Unraveling the Role of Social Media on Adolescents' Daily Goals and Affect:

The Interplay between Basic Psychological Needs and Screen Time

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Abstract

As today's adolescents are growing up in a digitized society, concerns have been raised about the impact of adolescents' social media use (SMU) on their day-to-day functioning. Grounded in Self Determination Theory (SDT), the aim of the present study was to examine how both screen time and basic psychological needs on social media relate to adolescents' daily goals and affective states. To this end, a 7-day diary study was conducted and screen time (i.e., duration and frequency) was monitored objectively through an application on adolescents' smartphones. In two daily surveys, participants reported on their basic psychological needs (i.e., satisfaction and frustration of the need for autonomy, competence, and relatedness) when spending time on social media, their experienced goal interference (i.e., guilt, goal conflict, rumination) and affective states (i.e., positive, and negative affect). Examining the data of 107 adolescents (*M* age= 15.28 years, *SD* = 1.66, range = 12–19; 53.3% female), multilevel path analyses revealed that, at the daily level, frustration of the basic psychological needs on social media was associated with temporary increases in guilt, goal conflict and negative affect. On contrary, when adolescents felt satisfied in their needs during their time on social media, they reported better affective states. The duration of screen time also yielded an interfering effect (i.e., main effect), but this effect was attenuated when adolescents experienced high need satisfaction during their time on social media (i.e., interaction effect). Some lingering effects were found, with need satisfaction on SMU in the afternoon predicting lower guilt and goal conflict and need frustration on SMU relating to elevated rumination in the evening. These findings highlight the complex interplay between basic psychological needs on SMU and screen time for adolescents' daily goal striving and affective well-being.

Keywords: Psychology; human computer interaction; HCI theory, concepts, and models; empirical studies in HCI; user studies; law, social and behavioral sciences

Research highlights:

- Moments when adolescents experience need frustration within their SMU are associated with more momentary guilt, goal conflict and worse affective states, while need-satisfying experiences coincide with better affective states.
- More screen time duration on social media is also associated with more guilt, goal conflict and more negative affect, but these effects are mitigated if adolescents experience need satisfaction during social media.
- Some of the afternoon effects lasted until the evening, with need satisfaction during SMU in the afternoon relating to less guilt and goal conflict in the evening and need frustration during SMU in the afternoon relating to more rumination about social media in the evening.
- Overall, the results point towards the need to adopt a nuanced perspective vis-à-vis adolescents' SMU, with both quantitative (i.e., time spent) and qualitative (i.e., need-based experiences) features as well as their interplay in conjunction accounting for adolescents' goal interference and affect.

Due to the portability and connectivity of ICT-devices (e.g., smartphones, tablets) people can continuously stay connected, with people's daily screen time typically exceeding 3 hours per day (Digimeter, 2023). Given that people spend so much time online, increasing concerns have been voiced about the interference of technology with individuals' daily functioning (e.g., McDaniel & Coyne, 2016). The widespread development and use of social media-apps (e.g., Instagram, TikTok and Snapchat) is thought to have further intensified this problem (Montag et al., 2019). Unique features of social media-apps, such as immediate connectivity, popping-up notifications, and the lack of a clearly defined endpoint (no 'stopping cues', Alter, 2017), contribute to prolonged social media use (SMU). Compared to other age groups, especially adolescents are among the most active users of social media (e.g., up to 45% report being online almost constantly; Anderson & Jiang, 2018) and were found to have more difficulties in disengaging from social media (Digimeter, 2023). For these reasons, the interference of SMU with adolescents' daily functioning deserves attention in research.

SMU might interfere with adolescents' daily thoughts and behaviors by eliciting feelings of guilt when spending time on social media (e.g., Reinecke et al., 2014) or by resulting in goal conflict, if the SMU stands in the way of achieving other important goals, such as doing schoolwork or chores (e.g., Halfmann et al., 2023). Even during offline activities, SMU may have a lingering effect, for instance, if adolescents continue dwelling on their previous online interactions and the consequences thereof (i.e., social media rumination; Hynes et al., 2020; Parris et al., 2020). Moreover, the endless stream of information, exposure to extreme content and unrealistic expectations inherent to social media can leave adolescents overwhelmed, disconnected, or even upset when putting their phone down (e.g., Popat et al., 2023), thereby altering their affective states. Importantly, how SMU interferes with adolescents' daily goals and affective states likely not only depends on how much time is spent, but also adolescents' subjective experiences, which are triggered by the stream of content or types of interactions.

Specifically, adolescents' psychological need-based experiences, as conceived in Self-Determination Theory (SDT, Ryan & Deci, 2017; Ryan, 2023), are likely to play a key role herein. According to SDT, digital environments, including social media, have both a growth-enhancing potential but can also come with pitfalls, depending on the extent to which social media satisfy or frustrate adolescents' basic psychological needs for autonomy, competence, and relatedness (Rigby, 2023; Vansteenkiste et al., 2023). Specifically, when media use is conducive to the satisfaction of basic needs, positive outcomes such as greater enjoyment and well-being are expected, whereas need frustration during media use is expected to relate to adverse outcomes, such as interference with other life domains and a propensity for addictive or compulsive behaviors (Adachi et al., 2023).

Therefore, the present study aimed to add to the emerging body of work on SMU from SDT-research by examining the role of both objectively logged quantitative aspects of SMU (e.g., duration and frequency) as well as the phenomenological experiences of need-satisfying and -frustrating when spendings time on social media in the prediction of goal interference (i.e., guilt, goal-conflict and rumination) and affective well-being (i.e., positive and negative affect). To this end, adolescents' social media quantity was objectively registered for 7 consecutive days together with two daily surveys measuring basic needs.

Quantity of SMU: Screen Time Frequency and Duration

Over the past years, a rapid increase in studies on the relationship between adolescents' SMU and general mental health could be witnessed. The majority of these studies conceptualized SMU as the frequency (i.e., how much someone opens an app) or the duration (i.e., how much time someone spends on certain apps or social media in general) of screen time on social media apps. These measures both represent 'quantitative' aspects of SMU. Recently, review studies have argued that the association between the quantity of SMU and well-being is not clear-cut (see Valkenburg et al., 2022 for a review). Therefore, to draw a more complete and dynamic viewpoint of adolescents' SMU, scholars have begun to study these dynamics at

the within-person level. However, this approach also yield mixed results. For example, while Orben et al. (2019) found a (small) reciprocal association between time spent on social media and life satisfaction, Beyens et al. (2020) found overall SMU duration to be unrelated to adolescents' momentary affect.

Several factors may explain this mixed evidence. A first reason why the association between quantitative features of SMU and well-being is ambiguous may be due to the flaws of self-reports. When it comes to digital media in general, and social media in particular, most researchers have relied on self-reported measures, tapping into estimated time spent online (Subrahmanyam & Michiyan, 2022). Apart from differing in operationalization across studies (e.g., time frame, specificity), such self-reported estimates suffer from substantial measurement error (Johannes et al., 2021; Parry et al., 2021). In general, people have difficulties to estimate exactly how much time they spend on social media apps due to smartphones and fast internet being always available (see Subrahmanyam & Michiyan, 2022). Moreover, social media are often used in a fragmented manner throughout the day (e.g., Anrijs et al., 2018) and can be used in a habitual or even automatic manner, without explicit awareness (e.g., Meier et al., 2023). These retrospective biases are known to cause over- or underestimations of actual time spent online (Parry et al., 2021). Instead of relying on self-reports, another method involves employing smartphone logging, which are sometimes referred to as ‘objective’ measures. This technique utilizes an installed application to monitor quantitative aspects of social media use, such as screen time duration and frequency. Although self-reports and logged screen time appear moderately correlated, there is a general agreement that smartphone logging is more accurate (Parry et al., 2021), which explains why they have been strongly advocated (e.g., Valkenburg et al., 2022). Until now, only a handful of studies adopted smartphone logging for SMU (see Johannes et al., 2021). To illustrate, one study comparing objectively logged with self-reported measures of SMU in the prediction of well-being concluded that neither the type

of measurement nor the accuracy between both matters related meaningfully to well-being (Johannes et al., 2021).

Hence, a second reason for the conflicting findings might be screen time measures of social media – either objectively monitored or self-reported – exert a lesser influence when predicting overall well-being outcomes. Instead, their significance could be more pronounced for domain-specific outcomes, that is outcomes that more closely align with the domain of social media (e.g., Van der Wal et al., 2023). For example, spending excessive time on social media may elicit feelings of guilt, especially if it interferes with daily responsibilities and tasks or if adolescents feel that they used their time inefficiently, thereby creating goal conflict (Halfmann et al., 2023). Moreover, frequent SMU might induce rumination about social media-related activities, even during face-to-face activities (Hynes et al., 2020; Parris et al., 2020). Such daily instances where social media interferes with adolescents' goals and behavior are very prevalent and are important to further explore given their disruption of recovery experiences and media enjoyment (for an overview, see Reinecke & Meier 2020), but are often only indirectly examined in relation to quantitative aspects of SMU.

To address these issues, the present study will examine how social media both relates to affective well-being and goal interference in adolescents' day-to-day lives, thereby drawing an accurate picture of how much and how frequently adolescents use social media and how this fluctuates at the within-person level. The present study follows the former recommendation and makes use of a logging application (i.e., MobileDNA; Anrijs et al., 2018), to capture quantitative aspects of SMU objectively.

The Role of Basic Psychological Need Experiences

Although adopting log-based measures and a diverse set of outcomes is one step forward, quantitative aspects of SMU, such as the duration and frequency of screen time, fail

to cover the complexity of adolescents' experiences on social media (Van der Wal et al., 2023).Unique characteristics of social media, such as the highly diverse, individualized, yet social nature of the apps help to explain why subjective experiences on social media differ between persons and from moment-to-moment within the same person (Orben et al., 2020). For example, spending an hour on social media might involve regulating emotions by looking at calming or funny content or engaging in supportive conversations, leaving the adolescent feeling refreshed and motivated. Conversely, spending the same hour online might consist of endlessly scrolling through envy-inducing posts, comparing oneself negatively, which might leave an adolescent ending up feeling isolated and grumpy afterward. Additionally, similar content (e.g., profiles of attractive people) or types of use (e.g., active, or passive SMU) are received and interpreted differently by individuals, thus evoking heterogeneous responses (e.g., improved versus impoverished mood) (Valkenburg et al., 2022). Therefore, scholars have argued that adolescents' subjective experiences within social media are likely to determine its effect on their daily functioning more than the amount and frequency of SMU (e.g., Kaye et al., 2020; Meier & Reinecke, 2020; Odgers et al., 2020). When conceptualizing subjective experiences during SMU in research, it is important to capture experiences that are prevalent across the diverse and evolving landscape of social media (e.g., new apps, features) and that take into account the duality of positive and negative experiences reported by adolescents (e.g., Van der Wal et al., 2023). One theory that meets these criteria is Self-Determination Theory (SDT (Ryan & Deci, 2017; Vansteenkiste et al., 2023), a broad theory on human motivation and development which explains the effects of one's environment on their psychological functioning by looking at basic psychological need experiences.

According to SDT, people have three inherent and universal psychological needs, namely the need for autonomy (i.e., experiencing a sense of choice and freedom in thinking, acting, and feeling), competence (i.e., experiencing mastery) and relatedness (i.e., experiencing

a sense of belonging). The fulfillment or satisfaction of these needs is known to contribute to individuals' well-being and for the adoption of a healthy lifestyle (Vansteenkiste et al., 2020). Throughout adolescence, fulfilling the three fundamental psychological needs has been associated with effectively addressing various age-related challenges, such as school adjustment (Ratelle & Duchesne, 2014), self-worth (Erdvik et al., 2019), and sleep quality (Campbell et al., 2020). Conversely, the frustration of these same needs, which manifests via feelings of pressure (i.e., autonomy frustration), inadequacy (i.e., competence frustration) and loneliness (i.e., relatedness frustration), increases the risks for poor self-regulation and compensatory behaviors (Vansteenkiste & Ryan, 2013). In adolescents, need frustration was found to be a transdiagnostic vulnerability process explaining both the risks for eating disorders and depressive symptoms (Campbell et al., 2018).

According to SDT, basic psychological needs are not fixed or stable characteristics but rather dynamic and subject to variations within individuals. Research conducted with adolescents indicates that the daily fluctuations in their emotional states, which are characteristic during adolescence, can, in part, be attributed to variations in their need-based experiences (Vandenkerckhove et al., 2021; Laporte et al., 2021). Moreover, day-to-day changes in need fulfillment have been found to co-vary with variations in adolescents' well-being and authenticity (Thomaes et al., 2017). Also, certain studies have shown that binge eating symptoms and poor sleep tend to peak on days when adolescents experience more need frustration (Campbell et al., 2021; Verstuyf et al., 2013). Together, these studies highlight the dynamic nature of basic psychological needs, sparking the interest to better understand which situational factors, circumstances, and social interactions evoke varying need-experiences. Given the attractiveness of social media-apps during adolescence and the continuous availability, we expect social media to be a critical source of need satisfaction and frustration during adolescence.

Subjective Experiences on Social Media: Need-satisfying versus -Frustrating SMU

Over the past few years, an increasing number of studies have examined the role of need-based experiences in digital environments (for an overview see Rigby, 2023; Adachi & Rigby, 2023), including gaming (e.g., Przybylski et al., 2010) and internet usage (e.g., Liu et al., 2022; Shen et al., 2013; Wang et al., 2015). Similarly, need-based experiences can be examined with regard to SMU, with autonomy in the context of SMU referring to the experience of psychological freedom and authenticity in one's online interactions and being able to freely navigate to the profiles and content one is interested in. Competence on social media-apps includes feeling mastery in online skills, sharing accomplishments with social media contacts, receiving feedback, or gathering knowledge via social media profiles and content. Relatedness on social media includes experiencing your online interactions as positive and reciprocal or to feel part of a community or group on social media-apps (for an overview see Van de Casteele et al., 2023).

Until now, a handful of studies looked at need-based experiences when spending time on social media-apps. For example, in adults, the satisfaction of competence and autonomy during SMU was found to be significantly and positively related to enjoyment of Facebook use (Reinecke et al., 2014) and greater self-control (Johnson et al., 2021). In student populations, Sheldon et al. (2011) found that relatedness on Facebook is distinct from offline social relatedness, but that there are mental health benefits associated with feeling connected to others on Facebook. Together, these studies show that need satisfaction during SMU yields benefits for individuals' daily functioning. However, the literature is still limited, especially with regard to younger age groups. One cross-sectional study in adolescents showed that psychological need satisfaction in online friendships was positively related to life satisfaction, with the highest levels of need satisfaction being reported for those who more strongly endorsed positive attitudes towards those online friendships (Ang et al., 2015). Similarly, at the between person

level, adolescents who connected more through text messages were found to report lower average depression scores (Jensen et al., 2019). Another cross-sectional study shed light on the joint and supplementary effects of need-experiences in the domain of social media and in other 'offline' domains, hereby showing that the effects on mental health are strongest when both domains show high need satisfaction and low need frustration, but that offline need-experiences were more decisive for mental health (Van de Casteele et al., 2023). Given that, among adolescents, need-satisfying or frustrating experiences on social media are expected to foster or impede key developmental tasks (for an overview see Parent, 2023) and given the highly dynamic nature of both need-experiences (e.g., Van der Kaap-Deeder et al., 2015) and SMU (Orben et al., 2020), further exploration is needed, especially at the within-person level.

The Present Study

Although it is often thought that spending more time on social media is detrimental to adolescents' daily functioning, these effects are likely to differ between adolescents and even from moment-to-moment depending on adolescents' subjective experiences during their time on social media-apps. Grounded in SDT, a growing body of research indicates that the satisfaction and frustration of adolescents' basic psychological needs of autonomy, competence, and relatedness, are key experiences that may explain the varying effects of SMU. Yet, many issues remain unresolved. First, the literature is still very fragmented, and the unique contribution of need-frustrating experiences during SMU is underexplored, which may be particularly crucial for explaining daily goal interference. Second, until now, within-person effects are largely overlooked, while both need-based experiences as well as SMU are known to significantly fluctuate among adolescents. Third, the relative contribution of need-based experiences during SMU has not been considered in light of the quantitative aspects of adolescents' SMU.

Therefore, the overall aim of this study is to examine how both log-based measures (i.e., duration and frequency) and need-satisfying and -frustrating SMU predicts adolescents' daily functioning. To provide a nuanced insight in the correlates of need-based experiences and time spent on social media a diverse set of outcomes will be studied, namely goal interference (i.e., guilt for not partaking in other activities than SMU, experienced conflict with other goals, rumination about social media-related concerns during offline activities) and general affective states (i.e., positive, and negative affect). A 7-day diary study was conducted, involving one afternoon and one evening assessment. Throughout those 7 days, adolescents' smartphone use was monitored using the MobileDNA app to extract objective parameters of SMU duration and frequency. The following three hypotheses and two more explorative research questions were formulated.

First, we expect objectively measured quantity of SMU (i.e., duration and frequency) to be positively associated with daily goal interference (i.e., guilt, goal conflict and rumination), but taken into account existing evidence (e.g., Valkenburg et al., 2022), to a lesser extent with affective well-being (i.e., positive, and negative affect).

Second, adolescents' basic psychological need-experiences on social media are expected to have an additional effect on daily goal interference and affective well-being. Congruent with the distinction between need-satisfying and need-frustrating experiences, we examined their unique role. In light of the established relationship between general need-frustrating experiences (i.e., not on social media) and rumination (e.g., Van der Kaap-Deeder, 2016) as well as self-conscious negative emotions like guilt (e.g., Thøgersen-Ntoumani et al., 2018), we similarly expect that need-frustrating experiences during SMU will show the strongest associations with feelings of guilt and rumination about SMU. Further, the experience of goal conflict might be dependent upon both the frustration and satisfaction of basic needs during SMU. Need-frustrating experiences are expected to increase goal conflict, as it could

indicate that they are not achieving their desired outcomes from SMU (e.g., entertainment, connectedness). When adolescents' basic psychological needs are satisfied, they are expected to feel more energized to pursue their goals and exert more self-control (e.g., Johnson et al., 2021; Ryan & Deci, 2008), allowing adolescents to use social media responsibly and at suitable times without compromising other goals, thus limiting goal conflict. With regard to affective well-being, previous research showed that general need satisfaction relates positively to well-being outcomes (e.g., vitality, life satisfaction), while need frustration shows the strongest relationship to ill-being outcomes (e.g., depression, anxiety) (e.g., Vansteenkiste et al., 2020). Similarly, we hypothesize that need-satisfying experiences on social media will relate primarily and positively with positive affect, while need-frustrating experiences during SMU will relate primarily and positively with negative affect.

Third, this study examined whether the effects of time spent on social media depend on the degree of need satisfaction and frustration while using it. To measure this, interactions between duration and subjective experiences of need satisfaction and frustration were explored. We expect that the hypothesized negative spill-over effect from time spent on social media onto feelings of guilt, goal conflict, and rumination would be attenuated if SMU was experienced as need-satisfying. Reverse effects were expected when time on social media was strongly marked by need-frustrating experiences.

Fourth, we aimed to investigate exploratively whether the effects of the qualitative (i.e., need-based experiences) and quantitative SMU (i.e., duration and frequency) predictors in the afternoon had a lingering impact in the evening. For example, if adolescents had need-frustrating experiences in the afternoon, will they feel more guilty about this in the evening. We expect that most effects of SMU will be short-lived, however, rumination about SMU during offline activities might be more prone to such lingering effects.

Lastly, although the main focus of this study is at the day level, we were also interested in how these connections would unfold at the between-person level, were we expected to observe similar associations (i.e., adolescents who generally use more social media and experience more need frustration during SMU were expected to show worse daily functioning compared to those who, on average, use less and experience more need satisfaction on social media).

Methods

Participants and procedure

The data presented in this paper are part of a study involving a cross-sectional (see Van de Casteele et al., 2023) and daily diary study with three measurement occasions (morning, afternoon, evening). Specifically, the current study concentrates on exploring the within-day dynamics of need-based experiences during SMU, assessed twice, namely in the afternoon (4 P.M.) and evening (8 P.M.). These time points were selected to align with the predominant periods of adolescents' SMU, post-school hours, and evening times, and allowing ample time for the occurrence of need-based experiences. The decision to limit measurement to these specific time slots was made to reduce participant burden (Myin-Germeys & Kuppens, 2022).

The sample was collected in October-November 2022 as part of a course of developmental psychology in which the first author was a teaching assistant. As part of an assignment, the students enrolled for this course were trained and instructed to recruit one participant (excluding relatives, acquaintances). In total, 107 Dutch-speaking Belgian adolescents (*M* age= 15.28 years, *SD* = 1.66, range = 12–19; 53.3% female) participated in this 7-days diary study. Of all participants, 75.7% followed an academic track, 24.3% a technical track or vocational track. Although initially 179 adolescents enrolled, participants with low response rates (replied to <50% of the daily surveys, n = 6) and participants who repeatedly scored false on control items (>50% of control items, n = 6) were removed from the dataset. In

addition, 3 adolescents lost or replaced their smartphone during the study, impeding interpretations of the MobileDNA data. Additionally, some malfunctions occurred with regard to the smartphone logging with MobileDNA (i.e., no logging due to an error) and we were unable to link some of the logging data to the diary data (i.e., participants entered a wrong identification number), which unfortunately resulted in the loss of the data of 56 participants.

The data was collected in October-November 2022 as part of a course of developmental psychology at [blinded] where undergraduate students were trained and instructed to recruit one participant (excluding relatives, acquaintances). During a home visit, students assisted the installation of MobileDNA on the smartphones of the participants and explained how to fill out the daily surveys on a computer or smartphone. The participants were instructed to fill out the diary questionnaires every afternoon after coming home from school (4 P.M.) and every evening (8 P.M.) during seven consecutive days of a regular school week, starting from Monday. Each day, items were administered in the same order. Emails and Text messages were used as reminders to fill out the questionnaires. Participation was anonymous and voluntary. All participants gave their written consent, as well as one of their parents for participants under 16 years. Approval to conduct this study was obtained from the faculty's Ethical Committee (2021/203).

Measures

Log-Based Measures: MobileDNA

In order to collect objective data on participants' quantitative SMU, the logging application named MobileDNA was used. MobileDNA is a publicly available Android-only smartphone logging app, built by Ghent University. Once the MobileDNA-app is installed it logs detailed information about one's smartphone use. It logs which apps participants used, how much time is spent on each app and how often one checks his/her phone. It also logs the number

of notifications received from each app. On the one hand, MobileDNA is being used as a way to raise awareness of one's personal smartphone use (see for example Digimeter, 2023), allowing users to login on the app (on https://mobiledna.be/) and check their personal data throughout the day via the dashboard function. On the other hand, MobileDNA can be used as a research tool outputting raw data (see for example Anrijs et al., 2018). In this study, the former option was switched-off in order to measure adolescents' smartphone use as it naturally occurs. To extract quantitative aspects of social media-apps specifically, some steps were taken to process the large amount of raw data.

First, in the baseline questionnaire participants were asked to indicate which of the 13-listed social media-apps they regularly use on their smartphones (e.g., BeReal, Facebook, Instagram, WhatsApps, etc.). Participants were also given the option to add other social media-apps to the list if wanted. These answers were then used to determine which apps in the raw data would be categorized as social media-apps. Second, a daily composite score, combining the information of all aforementioned social-media apps, was created for screen time (i.e., how much time spent on the social media-apps) and social media frequency (i.e., how many times participants opened the apps). Third, the MobileDNA data were linked to daily surveys, by dividing the daily 'screen time-score' and 'frequency-score' according to timing of the three daily surveys, namely night-to-morning, morning-to-afternoon, afternoon-to-evening. Since participants had an hour and a half each time to complete the survey, linkage was done based on the individual moment at which participants completed the diary that day. If participants did not complete one of the diaries, the average completion time was used. Note that, in this study, we only use the afternoon and evening measure of the daily surveys, therefore we also only looked at the morning-to-afternoon and afternoon-to-evening data points in the MobileDNA data.

SMU Need-Experiences

To measure the basic psychological needs in SMU domain, a domain-specific version of the daily Basic Psychological Need Satisfaction and Frustration scale (BPNSFS) was used. The original 24-item version of the BPNSFS was formally validated in four culturally diverse samples (Chen, Vansteenkiste et al., 2015) and several domain-specific measures of the scale have been tested and validated over the past years (see Van der Kaap-Deeder et al., 2020), including in the context of social media (12-items; Van de Casteele et al., 2023). In the latter version, the items of the original BPNSFS were slightly adapted to fit the context of social media (e.g., “When I used social media, I had a warm feeling with the people I was in contact with”, “I felt the pressure to do things I didn't feel like doing”). In two samples, evidence revealed the presence of two factors: need satisfaction and need frustration within SMU, with Cronbach’s Alpha ranging between .73 and .86. In this current diary study, a total of 6 items were withheld from the scale of Van de Casteele and colleagues (2023), comprising 3 need satisfaction and 3 need frustration items – 1 for each need. These items were then reformulated specifically for momentary application. Participants were asked to fill in the items with respect to the past part of the day (i.e., in the afternoon survey "since this morning", in the evening survey "since this afternoon"). Note that the items were only presented if participants had indicated they had used social media over that past time frame. Items were answered on a 5-point Likert scale varying from 1 “not at all applicable” to 5 “completely applicable”. Cronbach’s alpha for SMU satisfaction and frustration was < on the within-day level and .84/.85 on the between-person level.

Goal Conflicts

Goal conflicts were measured with 2 items (“When I used social media, I found it difficult to stop”, “When I used social media, I was supposed to do something else") based on the 5-item version of Erdmann & Dienlin (2022). The two items were selected based on the highest face validity of the construct. Items were slightly adapted to make them amenable for a

daily format and were formatted to measure goal conflict experienced in the previous moment (i.e., "since this morning", "since this afternoon"). Both items were answered on a 5-point Likert scale varying from 1 “not at all applicable” to 5 “completely applicable”. The scale showed good reliability at the within-day (α = .72) and between-person (α = .89) level.

Feelings of Guilt

Feelings of guilt were measured using 1-item (“When I used social media, I felt guilty because I was on social media”) which was selected from the 5-item version reported in Erdmann & Dienlin (2022). Again, the item with the best face validity was selected and slightly adapted for the use of a daily measure. Participants indicated their feelings of guilt on a 5-point Likert scale and with regard to the previous part of the day (i.e., "since this morning", "since this afternoon").

Social Media Rumination

To measure rumination about SMU during offline activities, we used a shortened and adapted version of the rumination-scale (Luyckx et al., 2008; Van der Kaap-Deeder et al., 2016). Specifically, two items were selected and customized to fit the social media context (“When I was offline, it was hard for me to stop thinking about my social media”, “When I was offline, I tended to keep ruminating about my social media”). The two items were measured on a 5-point Likert scale. Participants were asked to report on their social media rumination with respect to the past part of the day (i.e., "since this morning", "since this afternoon"). Chronbach’s alpha at the within-day level was .63 and at the between-person level .94.

Affective states

To measure different affective states, we used a 6-item version of an emotion scale (see for example Keijsers et al., 2015). Two positively-valenced affects were used (“On this moment, I feel cheerful”, “On this moment, I feel content”), and four negative-valence affects

(e.g., “On this moment, I feel unhappy”, “On this moment, I feel sad”). Cronbach’s alpha for SMU positive and negative affect was .74/.65 on the within-day level and .92/.81 on the between-person level.

Plan of analysis

To investigate the main hypotheses, multilevel path analyses were performed in MPlus version 8.9. First, given the hierarchical structure of the data, with 14 measurement times (i.e., Level 1), being nested in 7 days (i.e., Level 2), within 107 individuals (i.e., Level 3), we first calculated intraclass correlations (ICC) at each level by building random intercept-only models. In this way, the decomposition of the variance could be examined at the three levels, indicating if multilevel modeling was appropriate. These models disaggregate the total variation in the data into between-person level variation (variance due to differences between individuals), between-day level variation (variance due to differences across day) and within-day variation (variance situated at the level of the measurements). Subsequently, for each outcome variable, a three-level path model was constructed to test the first two hypotheses, namely the concurrent associations between quantitative (i.e., duration, frequency) SMU and the need-based experiences during SMU in predicting guilt, goal conflict, rumination, and affective states. Third, in line with the third hypothesis, interactions were added to the three-level path models, to explore interaction effects between time spent on social media and the subjective need-based experiences during SMU. Lastly, to explore the lagged associations between the SMU predictors and the outcomes, multi-level path models were created with goal interference and affect in the evening being regressed on the afternoon measures of quantity and need-based experiences of SMU in the evening, controlling for their autocorrelations. In this last step, given that all regressions were within the same day (and not across days), each model included a within-day and between-person level, but no between day-level (i.e., two-level models). All multilevel path models controlled for participants’ age, gender, and education level.

Results

Descriptive statistics and preliminary Analyses

The total variation in each variable was decomposed into variation at the between-person (i.e., Level 3), between-day (i.e., Level 2) and within-day (i.e., Level 1) by testing nine random intercept-only models. As depicted in Table 1, around 40-50% of the variance is situated at the within-day level for most of the measures, except for SMU duration where the within-day variance was notably higher (83%). Importantly, all variables displayed significant variability at the within-day level, justifying our multilevel approach. However, only a small portion of the variance (0% to 15%) is situated at the between-day level (i.e., Level 2). Still, a comparison of two-level models with three-level models (see supplementary material) showed that three-level models best fitted the data (except for SMU duration). Therefore, in all further analyses, the three-level structure was taken into account but associations at the second level were not displayed.

The means, standard deviations and correlations of all study variables are shown in Table 1. Descriptive results from the MobileDNA data showed that the majority of participants used the following five apps: WhatsApp (96%), Instagram (94%), Snapchat (92%), YouTube (89%), and TikTok (81%). Figure 2 shows a heatmap of the average social media use throughout the day and across the week. Distinct patterns can be noted for school days versus weekend days. Note that on Wednesday, school in [blinded] ends at noon. On school days, the average adolescent in this study wakes up and checks their social media, rarely uses it during school hours except during lunch break, and maximally use it on school nights. On a day on the weekend, they start using social media later in the morning and more continuously throughout the day.

Primary Analysis

Concurrent Models

Within-Person Effects. Concurrent associations between the SMU predictors and outcomes are shown in Table 2. At the within-day level, adolescents were found to feel more guilty and experience more goal conflict at moments where they used more social media (i.e., duration) and experienced SMU frustration. No effects were found for rumination about social media during offline activities. Momentary need-based experiences were associated with fluctuations in positive affect, so that more positive affect was experienced when SMU satisfaction was high and SMU frustration was low. As for negative affect, an opposite pattern was found for need-based experiences, and small positive effects were found for SMU duration and frequency, whereby more SMU duration and more frequency were accompanied by more negative affect.

Interaction Effects. Interaction terms between SMU duration and satisfaction and SMU duration and frustration were added to the path models described in Table 2 at the within-day level and between-person level. As for the within-day effects, the interaction between SMU duration and satisfaction were negative and significant for guilt (-.11, $p<.01$), goal conflict (-.19, $p<.001$), rumination (-.07, $p<.05$) and negative affect (-.12, $p<.001$). As visualized in Figure 3-6, the interactions indicate when high duration on social media is mainly need-satisfying, the effects of SMU duration on guilt, goal conflict, rumination and negative affect are attenuated compared to the combination of high duration and low need satisfaction. Thus, a moment in the day during which adolescents made longer use of social media did not relate to concurrent negative outcomes if they experienced need satisfaction during their SMU. No significant interactions were found between duration and need frustration at the within-person level, neither were the interactions between duration and need satisfaction or frustration significant at the between-person level.

Lagged Models

Lagged associations between the SMU predictors and outcomes are presented in Table 3. All autocorrelations were significant, with large autocorrections for affective states and medium autocorrelations for other variables. Feelings of guilt and goal conflict in the evening were significantly associated with SMU satisfaction in the afternoon, so that more SMU satisfaction led to less guilt and goal conflict. Moreover, rumination about social media in the evening higher when more SMU frustration was experienced in the afternoon. No lagged associations between the quantitative SMU predictors and the outcomes were significant.

Between-Person Effects. At the between person-level (see Table 2), the results show that, on average, adolescents feel more guilty, experience more goal conflict and rumination when they score higher on SMU frustration. Additionally, SMU duration related significantly and positively with goal conflict, so that more goal conflict is experienced for adolescents who spend more time on social media. As for affective states, adolescents with more need satisfying experiences on social media were found to experience more positive affect and less negative affect, while more average need frustration on social media was related to more global negative affect.

Discussion

Adolescents' high time investment on social media-apps raises concerns about its potential impact on goal interference (i.e., guilt, goal conflict, rumination) and daily affect (i.e., positive, and negative affective states). However, the time spent online is likely not inherently problematic but instead relies on adolescents' subjective experiences during SMU (see e.g., Orben, 2020; Van der Wal et al., 2023). Grounded in SDT, this study employed a daily diary design including two measurements in a day, focusing on the subjective experiences of need satisfaction and need frustration when using social media. To overcome limitations of self-reported 'screen time', smartphone logging was utilized to estimate the duration and app-frequency of SMU. This approach allowed for an investigation of the relative contribution of

quantitative and experiential aspects of SMU in predicting adolescents' goal interference, reflected in guilt, goal conflict, and rumination, and affective states, an issue we addressed at the within-day and between-person level.

Time Spent on Social Media Matters, Yet Not Exclusively

Our first hypothesis pertained to the effects of objectively logged time measures of social media-apps. Findings indicated that during moments when adolescents spend more time on social media, they tended to simultaneously experience feelings of guilt and encounter goal conflicts. Furthermore, longer duration and higher frequency of app-events related to more negative affect, thus indicating that adolescents felt somewhat more drowned and upset during periods of intensive SMU. These findings align with qualitative studies that have reported similar experiences among adolescents (e.g., Popat et al., 2023) and with parents' observations of their children experiencing emotional stress due to SMU and being distracted from offline activities (e.g., Symons et al., 2017). Moreover, by examining quantitative aspects of SMU objectively, this study provides a nuanced perspective into the ongoing debate surrounding 'screen time' (see for example Kaye et al., 2020).

First, the findings show that the amount of objectively logged time on social media was more decisive than the frequency of app-events, as only a small positive association between frequency and negative affect was found. Second, the logged screen time and frequency in the present study were unrelated to positive affect and only showed small positive associations with fluctuations in negative affect. Similar results were found at the between-person level. This is in line with mixed evidence from research with self-reported (Valkenburg et al., 2022) and a handful of studies using objectively logged measures (Johannes et al., 2021), showing that the quantity of SMU (i.e., duration and frequency) is likely suboptimal to predict general well-being outcomes (Van der Wal et al., 2023), such as affective well-being. Nevertheless, in line

with our expectations, social media duration showed stronger within-day associations with guilt and goal conflict, while at the between-person level, it was primarily linked to goal conflict. This is unsurprising, given that goal conflict includes the idea of hindrance of one's goals or responsibilities by the time or emotional investment dedicated to social media activities (e.g., Halfmann et al., 2022). Thus, while excessive social media use may go hand in hand with adolescents' daily functioning, it was not found to fully account for the variations in goal interference and affect.

Beyond Screen Time: Need-Satisfying versus -Frustrating SMU

Therefore, grounded in SDT, our next hypotheses centered on the importance of adolescents' subjective experiences online, emphasizing the role of need satisfaction and -frustration of the basic psychological needs for autonomy, competence, and relatedness within social media. Regarding goal interference, not only the amount of time spent, but also moments marked by high need frustration during SMU were associated with feelings of guilt and goal conflict. Thus, when adolescents feel pressure, rejected or ineffective when using social media, they are more likely to instantly feel guilty about their SMU and aware that other tasks should have been prioritized. In line with our hypothesis that rumination about social media does not yet occur during or immediately after using social media, additional analyses revealed that need frustration exhibits lingering effects, leading adolescents to experience persistent thoughts about their prior social media interactions or activities later that day, even while engaged in other tasks. Further, need satisfaction did not yield immediate effects on goal interference but was found to protect adolescents' from feeling guilty and conflicted about their SMU in the evening.

Nevertheless, these latter effects could also be (partly) explained by other factors. For example, given the well-established relation between need satisfaction and healthy regulation

of behavior (Vansteenkiste et al., 2020), it could be that prior need-satisfying SMU creates less urges to use social media later that day. As such, the postponed effect of need satisfaction predicting less guilt and goal conflicts in the evening might be due to adolescents spending less time on social media. Yet, other scholars argue the opposite, namely that experiencing need satisfaction through online sources poses risks for addiction, as it might trigger a strong urge to spend even more time on social media (e.g., Hao et al., 2023; Liu et al., 2016). Overall, these findings show that need satisfaction during SMU appears to qualitatively differ in nature from need-frustrating SMU, potentially cultivating a more positive and balanced relationship with social media.

Particularly for affective states, need-based experiences demonstrated greater efficacy in predicting momentary shifts in adolescents' positive and negative affect compared to the time measures. In line with SDT's assumption that need satisfaction correlates stronger to well-being outcomes, while need frustration relates more to ill-being outcomes (Vansteenkiste et al., 2020), at the within-day level, need-satisfying SMU showed a positive and stronger association with positive affect and related negatively and to a lesser extent to negative affect, while an opposite pattern was found for need-frustrating SMU. Similar patterns were found at the between-person level. Thus, the finding that need-based experiences explain affective states over and above screen time on social media indicates the boundary conditions of when social media can leave adolescents feeling grumpy and irritable and when it also may temporarily boost contentment and joy.

The Interplay between SMU Quantity and Need-Based Experiences

Lastly, the present study was the first to examine whether the effects of time spent on social media depends on the degree of need satisfaction and frustration while using it. Interestingly, results of moderation analyses showed that need satisfaction during SMU

mitigated the negative effects of prolonged SMU duration on goal interference, rumination, and negative affect. Thus, when adolescents spent large amounts of time on social media, but they have strong need-satisfying experiences when doing so, the effects on goal interference and negative affect were attenuated. While these effects indicate the role of need-satisfying SMU as a buffering, potentially healthier type of SMU, it is important to consider certain nuances.

First, the temporal negative outcomes associated with excessive time on social media on guilt, goal conflict and negative affect were found to be attenuated, not reversed. To illustrate, the combination of both high duration and high need satisfaction did not yield magnified positive results, such as more positive affect. This seems to imply that there are limits when it comes to the benefits of need satisfaction within SMU.

In line with this, adolescents might overestimate the need-conducive potential of social media use. As such, they may anticipate a greater level of autonomy, competence, and relatedness satisfaction when using social media, but their forecasts may be misguided. In reality, they might unknowingly spend extended periods mindlessly scrolling, impeding their engagement in other crucial activities such as school, physical exercise, or sleep. Indeed, experiencing high need satisfaction within social media is likely to make its use more attractive and frequent, displacing time and opportunities for need satisfaction in everyday life (Ryan & Deci, 2017). Consistent with previous research findings, depending solely on social media for fulfilling one's needs may not be ideal for overall mental well-being (Van de Casteele et al., 2023).

Further, previous cross-sectional studies indicate that especially the common ground in need satisfaction experienced in virtual environments and everyday life explains mental health outcomes (Bradt et al., 2023; Van de Casteele et al., 2023). Therefore, in this study, it is likely that those adolescents experiencing high levels of need satisfaction within SMU also experience higher need satisfaction in everyday life, which together generates better affective states. Since

this study did not look at offline need experiences, the domain-specific and domain-transcending (i.e., general) role of need-based experiences cannot be separated.

Practical Implications

The emphasis on 'screen time' on social media-apps is not only a pitfall of scientific research but also parents, teachers and clinical practitioners often focus on setting time limits or encouraging digital 'detoxes'. Although helpful in some cases, such an approach only tells part of the picture, as it overlooks the many affordances and benefits of SMU (e.g., social support, peer connection, self-help tool), and fails to properly take the voice of adolescents into account (e.g., availability norms; Halfmann et al., 2023). Furthermore, advocating complete avoidance of social media is unrealistic, considering that social media is likely to remain an integral part of adolescents' lives and will likely continue to expand in the future. Based on the findings of the present study alternative approaches could be developed, highlighting both risks and opportunities of social media by looking at the phenomenological experiences of need satisfaction and need frustration.

Adolescents could be trained to become more mindful when using social media by exerting a deeper processing of their experiences on social media. Rigby & Ryan (2017) explain such mindful processing as "being aware of how one's feelings are being activated by media content and thus more open to reflecting on and integrating the potential relevance of those to one's real life" (p 46). For example, when scrolling through their social media feed and coming across posts about environmental conservation efforts, adolescents could be trained to reflect on the relevance for their own life, for example by considering how contributing to environmental initiatives in their community is in line with their personal values (i.e., autonomy), give them a purpose (i.e., competence) and might foster feelings of connectedness (i.e., relatedness).

On the other hand, adolescents could be trained on how to craft their own need satisfaction during their time on social media (i.e., need-crafting; Laporte et al., 2021). Such a training would include becoming aware of the people and activities on social media that fulfill their basic psychological needs, and conversely which profiles, content or interactions might trigger frustration of those needs. Consequently, adolescents could make autonomous choices when and how to create opportunities to experience greater need satisfaction, while limiting need frustration during their time on social media. To date, need-crafting programs have been shown to enhance need satisfaction and resilience in various life contexts (Laporte et al., 2022), yet its impact in virtual settings remains unexplored.

Both mindfulness and need-crafting practices might indirectly prevent excessive time spent on social media as both involve staying conscious of time spent within the virtual context in relation to other available options in the 'real world' (see also Rigby & Ryan, 2017).

Future Directions

Upon reflecting on conceptual and methodological decisions in this study, we aim to identify potential directions for future research. First, given that our study examined social media specific outcomes (e.g., social media rumination, goal conflicts) the predictors are limited to basic psychological need experiences in the domain of SMU. However, it could be that the observed positive effects of domain-specific need satisfaction are partially due to the fact that need satisfaction in SMU co-occurs with need satisfaction in other life domains. Therefore, future research could examine the dynamic interplay between different domain-specific need experiences and their joint and unique role in predicting domain-specific outcomes as well as overall mental health of adolescents.

Further, future research could investigate the characteristics defining events on social media that tend to fulfill or hinder needs. It's plausible that more interactive social media apps or activities, such as Snapchat or voice memos, offer more consistent prospects for need

satisfaction compared to passive apps or uses, such as watching reels on TikTok or viewing stories on Instagram (Adachi & Rigby, 2023). Despite social media being predominantly interactive, a considerable amount of time is often spent in a more 'passive consumption' mode (e.g., browsing, content watching; Verduyn et al., 2017). Nonetheless, within SDT research, even passive media consumption, like binge-watching, demonstrates potential for need fulfillment, not through active provision of opportunities for satisfaction, but by offering content and themes that satisfy viewers' needs (Adachi & Rigby, 2023; Erdmann & Dienlin, 2022).

Third, although this study included two surveys per day, the objectively logged data shows that each of those time frames consisted of 20 (social media) app-events on average. This demonstrates the very dynamic nature of SMU among adolescents. Therefore, future studies could try to replicate the findings of the present study over shorter timeframes, by adopting more intensive experience sampling designs with multiple measurement occasions each day. However, it is advised that the parameters of ESM studies (i.e., daily measures, total days, length of surveys) are well aligned to minimize participant burden (see Myin-Germeys & Kuppens, 2022 for an overview).

Limitations.

To our knowledge, the current study is the first look at time and need-based dynamics during SMU, while using a daily diary design and smartphone logging. Nevertheless, this study is not without limitations. A first limitation of the study is our relatively small sample size and the lack of sample diversity. For example, 75% of the study followed an academic track and only all participants had the Belgian nationality.

Second, although daily diary studies add to the literature of social media use, it is important to note that the results cannot be causally interpreted. The current study's outcomes could potentially be influenced by third variables, for instance, an individual's fulfillment of

autonomy, competence, and relatedness needs in face-to-face interactions or activities outside of social media might confound or interact with the observed results, as this could have impacted adolescents' perception of need satisfaction within social media usage.

Third, while the hypotheses of the present study are grounded in the robust theoretical framework of SDT, the absence of preregistration remains a limitation.

Lastly, although the use of log-based measures is often proposed as a 'gold standard' and therefore a strength of the present study, some disadvantages should be noted. First, given that most smartphone logging apps such as MobileDNA, are exclusively available for Android users, sampling bias might have occurred and it is unclear whether these results are generalizable to all social media users, including iPhone-users. Especially among younger age groups (16-24 years old) iPhone is preferred over Android (Szczygieł, 2023). Moreover, in adults, some differences between users of both operating systems were found in terms of demographics (e.g., Schmall, 2018) and security awareness (e.g., Reinfelder et al., 2014). However, no studies were found that compared SMU in particular or focused on adolescents using iPhones versus Android devices. Future studies should therefore examine potential differences between users of both operating systems in adolescent groups and try to replicate the findings of the present study for iPhone users. Moreover, some technical issues occurred when retrieving the logging data and some participants incorrectly entered their unique identification code into the MobileDNA app, making it impossible to link survey data with their smartphone loggings, both causing a significant loss of the sample size. Therefore, when using MobileDNA or other logging software in adolescent populations, we advise to carefully enter the identification code together with the participant so that loss of data can be limited.

Conclusions

This study delved into the effects of adolescents' SMU on their daily goal interference and affective states by considering both log-based measures and subjective need-based experiences on social media. While excessive time on social media led to immediate feelings of guilt, goal conflicts, and negative emotions, the study also found that subjective experiences during SMU play a significant role. When adolescents' needs are frustrated during SMU, it triggers immediate negative outcomes, including guilt, goal conflicts, and poorer affective states, often leading to rumination about social media later that day. Conversely, need-satisfying SMU resulted in less immediate rumination, improved emotional states, and reduced goal interference later in the day. Intriguingly, need satisfaction during SMU also acted as a buffer, mitigating the negative impact of prolonged screen time on social media. In a world where digital connectivity is central for adolescents, the findings point towards the need to adopt a nuanced perspective vis-à-vis adolescents' SMU, with both quantitative (i.e., time spent) and qualitative (i.e., need-based experiences) features as well as their interplay in conjunction accounting for adolescents' goal interference and affect.

References

Adachi, P. J. C., & Rigby, S. C. (2023). Captivated by Meaning: A Self-Determination Theory Perspective on Motivation for Entertainment Media. In R. M. Ryan (Ed.), The Oxford Handbook of Self-Determination Theory. Oxford University Press.

Alter, A. (2017). *Irresistible: The rise of addictive technology and the business of keeping us hooked.* Penguin Press.

Anderson, M., & Jiang, J. (2018). *Teens, Social Media & Technology.* Pew Research Center. https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology 2018

Ang, C., Talib, M. A., Tan, K., Tan, J., & Yaacob, S. N. (2015). Understanding computer mediated communication attributes and life satisfaction from the perspectives of uses and gratifications and self-determination. *Computers in Human Behavior*, *49*, 20–29. https://doi.org/10.1016/j.chb.2015.02.037

Anrijs, S., Bombeke, K., Durnez, W., Van Damme, K., Vanhaelewyn, B., Conradie, P., Smets, E., Cornelis, J., De Raedt, W., Ponnet, K., & De Marez, L. (2018). MobileDNA: Relating physiological stress measurements to smartphone usage to assess the effect of a digital detox. In *Communications in computer and information science* (pp. 356–363). https://doi.org/10.1007/978-3-319-92279-9_48

Beyens, I., Pouwels, J. L., Van Driel, I. I., Keijsers, L., & Valkenburg, P. M. (2020). The effect of social media on well-being differs from adolescent to adolescent. *Scientific Reports*, *10*(1). https://doi.org/10.1038/s41598-020-67727-7

Bradt, L., Vermote, B., Zaman, B., Vansteenkiste, M., Van de Casteele, M., & Soenens, B. (2023). Are Video Games and School Conflictual or Complementary Contexts for Affording Psychological Need Fulfillment? Implications for Adolescents' Problematic Gaming and School Adjustment. *Under review*

Campbell, R., Boone, L., Vansteenkiste, M., & Soenens, B. (2018). Psychological need frustration as a transdiagnostic process in associations of self-critical perfectionism with depressive symptoms and eating pathology. *Journal of Clinical Psychology*, *74*(10), 1775–1790. https://doi.org/10.1002/jclp.22628

Campbell, R., Vansteenkiste, M., Soenens, B., Vandenkerckhove, B., & Mouratidis, A. (2020). Toward a better understanding of the reciprocal relations between adolescent psychological need experiences and sleep. *Personality and Social Psychology Bulletin*, *47*(3), 377–394. https://doi.org/10.1177/0146167220923456

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van Der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction and frustration scale [Dataset]. In *PsycTESTS Dataset*. https://doi.org/10.1037/t73076-000

Digimeter (2023). imec.digimeter 2022 Digitale trends in Vlaanderen. In www.imec.be. https://www.imec.be/sites/default/files/2023-03/imec_digimeter_2022.pdf

Erdmann, E., & Dienlin, T. (2022). Binge-Watching, Self-Determination, and Well-Being. *Journal of Media Psychology*, *34*(6), 383–394. https://doi.org/10.1027/1864 1105/a000334

Erdvik, I. B., Haugen, T., Ivarsson, A., & Säfvenbom, R. (2019). Global Self-Worth among Adolescents: The Role of Basic Psychological Need Satisfaction in Physical Education. *Scandinavian Journal of Educational Research*, *64*(5), 768–781. https://doi.org/10.1080/00313831.2019.1600578

Halfmann, A., Meier, A., & Reinecke, L. (2023). Trapped between goal conflict and availability norm? *Journal of Media Psychology*. https://doi.org/10.1027/1864 1105/a000381

Hao, Z., Jin, L., & Huang, J. (2023). Offline and online basic need satisfaction and smartphone use behaviors: A mediation model. *Journal of Psychiatric Research*, *161*, 99–105. https://doi.org/10.1016/j.jpsychires.2023.03.016

Hynes, K., Lannin, D. G., Kanter, J. B., Yazedjian, A., & Nauta, M. M. (2020). Do Materialistic Adolescents Ruminate More About Their Social Media Posts? *Youth & Society*, *54*(5), 766–787. https://doi.org/10.1177/0044118x20984172

Jensen, M., George, M. J., Russell, M. R., & Odgers, C. L. (2019). Young adolescents' digital technology use and mental health symptoms: little evidence of longitudinal or daily linkages. *Clinical Psychological Science*, *7*(6), 1416–1433. https://doi.org/10.1177/2167702619859336

Johannes, N., Nguyen, T., Weinstein, N., & Przybylski, A. K. (2021). Objective, subjective, and accurate reporting of social media use: No evidence that daily social media use correlates with personality traits, motivational states, or well-being. *Technology, Mind, and Behavior*, *2*(2). https://doi.org/10.1037/tmb0000035

Johnson, B. K., Eden, A., Reinecke, L., & Hartmann, T. (2021). Self-control and need satisfaction in primetime: Television, social media, and friends can enhance regulatory resources via perceived autonomy and competence. *Psychology of Popular Media*, *10*(2), 212–222. https://doi.org/10.1037/ppm0000286

Kaye, L., Orben, A., Ellis, D., Hunter, S. C., & Houghton, S. (2020). The conceptual and methodological mayhem of "Screen Time." *International Journal of Environmental Research and Public Health*, *17*(10), 3661. https://doi.org/10.3390/ijerph17103661

Laporte, N., Soenens, B., Flamant, N., Vansteenkiste, M., Mabbe, E., & Brenning, K. (2021). The role of daily need crafting in daily fluctuations in adolescents' need-based and affective experiences. *Motivation and Emotion*, *46*(2), 137–149. https://doi.org/10.1007/s11031-021-09921-2

Laporte, N., Van Den Bogaard, D., Brenning, K., Soenens, B., & Vansteenkiste, M. (2022). Testing an Online Program to Foster Need Crafting During the COVID-19 Pandemic. *Current Psychology*. https://doi.org/10.1007/s12144-022-03012-2

Liu, Q., Fang, X., Wan, J., & Zhou, Z. (2016). Need satisfaction and adolescent pathological internet use: Comparison of satisfaction perceived online and offline. *Computers in Human Behavior*, *55*, 695–700. https://doi.org/10.1016/j.chb.2015.09.048

Liu, Q., Hu, Q., & Qi, D. (2022). Online Psychological Need Satisfaction and Social Networking Addiction: A Longitudinal Study Among Chinese Adolescents. *Child and Adolescent Social Work Journal*. https://doi.org/10.1007/s10560-021-00814-4

Luyckx, K., Schwartz, S. J., Berzonsky, M. D., Soenens, B., Vansteenkiste, M., Smits, I., & Goossens, L. (2008). Capturing ruminative exploration: Extending the four dimensional model of identity formation in late adolescence. *Journal of Research in Personality*, *42*(1), 58–82. https://doi.org/10.1016/j.jrp.2007.04.004

McDaniel, B. T., & Coyne, S. M. (2016). "Technoference": The interference of technology in couple relationships and implications for women's personal and relational well-being. *Psychology of Popular Media Culture*, *5*(1), 85–98. https://doi.org/10.1037/ppm0000065

Meier, A., Beyens, I., Siebers, T., Pouwels, J. L., & Valkenburg, P. M. (2023). Habitual social media and smartphone use are linked to task delay for some, but not all, adolescents. *Journal of Computer-Mediated Communication*, *28*(3). https://doi.org/10.1093/jcmc/zmad008

Meier, A., & Reinecke, L. (2020). Computer-Mediated Communication, Social Media, and Mental Health: A Conceptual and Empirical Meta-Review. *Communication Research*, *48*(8), 1182–1209. https://doi.org/10.1177/0093650220958224

Montag, C., Lachmann, B., Herrlich, M., & Zweig, K. A. (2019). Addictive Features of Social Media/Messenger Platforms and Freemium Games against the Background of Psychological and Economic Theories. *International Journal of Environmental Research and Public Health*, *16*(14), 2612. https://doi.org/10.3390/ijerph16142612

Myin-Germeys, I., & Kuppens, P. (Eds.). (2022) The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies (2nd ed.). Leuven: Center for Research on Experience Sampling and Ambulatory Methods Leuven.

Odgers, C. L., & Jensen, M. (2020). Annual Research Review: Adolescent mental health in the digital age: facts, fears, and future directions. *Journal of Child Psychology and Psychiatry*, *61*(3), 336–348. https://doi.org/10.1111/jcpp.13190

Orben, A., Dienlin, T., & Przybylski, A. K. (2019). Social media's enduring effect on adolescent life satisfaction. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(21), 10226–10228. https://doi.org/10.1073/pnas.1902058116

Orben, A., Weinstein, N., & Przybylski, A. K. (2020). Only holistic and iterative change will fix digital technology research. *Psychological Inquiry*, *31*(3), 235–241. https://doi.org/10.1080/1047840x.2020.1820221

Parent, N. (2023). Basic Needs Satisfaction through Social Media Engagement: A Developmental Framework for Understanding Adolescent Social Media Use. *Human Development*. https://doi.org/10.1159/000529449

Parris, L., Lannin, D. G., Hynes, K., & Yazedjian, A. (2020). Exploring social media rumination: associations with bullying, cyberbullying, and distress. *Journal of Interpersonal Violence*, *37*(5–6), NP3041–NP3061. https://doi.org/10.1177/0886260520946826

Parry, D. A., Davidson, B. I., Sewall, C., Fisher, J. F., Mieczkowski, H., & Quintana, D. (2021). A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nature Human Behaviour*, *5*(11), 1535–1547. https://doi.org/10.1038/s41562-021-01117-5

Popat, A., & Tarrant, C. (2022). Exploring adolescents' perspectives on social media and mental health and well-being – A qualitative literature review. *Clinical Child Psychology and Psychiatry*, *28*(1), 323–337. https://doi.org/10.1177/13591045221092884

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, *14*(2), 154–166. https://doi.org/10.1037/a0019440

Ratelle, C. F., & Duchesne, S. (2014). Trajectories of psychological need satisfaction from early to late adolescence as a predictor of adjustment in school. *Contemporary Educational Psychology*, *39*(4), 388–400. https://doi.org/10.1016/j.cedpsych.2014.09.003

Reinecke, L., & Meier, A. (2020). *Guilt and Media Use*. https://www.researchgate.net/profile/Adrian-Meier 2/publication/345737348_Guilt_and_Media_Use/links/5fc76f0f45851568d132504b/ uilt-and-Media-Use.pdf

Reinecke, L., Vorderer, P., & Knop, K. (2014). Entertainment 2.0? The role of intrinsic and extrinsic need satisfaction for the enjoyment of Facebook use. *Journal of Communication*, *64*(3), 417–438. https://doi.org/10.1111/jcom.12099

Reinfelder, L., Benenson, Z., & Gassmann, F. (2014). Differences between Android and iPhone Users in Their Security and Privacy Awareness. In *Springer eBooks* (pp. 156 167). https://doi.org/10.1007/978-3-319-09770-1_14

Rigby, S., & Ryan, R. (2017). Reflecting on Emotion's Role in the Relationship between Media Use and Subjective Well-Being. In L. Reinecke & M. Oliver (Eds.), *The Routledge Handbook of Media Use and Well-Being International Perspectives on Theory and Research on Positive Media Effects*. Taylor & Francis.

Rigby, C. S. (2023). Flourishing in Digital Environments: The Case for Self-Determination Theory as a Beneficial Framework for Individuals, Industry, and Society. In R. M. Ryan (Ed.), The Oxford Handbook of Self-Determination Theory. Oxford University Press.

Ryan, R. M., & Deci, E. L. (2008). From Ego Depletion to Vitality: Theory and findings concerning the facilitation of energy available to the self. *Social and Personality Psychology Compass*, *2*(2), 702–717. https://doi.org/10.1111/j.1751 9004.2008.00098.x

Ryan, R. M., & Deci, E. L. (2017). Self-Determination Theory: Basic psychological needs in motivation, development, and wellness. In *Guilford Press eBooks*. https://doi.org/10.1521/978.14625/28806

Ryan, R. M., Weinstein, N., Bernstein, J., Brown, K. W., Mistretta, L., & Gagné, M. (2010). Vitalizing effects of being outdoors and in nature. *Journal of Environmental Psychology*, *30*(2), 159–168. https://doi.org/10.1016/j.jenvp.2009.10.009

Scharkow, M. (2016). The Accuracy of Self-Reported Internet Use—A Validation study using client log data. *Communication Methods and Measures*, *10*(1), 13–27. https://doi.org/10.1080/19312458.2015.1118446

Schmall, T. (2018). iPhone and Android users are completely different people. *New York Post*. https://nypost.com/2018/10/25/iphone-and-android-users-are-completely different-people/

Sheldon, K. M., Abad, N., & Hinsch, C. (2011). A two-process view of Facebook use and relatedness need-satisfaction: Disconnection drives use, and connection rewards it. *Psychology of Popular Media Culture*, *1*(S), 2–15. https://doi.org/10.1037/2160 4134.1.s.2

Shen, C., Liu, R., & Wang, D. (2013). Why are children attracted to the Internet? The role of need satisfaction perceived online and perceived in daily real life. *Computers in Human Behavior*, *29*(1), 185–192. https://doi.org/10.1016/j.chb.2012.08.004

Subrahmanyam, K., & Michikyan, M. (2015). Methodological and Conceptual Issues in Digital Media Research. In J. Nesi, E. Telzer, & M. Prinstein (Eds.), *Handbook of Adolescent Digital Media Use and Mental Health*. Cambridge University Press.

Symons, K., Ponnet, K., Walrave, M., & Heirman, W. (2017). A qualitative study into parental mediation of adolescents' internet use. *Computers in Human Behavior*, *73*, 423–432. https://doi.org/10.1016/j.chb.2017.04.004

Szczygieł, B. (2023). iPhone vs Android Users: Key Differences. *Netguru*. https://www.netguru.com/blog/iphone-vs-android-users-differences

Thøgersen-Ntoumani, C., Ntoumanis, N., Carey, R., Dodos, L. A., Quested, E., & Chatzisarantis, N. L. D. (2018). A diary study of appearance social comparisons and need frustration in young women. *Personality and Individual Differences*, *122*, 120 126. https://doi.org/10.1016/j.paid.2017.10.020

Thomaes, S., Sedikides, C., Van Den Bos, N., Hutteman, R., & Reijntjes, A. (2017). Happy To Be "Me?" Authenticity, Psychological Need Satisfaction, and Subjective Well Being in Adolescence. *Child Development*, *88*(4), 1045–1056. https://doi.org/10.1111/cdev.12867

Valkenburg, P. M., Meier, A., & Beyens, I. (2022). Social media use and its impact on adolescent mental health: An umbrella review of the evidence. *Current Opinion in Psychology*, *44*, 58–68. https://doi.org/10.1016/j.copsyc.2021.08.017

Valkenburg, P. M., Van Driel, I. I., & Beyens, I. (2021). The associations of active and passive social media use with well-being: A critical scoping review. *New Media & Society*, *24*(2), 530–549. https://doi.org/10.1177/14614448211065425

Van de Casteele, M., Soenens, B., Ponnet, K., Flamant, N., Van Hees, V., Vansteenkiste, M. (2023). Growing Up and Thriving in the Digital Age: The Role of Need-Based Experiences Offline and on Social Media in Adolescents' Mental Health. Journal of Adolescence

Van Der Kaap-Deeder, J., Soenens, B., Ryan, R., & Vansteenkiste, M. (2020). *Manual of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS).* Ghent University.

Van Der Kaap-Deeder, J., Vansteenkiste, M., Soenens, B., Loeys, T., Mabbe, E., & Gargurevich, R. (2015). Autonomy-Supportive parenting and Autonomy-Supportive sibling interactions. *Personality and Social Psychology Bulletin*, *41*(11), 1590–1604. https://doi.org/10.1177/0146167215602225

Van Der Kaap-Deeder, J., Vansteenkiste, M., Van Petegem, S., Raes, F., & Soenens, B. (2016). On the Integration of Need–related Autobiographical Memories among Late Adolescents and Late Adults: The Role of Depressive Symptoms and Self congruence. *European Journal of Personality*, *30*(6), 580–593. https://doi.org/10.1002/per.2079

Van Der Wal, A., Valkenburg, P. M., & Van Driel, I. I. (2022). In Their Own Words: How Adolescents Differ in Their Social Media Use and How it Affects Them. *PsyArXiv*. https://doi.org/10.31234/osf.io/mvrpn

Vandenkerckhove, B., Soenens, B., Flamant, N., Luyten, P., Campbell, R., & Vansteenkiste, M. (2021). Daily ups and downs in adolescents' depressive symptoms: The role of daily self-criticism, dependency and basic psychological needs. *Journal of Adolescence*, *91*(1), 97–109. https://doi.org/10.1016/j.adolescence.2021.07.005

Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, *23*(3), 263–280. https://doi.org/10.1037/a0032359

Vansteenkiste, M., Ryan, R. M., & Soenens, B. (2020). Basic psychological need theory: Advancements, critical themes, and future directions. *Motivation and Emotion*, *44*(1), 1–31. https://doi.org/10.1007/s11031-019-09818-1

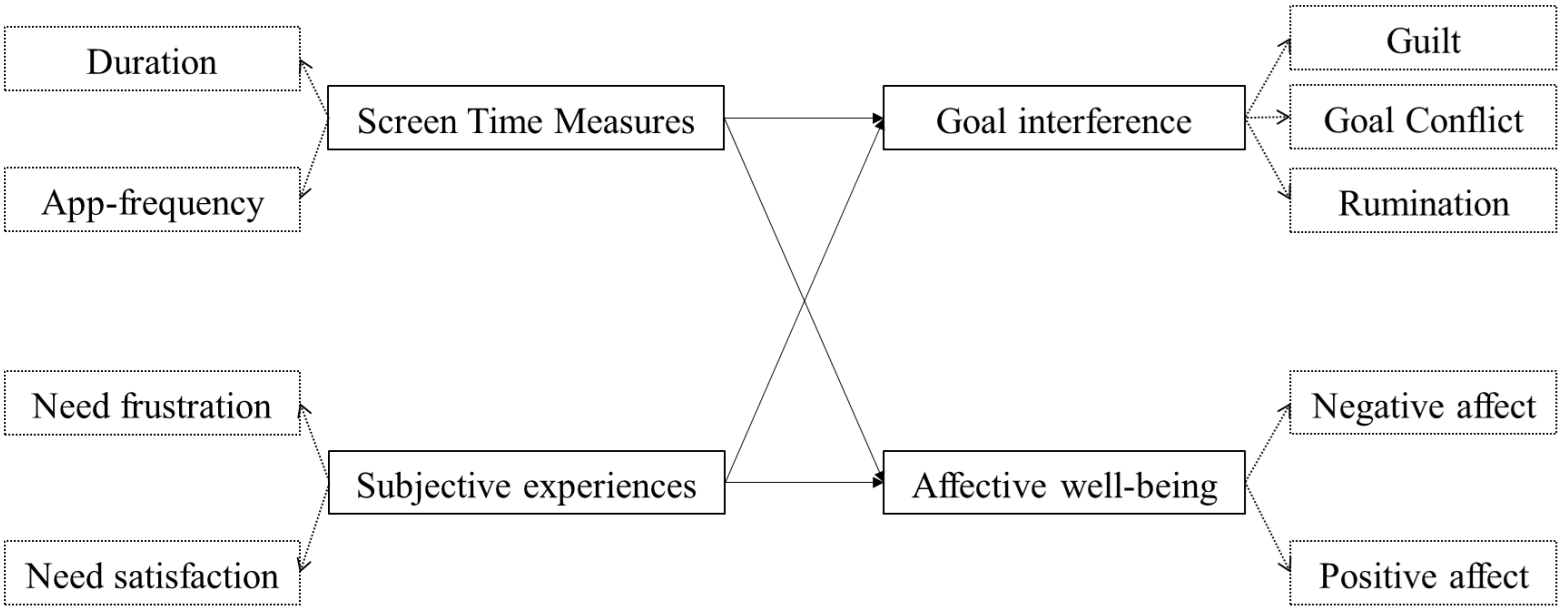
Vansteenkiste, M., Soenens, B., & Ryan, R. M. (2023). Basic Psychological Needs Theory: A Conceptual and Empirical Review of Key Criteria. In R. M. Ryan (Ed.), The Oxford Handbook of Self-Determination Theory. Oxford University Press.

Verduyn, P., Ybarra, O., Résibois, M., Jonides, J., & Kross, E. (2017). Do Social Network Sites Enhance or Undermine Subjective Well-Being? A Critical Review. Social Issues and Policy Review, 11(1), 274–302. https://doi.org/10.1111/sipr.12033

Verstuyf, J., Vansteenkiste, M., Soenens, B., Boone, L., & Mouratidis, A. (2013). Daily ups and downs in women's binge eating symptoms: the role of basic psychological needs, General Self-Control, and Emotional eating. *Journal of Social and Clinical Psychology*, *32*(3), 335–361. https://doi.org/10.1521/jscp.2013.32.3.335

Wang, L., Tao, T., Fan, C., & Gao, W. (2015). Does psychological need satisfaction perceived online enhance well-being? *PsyCh Journal*, *4*(3), 146–154. https://doi.org/10.1002/pchj.98

Figure 1. Overview of theoretical model and study hypotheses



Note. Need frustration/satisfaction refers to the frustration or satisfaction of participants' basic psychological needs within the context of social media use.

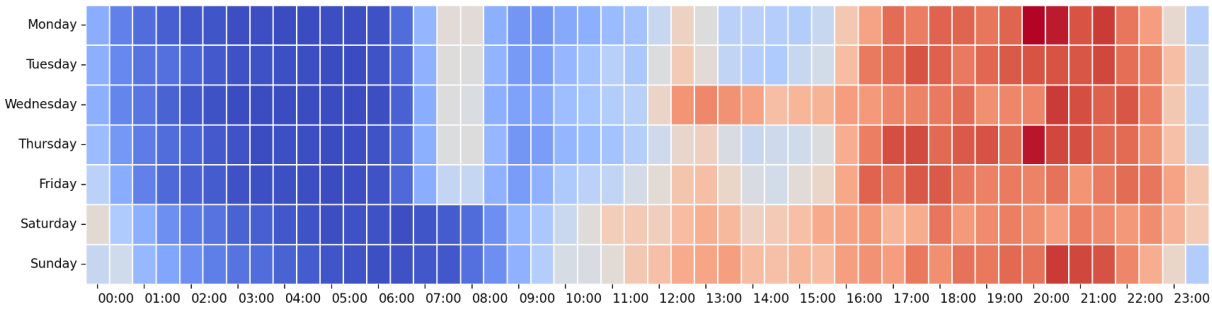
Table 1.

Within-day Variance, Descriptive statistics and Correlations Within-day and Between Person variables

Variable	Var	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. SMU satisfaction	.39	3.93	.71		-.11	.04	.01	-.01	.01	-.11*	.25***	-.16**
2. SMU frustration	.38	1.74	.62	-.57***		.14***	.13***	.30***	.25***	.08	-.16***	.21***
3. SMU duration	.83	26.75	24.62	.02	.10		.61***	.29***	.34***	.14**	-.05	.15***
4. SMU frequency	.55	19.91	16.46	-.06	.05	.66***		.17***	.24***	.13***	-.04	.14***
5. Guilt	.49	1.99	1.06	-.43***	.61***	.21	.05		.58***	.20***	-.17***	.24***
6. Goal Conflicts	.50	2.29	1.08	-.42***	.46***	.38***	.24*	.78***		.29***	-.14***	.23***
7. Rumination	.48	1.67	.89	-.41***	.69***	.17	.11	.60***	.63***		-.14**	.17***
8. Positive affect	.43	3.65	.85	.68***	-.50***	-.06	.00	-.35**	-.33**	-.18		-.42***
9. Negative affect	.43	1.64	.67	-.45***	.47***	.15	.01	.50***	-.45***	.39***	-.58***	

Notes. Var refers to the variance situated at the within-day level; Correlations on the within-day level are reported above the diagonal (i.e., Level 1), correlations on the between-person level (i.e., Level 3) are reported below the diagonal; * $p<.05$, ** $p<.01$, ***$p<.001$

Figure 2. Heatmap of Average Social Media Use Throughout the Day and Across the Week



Note. (Dark) blue refers to moments where social media is not/rarely used, (dark) red shows times where social media apps are intensively/maximally used.

Table 2.

Concurrent Associations between SMU Predictors Goal Interference and Affective States

	Goal interference			Affective states	
	Guilt	**Goal conflict**	**SMU Rumination**	**Positive affect**	**Negative affect**
Within-day Effects					
SMU satisfaction	.01	.03	-.08	.24***	-.15**
SMU frustration	.27***	.21***	.01	-.13***	.18***
SMU duration	.27***	.29***	.09	-.04	.09**
SMU frequency	-.02	.05	.08	-.01	.07*
Between-Person Effects					
SMU satisfaction	-.11	-.24	-.04	.59***	-.28*
SMU frustration	.55***	.31**	.65***	-.15	.28*
SMU duration	.22	.38*	.13	-.13	.09
SMU frequency	-.17	-.09	-.03	.15	-.04
Age	.16	.22*	.07	-.04	.02
Gender	.11	-.01	-.11	-.10	.18*
Education Level	-.14	-.08	.03	.00	.10
Model fit					
CFI	.99	.99	.99	.98	.98
RMSEA	.02	.02	.02	.03	.02
SRMR	.03/.51/.00	.03/.47/.00	.03/.30/.00	.04/.36/.00	.04/.37/.00

Note. Coefficients shown are standardized path coefficients; * $p<.05$, ** $p<.01$, *** $p<.001$

Figure 3. Effect of SMU Duration on Guilt Moderated by SMU Satisfaction

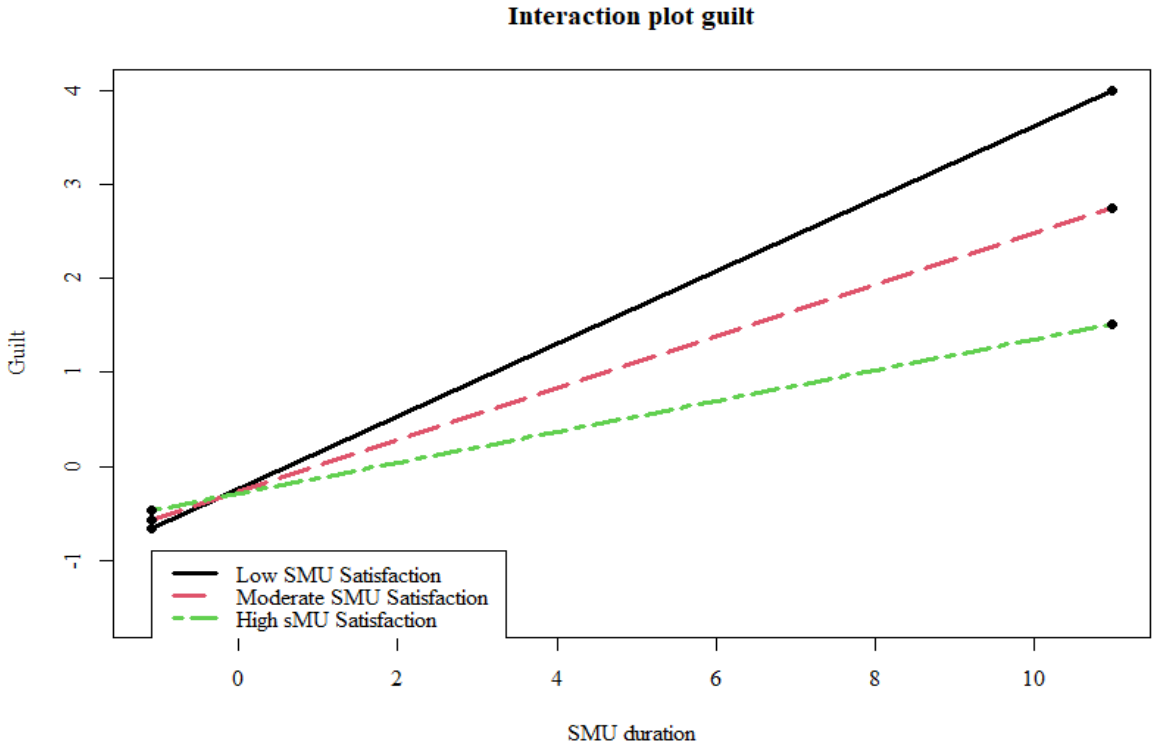


Figure 4 . Effect of SMU Duration on Goal Conflict Moderated by SMU Satisfaction

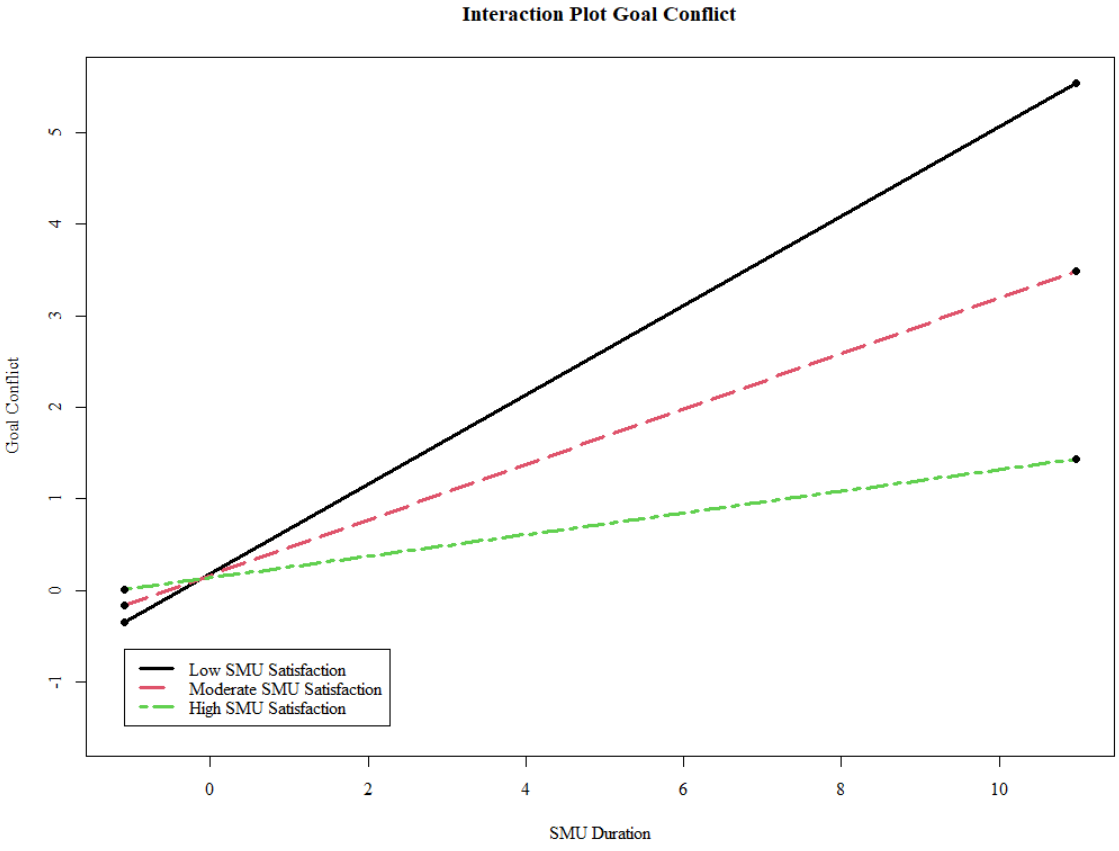


Figure 5. Effect of SMU Duration on Rumination Moderated by SMU Satisfaction

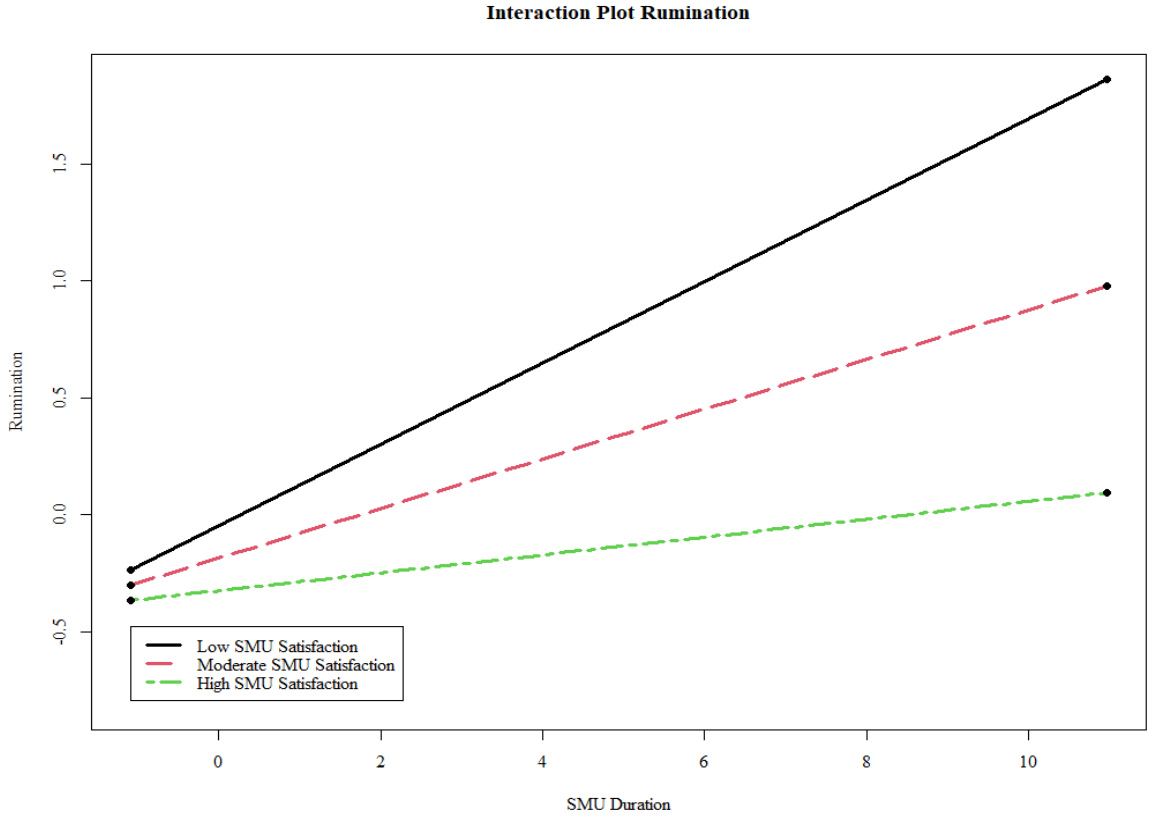


Figure 6. Effect of SMU Duration on Negative Affect Moderated by SMU Satisfaction