Sleep and Digital Altruism: Are Good Sleepers, Good Doers?

Sleep and Digital Altruism: Are Good Sleepers, Good Doers?

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Abstract

The present study was designed to examine the association of self-reported acts of digital altruism with sleep quantity and sleep quality. The sample included 228 adult (18+ years of age) participants residing in the United Sates, recruited through Facebook and Amazon Mechanical Turk (Mturk). Participants completed an online survey that included five scales (Sleep Quality Measure, Online Prosocial Behavior Scale, Internet Use Scale, Subjective Happiness Scale, BFI-10) as well as seven single item indicators which included motivation for being kind online and sleep quantity.

Bivariate correlations showed that sleep quantity—but not sleep quality—was positively correlated with performing digital altruism. Mediation analysis results revealed that the correlation between sleep quantity and performing digital altruism was fully mediated by happiness, which suggests that the mechanism by which sleep quantity impacts rates of performing digital altruism is driven by the fact that more sleep makes people happier which in turn makes them more digitally altruistic.

Regression results show that people who sleep more are more digitally altruistic. The association between sleep quantity and performing digital altruism was curvilinear, such that the effect reverses with very high amounts of sleep. The effect of sleep quantity on performing digital altruism remained significant when including demographic variables (sex, age, ethnicity, religion, education, platform). When incorporating all other study variables (receiving digital altruism, happiness, Internet use, personality (extraversion/agreeableness/conscientiousness/openness/neuroticism), motivation (help

others in need/paint myself in positive light/make the world a better place) the effect of sleep quantity on performing digital altruism was accounted for by motivation (to make the world a better place), receiving digital altruism, frequency of internet use, and extraversion. Results of this study suggest an association between sleep quantity and performing acts of digital altruism which extends previous research findings that sleep quantity is associated with performing traditional altruism. This finding lends support for prior research showing a positive association between online and offline behaviors. This study further highlights the importance of receiving sufficient sleep due to its association with increased happiness and more frequent acts of performing digital altruism, and simultaneously underscores the need for future research regarding risks associated with excessive sleep. Limitations and future directions of this research are noted.

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Chapter I

Introduction

Altruism and sleep are important fields of study, both individually and in combination. Engaging in acts of traditional altruism (i.e., altruism without the use of electronic technology) is associated with improvements in mental and physical health among adults as evidenced by lower levels of depression and anxiety (Musick & Wilson, 2003; Post, 2005; Schwartz, Meisenhelder, Yunsheng, & Reed, 2002), reduced levels of stress (Brown, & Brown, 2015; Mills, Reiss, & Dombeck, 2008; Raposa, Laws, & Ansell, 2016), longer lifespan (Brown, Consedine, & Magai, 2005; Poulin, Brown, Dillard, & Smith, 2013), and enhanced well-being (Robotham, 2012; Thoits & Hewitt, 2011). Thus, identifying ways to increase rates of altruism could potentially proffer better health. The importance of sleep to health and behavior is also well-documented. Receiving sufficient sleep and good quality sleep positively affect mental and physical health, whereas insufficient sleep or poor quality sleep negatively impacts mental and physical health (Colten & Altevogt, 2006; Patel, 2008; Taheri, Lin, Austin, Young, & Mignet, 2004). Despite these findings, the importance of sleep is often overlooked in Western societies, where people work longer hours and sleep fewer hours than in recent history. This is evidenced by the U.S. Center for Disease Control and Prevention declaring sleep deprivation a public health epidemic (CDC, 2013). Improving the amount and quality of sleep could be an efficient and effective solution to many societal problems as well as a potential avenue for increasing rates of altruism, as will be discussed later, necessitating integrated research with sleep.

Sleep and Traditional Altruism

The association between sleep and performing traditional altruism (e.g., prosocial behavior) has been documented, most frequently using the Dictator game, a game commonly used in altruism research. The Dictator game is designed to assess how participants respond to situations where self-interest and equality are in conflict. The game is played by two participants (player 1 is the dictator, player 2 is the recipient) and is double blind (i.e., neither participant knows the identity of the other, only what their specified role is). The dictator decides how an endowment (usually a small sum of money) shall be divided; the recipient has no input in the outcome of the game. Game theory predicts that the dictator would keep the maximum amount for himself/herself; therefore, any amount offered by the dictator to the recipient is presumed to reflect prosocial behavior that is termed "altruistic fairness" (Ferrara et al., 2015). The more money that the dictator offers to the recipient, the higher the dictator's altruism score.

Ferrara and colleagues (2015) assessed altruistic behavior after sleep deprivation in a sample of young adults using the Dictator game. Women were less altruistic after sleep deprivation than when they enjoyed undisturbed sleep. However, these results should be interpreted with caution as the study sample (n = 32) and scope (one night of rested sleep and one night of sleep deprivation) were limited. The present study includes a larger sample of adults and assesses sleep more globally to improve generalizability.

Dickinson and McElroy (2017) expanded on sleep restriction research by including circadian misalignment. It was hypothesized that sleepiness—whether due to sleep restriction or suboptimal time of the day—would be associated with fewer prosocial decisions. Prosocial behavior was measured with three well-known social decision tasks: the Ultimatum, the Dictator, and the Trust games. Chronic sleep restriction and adverse sleep states were found to directly

(and indirectly via sleepiness) reduce prosocial behaviors. Because Dickinson and McElroy (2017) employed at-home sleep manipulation protocols instead of using a laboratory setting, the results are more representative. However, prosocial behavior was measured in a laboratory setting only in the context of three specific games, which may not provide an accurate depiction of altruism in the real world. The present study assesses sleep quantity, sleep quality, and digital altruism (e.g., online prosocial behavior) as they naturally occur to better reflect reality.

Digital Altruism

Altruism is a broad concept, which has led to a lack of consensus among researchers regarding its conceptualization. Researchers from various fields have used conflicting definitions and theories for altruism, which Gruber (1997) suggests is the reason why many researchers avoid this area of research entirely. Altruism has evolved in form over time, with intermittent, episodic volunteering becoming a worldwide trend (Cnaan & Handy, 2005) as busy individuals are increasingly less able to make lengthy time commitments to charitable organizations. Indeed, research indicates that the biggest barrier to participation in altruistic activities is the time commitment (Cnaan & Handy, 2005). As a consequence, the internet has become a relatively newer and important venue for altruism (termed digital altruism), as evidenced by research showing that the ability to perform altruism is one specific reason individuals cite for using the internet (Price et al., 2005).

Wallace (2001) first identified the concept of digital altruism (i.e., altruism using electronic technology) by acknowledging that people on the internet are able to help each other in both small and large ways. Grant (2010) was the first to coin the term "digital altruism" using the term to refer to a spectrum of behaviors, such as posting positive comments on a social media page, providing information in an online forum such as Wikipedia, signing an online petition,

and making click-to-donate money contributions. The emergence of digital altruism—which allows people flexibility in time (24/7 access, no lengthy time commitment) and location (from the comfort and convenience of their own home), provides more people with the opportunity to engage in altruistic acts than before. Digital altruism also provides benefits specifically for socially isolated individuals—by providing the same positive social experiences that traditional altruism does, but online. Digital altruism thus has the potential to be beneficial for socially isolated individuals, especially socially isolated elderly persons, who are at substantial risk for shorter lifespans (Emmons, 2003; House, Landis & Umberson, 1988).

Although digital altruism is viewed by some as lazy because of the small investment required compared to traditional altruism—sometimes even referred to as "slacktivism" (Klisanin, 2011)—it is possible that some individuals may prefer digital altruism over traditional altruism because it allows them a convenient way to help others. For the economically challenged who may not be able to afford a monetary donation, the ability to show support for a charitable organization by "liking" their page, sharing their fundraising campaign on social media, or signing an online petition, allows them to participate in acts of digital altruism (Lacetera et al., 2014). Even the United Nations recognizes the importance of non-monetary acts of digital altruism. On the United Nations website, online volunteering is encouraged: "Everyone can make a difference. Share your skills, knowledge and ideas—from a computer anywhere in the world" (Sproull, 2011).

Little research has been conducted on digital altruism. Klisanin (2011) conducted a literature review of altruism and the internet to expand upon Gruber's (1997) "spectrum of altruism" by incorporating the internet, deriving three classifications for acts of digital altruism: everyday digital altruism ("expedient and requires little effort"), creative digital altruism ("to be

of use in relation to difficult, deep, and seemingly intractable human problems"), and co-creative digital altruism (corporate engagement in issues that "benefit humanity and the planet as a whole"). However, these classifications are not mutually exclusive. For example, signing and sharing an online petition on social media takes little effort (everyday digital altruism) but may also be useful in relation to a difficult problem (creative digital altruism). The behaviors assessed in the present study would be considered both everyday digital altruism and creative digital altruism.

Wang and Wang (2008) researched altruism in the context of motive in cybergaming. The altruism facet scale of the NEO-Personality Inventory Revised (NEO-PI-R: Costa & McCrae, 1992) was used to assess altruism as a personality trait. More altruistic gamers helped others in the context of online games more frequently than less altruistic gamers. Klisanin (2012) expanded upon the concept of altruistic gaming by researching the possibility of a cyberhero archetype, a counterpart to the cyberbully persona. The term "digital altruist" was designated for someone who engaged in occasional digital altruism, whereas "cyberhero" was dedicated to those who engage in frequent or outstanding acts of digital altruism. Self-reports revealed that the cyberhero archetype uses the internet and digital technologies for the good of others, and that the cyberhero archetype also embodies a transpersonal sense of self (i.e., a sense of identity that extends beyond the individual to encompass wider aspects of psyche). The research investigated both real world actions and otherworldly ideals, for which there was no validated scale for measurement, so the researcher devised a scale; however, the scale was not validated prior to gathering the data for the final analysis. Although the notion of a cyberhero is beyond the scope of the proposed research, it does provide an interesting counterpart to the cyberbully. Teaching children the notion of a cyberhero could provide them with a role model to

aspire to—that is actually attainable as compared to fictional superheroes—and could help promote digital altruism in future generations.

Leider and colleages (2009) conducted online field experiments in real-world social networks to examine prosocial giving. They employed a modified, online version of the Dictator game (which researchers deemed a "significant methodological advancement" as they were able to match subjects with their real-world friends) and a new "helping game" to assess prosocial giving across three contexts: baseline altruism (altruism toward random strangers), directed altruism (altruism that favors friends over strangers), and giving motivated by the prospect of future interaction. The social network of each university undergraduate participant was measured to identify close friends, social acquaintances, and strangers. Participants then engaged in a series of online games (the modified Dictator Game and the helping game) in which they made monetary allocation decisions for different types of named and nameless partners. Some decisions were anonymous (neither participant is informed of the decision-maker's choice) and others weren't (both participants were informed of the decision-maker's choices). Individuals were more altruistic toward friends than strangers, linked to the likelihood of future interaction, indicating that altruism is more likely between individuals who expect and desire to interact again in the future. Levels of altruism were similar among friends, suggesting some degree of homophily. It should be noted that while the study included a large sample size, it was not diverse, including individuals from only a single university. The present research expands upon this study by examining acts of digital altruism as they naturally occur in a real-world setting, as opposed to within a game setting.

The importance of research on digital altruism (i.e., online proscocial behavior) should not be underestimated. Research conducted by Wright and Li (2011) provides evidence that

face-to-face prosocial behaviors among young adults is positively associated with online prosocial behavior (e.g., digital altruism). Participants (n = 493 undergraduates) completed an online survey to assess electronic technology use and both online (social media, email, text, and chat forums) and face-to-face prosocial behaviors. After controlling for technology use and sex, face-to-face prosocial behavior significantly predicted online prosocial behavior. However, at the time the study was conducted there was no validated scale available to measure online prosocial behavior so the researchers adapted an offline prosocial behavior scale to capture online behavior; thus, the reliability of the scale is unclear. Nonetheless, these results support the co-construction theory (Subrahmanyam & Greenfield, 2008), such that young adults socialize similarly in their online and offline worlds, suggesting that the adapted scale adequately assessed online prosocial behavior.

Currently, there is a dearth of research on digital altruism. Although much research on online behavior focuses on negative online behavior, such as internet "trolls", cyber-crime, cyberbullying, and recruitment for terrorist organizations (Erreygers et al., 2018; Kircaburun & Tosuntas, 2017; Klisanin, 2011), the few aforementioned studies represent the limited research on positive forms of online behavior. However, the benefits of digital altruism combined with its accessibility and rapidly growing popularity make research on the topic particularly critical.

Sleep and Digital Altruism

Sleep and altruism have seldom been researched in concert, much less so the intersection of sleep and digital altruism. At most, the negative aspects of sleep quality with online behavior have been preliminarily explored. Previous studies indicate that, among adolescents and young adults, sleep disturbances are associated with cyberbullying. One longitudinal study of adolescents (Erreygers et al., 2018) revealed that poor sleep quality indirectly predicts later

cyberbullying via heightened anger, after controlling for digital media use. Similarly, Kircaburun and Tosuntas (2017) linked poorer sleep quality with high levels of cyberbullying among a sample of Turkish undergraduate students. Cyberbullying implies poor judgement or moral reasoning. An association between moral reasoning and altruism has been established (Eisenberg-Berg, 1979; Lararowitz, Stephan, & Friedman, 1976), although research in this area is limited. Social decisions become highly influenced by emotion following total sleep deprivation (Anderson & Dickerson. 2009), which is troubling, given that sleep deprivation impairs both emotional functioning (Killgore et al., 2007b) and emotional intelligence (Killgore et al., 2007a). Additionally, lack of sleep is associated with decreased moral awareness, which is an important precursor in making moral judgments (Barnes, Gunia, & Wagner, 2014).

Problematic uses of social media and poor sleep quality are both growing concerns in modern society, and both are on the rise (Turel & Bechara, 2017). Assessing the interplay of motor impulsivity and poor sleep quality in the context of problematic online behaviors, Turel and Bechara (2017) theorized that these behaviors were due to elevated motor impulsivity and poor sleep quality, such that poor sleep quality strengthens the effects of motor impulsivity on problematic behaviors on social media. Participants (n = 384 undergraduates) completed surveys to assess impulsivity (T0) and sleep quality, stress, and problematic online behaviors (e.g., swearing on the site, deviant use of the site, disadvantageous use of the site; at T1, (1 week after T0). After accounting for stress and demographics, poor sleep quality combined with greater motor impulsivity was associated with more problematic social media behavior. This finding is consistent with previous research that sleep-deprived individuals lack regard for typical social conventions (Ghumman & Barnes, 2013; Horne, 1993; Welsh, Mai, Ellis, & Christian 2018) and moral reasoning (Alkozei et al., 2018; Barnes, Gunia, & Wagner, 2014; Tempesta,

Couyoumdjian, Moroni, Marzano, De Gennaro & Ferrara, 2011), which are linked with altruism (Eisenberg-Berg, 1979; Lazarowitz, Stephan & Friedman, 1976). The results imply that greater sleep quality may reduce problematic social media behavior, at least among individuals with greater motor impulsivity. Although the direct association between sleep quality and problematic social media behavior was weak, this may be stronger among working adults who tend to be chronically sleep-deprived. While this study does provide valuable insight into the association between sleep and online behavior—its scope was limited to negative social media behavior. The association between sleep and digital altruism (i.e., online prosocial behavior) has yet to be examined.

Altruism and Personality

Substantial research has been conducted to examine the relationship between personality characteristics and altruism with mixed results. The Dictator Game is often employed to examine associations between traditional altruism and personality traits. Using a modified version of the Dictator Game, Ben-Ner and Kramer (2011) examined whether the association between personality and performing traditional altruism depends on the recipient of the altruism. The modified Dictator Game included multiple participants (a preliminary study evidenced no significant differences in giving, using 2 persons vs. many people) and the dictator was given one descriptor to describe each of the recipients (e.g., “is tall”, “is from Argentina”, “is your brother in law). Researchers categorized each of the descriptors into categories. Categories were defined as follows: kin (related persons); collaborator (potential contributor to one’s reproductive and/or survivability resources); neutral (someone who has no bearing on these resources); competitor (a direct competitor for or absconder of such resources). Regression results indicated that altruistic giving is recipient dependent. Although personality traits did not impact altruism

toward kin, significant associations were detected with non-kin for all personality traits except openness. Participants high in extraversion and neuroticism exhibited the highest levels of giving to all categories and those high in agreeableness showed the lowest levels of giving across categories. This unexpected finding might be a result of more neurotic participants more readily complying with a perceived implicit expectation to give some amount of money. Some subjects may be more prone to fairness and consequently more likely to give. Overall, altruistic giving was influenced by the perceived closeness of the recipient to the dictator with the greatest giving to kin, collaborators, neutrals, and competitors, respectively.

Oda and colleagues (2014) examined the relationship between The Big Five personality traits and performing traditional altruism toward specified recipients (i.e., strangers, acquaintances/friends, relatives) in daily life using the short form of the Japanese version of the Big-Five Scale and the Self-Report Altruism Scale Distinguished by the Recipient (SRAS-DR). The SRAS-DR (Oda, R., Dai, M., Niwa, Y., Ihobe, H., Kiyonari, T., Takeda, M., & Kai, H., 2013) assesses how frequently the individual has engaged in acts of traditional altruism in daily life. Extraversion was associated with performing traditional altruism toward all classes of recipients. Other personality traits were only associated with performing traditional altruism toward one type of recipient: Openness with strangers; Agreeableness with acquaintances/friends; and Conscientiousness with relatives. This study provides valuable insights into associations with traditional altruism in daily life and personality traits, and more specifically, how those associations differ based on the recipient. However, the sample consisted entirely of Japanese undergraduate students, and since Japanese culture is known to hold beliefs that can be very different from Western cultures, the results cannot be generalized to a larger population. The current study expanded on these results by examining associations between self-

reported acts of digital altruism and big five personality traits with a sample of participants from Western culture.

More recently, Hilbig, Theilmann, Hepp, Klein, and Zettler (2015) employed The Dictator Game to examine associations between performing traditional altruism and personality traits. However, the HEXACO model of personality was used for assessment, which includes the 5 domains of The Big Five Model plus a sixth domain (Honesty-Humility). Many previous studies had employed the HEXACO model of personality for assessment in The Dictator Game (Hilbig & Zettler, 2009; Hilbig, Zettler, Leist, & Heydasch, 2013; Thielmann & Hilbig, 2014; Thielmann, Hilbig, & Niedtfeld, 2014) but they all used a hypothetical scenario, whereas Hilbig and colleagues (2015) used actual incentivized games with real participants. Regression results revealed that the sixth personality trait (Honesty-Humility) predicted unique variance beyond those personality traits synonymous with The Big Five personality inventory (extraversion, agreeableness, openness, conscientiousness, neuroticism), of which, only extraversion was predictive of altruism, echoing the results from Oda and colleagues (2014).

The Dictator Game is just that—a game—and therefore might not be representative of altruism in daily life. Even though Hilbig and colleagues (2015) tried to get a more realistic measure of altruism by using incentivized games with actual participants, each participant was only given a $7 allocation (in coins!) to give/keep during the game, which participants may have considered insignificant and accordingly have been more willing to giving away. The current study aims to achieve a more realistic assessment of altruism by considering actual acts of digital altruism performed in daily life, as opposed to within a game setting.

Study Objectives & Hypotheses

The present study was designed to examine associations between sleep and digital altruism. The study tests three hypotheses. The first hypothesis is that sleep quantity and sleep quality will each be positively correlated with performing digital altruism, based on research connecting poor sleep quality with poor behavior (Erreygers et al., 2018) and sleep with performing traditional altruism (Dickinson & McElroy, 2017; Ferrara et al., 2015). The second hypothesis is that the correlation between sleep and performing digital altruism will be mediated by happiness, based on research showing that poor sleep quality inspires negative emotive states (i.e. anger; Erreygers et al., 2018) and that happy people are more likely to behave in kind ways (Otake et al., 2006). The third hypothesis is that the associations between sleep and performing digital altruism may be at least partially accounted for by other factors, in addition to happiness, including: Internet use based on evidence that one reason for using the internet is altruism (Diep et al., 2016; Price et al., 2015); personality traits based on previous evidence of associations between personality traits and performing traditional altruism (e.g., Hilbig et al., 2015; Oda et al., 2014); and moral reasoning based on previous findings linking moral reasoning with both sleep deprivation (e.g., Alkozei et al., 2018) and altruism (Eisenberg-Berg, 1979; Lazarowitz, Stephan & Friedman, 1976).

Significance of Study

Although the association between sleep and performing traditional altruism has been documented (primarily through sleep deprivation studies), the association between sleep and performing digital altruism has yet to be explored. Given the pervasiveness of the Internet in daily life and the current epidemic of poor sleep (BetterSleep.org, 2013) in the Western World, understanding the linkages between sleep and online behavior is critical. The Internet offers

innumerable opportunities for individuals to engage in small prosocial acts, which if enacted, make them more likely to engage in larger prosocial acts in the future (Sproull, 2011). Therefore, discovering factors (such as sleep quality or quantity) that may increase the likelihood of online prosocial behavior could ultimately have a large positive impact upon society. Although determining causation is beyond the scope of the present study, exploring associations is a first step in that direction.

To date, only the negative aspects of sleep and online behavior have been evaluated. The present study builds on theory by exploring the connection between sleep and positive online behavior, offering an expanded framework for future research. Understanding the association between sleep and digital altruism in a real world context provides valuable insight regarding online prosocial behavior, and the importance of sleep, potentially leading to the development of intervention solutions.

Chapter II

Method

The study was conducted using an online survey administered through the Survey Monkey website. The target sample was 200 participants; 100 from each of two recruitment methods. Participants were recruited through the researcher's Facebook page and through Amazon Mechanical Turk (Mturk) by specifically targeting adults (18 years or older) who are residents of the United States. Mturk is an online platform frequently used for survey research. Researchers, referred to on Mturk as "requestors", provide survey details (eligibility requirements, topic of survey, payment amount, and time involved with participation) and individuals who are registered with Mturk as "workers" can select jobs they would like to accept. If a worker accepts the job, they are provided a link to the survey and receive a completion code at the end of the survey which is used to verify completed work so payment can be received. The requestor can reject work which impacts the workers ability to complete future jobs on Mturk. Therefore, Mturk workers exhibit high levels of honesty and accuracy (Rand, 2012; Suri, Goldstein & Mason, 2011).

Participants

A total of 233 participants completed the survey. Of the 233 participants, 105 accessed the survey through Amazon Mechanical Turk; 128 accessed the survey through the researcher's Facebook page. A total of five participants were excluded from the sample because they completed the survey in less than 3 minutes, calling into question the validity of their responses. The final sample was comprised of 228 participants, 103 of which were recruited through

Amazon Mechanical Turk and 125 through Facebook. Participants ranged in age from 21 to 82 years old, with a mean age of 40. The sample was comprised of 56% (n = 128) females and 44% (n = 100) males. Participants predominately identified as Caucasian (85%, n = 193); the remainder identified as Asian/Pacific Islander (5%, n = 12), Black/African American (5%, n = 11), and Hispanic/Latino (5%, n = 12). Most participants (83%, n = 188) had at least some post-secondary education, with the majority of participants (58%, n = 132) holding at least a college degree.

Measures

The online survey included five demographic items to assess age, sex, ethnicity, education, and religiosity, along with five scales assessing (1) sleep quality, (2) digital altruism, (3) Internet use, (4) happiness, and (5) personality. Seven additional single-item indicators were included to supplement the scales.

Demographics

Demographic items assessed sex (*female, male*), age (*What is your age?*), ethnicity (*Asian/Pacific Islander, Black/African American, Hispanic/Latino, Native American/American Indian, White/Caucasian, Other*), religiosity (*not religious, spiritual but not religious, somewhat religious, very religious*), and education level (*some high school, high school diploma/GED, some college, trade/technical/vocational training, college degree, post graduate degree*). Detailed descriptions of these items can be found in Appendix A.

Sleep Quality and Quantity

Sleep quality was measured with 4 of the 5 items from the Sleep Quality Measure (Holfeld & Ruthig, 2014; Appendix B). This scale was selected to measure sleep quality due to its brevity and easy adaption to Survey Monkey. The four items measure specific aspects of sleep quality (e.g., *Do you have difficulty falling asleep?*). Responses on these items range from 1 (*every night to almost every night*) to 4 (*never*). The validation study for this scale demonstrated acceptable reliability (Cronbach's $\alpha = .79$). The Sleep Quality Measure has not been validated against more commonly used sleep indices such as the Pittsburgh Sleep Quality Index. However, Holfeld and Ruthig reported internal consistency in 2008 (Cronbach's $\alpha = .79$) and in 2010 (Cronbach's $\alpha = .74$) with a test-retest reliability of .76 which supports its content validity. Reliability for the scale in the present study is acceptable (Cronbach's $\alpha = .79$). Scale item scores were averaged. Additionally, a single open-answer item assessing sleep quantity (*On average, how many hours per night do you sleep?*) was included.

Digital Altruism

Digital altruism was measured with the Online Prosocial Behavior Scale (OPBS: Erreygers, et al., 2018; Appendix C). The OPBS consists of two subscales: one for performing online prosocial behavior (POPB) and one for receiving online prosocial behavior (ROPB). Participants are prompted to answer, "*How often have you done* (POPB; e.g., *say nice/friendly things to someone*) *or experienced* (ROPB; e.g., *someone said nice/friendly things to me*) *the following via electronic media* (*smart phone, computer, tablet*) *in the past month*?" Item responses range from 1 (*never*) to 5 (*every day*). The validation study for these scales (Erreygers, et. al., 2018) demonstrated acceptable reliability (Cronbach's $\alpha = .90$ for POPB and ROPB). Two additional single items assessed digital altruism: "*In the past month, how often*

have you signed an online petition?" and "*In the past month, how often have you donated money online*?" Item responses range from 1 (*never*) to 5 (*every day*). Reliability for the POPB scale (including the two single item indicators) in the present study (Cronbach's α = .92) and for the ROPB scale (Cronbach's α = .94) are high (i.e. above .90) which means they have excellent internal consistency. Scale item scores were averaged for POPB and ROPB, separately. In addition, three single item indicators were included to assess participants' motivation for being kind online: "*I'm kind online to help people who are in need.*" (motivation/help); "*I'm kind online to paint myself in a more positive light.*" (motivation/paint); and "*I'm kind online to make the world a better place*" (motivation/better) and were treated as single item indicators in analyses (Appendix D). Responses range from 1 (*strongly disagree*) to 5 (*strongly agree*).

Internet Use

Internet use was measured with the Internet Use Scale (IUS: Hills & Argyle, 2003; Appendix E). The scale includes 18 items, 14 of which were used to assess participants' frequency of use of various services (e.g., *Please indicate your frequency of use of each of the following Internet services*). Responses range from 1 (*never*) to 5 (*a lot*). The IUS also asks participants where they use the Internet (home, college, work, elsewhere) (e.g., *How often do you use the internet at work?).* Responses range from 1 (*never*) to 5 *(a lot*). The validation study (Hills & Argyle, 2003) for this scale relied upon face validity (i.e. that is seems to measure what it says it does) and demonstrated acceptable reliability (Chronbach's α = .84). Because of its newness, social media was not included in the IUS when it was established; therefore, the present study also included a single item to assess social media use (*Please indicate how frequently you use social media*). Responses range from 1 (*never*) to 5 (*a lot*). Reliability for the

scale (including the single item indicator) for the present study is acceptable (Cronbach's α = .89). Scale item scores were averaged.

Happiness

Happiness was measured with the Subjective Happiness Scale (Lyubomirsky & Lepper, 1997; Appendix F). The scale includes 4 items assessing participants' perceptions of their happiness (e.g., *Compared with most of my peers, I consider myself*…). Responses range from 1 (*less happy*) to 7 (*more happy*). The validation study (Lyubomirsky & Lepper, 1999) for this scale tested convergent validity against 5 other published measures of happiness and well-being (The Affect Balance Scale: Bradburn 1969; The Delighted-Terrible Scale: Andrews & Withey 1976; The Global Happiness Scale: Bradburn 1969; The Recent Happiness Item: Stewart et al., 1992; The Satisfaction With Life Scale: Diener et al., 1985) with significant correlations ranging from .52 to .72 (M = .62), between the Subjective Happiness Scale and the other five scales. Internal consistency for the Subjective Happiness Scale was tested for four separate samples using Cronbach's alpha and demonstrated good to excellent reliability (Cronbach's α = .79 to .94). Reliability for the scale in the present study is excellent (Cronbach's α = .92). Scale item scores were averaged.

Personality

The Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Openness, Neuroticism) are often measured with the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991) which consists of 44 items. This study measured personality with the BFI-10 (Rammstedt & John, 2007; Appendix G) which is a simplified, 10-item version of the BFI developed to provide a measure of personality under time constraints. The BFI-10 consists of 10

questions to assess five personality dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. Participants are prompted to answer, "*How well do the following statements describe your personality?... I see myself as someone who is… (e.g., reserved, tends to be lazy, etc.)"*. Responses range from 1 (*disagree strongly*) to 5 (*agree strongly*). In the original validation study, the BFI-10 was tested to determine how well it represented the full BFI-44 scales. The overall correlation was .83 (computed with Fisher's r-to-Z transformation), indicating that the BFI-10 accounts for nearly 70% of the variance in the BFI-44. Generalizability across time was demonstrated with test-retest correlations with an average stability coefficient of $r = .75$, indicating acceptable stability levels. Convergent validity was demonstrated through moderate-strong correlations between the NEO-PI-R and the BFI-10 ($r = .67$) and BFI-44 ($r = .78$), and through moderate correlations between the self-report and peer-report versions of the scales (BFI-10: $r = .44$; BFI-44 $r = .56$). Reliability for the personality dimensions for the present study are in line with prior results: extraversion (Cronbach's $\alpha = .83$), conscientiousness (Cronbach's $\alpha = .61$), neuroticism (Cronbach's $\alpha = .73$), openness to experience (Cronbach's $\alpha = .61$), and agreeableness (Cronbach's $\alpha = .44$). Scale item scores were averaged for each of the five personality dimensions. Although the reliability for agreeableness is low, this was a common finding in the development of this scale, and its use by other researchers ($\alpha = 0.43$: Thalmayer, Saucier, & Eigenhuis, 2011; $\alpha = 0.37$: Crede, Harms, Niehorster, & Gaye-Valentine, 2012). It is purported that low reliability for agreeableness may result when a large portion of the sample is very agreeable, which can be circumvented by adding a third item for agreeableness (*e.g., Is considerate and kind to almost everyone*) when reliability is low if the construct is crucial to a study (Rammstedt & John, 2007). Since

personality, including agreeableness, was not the focus of the present study, the survey was not repeated with the additional item.

Procedure

The online survey was developed and administered through SurveyMonkey.com.

Data Collection

The study aimed to include a large sample of middle-aged adults, therefore, the researcher posted the survey questionnaire on her Facebook page wherein there is a large pool of potential middle-aged participants. Because people with a high level of baseline altruism tend to have friends who exhibit higher levels of altruism themselves (Leider et al., 2009) the survey was also posted to Amazon Mechanical Turk (where random participants were paid $3.00 each to complete the survey) to limit homophily effects (Lacerta et al., 2014) and to ensure that a large, altruistically diverse sample was obtained.

Study Protocol

A link was provided by the researcher that navigated participants directly to the Survey Monkey website page that hosted the online survey. International individuals and individuals under the age of 18 were blocked from the survey link to ensure that all obtained results are from participants located in the United States and above 18 years of age. The survey began with a consent form which informed participants of: (1) purpose of the study, (2) types of questions that would be asked, (3) estimated time involved in participation, (4) confidentiality of responses, and (5) who to talk to if they had any questions or concerns (e.g. the researcher, the researcher's supervisor, Harvard University Internal Review Board). Participants who provided consent then

completed the online survey. The survey assessed demographics followed by the measurement scales (sleep quality, digital altruism, Internet use, happiness, personality) and the associated single item indicators.

Plan of Analysis

The survey data were exported from Survey Monkey directly into SPSS software. Analysis was performed using SPSSv.25.

Survey data for the established scales (sleep quality, digital altruism (POPB, ROPB), Internet use, happiness, and personality (openness, conscientiousness, extraversion, agreeableness, and neuroticism) were assessed for internal consistency using Cronbach's alpha. Results are reported in the Measures section. The single item indicators for sleep quantity and motivation represented conceptually different information, so these were treated as single item indicators.

Preliminary Analyses

Preliminary analyses tested whether differences on the study variables (sleep quality, sleep quantity, digital altruism, Internet use, happiness, personality, motivation) were a function of sex, ethnicity, education, age, religiosity, or platform. A series of one-way ANOVAs with sex, ethnicity, education (Appendix A), and platform (Mturk, Facebook), predicting each study variable (sleep quality, sleep quantity, digital altruism, Internet use, happiness, personality, motivation) separately were performed to assess mean-level differences on study variables associated with sex-, ethnicity-, education-, and/or platform-differences. All continuous variables met the assumption of normality. Due to the number of ANOVAs, a Bonferroni adjustment was applied, reducing the alpha level for significance to .001

$\left(\frac{.05}{14\ study\ variables * 4\ categorial\ demographic\ variables}\right)$ to avoid Type I error. Bivariate correlations were performed between age and religiosity with all study variables (sleep quality, sleep quantity, digital altruism, Internet use, happiness, personality, motivation) to determine whether study variables were linearly associated with age or religiosity. Due to the number of bivariate correlations, a Bonferroni adjustment was applied, reducing the alpha level for significance to .002 $\left(\frac{.05}{14\ study\ variables * 2\ continuous\ demographic\ variables}\right)$ to avoid Type I error. For ANOVA results, trends significant at an alpha level of .005 were explored.

Main Analyses

In order to test the hypothesis that sleep quantity and sleep quality will each be positively correlated with performing digital altruism (Hypothesis 1), bivariate correlations were performed between sleep quality, sleep quantity, and performing digital altruism. Given that poor sleep quality has been connected with poor behavior (Erreygers et al., 2018), sleep quantity has been connected with performing traditional altruism (Dickinson & McElroy, 2017; Ferrara, Bottasso, Tempesta, Carrieri, DeGennaro, & Ponti, 2015), and offline behavior has been connected with online behavior (Bosancianu, Powell, & Bratovic, 2013; Wright & Li, 2011), positive correlations were hypothesized between sleep quantity and sleep quality with performing digital altruism.

In order to test the hypothesis that the correlation between sleep and performing digital altruism will be mediated by happiness (Hypothesis 2), mediation analyses will test happiness as a mediator between sleep quality and sleep quantity with performing digital altruism. Given that

poor sleep quality inspires negative emotive states (i.e. anger; Erreygers et al., 2018) and that happy people are more likely to behave in kind ways (Otake et al., 2006), happiness is expected to mediate the correlations between sleep quality and sleep quantity with performing digital altruism, such that better sleep is associated with greater happiness, which in turn is associated with performing more digital altruism. A visual depiction of the mediation analysis is shown in Figure 1. First, a direct association (c) must be established as significant between X and Y, which is referred to as the total effect. Second, an association between X and M (mediator) must be established as significant. Third, when X and M are simultaneously used to predict Y, if b is significant, then M mediates X. If the association between X and Y (c') remains significant in the regression, then M partially mediates the association between X and Y. If the association between X and Y (c') becomes nonsignificant in the regression, then M fully mediates the association between X and Y. The indirect effect describes the effect that X has on Y via the mediator. PROCESSv3.1 (Hayes, 2013) is used to estimate the total effect (C), indirect effect, as well as (a), (b), and (c') using Model 4 with 10,000 bootstrapped samples.

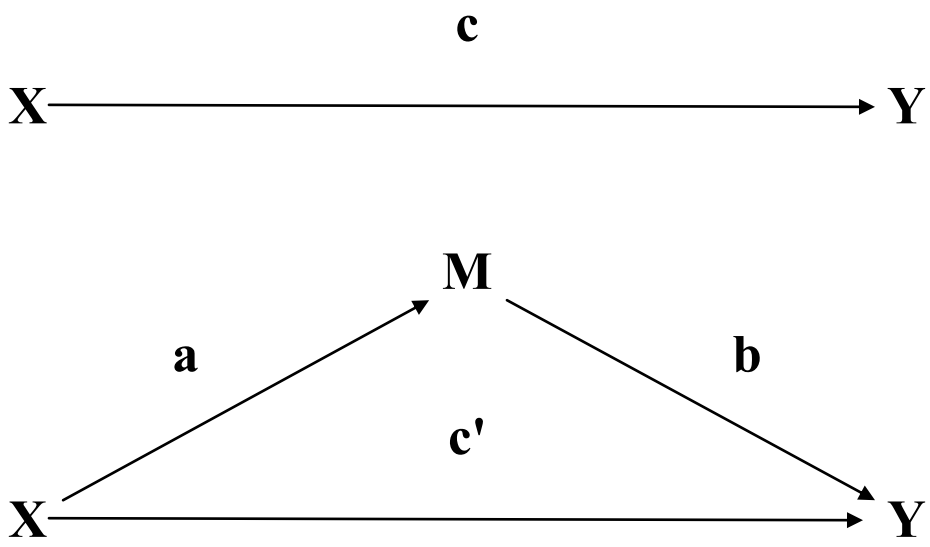


Figure 1. Mediation Model (Hayes, 2013).

In order to test the hypothesis that the associations between sleep and performing digital altruism may be at least partially accounted for by other factors (Hypothesis 3), a multiple linear regression was performed with sleep quantity and sleep quality predicting performing digital altruism (POPB). Sleep quantity and sleep quality predictors were included in the regression as linear, quadratic, and two-way interaction effects (Figure 2). Significant quadratic and two-way interaction effects were assessed graphically for interpretation.

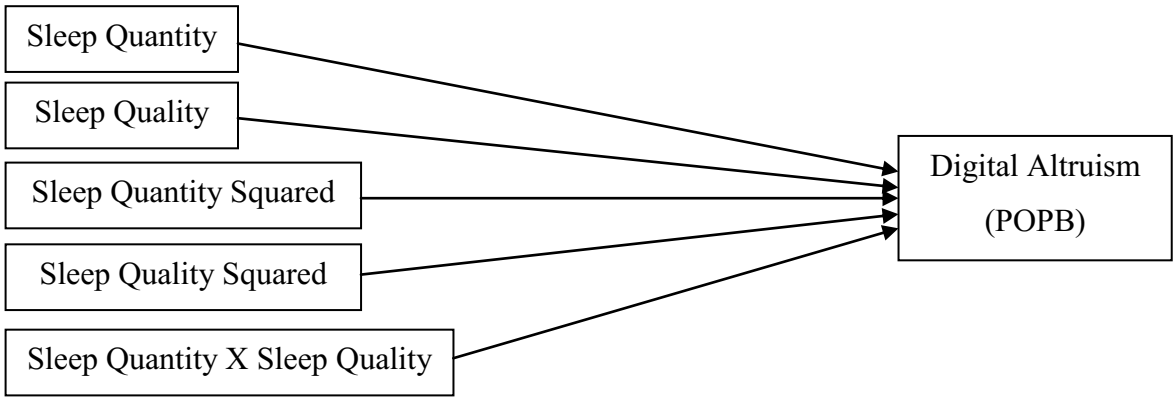


Figure 2. Sleep quantity and quality predicting performing digital altruism/POPB in a multiple linear regression.

The linear regression was performed three times. First, the linear regression was conducted as in Figure 2. Second, the linear regression was conducted when including all demographic variables (sex, age, religiosity, education, ethnicity, platform) simultaneously, in order to assess whether model effects were maintained when controlling for demographics. Third, the linear regression was conducted when including additional study variables (receiving

digital altruism, happiness, internet use, personality, motivation) simultaneously, in order to assess whether any other study variables account for the linear, quadratic, and/or two-way interaction effects of sleep on performing digital altruism. Previous research links internet use (Diep et al., 2016; Price et al., 2015), personality traits (e.g., Hilbig et al., 2015; Oda et al., 2014), moral reasoning (e.g., Alkozei et al., 2018) and receiving altruism (Eisenberg-Berg, 1979; Lazarowitz, Stephan & Friedman, 1976) with altruism, suggesting that these other study variables may absorb some of the association between sleep and performing digital altruism.

Chapter III

Results

Data were collected from 233 participants, including 128 individuals from Facebook and 105 individuals from MTurk. Data were excluded for participants who took less than three minutes to complete the study, which resulted in the exclusion of five participants. The final sample therefore consisted of 228 participants.

Tables 1 and 2 present the descriptive statistics for demographic and study variables. The average sleep time of participants was 6.9 hours per night, which aligns with the national average of 6.8 hours per night (CDC, 2013).

Preliminary Analyses

A series of one-way ANOVAS were conducted to determine if results for each of the study variables (sleep quality, sleep quantity, digital altruism, Internet use, happiness, personality, motivation) differed significantly ($p < .001$) by sex, ethnicity, education, or platform.

A trend towards sex differences emerged (Table 3) for sleep quantity ($F(1,225) = 8.34$, $p = .004$, $d = 0.38$) such that women tended to sleep more ($M = 7.17$, $SD = 1.37$) than men ($M = 6.65$, $SD = 1.34$). Results for receiving digital altruism (ROPB: $F(1,226) = 9.16$, $p = .003$, $d = 0.40$) also trended towards significance, such that women tended to receive more digital altruism ($M = 2.61$, $SD = 0.84$) than men ($M = 2.26$, $SD = .92$). Significant sex differences emerged for performing digital altruism (POPB: $F(1,126) = 23.49$, $p < .001$, $d = 0.63$), in that women performed more digital altruism ($M = 3.01$, $SD = 0.65$) than men ($M = 2.55$, $SD = 0.78$). Significant sex differences also emerged for happiness ($F(1,126) = 14.98$, $p < .001$, $d = 0.51$);

Table 1

Descriptive Statistics (Categorical Demographics)

Demographic Variable	Level	*n*	%
Sex	Female	128	56.1
	Male	100	43.9
Ethnicity	Asian/Pacific Islander	12	5.3
	Black/African American	11	4.8
	Hispanic/Latino	12	5.3
	White/Caucasian	193	84.6
Religiosity	Not religious	89	39.0
	Spiritual, but not religious	43	18.9
	Somewhat religious	59	25.9
	Very religious	35	15.4
Education	High school diploma/GED	39	17.1
	Some college	45	19.7
	Trade/Technical/Vocational Training	11	4.8
	College graduate	100	43.9
	Post graduate degree	32	14.0
Platform	Facebook	125	54.8
	Mturk	103	45.2

Table 2

Descriptive Statistics (Continuous Demographics and Study Variables)

Variable	*n*	*M*	*SD*
Age	226	39.73	12.94
Sleep Quantity	227	6.94	1.38
Sleep Quality	228	2.47	0.68
Digital Altruism			
POPB	228	2.81	0.74
ROPB	228	2.46	0.89
Happiness	228	4.69	1.59
Motivation/Help	228	3.71	1.22
Motivaton/Paint	228	2.22	1.20
Motivation/Better	228	3.64	1.30
Internet Use	228	2.74	0.66
Personality			
Extraversion	228	3.01	1.34
Agreeableness	228	3.46	1.05
Conscientiousness	228	4.13	0.83
Openness	228	3.69	1.03
Neuroticism	228	2.42	1.17

Note. Sleep quality was measured on a 4-point scale with higher values indicating better quality sleep. Motivation/Help = Help someone in need. Motivation/Paint = Paint myself in more positive light. Motivation/Better = Make the world a better place. Digital Altrusim, Internet use, and Personality were all measured on 5-point scales, with higher values indicating higher levels of the characteristic. Happiness was measured on a 7-point Likert scale, with higher values indicating higher levels of happiness.

Table 3

One-way ANOVA Results for Differences based on Sex

Factor	Dependent Variable	*df*	*F*	*p*	*d*
Sex	Sleep Quantity	(1,225)	8.34	.004	0.38
	Sleep Quality	(1,226)	0.32	.58	0.07
	Motivation/Help	(1,226)	18.87	< .001	0.56
	Motivation/Paint	(1,226)	0.16	.69	0.05
	Motivation/Better	(1,226)	20.40	< .001	0.58
	POPB	(1,226)	23.49	< .001	0.63
	ROPB	(1,226)	9.16	.003	0.40
	Internet Use	(1,226)	0.01	.91	0.01
	Happiness	(1,226)	14.98	< .001	0.51
	Extraversion	(1,226)	27.17	< .001	0.69
	Agreeableness	(1,226)	2.02	.16	0.18
	Conscientiousness	(1,226)	2.37	.13	0.20
	Openness	(1,226)	24.58	< .001	0.64
	Neuroticism	(1,226)	2.67	.10	0.21

women reported being happier (M = 5.04, SD = 1.48) than men (M = 4.24, SD = 1.62). In terms of personality, significant sex differences emerged for extraversion ($F(1,126) = 27.17$, $p < .001$, $d = 0.69$) and openness ($F(1,126) = 24.58$, $p < .001$, $d = 0.64$), such that women were more extraverted (M = 3.40, SD = 1.30) and open (M = 3.97, SD = 0.84) than men (M = 2.52, SD = 1.22; M = 3.32, SD = 1.14, respectively). Significant sex differences emerged for motivation to help individuals who are in need (Motivation/Help: $F(1,226) = 18.87$, $p < .001$, $d = 0.56$), and for motivation to make the world a better place (Motivation/Better: $F(1, 226) = 20.40$, $p < .001$, $d = 0.58$). Women were more frequently motivated to perform digital altruism by a desire to help others (M = 4.01, SD = 1.02) and a desire to make the world a better place (M = 3.97, SD = 1.03) compared to men (M = 3.33, SD = 1.35; M = 3.22, SD = 1.48, respectively). No other significant sex differences emerged for any of the other study variables (sleep quality, internet use, agreeableness, conscientiousness, neuroticism, Motivation/Paint).

Trends towards education differences emerged (Table 4) for performing digital altruism ($F(4,222) = 4.69$, $p = .001$, $\eta_\rho^2 = 0.07$) and for receiving digital altruism ($F(4,222) = 4.42$, $p = .002$, $\eta_\rho^2 = 0.07$). Tukey's HSD post hoc pairwise comparisons revealed that individuals with only a high school diploma were less frequently the recipients of digital altruism and performed digital altruism less often than all other groups.

Significant education differences emerged for Internet use ($F(4,222) = 10.78$, $p < .001$, $\eta_\rho^2 = 0.16$). Individuals with only a high school diploma used the Internet significantly less than all other groups. No other significant education differences emerged for any of the other study variables (sleep quality, sleep quantity, happiness, personality, motivation).

Table 4

One-way ANOVA Results for Differences based on Education

Factor	Dependent Variable	*df*	*F*	*p*	η_p^2
Education	Sleep Quantity	(4,221)	1.10	.36	0.02
	Sleep Quality	(4,222)	2.82	.03	0.04
	Motivation/Help	(4,222)	3.60	.01	0.06
	Motivation/Paint	(4,222)	3.19	.01	0.05
	Motivation/Better	(4,222)	2.05	.09	0.03
	POPB	(4,222)	4.69	.001	0.07
	ROPB	(4,222)	4.42	.002	0.07
	Internet Use	(4,222)	10.78	< .001	0.16
	Happiness	(4,222)	3.07	.02	0.05
	Extraversion	(4,222)	2.17	.07	0.03
	Agreeableness	(4,222)	2.47	.05	0.04
	Conscientiousness	(4,222)	1.36	.25	0.02
	Openness	(4,222)	2.96	.02	0.05
	Neuroticism	(4,222)	2.58	.04	0.04

No significant ethnicity differences or trends emerged (Table 5) for any of the study variables (sleep quality, sleep quantity, digital altruism, Internet use, happiness, personality, motivation).

There was a trend towards platform differences (Table 6) for receiving digital altruism ($F(1,226) = 9.87$, $p = .002$, $\eta_\rho^2 = 0.04$), in that Mturk participants tended to receive more digital altruism ($M = 2.66$, $SD = 0.79$) than Facebook participants ($M = 2.29$, $SD = 0.94$). There were significant platform differences for Internet use ($F(1,226) = 37.71$, $p < .001$, $\eta_\rho^2 = 0.14$), such that Mturk participants used the Internet more often ($M = 3.01$, $SD = 0.52$) than Facebook participants ($M = 2.51$, $SD = 0.68$). In terms of personality, significant platform differences emerged for extraversion ($F(1,226) = 15.26$, $p < .001$, $\eta_\rho^2 = 0.06$), such that Facebook participants were more extraverted ($M = 3.32$, $SD = 1.36$) than Mturk participants ($M = 2.64$, $SD = 1.23$). There were significant platform differences for Motivation/Help ($F(1,226) = 19.69$, $p < .001$, $\eta_\rho^2 = 0.08$) and Motivation/Paint ($F(1,226) = 14.01$, $p < .001$, $\eta_\rho^2 = 0.05$). Mturk participants more frequently cited their motivation for performing digital altruism as a desire to help someone in need ($M = 4.09$, $SD = 0.91$) and to paint themselves in a more positive light ($M = 2.54$, $SD = 1.28$) than did Facebook participants ($M = 3.40$, $SD = 1.36$; $M = 1.96$, $SD = 1.06$, respectively). No other significant platform differences emerged for any of the other study variables (sleep quantity, sleep quality, performing digital altruism, happiness, agreeableness, openness, conscientiousness, neuroticism, MotivationBetter).

Table 7 provides correlations between age, religion, and study variables. Age was negatively correlated with sleep quality ($r = -.26$, $p < .002$), receiving digital altruism ($r = -.23$, $p < .002$), and Internet use ($r = -.44$, $p < .002$; Table 7). Older participants tended to have poorer

Table 5

One-way ANOVA Results for Differences based on Ethnicity

Factor	Dependent Variable	*df*	*F*	*p*	η_p^2
Ethnicity	Sleep Quantity	(3,223)	0.24	.87	0.003
	Sleep Quality	(3,224)	0.63	.60	0.01
	Motivation/Help	(3,224)	1.24	.30	0.01
	Motivation/Paint	(3,224)	1.21	.31	0.01
	Motivation/Better	(3,224)	1.24	.30	0.01
	POPB	(3,224)	0.95	.42	0.01
	ROPB	(3,224)	0.58	.63	0.01
	Internet Use	(3,224)	1.59	.19	0.02
	Happiness	(3,224)	2.84	.04	0.03
	Extraversion	(3,224)	0.67	.57	0.01
	Agreeableness	(3,224)	0.80	.49	0.01
	Conscientiousness	(3,224)	0.60	.62	0.01
	Openness	(3,224)	0.57	.63	0.01
	Neuroticism	(3,224)	2.69	.05	0.03

Table 6

One-way ANOVA Results for Differences based on Platform

Factor	Dependent Variable	*df*	*F*	*p*	*d*
Platform	Sleep Quantity	(1,225)	0.17	.68	0.05
	Sleep Quality	(1,226)	0.32	.57	0.07
	Motivation/Help	(1,226)	19.69	< .001	0.60
	Motivation/Paint	(1,226)	14.01	< .001	0.49
	Motivation/Better	(1,226)	6.96	.01	0.35
	POPB	(1,226)	0.32	.57	0.07
	ROPB	(1,226)	9.87	.002	0.42
	Internet Use	(1,226)	37.71	< .001	0.82
	Happiness	(1,226)	1.12	.29	0.14
	Extraversion	(1,226)	15.26	< .001	0.52
	Agreeableness	(1,226)	2.46	.12	0.20
	Conscientiousness	(1,226)	1.25	.27	0.14
	Openness	(1,226)	0.67	.42	0.10
	Neuroticism	(1,226)	0.20	.66	0.05

Table 7

Bivariate Pearson Correlations (r) between Age, Religion, and Study Variables

Variable	Age	Religion
Sleep Quantity	.12	.13*
Sleep Quality	-.26**	.02
POPB	-.17**	.23**
ROPB	-.23**	.11
Motivation/Help	-.15**	.16*
Motivation/Paint	-.19**	.03
Motivation/Better	-.09	.25**
Internet Use	-.44**	-.09
Happiness	-.02	.23**
Extraversion	.05	.22**
Agreeableness	.02	.07
Conscientious	.17**	.03
Openness	-.004	.11
Neuroticism	-.12	-.004

Note. **$p < .002$ (two-tailed).

sleep quality, receive less digital altruism, and use the internet less frequently, relative to younger participants. No other correlations with age reached statistical significance.

Religiosity was positively correlated with performing digital altruism ($r = .23$, $p < .002$), happiness ($r = .23$, $p < .002$), extraversion ($r = .22$, $p < .002$), and motivation to make the world a better place (Motivation/Better: $r = .25$, $p < .002$). Participants who characterized themselves as more religious tended to perform more digital altruism, be happier, be more extraverted, and have their online behavior more motivated by a desire to make the world a better place, relative to participants who characterized themselves as less religious. No other correlations with religiosity reached statistical significance.

Main Analyses

Table 8 presents the bivariate correlations between study variables. Supporting Hypothesis 1, sleep quantity was positively correlated with performing digital altruism (POPB: $r = .18$, $p < .01$), although sleep quality was not (POPB: $r = .05$, $p=.41$). As the number of hours slept increased, rates of performing digital altruism also increased.

Mediation analyses were tested using PROCESSv.3.1 to assess Hypothesis 2, that the association between sleep and performing digital altruism would be mediated by happiness. Sleep quality was tested first. There was no total effect between sleep quality and performing digital altruism to mediate ($\beta = .05$, $p = .41$); thus mediation analysis halts. For sleep quantity, a significant total effect was observed ($\beta = .19$, $p < .005$). Sleep quantity positively predicted happiness ($\beta = .26$, $p < .001$). When including both sleep quantity and happiness in a regression predicting performing digital altruism, happiness was significant ($\beta = .41$, $p < .001$), but the effect of sleep quantity on performing digital altruism became nonsignificant ($\beta = .08$, $p = .20$).

This pattern of effects indicates that happiness fully mediated the effect of sleep quantity on digital altruism, with an indirect effect of .10 (95% CI = .04, .18).

The association between sleep and digital altruism may not be simply linear. Thus, a regression was performed including the linear, quadratic, and two-way interaction effects of sleep quantity and sleep quality to predict rates of performing digital altruism. Table 9 presents the results from this linear regression. Similar to the bivariate correlation results, sleep quantity, but *not* sleep quality, was associated with performing acts of digital altruism. However, the linear regression revealed both linear and quadratic associations between sleep quantity and performing digital altruism. Figure 3 illustrates this curvilinear effect, showing that as quantity of sleep increases up to 8 hours, performing digital altruism also increases; after 8 hours, the association reverses, such that as sleep increases beyond 8 hours, performing digital altruism decreases.

To test Hypothesis 3, that the associations between sleep and performing digital altruism may be at least partially accounted for by other factors, the linear regression was re-performed in two ways. First, all of the demographic variables (sex, age, ethnicity, religion, education, platform) were added into the linear regression from Figure 2 simultaneously. The regression results revealed that the effect of sleep quantity remained significant, suggesting that the effect of sleep quantity was not an artifact of demographic differences.

Second, all other study variables (receiving digital altruism, happiness, internet use, personality, motivation) were added into the linear regression from Figure 2 simultaneously. Given the aforementioned correlations between digital altruism (POPB) with happiness, Internet use, receiving digital altruism, personality traits, and motivation (see Table 8), it was expected that some of these study variables may at least partially account for the curvilinear effect of sleep

Table 8

Bivariate Pearson Correlations (r) between Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SleepQuantity													
2.SleepQuality	.30**												
3.POPB	.18**	.05											
4.ROPB	.07	.05	.82**										
5.MotivationHelp	.21**	.07	.51**	.49**									
6.MotivationPaint	-.05	-.03	.28**	.33**	.32**								
7.MotivationBetter	.30**	.11	.49**	.39**	.73**	.30**							
8.InternetUse	-.01	.04	.55**	.61**	.47**	.39**	.30**						
9.Happiness	.26**	.25**	.43**	.39**	.25**	.04	.32**	.19**					
10.Extraversion	.20**	.13	.36**	.31**	.18**	-.06	.18**	.03	.57**				
11.Agreeableness	.18**	.12	.23**	.28**	.22**	-.04	.19**	.17**	.40**	.45**			
12.Conscientious	.07	.03	.04	-.02	.02	-.03	.10	-.06	.24**	.17**	.10		
13.Openness	.35**	.11	.35**	.25**	.37**	.06	.39**	.18**	.39**	.28**	.15	.30**	
14.Neuroticism	-.03	-.002	-.02	.11	.07	.14	.01	.11	-.49**	-.37**	-.35**	-.31**	-.05

Note. $^{**}p < .01$ (two-tailed).

Table 9

Multiple Linear Regression Results for Sleep Quality and Sleep Quantity Predicting Performing Digital Altruism (POPB)

Predictor	*b*	SE(*b*)	β	*p*
Intercept	0.20	1.18	--	--
SleepQuantity	0.87	0.30	1.61	.004
SleepQuality	-0.62	0.47	-0.56	.19
SleepQuantity Squared	-0.05	0.02	-1.41	.01
SleepQuality Squared	0.11	0.08	0.54	.18
SleepQuantity*SleepQuality	-0.001	0.05	-0.01	.98

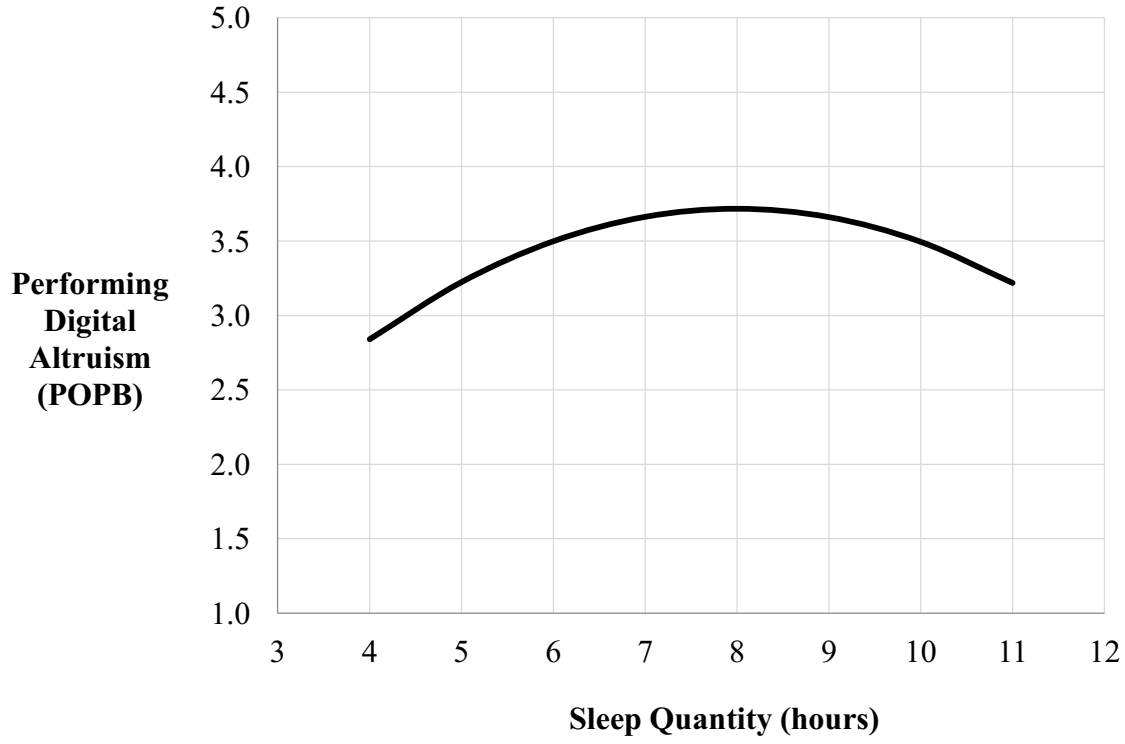


Figure 3. Curvilinear effect of sleep quantity predicting performing digital altruism (POPB).

quantity on performing digital altruism. Table 10 presents the regression results, including all study variables. Supporting Hypothesis 3, motivation (to make the world a better place), receiving digital altruism, Internet use, and extraversion accounted for the effect of sleep quantity, rendering it no longer significant in predicting performing digital altruism. These findings suggest that individuals who: (1) are motivated to make the world a better place, (2) are frequent recipients of digital altruism, (3) frequently use the Internet, or (4) are extraverted, perform acts of digital altruism regardless of how much they sleep.

Table 10

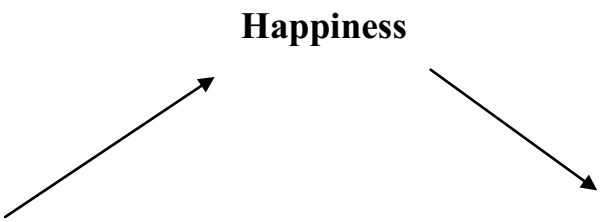
Regression Results Including All Study Variables in Predicting Performing Digital Altruism (POPB)

Predictor	b	SE(b)	β	*p*
Intercept	0.86	0.67		
SleepQuantity	-0.10	0.17	-0.19	.54
SleepQuality	-0.17	0.26	-0.16	.49
SleepQuantitySQ	0.01	0.01	0.27	.34
SleepQualitySQ	0.03	0.04	0.15	.49
SleepQuantityXQuality	-0.004	0.02	-0.03	.89
Motivation/Help	-0.02	0.03	-0.04	.46
Motivation/Paint	-0.01	0.02	-0.02	.46
Motivation/Better	0.10	0.03	0.17	.001
ROPB	0.55	0.04	0.66	<.001
Internet Use	0.12	0.05	0.10	.02
Happiness	0.03	0.02	0.08	.13
Extraversion	0.06	0.02	0.11	.01
Agreeableness	-0.05	0.03	-0.07	.08
Conscientiousness	0.01	0.03	0.01	.67
Openness	0.03	0.03	0.05	.25
Neuroticism	0.04	0.02	0.07	.11

Chapter IV

Discussion

This study examined self-reported acts of digital altruism in relation to sleep quantity and sleep quality, among adult participants residing in the United States. The study results support the notion that sleep quantity is positively associated with performing digital altruism. Interestingly, the results suggest that this association may be accounted for by the mechanism of happiness (Figure 4). Other results indicate that the effect of sleep quantity on digital altruism may be confounded by motivation (to make the world a better place), receiving digital altruism, Internet use, and extraversion (Figure 4).



Sleep Quantity ⟶ **Digital Altruism**

Figure 4. Mediation of Sleep Quantity on Digital Altruism via Happiness.

This hypothesized association between sleep and performing digital altruism (Hypothesis 1) was supported for sleep quantity, but not sleep quality. Individuals who sleep more are more digitally altruistic, suggesting that sleep quantity is not only associated with performing traditional altruism, as evidenced in prior studies (Dickinson

& McElroy, 2017; Ferrara et al., 2015), but also performing digital altruism, lending credence that people behave in similar ways online and offline (Bosancianu et al., 2013; Wright & Li, 2011). Notably, the association between sleep quantity and performing digital altruism was curvilinear, such that this effect wanes with very high amounts of sleep. Nonetheless, 7 to 9 hours of sleep was associated with the highest levels of performing digital altruism, underscoring the importance of established sleep guidelines and recommendations (7-9 hours per night for adults aged 18-65: Watson et al., 2015).

The reason for lower levels of performing digital altruism among participants who sleep more than 8 hours can only be speculated. Previous research indicates that depressed individuals often sleep more than 8 hours per day (Zhai, Zhang & Zhang, 2015; Grandner & Drummond, 2007; Grander & Kripke, 2004; Kripke, Brunner, Freeman, Hendrix, Jackson, Masaki, & Carter, 2001; Bliwise, Friedman & Yesavage, 1993) making it plausible that participants who sleep longer than 8 hours may also experience some degree of depressive symptomatology or poor physical health. Although a measure of depression was not included in the present study, a measure of happiness was surveyed, and indeed, findings from the present study suggest that the association between sleep quantity and digital altruism is fully mediated by happiness, supporting Hypothesis 2. People who get sufficient sleep and good quality sleep are happier (although sleep quantity and quality may be differentially associated with happiness in older adults 65+), in line with previous findings (Baglioni, Spiegelhalder, Lombardo & Riemann, 2010; Jaques, Taylore, Azaria, Ghandeharioun, Sano & Picard, 2015; Howell, Digdon, Buro & Sheptycki, 2008), and happier people, in turn, performed more digital altruism. This latter association is in line with findings that happy people

tend to behave in more kind ways compared to their less happy counterparts (Aknin, Dunn & Norton, 2012; Otake et al., 2006) and could be explained by the broaden-and-build theory of positive emotions (Fredrickson, 2004), by showing that higher levels of happiness may expand an individual's mindset to include thoughts of others. The associations between sleep quantity and sleep quality with happiness might be, at least in part, because people who receive sufficient sleep have fewer negative thoughts and feelings (Baum, Desai, Field, Miller, Rausch & Beebe, 2014; Babson, Trainor, Feldner & Blumenthal, 2010; Talbot, McGlinchey, Kaplan, Dahl & Harvey, 2010; Walker, 2009; Franzen, Siegle & Buysse, 2008) and because people who get sufficient sleep and good sleep quality (Baum et al., 2014: Mauss, Troy & LeBourgeois, 2013; Walker, 2009) and people of advanced age (65+) (Charles & Carstensen, 2009) have a greater ability to regulate negative emotions.

The study's results revealed that happiness is not the only factor that accounts for the association between sleep quantity and performing digital altruism. Supporting Hypothesis 3, the effect of sleep quantity on performing digital altruism was controlled for when receiving digital altruism, Internet use, motivation to make the world a better place, and extraversion were taken into account. The strong association between receiving digital altruism and performing the same may simply represent reciprocity and social learning (Silk, 2013; Maynard Smith, 1984; Axelrod & Hamilton, 1981; Bandura, 1977; Trivers, 1971). In terms of Internet use, the more time individuals spend on the Internet, the more they tend to engage in acts of digital altruism. Although this correlation could be at least partly an artifact of opportunity, previous research (Deip et al., 2016; Price et al., 2005) has shown that performing acts of digital altruism is a

specific reason why some individuals use the Internet. Being motivated to make the world a better place reflects moral reasoning, which has been previously tied to altruism (Eisenberg-Berg, 1979; Lazarowitz, Stephan & Friedman, 1976). As for extraversion, the link with digital altruism expands prior research linking it with traditional altruism (Hilbig et al., 2015; Oda et al., 2014; Ben-Ner, et al., 2011; Bekkers, 2006). Extraverted individuals may be more likely to perform digital altruism because they enjoy interacting with others, which is positively associated with happiness (Rohrer, Richter, Brummer, Wagner & Schmukle, 2018; Sandstrom & Dunn, 2014; Bartolini, Bilancini & Pugno, 2013; Pavot, Diener & Fujita, 1990), and in turn, happy people tend to behave in kind ways (Aknin, Dunn & Norton, 2012; Otake et al., 2006); or simply because they are frequent users of social media (Blackwell, Leaman, Tramposch, Osborne & Liss, 2017; Kuss, & Griffiths, 2011; Ryan & Xenos, 2011; Wilson, Fornasier & White, 2010) which presents more opportunities for them to engage in acts of digital altruism.

Limitations

Although this study expands the current understanding about the association between sleep and digital altruism, this study is not without limitations. First, this study relied on self-report measures, which, although commonly used within psychology, are not without potential for bias, especially in the present study where self-presentation bias may lead individuals to overestimate or exaggerate their altruistic behaviors. Second, self-selection bias may be at play since individuals who chose to participate may be more altruistically-inclined. Future studies may consider including an objective physiological measure of sleep quantity or sleep quality, as well as a measure to track actual online behavior, in order to validate the subjective measures. Sleep diaries can be valuable in

obtaining longitudinal and within-subject information and are easily adapted for online studies. Given the newness of digital altruism research, limited scale options were available. It is possible that acts of digital altruism were underreported due to the limited items included in the only available scale. Additionally, the majority of the sample (85%) was Caucasian, so the results may not be generalizable to all ethnicities. Generalizability across the lifespan is also uncertain due to sleep and health changes associated with advanced age (65+). Finally, the observational and cross-sectional nature of the study does not allow for the determination of causal relationships. Despite these limitations, this study contributes to a greater understanding of digital altruism, about which scant research presently exists. It also serves to further highlight the importance of sleep in the context of prosocial behavior.

Future Directions

The curvilinear association evidenced between amount of sleep and performing digital altruism suggests that people who sleep more are more digitally altruistic up to eight hours of sleep, after which their engagement in acts of digital altruism wanes. Determining the reason for the wane or plateau would provide valuable insight for sleep and prosocial behavior research. Prior research has shown that depressed individuals often sleep for longer periods of time (Zhai et al., 2015; Grandner & Drummond, 2007; Grander & Kripke, 2004; Kripke et al., 2001; Bliwise et al., 1993), so future research may include a depression scale, such as the Beck's Depression Inventory (BDI) (Beck, et al., 1961), to determine if participants who sleep more than 8 hours are depressed, or if participants who are less altruistic also tend to be more depressed. Additionally, participants may be screened for medical illnesses, sleep disorders, history of trauma, and

chronic stressors which could impact sleep quantity. The curvilinear results of the present study also raise the question of diminishing positive effects of sleep beyond the recommended 7 to 9 hours per night. The negative health implications of insufficient sleep are widely reported. The risks associated with excessive sleep, however, have received less attention (Jike, Itani, Watanabe, Buysee & Kaneita, 2018) and should be researched further to elucidate the possible consequences of sleeping beyond the recommended amount. Additionally, the potential confounding effects of health and aging warrant further investigation.

Developing a more comprehensive scale to assess digital altruism would aid research efforts. In the present study, acts of digital altruism may have been underreported due to the limited items included in the POPB scale. Developing a new scale with more options could provide a more accurate depiction of digital altruism. Additionally, creating a scale that includes motives for performing digital altruism (such as the single item motivation indicators included in this study) would be informative, and would help persuade altruism purists that the acts of digital altruism were performed with pure motives (i.e., for the benefit of others without consideration of the self).

Past and the present research results have shown an association between sleep and performing traditional and digital altruism, respectively. This lends support for research findings that people behave in similar ways online and offline (Bosancianu et al., 2013; Wright & Li, 2011). However, to obtain a more accurate picture of an individual's online vs. offline level of altruism, comparative analysis should be conducted using the same sample of individuals for both assessments.

Finally, future studies would be wise to evaluate the specific role of social media as it relates to sleep and digital altruism. In the context of sleep, social media use before and after bedtime is known to result in sleep disturbances (Levenson, Shensea, Sidani, Colditz & Primack, 2016), shorter sleep times (Bhat, Pinto-Zipp, Upadhyay & Polos, 2018), and decreases in sleep quality (Exelmans & Van Den Bulck, 2017). This is particularly troubling given that using electronic media as a sleep aid is a common practice of adolescents (Eggermont & Van Den Bulck, 2006), whose sleep is already fragile due to natural changes in circadian rhythm (Crowley, Cain, Burns, Acebo, & Carskadon, 2015; Hagenauer, Perryman, Lee, & Carskadon, 2009). More generally, the blue light emitted from all electronic media devices (i.e., smart phone, computer, television) has been shown to suppress the sleep promoting neurotransmitter melatonin (Figueiro, Wood, Plitnick & Rea, 2011), potentially delaying sleep wake rhythm, which is important to good health (Buysse, 2014). In the context of digital altruism, the sleep issues that social media use right before bed can cause may inadvertently reduce the likelihood of performing digital altruism because shorter sleep times (Bhat et al., 2018) and poor sleep quality are associated with decreases in happiness (Baglioni et al., 2010; Jaques et al., 2015; Howell et al., 2008) which in turn, makes an individual less likely to behave in kind ways (Aknin, Dunn & Norton, 2012; Otake et al., 2006).

Conclusion

Results of this study suggest an association between sleep quantity and performing acts of digital altruism which extends previous research findings that sleep quantity is associated with acts of traditional altruism (Dickinson & McElroy, 2017; Ferrara et al, 2015). This finding lends support for prior research showing a positive

association between online and offline behaviors (Bosancianu et al., 2013; Wright & Li, 2011). This study lends support to guidelines set by the American Academy of Sleep Medicine, Sleep Research Society, and the National Sleep Foundation which recommend that adults age 18-65 years sleep between 7 to 9 hours per night for optimal physical and mental health. Approximately 40% of American adults receive less than 7 hours of sleep per night (CDC, 2013), which not only puts them at risk for physical and mental health concerns, but as this study elucidates, puts them at risk for behaving less altruistically online. Making changes to our schedules to ensure sufficient sleep could not only improve our physical and mental health as evidenced by prior research (Raposa et al., 2016; Brown & Brown, 2015; Poulin et al., 2013; Robotham, 2012; Thoits & Hewitt, 2011; Mills et al., 2008; Brown et al., 2005; Post, 2005; Musick & Wilson, 2003) but could also potentially increase rates of digital altruism, which could ultimately make the world a kinder place.

Appendix A: Demographic Items

What is your sex?

Female

Male

What is your age? _____.

What is your ethnic origin?

Asian/Pacific Islander

Black or African American

Hispanic/Latino

Native American/American Indian

White/Caucasian

Other

Which statement best describes your religious beliefs?

Not religious

Spiritual, but not religious

Somewhat religious

Very religious

What is the highest level of education you have completed?

Some high school

High school dimploma/GED

Some college

Trade/Technical/Vocational training

College graduate

Post graduate degree

Appendix B: Sleep Quality Measure (Holfeld & Ruthig, 2014)

1. Do you have difficulty falling asleep?

1	2	3	4
Every night/almost every night	*Sometimes*	*Almost never*	*Never*

2. Do you awake a lot during the night?

1	2	3	4
Every night/almost every night	*Sometimes*	*Almost never*	*Never*

3. Do you wake up too early without being able to get back to sleep?

1	2	3	4
Every night/almost every night	*Sometimes*	*Almost never*	*Never*

4. Do you wake up feeling unrefreshed?

1	2	3	4
Every night/almost every night	*Sometimes*	*Almost never*	*Never*

One additional item was also assessed to measure Sleep Quantity:

On average, how many hours per night do you sleep? _____

Appendix C: Online Prosocial Behavior Scale (Erreygers et al., 2018)

Performing Online Prosocial Behavior (POPB)

How often have you done the following via electronic media (smartphone, computer, tablet…) in the past month? Rate each item using the Likert scale from 1 (*never*) to 5 (*every day*).

1	2	3	4	5
Never	*Rarely*	*Sometimes*	*Very Often*	*Every day*

1. Say nice/friendly things *to* someone
2. Say nice/friendly things *about* someone
3. Help someone or offer to help
4. Cheer up someone
5. Let someone know that you like him/her
6. Let someone know that you like something (e.g., like something, send a smiley)
7. Compliment or congratulate someone
8. Help someone with his/her school work
9. Support someone
10. Comfort/console someone

Two additional items were included in the scale:

11. Donate money
12. Sign an online petition

Receiving Online Prosocial Behavior (ROPB)

How often have you experienced the following via electronic media (smartphone, computer, tablet…) in the past month? Rate each item using the Likert scale from 1 (*never*) to 5 (*every day*).

1	2	3	4	5
Never	*Rarely*	*Sometimes*	*Very Often*	*Every day*

1. Someone said nice/friendly things *to* me
2. Someone said nice/friendly things *about* me
3. Someone helped me or offered help
4. Someone cheered me up
5. Someone let me know that he/she likes me
6. Someone let me know that he/she liked something I did (e.g., liked something, sent a smiley)
7. Someone complimented or congratulated me
8. Someone helped me with my school work
9. Someone supported me
10. Someone comforted/consoled me

Appendix D: Motivation for being kind online/Single item indicators

Select the response that best describes your reason for being kind online. Rate each item using the Likert scale from 1 (*Disagree strongly*) to 5 (*Agree strongly*).

1	2	3	4	5
Disagree strongly	*Disagree a little*	*Neither agree nor disagree*	*Agree a little*	*Agree strongly*

1. I am kind online to help people who are in need. (MotivationHelp)
2. I am kind online to paint myself in a more positive light. (MotivationPaint)
3. I am kind online to make the world a better place. (MotivationBetter)

Appendix E: Internet Use Scale (Hills & Argyle, 2003)

How often do you use the Internet at each of the following locations? Rate each item using the Likert scale from 1 (*never*) to 5 (*a lot*).

1	2	3	4	5
Never	*Rarely*	*Sometimes*	*Frequently*	*A lot*

1. Home
2. College/university
3. Work
4. Elsewhere

Please indicate your frequency of use of each of the following Internet services. Rate each item using the Likert scale from 1 (*never*) to 5 (*a lot*).

1	2	3	4	5
Never	*Rarely*	*Sometimes*	*Frequently*	*A lot*

1. E-mail to friends and family
2. Getting information in general
3. E-mail for work or studies
4. Getting information for work
5. Getting information for studies
6. Finding addresses
7. Random surfing
8. Shopping
9. Downloading software
10. Current news (e.g., online newspaper)
11. Online banking
12. News/discussion groups, electronic billboards (e.g., USENET)
13. Mailing lists (e.g., LISTSERVE, MAJORDOMO)
14. Visiting websites that contain “adult” material

An additional item was included in the scale:

15. Social media

Appendix F: Subjective Happiness Scale (Lyubomirsky & Lepper, 1997)

For each of the following statements and/or questions, please select the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

1	2	3	4	5	6	7
not a very happy person						*a very happy person*

2. Compared with most of my peers, I consider myself:

1	2	3	4	5	6	7
less happy						*more happy*

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

1	2	3	4	5	6	7
not at all						*a great deal*

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you? (Reverse scored)

1	2	3	4	5	6	7
not at all						*a great deal*

Appendix G: BFI-10 (Rammstedt & John, 2007)

How well do the following statements describe your personality? Rate each item using the Likert scale from 1 (*disagree strongly*) to 5 (*agree strongly*).

1	2	3	4	5
Disagree	*Disagree*	*Neither agree*	*Agree*	*Agree*
strongly	*a little*	*nor disagree*	*a little*	*Strongly*

1. I see myself as someone who is reserved. (Extraversion; Reverse scored)
2. I see myself as someone who is generally trusting. (Agreeableness)
3. I see myself as someone who tends to be lazy. (Conscientiousness; Reverse scored)
4. I see myself as someone who is relaxed, handles stress well. (Neuroticism; Reverse scored)
5. I see myself as someone who has few artistic interests. (Openness to Experience; Reverse scored)
6. I see myself as someone who is outgoing, sociable. (Extraversion)
7. I see myself as someone who tends to find fault with others. (Agreeableness; Reverse scored)
8. I see myself as someone who does a thorough job. (Conscientiousness)
9. I see myself as someone who gets nervous easily. (Neuroticism)
10. I see myself as someone who has an active imagination. (Openness to Experience)

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