

# Fluctuations in Behavior and Affect in University Students Using Deep Phenotyping

Constanza M. Vidal Bustamante<sup>1</sup>, Garth Coombs<sup>1</sup>, Habib Rahimi-Eichi<sup>1</sup>, Patrick Mair<sup>1</sup>, J.P. Onnela<sup>2</sup>, Justin T. Baker<sup>3</sup>, Randy L. Buckner<sup>1</sup>  
<sup>1</sup> Department of Psychology and Center for Brain Science, Harvard University; <sup>2</sup> Harvard T.H. Chan School of Public Health; <sup>3</sup> Psychotic Disorders Division, McLean Hospital

cvidal@g.harvard.edu

## BACKGROUND

- First-year university students must navigate new and increased academic and social demands and oftentimes poor sleep. This can contribute to psychological distress and increased vulnerability to mental illness.<sup>2,3</sup>
- Less is known about how affect and behavior fluctuate over extended periods of time, especially in relation to real-life stressors.

### Research Aims

- 1 Describe fluctuations in affect, sleep, academic and social activity over the year of the average college freshman
- 2 Explore the presence of student subgroups with distinct behavioral phenotypes and psychological distress
- 3 Leverage COVID pandemic to assess how same students respond to a new stressful life transition, 2 years later

## METHODS

- **Year-long freshman study:** 49 Harvard College first-year students recruited at beginning of Fall semester for a year-long deep digital phenotyping study<sup>4</sup>. Data were collected over full academic year (256 days).
- **Demographics:** 50% female; 63% White, 14% Black, 10% Asian. At baseline, 12% reported psychiatric diagnosis in their lifetime (8% active); by end of study, 16% reported dx in their lifetime (12% active).
- **COVID follow-up study (2 years later):** Week after being sent home due to pandemic, students invited to participate in 3-month follow-up study (daily and biweekly surveys). 43 of original 49 students enrolled. 14% reported new dx since freshman study. 32% of follow-up sample reported dx in their lifetime.

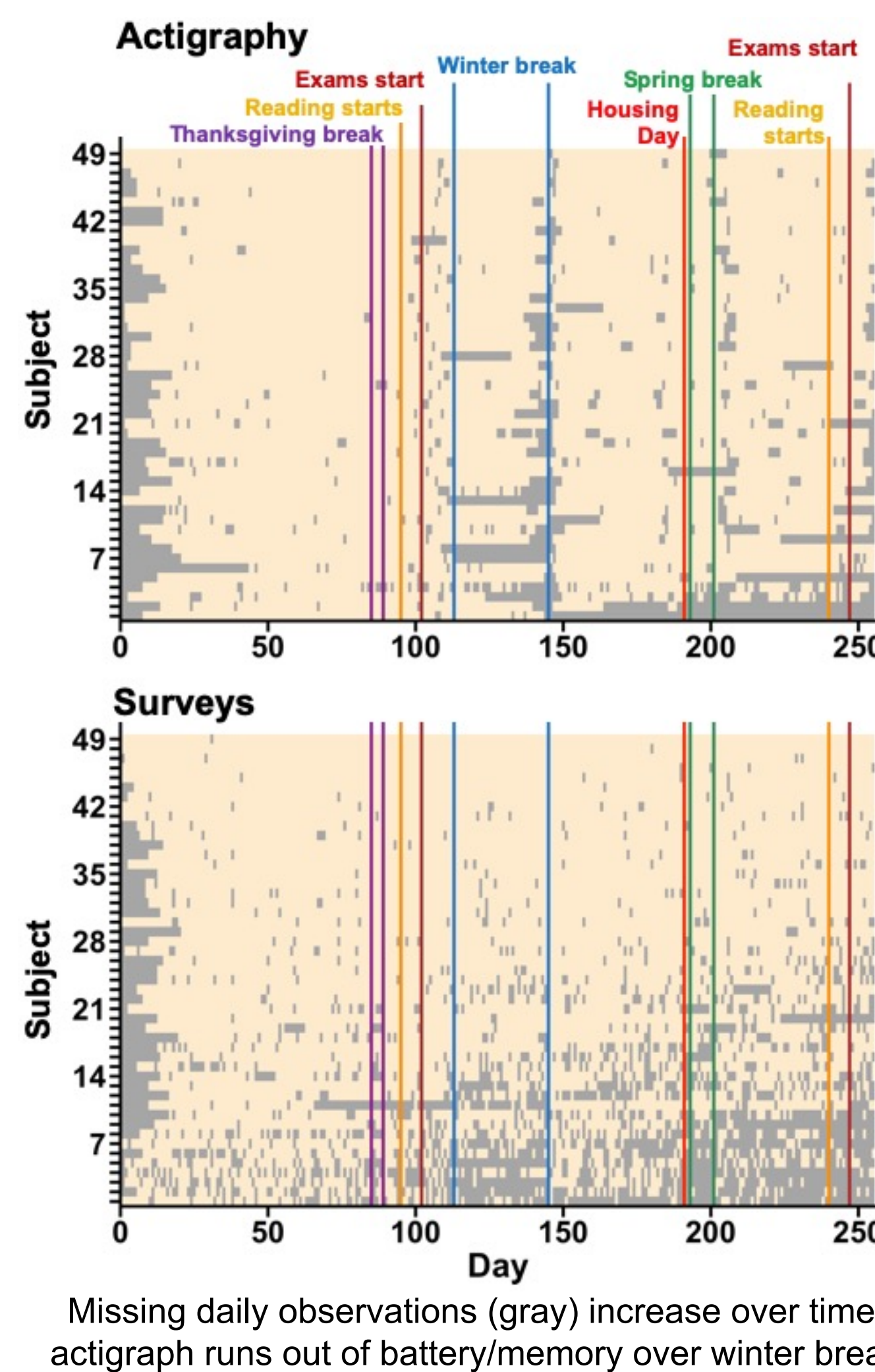


**GENEActiv actigraphy wristband worn continuously over the year**  
 In-house DeepPhenotypingSleep<sup>5</sup> pipeline used to estimate sleep events, in turn processed into daily metrics:

- Night sleep event duration

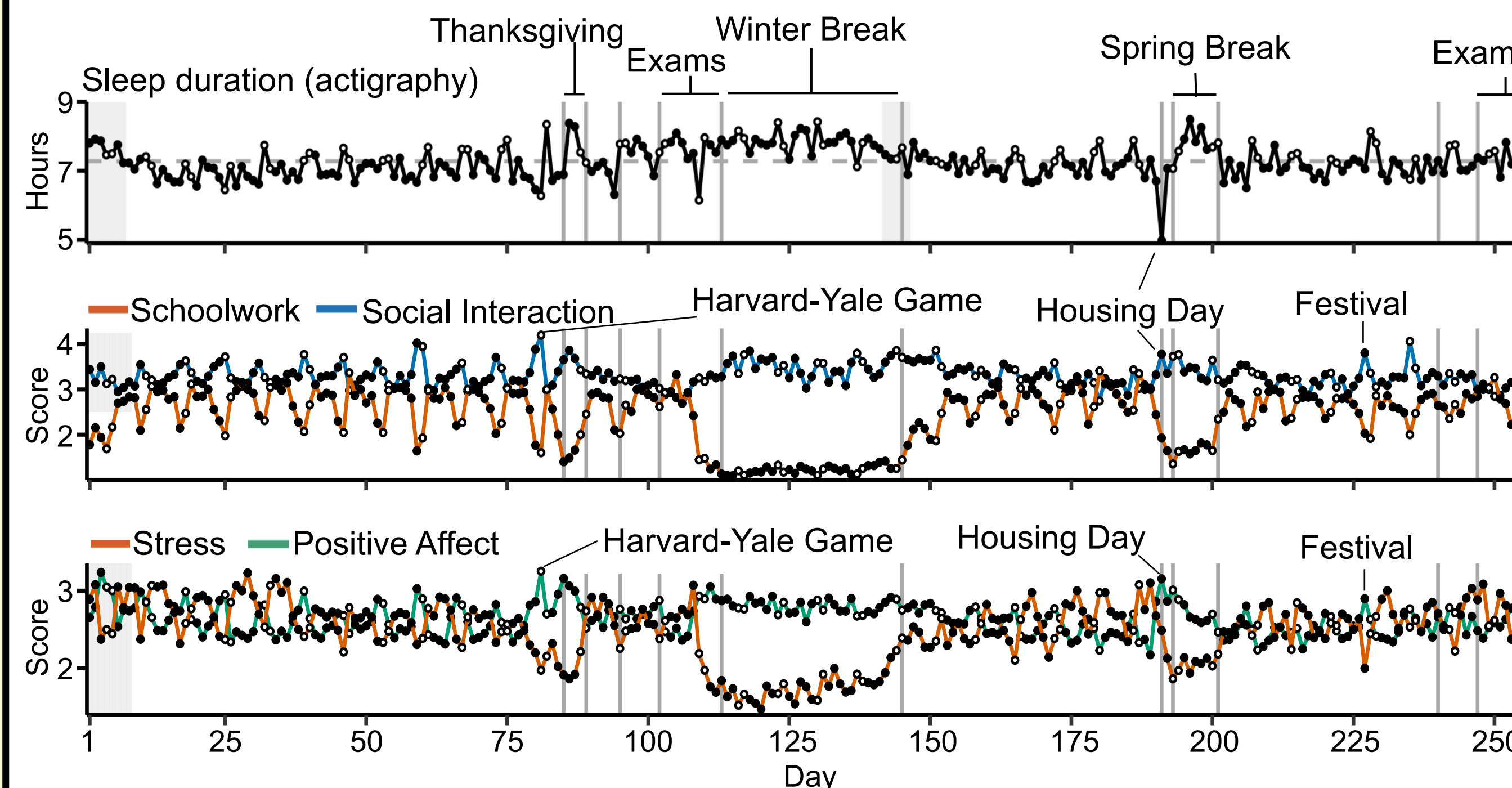
**Daily survey before sleep via Beiwu<sup>6</sup>, smartphone app**  
 1-5 Likert scale; items probed sleep quality, energy and physical activity levels, time spent on homework and socializing, stress levels and sources, and positive and negative affect.

**GPA and Symptoms Checklist 90-R collected 3x freshman year:** Subject-average GPA and Global Symptom Severity Index used in analysis



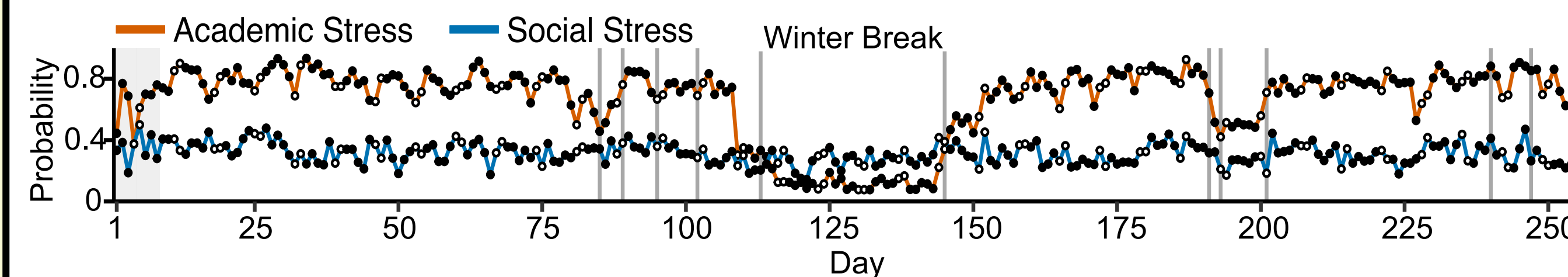
## RESULTS

### 1 Behavior and Affect Show School Break and Weekly Patterns



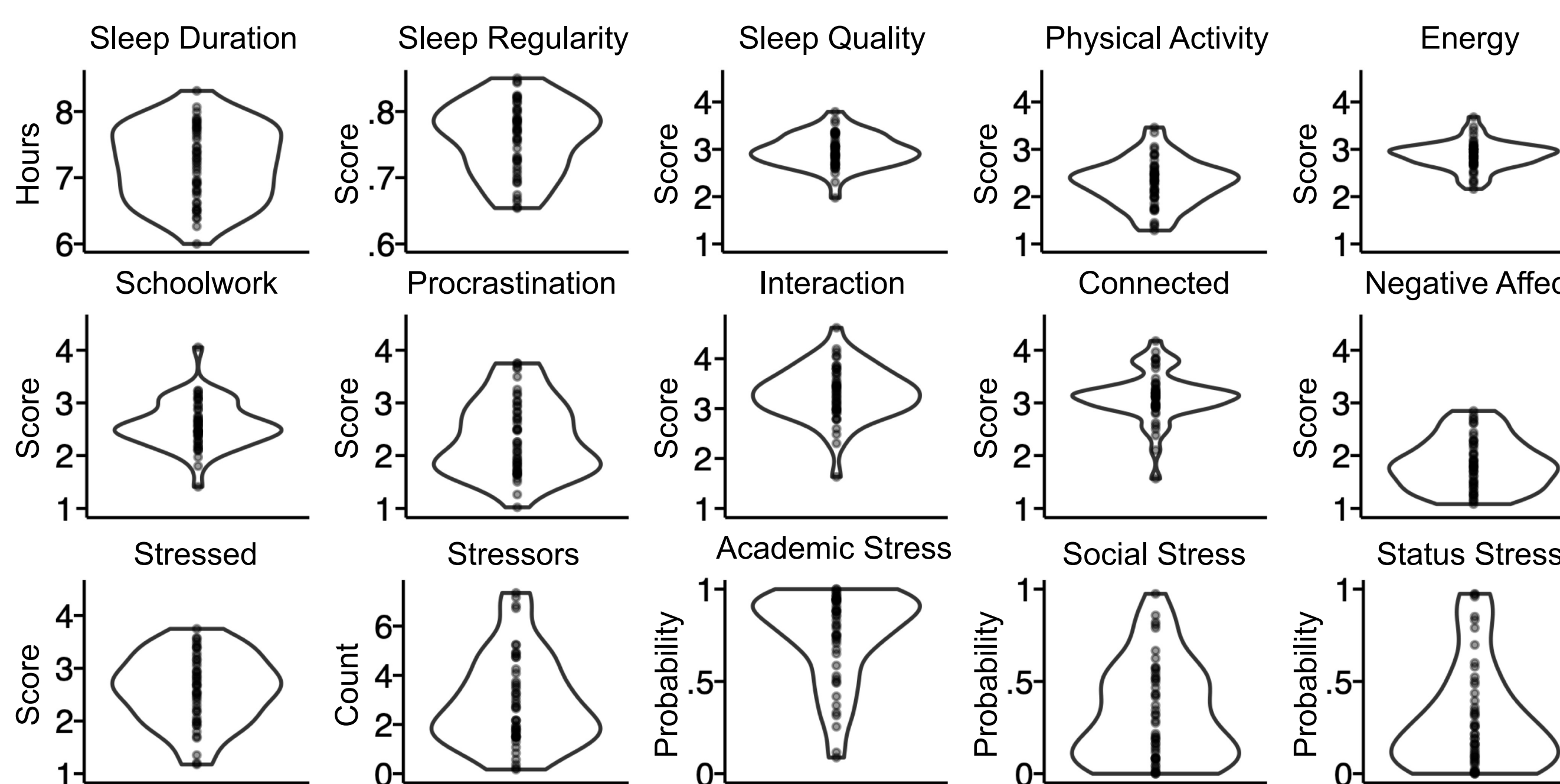
- On breaks and weekends, students felt less stressed, slept longer, and spent less time working and more interacting with others.
- Peaks in social interaction and positive affect on school-wide social events.

### Academics is Most Common Stressor but Social Stress is Relentless



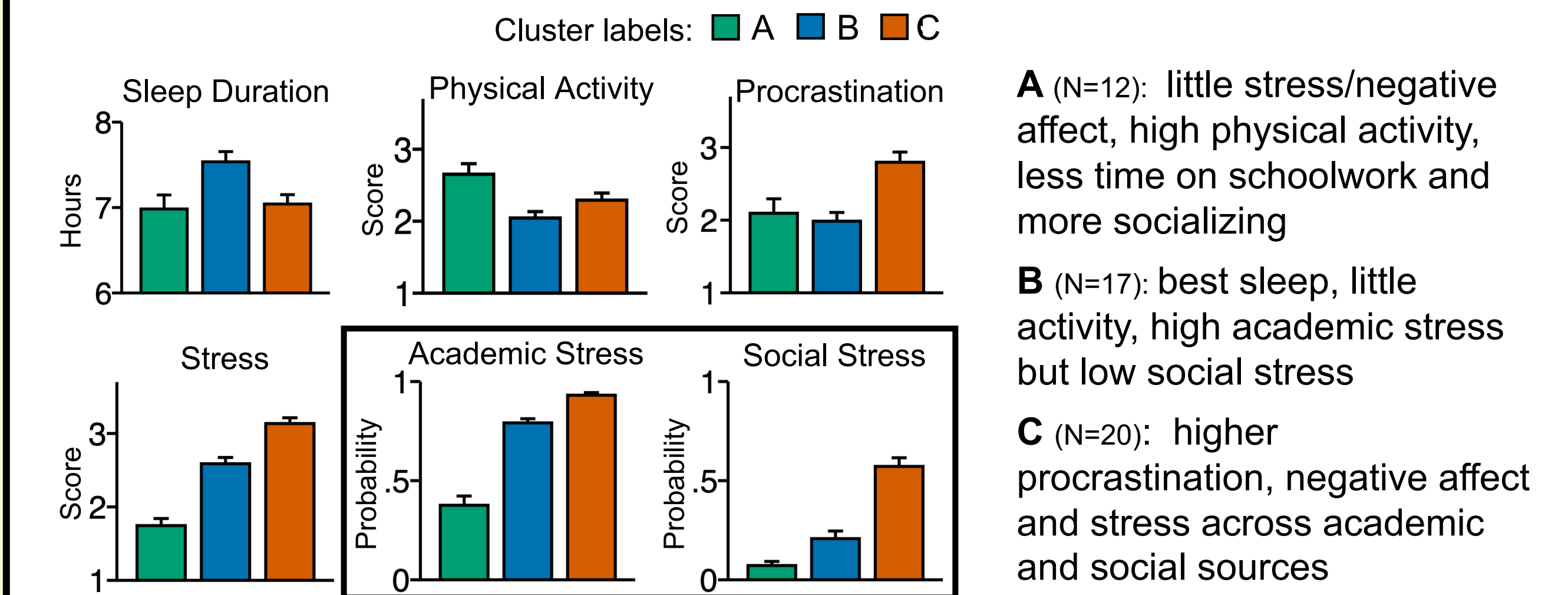
- Academic stress was much more frequent than social stress.
- But while academic stress went down substantially during the break, the frequency of social stress remained stable, despite the big change in environment.

### Most Measures Have High Between-Subject Variability

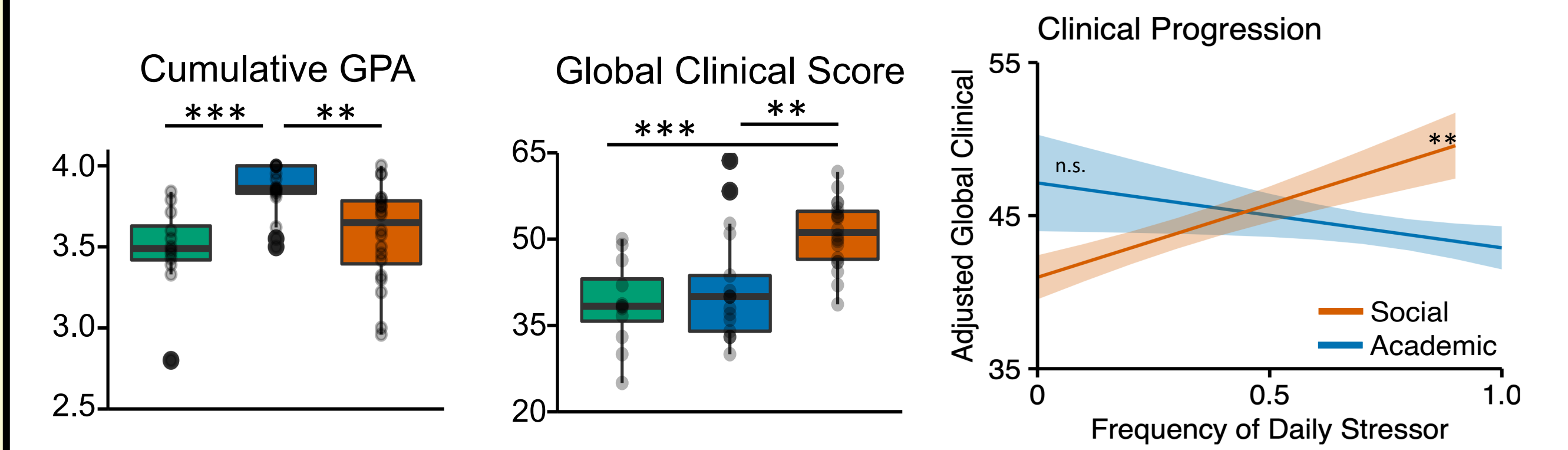


Latent profile clustering analysis conducted over this multidimensional between-subject space

### 2 Clustering Analysis Identifies Three Distinct Student Profiles

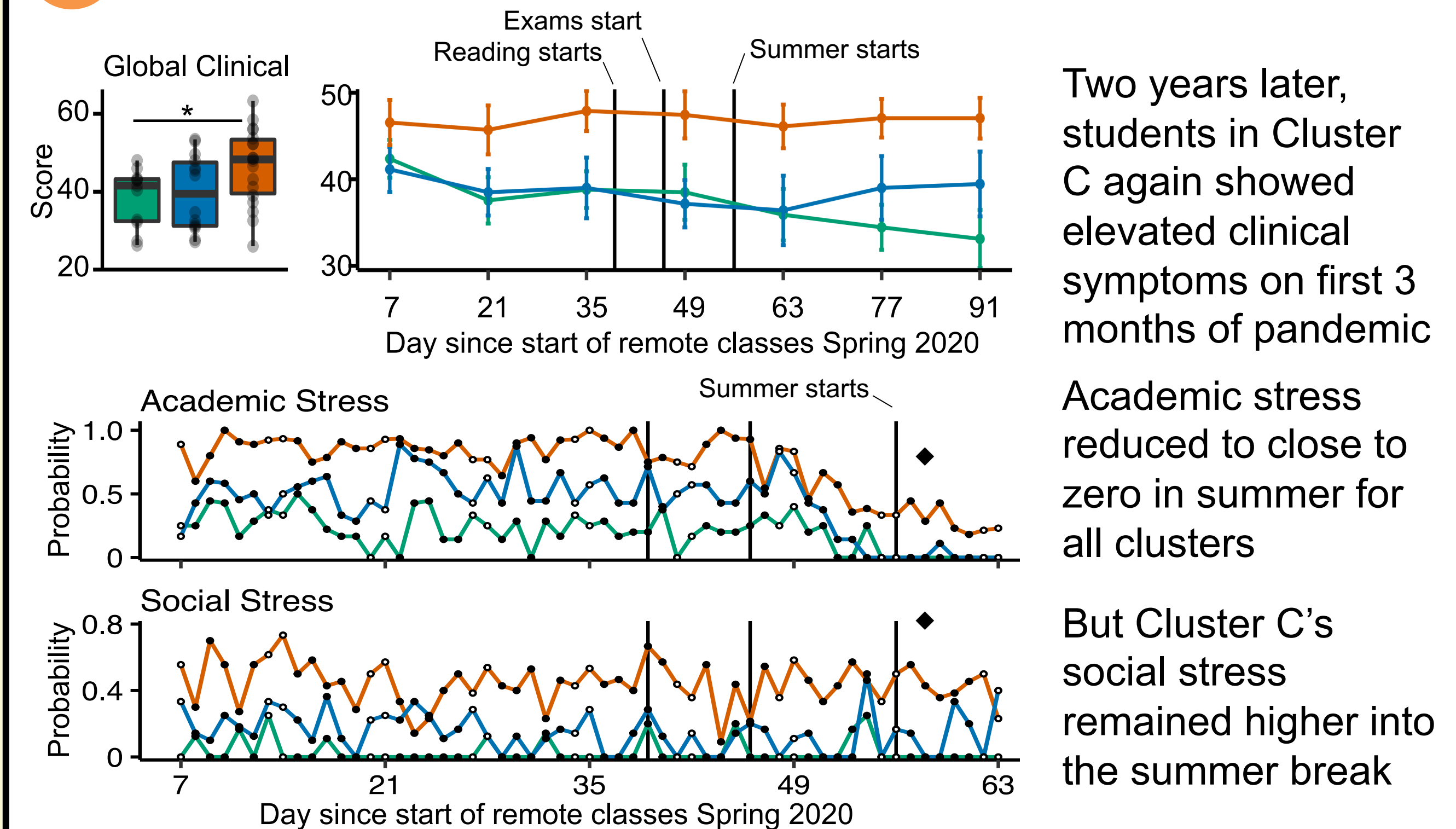


### Social Stress: Better Marker of Distress than Academic Stress



- Clusters predict external data on academic performance and clinical score: Cluster B highest grades, Cluster C highest clinical symptoms.
- Frequency of reporting **social** stress, but not academic stress, during the semester predicted subsequent global clinical symptoms at the end of the semester (post-hoc mixed effects model).

### 3 Clusters Prospectively Predict Pandemic Experiences



## CONCLUSIONS

- Deep phenotyping is feasible over extended periods of time
- Students' behavior and affect fluctuates with academic demands
- Multidimensional assessment of behavior and affect provides helpful insights into student subtypes and associated wellbeing
- Frequent academic stress is common and mostly disappears when school is off
- Persistent report of interpersonal stressors is a more sensitive marker of psychological distress
- Future directions: Individualized predictive models of wellbeing