unselfish and cooperative behavior in social dilemmas" (sect. 3.2, para. 3). Indeed, as economists and psychologists have realised, the anticipated costs of antisocial behaviours can reduce a propensity for so-called "short-sighted" or "impulsive" social transgressions, like stealing and aggression that may accrue immediate benefits, for instance, in terms of material wealth or status (Boyer 2008; Frank 1988).

Thus, one of the reasons humans avoid reactive violence is that the delayed interpersonal costs of doing so can be foreseen. However, we think the role of mental time travel into the future does not end here. It may have the opposite effect when people imagine futures that are volatile, uncertain, or harsh. In those circumstances, delayed relational and coalitional costs of immediate violence may be downplayed because they are foreseen as less likely to materialise, or less dramatic against the harsh backdrop of one's expected future (see Bolland 2003; Brezina et al. 2009). For this reason, a seeming "failure" of self-control in reactive violence may sometimes be caused not by a disinclination to plan ahead, as Van Lange et al. imply, but by very virtue of this ability. In other words, prudent foresight, in certain circumstances, should lead to a general prioritisation of the present (Bulley et al. 2016; see also Daly & Wilson 2005).

A second concern is that it is not clear what reasons the authors propose for the apparent links between average temperature/seasonal variation and life history, time perspective, self-control, and aggression. Are the purported relationships driven by explicit mental reasoning (as discussed previously), individual learning, cultural evolution, an evolved genetic predisposition or calibration mechanism, or some combination of these factors? At times Van Lange et al. point to individual reasoning and foresight, for instance, when they write that individuals "*realize* that they need to plan and prepare for the next season" (sect. 3.1, para. 8). At other times, they appeal to evolutionary adaptation or developmental plasticity: "Average temperature and seasonal variation in temperature have shaped the *evolution and development of differential adaptation* in terms of life strategy, time orientation, and self-control" (sect. 3.2, para. 1). And yet elsewhere, they seem to appeal to cultural evolution: "lower temperatures and especially greater seasonal variation in temperature *helps* individuals and *societies evolve* to be less aggressive" (sect. 3, para. 4; all emphases added).

Aside from inappropriately framing evolutionary processes in terms of goal directedness (e.g., that the environment "helps" people to evolve in a certain way), such statements fail to carefully delineate proximate (mechanistic/developmental) and ultimate (phylogenetic/functional) explanations, a practice that is critical when making evolutionary arguments (Mayr 1961; Tinbergen 1963). Given the potentially socially divisive nature of some possible interpretations of Van Lange et al.'s propositions, it seems particularly important to be clear about what kind of explanation the authors advance and, hence, what testable predictions follow (e.g., if their proposed explanation is at the phylogenetic level, it could be tested with genetic or twin studies).

The authors also apply their argument inconsistently. They do not adequately explain why seasonal temperature variation should encourage planning more than other important predictable environmental stressors. For example, many hot countries north of the equator are subject to seasonably variable, but reasonably predictable, precipitation (Brown & Lall 2006), leading to significant water stress (Oki & Kanae 2006), a fact that Van Lange et al. acknowledge. Nonetheless, they choose not to focus on the effects of variability in rainfall, reasoning that (1) the effects of temperature have been more thoroughly examined in the literature, (2) the associations between temperature and conflict appear to be stronger than those between rainfall and conflict, and (3) for most countries, temperature varies more predictably than rainfall. Whilst these might be good reasons to *focus on* the effects of temperature variability, they are not good reasons to *ignore* other climatic variables, which, by applying the authors' logic, should be important. In avoiding discussion of the effects of rainfall, as well as other variables, Van Lange et al. fail to answer a key question: Why shouldn't the predictable stressors of hot climates also engender planning and self-control as per the predictable stressors of cooler climates?

There is a risk that ambiguous reasoning, aired in an esteemed journal such as this, will play into the hands of old racist prejudices about evolved inferiority of certain peoples. So we want to end this commentary with a warning that, in addition to the theoretical shortcomings already discussed, there are large empirical holes in the authors' case. For example, the target article avoids adequate consideration of the historical contexts of the regions in question (e.g., the profound consequences of slavery and colonisation for equatorial countries [see Diamond 1999]). They also sidestep potential counterexamples from near the equator (e.g., the peaceful nature of places such as Singapore [The World Bank 2013]), from history (e.g., the simultaneous planning successes and extreme violence of ancient Mesoamerican societies [see Harner 1977]), and from prehistory (e.g., that the extended time perspective characteristic of our species arguably began to evolve in African savannah–dwelling hominins [see McBrearty & Brooks 2000; Suddendorf & Corballis 2007]).

NOTE

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Inconsistent with the data: Support for the CLASH model depends on the wrong kind of latitude

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Abstract: We argue that the CLASH model makes a number of questionable assumptions about the harshness and unpredictability of low-latitude environments, calling into question the life history strategy approach used, and that it is inconsistent with more nuanced global patterns of violence. We suggest an alternative account for less violence at high latitudes, based on a greater need for cooperation.

Van Lange et al. suggest that environmental harshness and unpredictability, associated with low-latitude equatorial environments, lead to faster life history strategies, of which increased violence and aggression is one consequence. In general, we agree that factors that correlate with latitudinal climatic variation might influence relative frequencies of fast and slow life history strategies and that this could plausibly lead to different rates of aggression and violence in different regions across the world. The CLASH model, however, depends on questionable characterizations of what constitutes harsh, unpredictable environments and shaky assumptions about Life History Theory, and is inconsistent with patterns of violent crime rates in many regions of the world.

The authors make a very specific argument about environmental predictability and harshness: they equate high temperatures and low seasonal variation in temperature with high levels of harshness and unpredictability. Conversely, high seasonal

variation, including the harsh winters that occur as one approaches the poles, are described as predictable, hence less harsh. Although environmental challenges apart from temperature and its annual fluctuations will undoubtedly contribute to harshness, Van Lange et al. argue that temperature is the environmental variable with the most explanatory power regarding violence and aggression, so for the moment we will limit our criticisms to that. It seems somewhat counterintuitive to us to assert that low seasonal variations in temperature automatically produce an unpredictable environment, which would render planning for the future an unprofitable activity. Harsh northern winters, on the other hand, may well provide selection pressure for future planning – not because the environment is mild and so a long, future-focused, life history strategy generally is adaptive – but simply because, if you don't plan and stockpile, you die. It seems more valid to argue that the harshness of extreme temperature fluctuations necessitates the capacity to plan, rather than to argue that the supposed harshness and unpredictability of annually consistent temperatures preclude planning. Indeed, strong seasonality has been recently associated with rises in violent crime because groups use warm periods to loot in preparation for the coming harsh periods (Landis 2014).

As the authors argue, one factor that does contribute to environmental harshness in the tropics is pathogen prevalence; this is the main "harsh" environmental factor associated with equatorial regions. The relationship between pathogens and latitude, however, is not straightforward. Disease is more prevalent at low latitude only where it is wet. Deserts and other arid environments have relatively low disease prevalence (Stromberg 1997), and in many other respects, equatorial regions (particularly wet ones) are less harsh, with plentiful, year-round resources.

In addition to theoretical difficulties, the CLASH model is enunciated with reference to only a subset of the available empirical evidence. The evidence reviewed is derived only from the Northern Hemisphere, because most people live in this hemisphere and it has therefore been the focus of most research. Van Lange et al. omit some awkward data points even from the Northern Hemisphere (Alaska has one of the highest rates of violent crime in the United States, and Russia is considered an outlier), and the Southern Hemisphere provides very obvious exceptions to the latitudinal pattern of violence: Australia and New Zealand have low levels of violence, whereas South Africa (which is at a similar latitude) has much higher levels (with African countries between South Africa and the equatorial countries much lower). Melanesian and Polynesian islands have relatively high levels of some kinds of violence, whereas more equatorial Southeast Asia has low levels of violence.

In an analogous kind of global analysis, patterns of women's preferences for masculinity in men's faces were attributed to patterns of disease prevalence (DeBruine et al. 2010), with women in areas of higher disease prevalence adopting a faster life history strategy and a preference for cues to good genes. A subsequent reanalysis of the data, however, showed that the pattern was more parsimoniously explained by the level of economic inequality present in each country (measured by the Gini coefficient), leading to increased levels of competition in equatorial countries (Brooks et al. 2010). Given the pattern of high-latitude countries in the Northern Hemisphere being characterised by relatively high wealth and low wealth inequality, it may be that the fast life history strategies associated with equatorial, high-violence countries, may also be attributed to this increased competition over resources.

Although there is a broad global pattern of lower levels of violence in places of higher latitude (with some important exceptions), this is not obviously a consequence of such climates proximally selecting for slow life history strategies, as the model requires. One alternative ultimate-level explanation is that surviving harsh, resource-poor winters requires high levels of cooperation, and this is what has led to lower levels of interpersonal violence in such regions, as interpersonal violence interferes with cooperative enterprises.

Such adaptation might result from cultural practices, selection on dispositional characteristics, or both. And high-latitude societies have exported both their practices and institutions. Some former European colonies have low violence, possibly because democratic governance took hold in those places, irrespective of their latitude. Former colonies where economic and political institutions are extractive rather than inclusive are among the least prosperous, successful, and peaceful places today (Acemoglu & Robinson 2012).

In conclusion, although we agree that the increased violence in equatorial countries may be partially attributable to fast life history strategies, we question whether the "harsh" environment proposed as the cause of this life history variation is plausibly disease prevalence. We also suggest that other factors, not included in the model, might better account for the generally lower levels of violence at high latitudes, as well as for the complex mosaic of violence patterns across the globe.

Reply to Van Lange et al.: Proximate and ultimate distinctions must be made to the CLASH model

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Abstract: Transcending reviewed proximate theories, Van Lange et al.'s CLASH model attempts to ultimately explain the poleward declension of aggression and violence. Seasonal cold is causal, but, we contend, principally as an ecologically relevant evolutionary pressure. We further argue that futurity and restraint are life history variables, and that Life History Theory evolutionarily explains the biogeography of aggression and violence as strategic adaptation.

Van Lange et al. present the CLASH model wherein average temperature and seasonal fluctuation influence self-control and future orientation, which in turn explains aggression and violence as they vary within and between countries. The authors contrast their CLASH model, derived from evolutionary-ecological theories, such as Life History (LH) Theory, with proximate models that focus on immediate environmental effects. We agree with the authors on the need to progress toward an ultimate explanation, derived from climate and LH variation. Nevertheless, we believe that the distinction made by the authors between *ultimate* and *proximate* explanations (Scott-Phillips et al. 2011) can be more precise. Our commentary thus focuses on disaggregating the two by asking for more clarification through the following questions: (1) How do self-control and future orientation relate to LH Theory? (2) Does biogeographical variation in climate and seasonality influence self-control and future orientation facultatively, developmentally, or evolutionarily? (3) How does the CLASH model's explanation of biogeographical variation relate to previous literature that clearly links biogeographical variation to evolved racial variation?

Proximate/ultimate distinctions come from specifying whether future orientation and self-control are subordinate expressions of LH or independently evolved and predictive variables.