Measuring adolescents' well-being: correspondence of naïve digital traces to survey data

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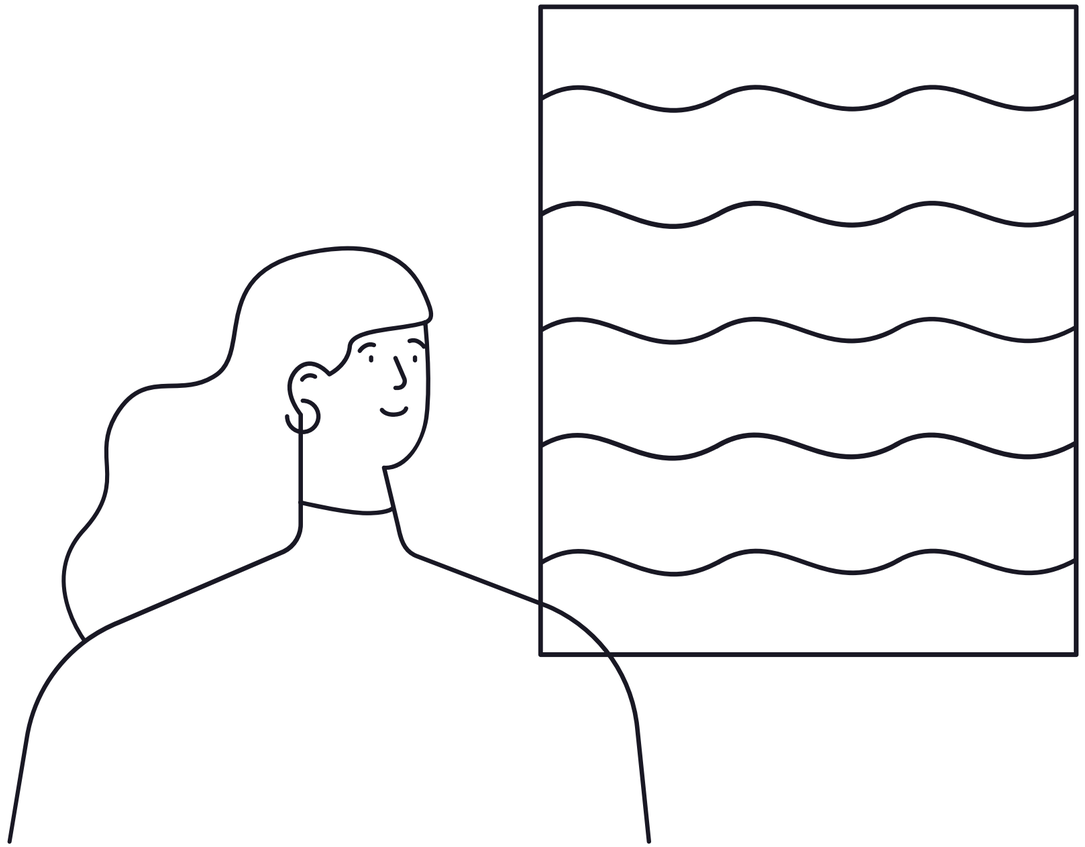
How do adolescents' behavioral patterns, moods, emotions, and other psychological states change over time?

How can we study these changes?



SURVEYS

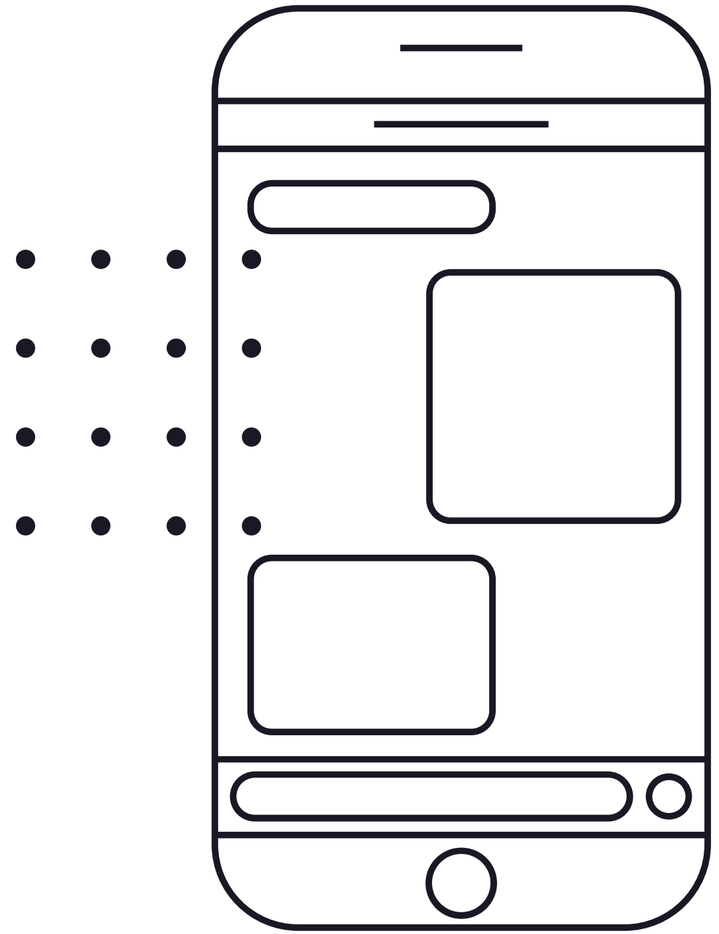
Too expensive and time-consuming to be conducted frequently

Problems with accuracy and validity of adolescents' self-reports (Fan et al. 2006; Robinson-Cimpian 2014)

DIGITAL TRACES

Fast
Inexpensive
Non-intrusive
High resolution

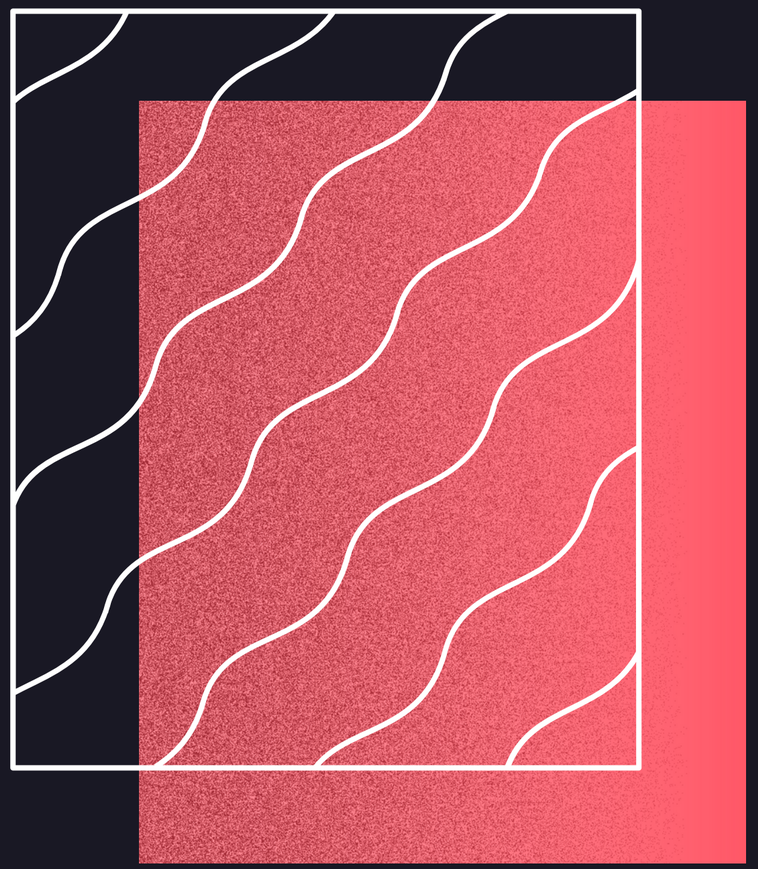
An increasing number of studies have predicted methal health conditions (De Choudhury et al. 2013; Eichstaedt et al. 2018; Tackman et al. 2019)
and analyzed emotive trends based on social media data (Golder & Macy 2011; Bollen et al. 2011; Garcia & Rimé 2019)



OUR STUDY:

How naïve digital traces* correspond to survey data on high school students' well-being?

*digital trace data that seem to reflect behavior, attitudes, or states



Relationships between:

1/ the sentiments of adolescents' social media posts and depression and anxiety

2/ day-of-week sentiment dynamics and self-reported mood

3/ time of adolescents' posts and their sleep patterns and quality

4/ relationships between (a) interaction-based metrics for online friendship and popularity on social media and (b) actual friendship ties and peer popularity and unpopularity

Survey:

Depression (PHQ-9)
Anxiety (Spilberger)
Friendship ties (with whom are you friends?)
Popularity (who do you consider popular/unpopular?)
Sleep quality (PSQI scale)

One school in Moscow
High school students (16-17 years old)
N=144
November 2017–February 2018

Daily self-reports (mobile app RealLife Exp):

Bedtime/wake up time (asked once per day in the morning)
Mood (assessed three times per day using a 5-point Likert scale, from 1 “very bad mood” to 5 “very good mood”)

Profiles on social networking site (VK.com)

Public posts (text, timestamps, number of likes)
- sentiments of posts via SentiStrength http://sentistrength.wlv.ac.uk/

Number of friends from the same school (based on the list of school students) and overall

DEPRESSION & ANXIETY

- Severity of depression is correlated with the proportion of strongly negative posts (Pearson’s r = 0.24, 90% CI [0.03, 0.43]) and the average strength of negative sentiment expressed in posts (Pearson’s r = 0.23, 90% CI [-0.02, 0.42])

- Students with moderately severe or severe depression: 22% of posts were strongly negative
- Moderate or mild symptoms of depression - 8.6% of posts
- No signs of depression - only 2% of posts

- No correlation with anxiety

MOOD & SENTIMENTS

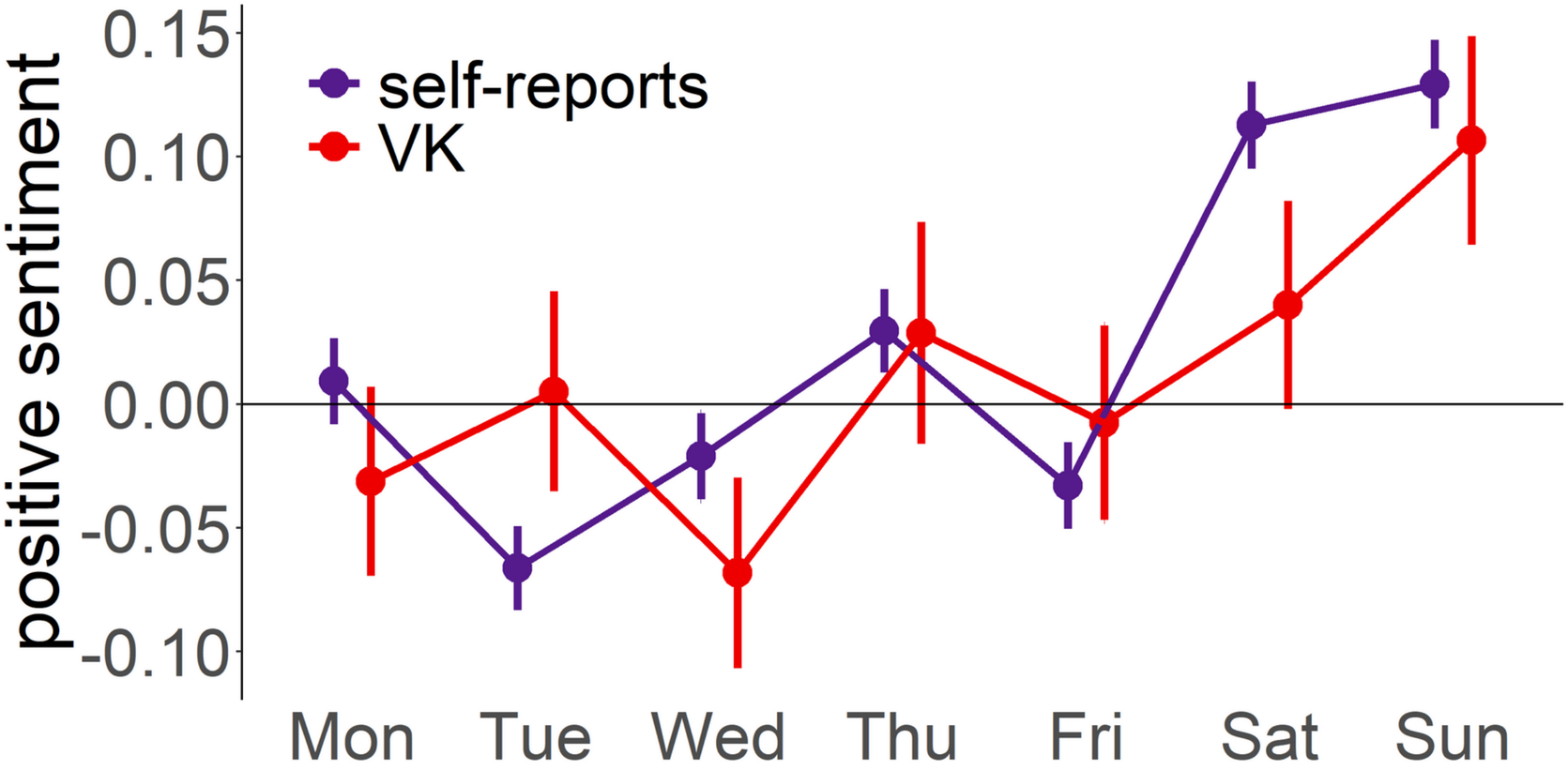


Fig. 1. Average level of positive sentiment (in SD units) over the course of the week based on self-reports and sentiment analysis of VK posts. Error bars indicate standard errors.

The proportion of late-night posts (written between 1 a.m. and 5 a.m.) is correlated with late bedtime (proportion of days when a participant went to bed after 1 a.m.)
r = 0.2, P = 0.024

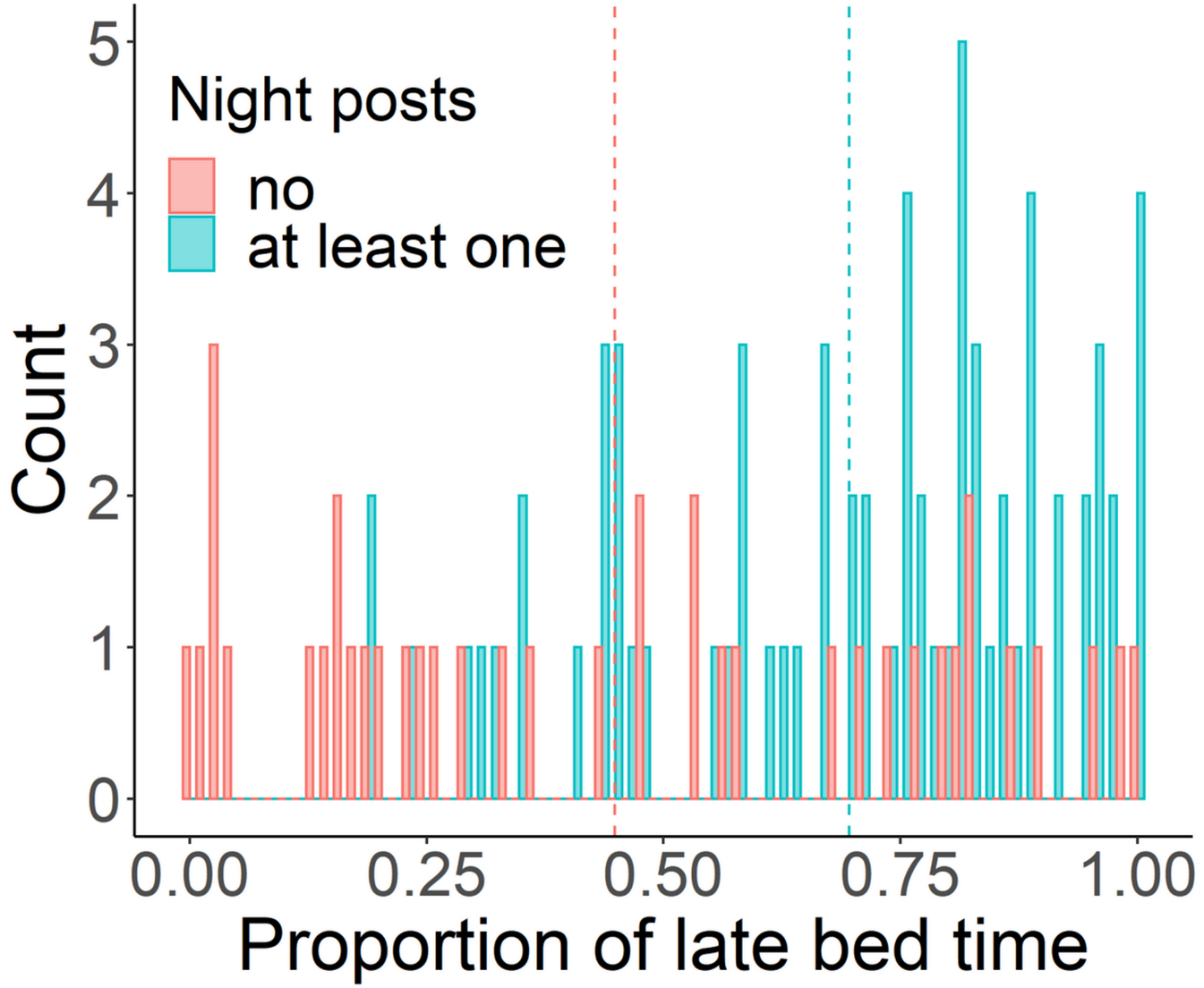


Fig. 2. The number of participants with different proportions of late bedtime (days when a participant went to bed after 1 a.m.) for those with at least one late-night post (written between 1 a.m. and 5 a.m.) and those without.

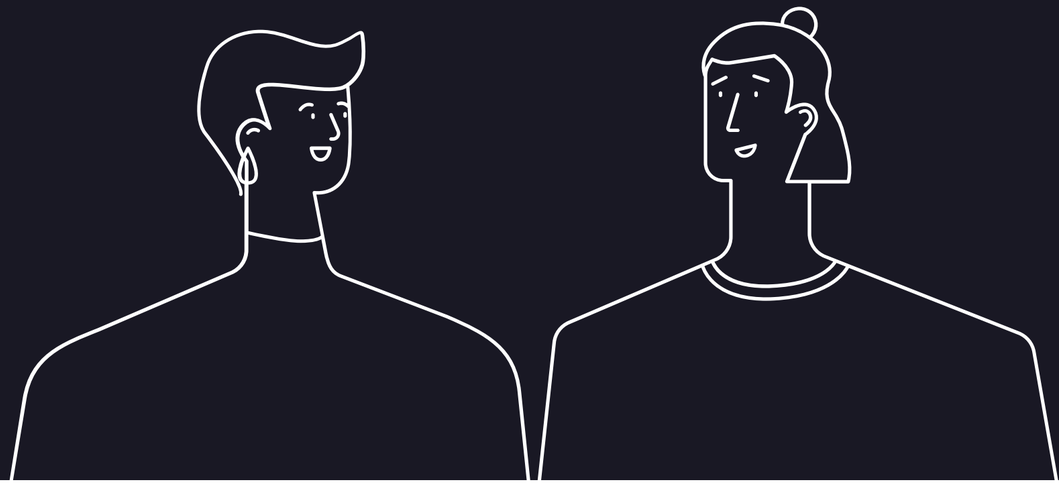
Late-night posting indicated less sleep as well as poorer sleep quality

Students who posted late at night slept 30 minutes less on average than those who did not

- On school days - 6 hours and 40 minutes (vs 7 hours and 10 minutes)
- On days off - 7 hours and 50 minutes (vs 8 hours and 20 minutes)

Sleep quality was correlated with late bedtime ($r = 0.26$, $P = 0.02$, 95% CI [0.008, 0.44])
Worse for those who had at least one late-night post ($P = 0.02$)
The means are 0.87 standard deviations apart (6.2 and 7.7 points on PSQI scale)

FRIENDSHIP & POPULARITY



Even for pairs with a high intensity of "likes" (i.e., every second post on VK is liked), the probability of an offline friendship is only 21%

Students who were mentioned as popular had, on average, 1.5 times as many VK friends from the same school than those who were not mentioned as popular

The same was not true for the overall number of friends on VK, which did not differ significantly for popular and unpopular students

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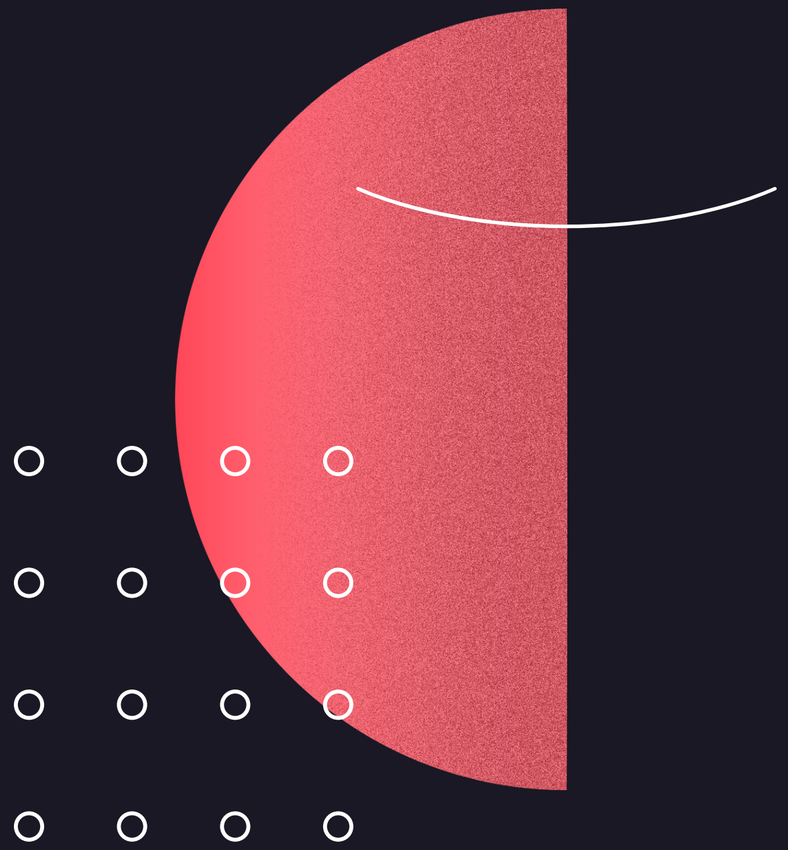
CONCLUSIONS



Digital trace measures of well-being can be treated and used as complementary data rather than as close proxies

The estimations of the correlations between digital trace measures and well-being can be useful for potential meta-analyses of the validity of digital trace data as a measure of adolescents' well-being

The data set https://osf.io/b57rp/

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