The Role of Self-control in regard to the Association between Binge-watching and Sleep over Time: An Experience Sampling Study

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Bachelor Thesis

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June 28th, 2021

Abstract

Introduction: The relatively new behavioral phenomenon called binge-watching describes the watching activity of more than two episodes and two hours on a daily basis. Since research concerning binge-watching is comparatively young, the consequences are not fully clear yet. However, possible consequences concern sleep, whereby it is expected that binge-watching has a negative impact on sleep in duration and quality. In addition, it is hypothesized that self-control may play a moderating role in this association.

Method: 78 participants (94.4% German, 82.9% female, age = 22.9 ± 0.18) took part in an experience sampling study conducted with the app "Ethica". After a baseline questionnaire, the participants were asked to fill out daily questionnaires concerning their VOD watching behavior and sleep for a period of 14 days. The association between binge-watching and sleep and the moderation effect of self-control was analyzed with linear mixed models.

Results: There was no significant association between binge-watching and sleep in quality and quantity found at the group level. Moreover, there was no significant moderation effect of self-control found concerning the association between binge-watching and sleep. However, self-control did show a significant effect direct on sleep duration ($B = 0.35$; $SE = 0.09$; $p < .01$).

Discussion: The current study did not confirm the assumed negative effects of binge-watching on sleep quantity or quality, nor had higher self-control the assumed diminishing effects on that association. Still, a significant effect of self-control on sleep duration was found, indicating that a higher trait of self-control positively influences sleep quantity. Future research is suggested to focus on more representative samples regarding age and occupation, since this study majorly focused on students.

Keywords: Binge-watching, sleep duration, sleep quality, self-control, moderation, experience sampling study

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Introduction

The phrase “just one more episode” is, for most Netflix watchers, a common one. Due to being available in over 190 countries in over 30 different languages, Netflix has an enormous reach. Notably, 61 percent of the participants of a study indicated watching Netflix on a regular basis (West, 2014). Even though Netflix is, with over a hundred million subscribers, the global leader since 2008 regarding streaming services, other contenders are challenging this position, like WarnerMedia, Apple, and The Walt Disney Company (Netflix, 2020). In Germany, on the other hand, Amazon Prime is at least as strongly represented as Netflix (Wenzel, Mahle & Pätzmann, 2016). As the numbers and offers of streaming platforms expanded enormously over the last years, so did the watching behavior of their users. The German video-on-demand (VOD) usage increased from 31.3 million to 40.6 million (Statista Digital Market Outlook, 2020).

The activity of excessively watching movies and series already existed before the accessibility of streaming devices, by watching, for example, multiple episodes in a row on DVD, VHS, DVR, or simply on television in a so-called TV marathon (Jenner, 2017). Already in the ’80s, some TV stations in the USA started featuring the rerun of certain series episodes behind each other in marathon sessions (Ahmed, 2017). Still, the popularity of watching multiple episodes of a series back-to-back strongly increased over the last few years. Especially on Netflix, there was a remarkable rise in consumed TV series. Contributing to that is the availability of entire seasons of TV series on Netflix since 2013, instead of waiting for a week-by-week release (Flayelle et al., 2020). This relatively new behavioral phenomenon of watching multiple TV show episodes in a single sitting is often referred to as binge-watching (Walton-Patttison, Dombrowski & Pressau, 2018).

The term “binge” in psychology commonly refers to problematic and addictive behaviors like binge-eating, binge-drinking, or binge-learning, which brings quite a negative association. In the case of binge-watching, neither the conceptualization nor the consequences are entirely clarified yet. Some researchers describe binge-watching as simply consuming more than one episode of the same television show in one sitting (Schweidel & Moe, 2016). Others conducted studies in which the definition is more specific. For instance, Rubenking, Bracken, Sandoval, and Rister (2018) analyzed eleven focus groups which showed that, for the participants, binge-watching is to view the same program for multiple episodes or a prolonged duration of time. The majority of participants agreed that for a watching activity to qualify as bingeing, watching four hours or more is necessary. Some also said that binging involves watching whole seasons of a TV show or being interrupted by falling asleep

(Rubenking et al., 2018). In sum, binge-watching research still lacks a consistent conceptualization and validated empirical measurement tools to capture the specific behavior reliably and accurately among viewers (Viens & Farrar, 2021). Therefore, a combination of the number of episodes watched and total watching duration may be best to operationalize binge-watching.

In recent years, increasingly more people regularly engaged in binge-watching, which has led to binge-watching becoming a subject of interest for scientific research (Flayelle et al., 2020). The results of a recent review of the already existing evidence concerning binge-watching indicate that binge-watching is a complex phenomenon that manifests itself in at least two ways. On the one hand, binge-watching can be highly rewarding and pleasurable. On the other hand, binge-watching can be an excessive and problematic behavior associated with negative outcomes. Similar to video gaming, a distinction should be made between healthy engagements in series watching and problematic binge-watching (Flayelle et al., 2020). Still, some studies suggest an addictive and harmful nature of binge-watching in general. However, according to Flayelle, Maurage, Vögele, Karila, and Billieux (2019), one has to be cautious in interpreting these studies since many studies used a confirmatory approach, expecting to find negative consequences. Matching this concern, Umesh and Boes (2019) stated that “giving binge-watching a systematic labeling of behavioral addiction would be premature and may result in adding one more behavioral phenomenon to the unlimited list of new behavioral addictions” (p. 183). According to a review of multiple studies, it is also important to mention that there were recurring discrepancies shown concerning the operationalization of binge-watching in various studies (Flayelle et al., 2020). Additionally, the research of binge-watching is still in its “infancy” (p. 3), therefore, results of studies concerning binge-watching should be interpreted cautiously (Flayelle et al., 2019).

Since binge-watching is a relatively young phenomenon, the potential consequences are not yet researched elaborately. Still, it gets more and more important concerning the already mentioned increased media consumption. One factor limiting the research of consequences of binge-watching is the difficulty determining direct consequences based on the feedback of a binge-watcher due to their partial inability to detect immediate changes caused by a binge-watching session which affect their body (Devasagayam, 2014). Even though most of the studies concentrate on the negative consequences of binge-watching, Vaterlaus, Spruance, Frantz, and Kruger (2019) found in binge-watching a facilitator concerning social opportunities. Specifically, by binge-watching inside jokes, joint watching, or even making friends can be facilitated. Still, there are more studies which concerned

themselves with negative consequences of binge-watching. The consequences of binge-watching can be divided into three broad patterns, namely physical and mental exhaustion, negative impact on self and relationships (e.g., depression, loneliness, and bad relationships), and negative impact on school and work (Gangadharbatla, Ackerman & Bamford, 2019).

One potential mechanism explaining the association between binge-watching and reduced physical and mental health is the loss of sleep in quality and quantity due to binge-watching. Getting sufficient sleep is essential for the human body to function well (Kroese, Evers, Adriaanse & de Ridder 2016). Especially concerning long-term consequences, sleep deprivation should not be underestimated since insomnia was proven to be associated with congestive heart failure, clinical depression, and hormonal imbalances (Katz and McHorney, 2002; Sigman, 2007). While recognizing the importance of a healthy sleeping pattern, 80 percent of adults worldwide still feel the need to improve their sleep quality (Philips, 2019). In addition, the National Sleep Foundation of America (2020) carried out a poll that showed that almost half of the adults feel sleepy three days a week on average. Insufficient sleep is an important but understudied issue since a large portion of the general population is experiencing insufficient sleep, and sleep intentions are not always in line with the actual behavior (Kroese et al., 2016).

One obstacle to healthy sleeping patterns appears to be binge-watching. According to a survey from 2019, almost half of the 18- to 24-year-old adults indicated losing sleep often due to binge-watching TV shows or streaming video series in the US. (Atomik Research, 2019). Not only the intriguing offer of watching series indefinitely is a problem for the sleeping process, but also the so-called pre-sleep arousal. According to Exelmans and Van den Bulck (2017a), media exposure arouses cognitive activities before sleeping, so that a longer period to “cool down” (p. 1004) is necessary to find sleep, which would postpone the point of sleeping. They also found an association between binge-watching and poorer sleep quality. Another important factor is the actual exposure to screens or monitors before sleeping. Fossum, Nordnes, Storemark, Bjorvatn, and Pallesen (2014) conducted a study that showed a positive relation between watching television, movies, and TV series in bed with insomnia. They linked this with the bright light exposure, especially with short wavelengths, which can postpone the sleep onset. Another study showed that protecting the eyes from the so-called blue light of the displays led to an improved sleeping pattern and a better-perceived sleeping quality (van der Lely et al., 2015). Oberschmidt (2017) concentrated her study on binge-watching and sleep concerning sleep quality and quantity and found that especially night-time watching had a negative effect on sleep outcome. She concluded, however, that

other possible predictors and cofounders should be considered, such as cognitive aspects or personality traits.

It is unclear why people would willingly dispense their important sleep for binge-watching. Interestingly, there appears to be a so-called attitude-discrepant behavior, which means that even though viewers may have a negative attitude towards binge-watching, they simply cannot help themselves to stop this behavior (Shim, Lim, Jung & Shin, 2018). Various individual characteristics might make an individual susceptible to binge-watching, especially self-control problems (Steins-Loeber, Reiter, Averback, Harbarth & Brand, 2020). Self-control can be defined as a person's motivation and capacity to resist or redirect a desire that possibly stands in conflict with an approved self-regulatory goal or value (Hofmann, Baumeister, Förster, & Vohs, 2012). Self-control challenges can manifest in various behaviors like executing the planned workout or resisting a piece of cake while being on a diet. But also, being tempted to binge-watch and delaying sleep. Even though self-control can also vary in its daily levels, it is mostly seen and measured as a rather stable personality trait. Hofmann, Reinecke & Meier (2017), who operationalized self-control as a trait, indicated that failed self-control regarding media consumption leads to conflicts with other tasks and obligations (like sleep) which turns media into a "guilty pleasure" (p. 15).

Failed self-control or problems with self-control already showed a direct association with giving into media desires easier (Reinecke & Hofmann, 2016). Also, lower levels of trait self-control showed an association with more bedtime procrastination (Kroese, De Ridder, Evers, & Adriaanse, 2014). However, it remains unclear whether self-control could also play a role in moderating the association between binge-watching and sleep. Exelmans and Van den Bulck´s study (2017b) showed an association regarding lower levels of trait self-control, binge-watching, and more bedtime procrastination. Their study, however, solely measured the delay of sleep, leaving room for research concerning the actual quality and quantity of sleep. They also examined self-control as a mediator, not as a moderator, and concentrated on evening television viewing and not VOD or binge-watching. Finally, they used retrospective self-reports of television viewing and sleeping behavior, which is vulnerable to bias due to the limits of human memory. Also, the interviews they conducted took place face-to-face, which could influence the participants' responses due to social desirability. Therefore, it would be relevant to explore if self-control plays a moderating role in the possible association between sleep and binge-watching in a more natural setting. Hofmann, Reinecke, and Meier (2017) present promising results, which show that self-control should be taken into consideration as a moderator when examining media use or in this case specifically binge-watching.

To sum up, not only the possible association between binge-watching and sleep is relevant to examine but also the possible moderation effect of self-control on this association. When taking the previous studies into account, self-control could buffer the association, meaning the more self-control, the less negative effect binge-watching would have on sleep. Therefore, this research aims to identify whether there is an association between binge-watching and sleep over time and a possible moderating effect of self-control on this association. This leads to the following research questions:

Research question 1: Is there an association between binge-watching and perceived sleep quality over time?

Research question 2: Is there an association between binge-watching and perceived sleep quantity over time?

Research question 3: Is the association between sleep quantity and binge-watching moderated by viewer's levels of self-control?

Research question 4: Is the association between sleep quality and binge-watching moderated by viewer's levels of self-control?

Methods

Design

The current study used an experience sampling method (ESM) to answer the research questions related to binge-watching, sleep, and self-control. ESM consists of a repeated sampling, using a mobile device, of momentary experiences in the participant's natural environment (Riediger, 2009). It can be compared to the concept of a diary study where it is assessed what kind of behaviors, thoughts, or feelings the participant is experiencing during the day over a longer time. For that, notifications are used to remind the participants that they should fill out a questionnaire at a particular time or event, depending on what the researcher is investigating. Applying ESM allows for modeling behaviors and feelings over time since time is included in the analysis as a relevant predictor variable (Barret & Barret, 2001). Compared to cross-sectional studies, ESM is less biased concerning retrospective responses since the specific behavior or state of feeling is asked for immediately during or after it occurs. For example, sleeping quality and quantity is to be rated first thing in the morning. Another critical difference is that ESM does not obtain its validity and reliability by having large samples but by repeated measures over time (Verhagen et al., 2016).

The study was approved (210327) by the Ethics Committee of the Faculty of

Behavioral Sciences (ECBMS) at the University of Twente. The sampling strategy used is called fixed-time-based sampling since the questions were always asked at the same point of time each day (Conner & Lehman, 2012). This strategy was chosen because it is best used for studying concrete events as well as behaviors that are not as susceptible to memory bias, which is the case in binge-watching.

Data collection started on 8th of April 2021 and ended on 22nd of April 2021, which makes a total of 15 days (Figure 1). The choice to administer the study for 15 days was based on an analysis of Van Berkel, Ferreira, & Kostakos (2017), as 14 days usually results in a good response rate, but an extra day was planned for the baseline measurement. On the first day, the participants were asked to fill out a questionnaire about their demographics and a baseline questionnaire for which they had the whole day to respond. For the following 14 days, they received one questionnaire every morning at 8:00 a.m. in which they answered questions about their watching behavior on the previous day and their sleep duration and quality during the night. They had time to fill it out until 12:30 p.m. The decision to have only one questionnaire per day in the morning can be supported due to investigating sleep, which usually takes place once at night. Since the aim was to avoid memory biases, the questionnaire had to be filled out in the morning. 135 minutes after the first notification, they were reminded once to fill the questionnaire out if not done already.

To design the study and administer the daily questionnaires, Ethica was used (Ethica, 2020). Ethica is a smartphone application specially developed for ESM studies, enabling researchers to formulate context-dependent surveys and send these out to participants. This allows for a daily data collection that is as easy as possible for the participants and leads to thorough observations of their daily behavior and feelings.

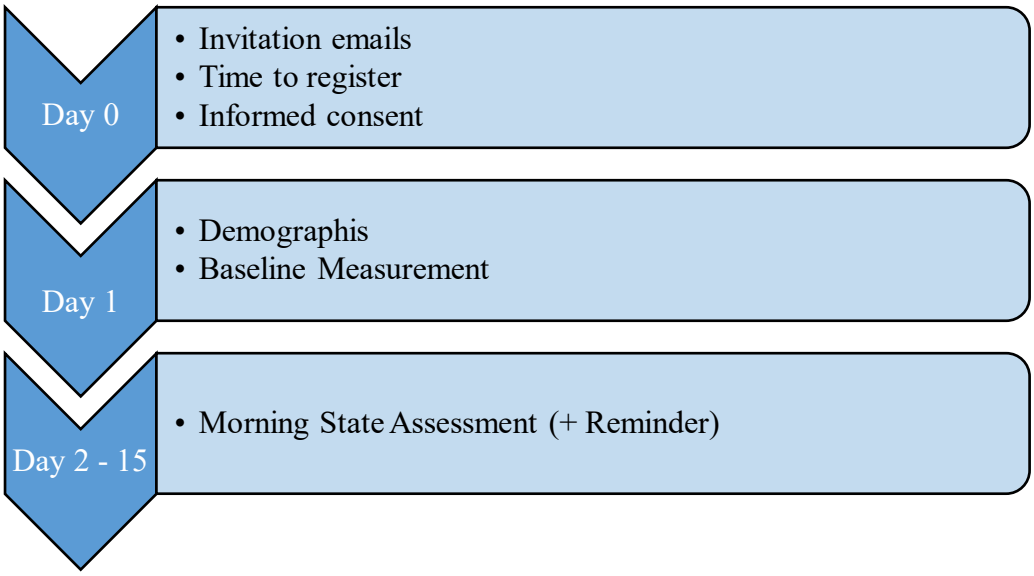

Figure 1. Flow-chart of the study and Measurement Design.

Participants

For this study, convenience sampling was used to gather participants from the researchers' network because the study is more of an effort for participants than a one-time questionnaire. The researcher assumed that the study would be adhered to more adequately when asking participants from close circles. It was chosen to keep the sample size somewhat small. Particularly, the aim was to recruit at least 40 participants. Similar studies like the one of Troles (2019) also recruited 45 participants, and Van Berkel, Ferreira & Kostakos (2017) stated in their review that a mean of 53 participants and a median of 19 participants was found in the ESM studies they included.

Materials

Since this study was a joint research of five other researchers investigating binge-watching for their bachelor theses, other questionnaires were involved, which focused on binge-watching regarding loneliness, motivation, stress, fear of missing out, and emotional stability (Appendix A). Surveys concerning these topics were therefore also included in the app on a daily basis and were filled out by the participants.

Demographics. The first questionnaire measured the demographic characteristics of the participants and was sent out on the first day at 8:00 a.m. This questionnaire dealt with information concerning the gender, age, nationality, and occupation of the participants. Additionally, the participants were asked to indicate which VOD streaming services they used, e.g., Netflix, Amazon Prime, etc. (Appendix A.1). For participating in this study, the

only inclusion criteria were to be at least 18 years old and being able to use a smartphone. Usually engaging in VOD watching, was not part of the inclusion criteria.

Trait Self-control. The second questionnaire was also sent on the first day at 10:00 a.m. and dealt with the baseline traits of the participants. This study focussed on self-control as a trait measured with the Brief Self-Control Scale (BSCS; Tangney, Baumeister, & Boone, 2004), which is based on the 36-item Self-Control Scale (SCS). In the BSCS, self-control is measured with 13 items on a 5-point Likert scale. Hereby the participant decides on a range from 1 (not at all like me) to 5 (very much like me) how strongly they identify themselves with the statements. By taking the average of the scores of the 13 items, one gets the total score whereby nine of the items were negatively formulated and reversed for the calculation. Tangney, Baumeister, and Boone (2004) showed that the reliability and validity of the BCSC are more than sufficient with a high test-retest reliability ($r = .87$) and high internal consistency ($\alpha = .85$). Inadvertently only the first nine items of the BSCS were administered in the current study. Cronbach's alpha of these nine items was still sufficient ($\alpha = 0.72$). Therefore, the data was still used to compute a total scale score for trait self-control.

Daily VOD watching. To assess the VOD watching among participants, they received a notification each morning at 8:00 a.m. to fill out a questionnaire which they could complete by 12:30 p.m. (Appendix A.3). First, the participants were asked how long they watched VOD services yesterday. The answers ranged from "none", "less than 1 hour" to "more than 5 hours". It was also indicated that they should round up or down if it was not watched a full hour. Then it was asked how many episodes the participant watched yesterday, and it was also mentioned that movies, as well as documentaries, counted as one episode. The next question concerned the time when VOD content was watched, ranging from morning (6 a.m.-12 p.m.) till night (11 p.m. – 6 a.m.)

Daily Sleep. Daily sleep was measured in the morning of each day by using selected items adapted from The Pittsburgh Sleep Quality Index ($\alpha = .83$) (PSQI; Buysse, Reynolds, Monk, Berman & Kupfer, 1989). To examine the sleep quantity, the question "How many hours did you sleep approximately?" had to be answered by indicating the suitable number of hours in a selection list of integer numbers. Sleep quality was measured by responding to the question "Last night, how would you rate your quality of sleep?" as it was used in an experience sampling study of Lydon et al. (2016) on a touchpoint continuum with anchors at 0 = "Very bad" to 10 = "Very good". Hereby the continuum was adjusted from the original study by using a continuum from 1 to 10 instead of 1 to 100.

Procedure

All interested participants were firstly informed via email how to participate in the study, about the longitudinal nature of the research, and provided with first details about the general procedure of the study (Appendix B). After downloading the mobile application Ethica and the registration, all the participants received the informed consent form according to the guidelines of the ECBMS (Appendix C), which they had to accept to participate in the study. Each participant took part voluntarily and was able to withdraw from the study at any time without giving a reason.

On the first day of the research, the participants received their first two questionnaires in the morning about the demographics and baseline traits at 8 a.m. and 10:00 a.m. They had the whole day to fill out these questionnaires. When pretesting the questionnaires, the baseline questionnaire took around 15 minutes, the demographic questionnaire around 5 minutes. These two questionnaires were the only ones the participants had to fill out on Day 1. Then, from the second day on, the participants received the two daily questionnaires. Thus, participants got a notification at 8 a.m. and a reminder at 10:15 a.m. if the questionnaire was not filled out yet. Responding to these questionnaires took around 2 minutes when pretesting them. They expired after the given period, which was from 8 a.m. to 12:30. The second questionnaire was available from 6 p.m. and concentrated on the measurements of the other researchers. If any questions about the study arose, the participants could reach out to the researcher via email or WhatsApp, who tried to answer their questions the best possible. After 15 days of data collection, an email was sent out to thank the participants for their participation.

Data Analysis

For the data analysis, the statistical program for social sciences (SPSS, version 25) was used. The cut-off point used for inclusion of participants for analysis was set at having a completion rate of at least 70 percent of assessments since the response rates were comparatively high. Cutting it down to 50 percent, which was recommended by Conner & Lehman (2012), would have led to an unnecessarily high amount of missing data. Numerical variables were re-coded, as well as negatively formulated answers. The answers of the demographic assessment, including age, gender, nationality, and occupation, were examined through descriptive statistics. Mean estimates for sleeping and watching behavior over time and across participants were analyzed through linear mixed models to ensure relevant results despite repeated measurements. Day 14 and 15 were excluded from the analyses since several

participants started later and including these days would have caused too much missing data for the statistical analyses.

Moreover, it seemed suitable to use a cut-off point on the number of episodes and on the duration of time spent VOD watching. Therefore, a minimum of two episodes was chosen as it was often used in previous studies according to the review of Flayelle et al. (2020). In addition, a minimum of two hours of VOD watching was chosen, as in the same review of Flayelle et al. (2020), a cut-off point of one hour or three hours is most common. Therefore, the mean was chosen for this study. With that, the dichotomous variable "binge-watching" was created with two episodes and two hours of watching, to separate VOD watching from binge-watching.

To analyze the hierarchical and nested repeated measurements, a series of Linear Mixed Models (LMMs) with an auto regressive (AR1) structure for the repeated measurements were used. Because the data collection takes place over a period of time, instead of a single point of time, participants in ESM studies often miss one or more questionnaires. By applying LMMs, this data can still be used since it inherently estimates missing data based on previous responses. It is also suitable since, in comparison to the standard linear and logistic regression analysis techniques, it takes into account the nested repeated measurements arising by collecting data from the same participants repeatedly over 14 days (Verhagen et al., 2016). In all models, time was set as the repeated measurements, including the measurements on each of the 14 days, and the participants' username was set as the subjects.

In order to answer the first research question on whether there is an association between binge-watching and perceived sleep quality over time, the score of sleep quality was used as the dependent variable and the number of episodes and hours of watching as a covariate in two separate LMMs. In addition, one LMM was conducted with sleep quality as a dependent variable and binge-watching as an independent variable. In order to analyze the association between binge-watching and sleep quantity, the hours of sleep were used as the dependent variable and the number of episodes and hours of watching as covariates in two additional models. In addition, one LMM was conducted with sleep quantity as a dependent variable and binge-watching as an independent variable.

To further explore the nature of the association between binge-watching and sleep, a moderation analysis in terms of the LMM was conducted. The dependent variable in two different LMMs was the score of perceived sleep quality and hours of sleep respectively. As the independent variables binge-watching, the mean score of self-control, and the interaction

term between binge-watching and self-control were set as fixed factors and covariates. As significance level, $p = 0.05$ was used for all named analyses.

Results

General

The recruited sample of 81 participants completed the daily questionnaires via Ethica for 14 days. Six participants had to be excluded from the data set due to their low completion rates making a total of 75 respondents. The final participants were majorly young adults with a mean age of 22.9 years, 82.9% female and 17.1% male. The nationalities varied from German (94.6%), Dutch (1.4%) to "Other European" (4%). The average score of the self-control scale was 2.89 ($SD = 0.54$). As current occupation, 77.2% of the sample indicated to be "Student", 8% "Apprentices", 4.1% "Full-time employees", 1.4% Unemployed and 2.7% "Other" (Table 1).

Table 1

Characteristics of the Sample Population (N = 75)

Characteristics		n (%)	M (SD)
Age in years	19 – 60	75 (100)	22.9 (0.18)
	19-30	73 (97.4)	
	30 – 60	2 (2.6)	
Gender	Female	62 (82.9)	
	Male	13 (17.1)	
Nationality	German	71 (94.6)	
	Dutch	1 (1.4)	
	Other European	3 (4)	
Occupation	Student	58 (77.2)	
	Apprentice	6 (8)	
	Part-time employee	3 (4.1)	
	Full-time employee	5 (6.5)	
	Unemployed	1 (1.4)	
	Other	2 (2.7)	

Note. n = numbers of the sample; M = Mean; SD = Standard Deviation

Watching Behavior

On average, participants indicated to watch an estimated length of 1.65 hours daily (*SE* = 0.74) VOD. The estimated average number of episodes watched was 2.38 episodes per day (*SE* = 0.21). Concerning the time of watching VOD, the majority of measurement occasions (69.5%) took place at least one time at night (11 p.m. – 6 a.m.). With the given cut-off point of watching two episodes and two hours of VOD, 48.2% of the measurement occasions qualified as so-called "binge-watching". The watching behavior seemed to fluctuate during the week, with minimal increases towards the weekend and peaks on the first Wednesday (Figure 2).

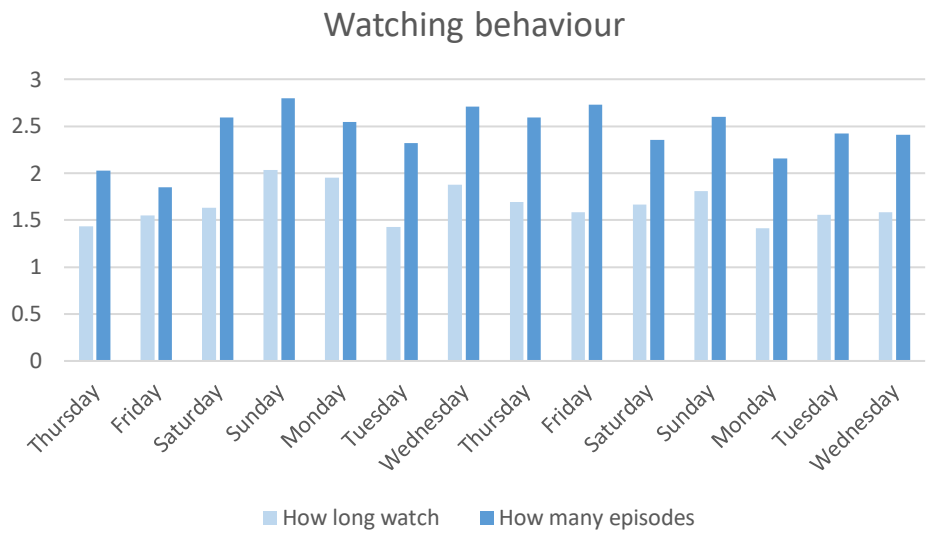

Figure 2. Watching behavior of all Participants in length and number of episodes

Sleep quality and quantity over time

The estimated average sleep quantity in participants was 7.49 hours per night (*SE* = 0.05), while the estimated average score of sleep quality was 6.39 (*SE* = 0.1). As shown in Figure 3, the hours of sleep increased slightly on the weekends, while the quality of sleep seemed unaffected by the different weekdays. Both average sleep quantity and quality were rather stable over the two weeks.

Figure 3. Sleeping behavior of all participants in length and rating of quality throughout the week

Association between VOD watching and sleep

Multiple linear mixed models were executed to test the association between the participants' VOD watching behavior and sleep. Neither binge-watching nor the number of hours or episodes watched was significantly associated with sleep quantity or sleep quality over time at the group level. None of the six LMMs showed a significant effect (Table 2).

Moderating role of self-control on the relation between binge-watching and sleep

Another two LMMs were conducted to examine the moderating role of self-control on the relation between binge-watching and sleep. Neither binge-watching in association with sleep quality with self-control as moderating variable, nor binge-watching in association with sleep quantity with self-control as moderating variable, showed significant effects. Nevertheless, while running the LMM with self-control as moderating variable, self-control showed a significant effect on "Hours of sleep". Therefore, a post hoc analysis was conducted by executing another LMM with "Hours of Sleep" as a dependent variable and "Self-control" as an independent variable. The results showed that self-control had a significant effect on the participants' duration of sleep (F (1, 277.18) = 14.8; $p < .01$). The unstandardized parameter estimate was positive ($B = 0.35$; $SE = 0.09$), indicating that higher self-control led to an increased duration of sleep, even though this effect appeared to be small (Table 3).

Table 2

Linear Mixed Model Analysis with Fixed Factors and Covariates

Dependent variable	Covariate/Factor	B (SE)	95% CI (LB, UB)	F (df1, df2)	p
Hours of sleep	Binge-watching	0.02 (0.09)	(-0.15, 0.19)	F 0.04 (1, 913.07)	.85
Hours of sleep	Hours watched	0.01 (0.03)	(-0.05, 0.06)	0.2 (1, 856.91)	.88
Hours of sleep	Episodes watched	-0.01 (0.01)	(-0.03, 0.02)	0.23 (1, 510.08)	.63
Quality of sleep	Binge-watching	-0.06 (0.14)	(-0.33, 0.21)	0.2 (1, 926.12)	.66
Quality of sleep	Hours watched	0.04 (0.5)	(-0.05, 0.13)	0.91 (1, 935.59)	.34
Quality of sleep	Episodes watched	-0.001 (0.02)	(-0.05, 0.05)	0.002 (1, 644.65)	.96
Hours of sleep	Self-control	0.35 (0.09)	(0.17, 0.53)	14.8 (1, 277.18)	.01

Note. B = B-estimate; SE = standard error; LB = Lower Bound of the 95% confidence interval, UB = Upper Bound of the 95% confidence intervals

Table 3

Linear Mixed Model Analysis of Moderation Effects with Fixed Factors and Covariates

Dependent variable	Covariate	B (SE)	95% CI (LB, UB)	F (df1, df2)	p
Hours of sleep	Binge-watch* Self-control	-0.01	(-0.33, 0.31)	0.003 (1, 901,74)	.96
Quality of sleep	Binge-watching * Self-control	0.06 (0.26)	(-0.45, 0.56)	0.05 (1, 909.47)	.82

Note. B = B-estimate; SE = standard error; LB = Lower Bound of the 95% confidence interval, UB = Upper Bound of the 95% confidence intervals

Discussion

Interpretation and implications of the main finding

This study was the first study investigating patterns of binge-watching in relation to sleep and self-control over time by using ESM. It was aimed to gain a deeper insight into whether the amount of VOD or binge-watching interferes with the sleep quality as well as quantity of the user and if self-control plays a moderating role in this possible association. There was no significant direct association between binge-watching and sleep in quality or quantity found. Also, self-control did not moderate the association between sleep and binge-watching. In other words, the amount of binge-watching did not influence sleep in length or quality, nor did self-control amplify or weaken this association.

Results concerning binge-watching and sleep of this study were contrary to previous findings. For example, Exelmans and Van den Bulck (2017a), found an association between binge-watching and poor sleep quality. Further, Fossum et al. (2014) found an association between watching TV series and insomnia. Both studies focused on a different target group or using another method than in the current study, which could explain the different outcomes. Still, some studies can partly support the results of the current study. Even though Oberschmidt (2017) found a significant correlation between binge-watching and sleep outcome in her cross-sectional survey study, this only referred specifically to binge-watching at night. An overall correlation between sleep outcome and binge-watching was not found, similar to the current study. It can be hypothesized that students, who made up most of the current sample, do not have as a strict of a schedule as a person who already works daily. Therefore, they can engage in binge-watching, also at night, without decreasing the hours of sleep.

The notion of students having a less strict schedule can be supported by the findings of Majumdar, Biswas, and Sahu (2020). They conducted research on the sleeping behavior of students and office workers, whereby students overslept and napped during the daytime about half an hour more per day than office workers. Suiting these findings, Lima, Medeiros, and Araujo conducted a study in 2002 examining whether a late sleeping pattern is related to the quality of sleep. Results showed that this is not the case as students with a later onset of sleep slept longer and even showed a better quality of sleep. This would explain why, even if students engage in binge-watch at night, their sleep quality and quantity are not influenced, since solely a later onset does not interfere with those aspects of sleep. In this case, it would be valuable for future research to examine if there is an association between binge-watching and sleeping patterns in terms of a later onset instead of sleeping quality and quantity among

students.

Concerning the potential moderation effect of self-control, the results showed that self-control did not moderate the association between binge-watching and sleeping behavior. A higher or lower score of self-control did not increase or decrease the influence of binge-watching on sleep. Even though Hofmann, Reinecke and Meier (2017) described self-control as a moderator on the association between media use and wellbeing, no comparable results were found in this study. The trait self-control does not influence the association between media use in form of binge-watching and well-being in form of sleep outcome. For future research, other character traits should be taken into consideration. It would also be interesting for future research to investigate if age or occupational differences change the outcome, since this sample majorly consisted of young students.

Regarding the participants' sleeping behavior, the participants rated their sleep on a scale from one to ten with a score between six to seven on average. This supports the statement of Philips (2019), suggesting that sleep quality is to be improved for a lot of people. Coming to the hours of sleep, the sample slept seven and a half hours per night on average, a similar amount as in the study of Schlarb, Kulessa, and Gulewtisch (2012), where they investigated sleep amongst German university students. This seems quite much compared with working adults in the year 2017, who majorly indicated to sleep around six to seven hours leading to the assumption that students sleep more (Statista, 2017). This could again be explained by not having the regular working schedules, a family to take care of, or different factors of other adults that could lead to a more restricted sleeping schedule. When taking into account the low variation of the sleeping behavior, it makes sense, that no significant association could be found between sleep and binge-watching since the hours stayed relatively the same over the whole week.

Even though it was not formulated as a specific research question, a significant and positive direct effect was found regarding the trait self-control and sleep quantity over time. Meaning that the more self-control the participant indicated, the more hours they slept. This is in line with Meldrum, Barnes, and Hay (2015), who found that sleep deprivation and low self-control are positively related. In addition, Kroese et al. (2014) found that people who are low in self-regulation or self-control as a trait are more likely to postpone their bedtime since they are occupied with different activities or intentions which they find hard to quit. Also interesting is the possible reciprocal relationship between low self-control and sleep. Meaning that not only lower self-control could lead to lower sleep duration, but also a lower amount of sleep could lead to lower self-control (Pilcher, Morris, Donnelly & Feigl, 2015). Pilcher et al.

(2015) reviewed the interactions between sleep habits and self-control and found that poor sleeping habits, including inconsistent sleep times and inadequate sleep quantity, could negatively impact self-control.

The current findings support the notion of Flayelle et al. (2019), who state that binge-watching is an overly pathologized phenomenon, and one should be cautious when conducting research in that area since a lot of researchers are following a negatively biased approach, eager to find harmful consequences of binge-watching. As this study did not show any significant results, it is also possible that binge-watching simply does not have any negative consequences on sleep in quality or quantity, nor has self-control anything to do with this lack of association. Suiting to this, according to the chosen cut-off point based on the systematic review of Flayelle et al. (2020) of two hours and two episodes as minimum, almost half of the measurement occasions could be described as binge-watching. Regarding this and that binge-watching increasingly got more popular over the last years, one could say that binge-watching became the new normal way of watching VOD. Future research is necessary to confirm this notion especially with regard to a more representative sample.

Strengths

The high sample size of 75 participants was one strength of this study, as more variety within the sample can be expected. Even though it is not necessary for ESM to have a big sample since repetitive measurements maximize the validity and reliability, it was still interesting to have a broad insight into the behavior of many participants (Riediger, 2009). Another strength was using ESM, which allows for more profound insight into the participant's lives by collecting daily information from them concerning sleep and binge-watching during a longer period. Specific advantages of ESM lie in minimizing retrospective response biases and maximizing the validity of the assessment by the repetitive measurements. Since human memory imposes limits in its validity when reporting retrospectively, this bias can be avoided by ESM because the measurement takes place immediately in the natural environment of the participant. Especially in social and behavioral research this method allows for clarity and precision in-depth (Riediger, 2009). Due to the increasing number of people possessing a mobile device, ESM is getting easier to implement nowadays, especially for a young sample like the current study. ESM studies give the researcher insight into the specific daily experiences or behaviors of a participant or in multiple participants over a period from several days to weeks (Van Berkel, Ferreira & Kostakos, 2017). This also allows to capture fluctuations of these experiences like if the

watching or sleeping behavior differed on weekdays in comparison to the weekend (Schneider, 2006).

Limitations and alternative explanations

Besides the mentioned strengths, this study faced some limitations which should be considered. Since the study took place approximately one year after the outbreak of COVID-19, it was possibly susceptible to different results than in a normal setting. As Dixit, Marthoenis, Arafat, Sharma, and Kar (2020), found the watching behavior of the population already changed in the first year of the pandemic. It is possible that the increased watching behavior led to persons getting used to spending a lot of time with VOD watching and therefore, being less susceptible to differences in their behaviors. Additionally, it is also possible that the pandemic changed the sleeping behavior of participants since working or studying from home allows for a more flexible sleeping schedule. This could result in diminishing or even suppressing associations between the two variables of interest.

Furthermore, even though ESM has its advantages as a method, it also brings some limitations with it. For once, the researcher has to rely on self-reports provided by the participants. Depending on how advanced their introspective abilities are, they could rate their sleep quality or self-control differently than it actually is. A solution for that problem could be a sleep monitor device, giving more detailed and accurate information about the sleep quantity. Another limitation of ESM is the potential to create measurement reactivity. Meaning that periodically asking the same questions per day about certain behavior could increase self-reflected awareness. With that, the behavior itself might be influenced (Barret & Barret, 2001). For example, this could lead to participants being more aware of their VOD behavior and trying to change it.

Additionally, by recruiting the participants by the researchers themselves, a certain selection bias could distort the results. Since the participants were majorly from the researcher's social environment, the sample consisted mostly of young female students. This could distort the results in certain points since people at this age are most likely to watch VOD (Atomik Research, 2019). Meaning that when taking into account also people with a steady working job on the weekdays or with family, the results could have been different. Moreover, studying itself can be pretty demanding, which could also result in having a sample of higher self-control than in a population that is not engaging in studying. Lastly, considering that the researchers gathering the data were all German bachelor students, the nationality of the sample was also biased, resulting in having majorly German participants. This could be problematic for generalizing the results to other countries.

Contributions and future research

This work contributes to existing research on binge-watching and its association to sleep while considering the influence of self-control. As there was no significant effect found concerning the original research questions, it showed that binge-watching did not have a negative or positive consequence on sleep, neither in its duration nor in its perceived quality, and that self-control does not influence this association. Still, it is possible that the results would look different when changing the target group of the study to participants with a more regulated schedule like participants with a steady working job on a five-day working week, an established family life, or participants outside the "academic bubble". This could be worth investigating for future research. Further, it would be interesting to see if the sleeping pattern of students changes due to binge-watching, meaning the sleep quality and quantity stays the same, but sleep onset will be delayed. That would be in line with the findings of Sigman (2007), in which he mentions that melatonin levels, a sleep-promoting hormone, rise in the dark. When staring at a light screen before sleeping, the melatonin production can be decreased. Even though it would not influence the length or the quality of sleep, it could postpone sleeping itself. Also, future studies could investigate the possible influence of self-control on this association, since low self-control can lead to delaying the bedtime, as Exelmans and Van den Bulck (2017a) showed in their study, still using another method and target group.

Furthermore, future studies could take self-control into account as a state measure instead of a trait measure. The important difference is that trait self-control describes rather the stable ability to handle dilemmas of self-control in a way that the desired goal is prioritized (De Ridder, Kroese & Gillebaart, 2018). On the other side, state self-control is a more transient level of self-control in a particular moment. Self-control failure arises when effortful inhibition is no longer possible since the individual finds themselves in a state of ego depletion. This concept is called strength model of self-control, which describes that after the previous exertion of self-control, resources are exhausted, which leads to lower performances on tasks requiring self-control (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Considering this, one could investigate in future research if the state of self-control, also measured on a daily basis, can be associated with binge-watching, and sleeping.

Lastly, even though experience sampling allows for a more detailed insight into the participants' everyday lives, this study's findings still describe the behavior on a group level. This leaves the opportunity open for longitudinal research on an individual level.

Conclusion

Overall, against previous assumptions no negative effects of binge-watching on sleep quantity or quality were found, nor had higher self-control the assumed diminishing effects on that association. Even though the results cannot be generalized to the whole population concerning age and occupation, it still gives an important insight into the sleeping and watching behavior of young adults and how self-control does positively influence sleep duration. However, this study faced some challenges, which should be considered when interpreting the results or replicating the study.

References

Ahmed, A. A. A. M. (2017). New era of TV-watching behavior: Binge watching and its psychological effects. *Media Watch, 8*(2), 192-207. doi: 10.15655/mw/2017/v8i2/49006

Atomik Research (2019) AASM Sleep Prioritization Survey Binge-Watching Past Bedtime, https://www.statista.com/statistics/1075454/binge-watching-tv-after-bedtime-us/. Accessed on 21 February 2021.

Barrett, L. F., & Barrett, D. J. (2001). An introduction to computerized experience sampling in psychology. *Social Science Computer Review*, *19*(2), 175-185. doi: 10.1177/089443930101900204

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74* (5), 1252–1265. Doi:10.1037/0022-3514.74.5.1252

Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*, *28*(2), 193-213. Doi:10.1016/0165-1781(89)90047-4

Conner, T. S., & Lehman, B. J. (2012). Getting started: Launching a study in daily life. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (89 –107). The Guilford Press.

Devasagayam, R. (2014). Media bingeing: A qualitative study of psychological influences. *Once Retro Now Novel Again: 2014 Annual Spring Conference Proceedings of the Marketing Management Association* (pp. 40-44), http://www.mmaglobal.org/publications/Proceedings/2014-MMA-Spring-Conference Proceedings.pdf#page=56. Accessed on 01 March 2021.

de Ridder, D., Kroese, F., & Gillebaart, M. (2018). Whatever happened to self-control? A proposal for integrating notions from trait self-control studies into state self-control research. *Motivation Science*, *4*(1), 39. doi: org/10.1037/mot0000062

Dixit, A., Marthoenis, M., Arafat, S. Y., Sharma, P., & Kar, S. K. (2020). Binge watching behavior during COVID 19 pandemic: a cross-sectional, cross-national online survey. *Psychiatry research*, *289*, 113089. doi: 10.1016/j.psychres.2020.113089

Ethica Data (2020), https://ethicadata.com/. Accessed on 24 June 2021.

Exelmans, L., & Van den Bulck, J. (2017a). Binge viewing, sleep, and the role of pre-sleep arousal. *Journal of Clinical Sleep Medicine*, *13*(8), 1001-1008. doi.org/10.5664/jcsm.6704

Exelmans, L., & Van den Bulck, J. (2017b). “Glued to the Tube” The Interplay Between Self Control, Evening Television Viewing, and Bedtime Procrastination. *Communication Research*, *48*(4), 594–616.. doi.org/10.1177/0093650216686877

Flayelle, M., Maurage, P., Di Lorenzo, K. R., Vögele, C., Gainsbury, S. M., & Billieux, J. (2020). Binge-watching: What do we know so far? A first systematic review of the evidence. *Current Addiction Reports*, *7*(1), 44-60. doi: 10.1007/s40429-020 00299-8

Flayelle, M., Maurage, P., Vögele, C., Karila, L., & Billieux, J. (2019). Time for a plot twist: Beyond confirmatory approaches to binge-watching research. *Psychology of Popular Media Culture*, *8*(3), 308. doi.org/10.1037/ppm0000187

Fossum, I. N., Nordnes, L. T., Storemark, S. S., Bjorvatn, B., & Pallesen, S. (2014). The association between use of electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness, morningness, and chronotype. *Behavioral Sleep Medicine, 12*(5), 343-357. doi: 10.1080/15402002.2013.819468

Gangadharbatla, H., Ackerman, C., & Bamford, A. (2019). Antecedents and consequences of binge-watching for college students. *First Monday, 24*(12). doi: 10.5210/fm.v24i12.9667

Hofmann, W., Reinecke, L., & Meier, A. (2017). *Of sweet temptations and bitter aftertaste: Self-control as a moderator of the effects of media use on well-being*. L. Reinecke & M. B. Oliver (Eds.), The Routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects (pp. 211 222). New York: Routledge.

Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012). Everyday temptations: an experience sampling study of desire, conflict, and self-control. *Journal of Personality and Social Psychology, 102*(6), 1318-1335. doi: 10.1037/a0026545

Jenner, M. (2017). Binge-watching: video-on-demand, quality TV and mainstreaming fandom. *International journal of cultural studies*, *20*(3), 304-320. doi:10.1177/1367877915606485

Katz, D. A., & McHorney, C. A. (2002). The relationship between insomnia and health related quality of life in patients with chronic illness. *Journal of Family Practice, 51*(3), 229-234.

Kroese, F. M., De Ridder, D. T. D., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: Introducing a new area of procrastination. *Frontiers in Psychology, 5* (611). doi:10.3389/fpsyg.2014.00611

Kroese, F. M., Evers, C., Adriaanse, M. A., & de Ridder, D. T. (2016). Bedtime procrastination: A self-regulation perspective on sleep insufficiency in the general population. *Journal of health psychology*, *21*(5), 853-862. doi: 10.1177/1359105314540014

Lima, P. F., Medeiros, A. L. D., & Araujo, J. F. (2002). Sleep-wake pattern of medical students: early versus late class starting time. *Brazilian Journal of Medical and Biological Research*, *35*(11), 1373-1377, https://www.scielo.br/j/bjmbr/a/MmjCZrwywhFBRWsZpdTpMHg/?lang=en&forma=pdf. Accessed 01 June 2021.

Lydon, D. M., Ram, N., Conroy, D. E., Pincus, A. L., Geier, C. F., & Maggs, J. L. (2016). The within-person association between alcohol use and sleep duration and quality in situ: An experience sampling study. *Addictive behaviors, 61*, 68-73. doi: 10.1016/j.addbeh.2016.05.018

Majumdar, P., Biswas, A., & Sahu, S. (2020). COVID-19 pandemic and lockdown: cause of sleep disruption, depression, somatic pain, and increased screen exposure of office workers and students of India. *Chronobiology International*, *37*(8), 1191-1200. doi: 10.1080/07420528.2020.1786107

Meldrum, R. C., Barnes, J. C., & Hay, C. (2015). Sleep deprivation, low self-control, and delinquency: A test of the strength model of self-control. *Journal of youth and adolescence*, *44*(2), 465-477. DOI 10.1007/s10964-013-0024-4

National Sleep Foundation (2020). Americans Feel Sleepy 3 Days a Week, With Impact on Activities, Mood & Acuity, https://www.sleepfoundation.org/wp content/uploads/2020/03/SIA-2020-Q1-Report.pdf?x37976. Accessed on 21 February 2021.

Netflix (2020). *About Netflix*, https://media.netflix.com/de/about-netflix. Accessed 17 February 2021.

Oberschmidt, K. (2017) The relationship between Binge-watching, Compensatory Health Beliefs, and Sleep (Bachelor's thesis). https://essay.utwente.nl/72663/1/Oberschmidt_BA_BMS.pdf. Accessed 17 April 2021

Pilcher, J. J., Morris, D. M., Donnelly, J., & Feigl, H. B. (2015). Interactions between sleep habits and self-control. *Frontiers in human neuroscience*, *9*, (284). doi: 10.3389/fnhum.2015.00284

Philips (2019). Percentage of adults in select countries worldwide who agreed with select sleep habits as of 2019, https://www.statista.com/statistics/1036637/sleep-habits-of adults-worldwide/. Accessed 21 February 2021.

Reinecke, L., & Hofmann, W. (2016). Slacking off or winding down? An experience sampling study on the drivers and consequences of media use for recovery versus procrastination. *Human Communication Research, 42*(3), 441-461. doi.org/10.1111/hcre.12082

Riediger, M. (2009). Experience sampling. German Council for Social and Economic data, *Psychology of Science, 62*, 4-5, https://www.jstor.org/stable/pdf/j.ctvbkk43d.35.pdf. Accessed 25 May 2021.

Rubenking, B., Bracken, C. C., Sandoval, J., & Rister, A. (2018). Defining new viewing behaviours: What makes and motivates TV binge-watching? *International Journal of Digital Television*, *9*(1), 69-85. doi: 10.1386/jdtv.9.1.69_1

Schlarb, A. A., Kulessa, D., & Gulewitsch, M. D. (2012). Sleep characteristics, sleep problems, and associations of self-efficacy among German university students. *Nature and science of sleep*, *4*(1). doi: 10.2147/NSS.S27971

Schneider, B. (2006). In the Moment: The Benefits of the Experience Sampling Method. In M. Pitt-Catsouphes, E. E. Kossek, & S. Sweet (Eds.*), The work and family handbook: Multi-disciplinary perspectives, methods, and approaches* (pp. 469–488). Lawrence Erlbaum Associates Publishers.

Schweidel, D. A., & Moe, W. W. (2016). Binge watching and advertising. *Journal of Marketing*, *80*(5), 1-19. doi: 10.1509/jm.15.0258

Shim, H., Lim, S., Jung, E. E., & Shin, E. (2018). I hate binge-watching but I can't help doing it: The moderating effect of immediate gratification and need for cognition on binge watching attitude-behavior relation. *Telematics and Informatics*, *35*(7), 1971-1979. doi.:10.1016/j.tele.2018.07.001

Sigman, A. (2007). Visual voodoo: The biological impact of watching TV. *Biologist*, *54*(1), 12-17, http://aricsigman.com/IMAGES/VisualVoodoo.pdf. Accessed 14 March 2021.

Statista Digital Market Outlook (2020). Digital Media Report 2020, https://de.statista.com/statistik/studie/id/45113/dokument/digital-media-report/. Accessed 14 March 2021.

Statista (2017) Durchschnittliche Schlafdauer in Deutschland im Jahr 2017, https://de.statista.com/statistik/daten/studie/801663/umfrage/durchschnittliche schlafdauer-in-deutschland/. Accessed 9 June 2021

Steins-Loeber, S., Reiter, T., Averbeck, H., Harbarth, L., & Brand, M. (2020). Binge Watching Behaviour: The Role of Impulsivity and Depressive Symptoms. *European addiction research*, *26*(3), 141-150. Doi: 10.1159/000506307

Tangney, J. P., Boone, A. L., & Baumeister, R. F. (2018). *High self-control predicts good adjustment, less pathology, better grades, and interpersonal success*. Self-regulation and self-control (1st ed.), 173-212, London: Routledge.

Troles, H. (2019) *Binge-watching and its influence on psychological well-being and important daily life* duties: *An Experience Sampling Study* (Bachelor Thesis). https://essay.utwente.nl/78395/1/Troles_BA_Psychology.pdf. Retrieved 17 April 2021.

Umesh, S., & Bose, S. (2019). Binge-watching: A matter of concern? *Indian journal of psychological medicine*, *41*(2), 182-184. Doi:10.4103/IJPSYM.IJPSYM_279_18

Van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The experience sampling method on mobile devices. ACM Computing Surveys (CSUR), 50(6), 1-40. Doi: 10.1145/3123988

Van der Lely, S., Frey, S., Garbazza, C., Wirz-Justice, A., Jenni, O. G., Steiner, R., ... & Schmidt, C. (2015). Blue blocker glasses as a countermeasure for alerting effects of evening light-emitting diode screen exposure in male teenagers. *Journal of Adolescent Health*, *56*(1), 113-119. doi: 10.1016/j.jadohealth.2014.08.002

Vaterlaus, J. M., Spruance, L. A., Frantz, K., & Kruger, J. S. (2019). College student television binge watching: Conceptualization, gratifications, and perceived consequences. *The Social Science Journal*, *56*(4), 470-479. doi: 10.1016/j.soscij.2018.10.004

Verhagen, S. J., Hasmi, L., Drukker, M., van Os, J., & Delespaul, P. A. (2016). Use of the experience sampling method in the context of clinical trials. *Evidence-based mental health*, *19*(3), 86-89. doi: 10.1136/ebmental-2016-102418

Viens, A., & Farrar, K. M. (2021). Conceptualizing and Measuring Binge Watching. *Communication Studies,* 1-18. Doi: 10.1080/10510974.2021.1876748

Walton-Pattison, E., Dombrowski, S. U., & Presseau, J. (2018). 'Just one more episode': Frequency and theoretical correlates of television binge watching. *Journal of health psychology*, *23*(1), 17-24. doi:1 0.1177/1359105316643379

Wenzel, P., Mahle, I., & Pätzmann, J. U. (2016). Streaming services & service design: An analysis of Netflix and Amazon video based on the Gap Model by Parasuraman, Berry

& Zeithaml. *Journal of Brand Planning* (5), 20–31. http://hdl.handle.net/10419/178306. Accessed 17 February 2021.

West, K. (2014), 'Unsurprising: Netflix survey indicates people like to binge watch TV', CinemaBlend, 13, http://www.cinemablend.com/television/Unsurprising-Netflix Survey Indicates-People-Like-Binge-Watch-TV61045.html. Accessed 20 February 2021.

Appendix A
Questionnaires in the Ethica application

A.1 Demographics and general information

Collect information about the participants and their background

Thank you for participating in our study and welcome to your first questionnaire 😊 With this questionnaire we want to gain some information about you and your background - no worries, just some casual facts. Have fun filling it out!

PS: concerning the whole study coming up: please try to fill out the questionnaires on time! You will receive reminders so you won't forget it since we know how easily that can happen. Still, *if* it happens that you forget to fill out one questionnaire that is okay, please just continue with the next ones, so we can still use the data! Thank you 💟

1. What is your age?

2. What is your gender?
   - Female
   - Male
   - Diverse
   - Wish not to disclose

3. What is your nationality
   - German
   - Dutch
   - Other European
   - Non-European

4. What is your occupation
   - Pupil
   - Student
   - Apprentice
   - Part-time employee
   - Full-time employee
   - Unemployed
   - Self-employed
   - Other

5. Which streaming services are you using?

- Netflix
- Amazon Prime
- Disney+
- TVNow
- Joyn
- Youtube
- Sky
- Hulu
- Maxdome
- Dazn
- Other
- I do not use streaming services

Great work! Thank you for your information, if you have a couple more minutes, please take a look at the baseline measurement. Thank you!

A.2 Baseline measurement

Please fill out this questionnaire! Thank you!

This questionnaire only needs to be filled out **once**. We know this one is a bit longer than the others (it will take you around 10 minutes to fill it out) but please take your time and answer as honest as possible. The daily questionnaires will take you **way less** time to fill out, we promise! 😊

1. In the last month, how often have you been upset because of something that happened unexpectedly?
   - Never
   - Almost Never
   - Sometimes
   - Fairly Often
   - Very Often

2. In the last month, how often have you felt that you were unable to control the important things in your life?
   - Never
   - Almost Never
   - Sometimes
   - Fairly Often
   - Very Often

3. In the last month, how often have you felt nervous and “stressed”?
   - Never
   - Almost Never
   - Sometimes
   - Fairly Often
   - Very Often

4. In the last month, how often have you felt confident about your ability to handle your personal problems?
    - Never
    - Almost Never
    - Sometimes
    - Fairly Often
    - Very Often

5. In the last month, how often have you felt that things were going your way?
    - Never
    - Almost Never
    - Sometimes
    - Fairly Often
    - Very Often

6. In the last month, how often have you found that you could not cope with all the things that you had to do?
    - Never
    - Almost Never
    - Sometimes
    - Fairly Often
    - Very Often

7. In the last month, how often have you been able to control irritations in your life?
    - Never
    - Almost Never
    - Sometimes
    - Fairly Often
    - Very Often

8. In the last month, how often have you felt that you were on top of things?
    - Never
    - Almost Never
    - Sometimes
    - Fairly Often
    - Very Often

9. In the last month, how often have you been angered because of things that were outside of your control?
    - Never
    - Almost Never
    - Sometimes
    - Fairly Often
    - Very Often

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

- Never
- Almost Never
- Sometimes
- Fairly Often
- Very Often

11. I am relaxed most of the time
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

12. I seldom feel blue
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

13. I get stressed out easily
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

14. I worry about things
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

15. I am easily disturbed
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

16. I get upset easily
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

17. I change my mood a lot
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

18. I have frequent mood swings
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

19. I get irritated easily
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

20. I often feel blue
    - Very accurate
    - Moderately accurate
    - Neither inaccurate nor accurate
    - Moderately inaccurate
    - Very inaccurate

21. Please indicate now, how often do you experience the following feelings: I experience a general sense of emptiness.
    - None of the time
    - Rarely
    - Some of the time
    - Often
    - All of the time

22. There are plenty of people I can rely on when I have problems.
    - None of the time
    - Rarely
    - Some of the time
    - Often
    - All of the time

23. There are many people I can trust completely.
    - None of the time
    - Rarely
    - Some of the time
    - Often

- All of the time

24. I miss having people around.
    - None of the time
    - Rarely
    - Some of the time
    - Often
    - All of the time

25. There are enough people I feel close to.
    - None of the time
    - Rarely
    - Some of the time
    - Often
    - All of the time

26. I often feel rejected.
    - None of the time
    - Rarely
    - Some of the time
    - Often
    - All of the time

27. I fear others have more rewarding experiences than me
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

28. I get worried when I find out my friends are having fun without me.
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

29. I get anxious when I don't know what my friends are up to.
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

30. It is important that I understand my friends "in jokes".
    - Not all true of me
    - Slightly true of me

- Moderately true of me
- Very true of me
- Extremely true of me

31. Sometimes, I wonder if I spend too much time keeping up with what is going on
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

32. It bothers me when I miss an opportunity to meet up with friends.
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

33. When I have a good time, it is important for me to share the details online.
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

34. When I miss out on a planned get-together it bothers me.
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

35. When I go on vacation, I continue to keep tabs on what my friends are doing.
    - Not all true of me
    - Slightly true of me
    - Moderately true of me
    - Very true of me
    - Extremely true of me

36. You are almost done! Just a few questions more 🏁

37. I am good at resisting temptations (*Self-control scale start)
    - Not at all like me
    - Not like me
    - Neutral
    - Like me

- Very much like me

38. I have a hard time breaking bad habits
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

39. I am lazy
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

40. I say inappropriate things
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

41. I do certain things that are bad for me if they are fun
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

42. I refuse things that are bad for me.
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

43. I wish I had more selfdiscipline
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

44. People would say that I have iron self-discipline
    - Not at all like me
    - Not like me

- Neutral
- Like me
- Very much like me

45. Pleasure and fun sometimes keep me from getting work done (*Self-control scale end)
    - Not at all like me
    - Not like me
    - Neutral
    - Like me
    - Very much like me

46. I needlessly delay finishing jobs, even when they're important.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

47. I postpone starting in on things I don't like to do.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

48. When I have a deadline, I wait until the last minute.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

49. I delay making tough decisions.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

50. I keep putting off improving my work habits.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

51. I manage to find an excuse for not doing something.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

52. I put the necessary time into even boring tasks, like studying.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

53. I am an incurable time waster.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

54. I'm a time waster now but I can't seem to do anything about it.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

55. When something's too tough to tackle, I believe in postponing it.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

56. I promise myself I'll do something and then drag my feet.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

57. Whenever I make a plan of action, I follow it.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

58. Even though I hate myself if I don't get started, it doesn't get me going.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

59. I always finish important jobs with time to spare.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

60. I get stuck in neutral even though I know how important it is to get started.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

61. Putting something off until tomorrow is not the way I do it.
    - Disagree
    - Slightly disagree
    - Neither disagree nor agree
    - Slightly agree
    - Agree

62. YOU DID IT! We are proud of you, thank you so much for giving us your time 💟 See you again for the daily measurements and like we said, those are not as long as this questionnaire so please keep filling them out 😊

A 3 Morning questionnaire

1. We wish you a wonderful morning 🌞

Please take a moment to reflect and fill out this short questionnaire!

2. How **long** did you watch VOD services **yesterday**?

(If you did not watch a full hour, please just round up/off - e.g., if you watched more than 1 hour and 30 minutes please indicate 2 hours)

- I did not watch
- Less than 1 hour
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- 5 hours
- More than 5 hours

3. How many **episodes** did you watch **yesterday**? (please set the number to 0 if you did not watch any episodes and please count all movies/documentaries you watched also as episodes)
4. At what **time** did you start watching video-on-demand content **yesterday**?

(Multiple answers possible)

- Morning (6 a.m. – 12 p.m.)
- Afternoon (12 p.m. – 6 p.m.
- Evening (6 p.m. – 11 p.m.)
- Night (11 p.m. – 6 a.m.)
- I did not watch VOD services

5. What were your **reasons** for watching? (multiple answers are also possible)

- Entertainment
- Boredom/Nothing else to do
- Stress
- Interest/Curiosity
- Escape from reality/ Distraction
- Peer activity (watching with friends/family)
- Procrastination/Avoidance of responsibilities
- Information seeking
- Relaxation/Taking a break
- Loneliness
- Other
- I did not watch VOD services

6. How many **hours** did you **sleep approximately**?
7. Last night, how would you rate your **quality of sleep**?
8. Did you eat a snack yesterday **after dinnertime**?

- Yes
- No
- I cannot remember

9. If you ate a snack yesterday during the evening, which **type(s) of snack(s)** did you eat? (Multiple answers possible)

- Chocolate, candy, cake, ice cream or something similar
- Chips, flips or something similar
- Fruit or vegetables or something similar

- Crackers, nuts, yoghurt or something similar
- Other
- I cannot remember
- I did not eat a snack

10. What is your **current stress level**?
11. How **lonely** do you feel at the moment?

- Not at all
- Only a little
- To some extent
- Rather much
- Very much

12. That's already all we needed from you for now, see you in the evening.

Have a nice day! 

Appendix B
Invitation emails

Dear Participant,

Thank you very much for taking your time and supporting us with our bachelor thesis study! We will tell you everything you need to know before you can get started.

Overall, the aim of the study is to have a look at video on demand (VOD) watching behaviour and health related concepts. With the help of our questionnaires, we would like to gain more insights into your viewing behaviour over the next 14 days.

As of today, we would kindly like to ask you to download the **Ethica Data** app for either your Android or IOS smartphone. You will use this app on a daily basis to answer our little questionnaires and help us gather data.

Once you downloaded the app and created an account with your mail address, you can click on **Join Study** and enter the following code:

1712

And just like that you are part of our research!

To get started we would like to ask you to read our consent form and indicate whether you like to participate or not. After that you are done for today! **Tomorrow** you will receive your **first two questionnaires**, remember that these might take a little bit longer as these are baseline questionnaires. You probably will need 10 – 15mins to answer them. **After that**, you will receive a morning and an evening questionnaire for the next 14 days. These questionnaires are really short and will take you approximately 3mins in total to complete.

That is all you need to know! We would like to thank you again and wish you a lot of fun answering the questions.

Maybe you can even find out more about yourself!

Your dedicated psychology researchers,

Christine, Naomi, Lara, Annika, Celine, and Jeremy

Appendix C

Informed consent form

Informed consent

Welcome to our study about video-on-demand (VOD) watching behaviour!

Thank you for your time and support! Please read the following information carefully.

The aim of this research is to explore the relation between VOD watching and (mental) health-related variables. With your participation in this research you will help to make a contribution to the scientific knowledge of VOD watching behaviour.

You can participate in this study if you are at least 16 years old and proficient in English. Ethica is used over a 14-dayperiod to respond to short questionnaires on a daily basis. Please make sure that the notifications on your device for the application (Ethica) are turned on. This facilitates you to answer the questions in the pre-determined time frame.

At the start of the study, you will be asked to fill out a baseline questionnaire with questions about demographics, and personality traits. This questionnaire will take around 10 minutes to fill out. From the 8th of April, you will be asked to fill out a short questionnaire twice a day. The questionnaire will be around 5 minutes and the questions asked are about your mood, behaviour and feelings.

This research is not expected to pose any risks. One side effect that can occur is that you might be more aware of your daily mood, behaviour, and feelings. The participation in this study is voluntary. If you wish to withdraw from this research, you can do so at any time without giving a reason.

All your answers will be treated confidentially. Therefore, all personal data (e.g., e-mail, age, gender, etcetera) will be anonymized and will not be published and/or given to a third party.

The study has been approved by the Ethics Committee of the University of Twente, and is thus compliant with internationally recognised guidelines on ethical research.

If any questions or concerns arise before, during or after your participation, do not hesitate to contact the researchers:

Christina Ernsting (c.ernsting@student.utwente.nl)

Jeremy Hanhoff

Celine Mezielis

Naomi Nitsche

Lara Schwerdtner

I have fully read and understand the text above and I am willing to participate in this study.