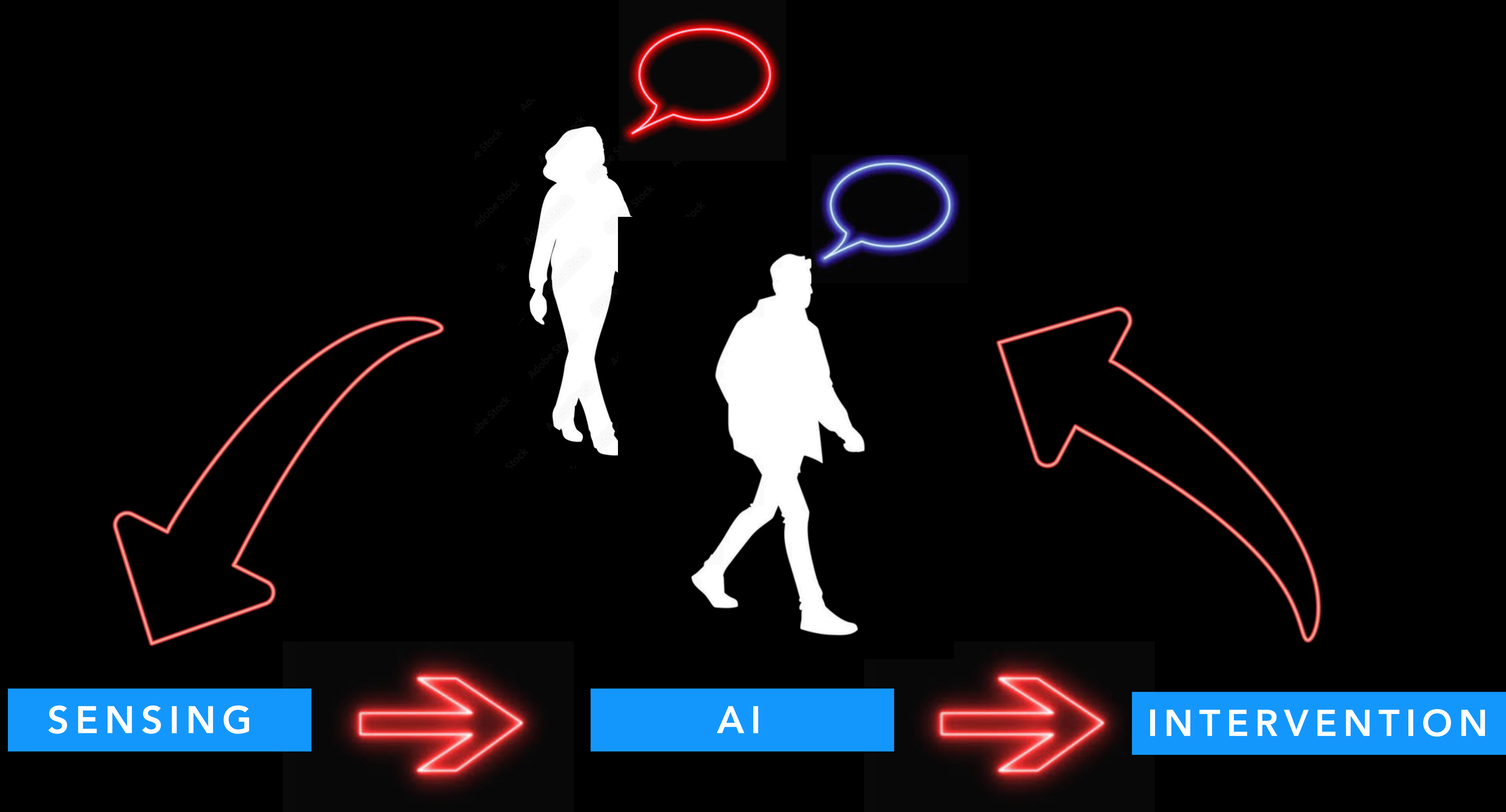
Show drafts

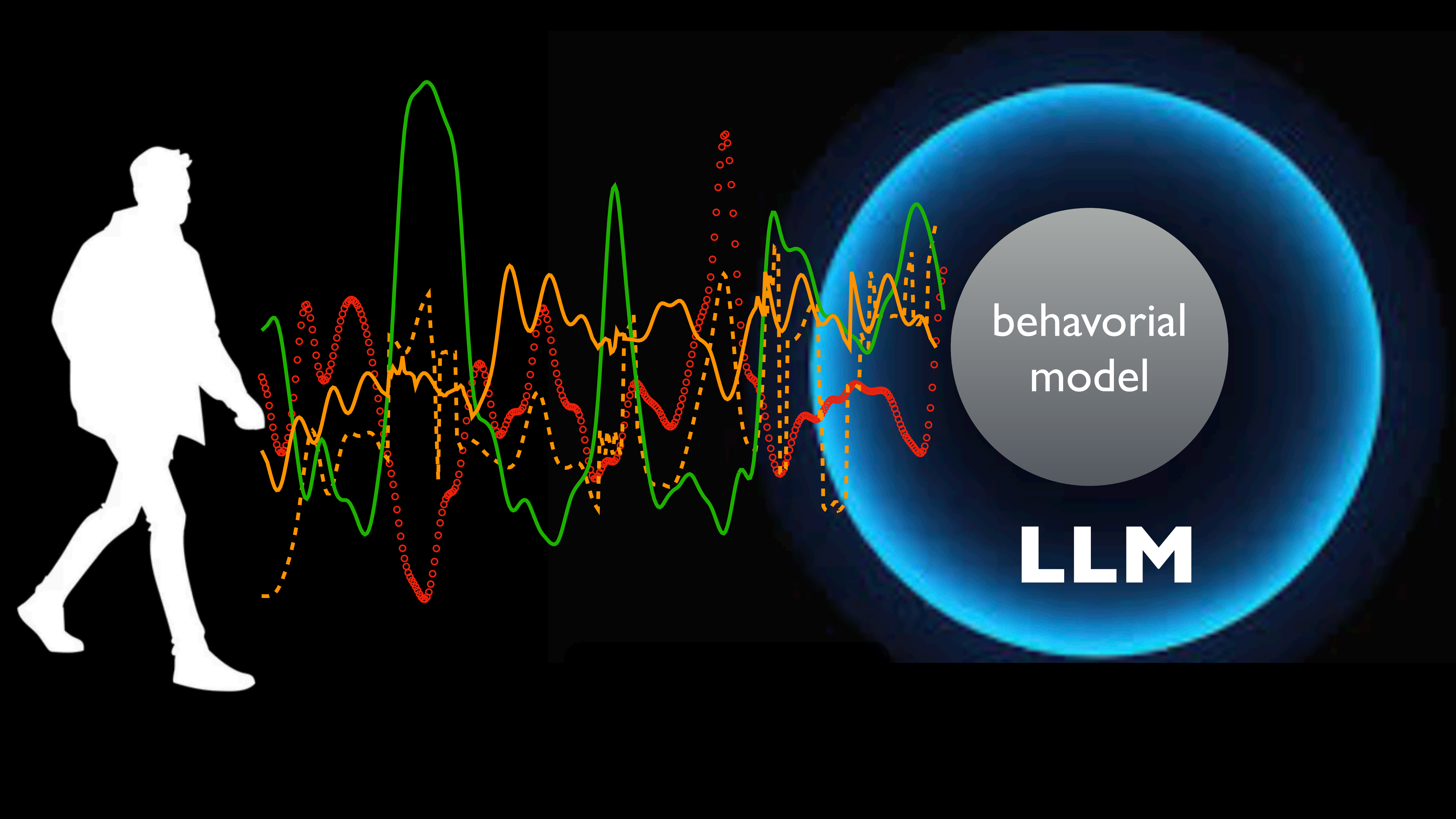


Great plan, Andrew! Remember to take it easy on yourself if you can't stick to the plan perfectly right away. Small steps can lead to big improvements. I'm rooting for you!

HOW DO WE GET THERE?



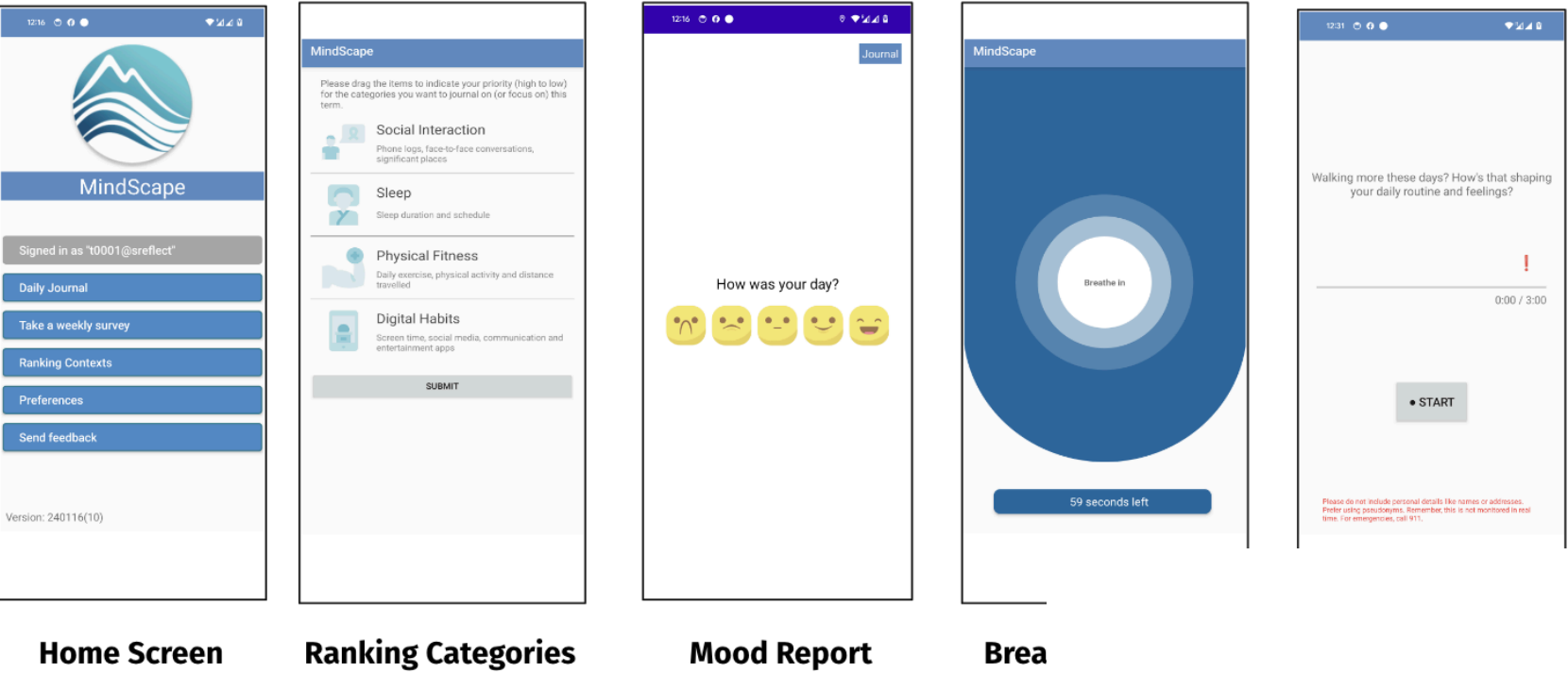




behavioral
model

LLM

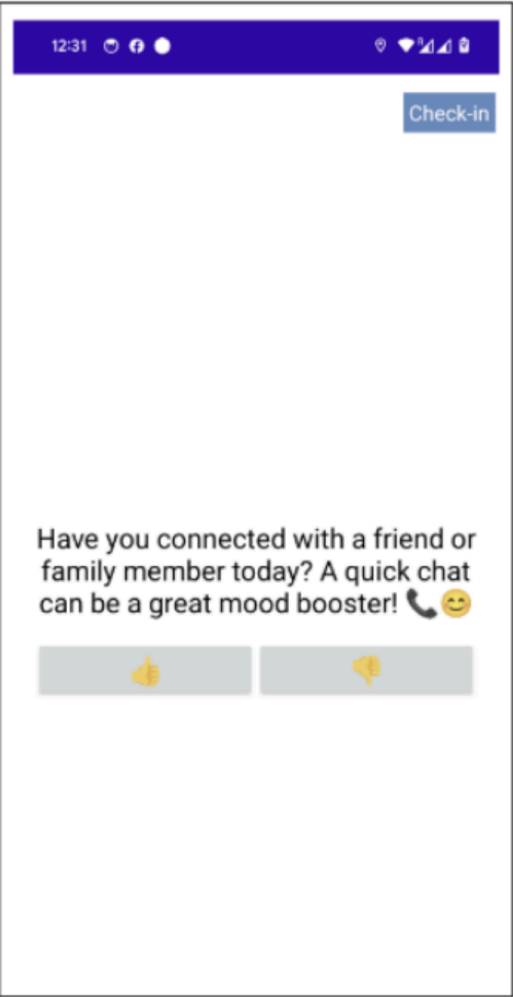
INTERFACING BEHAVIORAL SENSING AND LLMS



Sample Prompts

- You’ve embraced more face-to-face chats and less screen time. **How’s this new social rhythm shaping your day?**
- You seem **quieter on calls and texts lately**. Could a **catch-up with friends** bring some cheer?
- Your **digital habits have improved**. Noticed any changes in your sleep with more screen-free time before bed?
- Noticed **your time at the gym is up**. What new workout or routine inspir change, and how does it feel integrating it?
- With a **busy academic term**, have you thought of a **new routine to mainta sleep schedule?**
- Describe the moment this week that made you feel on top of the world.

Check-ins



Simple, quick reflections 4 times a day:
12.30 (Morning)
3.30 (Afternoon)
6.30 (Evening)
11 PM (Night)

- “Enjoying a slow-paced evening could have been just what you needed.”
- “Enjoyed moving from one place to another this morning while being mostly on the go?”
- “Found a cozy spot for some afternoon reading, I bet?”
- “Diving into a good book or study session at your favorite spot this afternoon sounds like a productive time!”
- “Hope your evening’s solo study session felt productive!”
- “Exploring and socializing seemed to fit your night, how about that

PROMPT ENGINEERING

GPT-4 Prompt

1. System Prompt

You are an assistant that is helping create responses for a self-journaling application. Given the user's mood score (most important), sensing data, and previous responses, create a succinct self-journaling prompt. The intended user are undergraduate students at a top institution. The prompt must pinpoint a specific behavior or pattern that might need improvement or adjustment. Design the prompt in a way that forces users to do some type of interpretation and encourage them to respond to in their own words. For context use the user trends, mood score and the community stress index. Take note of how user is feeling (i.e., their mood) before crafting the prompt that would be appropriate for them to see. The response should be focused on the user priorities ranked from highest to lowest. The response should have a greater sense of personality, relationality, to solicit rich narratives. To mitigate against the "cold" feel of the response, create a "voice" in the response that would have some warmth, such as including thank you messages.

2. User Context

[User Mood]

User Mood Score (1 lowest, 5 highest): *<Self-reported mood>*

[Previous Prompts]

Previous Responses: *<List of previous journaling prompts>*

[Community Stress Index]

Community Stress Index (1 lowest, 5 highest):

<Stress index generated based on current week in the term>

[User Priorities]

Priorities [highest to lowest]: *<Self-reported priority>*

[User Data]

Today's Date: *<date>*

<List of user trends>

Duration of incoming phone calls: increasing by 10%

Walking duration: stable

.....

Screen time: decreasing by 12%

Frequency of use of social apps: increasing by 20%

3. Prompt Optimization

[Response Rules]

1. Response should not use over-the-top words. Only conversational language.
2. Avoid repetitive response by using the context of the "Previous Prompts". Do not mention the same idea conveyed in Previous Prompts.
3. Do not provide a generic or offensive, argumentative, or mentally damaging response, instead be friendly and upbeat.
4. Do not mention specific data points (for example do not say "Your mood score was 1/5 for the week").
5. A suitable example would be "Your step count indicates that you have been more active today than the rest of the week. What activities did you engage in, and how did they make you feel?"
6. Do not write leading questions. The response should not be too open-ended. Make it more direct so that it can help direct thoughts better.
7. Have a conversational and qualitative response, not a clinical and quantitative one (for example do not say "I saw your sleep is deteriorating").
8. Should be less than 250 characters.
9. MUST respond with only the prompt, do not give any prefix such as "prompt" and do not use double quotes at the start and end of the response.
10. Avoid any repetitions that might be stigmatizing or feel exclusionary (such as, "if you have a partner"). Response should speak to both group and individual situations.
11. Since this is being used by young students, make the response more relatable, trendy, gen-z friendly.
12. Do not include any "tip: ", "question: " etc and do not use hashtags.

4. Strategy

If user reports low mood score (<3), the response should either elicit gratitude towards others or encourage self-compassion. Choose one randomly. In case of self-compassion, it should promote self-positivity and encourage users to reflect on positive attributes in their life rather than trying to solicit rich narratives. In case of gratitude, it should ask users to respond about things they are grateful for today. Ideally, it teaches users to shift their attention away from negative aspects of their lives and instead to learn to appreciate what they have and what others have done for them. This mindset shift counterbalances the "negativity bias" or one's tendency to pay more attention to negative stimuli in the environment.

[Gratitude]

With academic term stress peaking, have you found moments to appreciate successes or kindnesses from your day?

[Self-compassionate]

Amid your busy days, you've been getting more sleep but also more screen time. How do you feel about this trade-off, and could there be a balance you'd like to aim for?

[Regular]

Given that you're feeling on top of the world today, how has interacting with your friends via texts and calls contributed to your vibe?

BEHAVIORAL SENSING DATA

[User Mood]

User Mood Score (1 lowest, 5 highest): *<Self-reported mood>*

[Previous Prompts]

Previous Responses: *<List of previous journaling prompts>*

[Community Stress Index]

Community Stress Index (1 lowest, 5 highest):

<Stress index generated based on current week in the term>

[User Priorities]

Priorities [highest to lowest]: *<Self-reported priority>*

[User Data]

Today's Date: *<date>*

<List of user trends>

Duration of incoming phone calls: increasing by 10%

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....

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User Trends:

Social Interaction

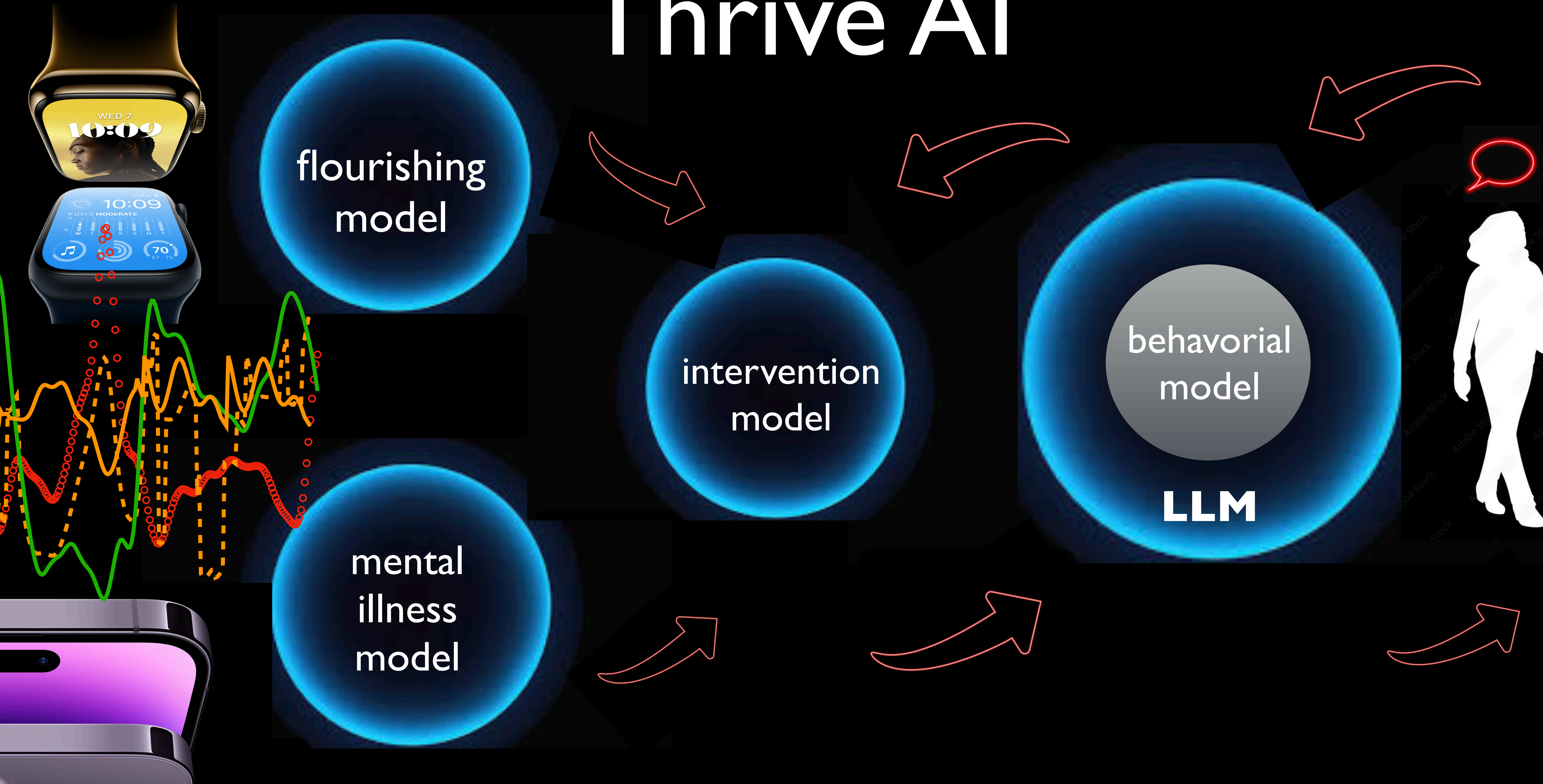
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{%endif %}
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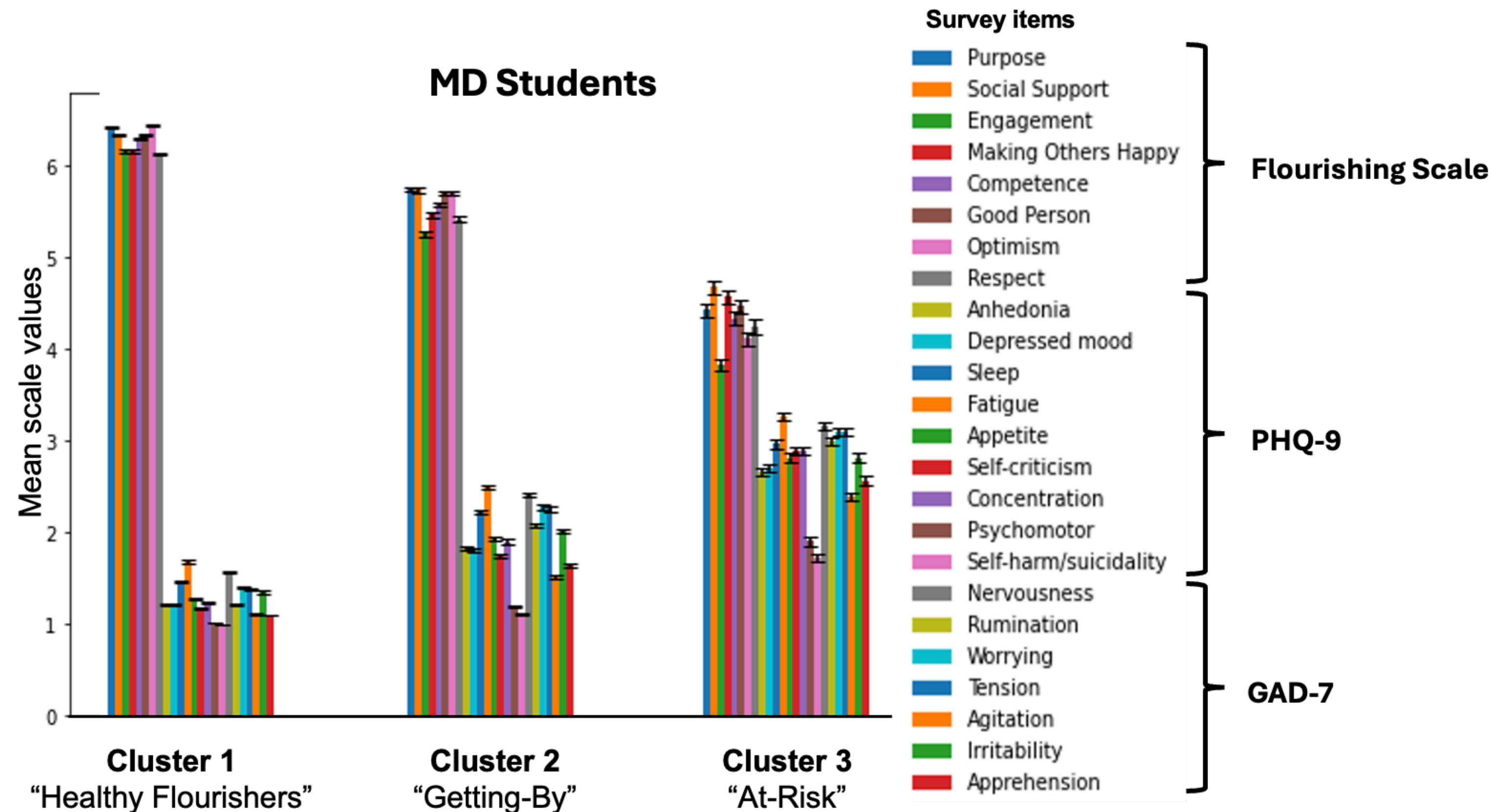
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{%endif %}
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{%endif %}
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Thrive AI



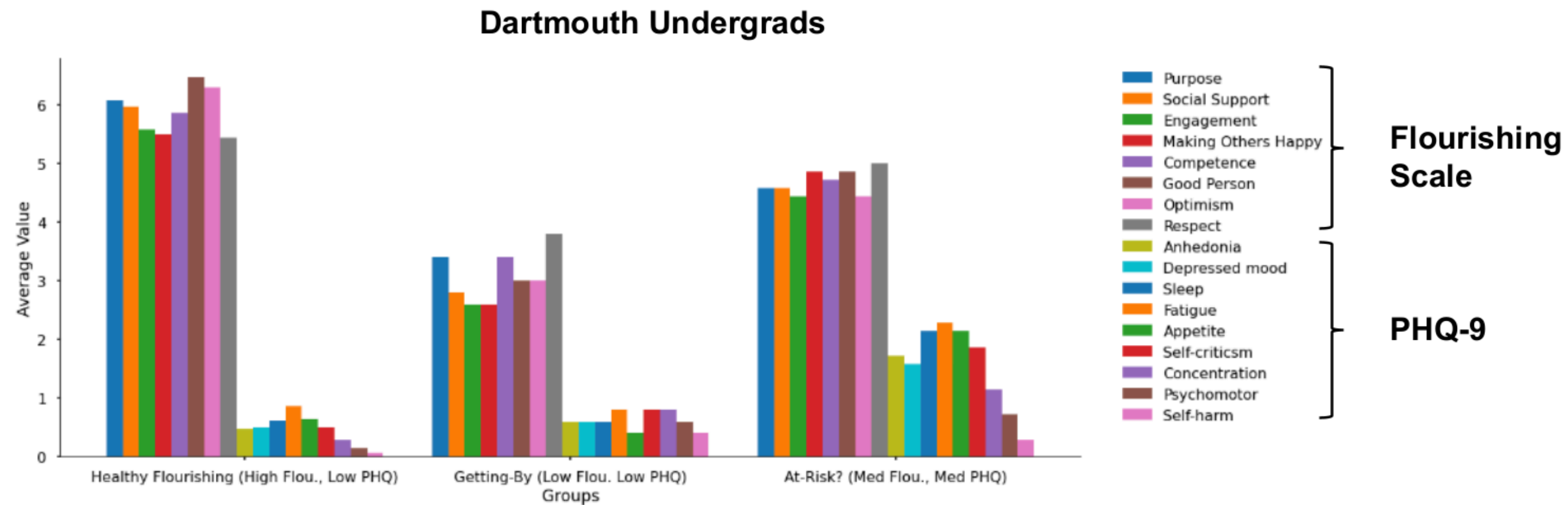
DARTMOUTH MEDICAL STUDENTS TODAY (2024)



Professor Thomas Thesen

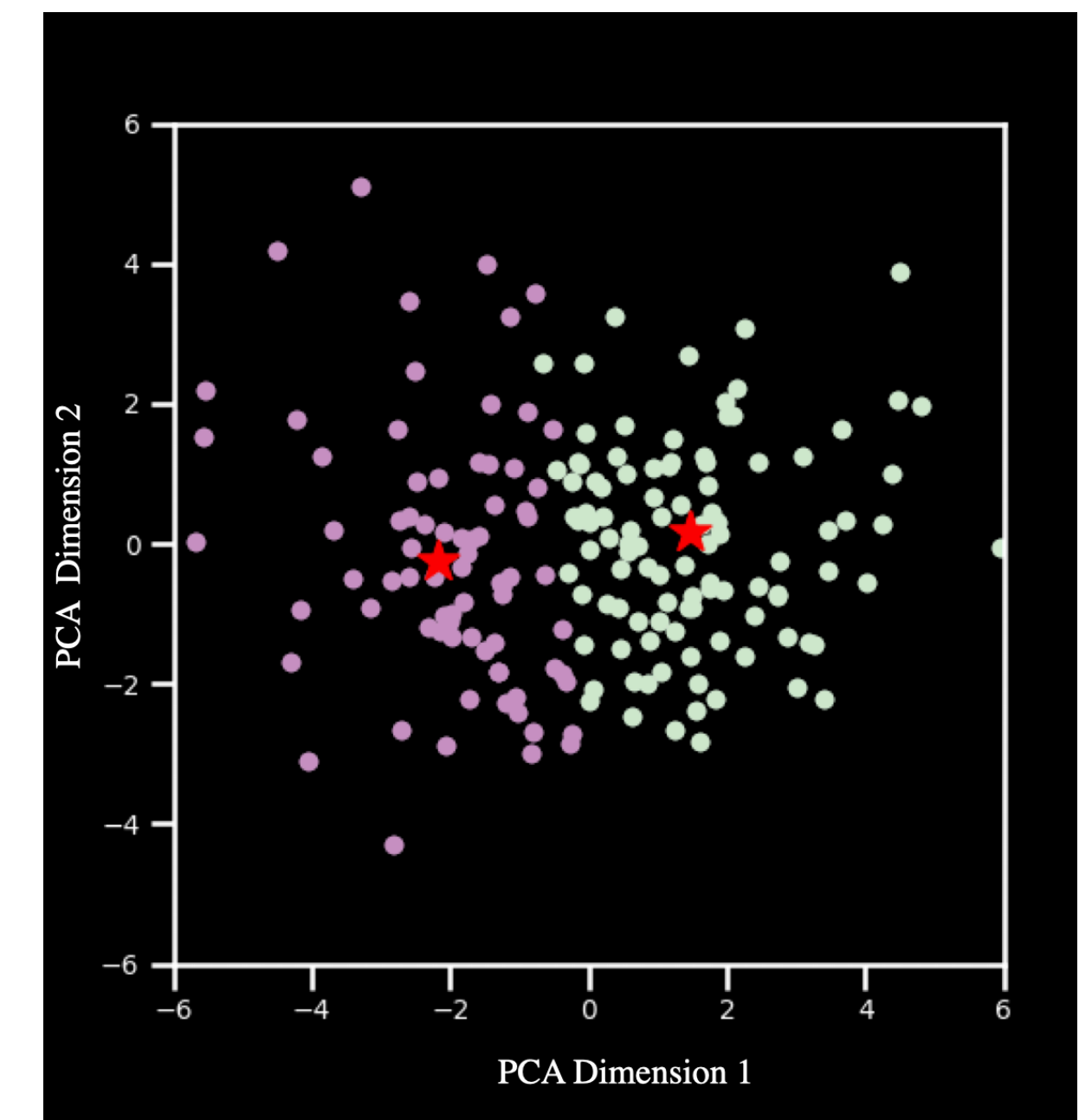
Slide courtesy of Professor Thomas Thesen.
Thesen, T., Marrero, W. J., Konopasky, A. J., Duncan, M. S., & Blackmon, K. E. (2024). Towards precision well-being in medical education. *Medical Teacher*,

DARTMOUTH UNDERGRADS A DECADE AGO (2014)



Wang, R., Chen, F., Chen, Z., Li, T., Harari, G., Tignor, S., ... & Campbell, A. T. (2014, September). StudentLife: assessing mental health, academic performance and behavioral trends of college students using smartphones. In *Proceedings of the 2014 ACM international joint conference on pervasive and ubiquitous computing* (pp. 3-14).

dataset: <https://www.kaggle.com/datasets/dartweichen/student-life>





THRIVE AI WILL PREDICT
MENTAL HEALTH AND HELP
STUDENTS TO STAY HEALTHY
AND FLOURISH ON CAMPUS



**STUDENTS SHOULD NOT JUST
SURVIVE; THEY SHOULD
THRIVE!**



THANKS FOR LISTENING