



Creatures of the night: Chronotypes and the Dark Triad traits

Peter K. Jonason^{a,*}, Amy Jones^b, Minna Lyons^b

^aUniversity of Western Sydney, Australia

^bLiverpool Hope University, United Kingdom

ARTICLE INFO

Article history:

Received 14 March 2013

Received in revised form 26 April 2013

Accepted 1 May 2013

Available online 25 May 2013

Keywords:

Dark Triad
Narcissism
Psychopathy
Machiavellianism
Morningness:eveningness
Chronotype
Evolutionary psychology

ABSTRACT

In this study ($N = 263$) we provide a basic test of a niche-specialization hypothesis of the Dark Triad (i.e., narcissism, psychopathy, and Machiavellianism). We propose that in order to best enact a “cheater strategy” those high on the Dark Triad traits should have optimal cognitive performance and, thus, have a night-time chronotype. Such a disposition will take advantage of the low light, the limited monitoring, and the lessened cognitive processing of morning-type people. The Dark Triad composite was correlated with an eveningness disposition. This link worked through links with the “darker” aspects of the Dark Triad (i.e., Machiavellianism, secondary psychopathy, and exploitive narcissism); correlations that were invariant across the sexes. While we replicated sex differences in the Dark Triad, we failed to replicate sex differences in chronotype, suggesting eveningness may not be a sexually selected trait as some have argued but is a trait under natural selective pressures to enable effective exploitations of conspecifics by both sexes.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

A fundamental individual difference in biology (see Rosbash & Hall, 1989) is the distinction between nocturnality (i.e., activity during the night) and diurnality (i.e., activity during the day). This distinction is accompanied by a number of specialized adaptations. For instance, chimpanzees (*Pan troglodytes*) and spider monkeys (genus *Ateles*) have evolved for diurnality (Campbell, Fuentes, MacKinnon, Panger, & Bearder, 2007). Both have evolved specialized psychological systems like color-vision to forage for ripe fruits. In contrast, nocturnal animals like tarsiers (genus *Tarsius*) and cats (genus *Felidae*) have specialized adaptations for finding food at night. Tarsiers, for example, have evolved eyes that are so large they do not fit within their eye-sockets (Fleagle, 1999), and cats have reflective lenses (i.e., *Tapetum lucidum*) to amplify ambient light at night (Ollivier et al., 2004). Like vision, personality traits may represent specialized adaptations for carving up the multidimensional human niche (Figueredo et al., 2006; Jonason, Webster, Schmitt, Li, & Crysel, 2012). In this study we correlate individual differences in chronotypes (i.e., tendency to be a night-owl or an early-riser) and the Dark Triad traits (i.e., narcissism, psychopathy, and Machiavellianism).

“Chronotype” is an individual difference that reflects people’s propensity to go to sleep early or late in the evening and to wake up early or late. At one end of the spectrum are early risers who ex-

hibit optimal cognitive functioning earlier in the day than those on the opposite end of the spectrum who exhibit their optimal cognitive performance later in the day (Horne, Brass, & Pettitt, 1980; Horne & Östberg, 1976; Roberts & Kyllonen, 1999; Tankova, Adan, & Buela-Casal, 1994). Some have argued that diurnality is the ancestral state for human beings given our most recent common ancestors (i.e., Great Apes) who share this tendency (Kanazawa & Perina, 2009; Piffer, 2010) but this idea fails to take into account that nocturnality is the ancestral state for the most likely common primate ancestor; a small, nocturnal shrew-like animal (Fleagle, 1999) and, thus, nocturnality could be argued as the ancestral condition just as easily.¹ We would contend that humans have retained the ability for both, with diurnality being the more recent (i.e., derived) adaptation but the potential for nocturnality still lingering in our genes (i.e., primitive). With this flexibility, some humans may find it adaptive to occupy this under exploited niche for their adaptive goals. We contend the Dark Triad traits may represent a specialized adaptation for night-time living.

There is considerable empirical evidence to believe the Dark Triad are linked to such a disposition. First, both the Dark Triad traits (Vernon, Villani, Vickers, & Harris, 2008) and chronotype (Hur, 2007; Hur, Bouchard, & Lykken, 1998; Klei et al., 2005) are heritable. Second, an evening chronotype has been linked to increased mating success in the short-term context (Gunawardane,

* Corresponding author. Address: School of Social Sciences and Psychology, University of Western Sydney, Milperra, NSW 2214, Australia. Tel.: +61 0434104710.

E-mail address: p.jonason@uws.edu.au (P.K. Jonason).

¹ This highlights the pernicious problem in evolutionary psychology of (1) generating hypothetical scenarios or “just-so stories” and (2) a problem with reasoning by homology given the problem of pinning down the appropriate ancestor to focus on.

Piffer, & Custance, 2011; Piffer, 2010; Randler et al., 2012), as well as to impulsivity, risk-taking, sensation-seeking (Adan, Natale, Caci, & Prat, 2010; Caci, Robert, & Boyer, 2004; Digdon & Howell, 2008; Killgore, 2007; Russo, Leone, Penolazzi, & Natale, 2012), extraversion (Diaz-Morales, 2007; Matthews, 1988; Randler et al., 2012; but see Tonetti, Fabri, & Natale, 2009), and limited conscientiousness and agreeableness (Randler, 2008; Tsaousis, 2010). Furthermore, an evening chronotype is more common in those with individualistic predispositions over collectivistic, other-orientated ones (Vollmer & Randler, 2012). All of these have been linked to the Dark Triad (Jonason, Koenig, & Tost, 2010; Jonason, Li, & Teicher, 2010; Jonason, Li, Webster, & Schmitt, 2009; Jonason & McCain, 2012; Jonason & Tost, 2010; Jonason, Valentine, Li, & Harbeson, 2011; Jonason & Webster, 2010; Jones & Paulhus, 2011; Lee & Ashton, 2005; Paulhus & Williams, 2002).

However, there are also good theoretical reasons to believe the Dark Triad might be associated with a specialization to a night-time chronotype. There is likely a co-evolutionary arms race between cheaters and those who wish to detect and punish them (Cosmides & Tooby, 1992; Cummins, 1999). The Dark Triad traits may represent specialized adaptations to avoid cheater detection (Jonason & Webster, 2012). The Dark Triad traits are characterized by entitlement, superiority, dominance (i.e., narcissism), glib social charm, manipulateness (i.e., Machiavellianism), callous social attitudes, impulsivity, and interpersonal antagonism (i.e., psychopathy). One manner by which these traits might be adaptive is by predisposing individuals to exploit the night-time niche. With fewer people awake, the lessened light, and the diminished cognitive processing of those with morning disposition, enacting a “cheater strategy” (Jonason & Webster, 2012; Mealey, 1995) might be easier at night; all of which diminishing detection risks. Indeed, most crimes (Laubichler & Ruby, 1986; Stroebel et al., 2010) and most sexual activity peaks at night (Reinberg & Lagoguey, 1978), suggesting just such a link. Therefore, we predict the Dark Triad will be linked to a tendency to being a “night-owl”.

The Dark Triad traits are not monolithic. Although Machiavellianism (as measured by the MACH IV; Christie & Geis, 1970) appears to be one-dimensional (Hunter, Gerbing, & Boster, 1982), both narcissism (as measured with the NPI; Raskin & Terry, 1988) and psychopathy (as measured with the SRP III; Paulhus, Neumann, & Hare, in press) are multidimensional (Ackerman et al., 2011; Falkenbach, Poythress, Falki, & Manchak, 2007; Hicks, Markon, Patrick, Krueger, & Newman, 2004; Raskin & Terry, 1988). We expect the “darker” aspects of these traits to be the primary berth of any links between the Dark Triad and chronotype. We expect secondary or hostile/reactive psychopathy (see Falkenbach et al., 2007; Hicks et al., 2004) to be related to an evening orientation, as it is associated with social manipulation, deviance, aggressive, impulsivity, and neuroticism. Similarly, we expect the entitlement/exploitativeness aspect of the three dimensional model of the Narcissistic Personality Inventory (Ackerman et al., 2011) to be linked to an evening chronotype more than the other aspects (e.g., leadership/authority; grandiose exhibitionism).

In this study we provide a simple test of the niche-specialization hypothesis for the Dark Triad. That is, in order to be adaptive, the traits should facilitate the active exploitation of specialized niches (Jonason & Schmitt, 2012; Jonason et al., 2011). One such niche might be night-time, providing for diminished detection risk for those predisposed to be “bad”.

2. Method

2.1. Participants and procedure

Two hundred and sixty-three volunteers (74 males; $M = 24.72$, $SD = 8.71$) participated in an online study advertised to students

in a university in northwest England ($n = 55$), on an on-line psychology participation website ($n = 147$), and via e-mail and social media advertising ($n = 61$).² The front page of the survey provided information on the nature of the study, as well as relevant ethical issues. Participants exited the survey via a page that included the researchers' contact details and a full debrief.

2.2. Measures

Narcissism was assessed with the widely used 40-item Narcissistic Personality Inventory (Raskin & Terry, 1988). Participants chose one of two statements for each item, one reflecting narcissistic attitude (e.g., “I have a natural talent for influencing people”), whereas the other did not (e.g., “I am not good at influencing people”). The narcissistic choices were averaged to create an index of leadership/authority (Cronbach's $\alpha = .78$), grandiose exhibitionism ($\alpha = .79$), and entitlement/exploitativeness ($\alpha = .57$), and overall narcissism ($\alpha = .87$).

The 64-item Self-Report Psychopathy Scale-III (Paulhus et al., in press)³ was used to assess subclinical psychopathy. Participants rated how much they agreed (1 = *strongly disagree*; 5 = *strongly agree*) with statements such as: “I enjoy driving at high speeds” and “I think I could beat a lie detector.” The items were averaged to create indices of secondary ($\alpha = .90$) and primary ($\alpha = .77$), along with overall psychopathy ($\alpha = .91$).

Machiavellianism was measured with the 20-item MACH-IV (Christie & Geis, 1970), where participants were asked how much they agreed (1 = *strongly disagree*; 7 = *strongly agree*) with statements such as: “It is hard to get ahead without cutting corners here and there” and “People suffering from incurable diseases should have the choice of being put painlessly to death.” The items were summed to create a Machiavellianism index ($\alpha = .75$).

All of the Dark Triad instruments were significantly, positively correlated with each other. Machiavellianism was associated with psychopathy ($r(263) = .61$, $p < .01$) and narcissism ($r(263) = .38$, $p < .01$) and psychopathy and narcissism were linked ($r(263) = .52$, $p < .01$). In a principal components analysis, the three Dark Triad traits loaded on a single factor that explained 67.10% of the variance in the traits (Eigen = 2.01). Therefore, we created a composite Dark Triad measure by averaging standardised scores for the three instruments ($\alpha = .73$).

Chronotypes were measured with the 19-item Morningness–Eveningness Questionnaire (Horne & Östberg, 1976), asking participants about their sleep timing and schedules with questions such as: “If you got into bed at 11 PM, how tired would you be? (0 = *not at all tired*; 5 = *very tired*)” and “During the first half hour after you wake up in the morning, how do you feel? (1 = *very tired*; 4 = *very refreshed*). Higher scores indicate a morning type, and low scores a more evening type orientation. The items were summed to form an index of chronotype ($\alpha = .81$, $M = 46.70$; $SD = 9.68$).

3. Results

We investigated the relationship between chronotype and the Dark Triad in a series of zero-order correlations (see Table 1). The composite Dark Triad score ($r(261) = -.16$, $p < .01$), total psychopathy ($r(261) = -.14$, $p < .01$), secondary psychopathy ($r(261) = -.14$, $p < .01$), Machiavellianism ($r(263) = -.14$, $p < .01$), and the entitlement/exploitativeness facet of the NPI ($r(261) = -.20$,

² No differences were detected across sample type and, thus, results are collapsed across that distinction.

³ Although still in press, this scale has repeatedly been used in Dark Triad research despite its status (e.g., Jonason, Li, Webster, & Schmitt, 2009; Jonason, Lyons, Bethell, & Ross, 2013; Jones & Paulhus, 2011; Lee & Ashton, 2005; McDonald, Donnellan, & Navarrete, 2011; Paulhus & Williams, 2002; Vernon et al., 2008).

Table 1
Descriptive statistics and a summary of zero-order correlations and regression values for the Dark Triad (predictor variables) and chronotype (outcome variable).

	<i>r</i>	β (<i>t</i>)	<i>M</i> (<i>SD</i>)
Dark Triad	-.14* [-.23**]	–	0.00 (0.80)
Narcissism	-.04 [-.05]	.04 (0.60)	0.34 (0.18)
Entitlement/ exploitativeness	-.20** [-.36**]	-.24 (-3.33**)	0.19 (0.26)
Grandiose exhibitionism	-.05 [.07]	-.05 (-0.69)	0.30 (0.26)
Leadership/authority	.05 [.07]	.18 (2.29*)	0.40 (0.26)
Psychopathy	-.13* [-.18**]	-.09 (-1.05)	142.56 (27.99)
Primary	-.07 [-.11]	.16 (-1.07)	75.16 (16.57)
Secondary	-.18** [-.26**]	-.20 (-2.63**)	67.40 (14.54)
Machiavellianism	-.14* [-.23**]	-.09 (-1.07)	75.16 (16.57)

* $p < .01$, ** $p < .001$, ‘–’ denote variables not included in the regression.

Correlations in brackets are the disattenuated values using the reliability for the scales.

$p < .01$) were all related to an evening-type orientation. In Table 1, we also report the attenuated correlations between chronotype and the Dark Triad variables. None of the correlations were moderated by sex of the participant (full results can be obtained from the third author). Although men scored higher on Machiavellianism ($t(261) = -3.16$, $p < .01$, Hedge’s $g = -0.31$), psychopathy ($t(261) = -7.60$, $p < .01$, $g = 1.05$), and narcissism ($t(261) = -4.46$, $p < .01$, $g = -0.61$) than women did, however, we failed to replicate (Adan & Natale, 2002; Tonetti, Fabri, & Natale, 2008; Tsai & Li, 2004) sex differences in chronotypes ($t = 0.13$, $g = 0.02$), thus precluding mediation analyses.

In order to control for shared variance between the Dark Triad and its sub-components, we ran two regressions where chronotype was entered as the outcome variable, and Machiavellianism, psychopathy and NPI-total scores as the predictor variables. When the shared variance between the Dark Triad traits was controlled for, none of the three emerged as a significant predictor of chronotype. In order to investigate the relative importance of the Dark Triad sub-components, we ran a second regression where Machiavellianism, secondary and primary psychopathy, and the three NPI facets were entered as the predictor variables. When shared variance between the Dark Triad sub-components were controlled for, secondary psychopathy ($\beta = -20$, $p < .01$) and the entitlement/exploitativeness facet of the NPI ($\beta = -24$, $p < .01$) were linked to the evening chronotype. Leadership/authority had a relationship with morning chronotype ($\beta = .18$, $p < .01$). Primary psychopathy also had a non-significant trend towards morning chronotype, ($\beta = .16$, $p < .10$).

4. Discussion

Evolutionary psychologists (Jonason et al., 2012; McDonald et al., 2011) suggest the Dark Triad traits might be an adaptive set of personality traits. In the past, research has focused on mating success (Jonason et al., 2009, 2011) and mechanisms (Jonason et al., 2010; 2013; Jonason & Webster, 2012) through which they operate. In contrast, we have tried to understand how the Dark Triad traits might be adaptive through the pairing with a certain environment. This niche-specialization hypothesis was tested by correlating the Dark Triad traits with morningness–eveningness. We found that the Dark Triad, especially its “darker” (Rauthmann, 2012) aspects (i.e., Machiavellianism, secondary psychopathy, and exploitive narcissism), were linked to a night-time specialization. We would contend that such a specialization may facilitate the “cheater strategy” these traits embody (Jonason et al., 2012; Mealey, 1995). It is possible that these Dark Triad traits relate to greater cognitive functioning at night to facilitate the protean social style (Jonason & Webster, 2012) by outthinking those set

on detecting and punishing them (Cosmides & Tooby, 1992; Cummins, 1999) along with lower detection risk with fewer vigilant eyes and a diminished capacity to see the actual exploitation given darkness.

We failed to find sex differences in morningness–eveningness (Adan & Natale, 2002; Tonetti et al., 2008; Tsai & Li, 2004), although not all studies have found such a difference (see Randler, 2007). This also fails to support the sexual selection argument for night-time orientation (Kanazawa & Perina, 2009; Piffer, 2010). This argument contends that (young) men may have adaptively benefitted from pursuing “night-time adventures” including sex and other antisocial, yet reproductively useful, behaviors. We had hoped to show mediation for sex differences in the Dark Triad by morningness–eveningness but could not. Our results suggest that while men may score higher than women do on the Dark Triad traits (Jonason et al., 2009, 2013) the sexes do not differ in the time of the day they have optimal cognitive performance. This might suggest a natural selection, instead of a sexual selection, argument. It could be adaptively effective for anyone pursuing a fast life strategy like that embodied in the Dark Triad to occupy and exploit a low-light environment where others are sleeping and have diminished cognitive functioning. Such features of the night may facilitate the casual sex (Jonason et al., 2009), mate-poaching (Jonason, Li, & Buss, 2010), and risk-taking (Jonason, Koenig, et al., 2010) the Dark Triad traits are linked to.

This study had a number of limitations. First, we only used one measure of morningness–eveningness. We have used this one measure as we saw it as the “gold-standard” having been used numerous times (e.g., Adan et al., 2010; Russo et al., 2012), however, other measures exist (see Randler, 2007; Vollmer & Randler, 2012) and warrant attention. Second, our correlations were rather small in comparison to other work on the Dark Triad (e.g., Jonason et al., 2009, 2013). However, similarly low correlations have been reported in most studies assessing the relationship between personality traits and chronotype (Randler, 2008; Russo et al., 2012; Tsaousis, 2010). Third, we sampled a predominantly college-student sample. Although our effects were robust to differences in sample-type, it is possible that the links between the Dark Triad traits and night-time preferences may be strongest in college-students because of the freedom afforded to stay up late and lessened need to work relative to adults. Future research should address these limitations, but, given our results are (1) consistent with our predictions and (2) the predictions are based on the *a priori* logic provided by evolutionary psychology–life history theory in particular—we feel confident in our results.

We proposed and tested a relatively new hypothesis to account for the presence of the Dark Triad as indicators of an evolved psychosocial strategy directed towards the immediate extraction of resources from the socioecology (Jonason & Schmitt, 2012; Jonason & Webster, 2012). We have provided a unique test, arguing and showing that those high on the Dark Triad may be characterized by cognitive biases that orient them to occupy an environment that will facilitate their life history strategy. In short, those high on the Dark Triad traits like many other predators (e.g., lions, African hunting dogs, scorpions), are creatures of the night.

References

- Ackerman, R. A., Witt, E. A., Donnellan, M. B., Trseniewski, K. H., Robins, R. W., & Kashy, D. A. (2011). What does the narcissistic personality inventory really measure? *Assessment*, 18, 67–87.
- Adan, A., & Natale, V. (2002). Gender differences in morningness–eveningness preference. *Chronobiology International*, 19, 709–720.
- Adan, A., Natale, V., Caci, H., & Prat, G. (2010). Relationship between circadian typology and functional and dysfunctional impulsivity. *Chronobiology International*, 27, 606–619.
- Caci, H., Robert, P., & Boyer, P. (2004). Novelty seekers and impulsive subjects are low in morningness. *European Journal of Psychiatry*, 19, 79–84.

- Campbell, D. J., Fuentes, A., MacKinnon, K. C., Panger, M., & Bearder, S. K. (2007). *Primates in perspective*. New York: Oxford University Press.
- Christie, R., & Geis, F. L. (1970). *Studies in Machiavellianism*. New York: Academic Press.
- Cosmides, L., & Tooby, J. (1992). Cognitive adaptations for social exchange. In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 163–228). New York: Oxford University Press.
- Cummins, D. (1999). Cheater detection is modified by social rank: The impact of dominance on the evolution of cognitive functions. *Evolution and Human Behavior*, 20, 229–248.
- Diaz-Morales, J. F. (2007). Morning and evening-types: Exploring their personality styles. *Personality and Individual Differences*, 43, 769–778.
- Digdon, N. L., & Howell, A. J. (2008). College students who have an eveningness preference report lower self-control and greater procrastination. *Chronobiology International*, 25, 1029–1046.
- Falkenbach, D., Poythress, N., Falki, M., & Manchak, S. (2007). Reliability and validity of two self-report measures of psychopathy. *Assessment*, 14, 341–350.
- Figueredo, A. J., Vásquez, G., Brumbach, B. H., Schneider, S. M. R., Sefcek, J. A., Tal, I. R., et al. (2006). Consilience and life history theory: From genes to brain to reproductive strategy. *Developmental Review*, 26, 243–275.
- Fleagle, J. G. (1999). *Primate evolution and adaptation* (2nd ed.). New York: Academic Press.
- Gunawardane, K. G. C., Piffer, D., & Custance, D. M. (2011). Evidence of sexual selection for evening orientation in human males: A cross-cultural study in Italy and Sri Lanka. *Interdisciplinary Bio Central*, 3, 1–8.
- Hicks, B. M., Markon, K. E., Patrick, C. J., Krueger, R. F., & Newman, J. P. (2004). Identifying psychopathy subtypes on the basis of personality structure. *Psychological Assessment*, 16, 276–288.
- Horne, J. A., Brass, C. G., & Pettitt, A. N. (1980). Circadian performance differences between morning and evening types. *Ergonomics*, 23, 29–36.
- Horne, J. A., & Östberg, O. (1976). A self-assessment questionnaire to determine morningness–eveningness in human circadian rhythms. *International Journal of Chronobiology*, 4, 97–110.
- Hunter, J. E., Gerbing, D. W., & Boster, F. J. (1982). Machiavellianism beliefs and personality: Construct invalidity of the Machiavellianism dimensions. *Journal of Personality and Social Psychology*, 43, 1293–1305.
- Hur, Y. M. (2007). Stability of genetic influence on morningness–eveningness: A cross-sectional examination of South Korean twins from preadolescence to young adulthood. *Journal of Sleep Research*, 16, 17–23.
- Hur, Y. M., Bouchard, T. J., & Lykken, D. T. (1998). Genetic and environmental influences on morningness–eveningness. *Personality and Individual Differences*, 25, 917–925.
- Jonason, P. K., Koenig, B., & Tost, J. (2010). Living a fast life: The Dark Triad and life history theory. *Human Nature*, 21, 428–442.
- Jonason, P. K., Li, N. P., & Buss, D. M. (2010). The costs and benefits of the Dark Triad: Implications for mate poaching and mate retention tactics. *Personality and Individual Differences*, 48, 373–378.
- Jonason, P. K., Li, N. P., & Teicher, E. A. (2010). Who is James Bond? The Dark Triad as an agentic social style. *Individual Differences Research*, 8, 111–120.
- Jonason, P. K., Li, N. P., Webster, G. W., & Schmitt, D. P. (2009). The Dark Triad: Facilitating short-term mating in men. *European Journal of Personality*, 23, 5–18.
- Jonason, P. K., Lyons, M., Bethell, E. J., & Ross, R. (2013). Different routes to limited empathy in the sexes: Examining the links between the Dark Triad and empathy. *Personality and Individual Differences*, 54, 572–576.
- Jonason, P. K., & McCain, J. (2012). Using the HEXACO model to test the validity of the Dirty Dozen measure of the Dark Triad. *Personality and Individual Differences*, 53, 935–938.
- Jonason, P. K., & Schmitt, D. P. (2012). What have you done for me lately? Friendship-selection in the shadows of Dark Triad traits. *Evolutionary Psychology*, 10, 400–421.
- Jonason, P. K., & Tost, J. (2010). I just cannot control myself: The Dark Triad and self-control. *Personality and Individual Differences*, 49, 611–615.
- Jonason, P. K., Valentine, K. A., Li, N. P., & Harbeson, C. (2011). Mate-selection and the Dark Triad: Facilitating a short-term mating strategy and creating a volatile environment. *Personality and Individual Differences*, 51, 759–763.
- Jonason, P. K., & Webster, G. D. (2012). A protean approach to social influence: Dark Triad personalities and social influence tactics. *Personality and Individual Differences*, 52, 521–526.
- Jonason, P. K., & Webster, G. D. (2010). The Dirty Dozen: A concise measure of the Dark Triad. *Psychological Assessment*, 22, 420–432.
- Jonason, P. K., Webster, G. W., Schmitt, D. P., Li, N. P., & Crysel, L. (2012). The antihero in popular culture: A life history theory of the Dark Triad. *Review of General Psychology*, 16, 192–199.
- Jones, D. N., & Paulhus, D. L. (2011). The role of impulsivity in the Dark Triad of personality. *Personality and Individual Differences*, 51, 679–682.
- Kanazawa, S., & Perina, K. (2009). Why night-owls are more intelligent. *Personality and Individual Differences*, 47, 685–690.
- Killgore, W. D. S. (2007). Effects of sleep-deprivation and morningness–eveningness traits on risk-taking. *Psychological Reports*, 100, 613–626.
- Klei, L., Reitz, P., Miller, M., Wood, J., Maendel, S., Gross, D., et al. (2005). Heritability of morningness–eveningness and self-reported sleep measures in a family-based sample of 521 hutterites. *Chronobiology International*, 26, 510–525.
- Laubichler, W., & Ruby, M. (1986). Diurnal relations of criminal behavior. *Archives of Kriminologie*, 177, 176–184.
- Lee, K., & Ashton, M. C. (2005). Psychopathy, Machiavellianism, and narcissism in the five-factor model and the HEXACO model of personality structure. *Personality and Individual Differences*, 38, 1571–1582.
- Matthews, G. (1988). Morningness–eveningness as dimension of personality; trait, state, and psychophysiological correlates. *European Journal of Personality*, 2, 277–293.
- McDonald, M. M., Donnellan, M. B., & Navarrete, C. D. (2011). A life history approach to understanding the Dark Triad. *Personality and Individual Differences*, 52, 601–605.
- Mealey, L. (1995). The sociobiology of sociopathy: An integrated evolutionary model. *Behavioral and Brain Sciences*, 18, 523–599.
- Ollivier, F. J., Samuelson, A., Brooks, D. E., Lewis, P. A., Kallberg, M. E., & Komáromy, A. M. (2004). Comparative morphology of the tapetum lucidum (among selected species). *Veterinary Ophthalmology*, 7, 11–22.
- Paulhus, D. L., Neumann, C. S., & Hare, R. (in press). *Manual for the self-report psychopathy scale (SRP)*. Toronto: Multi-Health Systems.
- Paulhus, D. L., & Williams, K. M. (2002). The dark triad of personality: Narcissism, Machiavellianism, and psychopathy. *Journal of Research in Personality*, 36, 556–563.
- Piffer, D. (2010). Sleep patterns and sexual selection: An evolutionary approach. *Mankind Quarterly*, 50, 361–375.
- Randler, C. (2007). Gender differences in morningness–eveningness assessed by self-report questionnaires: A meta-analysis. *Personality and Individual Differences*, 43, 1667–1675.
- Randler, C. (2008). Morningness–eveningness, sleep–wake variables and big five personality factors. *Personality and Individual Differences*, 45, 191–196.
- Randler, C., Ebenhö, N., Fischer, A., Höchel, S., Schroff, C., Stoll, J. C., et al. (2012). Chronotype but not sleep length is related to salivary testosterone in young adult men. *Psychoneuroendocrinology*, 37, 1740–1744.
- Raskin, R. N., & Terry, H. (1988). A principal components analysis of the narcissistic personality inventory and further evidence of its construct validity. *Journal of Personality and Social Psychology*, 54, 890–902.
- Rauthmann, J. F. (2012). The Dark Triad and interpersonal perception: Similarities and differences in the social consequences of narcissism, Machiavellianism, and psychopathy. *Social Psychological and Personality Science*, 3, 487–496.
- Reinberg, A., & Lagoguey, M. (1978). Circadian and circannual rhythms in sexual activity and plasma hormones (FSH, LH, testosterone) of five human males. *Archives of Sexual Behavior*, 7, 13–30.
- Roberts, R., & Kyllonen, P. (1999). Morningness–eveningness and intelligence: Early to bed, early rise will likely make you anything but wise. *Personality and Individual Differences*, 27, 1123–1133.
- Rosbash, M., & Hall, J. C. (1989). The molecular biology of circadian rhythms. *Neuron*, 3, 387–389.
- Russo, P. M., Leone, L., Penolazzi, B., & Natale, V. (2012). Circadian preference and the big five: The role of impulsivity and sensation seeking. *Chronobiology International*, 29, 1–6.
- Stroebel, A. M., Bergner, M., Reulbach, U., Biermann, T., Groemer, T. W., Klein, I., et al. (2010). Statistical methods for detecting and comparing periodic data and their application to the nycthemeral rhythm of bodily harm: A population based study. *Journal of Circadian Rhythms*, 8, 10.
- Tankova, I., Adan, A., & Buela-Casal, G. (1994). Circadian typology and individual differences: A review. *Personality and Individual Differences*, 16, 671–684.
- Tonetti, L., Fabri, M., & Natale, V. (2008). Sex differences in sleep-time preferences and sleep need: A cross-sectional survey among Italian pre-adolescents. *Chronobiology International*, 25, 745–759.
- Tonetti, L., Fabri, M., & Natale, V. (2009). Relationship between circadian typology and big five personality domains. *Chronobiology International*, 26, 337–347.
- Tsai, L., & Li, S. (2004). Sleep patterns in college students: Gender and grade differences. *Journal of Psychosomatic Research*, 56, 231–237.
- Tsaousis, I. (2010). Circadian preferences and personality traits: A meta-analysis. *European Journal of Personality*, 24, 356–373.
- Vernon, P. A., Villani, V. C., Vickers, L. C., & Harris, J. A. (2008). A behavioral genetic investigation of the Dark Triad and the Big 5. *Personality and Individual Differences*, 44, 445–452.
- Vollmer, C., & Randler, C. (2012). Circadian preferences and personality values: Morning types prefer social values, evening types prefer individual values. *Personality and Individual Differences*, 52, 738–743.