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Associations of Maladaptive Psychological Processes and Noctcaelador in a University Student Sample: A Follow-Up Study

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Abstract
Previous research among university students found that noctcaelador, psychological attachment to the night sky, was significantly related to higher levels of hypomania and lower levels of depressiveness and defensiveness. However, those findings involved a clinical measure of psychological dysfunction. The current study aimed to replicate those results utilizing a measure designed for nonclinical samples and controlling possible influences of openness to experience. A sample of 135 (71.9% female) undergraduate students completed brief measures of noctcaelador, maladaptive psychological processes, and openness to experience. Replicating previous findings, while noctcaelador was unrelated to most indices of maladaptive processes, it was significantly positively related to hypomanic processes after controlling openness to experience and gender. Additionally, noctcaelador was significantly related to scales measuring nonordinary perceptual experiences and valuing emotional expressivity after controlling gender and openness. Previous findings of relationships with depressive and defensive responding were not replicated. The results were interpreted in the context of a self-structural model of noctcaelador and previous research. Additional investigation is needed to extend these findings and understand possible mechanisms and contexts for the results.

Keywords: Noctcaelador, Night Sky, Psychopathology, Hypomania, Schizotypy, Expressivity

1. Introduction

Empirical examinations of psychological processes associated with interest in night sky watching have been relatively scant. This is noteworthy considering the night sky, the sky as seen at night, has been of importance to some individuals for thousands of years [1, 2, 3]. Surveys among contemporary samples estimated that 57.5 – 64.2% of national park visitors noticed or watched the night sky at least monthly [4], whilst 58.0 – 62.5% of astronomers and university students, respectively [5, 6], viewed the night sky at least weekly.

Considering that night sky watching may be one way of enhancing well-being by connecting with nature [7], understanding the psychology of night sky watching could provide one avenue to understanding night-related relationships with the natural world as well as dark nature activities and attitudes toward dark skies protection [8, 9]. Preliminary factor analyses examining self-reported night sky watching behaviors and attitudes identified a single latent variable that accounted for most of the variance [10, 11]. Due to emotional underpinnings of several items, the factor was coined "noctcaelador" and described as psychological attachment to the night sky [10]. Subsequent findings using quantitative and qualitative methodology supported the existence of the construct [12, 13, 14, 15].

Noctcaelador is related to, and hypothetically influences, numerous night sky-related behaviors such as stargazing, astro-tourism (traveling away from home for night sky watching), owning stargazing equipment, and attendance at planetariums or observatories [5, 16]. Noctcaelador also is related to feelings of connectedness with nature and enjoyment of night cityscapes [8, 17]. These associations might suggest a broader connection with the environment and are consistent with findings that noctcaelador is related to preference for spending time outdoors [18].

Research examining associations with specific traits suggest noctcaelador is related to two domains of variables: 1) a rational, curious cognitive style [19, 20, 21, 22, 2] a tendency to experience divergent, unusual mental experiences, e.g., creative processes, artistic pursuits, fantasy proneness, hallucinations, and magical ideation [23, 24, 25, 26, 27]. Considering that noctcaelador appears to

exist in the factor space of openness to experience of the big five personality model [28, 29, 30] and of intellectual and aesthetic stimulation [31], it is possible both domains of noctcaelador correlates could be explained by openness to experience. However, some findings suggest noctcaelador is statistically separable from openness [32] as well as interest in astronomy [33] and even frequency of night sky watching [34].

Findings have been mixed with regards to variables associated with possible psychophysiological bases of noctcaelador. For example, noctcaelador was associated with mixed handedness (vs. left or right handedness) [35] and sensation seeking [36] but not morning-evening chronotype [37] or self-reported biological sex [38]. With regards to cognitive functioning, noctcaelador has been related to enjoyment of complex stimuli [39] but not cognitive ability [40], and only slightly to educational attainment [41]. Given these findings, noctcaelador may relate more to a tendency to become hypnotically absorbed in the complexity and beauty of the night sky [42] rather than capacity for reasoning or complex processing.

With regards to adaptive-maladaptive psychological processes, a recent study observed no significant relationships for noctcaelador with well-being, emotional dysregulation, or resilience [8]. Noctcaelador is related to less habitual sleep length [43], which is associated with maladaptive processes [44, 45]. However, subsequent research found this was mediated by watching the night sky to cope [46]. Taken together these findings suggest that noctcaelador may partly serve as a means of maintaining a sense of psychological balance among some individuals rather than increasing well-being.

A recent exploratory study [40] found that university students higher in noctcaelador tended to score higher on hypomania and lower on defensiveness and depression using the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) [47]. On one hand, the findings were interpreted as consistent with previous theory that noctcaelador relates to a more permeable psychic structure which facilitates divergent thought processes, nonordinary perceptual experiences, seeking novelty, and attempts to regulate the self [48]. On the other hand, it should be noted that the sample was small and the MMPI-2, being devised for clinical populations, might have different meanings among university students [49]. The purpose of the current study is to follow-up and replicate the recent MMPI-2 study using a relatively larger sample and a measure of maladaptive psychological processes devised for university student samples.

Maladaptive psychological processes indicate long-standing patterns of thinking, feeling, behaving, and defenses that create difficulty for oneself and/or other individuals [50]. Measures of maladaptive psychological processes generally include some combination of these dimensions [51]. A relatively brief measure of maladaptive psychological processes designed specifically for university student samples is the Ausburg Multidimensional Personality Instrument (AMPI) [52, 53]. The AMPI was developed to identify putatively maladaptive processes similar to those measured by the MMPI-2 but without clinical implications. AMPI scales are described in Table 1. Among college student samples, AMPI scales have been predictably related to nightmares [34], big five personality factors, approach to the academic environment, vocational interests, creativity [54], and psychopathology syndromes [55].

Table 1: Descriptions of Ausburg Multidimensional Personality Instrument scales

Scale Name	Description for Higher Scores
Validity scales [53, 56]	
Virtuousness	Portraying oneself overly favorably
Unlikeliness	Exaggeration of distress
Guardedness	Defensive denial of unpleasant experiences
Clinical scales [52]	
Somatization	Common physical discomforts
Dysphoria	Meaninglessness and anhedonia
Hystericality	Avoiding responsibility and desire to be liked
Psychodeviance	Machiavellian attitudes and behaviors
Feminine Interests	Valuing feelings, relationships, and aesthetics
Paranoia	Interpersonal suspiciousness
Anxiousness	Worrying and easily stressed
Schizotypic	Unusual perceptual experiences and thoughts
Hypomania	High energy levels and flight of ideas
Introversion	Reserved attitude toward social interaction
General Distress [57]	Symptoms of general psychological discomfort

Given AMPI scale descriptions, previous relationships between noctcaelador and similar variables have been observed. For instance, noctcaelador was found to relate to compulsiveness [58] and worry [26], which may indicate anxiousness. Another study found a relationship between noctcaelador and mistrust of instructors [59], possibly indicating suspiciousness or paranoia. Further, previous studies indicated that noctcaelador was related to both hallucinations [25] and magical ideation [24], which might suggest schizotypic processes. Finally, previous findings that noctcaelador was related to higher hypomania and lower depression scores on the MMPI-2 [40] may indicate mood dysregulation.

Findings have been mixed with regards to gender roles, which is ostensibly reflected in the AMPI Feminine Interests scale. One study observed a relationship between noctcaelador and an androgenous gender role, but not with masculine or feminine roles [38]. Another study found a nonsignificant relationship between noctcaelador and the masculinity-femininity scale of the MMPI-2, purported to measure openness to nontraditional gender roles [47]. These mixed findings may suggest influences of other variables such as gender [52] and openness to experience [60].

Another area of interest for the current study was to examine possible confounding influences of openness to experience. Both noctcaelador [28] and some aspects of psychological dysfunction [61, 62] have been related to openness.

Given the review above, the following hypotheses were formed:

- Hypothesis 1 (H1): noctcaelador would positively significantly correlate with scores on the AMPI Anxiousness scale.
- Hypothesis 2 (H2): noctcaelador would significantly positively correlate with scores on the AMPI Paranoia scale.
- Hypothesis 3 (H3): noctcaelador would significantly positively correlate with scores on the AMPI Feminine Interests scale. However, given possible similar overlap of this scale's content and openness to experience, it was expected that controlling openness would make the relationship nonsignificant.
- Hypothesis 4 (H4): noctcaelador would positively

significantly correlate to scores on the AMPI Schizotypic scale.
- Hypothesis 5 (H5): Noctcaelador would significantly positively correlate with scores on the AMPI Hypomania and negatively to AMPI Dysphoria scales.

2. Methods and Measures

2.1 Participants and Procedure

Participants included 135 students (97 females, 35 males, 3 unidentified) enrolled in undergraduate psychology courses at a university in the United States. Totals do not always equal 135 because some data was missing. Participant ages ranged from 18-59 years (28.81 ± 10.36).

Methodology of this study was determined to be nonregulated by the local Institutional Review Board. The study was carried out in accordance with the Helsinki Declaration of 2000 and ethical principles of the American Psychological Association. Measures were completed anonymously as "paper and pencil" questionnaires in group settings. No time limits were imposed for completing surveys. Nominal extra course credit was provided as an incentive for participation.

2.2 Measures

2.2.1 Noctcaelador: An abbreviated 4-item version [48] of the Noctcaelador Inventory [63] was used to measure psychological attachment to the night sky (e.g., "Having time to look at the night sky is important to me"). Participants responded 1 (*strongly disagree*) to 5 (*strongly agree*). Higher composite scores indicate more noctcaelador. The 4-item version was reported to have an average correlation coefficient of .960 with the original 10-item scale. Validity of the abbreviated and longer versions has been supported [48, 64] A 1-month retest reliability coefficient was reported as .810 [48].

2.2.2 Ausburg Multidimensional Personality Instrument (AMPI): The 52-item AMPI [52, 53] includes 10 "clinical" scales of various domains (e.g., "My mind has been so full of different ideas I couldn't focus on one thing" [Hypomania]), and 3 validity scales that measure approach to the test (e.g., "Sometimes my own voice seems far away" [Unlikeliness]). All scale descriptions are presented in Table 1. Each clinical and validity scale contains 4 items. Additionally, Kelly [57] suggested that responses to 9 items across clinical scales could be used to produce a composite index of psychological distress – the General Distress Scale (GDS). Participants responded using a 1 (*strongly disagree*) to 5 (*strongly agree*) response scale. Higher composite scores indicate more of the respective domains of each scale. Validity of the clinical scales [54, 55, 65], validity scales [53, 56], and GDS [57] have been supported. Scale internal consistency reliability coefficients have been estimated between .670-.086 [52, 53, 57].

2.2.3 Openness to Experience: Openness to experience was measured using a 4-item version [33] of the openness to experience subscale of Saucier's [66] Mini Markers. The Mini Markers include adjectives which respondents use to describe themselves (e.g., "Complex"). Participants responded using a 1 (*extremely inaccurate*) to 9 (*extremely accurate*) scale. Higher composite scores indicate more openness to experience. Validity of the measure has been supported [33, 67]. The internal consistency reliability coefficient has been estimated at .740 [33].

2.3 Data Analyses

Statistical analyses were done using SPSS v. 30 for Windows (IBM Corp., Armonk, N.Y., USA). Prior to the study a power analysis found that an adequate sample size for partial correlations controlling two variables, expecting a medium effect size (r = 0.300), a power of 0.80, and significance level of .050 (2-tailed) was 86. Independent samples *t*-tests were used to examine gender differences with Cohen's *d* as effects size. Pearson product moment correlation coefficients were calculated to examine relationships between noctcaelador and other variables. Partial correlations were calculated between noctcaelador and AMPI scales while controlling openness scores. Gender (1 = male, 2 = female) was also controlled as there were grounds to do so. Correlation coefficient effect sizes were considered small, medium, or large if they reached .10, .30, and .50, respectively [68]. Findings were considered significant if $p < .050$ (two-tailed).

3. Results

Gender analyses (Table 2) revealed that males scored significantly higher than females on AMPI Guardedness, Dysphoria, Psychodeviance, and Schizotypic scales. Females scored significantly higher than males on AMPI Feminine Interests and Anxiousness scales. Hypomania neared but did not reach statistical significance with males scoring higher than females.

Table 2: Descriptive statistics and gender differences

	All (*N*=135)	Male (n=35)	Female (n=97)			
Variable	***M* ± *SD***	***M* ± *SD***	***M* ± *SD***	***t***	***p***	***d***
Noctcaelador	10.50 ± 3.92	10.74 ± 4.12	10.35 ± 3.60	0.64	.524	.127
Openness	22.91 ± 5.75	24.15 ± 6.21	22.51 ± 5.61	1.43	.156	.285
AMPI-Virtuousness	11.84 ± 2.52	11.50 ± 2.78	11.95 ± 2.45	0.89	.378	.177
AMPI-Unlikeliness	9.32 ± 2.85	9.71 ± 3.41	9.04 ± 2.48	1.32	.190	.263
AMPI-Guardedness	12.71 ± 2.80	13.56 ± 2.38	12.36 ± 2.90	2.16	.033	.431
AMPI-Somatization	10.02 ± 3.25	9.21 ± 3.20	10.23 ± 3.21	1.60	.112	.319
AMPI-Dysphoria	8.83 ± 3.04	9.76 ± 3.01	8.38 ±2.90	2.36	.019	.475
AMPI-Hystericality	12.13 ± 3.16	11.79 ± 3.39	12.24 ± 3.10	0.70	.484	.140
AMPI-Psychodeviance	8.53 ± 2.72	10.02 ± 2.82	7.95 ± 2.46	4.08	<.001	.814
AMPI-Feminine Interests	12.68 ± 2.72	10.85 ± 2.52	13.32 ± 2.52	4.92	<.001	.981
AMPI-Paranoia	9.88 ± 3.32	10.47 ± 3.74	9.61 ± 3.15	1.30	.197	.259
AMPI-Anxiousness	12.83 ± 3.58	11.29 ± 4.25	13.34 ± 3.20	2.93	.004	.585
AMPI-Schizotypic	8.17 ± 3.66	9.47 ± 4.10	7.58 ± 3.27	2.70	.008	.539
AMPI-Hypomania	12.08 ± 3.31	13.00 ± 3.68	11.74 ± 3.14	1.92	.057	.384
AMPI-Introversion	11.27 ± 3.81	12.06 ± 3.82	10.91 ± 3.76	1.53	.129	.305
AMPI-Distress	20.03 ± 6.19	24.00 ±7.68	22.53 ± 5.53	1.20	.234	.239

Note: *SD*=Standard deviation. AMPI=Ausburg Multidimensional Personality Instrument. The 3 participants with unidentified gender were not included in gender analyses.

Pearson correlation coefficients indicated that noctcaelador was statistically significantly related to openness to experience, and AMPI Unlikeliness, Paranoia, Schizotypic, and Hypomania scales (Table 3), though with small effects. After accounting for openness to experience and gender, noctcaelador was no longer significantly related to the AMPI Paranoia and Unlikeliness scales but remained significantly related to AMPI Schizotypic and Hypomania scales (Table 3). After controlling openness and gender, noctcaelador was significantly, positively related to the AMPI Feminine Interests scale.

Table 3: Pearson and partial correlations for noctcaelador

Variable	*r*	Partial *r* Holding Openness and Gender Constant
Openness	.20*	
AMPI-Virtuousness	.09	.08
AMPI-Unlikeliness	.23**	.17
AMPI-Guardedness	.06	.02
AMPI-Somatization	.04	.02
AMPI-Dysphoria	.05	-.02
AMPI-Hystericality	-.10	-.12
AMPI-Psychodeviance	.08	.04
AMPI-Feminine Interests	.16	.18*
AMPI-Paranoia	.17*	.15
AMPI-Anxiousness	.07	.08
AMPI-Schizotypic	.25**	.21*
AMPI-Hypomania	.28**	.24**
AMPI-Introversion	-.05	-.09
AMPI-Distress	.09	.04

Note: $N = 135$. *$p < .05$ **$p < .01$. AMPI=Ausburg Multidimensional Personality Instrument.

For exploratory purposes, additional partial correlations were calculated between noctcaelador and AMPI Feminine Interests, Paranoia, and Unlikeliness (the scales that changed in significance from Pearson to partial correlation analyses) while holding either gender or openness constant. While holding only openness constant, correlations of noctcaelador with AMPI Unlikeliness, $r = .23$, $p = .008$, and Paranoia, $r = .17$, $p = .049$, scales remained significant while Feminine Interests, $r = .16$, $p = .075$, remained nonsignificant. However, after controlling gender, the correlation for AMPI Unlikeliness, $r = .17$, $p = .051$, neared but was no longer significant. AMPI Paranoia, $r = .15$, $p = .094$, was no longer significant. However, after controlling gender, AMPI Feminine Interests, $r = .20$, $p = .027$, was significantly related to noctcaelador.

4. Discussion

The purpose of the current study was to replicate previous findings [40] of relationships between noctcaelador and maladaptive psychological processes using a measure developed for nonclinical populations and controlling openness to experience. The results were partly consistent with the study hypotheses and previous findings. In terms of previous findings [40], first, and perhaps importantly, noctcaelador was unrelated to most indices of maladaptive processes. Furthermore, the current study replicated the relationship between noctcaelador and hypomania, though the relationship was lower than previously observed. However, the current study did not replicate the relationship between noctcaelador and depressive or defensive responding.

The hypotheses of the current study predicted that noctcaelador would positively, significantly relate with AMPI Paranoia, Schizotypic, and Hypomania scales. These hypotheses were generally supported. However, noctcaelador's relationship with paranoia became nonsignificant when accounting for gender. This suggests that paranoia is indirectly related to noctcaelador through gender-related factors rather than a primary associated process. Previous findings indicated that gender differences in paranoia were influenced by feelings of safety [69]. It could be that safety, to some extent, is related to comfort associated with night sky attachment [48].

Perhaps the major findings of the current study were that after accounting for gender and openness, noctcaelador remained significantly related to hypomanic and schizotypal processes. This was consistent with previous results indicating noctcaelador was related to hypomania [40] and nonordinary perceptual processes and beliefs [24, 25]. Descriptively, these findings imply that noctcaelador is associated with high levels of energy, rapid thought processes, a tendency to experience nonordinary perceptual processes, and an openness to consider unusual ideas. However, the question of how these elements might relate to noctcaelador is not evident from the current findings.

Previous writers noted similarities between hypomania and schizotypy [70]. It might be that similar processes underlie both phenomena. Physiologically, overlap may involve similar genetic and dopaminergic etiologies [71]. From a psychological perspective these similarities may represent a permeable psychic structure, what Hartmann called "thin" mental boundaries [72]. This is also consistent with noctcaelador's relationship with openness to experience [30, 73]. In line with previous theory [48], permeable boundaries could facilitate both the rapid and divergent ideas as well as nonordinary perceptual experiences associated with noctcaelador. Future research might examine hypomanic processes and self-structural elements in relation to noctcaelador.

The hypothesis that noctcaelador would be significantly related to AMPI Feminine Interests, except when controlling openness to experience, was not supported. Indeed, noctcaelador was only significantly related to the Feminine Interests scale after controlling gender; controlling openness had little effect. This unexpected result might partly indicate a masking, or suppression, effect of gender noted on some self-report gender role variables. Specifically, some men may have under endorsed (and some women over endorsed) the emotionally expressive characteristics included on the AMPI Feminine Interests scale as a form of self-image protection [74]. If so, controlling gender may have allowed the scale to reflect a more androgynous expressivity domain, associates of which have been related to noctcaelador [23, 39, 75, 76].

Unlike a previous study that found the MMPI-2 depression scale was significantly negatively related to noctcaelador [40] and hypotheses of the current study, the AMPI Dysphoria scale was not significantly related to noctcaelador. Differences between current and previous findings may have been due partly to measurement issues. First, the brevity of the AMPI scales may reduce representation of their intended domains. Second, as noted previously, the AMPI was developed to assess maladaptive processes among *nonclinical* samples. Ergo, its Dysphoria scale may tap

somewhat different dimensions than the MMPI-2 Depression scale (i.e., feelings of meaninglessness and anhedonia on the AMPI compared with pessimism, discouragement, and self-criticism on the MMPI-2) [47, 52]. Additional investigation using both depression measures and those tapping different aspects of depressive experiences [77, 78] might further clarify this issue.

The hypothesis that noctcaelador would relate to the AMPI Anxiousness scale was not supported. On the surface, this appears inconsistent with previous studies that noctcaelador was related to compulsiveness [58] and worry [26]. However, closer inspection reveals that the measures used in those studies reflected nonpathological and relatively specific manifestations of these phenomena. This might contrast to the more maladaptive and nonspecific retrospective estimates assessed by the AMPI. Also, it may be that some forms of nonpathological cognitive and behavioral perturbation are aligned with a vigilant problem-focused style which previously was found to relate with noctcaelador [19].

Unexpectedly the current study found a significant correlation between noctcaelador and the AMPI Unlikeliness scale. Unlikeliness has been suggested to measure a negative response style [79]. Therefore, it is possible that negative responders simply endorsed more of anything that seemed unusual to them, including noctcaelador items. Interestingly, the relationship of Unlikeliness with noctcaelador was rendered nonsignificant when controlling gender and openness. This is curious considering that neither noctcaelador nor Unlikeliness had significant gender differences. Additional research should explore this further.

The current study has several limitations which should be acknowledged. The sample was relatively small and homogeneous consisting primarily of female university students. Also, the scales used were relatively brief which may have limited their ability to provide accurate and nuanced measurement of their domains. Also, the study was cross-sectional making it essentially a snapshot in time rather than a reflection of ongoing experiences. This methodology also precludes cause-effect relationships. It is unknown if noctcaelador or maladjustment domains influence each other or if other unmeasured variables influenced the findings [80].

Future research might attempt to overcome limitations of this study by using experimental methodology – manipulating either psychological experience or night sky exposure. Longitudinal designs might also provide information about directionality of influence among the constructs. Given the relatively large number of university students found to endorse frequent night sky watching compared to other samples [4, 5], larger community samples might provide more generalizable estimates of noctcaelador and related processes. Additionally, future research is needed to better understand the current findings. For instance, as noted previously, it would be helpful to examine possible influences of the self-structure on noctcaelador and related processes. Also, the use of multiple measures of the same, or similar, phenomena might better delineate contexts for some of the current findings. For instance, including a multidimensional measure of hypomanic processes would provide additional knowledge about what aspects of hypomania are related to noctcaelador [81].

5. Conclusion

In conclusion, the current study replicated findings that noctcaelador is related to some form of hypomanic processes as well as nonordinary perceptual experiences [25, 40] outside the influences of both openness to experience and gender. As such, these findings further previous work indicating that while noctcaelador is related to openness, it is separate, accounting for its own variance [32]. The findings of this study could be conceptualized through the lens of self-structural explanations of noctcaelador [48] or indicate routes for further investigation such as neurophysiological underpinnings and contexts for these findings. Additional investigations are needed to remedy limitations of the current study and extend its results.

6. References

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