

Associations Among Chronotype, Big Five Personality Factors, and Sensation-Seeking in Two Adult Samples

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Abstract

Chronotype, or an individual's preference for morningness or eveningness, has been widely studied across medicine, genetics, and psychology. Chronotype has been linked to personality traits, academic performance, and a variety of behaviors, with evening-types often displaying higher levels of impulsivity, disinhibition, and sensation-seeking, traits that are often found among the criminal population. Despite these associations, few studies have directly examined the link between chronotype, personality, and criminal behavior, even though some traits are prevalent within both evening-type and criminal populations. The present research consists of two studies exploring the relationships between the Big Five personality traits, chronotype, and sensation-seeking. We hypothesized that evening-types would score higher on sensation-seeking, a personality trait commonly associated with criminal behavior. Study 1 included 219 adults, and Study 2 included 83 adults. Participants completed the Ten Item Personality Inventory (TIPI) and the Lark-Owl Chronotype Indicator (LOCI), with Study 2 also including the Sensation Seeking Scale (SSS). Results showed that morning-types were more conscientious, emotionally stable, and extraverted, while evening-types were less conscientious and more disinhibited. These findings support existing research on chronotype and personality and highlight the potential role of chronotype in behavioral tendencies related to risk-taking and impulsivity.

Keywords: chronotype, Big Five personality traits, sensation-seeking, criminality

1. Introduction

Chronotype, or the tendency to be either a morning-type or an evening-type individual, has been well researched in a variety of different academic fields, including medicine and psychiatry (Montaruli et al., 2021; Zou et al., 2022), genetics (Jones et al., 2019; Kalmbach et al., 2017), and psychology (Lipnevich et al., 2017; Randler et al., 2017; Soehner et al., 2007). Chronotype is also defined as the circadian preference, with individuals preferring to get up early and go to bed early, and others preferring to go to bed late and wake up late (Gao et al., 2019; Randler et al., 2017). Previous research on chronotype has largely focused on how chronotype is determined in an individual (Kalmbach et al., 2017), as well as its relation to academic performance (Ebersbach et al., 2016), healthy or unhealthy behaviors (Biss & Hasher, 2012; Mazri et al., 2019), and personality (Randler et al., 2017; Kivelä et al., 2018). Randler et al. (2017) investigated relationships between chronotype, as measured by the German version of the Morning-Evening-Questionnaire, and personality, as measured by the German version of the NEO-FFI-30. Results showed that age, extraversion, and conscientiousness all positively correlated with people's tendency toward being a morning person, while openness to experience was positively correlated with being an evening person (Randler et al., 2017). Lipnevich et al. (2017) examined the relations between morningness-eveningness and the Big Five Personality Traits. They found moderate relationships between conscientiousness and chronotype, weak to moderate relationships between agreeableness and chronotype, and moderate relationships between extraversion, openness and eveningness. Additionally, other personality researchers have linked evening chronotypes with personality characteristics such as impulsivity, disinhibition, and sensation seeking (Kivelä et al., 2018). More recent research has found that chronotype is linked to aggression (Belfry et al., 2020) and mood disturbances (Soehner, et al., 2007; Zou et al., 2022), thereby supporting the association between chronotype and various personality traits.

Much of the research that investigates personality, including Randler et al. (2017), have used long personality instruments such as the Eysenck Personality Questionnaire (EPQ) to get a clear grasp on one's entire personality profile. However, long measures are not always available nor possible to administer during studies, which is why a different personality instrument was created. The Ten Item Personality Inventory (TIPI; Gosling, 2003) has previously been used to link personality to a diverse array of factors including academic success (Shi et al., 2022), exercise performance (Lundy et al., 2025), occupational fitness (Clements, 2020), and political attitudes (Boston et al., 2018). Shimotsukasa et al. (2018), used the TIPI – Japanese version (TIPI-J; Gosling et al., 2003) to investigate the relationship between the Big Five of personality and criminal offenses. Results suggest that prisoners overall tended to show higher levels of agreeableness, openness, conscientiousness, and extraversion, when compared with non-criminal adult samples. Such research reinforces the TIPI's validity and supports usefulness as a concise measure of personality in diverse study settings.

2. Study One

Building on the foundational studies of personality and chronotype, the primary aim of Study 1 was to explore the relationships between the Big Five personality traits and dimensions of chronotype (morningness and eveningness). We hypothesized that conscientiousness and extraversion would positively correlate with morningness. Conversely, a negative correlation between conscientiousness and eveningness was expected.

2.1 Method

2.1.1 Participants

Participants were 219 adults (Women = 146, Men = 49, Non-binary = 2, Did not report = 22) who were invited to participate via social media using Facebook, Instagram, LinkedIn, WhatsApp, and Snapchat. The mean age of participants was 33.52 ($SD = 13.75$). Out of 159 participants who self-reported chronotype, 69 identified as a morning-type, 78 identified as an evening-type, and 12 were not sure.

2.1.2 Materials

For this study, the following questionnaires were administered to participants: the Ten Item Personality Inventory (TIPI; Gosling et al., 2003) and the Lark-Owl-Chronotype-Indicator (LOCI; Roberts, 2018). Additionally, participants completed a demographic questionnaire developed by the authors, which asked questions about age, gender, and self-report questions in which participants identified themselves as either a morning-type or evening-type.

(1) Ten Item Personality Inventory (TIPI)

The Ten Item Personality Inventory (TIPI; Gosling et al., 2003) was used to measure personality. This short 10-item questionnaire is designed to assess individuals' personalities according to the Big Five personality traits in the Five Factor Model of personality (FFM; Costa & McCrae, 1992). Individuals rate the extent to which the personality traits apply to themselves on a Likert scale from 1 to 7, where 1 means disagree strongly and 7 means agree strongly. We used average scores for each of the five traits measured. The TIPI was chosen over a longer measure of personality due to its brevity, which conserves time for the participants. The test-retest reliability of the TIPI, as tested by Gosling et al. (2003), showed the following Cronbach's alpha values: $\alpha = .77$ for Extraversion, $\alpha = .71$ for Agreeableness, $\alpha = .76$ for Conscientiousness, $\alpha = .70$ for Emotional Stability, and $\alpha = .67$ for Openness to Experience (Mean Cronbach $\alpha = .72$).

(2) Lark-Owl-Chronotype-Indicator (LOCI)

To measure participants' chronotype, we administered the Lark-Owl-Chronotype-Indicator (LOCI; Roberts, 2018). This 37-item inventory measures individuals' tendencies to either rise early or sleep late, in addition to their tendency toward sleep deprivation. The LOCI has three subscales: the Morning Scale (13 items), the Evening Scale (13 items), and the Propensity for Sleep Debt Scale (12 items). Participants rate each question on a scale of 1-6, where 1 is never and 6 is always. Reliabilities for LOCI Morningness, obtained in three samples were $\alpha = .90$, $\alpha = .88$, and $\alpha = .88$. Reliabilities for LOCI Eveningness, obtained in those same three samples were $\alpha = .84$, $\alpha = .83$, and $\alpha = .82$.

2.1.3 Procedure

This study was administered online using Qualtrics software. Participants were invited to participate via social media. After granting consent, participants answered demographic questions about gender and age. Participants then completed the TIPI (10 items) and LOCI (37 items). Following completion of these questionnaires, participants were debriefed, thanked, and the survey concluded.

2.1.4 Results

(1) Correlations between Chronotype and the Big Five of Personality

To examine direct associations between chronotype and the Big Five personality traits, Spearman's rho correlations were used. As shown in Table 1, morningness was positively correlated with conscientiousness ($r_s(159) = .22, p = .005$), emotional stability ($r_s(159) = .31, p < .001$), and extraversion ($r_s(159) = .20, p = .012$). In contrast, eveningness was negatively correlated with conscientiousness ($r_s(158) = -.21, p = .009$). This indicates that morning-type individuals are more conscientious, emotionally stable, and extraverted. Conversely, evening-types are less conscientious. Considering this result, the hypothesis that conscientiousness and extraversion will correlate positively with morningness, was supported. These results also support the hypothesis that conscientiousness correlates negatively with eveningness. There were also some correlations between personality traits. Extraversion correlated positively with emotional stability ($r_s(159) = .17, p = .035$) and openness to experience ($r_s(158) = .17, p = .038$), but negatively with agreeableness ($r_s(159) = -.19, p = .017$). Additionally, emotional stability positively correlated with agreeableness ($r_s(159) = .24, p = .003$) and conscientiousness ($r_s(159) = .26, p = .001$).

(2) Independent Samples *t*-test

An independent samples *t*-test was used to examine gender differences on the Big Five of Personality. Due to unequal variances between groups on the trait of extraversion, we adjusted degrees of freedom using the Welch-Satterthwaite approximation. Our results show that men scored significantly higher than women on extraversion, $t(70.65) = 2.90, p = .005, d = 1.66, 95\% \text{ CI } [0.11, 0.66]$. Men also scored significantly higher on emotional stability, $t(155) = 3.09, p = .002, d = 1.37, 95\% \text{ CI } [0.21, 0.96]$. Women scored significantly higher than men on agreeableness, $t(155) = -3.05, p = .003, d = 1.15, 95\% \text{ CI } [-0.96, -0.20]$, and conscientiousness, $t(155) = -2.13, p = .034, d = 1.31, 95\% \text{ CI } [-0.78, -0.03]$.

Table 1. Correlations for Chronotype and the Big Five of Personality

Variable	M	SD	1	2	3	4	5	6	7
1. Morningness	-	-	-	-					
2. Eveningness	-	-	-	-					
3. Extraversion	4.38	1.69	.20*	.05	-				
4. Emotional Stability	4.74	1.41	.31**	-.06	.17*	-			
5. Openness to Experience	5.15	1.78	-.12	.18*	.17*	.01	-		
6. Agreeableness	4.83	1.18	-.04	-.04	-.19*	.24**	.11	-	
7. Conscientiousness	5.57	1.32	.22**	-.21**	-.10	.26**	-.09	.08	-

* $p < .05$. ** $p < .01$

3. Study Two

Although previous research has explored the relationship between personality and chronotype, as well as between personality traits and criminality, no studies have specifically examined the connection between chronotype and criminality. Research on chronotype and personality has revealed that evening-types are associated with traits such as disinhibition, sensation-seeking, and impulsivity (Kivelä et al., 2018). Additionally, being an evening-type is linked to these traits, which are also prevalent in criminal men. For instance, Longato-Stadler et al. (2002) found that criminal men scored higher on sensation-seeking and impulsivity compared with non-criminal men. Similarly, Sinha (2016) demonstrated that criminal men scored higher on impulsiveness than controls. Related studies of gender differences in criminal offending suggest that men in general are more likely than women to display various traits associated with criminality (Smith, 2014).

Building on this body of research, we aimed to investigate not only the relationship between the Big Five personality traits and chronotype but also to expand on previous research by incorporating measures of sensation-seeking (thrill-seeking). This addition allowed us to explore the potential prevalence of specific chronotypes found

within a criminal population more closely. Thrill-seeking was included as a personality characteristic due to its known association with evening-types (Kivelä et al., 2018) and its prevalence among male criminals (Longato-Stadler et al., 2002). Hence, the primary aim of Study 2 was to examine the relationships between the Big Five personality traits and chronotype, while incorporating sensation-seeking as an additional personality trait. The same correlations between the Big Five personality traits and chronotype as expected in Study 1 was expected in Study 2. Moreover, it was anticipated that evening-types would score higher on measures of sensation-seeking compared with morning-types.

3.1 Method

3.1.1 Participants

Participants were 83 adults (Women = 55, Men = 27, and 1 did not report) who were invited to participate via social media using Facebook, Instagram, LinkedIn, WhatsApp, and Snapchat. The mean age of participants in this study was 27.14 ($SD = 10.05$). Out of 83 participants who self-reported chronotype, 28 identified as a morning-type, 40 identified as an evening-type, 11 identified as neither, and 4 were not sure.

3.1.2 Materials

For this study, the following questionnaires were administered to participants: the TIPI, the LOCI, and the Disinhibition subscale and the Thrill and Adventure Seeking subscales from the Sensation Seeking Scale (SSS; Zuckerman et al. 1964). Additionally, participants also completed the same demographic questionnaire and a self-report question in which participants self-identified as either a morning-type or evening-type.

(1) Sensation Seeking Scale (SSS)

The SSS is a forty-item questionnaire initially developed by Zuckerman et al. (1964) to sample a broad sensation-seeking tendency. The SSS has four primary scales (Disinhibition, Boredom Susceptibility, Thrill and Adventure Seeking, Experience Seeking) and one total score. However, for the purposes of this study only the Disinhibition and Thrill and Adventure Seeking scales were used. Reliability for the Disinhibition scale, obtained in a study was $\alpha = .83$, Reliability for the Thrill and Adventure Seeking scale, obtained in that same study was $\alpha = .91$ (Gray and Wilson, 2007).

3.1.3 Procedure

To mirror conditions with Study 1 as closely as possible, this study was also administered online using Qualtrics software. Participants were invited to participate via social media. After granting consent, participants answered demographic questions about gender and age. Participants then completed the TIPI (10 items), LOCI (37 items), and the SSS (20 items). Following completion of these questionnaires, participants were debriefed, thanked, and the survey concluded.

3.1.4 Results

(1) Correlations between Chronotype, the Big Five Personality Traits, and Sensation-seeking

To examine direct associations between chronotype, the Big Five personality traits, and thrill-seeking, Spearman's rho correlations were used. As shown in Table 2, morningness was positively correlated with conscientiousness ($r_s(83) = .44, p < .001$) and emotional stability ($r_s(82) = .42, p < .001$). In contrast, eveningness was negatively correlated with conscientiousness ($r_s(82) = -.25, p = .027$) and positively correlated with disinhibition ($r_s(77) = -.35, p = .002$). This indicates that morning-type individuals are more conscientious and emotionally stable. Additionally, evening-types are more disinhibited, or tend to be more impulsive. Moreover, evening-types show significant relationships on the subscale disinhibition, while morning-types showed no significant relationships. Considering this result, the hypothesis that conscientiousness would correlate positively with morningness, was supported. Between personality traits there were also some significant relationships. Thrill-seeking was positively correlated with conscientiousness ($r_s(81) = .25, p = .025$) and disinhibition ($r_s(78) = .36, p = .004$). Additionally, disinhibition was positively correlated with extraversion ($r_s(78) = .23, p < .041$).

Table 2. Correlations for Chronotype, the Big Five of Personality, and Sensation-seeking

Variable	M	SD	1	2	3	4	5	6	7	8	9
1. Morningness	-	-	-	-							
2. Eveningness	-	-	-	-							
3. Extraversion	4.13	1.43	.21	.10	-						
4. Emotional Stability	4.45	1.71	.42**	-.04	.09	-					
5. Openness to Experience	5.31	1.06	-.13	.13	.28*	.02	-				
6. Agreeableness	4.77	1.01	.09	-.16	-.08	.20	.22*	-			
7. Conscientiousness	5.24	1.33	.44**	-.24*	.07	.24*	.07	.16	-		
8. Thrill-seeking	15.47	2.66	.17	.09	.16	.02	.18	.03	.25*	-	
9. Disinhibition	14.97	2.94	-.13	.35**	.23*	-.15	.37**	-.09	.32**	-	-

* $p < .05$. ** $p < .01$

(2) Independent Samples *t*-test

Similar to Study 1, an independent samples *t*-test was conducted to examine gender differences on the measured personality traits. Our results show that men scored significantly higher than women on emotional stability, $t(79) = 3.02, p = .003, d = 3.26, 95\% \text{ CI } [0.23, 1.18]$. Our results also showed that there was a significant difference in thrill-seeking scores between men and women, $t(78) = 2.61, p = .011, d = 2.57, 95\% \text{ CI } [0.14, 1.10]$, with men scoring significantly higher than women. There were no significant differences between men and women in the variables of extraversion, agreeableness, conscientiousness, openness to experience, disinhibition, and ethical decision-making.

In Study 2, an independent samples *t*-test was used to not only compare men with women, but also compare self-reported morning-type individuals to evening-type individuals. We found that there were significant differences between the two groups. Morning-type individuals scored significantly higher than evening-types on conscientiousness, $t(80) = 2.77, p = .007, d = 2.55, 95\% \text{ CI } [0.17, 1.05]$, and emotional stability, $t(79) = 2.13, p = .036, d = 3.33, 95\% \text{ CI } [0.03, 0.91]$. Our data suggests that morning-type individuals are significantly more likely to be conscientious and emotionally stable than evening-types. The independent samples *t*-test also indicated a significant difference in disinhibition scores between morning-types and evening-types, $t(75) = -2.79, p = .007, d = 2.81, 95\% \text{ CI } [-1.09, -0.17]$, with evening-types scoring higher on disinhibition than morning-types. This finding suggests that evening-types are significantly more likely to be disinhibited than morning-types. Furthermore, there were no significant differences between morning and evening-types in the variables extraversion, agreeableness, openness to experience, thrill-seeking, and ethical decision-making.

4. Discussion

4.1 Personality Traits and Chronotype

Results from the current studies align with previous research on personality, chronotype, and associated traits (Randler et al., 2017; Lipnevich et al., 2017; Kivelä et al., 2018). Specifically, we found that morningness is positively associated with emotional stability and conscientiousness, which is consistent with prior studies linking morningness with these traits (DeYoung et al., 2007; Jackson & Gerard, 1996; Lipnevich et al., 2017; Randler et al., 2017; Tonetti et al., 2009).

These studies contribute to a growing body of literature suggesting that chronotype is related to several personality factors that also influence subjective well-being and life satisfaction. For instance, previous research has shown that both young and older adults who identify as morning-types tend to report better overall health and higher subjective well-being (Biss & Hasher, 2012). A recent study by Tsapakis et al. (2024) similarly found that among psychiatric patients in Greece, morning chronotypes were linked to better emotional well-being.

In contrast, evening chronotypes have been associated with a higher likelihood of developing addictive behaviors and lower emotional adjustment, likely due to differences in neural reward pathways (Giannotti et al., 2002; Logan

et al., 2014). Additionally, evening-types consistently exhibit lower emotional stability, lower conscientiousness, and higher levels of depressive symptoms (Gorgol et al., 2022).

Our results from Study 2 support these findings, showing that morning-types exhibit higher emotional stability. This is consistent with Zhang et al. (2022), who found that chronotype and risk-taking behavior are mediated by self-control and emotional regulation. Individuals with greater emotional stability and self-control tend to engage in less risky behavior (Zhang et al., 2022).

4.2 Personality Traits and Criminality

Our findings align with previous research showing that certain personality traits, such as impulsivity and low emotional stability, are overrepresented in both clinical and criminal populations (Haapasalo, 1990; Sinha, 2016; Shimotsukasa, 2018). We also found that evening-types scored higher in disinhibition, while morning-types exhibited greater emotional stability, supporting a possible link between chronotype, personality traits, and criminal behavior. Additionally, consistent with well-established findings that men are overrepresented in criminal statistics (Armstrong et al., 2022; Boyle, 2024; Smith, 2014), our data revealed significantly higher thrill-seeking scores among male participants, reinforcing the idea that certain personality traits may contribute to gender differences in risk-taking and antisocial behavior.

Previous research on personality and criminal behavior suggests that criminals and non-criminals exhibit distinct personality traits (Haapasalo, 1990; Sinha, 2016; Shimotsukasa et al., 2018). For example, Sinha (2016), reported that criminals exhibit lower emotional stability compared to non-criminal controls. Sinha (2016) aimed to examine the relationship between personality traits and criminal behavior, as well as assess whether these traits could predict future recidivism. In addition to reduced emotional stability, criminals were found to display characteristics such as independence, suspicion, attention-seeking behavior, carelessness, and a lack of concern for others. However, no definitive conclusions were drawn regarding the predictive value of these traits for recidivism. Sinha (2016) emphasized the need for further research in this area. Similarly, research by Shimotsukasa et al. (2018) on the Big Five personality traits in relation to criminal offenses found that, overall, prisoners scored higher in agreeableness, openness, conscientiousness, and extraversion compared to controls.

Moreover, sensation-seeking has been specifically linked to criminal behavior. Haapasalo (1990) conducted a study in Finland, demonstrating that male offenders scored significantly higher on the Sensation Seeking Scale than non-offenders. These findings suggest that sensation-seeking tendencies may be more pronounced in individuals engaged in criminal activity. Burt and Simons (2013) found that thrill-seeking and self-control appear to have separate influences on individuals' decisions to engage in criminal behavior. This tendency may be linked to both functional and structural abnormalities in specific brain regions, such as the amygdala (Beech et al., 2018).

It is possible that developmental and neurological mechanisms related to the puberty transition may influence chronotype, personality, and possibly criminality. It is well-established that adolescent and emerging adult populations are more likely to engage in sensation-seeking and reckless behavior (Arnett, 1996; Duell et al., 2018), as well as showing higher rates of criminal behavior than during other stages of the human lifespan (Ulmer & Steffensmeier, 2014). Adolescents also tend to temporarily adopt an evening-type chronotype during puberty (Karan et al., 2021), and among these adolescent populations, evening-type individuals are more likely to engage in risk-taking behavior than morning-types (Wang et al., 2021). It is possible that the same neurological mechanisms that lead to a temporary chronotype shift during adolescence also underlie the increase in risk-taking behavior and criminal behavior among this population. Adolescence is a critical period for brain development, particularly in regions responsible for impulse control and decision-making. Additionally, evening-types, who often experience delayed circadian rhythms, may be more susceptible to sleep disturbances and cognitive impairments. These disruptions could, in turn, contribute to an increased propensity for risk-taking behavior and criminality, underscoring the need for further research in this area.

4.3 Limitations and Final Conclusions

There are several limitations in the present studies that should be considered when interpreting the results. The sample sizes were relatively small, 219 participants in Study 1 and 83 in Study 2, especially compared with previous studies on similar topics. A larger sample size would increase the reliability of the findings, provide more robust data, and help uncover more subtle effects. Additionally, our sample was disproportionately female (146 women in Study 1 and 55 in Study 2), which limits the generalizability of the findings, particularly since criminality is more prevalent among men in the general population (Boyle, 2024; Smith, 2024; United States Department of Justice, Federal Bureau of Investigation, 2019).

Another limitation is the reliance on self-report measures, such as the TIPI, LOCI, and SSS. These tools are susceptible to social desirability and response biases, which may distort the data, particularly when assessing sensitive topics like personality traits and criminal behavior. These biases could potentially lead to inaccuracies in the conclusions drawn from the studies.

Despite these limitations, the results are consistent with previous research on chronotype and personality, and they offer valuable insights for future investigations. Notably, the biopsychosocial factors that contribute to the development of chronotype in humans remain largely unexplored. While animal studies have provided foundational insights into chronotype development (Refinetti et al., 2019), the mechanisms at play in human development need further investigation. Additionally, there is a growing body of research linking chronotype with specific psychopathologies (Zou et al., 2022), which warrants further exploration of how personality traits of evening- and morning-types align with those seen in clinical populations.

Lastly, these studies lay the groundwork for future research examining the role of personality traits in criminal behavior. Future studies should expand on these findings by investigating whether these associations extend beyond mere correlation, particularly in the context of risk assessments for criminal behavior. To improve generalizability, future studies should also include a larger male sample. Furthermore, research could explore whether these traits can serve as predictive markers for criminal behavior or be utilized in preventative measures within criminal justice interventions.

5. Author Contributions

Marit de Lau and Rebecca D. Foush e equally contributed to all parts of this paper. This article is based on the senior thesis completed by Marit de Lau (2022). Data from this project was previously presented at the Midwestern Psychological Association 94th Annual Meeting in Chicago, IL in April 2022 (de Lau, 2022).

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7. Conflict of Interest Statement

We have no known conflicts of interest to disclose.

8. Data Availability Statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

9. Ethics Statement

This study was reviewed and approved by the Lindenwood University IRB.

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