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# Worry Domains and Worry Related Sleep Disturbance in Relation to Noctcaelador

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**Abstract**
Noctcaelador, defined as psychological attachment with the night sky, has previously been associated with scores on aggregated worry content and worry related sleep disturbance (WRSD). However, specifics and mechanisms of these relationships are unclear. The present study examined whether these relationships reflect generalized pathological worry or more differentiated associations. Undergraduate students (N = 130) completed measures of pathological worry, worry content domains, WRSD, and noctcaelador. Noctcaelador was positively correlated with world-environmental worry content and WRSD but not with pathological worry or other worry domains. Findings suggest that noctcaelador is selectively associated with an outwardly directed worry focus and cognitive appraisal of WRSD rather than generalized worry severity. Implications for models of psychological structure and nocturnal cognitive engagement are discussed.

**Keywords:** Noctcaelador, Worry Content, Worry Related Sleep Disturbance, Pathological Worry, World Worry, Environmental Worry

## 1. Introduction

Worry has been described as a chain of negative, future-oriented thought [1]. Excessive worry is a defining feature of generalized anxiety disorder [2], yet worry is common in nonclinical populations. An earlier study estimated that 38% of college students worried daily and 72% at least monthly [3]. However, this may be an underestimation given that reports of worry have increased over the past two decades [4]. Although often conflated with rumination, obsessions, and anxiety, worry has been demonstrated to be conceptually and statistically distinct from these constructs [5-8].

Research has assessed and conceptualized worry in two primary ways: Pathological worry severity and content of worry. Although content-based worry measures are sometimes described as "nonpathological," they are strongly correlated with pathological worry and do not necessarily reflect adaptive forms of worry [9, 10]. Pathological worry has been associated with nightmares, anxious apprehension, perseveration, general negative affect, and depression [11-13]. In contrast, worry content measures identify distinct domains of concern and have been linked to narcissistic traits [14], shyness [15], diffuse family roles [16], intolerance of uncertainty [17], lower self-actualization [18], and less alcohol use [19]. Financial, relational, academic, work, social adequacy, and climate-related worry themes have been identified among young adults, with partially distinct correlates [20-22].

Both pathological worry and worry content have been associated with sleep disturbance [11], which has been proposed as one pathway linking worry to poorer health outcomes [23]. The term worry related sleep disturbance (WRSD) has been used to describe perceived delay of or waking from sleep due to worry [24]. Approximately 40% of individuals in one community sample attributed sleep disturbance to worry [25]. Although related to trait worry, WRSD and worry are statistically separable; each has predicted insomnia severity independently after controlling for anxiety [26]. WRSD likely reflects subjective meta-appraisal of nocturnal cognitive activation rather than objective sleep impairment [27] and has been associated with arousability and pre-sleep cognitive activity [28]. While there may be reciprocal relationships, longitudinal evidence indicates that worry predicts sleep disruption, in general, and attributions of sleep disturbance to worry [29, 30]. In addition to generalized worry, specific worry content such as financial, academic, relational, and health have been linked to sleep disturbance [31], although only relational worry has shown unique associations with reduced sleep length when domains are examined simultaneously [32]. Another variable that has been related to both worry content and WRSD is noctcaelador [33, 34].

The term noctcaelador refers to an emotional bond with the night sky [35]. While humans have long engaged in aesthetic appreciation and existential reflection of the night sky [36, 37], noctcaelador reflects not only enjoyment of observation but also felt connection with the night sky [38]. Factor analytic and qualitative research supports its existence as a measurable, observable construct [39, 40]. Individuals higher in noctcaelador report more frequent and prolonged night sky engagement [41].

Noctcaelador has been associated with openness to experience [42, 43] and absorptive engagement in intellectual and artistic activities [44-46]. Within the psychic structure model of noctcaelador, the construct reflects a relatively permeable psychological structure and heightened responsiveness to aesthetic and existential stimuli, potentially shaped by night sky-related experiences of awe and calmness [47, 48]. Noctcaelador has also been related to enjoyment of effortful cognitive activity and problem-focused coping [45, 49, 50]. Additionally, associations with decreased sleep length and hypomanic activity [51, 52], as well as mistrust and paranoia-like processes [53, 54], suggest that noctcaelador may intersect with cognitive activation and perceptual sensitivity. However, it is not related to temperament independently, though temperament has been linked to noctcaelador indirectly through creative personality factors [55]. Developmental exposure and psychological factors beyond simple opportunity to view the night sky may also contribute [40, 56, 57]. Noctcaelador has additionally been linked to appreciation of nature [38] and enjoyment of urban nightscapes [58].

As noted previously, past research found associations between noctcaelador and aggregated worry content [33] and WRSD [34]. However, in those studies, pathological worry, distinct worry domains, and WRSD were not examined simultaneously. It therefore remains unclear whether prior findings reflect generalized worry severity, i.e., pathological worry, or more differentiated relationships with specific worry themes and appraisal of nocturnal cognitive activity as affecting sleep.

There is reason to believe that noctcaelador's associations with worry are selective rather than generalized. Noctcaelador has been linked to openness, absorption, and appreciation of external environments [38, 43, 46, 58], characteristics more consistent with outwardly directed or environmental concern than with proximal personal stressors. The only temperament style found to relate to noctcaelador (though indirectly) has been a tendency towards activity, not emotional stability or fear responses [55]. Similarly, associations with decreased sleep length and hypomanic activity [51, 52] suggest heightened nocturnal cognitive engagement, which may relate specifically to WRSD rather than to pathological worry severity. Moreover, within the psychic structure framework [47], noctcaelador may involve environmental attunement and increased awareness of internal cognitive processes at night. Taken together, noctcaelador might be expected to relate with external, environmentally focused worry themes and WRSD, but not necessarily with generalized pathological worry or more self-referenced worry domains.

The present study sought to clarify previously observed relationships of noctcaelador with worry and WRSD [33, 34]. As such, measures were chosen to examine pathological worry, specific worry content domains (living conditions, esteem-related, world-environmental, and academic), and WRSD as related to noctcaelador within the same model. Based on the rationale above and previous research, it was hypothesized that noctcaelador would be positively associated with WRSD and world-environmental worry.

## 2. Methods

### 2.1 Participants and Procedure

Participants were 130 undergraduate students (96 women, 32 men, 2 unidentified) enrolled in psychology courses at a university in the United States. Ages ranged from 18 to 59 years (M = 28.44, SD = 10.10).

The study was determined to be nonregulated by the local Institutional Review Board and was conducted in accordance with the Helsinki Declaration of 2000 and the ethical principles of the American Psychological Association. Questionnaires were completed anonymously in paper-and-pencil format during group classroom sessions, with participation voluntary and no time limits imposed. Nominal extra course credit was provided for participating. Portions of this dataset have been reported previously [53].

### 2.2 Measures

#### 2.2.1 Student Worry Scale (SWS)

The 10-item SWS [59] assesses frequency of common worry content. Prior factor analytic work identified three SWS domains: living conditions ("financial concerns," "my living conditions," "health concerns," "job prospects"), esteem-related ("academic demands," "religious matters," "personal relationships," "what people think of me"), and world-environmental ("world affairs," "environmental matters") [60]. Because a separate academic worry measure was included in the present study, the item "academic demands" was excluded from the esteem-related subscale. Items are rated on a 4-point scale from 1 (Almost never) to 4 (Almost always). Higher total scores indicate greater frequency of worry within each domain. Adequate validity and reliability have been reported [59, 60]. In the present sample, coefficient alpha for the full scale was .789.

#### 2.2.2 Academic Worry

Academic worry was assessed using the 5-item academic concerns subscale of the Student Worry Questionnaire-30 [61]. This subscale measures worry about academic performance and workload demands. Items are rated on a 5-point scale from 0 (Almost never) to 4 (Almost always). Higher total scores reflect greater academic worry. Prior research has supported the scale's validity and reliability [20, 61]. In the present sample, coefficient alpha was .940.

#### 2.2.3 Three Item Worry Index (TIWI)

The Three Item Worry Index [62] assesses general pathological worry in terms of severity, frequency, and self-identification as a worrier. Items are rated on an 11-point scale from 0 (Never) to 10 (Very much). Higher total scores indicate greater pathological worry. Validity and reliability have been supported in previous research [62-64]. In the present sample, coefficient alpha was .969.

#### 2.2.4 Sleep Disturbance Ascribed to Worry (SAW)

WRSD was assessed using the 5-item SAW: a measure of perceived difficulty initiating and maintaining sleep due to worry (24,65). Items are rated on an 11-point scale from 0 (Never) to 10 (Very often). Higher total scores reflect greater perceived worry-related sleep disturbance. Validity and reliability have been supported in prior studies [65, 66]. In the present sample, coefficient alpha was .904.

### 2.2.5 Noctcaelador Inventory-4 (NI-4)

The 4-item Noctcaelador Inventory [67] assesses emotional attachment to and enjoyment of the night sky. Items are rated on a 5-point scale from 1 (Strongly disagree) to 5 (Strongly agree). Higher total scores indicate more noctcaelador. Support for reliability and validity have been reported previously [67]. In the present sample, coefficient alpha was .865.

### 2.3 Data Analyses

Analyses were conducted using SPSS version 30 for Windows (IBM Corp., Armonk, NY, USA). Pearson product-moment correlations were calculated to examine bivariate relationships between noctcaelador and study variables. Correlation coefficients of .10, .30, and .50 were considered small, medium, and large, respectively [68]. A simultaneous linear regression analysis was conducted with noctcaelador (NI-4) as the dependent variable and pathological worry (TIWI), academic worry, SWS domains (living conditions, esteem-related, and world-environmental), and WRSD (SAW) entered as predictors. Statistical significance was evaluated using two-tailed tests with $p < .050$.

## 3. Results

Table 1 presents descriptive statistics and Pearson correlations between noctcaelador and study variables. Noctcaelador was positively correlated with world-environmental worry ($r = .312$, $p < .001$) and WRSD ($r = .306$, $p < .001$), with medium effects sizes. Noctcaelador was not significantly correlated with living conditions worry ($r = .056$, $p = .524$), esteem-related worry ($r = .023$, $p = .798$), academic worry ($r = −.020$, $p = .823$), or pathological worry ($r = .105$, $p = .235$), each with very small or small correlations.

**Table 1:** Descriptive statistics and correlations with noctcaelador

| Variable | M | SD | r | p |
|---|---|---|---|---|
| Noctcaelador (NI-4) | 10.48 | 3.85 | — | — |
| SWS living conditions worry | 9.64 | 2.81 | .056 | .524 |
| SWS esteem-related worry | 7.02 | 2.27 | .023 | .798 |
| SWS world-environmental worry | 3.55 | 1.18 | .312 | < .001 |
| Academic worry (SWQ-30-Academic) | 13.58 | 5.79 | −.020 | .823 |
| Pathological worry (TIWI) | 17.28 | 8.20 | .105 | .235 |
| Worry related sleep disturbance (SAW) | 18.45 | 11.73 | .306 | < .001 |

The overall model of the linear regression using worry-related variables to predict noctcaelador was significant accounting for 12.3% of the variance ($p = .001$). As shown in Table 2, WRSD ($\beta = .33$, $p = .005$) and world-environmental worry ($\beta = .25$, $p = .009$) were significant unique predictors of noctcaelador. Pathological worry and the remaining worry domains were not significant predictors ($ps \geq .447$). Collinearity diagnostics were acceptable (VIF < 2.69), indicating multicollinearity was not a problem.

**Table 2:** Simultaneous regression predicting noctcaelador

| Variable | β | t | p |
|---|---|---|---|
| WRSD | .33 | 2.84 | .005 |
| Pathological worry | −.10 | 0.76 | .447 |
| Academic worry | −.01 | 0.11 | .914 |
| Living conditions worry | −.09 | 0.72 | .474 |
| World-environmental worry | .25 | 2.65 | .009 |
| Esteem-related worry | −.04 | 0.36 | .720 |
| | $R^2 = .123$ (adjusted), $F = 4.02$, $p = .001$. | | |

## 4. Discussion

The present study sought to clarify previously reported associations between noctcaelador and both worry and WRSD [33, 34]. By examining pathological worry, distinct worry content domains, and WRSD simultaneously, the aim was to determine whether earlier findings reflected a generalized worry tendency or more differentiated patterns of association. Consistent with, and extending prior research [33, 34], noctcaelador was positively correlated with world-environmental worry and WRSD. Of note, when all worry variables were considered simultaneously, WRSD and world-environmental worry continued to uniquely, significantly relate to noctcaelador. These findings suggest that the previously observed relationships [32, 33] were selective rather than global. This is also consistent with conceptions of WRSD as an independent metacognitive appraisal variable, not merely an outcome of worry [26]. The association with WRSD and world-environmental worry outside of pathological worry and other worry content indicates that noctcaelador relates to WRSD and particular themes of worry rather than to pathological worry per se.

WRSD seems to reflect subjective appraisal of nocturnal cognitive activation [27]. Individuals higher in noctcaelador report greater engagement with the night sky [41, 44] and have shown associations with reduced sleep length, hypomanic-like activity, and (indirectly) an active temperament [51, 52, 53, 55]. As such, it is plausible that increased cognitive engagement with experiences heightens awareness of cognitive activity occurring during the night. The present findings are consistent with the possibility that noctcaelador intersects with metacognitive awareness of cognitive processes rather than with general pathological worry.

Previous associations of noctcaelador with absorptive engagement of external stimuli [46], appreciation of nature [38], interest in the outdoors [70], and enjoyment of nightscapes [58] may suggest an outward awareness to some degree. In that case, clarifying earlier findings involving aggregated worry content [33], it is possible that world-environmental worry may represent concern extending beyond immediate personal worries, or a general tendency to worry, to concerns about something larger than oneself. This is also consistent with reports of a medium-size relationship between noctcaelador and protectionism towards dark skis [38].

Although the present study was not designed to test the psychic structure model of noctcaelador [47, 67], the results are broadly compatible with it. The model proposes that noctcaelador is shaped partly when individuals with relatively permeable psychological structures have positive night sky experiences. It is possible that the reinforcing nature of the night sky may promote heightened responsiveness to external stimuli leading to world-environmental awareness and concern. The model is less clear about how noctcaelador would relate to appraising cognitive processes to sleep disruption. It may be that the permeable psychic structure noted in the model also allows for heightened cognitive activity which is then appraised as sleep disruptive [52, 53].

Several limitations to the current study should be noted. The cross-sectional design does not allow cause-effect inferences, and all variables were assessed by self-report in

a university student sample. Shared method variance and sample characteristics may limit generalizability. Although collinearity diagnostics were acceptable, moderate intercorrelations among worry domains may attenuate detection of additional unique effects. Also, the worry measures were somewhat brief, perhaps limiting their sensitivity. Additional research is needed to correct these methodological issues.

Following the notion of permeable psychological structure as foundational to noctcaelador, previous work has linked noctcaelador to inconsistent handedness [71]. Inconsistent handedness has been associated with increased threat perception [72]. Thus, the relationship of noctcaelador with world-environmental worry may partly signify increased awareness on the part of individuals with heightened threat perception of possible lessened availability of the night sky – a valued object to those high in noctcaelador. Interestingly, inconsistent handedness may also manifest as heightened interhemispheric interaction with nonordinary processing [72], descriptions of which resemble a permeable psychological structure [73]. Future research is needed to clarify these points further examining if hemispheric connectedness influences relationships of worry content and WRSD (as well as psychological permeability, in general) to noctcaelador. Additional research is also needed to examine possible influences of third variables such as absorption, creativity, or boundary thinness.

In summary, noctcaelador appears to intersect selectively with outwardly directed world-environmental worry and sleep disturbance ascribed to worry, rather than with generalized pathological worry or self-involved worry content. Integrating these findings with prior work on psychological structure, absorption, and interests [44, 46, 47] suggests that noctcaelador may reflect a differentiated cognitive–affective style characterized by environmental attunement and heightened nocturnal cognitive awareness.

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