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# Everyone does it—differently: A window into emerging adults' smartphone use

Nastasia Griffioen<sup>1✉</sup>, Hanneke Scholten<sup>2</sup>, Anna Lichtwarck-Aschoff<sup>3</sup>, Marieke van Rooij<sup>2</sup> & Isabela Granic<sup>1</sup>

Concerns regarding smartphones' and social media's impact on youth remain high amidst a growing realization that current research is not designed to confirm (or refute) such concerns. This study aims to answer fundamental questions regarding youths' use of smartphones, by implementing a novel user-centric research method. The smartphone use of 114 emerging adults was recorded, followed by in-depth interviews that incorporated the recording and in-app information to help participants recall their behaviours, motivations, and feelings. Results indicate that smartphone use is indeed ubiquitous; 88 out of 114 participants started using their smartphone as soon as they were left alone. However, the findings of this study also demonstrate great diversity in smartphone use, in e.g. social media platforms used and motivations for using different apps. These results illustrate that it no longer seems sensible to refer to "screen time" as if it represents a homogeneous phenomenon across youth. Additionally, preliminary indications have been found of relationships between individual differences in mental health indices and variations in smartphone use. The current study provides new insights into youths' smartphone use and its relationship with wellbeing.

<sup>1</sup>Department of Developmental Psychopathology, Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, The Netherlands. <sup>2</sup>Faculty of Behavioural, Management and Social Sciences, University of Twente, Enschede, The Netherlands. <sup>3</sup>Faculty of Behavioural and Social Sciences, University of Groningen, Groningen, The Netherlands. ✉email: [nastasia.griffioen@ru.nl](mailto:nastasia.griffioen@ru.nl)

## Introduction

Smartphones occupy young people's hands and minds wherever one looks. While children and adolescents are occupied with their digital devices, concerned adults are asking: Are smartphones bad for youth? Are these portable screens "destroying a generation" (Twenge, 2017)? Concerns regarding smartphones' impact on adolescents and emerging adults have in some cases even taken on the shape of policies being put in place to restrict children's access to their phones, such as those implemented in France (Willsher, 2017). Despite this surge in attention to smartphones and their impact on wellbeing, there is much we still do not know about youth and their relationships with smartphones. In this study, we aimed to fill this gap by conducting data-supported and in-depth interviews with emerging adults immediately following naturalistic observations of spontaneous smartphone use.

Many earlier attempts have been made to shed light on young people's smartphone use, and a considerable number of studies suggests that new digital technologies are negatively affecting young people's mental health (Kelly et al., 2018; Twenge and Campbell, 2019; Twenge et al., 2017). There are indeed clear indications that adolescent and emerging adult mental health is suffering a decline over the last decade (De Graaf et al., 2012; Gore et al., 2011; Mojtabai et al., 2016; Twenge et al., 2017). However, the causal relation between mental health and smartphone trends is far from clear. Recent meta-analytic research has suggested analytical and methodological problems (Odgers and Jensen, 2020; Orben, 2020; Orben et al., 2019), including an over-reliance on self-report questionnaires that remains the norm for the vast majority of studies (Griffioen et al., 2020). As a result, data on smartphone use is unreliable and its validity is questionable: correlations between self-reported and passive sensing data (i.e., data collected through a mobile application running in the background) are low, with people consistently either over- or underestimating their actual smartphone use (Ellis, 2019; Ellis et al., 2019).

"Screen time" (i.e., how much time is spent using social media or other digital technologies) has so far received the bulk of scientific attention (Kim, 2017; Lee et al., 2011; Rae and Lonborg, 2015; Ryan and Xenos, 2011; Sampasa-Kanyinga and Lewis, 2015; Simoncic et al., 2014). However, asking about 'time spent using a smartphone' gives researchers very little information, given the massive number of actions, contexts, and feelings that these devices engender. Moreover, it is becoming increasingly clear that "screen time" itself, in terms of a simple frequency and duration count, is not informative enough when it comes to understanding wellbeing (Granic et al., 2020). We have a very limited understanding, for instance, of what exactly is being done on smartphones. What kinds of apps do emerging adults use? Who are they interacting with on these apps? Why do they use their smartphones in general, and specific apps in particular? It would be a mistake to think that emerging adults are mindless about their smartphone use. For instance, they reflect on how smartphones may affect their relationships with others (Price-Mitchell, 2014). However, what emerging adults think and feel about their own smartphone use is rarely addressed in scientific literature.

Additionally, different youth may have different needs and goals when using their smartphone, and these differences likely tie into their personal characteristics (Demircioğlu and Göncü Köse, 2018). For instance, social media's potential for (negative) social comparison has been discussed extensively (Haferkamp and Kramer, 2011; Hanna et al., 2017; Hicks and Brown, 2016; Jang et al., 2016; Lee, 2014). Active use such as liking, posting, and commenting in digital contexts has been related to more positive mental health outcomes than passively scrolling around (Escobar-Viera et al., 2018; Shaw et al., 2015; Verdunyn et al.,

2015). However, we argue that there is far more complexity that underlies these relations. For example, passive observation of other people's 'perfect' lives on social media may not be problematic for many people, but for individuals with low self-compassion, this passive consumption may be particularly detrimental. Self-compassion refers to kindness and empathy for the self in light of one's failings (Neff, 2003) and has not yet been investigated in relation to social media use. Similarly, feelings of depression, anxiety, or stress in the moment may play a role in how and why youth interact with social media, and what, in turn, they get out of these interactions. In addition, youth who are sensitive to rejection (a correlate of the mental health symptoms previously mentioned (Gao et al., 2017; Mellin, 2008)) may be less likely to 'put themselves out there' on social media, which may in turn impact the extent and kind of feedback they receive from their peers on these networks. In sum, in a field that has focused almost exclusively on the negative or psychopathological relations between digital activity and outcomes, there is a great deal of basic, descriptive information that is missing about how and why the average young person uses their device.

We argue that researchers—as well as policy-makers, parents, teachers, and young people themselves—need basic, detailed, and reliable data about smartphone use and its relation to mental health and wellbeing before further policy decisions, parenting advice, and educational reforms are implemented (Willsher, 2017). Using a person-centric research paradigm designed specifically to uncover these aforementioned aspects of smartphone use (Griffioen et al., 2020), we aimed to provide data that described emerging adults' digital activity. Through extensive and open interviews, combined with objective data that anchored these interviews to recordings of actual smartphone use, we were able to collect a wealth of information that is missing from previous studies (Piwiek and Joinson, 2016).

**Research design.** The current study examined 114 emerging adults' digital behaviour, based on a 10-minute observation period in an informal, social lab space. Participants were asked to wait for 10 min, during which they were recorded without being aware of it. Following this observation period, the real aim of the study was revealed to participants and participants were asked whether they would be willing to engage in an interview regarding how they spent their time during the researcher's absence, with the use of the video recording and participants' own phone to stimulate recall of events. During this interview, researcher and participant together reviewed the recording. Using this recording, the participant's activities, motivations, and feelings were extensively discussed and mapped out.

## Method

**Participants.** A total of 125 participants (106 female, 19 male) were recruited from the Radboud University's online participant-study administration tool (SONA) (age:  $M = 21.23$ ,  $SD = 2.23$ , range = 18–25). On average, the protocol took 1.5 h to complete, and participants were compensated with either €15 VVV gift cards (a type of gift card that can be redeemed in many different Dutch stores) or 1.5 study participation credits. Participants were recruited between April and December 2019 and were eligible if they met our age requirement (between 18 and 25 years of age). Although 125 participants were tested, we had to exclude 11 participants from analyses, either because they did not feel comfortable with the researchers using their recording and withheld their consent (4 participants, meaning the stimulated recall interview could not take place) or because of quality-

problems with the video recording which would render the stimulated recall interview not sufficiently reliable (7 participants).

**Procedure.** The present paper utilizes data from a study that was originally designed to investigate stress regulation and social media use. In this study, participants were assigned to either a stress or a control condition (see the section “Manipulation phase”). Due to the timing of study elements, however, the manipulation failed its purpose. As a result, no significant differences between conditions were found on smartphone use variables or any of the other variables discussed in the present paper. For that reason, conditions have been collapsed, and descriptive data of all participants have been combined, and have been presented here.

**Questionnaire phase.** Upon coming into the bar lab, participants were asked to read the study information letter and sign an informed consent form. Electrocardiogram (ECG) equipment was applied, and participants were asked to turn their phones off and on, supposedly to perform ECG calibration checks. In reality, this was done to (1) check whether the participant had their phone at hand, and (2) to nudge participants to have their phone close by for the monitoring phase.

After the physiological equipment was set up, the participants were asked to fill out Dutch or English versions of a number of psychometric questionnaires: the Depression, Anxiety and Stress Scale—21 items (DASS-21) (Lovibond and Lovibond, 1995), the Cognitive Emotion Regulation Questionnaire Short (CERQ-short) (Garnefski and Kraaij, 2006), the State-Trait Anxiety Index—Trait part (STAI-T) (Spielberger et al., 1983), the Self-Compassion Scale (SCS) (Raes et al., 2011), and the Rejection Sensitivity Questionnaire for Adults (A-RSQ) (Berenson et al., 2013).

**Manipulation phase.** Depending on the condition that the participants had been assigned to, they were asked to perform one of two tasks, both lasting 10 min. If participants had been assigned to the stress condition, they were asked to perform the Leiden Public Speaking Task (Westenberg et al., 2009). In the Leiden Public Speaking Task, participants are told that they will have to give a brief, recorded presentation of five minutes in front of a pre-recorded audience, for which they will have 5 min to prepare. This and similar protocols (e.g., Trier Social Stress Tests; Kirschbaum et al., 1993) are often used to elicit a stress response and estimate effects of stress on other phenomena or processes (Campbell and Ehler, 2012). If assigned to the control condition, participants were given two short presentations to view and rate. Both tasks were matched for duration.

**Smartphone use monitoring.** Participants were then asked to wait in the room for 10 min while the tester went to “help a colleague tester set up another participant”. If participants had brought a bag and/or coat with them, these items were placed in their vicinity, as participants were told not to move from their seat as to not disturb the ongoing physiological measurement. Participants were instructed that they were free to do anything they wanted as long as they remained seated. If asked whether using a phone was allowed, the experimenter conceded that this was indeed fine. After any necessary explanation, the experimenter exited the room and quickly went to the control room, where an overhead video camera in the bar lab was remotely switched on to record participants’ activities in the room during the 10-min monitoring phase. This camera’s focus and zoom were adjusted in such a way that apps and general behaviours (such as typing and swiping) were visible, but no text or images were legible or recognizable.

**Stimulated recall interview.** After the 10 min of the monitoring period had passed, the recording was quickly uploaded to a secure server so that it might be accessed a couple of minutes later for the interview from within the bar lab room. Upon the researcher’s return, participants were partially debriefed and told that the true aim of the study was to gain insight into how youth spend their spare time. Participants were told that the researcher would like to spend the remainder of the study time on an interview with the participant discussing these past 10 min. Participants were also told at this point that a video recording had been made to aid the participant in their recollection of their behaviour. Then they were asked to provide additional informed consent. If they did so, the ‘stimulated recall’ interview took place, during which the participants’ activities, motivations, and feelings related to their smartphone use were mapped on a ‘stimulated recall chart’. For an example of such a chart (see Fig. 1). Out of 114 participants, only four declined to participate in the stimulated recall interview.

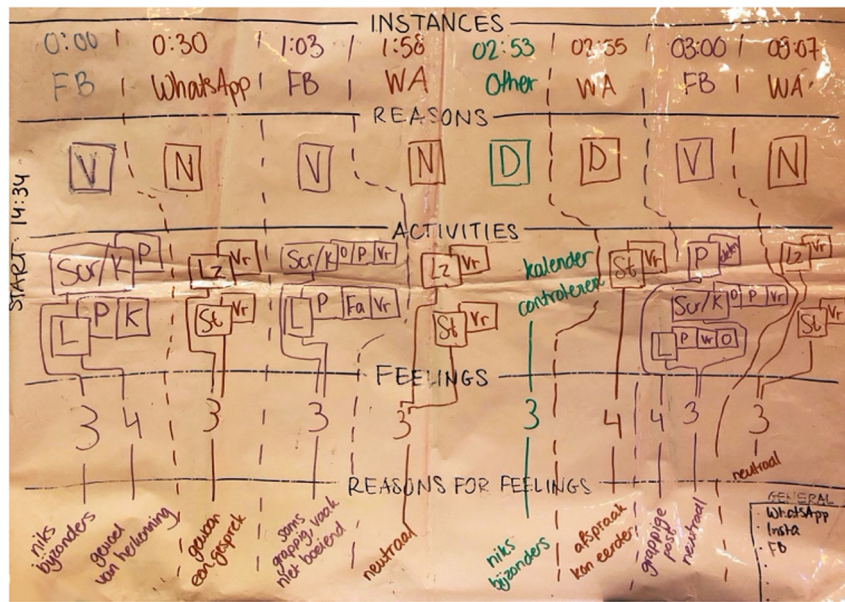
During the stimulated recall interview, the experimenter played back the video footage in short segments. During this playback, the experimenter asked the participant what they were doing at a given time point, while recording the video time stamp corresponding to the start of every new activity. Participants were prompted to talk about why they had started to engage in the activity, what exactly they were doing, and how they felt while engaging in that activity. These feeling scores were determined for each sub-activity (e.g. scrolling on social media, or sending a message to close contacts) by presenting the participant with a visual 5-point smiley scale (ranging from very negative to very positive). In places where the video footage did not provide sufficient detail for accurate recollection, participants were asked whether they would be willing to look up information about what they had done on their phones (e.g., in social media data logs, or messaging logs). The entire video footage of 10 min was processed and discussed, a process that on average took about 30–45 min.

**Debrief and compensation.** Upon finishing the interview, the participant was asked to fill out a debrief questionnaire and then fully debriefed. After this, they received compensation, either in the form of a gift card or study participation credits. If the participant did not consent to conducting the interview with the aid of the video recording, the interview did not take place, and the participant was debriefed, and given a reward corresponding to the time spent in the study. This study protocol was approved by the Ethics Committee of the Faculty of Social Sciences at the Radboud University Nijmegen. For more details regarding this stimulated recall method and its development and implementation, see Griffioen et al. (2020).

**Variables.** Variable names as described below match the variable names in the correlogram which can be found in the Supplementary Materials (see Supplementary Fig. 1), with the exception that low dashes have been removed in the following overview for readability.

**Individual features.** *Stress Symp*: DASS Stress score; *Anxiety Symp*: DASS Anxiety score; *Depression Symp*: DASS Depression score; *Self-Compassion*: Self-Compassion Questionnaire score; *Rejection Sens*: Rejection Sensitivity Questionnaire score; *Anxiety Propens*; State-Trait Anxiety Inventory Trait score.

**General smartphone use.** *Nr. App Bursts*: number of app bursts; *Nr. Unique Apps*: number of unique phone apps used; *Time Till Phone*: seconds from start of monitoring till phone use; *Avg App Time*: average amount of seconds spent per app instance; *Gen Goal Prop*: proportion of all app bursts that was motivated by a



**Fig. 1 Stimulated recall chart.** An example of a filled-out stimulated recall chart. Rows indicate (from top to bottom): timestamp start and app/activity, motivation abbreviation (Dutch), specific activity and related social ties attached to top right, feeling score, and feeling elaboration (Dutch).

goal, *Gen Habit Prop*: proportion of all app bursts that was motivated by habit, *Gen Bore Prop*: proportion of all app bursts that was motivated by boredom, *Gen Notif Prop*: proportion of all app bursts that was motivated by a notification.

*Social media. Nr. SM Bursts*: number of social media bursts; *SM Time*: seconds of social media use; *Unique SM*: number of unique social media apps used; *FB Time*: seconds spent on Facebook; *Insta Time*: seconds spent on Instagram; *Snap Time*: seconds spent on Snapchat; *SM Close Tie Act*: proportion of social media activities related to close ties; *SM Feel Scrol*: mean feeling score for reading/scrolling/browsing activities on social media; *SM Feel Like*: mean feeling score for like activities on social media; *SM Feel Com*: mean feeling score for commenting activities on social media; *SM Feel Gen*: mean feeling score for activities on social media in general; *SM Prop Time*: proportion of time spent on social media; *SM Active Act*: number of active social media activities; *SM Goal Prop*: proportion of social media bursts that was motivated by a specific goal; *SM Habit Prop*: proportion of social media bursts that was motivated by habit; *SM Bore Prop*: proportion of social media bursts that was motivated by boredom; *SM Notif Prop*: proportion of social media bursts that was motivated by a notification.

*Browsing. Nr. Brow Bursts*: number of browsing bursts; *Brow Prop Time*: proportion of time spent on browsing; *Brow Motiv*: motivations for starting a browsing burst; *Brow Feel*: mean feeling score for browsing activities.

*Messaging. Nr. Mes Bursts*: number of messaging bursts; *Mes Close Tie Act*: proportion of messaging activities done with friends, family, and/or romantic partner(s); *Mes Feel*: feeling score for messaging activities; *Mes Prop Time*: proportion of time spent on messaging; *Mes Motiv*: motivations for starting a messaging burst.

*Other. Other Prop Time*: proportion of time spent on ‘other’ activities; *Other Feel*: mean feeling score for ‘other’ smartphone activities.

*Offline. Nr. Off Bursts*: number of offline activity bursts; *Off Prop Time*: proportion of time spent on offline activities; *Off Motiv*: reasons for starting a burst of offline activities; *Off Feel*: mean feeling score for offline activities.

**Data analyses**

*Correlations.* All continuous variables (with the exception of “SM Feel Post”; not enough data points to compute correlation) have been included in a correlation matrix computed in R (R Core Team, 2017) using the “RcmdrMisc” package. All pairwise complete observations were included in this computation, and *p*-values were adjusted for multiple comparisons through use of the *rcorr.adjust* function in that same R package. This function computes Pearson correlations which are then corrected for multiple comparisons using Holm’s method (Holm, 1979). Crude motivation variables (e.g., “Off Motiv”) were not included in correlogram because they are categorical. In some cases, such as for smartphone use in general and for social media in particular, continuous proportion variables were calculated (e.g., “SM Goal Prop”), and included in the correlation matrix. For a complete overview of the correlogram (see Supplementary Fig. 1).

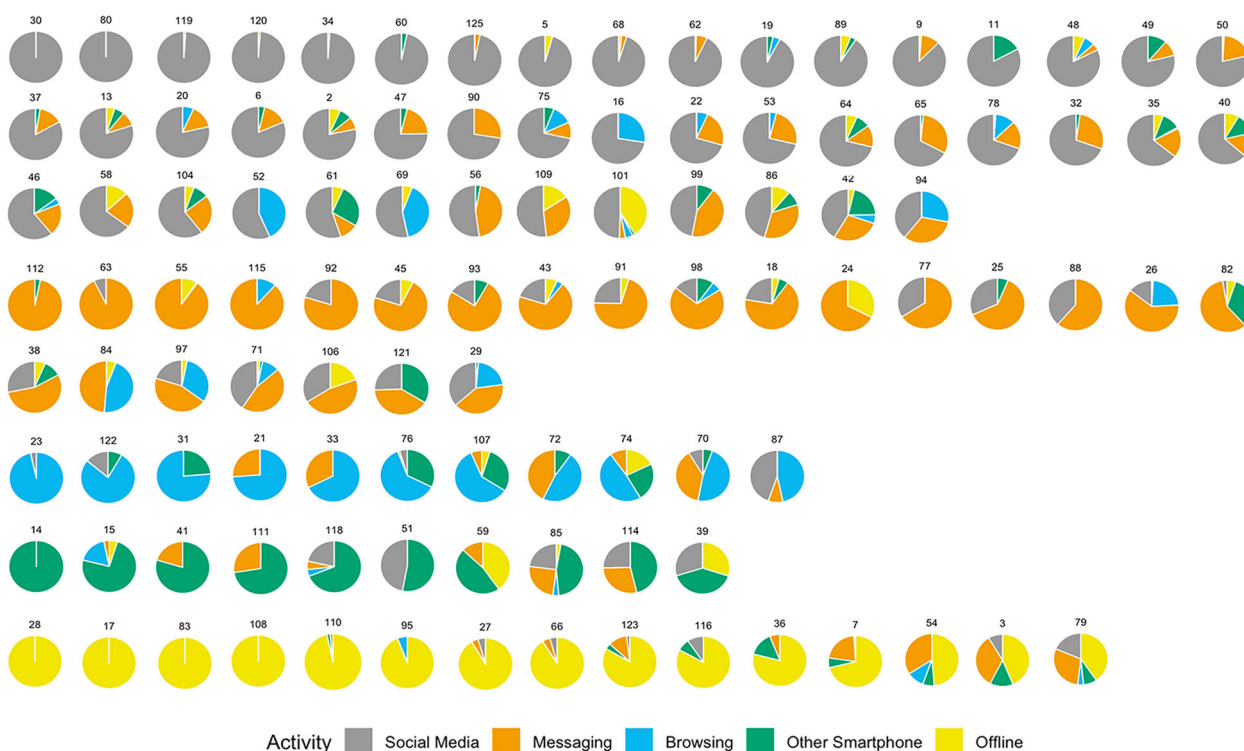
*Comparison of feeling scores.* For both the comparison between general activity type feeling scores and social media activity type feeling scores, analyses of variance and Tukey’s HSD post-hoc tests were run to establish significant differences between feeling score averages. Although the feeling scores for different activity types (whether general or within social media) are nested within participants, the large differences in number of samples per activity type feeling scores led us to treat these activity types as separate groups. These differences in samples per feeling score variable result from the fact that, for instance, many participants did not engage in activities such as liking or posting on social media, whereas most of the participants engaged in scrolling/reading.

**Results**

**Smartphone use is (almost) ubiquitous.** In our sample of 114 emerging adults, 96.5% (*n* = 110) used their smartphone at some



Individuals' Activities Division



**Fig. 2 Individuals' activities division.** Individual participants' activity pie charts. While we tested 125 participants, we present data on 114 of these participants. Participants for whom we did not have data ( $n = 11$ ), either because of technical difficulties, or because the stimulated recall interview did not take place, are not included in this figure. Participant IDs reported above the individual pie charts.

point during the 10-min monitoring period. Eighty percent of these emerging adults ( $n = 88$ ) picked up and started using their phone as soon as the experimenter had left the room. Almost half of the participants, 48.2% ( $n = 55$ ), used their smartphone from start to finish during the monitoring period.

Interestingly, when our participants did engage in offline activities (i.e., not involving their smartphone), they predominantly reported doing so with a specific goal in mind (56% of the cases), for instance because they wanted to drink or eat ( $n = 16$ ), or because they wanted to look around out of curiosity for their surroundings ( $n = 20$ ). The four participants (3.5%) who did not use their smartphone at all spent their time 'relaxing', reading, and looking around, with two participants explicitly explaining during the interview that they consciously wanted to use the 10 min to simply 'not do anything'.

**Smartphone use comes in different shapes.** While there seems to be uniformity in that almost all participants used their smartphone at some point during our observation, there is also great diversity in *how* they spent time on their smartphone, and *what* activities they engaged in. In Fig. 2, participants' variation in smartphone use is depicted according to five main categories of apps: social media (e.g., Instagram, Facebook), messaging (e.g., WhatsApp, Facebook Messenger), browsing (e.g., online shopping, reading articles), 'other activities' (i.e., the use of smartphone apps that do not fall under either of the preceding categories, such as games or public transportation apps), and offline activities (i.e., anything not involving a smartphone). Participants' charts are grouped according to the activity that they spent the most time on during our monitoring period. The figure illustrates that there seem to be different profiles of smartphone use among our participants, such as the participants who only used social media, or only engaged in offline activities.

Additionally, we found a great deal of variation in how often participants switched between different apps in the 10-min period. While some switched only once (the minimum), others switched up to 21 times (the maximum). When it comes to how many different (i.e., unique) apps were used by participants, some used only 2 different apps, whereas others used up to 9 during our monitoring period (Mdn = 3, IQR = 2.25, 4.75). Individuals' average time spent on one app ranged from 28.6 sec to the full 10 min (Mdn = 100, IQR = 66.45, 150). The corresponding average feeling scores for the different smartphone activity types were mostly above 3 (see Table 1), and an analysis of variance indicated a significant difference between some of the mean feeling scores,  $F(4337) = 4.843, p < 0.001$ . A Tukey's HSD test of multiple comparisons indicated that only two pairs represented significant differences. Messaging feeling scores were on average significantly higher than social media scores, even though only a little ( $M_{diff} \text{ messaging} - \text{social media} = 0.285, p = 0.014$ ), and significantly higher than feeling scores for 'other' activities ( $M_{diff} \text{ other} - \text{messaging} = -0.380, p = 0.001$ ).

Looking at how participants felt in general while using their smartphone, we found that only a quarter ( $n = 29$ ) of emerging adults indicated that they felt negatively about an activity that they had engaged in during the monitoring period. When asked why they felt bad, participants gave a variety of reasons, ranging from boredom to a favourite football club losing, to bad weather. Emerging adults' explanations for 'bad moments' on the smartphone were rarely tied to other people in their network: this was the case only in 6 out of 45 reasons (13.3%), with these 45 reasons having been reported across 30 participants who had reported one or more negative feeling scores throughout the monitoring period.

Positive emotions were much more prevalent (reported by 93.9%, all except seven emerging adults in our sample).

**Table 1 Descriptives of feeling scores per smartphone activity type.**

Smartphone activity type	Number of participants	Minimum	Maximum	Mean	SD	Median	IQR
Social media	90	2.00	5.00	3.47	0.53	3.40	3.00, 4.00
Messaging	91	2.30	5.00	3.76	0.61	3.80	3.30, 4.00
Browsing	43	2.00	5.00	3.48	0.64	3.50	3.00, 4.00
Other	71	2.00	5.00	3.38	0.58	3.30	3.00, 4.00
Offline	59	2.00	5.00	3.64	0.71	3.70	3.00, 4.00

Explanations for positive feelings while using their smartphone ranged from funny posts, to favourite football clubs winning, to enjoying others' photos, to simple curiosity. Importantly, in contrast to negative feeling scores the explanations for positive feeling scores were often (29.7%) related to something someone in their network had said, done or shared. Having established that participants used their phones for different types of activities, we examined more closely the specifics of these activity types.

### Social media

#### Variety in use

Although social media was a common activity in our sample, 21% ( $n = 24$ ) of participants did *not* use social media during our monitoring period. Among those who did use social media, the amount of time they spent there and how many platforms they used varied greatly. Some spent no more than a minute on social media ( $n = 13$ , 11%), whereas others spent between a minute and five minutes ( $n = 34$ , 30%) and yet others spent between five and the full ten minutes on social media ( $n = 43$ , 38%). Most participants ended up using one or two different platforms (30% and 32%, respectively), whereas some ended up using our sample's maximum of four different social media platforms within our 10-min monitoring period (3%). Additionally, we have found 20 different combinations of social media platforms, in which Facebook, Snapchat and Instagram featured prominently, in addition to lesser-known platforms such as Jodel and Polarsteps (see Fig. 3). There thus seems to be considerable variation in which social media are used by emerging adults.

#### Feelings and active vs. passive use

Active use of social media (i.e., posting, commenting) was very limited; approximately half of our participants ( $n = 48$ , out of the 90 that used social media) engaged in some sort of active behaviour on social media, but on average, these emerging adults only engaged in 1 active social media behaviour during the 10-min monitoring period ( $Mdn = 1$ ,  $IQR = 0.2$ ). When they did engage in an active social media behaviour, participants most often said to feel positively about their time on social media in that moment. See Table 2 for an overview of mean feeling scores per social media activity type.

A one-way analysis of variance showed that the effect of social media activity type on feeling scores was significant,  $F(3125) = 2.77$ ,  $p = 0.04$ . Post hoc analyses using Tukey's HSD test of multiple comparisons, however, showed that none of the social media activity pairs were significantly different from one another.

#### Motivations and active vs. passive use

Whereas a group of young adults made a deliberate and conscious choice to not use their smartphone at all (see Section 2.1), social media use was most often initiated by habit or boredom (see Table 3). We also found that reporting 'habit' more often as the reason for using social media was associated with a more passive kind of social media use (see Supplementary Fig. 1 for all correlations). More frequent reporting of 'notifications', on the other hand, as the reason for using social media was associated with more active social media behaviours.

#### With whom?

A third of emerging adults (33%) did not interact with or see content of close social ties (i.e., friends, family, romantic partner(s)) while on social media. From our observations, it has become clear that for a number of platforms, such as Facebook, young people's timelines are often flooded with posts by companies or group pages. There do not seem to be any associations between proportion of activities related to close social ties and having a specific type of motivation for using social media (see Supplementary Figure 1).

### Messaging

#### Variety in use

Compared to social media, messaging (e.g., WhatsApp, Facebook Messenger) was used by slightly more participants in our sample ( $n = 91$ , 83%). While some participants did

not message others at all, a number of participants opened a messaging app only once ( $n = 27$ ), and 13% ( $n = 14$ ) engaged in intensive back-and-forth's (i.e., 5 or more messaging bursts) with their contacts. Most participants engaged in both reading and sending messages, but some only read messages without replying ( $n = 12$ , 13%), and an even smaller part ( $n = 3$ ) of our sample indicated having not read any messages and to only have sent one or more messages (3%).

#### Feelings

As can be seen in Table 1, messaging activities on average had the highest feeling scores, which is perhaps unsurprising given that messaging interaction took place mostly with peers who are likely close to the emerging adults (see below). Looking at the few participants ( $n = 6$ , 7%) who reported relatively low feeling scores, we see that these low feeling scores had to do with things like participants feeling grumpy or disappointed, discussing a sensitive subject, not wanting to do something that was asked of them, or finding themselves in an awkward situation.

#### Motivations

When asked why participants had engaged in messaging, notifications and goals turned out to play the largest role (see Table 3). In contrast to using social media, boredom and habit were rarely mentioned as the motivation for participants to message. Boredom was only ever mentioned in combination with other motivations such as goals and notifications, and a similar situation is found for the 'habit' motivation: only 3 participants in our sample reported habit as the only motivation to use messaging (3%).

#### With whom?

Roughly a third of the participants ( $n = 30$ ) who engaged in messaging interacted almost solely with close ties (i.e., friends, family and/or romantic partner(s)). Most emerging adults who used messaging (51%) interacted more with friends than they did with other ties.

### Browsing

#### Variety of use

Approximately two in five participants ( $n = 42$ , 37%) browsed the internet during our monitoring period, and—echoing the findings for other activity types—there is considerable variation in how much relative time was spent on browsing during the monitoring period (see Fig. 2, blue sections). Activities while browsing were varied, ranging from shopping for shoes and clothes, to checking the news and weather, or visiting websites related to school or work.

#### Feelings

Regarding how participants feel during browsing, we see a very similar pattern to that of the feeling scores for social media, with a moderately positive mean feeling score of 3.48 out of 5 ( $SD = 0.64$ ).

#### Motivations

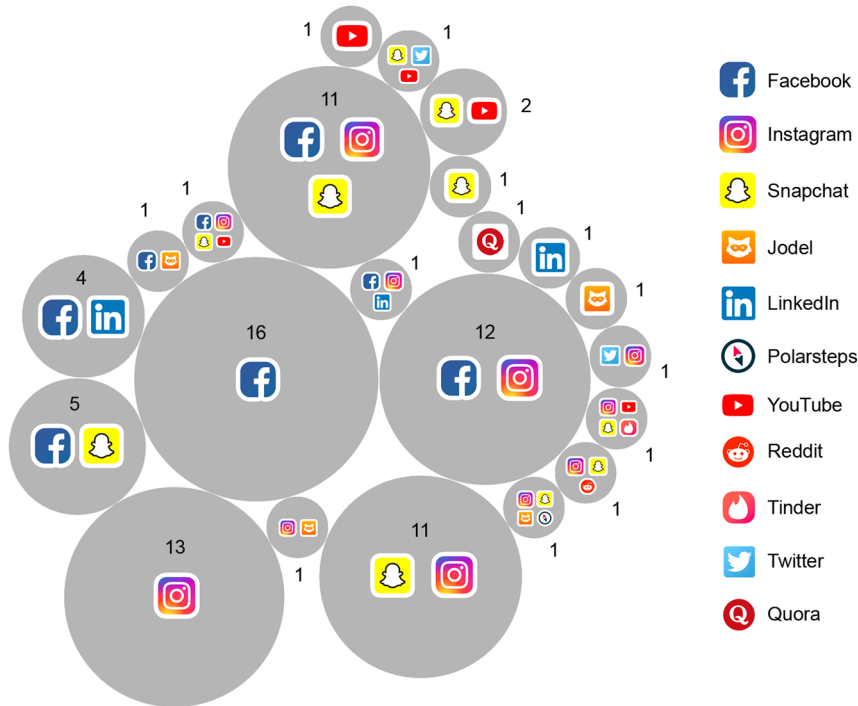
Similar to offline and messaging activities, participants who browsed online most often indicated having a specific goal in mind as the reason for this activity (see Table 3). This is again in stark contrast to the motivations mentioned for social media use, but understandable given that for web shops and weather or public transportation websites it would indeed make more sense to visit them when a specific goal needs to be met, rather than to pass the time.

### Other smartphone activities

#### Variety of use

Out of our 114 participants, 71 participants (62%) engaged in an 'other' activity at least once during the monitoring period. However, this category of activities—comprised of anything done on the smartphone that was not messaging, social media or browsing—appeared to be rank lowest in terms of being done the most. Meaning, for only 10 of our 114 participants (9%), these other activities took up the bulk of their time. Although playing games (6 participants) and browsing through photos (10 participants) can be

Social Media Platform Combinations Used



**Fig. 3 Bubble chart depicting social media platform use.** The bubbles in this chart depict which social media platforms were used by how many participants in our study, and in which combinations. Bubble size corresponds to popularity of the combination, number of participants using this combination is indicated within or next to the bubble.

**Table 2 Descriptives of feeling scores per social media activity subtype.**

Activity subtype	Number of participants	Minimum	Maximum	Mean	SD	Median	IQR
Reading/Scrolling	89	2.00	5.00	3.41	0.58	3.30	3.00, 4.00
Posting	6	4.00	4.00	4.00	0.00	4.00	4.00, 4.00
Commenting	8	2.00	4.00	3.58	0.80	4.00	3.62, 4.00
Liking	30	2.50	4.50	3.64	0.55	4.00	3.00, 4.00

**Table 3 Counts of motivations mentioned per activity type.**

Motivation	Activity type				
	Social media	Messaging	Browsing	Other	Offline
Boredom (Only)	49 (15)	10 (0)	7 (4)	15 (6)	18 (13)
Habit (Only)	<b>54 (17)</b>	17 (3)	10 (5)	17 (6)	4 (4)
Notification (Only)	16 (1)	59 (21)	3 (1)	15 (7)	n/a
Goal (Only)	34 (6)	<b>67 (21)</b>	<b>32 (27)</b>	<b>46 (26)</b>	<b>33 (28)</b>

Counts represent the number of times a motivation has been mentioned for an activity type (i.e., either in combination with other motivations, or alone). The number of times a motivation was the only motivations mentioned for an activity type is indicated between brackets. Most frequent motivations are indicated in bold.

considered pleasant activities related to leisure, the Other activities category to a considerable extent consisted of work- or school-related activities such as checking/ updating one’s calendar (13 participants), reading notes or school work (5) and checking/ cleaning up one’s mail (33 participants). None of our participants indicated to use email for informal interpersonal communication, and instead explained to be using mail for work, school and advertisements from shops and companies. For this reason, mail was made a part of the Other category.

**Feelings**

On average Other activities were given lower feeling scores than the other activity categories, as can be seen in Table 1 ( $M = 3.38, SD = 0.58$ ). However, this feeling score

does not differ significantly from any other activity feeling score except for Messaging, as was indicated by the Tukey’s HSD test of multiple comparisons discussed earlier in the section “Procedure”.

**Motivations**

Similarly to Messaging and Browsing activities, Other activities were most often motivated by a specific goal that participants had in mind, which is not surprising given the frequency of activities such as checking calendars, mails and even browsing through photos (for instance, because participants were looking for a specific photo they wanted to send to a friend).

## Offline activities

### Variety of use

Approximately half of our participants ( $n = 59$ , 53%) engaged in at least one offline activity during the monitoring period. Offline activities are activities that do not involve the smartphone, and mostly consisted of things like looking around the room or taking a moment for themselves (29 participants), drinking some water or eating a snack (17 participants), or reading through notes or books that the participants had in their bag (5 participants). Interestingly, with regards to doing nothing in particular, many participants indicated that this was a conscious choice to have a moment of rest amid their—usually—hectic day. As mentioned in the section “Participants”, for two participants this was even reason enough to not do anything for the entire duration of the monitoring period.

### Feelings

Feeling scores related to Offline activities are on average moderately positive and rank the second highest among the activity types discussed here ( $M = 3.64$ ,  $SD = 0.71$ ) (see Table 1). One might speculate that this relatively positive scoring of offline activities has to do with the fact that for most, not using the phone is a particularly conscious choice given that almost all had a smartphone to turn to. However, as was the case with the Other activities, the Tukey’s HSD test of multiple comparisons indicated that feeling scores for Offline activities do not significantly differ from any other activity category.

### Motivations

In line with all previous non-social media activities, offline activities are characterized by a specific goal being the dominant motivation for engaging in these activities (see Table 3). In fact, among the activity categories discussed presently, offline activities were least likely to have come from habit (only in four cases). Again, this may have to do with the fact that emerging adults seem to be particularly ready to turn to their smartphone if given the chance, and situations in which they turn away from their phone therefore seem most likely to be stemming from a conscious choice to do so.

**Individual features matter.** Although the analysis into smartphone use and individual correlates is only exploratory, our data seem to suggest that what is done on smartphones may differ greatly from person to person, illustrated for example by the individual differences in types of activities engaged in and differences in the social media apps that were used. Individuals’ personal features and traits may relate to such patterns in smartphone behaviours and experiences. As one step towards understanding these individual differences, a number of mental health measures were examined. We assessed a number of short-term mental health symptom variables: last week’s depression, anxiety and stress symptoms (DASS-21) (De Beurs, 2010; Lovibond and Lovibond, 1995). We also examined more long-term personal propensity characteristics, such as the propensity for anxiety (STAI-T) (Spielberger et al., 1983), rejection sensitivity (RSQ) (Berenson et al., 2009), and self-compassion (SCQ) (Raes et al., 2011). Here, we discuss the correlations we found between these mental health measures and our primary smartphone use variables (also see Supplementary Fig. 1 in the Supplementary Materials). We would like to stress that the correlations reported below have been corrected for multiple testing, but nevertheless remain exploratory and function mainly as a starting point which future confirmatory studies can build and expand on.

First, looking at short-term symptoms, we found that emerging adults scoring high on depression symptoms, compared with those that scored low, reported less positive feelings associated with using social media (both in general:  $r(88) = -0.27$ ,  $p = 0.009$ ; and specifically for scrolling on social media:  $r(88) = -0.24$ ,  $p = 0.021$ ), and at the same time seemed to spend more time on Facebook in particular ( $r(89) = 0.38$ ,  $p = 0.000$ ). High stress symptom scores were similarly negatively related to feeling scores for social media use in general ( $r(88) = -0.27$ ,  $p = 0.011$ ) and scrolling on social media in particular ( $r(88) = -0.36$ ,  $p = 0.000$ ). The same was true for high anxiety symptom levels (social media general feeling:  $r(88) = -0.29$ ,  $p = 0.018$ ; social media scrolling feeling:  $r(88) = -0.23$ ,  $p = 0.028$ ), which additionally were negatively related to the number of unique social

media platforms that had been used during the monitoring period ( $r(86) = -0.24$ ,  $p = 0.026$ ).

Second, looking at more long-term individual propensity measures, we found that higher rejection sensitivity—a trait that is highly relevant to social interactions—was also related to fewer messaging activities ( $r(108) = -0.23$ ,  $p = 0.014$ ), less relative time spent while messaging ( $r(108) = -0.23$ ,  $p = 0.015$ ), and a less positive feeling while messaging ( $r(89) = -0.29$ ,  $p = 0.018$ ). Additionally, a higher rejection sensitivity score was also related to a less positive feeling while using social media (both in general:  $r(88) = -0.31$ ,  $p = 0.003$ ; and for scrolling in particular:  $r(88) = -0.24$ ,  $p = 0.025$ ).

Third, we found that anxiety propensity scores were—similarly to recent anxiety symptoms—negatively related to feeling scores for social media use in general ( $r(88) = -0.29$ ,  $p = 0.006$ ) and scrolling on social media in particular ( $r(88) = -0.31$ ,  $p = 0.003$ ). Additionally, anxiety propensity was related to fewer unique social media platforms used ( $r(86) = -0.25$ ,  $p = 0.020$ ). Finally, anxiety propensity also seemed to be similarly related to lower feeling scores when browsing ( $r(41) = -0.33$ ,  $p = 0.029$ ) and to lower feelings scores for ‘other’ activities ( $r(65) = -0.47$ ,  $p = 0.000$ ) (e.g., playing a game, looking through photos).

Last, and in contrast to the previous propensity scores, self-compassion was positively related to a number of smartphone indices, such as to number of messaging activities ( $r(108) = 0.19$ ,  $p = 0.047$ ) and a more positive feeling while messaging ( $r(89) = 0.28$ ,  $p = 0.007$ ) and while using social media ( $r(88) = 0.24$ ,  $p = 0.023$ ). Additionally, participants scoring higher on self-compassion also saw more posts from/interacted more with close ties on social media ( $r(88) = 0.25$ ,  $p = 0.020$ ). Moreover, self-compassion—in contrast to anxiety—was positively related to a more varied palette of social media platforms used ( $r(86) = 0.25$ ,  $p = 0.019$ ), engagement in fewer non-smartphone activities ( $r(111) = -0.21$ ,  $p = 0.025$ ) as well as higher feeling scores while engaging in ‘other’ activities ( $r(65) = 0.37$ ,  $p = 0.002$ ) (e.g., playing a game, looking through photos).

## Discussion

Using a novel, user-centric research paradigm, we delved into emerging adults’ smartphone use when left alone for a short period of time. In rigorous, detailed and data-aided interviews with emerging adults, we explored what they did on their smartphones, how they felt while doing it, why they did it, and with whom. We found that, although smartphone use is ubiquitous, the patterns and functions of use varied a great deal. Youth can differ greatly in terms of which apps they use, what and who they encounter on these apps and how they feel about their smartphone use. Moreover, young people’s individual characteristics in some cases seem to be related to their smartphone and social media experiences. These data constitute strong evidence suggesting that indeed “screen time” is a term that holds little descriptive or explanatory power anymore (Granic et al., 2020). That being the case, it is now becoming increasingly clear that there can thus be no uniform effect of ‘screen time’ or smartphone use on wellbeing. Going forward, we clearly need a more concrete, specific, and functional account of digital activity.

First, it has become clear from the great diversity in social media platforms used in our study (see Fig. 3) that it is important to recognize the different affordances—action possibilities (Gibson, 1977)—provided by different smartphone apps (Moreno and Uhls, 2019). Not all participants used the ‘major’ social media platforms (e.g., Facebook, Instagram) that are most commonly associated with the term ‘social media’. This is particularly relevant given that most studies on the subject of social media use and wellbeing have focused solely on Facebook (Burke and Kraut,



2016; Chou and Edge, 2012; Chow and Wan, 2017; Deters and Mehl, 2013; Faelens et al., 2019; Fardouly et al., 2015; Krasnova et al., 2013; Labrague, 2014). As we have seen, emerging adults tend to use multiple platforms in many different combinations, and likely for many different functions. Digital social contexts can vary on a number of such affordance dimensions, such as the extent to which information is or is not public, permanent, visual and interpersonal (Nesi et al., 2020). For example, Snapchat is a highly private network, whereas Twitter is public-only. We would thus strongly urge researchers in the field of social media use and wellbeing to broaden their studies to incorporate different and common affordances across platforms.

Second, we found that whereas many smartphone and offline activities are deliberate and goal-directed, social media use in particular is almost always born out of habit or boredom. Indeed, in our interviews, participants often said that opening and scrolling on social media was almost an automatic, thoughtless act. Surprisingly, we did not find boredom or habit motivations for social media use to be correlated to more negative feeling scores for social media use. One explanation for this might be that habitual/boredom inspired behaviour might just not be as harmful as often assumed, with some studies for instance showing stress-relieving effects of habitual behaviour (Wood et al., 2002). Alternatively, the negative connotation generally accompanying habitual and boredom behaviour might enter the picture at a later point, for instance during the reflection and realization that these motivations were at play.

Third, our data call into question the prevalent view that most negative feelings associated with smartphones and social media stem from envy and social comparison, as evidenced by the multitude of studies conducted on this matter (Appel et al., 2015; Krasnova et al., 2013, 2015; Lin and Utz, 2015; Tandoc et al., 2015). In fact, we found negative feelings stemmed mostly from aimlessness, boredom, and other factors of non-social nature (e.g., a favourite football team losing). On the contrary, it seems that social contacts (in addition to youth's interests) were the factors more often related to positive feelings while using a smartphone. These results indicate that—although jealousy and envy may emerge while using social media—the social aspect of social media use and smartphone use is more than anything related to good, positive feelings.

Last, our data clearly illustrate that each individual uses her or his smartphone in a different way (see Fig. 2), and that individual features can be related to the positivity of feelings while using smartphones and to the behaviours exhibited by youth (e.g., more or less messaging contact). This fits well with an identity development and expression point of view: smartphones and social media are ideal tools for expressing and satiating one's identity needs, such as communion and agency (Granic et al., 2020), and those needs are expressed in youth's behaviours. Understanding the needs and goals of young people will help put their smartphone use into the context of their everyday lives and personal characteristics, which can help pinpoint the digital experiences that will contribute to both healthy normative development as well as the emergence of serious mental health concerns. Whether emerging adults' needs are supported or suppressed in the digital world depends on the individual adolescent and how they approach and experience those digital contexts (Beyens et al., 2020), as well as on the design of those contexts (Granic et al., 2020). Contexts which can directly affect smartphone behaviours, for instance by stimulating passive consumption or not.

Additionally, youth's smartphone behaviours in turn likely affect the kinds of experiences that are fed back to them. People's own engagement with social ties, for instance, predicts perceived reciprocal engagement (Lemay et al., 2007), and people who are more engaged in others' welfare experience higher relationship

satisfaction and wellbeing (Le et al., 2013). In terms of implications from our own study, future research will need to investigate whether altering self-compassion and rejection sensitivity changes how young people engage with their smartphones. Based on the current results, the correlations between social media use and individual dispositions like rejection sensitivity and self-compassion are not sufficiently clear to draw strong conclusions. Future confirmatory studies will therefore need to establish whether these individual characteristics do indeed play a role in social media use, and whether fostering self-compassion and decreasing rejection sensitivity holds some promise for preventing any potential negative mental health effects of smartphone use. Luckily, the culture on social media seems to have taken a turn for the better in recent years, with influencers on different platforms advocating for more self-love and -compassion (Menato, 2017). When these digital tools are used in ways that do indeed meet emerging adults' identity needs, it is more likely that smartphone use will become a tool for good (such as connecting people and stimulating self-development), rather than something to be wary of.

While our data provide valuable insights into the digital experiences and behaviours of emerging adults, there are some limitations to our design, and a number of important advances remain to be made. First, we were only able to monitor our sample of emerging adults for a very brief period of time, limiting our understanding of how such behaviours may change and manifest throughout young adults' daily lives. We would argue, however, that similar 'in-between moments' are very much present in our daily lives (e.g., waiting for the bus, passing time between classes), and that, as such, the monitoring period in our study gives a realistic window into what it is that emerging adults do in such situations. Regardless, much remains to be gained in our understanding of the ways in which individual past experiences, expectations, and values tap into and are affected by smartphone use and experiences. Continuing to work towards such an understanding will thus require taking into account more than just present smartphone behaviour. We are hopeful that methods that are similarly detailed to the one presented here will soon be integrated with longitudinal study designs. Particularly promising would be studies that integrate application programming interfaces (API) (Lomborg and Bechmann, 2014) with experience sampling methods (ESM) (Csikszentmihalyi and Larson, 2014) and follow young people in an observational study that spans months or years, with passive mobile phone data collection. In combination with conversations with young adults (preferably aided by objective data, as in this study), this kind of research agenda will provide substantially more insightful information regarding the interplay between smartphone use and emerging adults' wellbeing.

Second, the sample in our work suffers from the same flaw as many other social sciences studies (Lakes, 2013): our sample was homogeneous in that it consisted of primarily higher-educated Western young women. Thus, it is important to note that all interpretations of the findings are restricted to youth who share similar demographics. Future research should include a much more diverse sample, with diverse socio-economic and cultural backgrounds. It has become increasingly clear that there is a very real "digital divide" (UNCTAD, 2020), separating well-off young adult populations from those in less prosperous parts of the world. Additionally, different platforms and apps may cater to different needs, such as self-expression (e.g., Snapchat), finding like-minded people (e.g., Facebook groups), engaging in discussions (e.g., Twitter), or self-promotion (e.g., Instagram). These needs will likely depend on the cultural and socio-economic situation youth find themselves growing up in, which inevitably develop into psychological individual characteristics (Dwairy,

2010; Murphy-Berman and Berman, 2003; National Institute of Mental Health, 2001). Tracking the contexts in which certain platforms are used will also likely provide valuable insights into the interplay between these individual characteristics and effects of smartphone use.

Contrary to a lot of media hype and scholarly handwringing, our data suggests a complex, dynamic, and variable picture when it comes to the use and impacts of smartphone and social media use. Our results revealed that, while there are superficial similarities between youth regarding smartphone use (i.e., almost all turn to their smartphone instantaneously when they have some free time), there was far more variability in patterns of use than has previously been found with self-report studies. Prior to the current study, past methods have largely relied on retrospective, global approximations of social media and smartphone use, and they have failed to identify the fine-grained details of emerging adults' real-time digital activity. Consistent with growing interest in personalized approaches (Beyens et al., 2020), our work highlights the need for more detailed and personal approaches to smartphone use and wellbeing research, and has provided a small yet important window into emerging adults' digital lives.

### Data availability

The datasets generated and/or analysed during the current study are at present not publicly available due to other ongoing manuscripts, but are available from the corresponding author on reasonable request. Data will be made available on a data repository as soon as current ongoing work involving the dataset has finished.

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## Competing interests

The authors declare no competing interests.

## Additional information

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**Correspondence** and requests for materials should be addressed to N.G.

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