

sect. 3, para. 4) for which we cannot find empirical support in a large data set with data-driven analyses. After providing greater nuance in our theoretical review, we suggest that Van Lange et al. revisit their model with an eye toward the social determinants of self-control.

Van Lange et al. formulated a theoretical model in which they proposed climate as a predictor of self-control (and aggressive behavior). We comment on the proposition “that lower temperatures and especially greater seasonal variation in temperature call for individuals and societies to adopt ... a greater degree of self-control” (sect. 3, para. 4), which, they argue, is due to a slower life history strategy. In developing their theoretical position, the authors propose distance from the equator as a predictor of self-control. They advocated a “data-driven” approach, allowing one “to derive precise estimates of the variance accounted for by various predictor variables” (sect. 5.3.1, para. 2). In our Human Penguin Project (HPP; available at: <https://osf.io/2rm5b/>), we collected latitude, self-control, and a variety of important social predictors from 12 countries with varying distances from the equator. These variables allowed us to test the proposed relationship between distance from the equator and self-control. The social predictors included variables such as social network quality and size and variables that are crucial for Life History Theory, like people’s attachment styles (Del Giudice 2008). Together, we provide the very first test of the authors’ proposed model through data-driven analyses (a method called *supervised machine learning*; for more technical discussions, see Breiman [2001]; IJzerman et al. [2016]; Yarkoni & Westfall [2016]) as proposed by the authors, and in a more traditional null hypothesis significance testing confirmatory manner (a mediation analysis).

We analyzed data from 1507 participants from 12 countries on three different continents, with countries at varying levels of distance from the equator. The underlying analytical details (including a detailed explanation of supervised machine learning) are reported online (<https://osf.io/gtj38/>). Our method is very powerful and robust, as it validates the model internally as it tests the strength of the model and the size of the error. We found distance from the equator to be a significant predictor of self-control (Tangney et al. 2004), but barely so: It was the 14th predictor in our list and comparable in prediction power to whether participants spoke Serbian or not (the 13th predictor).² As we could compare the strength of different predictors, our analyses revealed that the power to predict self-control was much greater for such variables as attachment anxiety, proneness to feeling nostalgia (a complex social emotion), social network size, level of complex social integration, and participants’ attachments to their homes. Plotting these variables, controlling for the remainder of the model, further confirmed the stronger relationship of social determinants over distance from the equator (<https://osf.io/vzvbe/>).

Was distance from the equator then a reliable predictor of climate? We think so: Equator distance correlated strongly with the minimum temperature of that day ($r = 0.90$, $N = 1463$). We further explored whether attachment anxiety would mediate the relationship between equator distance and self-control; attachment anxiety (a strong predictor of self-control) could be indicative of differing life history strategies (Del Giudice 2008). There was no such relationship, as distance from the equator failed to be related to attachment anxiety ($t = 0.02$, $p = .99$), with a nonsignificant mediation onto self-control (95% confidence interval [CI]: 0.0007 to 0.0007). To be sure, we also tested for attachment avoidance, which also was not predicted by equator distance ($t = 0.02$, $p = .85$, 95% CI: 0.0003 to 0.0004). We thus find little evidence that distance from the equator matters for predicting self-control and life history strategies, and our analyses support the idea that the social environment is much more important in predicting self-control.

How could this be so? The authors reviewed evidence that seemed supportive of their relationship between climate and self-control. However, our reading of the literature suggests more nuance. Warmer water temperatures are indeed associated

with faster growth, earlier death, and higher risk acceptance for some animals (all indicative of a faster life history trajectory [Holt & Jørgensen 2014]). But in contrast, warm-blooded mesopelagic fish (which live in an extremely *cold* environment) *also* exhibit a precocious maturation comparable to that of other animals in *warmer* environments (Miya & Nemoto 1986). And life history strategies cannot be easily extended from animals to humans. Humans are more unusual in that both slow and fast life history strategies can involve effortful control and impulsivity (Del Giudice 2015). Furthermore, warmer temperatures are not just related to aggression; a wealth of evidence in humans indicates that higher temperatures can also relate to *prosocial* behavior (cf. IJzerman et al. 2015a).

Furthermore, the authors neglected the fact that self-control via internalized norms is not linked to time horizon, but to a feeling of *obligation*. It is thus strongly influenced by the relevance of goals (Lindenberg 2013). For example, Dutch males scoring higher on honor concerns respond more aggressively when insulted, but less aggressively when not insulted (IJzerman et al. 2007). A recent study also indicated that the relationship between armed conflict and heat waves or droughts is due to the fact that heat waves or droughts exacerbate existing ethnic strife (Schleussner et al. 2016). Goal relevance, rather than a lack of self-control, strengthens aggressive responding in these cases.

In short, a broader consideration of the literature speaks against most of the propositions of their theoretical model. Most critically our data, which were suited for testing many of their claims, do not provide empirical support, likely because their theoretical model is *underfitted*, with the link between climate and self-control being underspecified. It is thus not surprising that the HPP provided evidence against their model, which we take as a strong suggestion for the authors to revisit their proposed link between climate and self-control.

In reformulating their model, we further advise that they give greater weight to established theories on the complex relationships between self-control, life-histories, culture, social organization, and violence, such as the literature mentioned previously, as well as literature on the development of culture (Diamond 1999) and the antecedents of violence (Fiske & Rai 2015). These theories support our results that the social environment rather than climate predicts self-control, and we suspect it is this social environment that mostly predicts aggressive behaviors. Cultures are not *individuals writ large*; they invariably are complex and cannot be reduced to a simple main-effect model.

NOTES

1. Hans IJzerman is the lead author of this article and Siegwart Lindenberg the last. All other authors are listed alphabetically. Address correspondence to Hans IJzerman.

2. Notably, when testing *solely* for the correlation between distance from the equator and self-control, we find a significant correlation ($r = 0.12$, $N = 1484$). However, our machine learning approach did not detect a similar pattern, and we think the correlation is spurious and overfitted (Yarkoni & Westfall 2016).

Where the psychological adaptations hit the ecological road

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Peter K. Jonason^a and David P. Schmitt^b

^aSchool of School of Social Sciences and Psychology, Western Sydney University, Penrith, NSW 2751, Australia; ^bDepartment of Psychology, Bradley University, Peoria, IL 61625.

p.jonason@westernsydney.edu.au dps@fsmail.bradley.edu

www.peterjonason.com

<http://www.bradley.edu/academic/departments/psychology/faculty/profile.dot?id=132756>

Abstract: We argue that the target authors focus too much on adaptive behavioral *responses* and not enough on actual psychological *adaptations*. We suggest the Dark Triad traits may represent facultative, psychological adaptations sensitive to seasonal variance and food shortages. We document that shorter distances from the equator are linked to higher national narcissism levels, whereas longer distances are associated with higher national-level machiavellianism. Dark Triad traits may serve as critical survival mechanisms when prioritizing oneself over and/or at the cost of others.

Van Lange et al. provide a compelling new way of understanding the often cited yet poorly understood relationship between heat and violence at the societal level. Unlike most social psychological models, the authors adopt an evolutionary framework—Life History Theory—that suggests manifestations of violence, aggression, and limited self-control are adaptive responses to the environmental contingencies of sharp seasons *and* temperature. For instance, in climates like those found in Canada, there is a greater need for cooperation and long-term planning given extreme seasonality. As such, they argue one should expect (and empirically it appears to be the case) that Canadian populations are characterized by *slow* life history traits such as limited aggression and high levels of future planning.

We argue here, however, that Van Lange et al.’s evidence of mere behavioral manifestations of life history traits fails to adequately test their evolutionary hypothesis because it does not focus on the actual underlying adaptations themselves. Their approach conflates adaptive behavioral *responses* with actual psychological *adaptations*. From an evolutionary perspective, behaviors such as violence and cooperation are likely linked to differences in local ecology (Schmitt 2015), but do so by interacting with internal, psychological adaptations that, we would suggest, are the constellations of hormonal, cognitive, neurological, and motivational dispositions that most researchers call personality traits (Jonason & Ferrell 2016). Selection has acted on these traits—not the specific behavioral outputs of the traits—as facultative adaptations, and it is these specially designed dispositions that interact with local ecologies in ways that ultimately produce the patterns of behavior that appear to support the authors’ hypotheses.

One set of potential facultative, psychological adaptations that have been successfully studied using a life history framework are the Dark Triad personality traits (Jonason et al. 2012): machiavellianism, narcissism, and psychopathy (Paulhus & Williams 2002). The Dark Triad traits are characterized by vanity and self-centeredness (i.e., narcissism), manipulation and cynicism (i.e., machiavellianism), and callous social attitudes and amorality (i.e., psychopathy). These traits predict variance in community, online, and college student samples that reflect both (1) life history behavioral indicators and (2) the psychological adaptations that are precursors to both aggression and cooperation as highlighted by Van Lange et al. For example, these traits are correlated with lower-order aspects of personality that serve to facilitate both cooperation and aggression, such as limited self-control (Jonason & Tost 2010) and empathy (Wai & Tiliopoulos 2012). Psychopathy and narcissism are particularly correlated with various forms of aggression (Jonason & Webster 2010) and heightened competitiveness (Jonason et al. 2015b). Conversely, machiavellianism is distinguished by its long-term, tactical, strategic, and pragmatic nature (Jonason & Webster 2012), which may serve individuals who live in environments where resources are variable and future planning is essential. In addition, the importance placed on physical attractiveness in narcissism might be an adaptive response to higher pathogen loads in warmer climates (i.e., near the equator). Overall, based on this we expect that distance from the equator will be negatively correlated with narcissism and psychopathy (potentially) and positively correlated with machiavellianism.

Thus, we suggest Dark Triad personality traits represent facultative, psychological adaptations that are sensitive to seasonal variance and food shortages. Over evolutionary time, climatological patterns and resource irregularity would be fairly recurrent. Those people who were differentially characterized by these traits across varying environments may have been selected because the traits facilitated context-specific, or in this case climate-specific, survival. It may be useful, and perhaps adds to and improves the authors’ assertions, to test ostensible dispositional adaptations—Dark Triad traits—for environmentally contingent links to survival, as opposed to the behaviors that

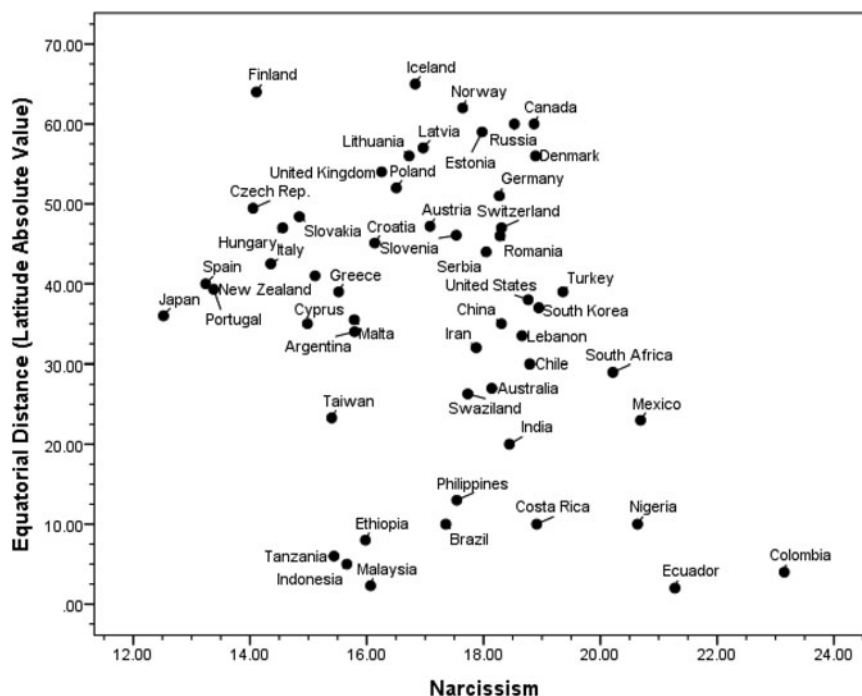


Figure 1. (Jonason & Schmitt). National narcissism levels related to distance from the equator across 53 nations from the International Sexuality Description Project 2 (Schmitt 2015).

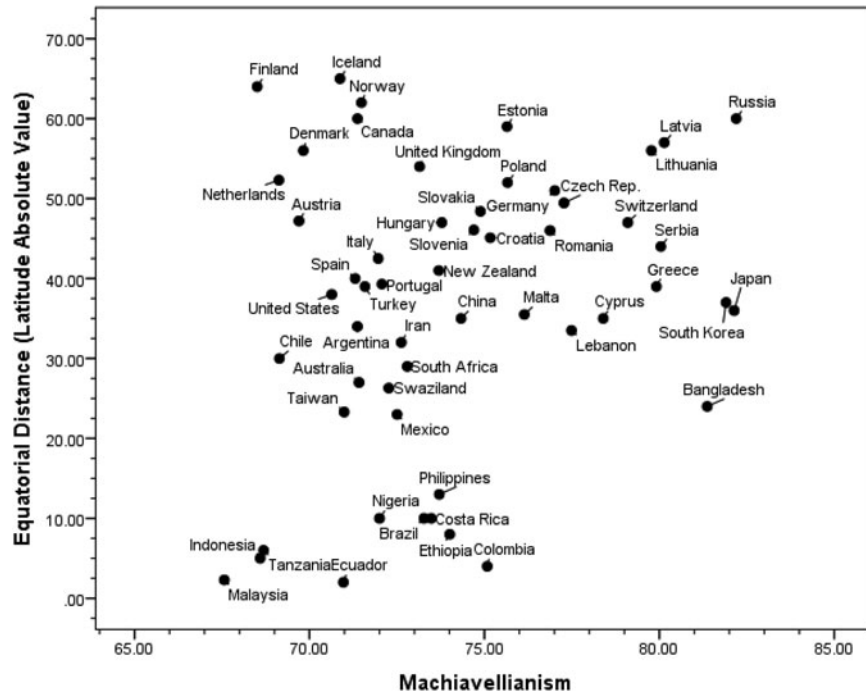


Figure 2. (Jonason & Schmitt). National machiavellianism levels related to distance from the equator across 54 nations from the International Sexuality Description Project 2 (Schmitt 2015).

are manifested from recurrent adaptive person × ecology interactions.

To add to and improve on the authors’ argument, and the data brought to bear on the CLASH model, we highlight here findings from the International Sexuality Description Project 2 (see Schmitt 2015). ISDP-2 was a collaboration of more than 100 psychologists around the world in which surveys were administered to 36,314 people across more than 50 nations. As part of ISDP-2, participants were administered measures of narcissism (e.g., NPI [Raskin & Terry 1988]), machiavellianism (e.g., MACH-20 [Christie & Geis 1970]), and psychopathy (e.g., SRP-III [Paulhus et al. 2009]). (More details about ISDP-2 methods and samples are available on request.)

At the national level, the shorter the distance from the equator, the higher were the national narcissism levels ($r(51) = -0.25, p < .05$) (Fig. 1). In contrast, machiavellianism become more evident the greater the distance from the equator ($r(52) = 0.24, p < .05$) (Fig. 2). Psychopathy was not sensitive to variation in distance from the equator ($r = 0.01$). The results in the target article, therefore, might be a function of these Dark Triad adaptations for survival under varying levels of climatological threat. That is, the Dark Triad traits – particularly high narcissism and low machiavellianism – may serve as survival mechanisms when the organism is under threat, the time when prioritizing oneself is most important. Prioritizing oneself over and/or at the cost of others is at the core of these traits.

These findings represent a climate-specific, adaptationist view of Dark Triad traits, which is in contrast to most work that has focused on sexual selection arguments of the Dark Triad (Jonason et al. 2009). Our assertions here might conflict with the pathological view of antisocial traits (Hare 1985). Such psychological survival adaptations may be pseudopathologies (Jonason et al. 2015a) that confer benefits to the person at the cost of the group (Crawford & Anderson 1989).

In conclusion, we agree with the thrust of the CLASH hypothesis, but feel the authors have not presented the best tests of their climate-linked hypotheses. We have presented evidence here that we feel better tests their assertions by examining ostensible psychological preconditions and adaptations for survival. We encourage future work to not conflate manifestations of psychological

adaptations with the adaptations themselves because, after all, it is called evolutionary *psychology* for a reason.

Warm coffee, sunny days, and prosocial behavior

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Sara Konrath

Lilly Family School of Philanthropy, Indiana University, Indianapolis, IN 46202.

skonrath@iu.edu

www.IPEARlab.org

Abstract: This commentary discusses the research finding that warmer temperatures are associated with more prosocial outcomes. It calls for future research and theory on climate-related variables and social behavior to allow for both positive *and* negative emotional and behavioral responses to warmer temperatures.

In the target article, Van Lange et al. go beyond the documentation of interesting temperature-aggression effects and try to explain such findings with their theoretical model. However, there are some critical points for further consideration. First, the CLASH model focuses only on “hot” (i.e., reactive) aggression and does not try to explain “cold” aggression, the kind of calculated, planful aggression that takes a degree of self-control and future orientation to execute. A parsimonious model of the role of climate-related variables in aggression and violence should explain both types of aggression. Would “cooler” aggressive behaviors be more likely to occur in cooler climates and/or those with more seasonal variation in temperature? How does their model address such types of aggression?

Second, and worthy of further elaboration, the CLASH model does not account for the research finding that warmer temperatures (and the concept of warmth more generally) are also associated with increased prosocial behaviors and that both hot *and* cold temperatures have been found to reduce self-control (Gailliot 2014). These results, at first glance, seem to contradict the