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Aggression and Violence Around the World: A Model of CLimate, Aggression, and Self-control in Humans (CLASH)

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Abstract: Worldwide there are substantial differences within and between countries in aggression and violence. Although there are various exceptions, a general rule is that aggression and violence increase as one moves closer to the equator, which suggests the important role of climate differences. While this pattern is robust, theoretical explanations for these large differences in aggression and violence within countries and around the world are lacking. Most extant explanations focus on the influence of average temperature as a factor that triggers aggression (The General Aggression Model), or the notion that warm temperature allows for more social interaction situations (Routine Activity Theory) in which aggression is likely to unfold. We propose a new model of CLimate, Aggression, and Self-control in Humans (CLASH) that seeks to understand differences within and between countries in aggression and violence in terms of differences in climate. Lower temperatures, and especially larger degrees of seasonal variation in climate, calls for individuals and groups to adopt a slower life history strategy, and exert more focus on the future (versus present), and a stronger focus on self-

control. The CLASH model further outlines that slow life strategy, future orientation, and strong self-control are important determinants of inhibiting aggression and violence. We also discuss how CLASH is different from other recently developed models that emphasize climate differences for understanding conflict. We conclude by discussing the theoretical and societal importance of climate in shaping individual and societal differences in aggression and violence.

Keywords: aggression; climate; seasonal variation; self-control; temperature; time-orientation; violence.

1. Introduction

"The heat made people crazy. They woke from their damp bed sheets and went in search of a glass of water, surprised to find that when their vision cleared, they were holding instead the gun they kept hidden in the bookcase."

— Kristin Hannah, *Summer Island: A novel* (2004)

Aggression and violence tear the fabric of society. They often pose a threat to feelings of safety and trust, undermine healthy relations among people, and bring about considerable suffering and unnecessary loss to people in many countries (Anderson 2001; Hsiang et al. 2013; Van de Vliert 2009). One of the many factors that can make people more aggressive and violent is heat, as suggested by the opening quote from Kristin Hannah. One major scientific puzzle derives from the observation that the prevalence of aggression and violence differ within and between countries among the world. As a general trend, aggression and violence increase as countries become closer to the equator (e.g., Walker et al. 1990). These differences are large and widespread. For example, data from the 2013 Global Study on Homicide (United Nations Office on Drugs and Crime [UNODC], 2013) reveal that, per 100,000 people, the rates for homicide are higher for various countries in Central America (26 per 100,000) and Middle Africa (18 per 100,000) than for Europe (5 per 100,000) and Northern America (5 per 100,000). There are, however, exceptions to this general "rule". For example, although South Africa is quite distant from the equator, it has a very high violent crime rate (30 per 100,000). Violent crime differences also occur within continents. For example, differences in violent crime rates occur along the North-South Axis in Europe, with homicide rates from about 4 per 100,000 in Albania, Montenegro, and Turkey to less than 1 per 100,000 in Scandinavia. For within continent

comparisons, there are exceptions as well, most notably Russia, with a homicide rate of at least 5 per 100,000.

Likewise, violent crime differences also occur within countries. The Federal Bureau of Investigation (FBI) crime report confirmed once again a consistent fact—the South of the USA has more violent crime than the North (FBI, 2011). Similarly, mafia-related homicides are much higher in the South than in the North of Italy (United Nations Office on Drugs and Crime [UNODC], 2013). Beginning at the global level and ending at the sub-national level, whether across regions, sub-regions, or countries, two robust trends occur with regards to aggression and violence: (1) there are massive differences between countries (and sometimes within countries), and (2) one tends to see more aggression and violence for locations closer to the equator than for locations further from the equator.

This bigger picture is supported in a recent meta-analysis on climate and conflict (see Burke et al. 2015), which found that climate is associated with violence in 46 of 56 (82%) of published studies. Moreover, temperature is associated with violence in 20 out of 24 studies (83%). They also showed that effects were stronger for temperature increases than for rainfall, and were stronger for intergroup conflict than for interpersonal conflict. Taken together, this meta-analysis provides a strong — and interdisciplinary — empirical foundation for the conclusion that "large variations in climate can have large impacts on the incidence of conflict and violence across a variety of contexts" (Burke et al. 2015, p. 610).

Although there are large differences in aggression and violence within and across countries, theoretical explanations for these differences are lacking. Most explanations focus on the influence of average temperature as a factor that triggers aggression and violence (General Aggression Model), or the notion that warm temperature allows for more social interaction situations (Routine Activity Theory) in which aggression and violence are likely to unfold. We propose a new model of CLimate, Aggression, and Self-control in Humans (CLASH) that seeks to understand differences within and between countries in aggression and violence in terms of differences in climate. Specifically, it proposes that higher average temperature, and especially smaller seasonal variation in temperature, calls for individuals and groups to adopt a faster life strategy, and exert greater focus on the present (versus future) and less focus on self-control. The CLASH model further outlines that fast life strategy, short-term orientation, and lack of self-control are important determinants of aggression and violence.

Throughout this article, we use the terms aggression and violence to describe broad classes of behavior intended to harm others. Aggression is defined as any behavior that is intended to harm another person who is motivated to avoid that harm, and violence is defined as any behavior that is intended to cause extreme physical harm (e.g., injury, death) to another person who does not want to be harmed (cf. Anderson & Bushman 2002). All violent acts are aggressive, but not all aggressive acts are violent—only acts intended to cause extreme physical harm are classified as violent. Also, our focus is not limited to acts of interpersonal aggression and violence. We also include acts of intergroup conflict, such as political violence, wars, and riots (see Burke et al. 2015).

As will be discussed, our conceptualization focuses on life strategies, time-orientation, and self-control, as constructs that are key to understanding aggression and violence. Each of these variables is shaped by climate (e.g., differences in average temperature, seasonal variation in temperature). Moreover, self-control in particular, is assumed to be a powerful predictor of aggression and violence. Indeed, poor self-control is one of the "strongest known correlates of crime" (Pratt & Cullen 2000, p. 952), especially violent crime (Gottfredson & Hirschi 1990; Henry et al. 1996). Therefore, we focus on those forms of aggression and violence that are due to low self-control. Specifically, we focus on "hot," impulsive, angry behavior intended to harm another person who does not want to be harmed — called *reactive aggression* (also called hostile, affective, angry, impulsive, or retaliatory aggression; e.g., Buss 1961; Dodge & Coie 1987). Reactive aggression is prone to occur in situations where, for example, time to think is limited, cognitive load is high, immediate retaliation is feasible, and where there is "a sense of urgency" to respond (e.g., in response to public humiliation, in direct confrontations). Reactive aggression can be a criminal act (e.g., assault, murder), or a noncriminal act (e.g., swearing at a rude driver, screaming at one's spouse).

Before we discuss our model in greater detail, we should explicate three foci of the present theoretical analysis. First, we acknowledge that comparisons within countries are less complex than comparisons between countries. In general, there are far fewer differences within countries than between countries. Differences between countries (e.g., historical, economic, political variables) are exceptionally difficult to disentangle from climate differences (cf. Burke et al. 2015). Thus, our analysis focuses more on within-country than on between-country comparisons of climate differences. Of course, we acknowledge that between-country comparisons are

important when considering the scientific principle of efficiency (i.e., explaining a lot of variance using a relatively parsimonious model) and the societal urgencies the world faces (e.g., global change, migration issues, and international cooperation; cf. Van Lange 2013).

Second, we focus on the Northern Hemisphere for methodological and practical reasons. The large majority of the people live in the Northern hemisphere. Moreover, past research has focused on countries in the Northern hemisphere. It is this past research that is in strong need of a new model that is able to account for pronounced differences between Southern and Northern environments (in the Northern hemisphere) on several important dimensions—time orientation, self-control, aggression, and violence. Theoretically, the distance from the equator should work the same way in the Southern Hemisphere as in the Northern Hemisphere. Indeed, in the final analysis, we believe that it is desirable, from a scientific and societal perspective, to extend the model to both hemispheres (cf. Henrich et al. 2010).

Third, as the name conveys, CLASH focuses on humans, rather than other animals. Of course, we acknowledge that animals also adapt and respond to climate differences (see Burghardt 2013). For example, climate differences are associated with hibernation and storage of food for some species (e.g., bears, skunks, and chipmunks), migration to other regions for some species (e.g., fish, birds, and butterflies), and movement to specific locations such as underground or holes in trees in the same region for some species (e.g., mice, snakes, and frogs). Climate is also linked to seasonal “planning” of reproduction for many species, who mate in the Spring (Wikelski et al. 2000). Although these patterns of adaptation can be viewed in terms of life history strategies, time-orientation, and self-control, we believe it is premature to link these patterns to aggression and violence in other animals, for two reasons. First, we do not know of

any empirical literature on the link between climate differences and aggression among the same animal species. It is more likely that throughout evolutionary history, animals have either adapted to the local climatological circumstances or migrated to more fitting circumstances. These topics are the beyond the scope of this article. Second, as illustrated above, many species have their own unique way of adapting to annual differences in seasonal climate. These reasons are not to imply that we regard an examination of comparative research as unimportant. Indeed, we hope, of course, that the specific tests of CLASH may be extended to humans *and* other animals in the future.

The rest of the article is organized as follows. Section 2 presents the existing evidence and theories linking climate to aggression and violent crime. Before we describe our CLASH model, it is necessary to provide a brief overview of theories and research relevant to differences in aggression and violence, both within and between countries. This is especially important in order to outline what CLASH contributes to our current understanding of violence within and across countries. Section 3 discusses theory and research relevant to two propositions that provide the foundation for CLASH. Given that climatological approaches are not common in the social and behavioral sciences, Section 4 includes a broad discussion about the ubiquity of climate for understanding human behavior in groups and societies. Because CLASH offers a novel and general framework, Section 5 considers caveats and future directions of CLASH. Section 6 concludes by outlining theoretical issues and broader scientific and societal implications of CLASH. The final section includes some concluding comments.

2. Contemporary explanations of cultural differences in violence

Several theorists and researchers have attempted to answer the question of why there is so much variation in aggression and violence around the world, often inspired by the observation that countries closer to the equator are generally more violent. One widely shared belief amongst experts and laypeople alike is that hot temperatures increase violence. The belief that hot temperatures increase violence has inspired researchers to examine the role of average heat (climate) and incidental heat (weather) on violence rates since the late 1800s (e.g., Dexter 1899; Lombroso 1899/1911; for comprehensive reviews; see Brearley 1932; Cohen 1941; Falk 1952).

Considerable research has shown that as temperature increases, violent crime (e.g., murder, rape, assault, violent riots) also increases (Anderson 1987, 1989; Carlsmith & Anderson 1979; deFronzo 1984; Michael & Zumpe 1986), but there is no corresponding increase in nonviolent crimes. Also, as noted earlier, a variety of studies conducted in the USA have shown that Southern states with warmer climates typically have higher violent crime rates than Northern states with cooler climates (e.g., Anderson & Anderson 1996; Lombroso 1988/1911; United Nations Office on Drugs and Crime [UNODC] 2013). Similarly, time-period studies on temperature variability have found higher violent crime rates in hotter years, seasons, months, and days (e.g., Anderson et al. 1997; Leffingwell 1892). In addition, field and archival studies have found a positive association between heat and aggression in a variety of forms (e.g., horn honking, number of major league baseball batters hit by pitched balls, prison inmate violence; Haertzen et al. 1993; Kenrick & MacFarlane 1984; Reifman et al. 1991). Overall, the evidence from correlational studies, field experiments, and archival studies of violent crimes provide

evidence for the "heat effect" – higher temperatures are associated with higher levels of aggression and violence.

Given that various empirical studies have shown that as temperature increases, so does aggression and violence, it becomes important to ask an obvious question: What is it about high temperatures that makes people generally more aggressive and violent? The two most popular theories offered to account for this positive relation between temperature and violence are the General Aggression Model (Anderson & Bushman 2002) from psychology, and the Routine Activity Theory (Cohen & Felson 1979; Rotton & Cohn 2001) from law and criminology.

2. 1. General Aggression Model. In the General Aggression Model (e.g., Anderson & Bushman 2002), two types of input variables can influence whether a person acts aggressively: personal variables (e.g., genetic predispositions, trait aggression, gender, attitudes about violence) and situational variables (e.g., alcohol, violent media, provocation, hot temperatures). The relevant situational variable here is hot temperatures. According to the model, there are three possible routes to aggression and violence — through angry feelings, aggressive thoughts, and physiological arousal. Together these three routes comprise an individual's present internal state, which encourages or discourages aggression and violence. However, these routes are not mutually exclusive or even independent. For example, someone who has aggressive ideas might also feel angry and have elevated blood pressure. Hot temperatures appear to operate through all three routes. For example, hot temperatures make people angry, increase aggressive thoughts, and also increase physiological arousal (e.g., heart rate, blood circulation, perspiration). This unexplained source of arousal from the heat can be mislabeled as "anger," especially in

situations involving provocation, and thus lead to reactive aggression (Zillmann 1979). This might help explain why a minor provoking social event, such as an accidental bump in a hot crowded bar can lead to the trading of insults, punches, and possible even bullets (Anderson 2001).

2.2. Routine Activity Theory. The Routine Activity Theory (Cohen & Felson 1979; Rotton & Cohn 2001) conceptualizes the effect of weather on violent crime rates in terms of the amount of social contact. As one scholar wrote, "the greater frequency of crimes against the person in summer months is probably due to the greater frequency of contact among human beings in those months rather than the effects of temperature on the propensity to criminality" (Sutherland & Cressey 1978, p. 119). The rationale behind the Routine Activity Theory is relatively straightforward—during warmer weather, individuals are more likely to leave the safety of their homes, schools, and jobs, and spend more time outside in public spaces, where interactions with others can become "heated" and aggressive (Cohn 1990). Consistent with these predictions, violent crime rate data from Minneapolis, Minnesota, and Dallas, Texas indicate that the relation between hot temperatures and violent crime is stronger during time-periods in which individuals spend generally more time outdoors, during evening rather than afternoon hours, and during weekends rather than weekdays (e.g., Cohn & Rotton 1997; Rotton & Cohn 2001).

2.3. Hot or not: Past theory and research. Despite the wealth of empirical studies on the heat effect, three limitations are worth mentioning. First, although the General Aggression Model (Anderson & Bushman 2002) proposes that heat-induced anger, aggressive thoughts, and physiological arousal can lead to more aggression, it is unlikely that these factors *alone* would

lead to real-life extreme violent behaviors such as homicide. Indeed, there is evidence that the effect sizes of heat-induced hostility are relatively modest, both inside and outside the lab (e.g., Ferguson & Dyck 2012). Moreover, laboratory experiments have yielded mixed results. Indeed, some experiments indicate that extremely hot temperatures can actually inhibit aggression presumably because people want to escape the heat rather than fight (e.g., Baron 1972; Baron & Bell 1975, 1976). Also, some evidence suggests that aggression and violence are smaller in hot climates than in warm climates (e.g., Van de Vliert et al. 1999). Taken together, past research suggests that the mechanisms underlying relationship between heat and aggression are in need of further scientific understanding (see Anderson & Anderson 1998).

Second, although Routine Activity Theory proposes that the link between temperature and crime is a result of individuals congregating in public spaces with increased social interaction, this perspective has not always received empirical support (Rotton & Cohn 2000). For example, although there is a greater likelihood of violent behaviors to take place amongst young people in a bar room setting, violent behaviors are unlikely to occur in this setting amongst mixed age-sex groups (Felson 1998). This observation is consistent with what is known in the criminology literature as the "night-time economy," which consists primarily of bars, pubs, and nightclubs — settings in which alcohol-related violence can occur (Teece & Williams 2000). For example, the relation between hot temperature and violent crime is generally stronger during weekend evenings and night-time hours when the temperatures are cooler, and around pubs and night clubs (e.g., Allen et al. 2003; Bushman et al. 2005; Tierney & Hobbs 2003). Another study found that robbery rates tend to increase in the evening during the fall when the sun sets earlier, and tend to decrease in the spring when the sun sets later (Doleac & Sanders 2013). Moreover, a

handful of individuals congregating in public places (e.g., during festivals) can actually lead to identification and social cohesion (Whitehouse & Lanman 2014). All else being equal, social contact appears to be a necessary, but not a sufficient condition for the occurrence of violent crime. In addition, much violence occurs inside the home among family members and close friends rather than outside the home (e.g., DeWall et al. in press; Krahé in press).

Third, various studies that have examined climate differences and violence around the world include countries with high average temperatures and small seasonal variation (e.g., India, Indonesia, Kenya, and Sub-Saharan Africa; see Burke et al. 2015; Simister & Van de Vliert 2005; Van de Vliert 2009). However, many studies on the association between temperature and aggression or violence, especially field studies and laboratory experiments, have been conducted in the USA. But even within the USA, the General Aggression Model and the Routine Activity Theory cannot explain some other violence-relevant attitudes that are quite different for most states in the South versus those located in the North. For example, in most Southern states, there is greater approval and support for corporal punishment, gun ownership, and capital punishment than in most Northern states (Shackelford 2005). Several scholars have argued that pro-violence attitudes in the South of the USA are characterized by "machismo"—masculine aggression (Simister & Van de Vliert 2005), or a "southern culture of honor"—an ideology justifying the use of violence for self-defense, and in defense of one's "honor" or reputation for being strong, tough, brave, and manly (e.g., Cohen 1996, 1998; Cohen & Nisbett 1994, 1996; Cohen et al. 1996; Cohen et al. 1999; Nisbett 1993; Nisbett & Cohen 1996).

Some scholars have proposed that the southern culture of honor in the USA developed in response to the herding economy of the frontier region of the South (Nisbett & Cohen 1996). Because herding (more than farming) places an individual at risk for losing everything due to theft, and because the South of the USA was a frontier region where the state had little power to prevent or punish theft of property, individuals created and enforced their own system of law and order defined by "the rule of retaliation." However, there is no clear description of how the southern culture of honor was maintained until today, especially since the Southern USA today is not based on a herding economy and is not lawless (Shackelford 2005). It is possible that the psychological mechanisms underlying the behavioral manifestations of the southern culture of honor were selected as a solution to some other adaptive problem characteristic of the South (versus North).

To summarize, although contemporary explanations of cultural differences in violence provide compelling cultural accounts of violence, they have conceptual and methodological limitations. The explanations focus more on behavioral patterns than on underlying mechanisms. The culture of honor hypothesis focuses on historical determinants in particular regions of the USA. Perhaps most importantly, the explanations do not include an account of the climate differences that may underlie the exceptionally large and widespread differences in violent crime within and between various countries around the world.

3. CLASH: A model of climate, aggression and self-control in humans

Our model of CLimate, Aggression, and Self-control in Humans (CLASH; see Figure 1) seeks to explain differences within and between countries in terms of temperature, and especially

seasonal variation in temperature. Using an extension of Life History Theory, and the broader literature on time-orientation and self-control, we advance two propositions to suggest that temperature-related aggression and violence can be understood in terms of time-orientation and self-control. Although theoretical in nature, the propositions are rooted in research conducted in various fields and disciplines of the social and behavioral sciences, with an emphasis on the social and evolutionary psychology.

Our propositions are organized around calls for the development of more interdisciplinary theories. Three broad categories of factors that influence aggression and violence levels in countries and regions are: (1) climatological, (2) evolutionary, and (3) psychological. Our goal is not to exhaustively catalogue the many factors that influence aggressive and violent behaviors. Rather, our goal is to advance the theoretical understanding of the pronounced differences in aggression and violence within and between countries around the world. Unlike other explanations that primarily focus on average differences in climate (hot versus cold climates), we focus on average temperature and especially the broad influence of seasonal variation in climate (small or big annual differences within a location) on life strategy, time-orientation, self-control, aggression, and violence. Thus, our CLASH model provides a novel perspective to understanding why countries and regions closer to the equator tend to have higher levels of aggression and violence than do countries farther away from the equator.

The key climatological variables that influence aggression and violence are average temperature and seasonal variation in temperature. Of course, climate also entails variables such rainfall, wind, and water availability, as well as climate indices (e.g., El Niño Southern Oscillation

Index). We focus on temperature for three reasons. First, the extant body of research has primarily examined temperature as the key climatological variable (e.g., Van de Vliert 2013). Second, a recent meta-analytic study has revealed that the association between temperature and conflict is at least four times as strong as the association between rainfall and conflict (Burke et al. 2015). Third, for most countries, there is greater predictable seasonal variation for temperature than for other climatological variables, such as rainfall. Thus, although we share the view that climate differences in terms of averages and seasonal variability differ in several interesting respects, we focus on temperature as the key variable, rather than precipitation.

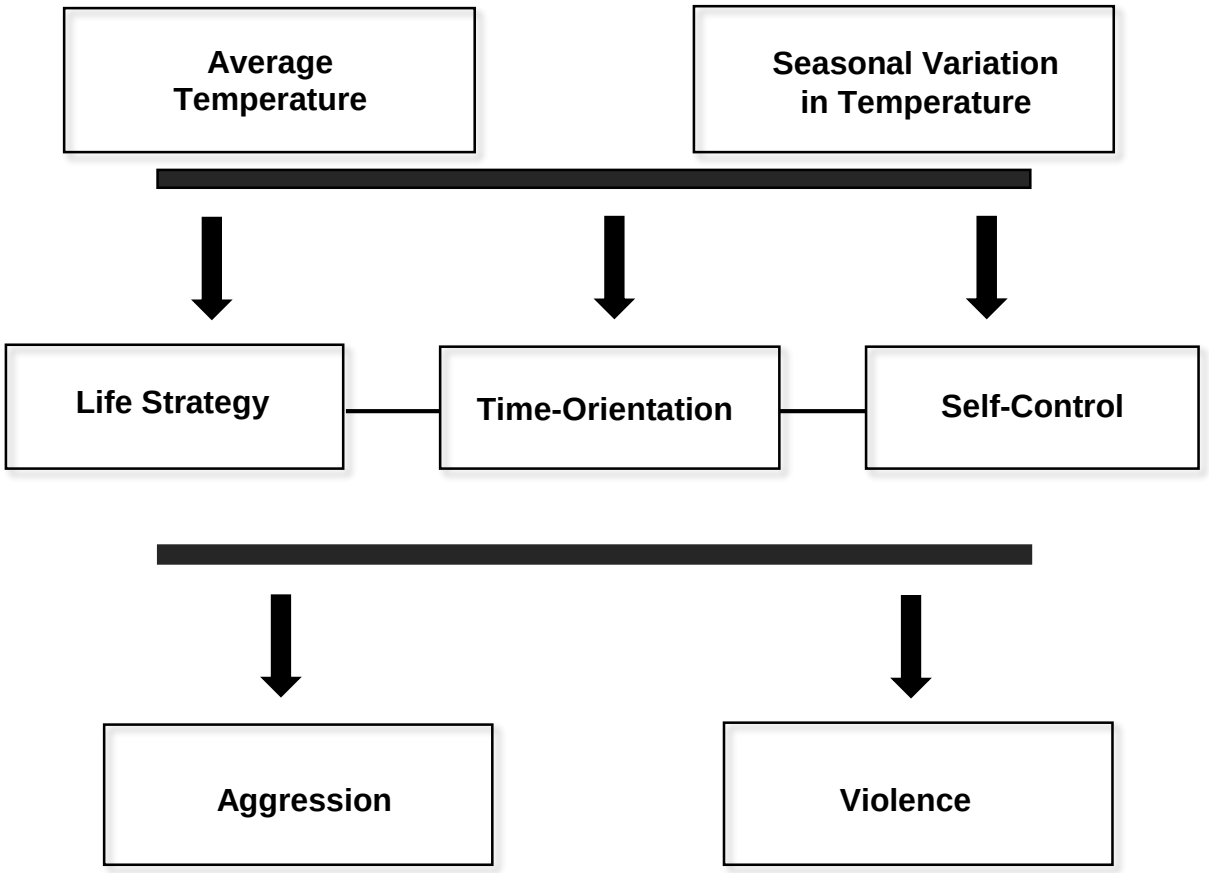

Figure 1. *A model of CLimate, Aggression, and Self-control in Humans (CLASH)*

In the next section, we discuss in detail two propositions that provide the foundation for our CLASH model. One broad assumption of CLASH is that adaptation to various climates is reflected in slow and fast life strategies, in differences in time-orientation and self-control, and in differences in aggression and violence levels. The first proposition is that lower temperatures and especially greater seasonal variation in temperature calls for individuals and societies to adopt a slower life strategy, a greater future-orientation, and a greater degree of self-control (*Proposition 1*). The second proposition is that lower temperatures and especially greater seasonal variation in temperature helps individuals and societies evolve as less aggressive and less violent in situations requiring future-orientation and self-control *(Proposition 2*). As with all scientific propositions, these propositions undoubtedly will be subject to revision, refinement, and progress. The primary goal of CLASH is to propose a new theoretical model, and the propositions should help researchers to develop and test specific hypotheses relevant to CLASH.

3.1. Lower temperatures and especially greater seasonal variation in temperature calls for individuals and societies to adopt a slower life strategy, a greater future-orientation, and enhanced self-control (*Proposition 1*)

One key lesson of evolutionary theory is that resources for survival and reproduction are not infinite. Hence, a basic challenge to all organisms is the successful allocation of resources needed for survival and reproduction. Natural selection favors *resource allocation strategies* that, in response to environmental conditions, enhance an organism's inclusive fitness over the lifespan (Ellis et al. 2009).

A prominent theory that focuses on how different resource allocation strategies arise from different exposures to environmental conditions is Life History Theory (Hill 1993; Kaplan & Gangestad 2005; MacArthur & Wilson 1967; Pianka 1970). This theory concerns the allocation of finite resources across different fitness-relevant activities. According to some theorists, two features of an environment are essential for psychological development and adaptation: Harshness and unpredictability (Ellis et al. 2009; Griskevicius et al. 2011). Harshness refers to the rates of mortality and morbidity caused by largely uncontrollable factors (e.g., high rates of infectious disease; Frankenhuis et al. 2016). Unpredictability refers to the uncertainty of future outcomes. The environmental threats of harshness and unpredictability, in combination with the available resources one has for coping with environmental threats, largely determine how stressful an environment is. These are features that are often reflected in higher morbidity and mortality (Adler et al. 1993; Chen et al. 2002).

Life History Theory proposes that people adapt to (un)harshness and (un)predictability by adopting either fast or slow life history strategies. Relative to slow life strategies, fast life history strategies are associated with reproducing at an earlier age, having more uncommitted and less stable sexual relationships, having more children, and investing less time, effort, and resources into each child. Also, relative to slow strategies, fast life strategies tend to be associated with short-term planning, greater risk-taking, focus on immediate gratification for short-term benefits, and more aggression (e.g., Ellis et al. 2009; Frankenhuis et al. 2016; Griskevicius et al. 2011; Nettle 2010; Simpson et al 2012). Thus, Life History Theory posits that people adapt to harsh and unpredictable environments by adopting faster life strategies. Because the future is

unpredictable and people tend to live shorter in such environments, it is adaptive for people to enact fast life strategies as delayed payoffs may never be realized. In contrast, when environments are unharsh and predictable, people adopt slower life strategies. Because the future is more predictable and people tend to live longer in such environments, it is adaptive for people to enact slower life strategies as delayed payoffs are likely to be realized (Ellis et al. 2009; Griskevicius et al. 2011; Simpson et al. 2012).

An abundance of research has supported this view. As noted earlier, threats of harshness and unpredictability are often reflected in higher morbidity and mortality. Lower SES is related to nearly all forms of morbidity and mortality (Adler et al. 1993; Chen et al. 2002; Miller et al. 2011). From a life history perspective, one might expect that low SES individuals should enact faster life strategies than high SES individuals because they are more likely to suffer premature disability and death (Adler et al. 1993; Chen et al. 2002; Miller et al. 2011). Indeed, lower SES is associated with a number of fast life strategies, such as earlier sexual activity (e.g., Ellis et al. 2003; Kotchick et al. 2001), higher rates of adolescent pregnancy and childbearing (e.g., Ellis et al. 2003; Miller et al. 2001), greater number of offspring (Vinning 1986), and lower levels of parental investment per child (e.g., Belsky et al. 1991; Ellis et al. 1999).

Findings similar to those found for low SES can also be found for other cues of environmental harshness and unpredictability. For example, past research has shown that there is a greater likelihood for individuals growing up in harsh and unpredictable family environments (e.g., homes with a lot of fighting between family members) to experience faster sexual maturation, earlier age of reproduction, and higher reproductive rates (e.g., Chisholm 1999; Kim et al.1997).

Moreover, neighborhood deterioration and danger (e.g., assaults, muggings, burglaries, thefts, presence of gangs and drug addicts) are associated with earlier sexual activity and higher rates of risky sexual behaviors (e.g., Lauritsen 1994; Upchurch et al. 1999). Furthermore, as resources become increasingly scarce, females increasingly prefer mates who have access to resources, and parents increasingly invest in their offspring's reproductive value (e.g., Bugenthal & Beaulieu 2004; Durante et al. 2015; Kruger et al. 2008).

Our CLASH model extends Life History Theory. In particular, whereas Life History Theory emphasizes unpredictability and harshness as sources of environmental stress, CLASH emphasizes predictability as a source of control over environmental stress (see also Ellis et al. 2009). By control, we mean activities that one could take to optimally adapt to predictable change, especially in preparation of predictable harsh circumstances. Although control is always low in unpredictable situations, control can be high in predictable situations. CLASH proposes that the combination of predictability and control shape a slow life strategy, a future time orientation (e.g. an orientation relevant to planning purposes), and a focus on self-control (to control short-temptations and pursue long-term goals).

CLASH proposes that distance to the equator is associated with a slower life strategy, a stronger future-orientation, and a greater focus on self-control. The key explanatory variables are average temperature *and* seasonal variation in temperature (see Figure 1). In societies closer to the equator, the climate is warmer and less variable per season, and so individuals have less need to plan ahead to ensure survival and reproduction. That is, there is little need to focus on the future or develop a longer time perspective (Kruger et al. 2008), or to exercise self-control (Baumeister et al. 2013). Moreover, societies closer to equator are also relatively harsh and unpredictable.

Hot temperatures can be an important source of stress, not only in terms of everyday life but also as a threat to the harvest failure in agriculture. Another source of harshness and unpredictability is pathogen stress. Indeed, parasitic and infectious disease prevalence, such as Malaria or Zika virus, is considerably higher in countries closer to equator (e.g., Guernier et al. 2004) which poses a threat to survival and may activate human cognition and behavior (e.g., Fincher et al. 2008; Fincher & Thornhill, 2012). Also, there is some evidence that the risk of natural disasters tend to increase as one moves closer to the equator (National Oceanic and Atmospheric Administration, 2016).

In societies more distant from the equator people face both lower temperatures and greater seasonal variation in temperature. Both characteristics, but especially seasonal variation in temperature, should give rise to a slower life strategy, a stronger future-orientation, and a stronger focus on self-control. Although there is some harshness in these societies as well, there is also predictability of events that is largely controllable in terms of planning and "coping". In particular, individuals in these societies realize that they need to plan and prepare for the next season. For example, food supply is less plentiful and less varied during winter, posing a serious threat to health. Yet the quality and quantity of food supply can be promoted by adopting a future orientation (e.g., planning) and by exercising self-control (resisting the temptation to consume the harvest directly, a commitment to work hard to optimize the harvest for later; Ainslie 2013; Baumeister et al. 2013). Indeed, an analysis of work-related values in 40 countries found that countries located farther from the equator tend to place greater value on future-oriented rewards such as perseverance and thrift (Hofstede 2001). In the next sections, we discuss empirical

evidence that is relevant to CLASH. We begin by discussing evidence relevant to life strategies, followed by evidence relevant to time-orientation and self-control.

3.1.1. Fast versus slow life strategy. According to CLASH, locations with lower temperatures and greater seasonal variation in temperature lead to a slower life strategy. Distance from the equator is a good approximation for lower temperatures and greater seasonal variation in temperature. Consistent with our prediction, life expectancy is lower for countries closer to the equator than for countries farther from the equator. For example, several African countries, Haiti, and Pakistan, have life expectancies lower than 65 years, whereas many European countries, and North America, have life expectances higher than 80 years (World Health Organization, 2013). Of course, there are also some exceptions, most notably high-latitude countries near Russia (with life expectancies often lower than 70) and low-latitude countries such as Ecuador, Thailand, and Indonesia (with life expectancies around 70 or higher).

As noted earlier, one of the strongest and most objective indicators of slow versus fast life strategies is the mother's age at first birth. According to the World Factbook (2014), the mother's age at first birth is less than 20 years (on average) in countries closer to the equator (e.g., Gaza Strip, Liberia, Bangladesh, various middle African countries such as Kenya, Mali, Tanzania, Uganda). In contrast, the mother's age of first birth is greater than 28 years (on average) in countries further from the equator (e.g., Japan, Canada, and nearly all European countries). There are some exceptions to this general rule, such as Hong Kong and Singapore. Within the USA, a similar trend occurs, albeit less pronounced (National Vital Statistics Reports). The five states with the lowest age of mother's first birth are in the South —

Mississippi (age 22.5), Arkansas (age 22.7) New Mexico and Louisiana (age 23.0), and Oklahoma (age 23.1). In contrast, the five states with the highest age of mother's first birth are in the North — Massachusetts (age 27.8), Connecticut (age 27.2), New Jersey (age 27.1), New Hampshire (age 26.7), and New York (age 26.4).

Research also supports our hypothesis that a slow life history strategy is characterized by behaviors that reflect long-term planning, such as more restrictive reproductive behavior with greater parental investment in offspring. Under predictable environmental conditions, slower life history strategies would be better to enhance an individual's inclusive fitness. Even when some harsh conditions become predictable, one can often exert some control by anticipating, preparing, and planning activities relevant to these conditions (e.g., Griskevicius et al. 2011). In these kinds of predictable and controllable environments, individuals contribute to their own embodied capital (e.g., growth and maintenance of their body and mind, accumulation of knowledge and skills; Mittal & Griskevicius 2014). Thus, there is growing evidence that predictable environments tend to promote a slower life strategy, in terms of lower mortality and morbidity, delayed reproduction, and higher contributions to one's own embodied capital.

3.1.2. Time-orientation and self-control. One key assumption in CLASH is that the harshness and predictability of the environment influence time-orientation and self-control.

In this section, we review the empirical evidence relevant to similarities and differences within and between countries in terms of both time-orientation and self-control. Before doing so, we start with outlining the differences between these two concepts, and then provide a brief general review of time-orientation.

Time-orientation is strongly connected to concepts such as "time perspective" and "temporal discounting". It is also closely linked to self-control and related concepts such as delay of gratification and impulsivity. An orientation on the present is linked to lower levels of self-control than an orientation on the future (e.g., Baumeister et al. 1994). However, it is important to distinguish between the broad concepts of time-orientation and self-control. Self-control is generally conceptualized as the ability to resist and manage "temptations" and "impulses" (see Baumeister & Tierney 2011; Joireman et al. 2008), whereas time-orientation is generally conceptualized as an orientation on the present versus the future (cf. Boniwell & Zimbardo 2004; Joireman et al. 2003).

Time has objective or at least consensual features, such as "geographical" and "clock time" (Snyder & Lopez 2009; Boniwell & Zimbardo 2004). Yet, people experience time differently across countries around the world. For example, there are large differences in time urgency when one compares the USA to Brazil (Levine, 2006). In the USA, the conception of time emphasizes the urgency of using time efficiently—making every minute count (Levine et al. 1980). In contrast, in Brazil public clocks and personal timepieces often are intentionally set at different times (with differences up to 20 minutes), students often come late to class, and individuals often come late to formal appointments. Some of these differences may also be reflected in language. Countries farther from the equator emphasize the "extrinsic" value of time (e.g., "time is money"), whereas countries closer to the equator emphasize the "intrinsic" value of time. For example, in Mexico the phrase "Give time to time" (*Darle tiempo al tiempo*) is common; in Africa the phrase "Even the time takes its time" is common; and in Trinidad the phrase "Any

time is Trinidad time" is common (Levine 2006). Other scholars have distinguished between clock-time cultures and event-time cultures. Clock-time cultures are more future-oriented than are event-time cultures. For example, the USA and Northern European countries are clock-time cultures that rely heavily on schedules and punctuality, whereas most countries in Latin America are event-time cultures that go with the natural flow of social events (Brislin & Kim 2003; Levine 2006).

Some research has focused on "pace of life", defined in terms of rapidity or density of experiences, meaning, perceptions and activities (Werner et al. 1985, p. 14). A slower pace of life corresponds to a present orientation, whereas a faster pace of life corresponds to a future orientation. An analysis of individuals from 31 countries found that individuals from colder countries located further from the equator had a faster pace of life than did individuals from warmer countries located nearer the equator (Levine & Norenzayan 1999). Pace of life was measured using three behaviors: (1) the average walking speed of individuals, (2) the average time needed for a routine transaction in a post office, and (3) the average accuracy of public clocks. Another study compared Fresno, California versus Niteroi, Brazil and found that public clocks and personal time pieces were less accurate in Brazil, and that Brazilians were more likely to be late for appointments, were more flexible in their definitions of *early* and *late*, were less likely to attribute being late to internal factors, were less likely to express less regret over being late, and were less likely to rate punctuality as an important characteristic in a businessperson and friend in comparison to Americans (Levine et al. 1980). Niteroi, Brazil is located much nearer the equator than Fresno, California is.

Unfortunately, large cross-national studies on self-control are relatively sparse. Most studies on self-control are conducted in the USA, and if they are cross-national they often include countries from similar global regions. Also, some studies use domain-specific assessments of self-control (e.g., dieting) or use anti-social behaviors that are not aggressive (e.g., truancy). One exception is a recent study that examined a self-report measure of self-control among children (Botchkavar et al. 2015). This study found higher levels of self-control in Northern European countries (e.g., Scandinavian countries, Iceland) than in Southern European countries or the USA. This finding, along with findings from cross-national studies on time-orientation, provides some initial evidence for greater levels of self-control in countries farther from the equator.

3.1.3. Conclusions. Taken together, the empirical evidence supports the proposition that individuals and cultures are more likely to adopt a slower life strategy, and to become more future-oriented, as less present-oriented, as average temperatures become cooler and seasonal variation in temperature become greater. We should acknowledge that most studies involve comparisons among only a few countries, although a few studies compare over 20 countries. Moreover, there may be various third variables that account for these differences. For example, there might be a positive association between a country's wealth or prosperity and future orientation (Milfont & Gapski 2010). It is also noteworthy that the evidence typically yields support across a variety of indicators of time-orientation, and that very few studies yield conflicting evidence. Unfortunately, the "ideal" study has still to be conducted, which would correlate distance from the equator, average and seasonal variation in temperature, with time-orientation and self-control. For a comprehensive test of Proposition 1, we recommend the use of both self-report measures of time-orientation and self-control, but also instruments or

assessments that do not rely on self-reports, such as unobtrusive behavioral measures. Thus, although the evidence is not yet conclusive, the available evidence provides a relatively coherent picture that certainly is in line with Proposition 1 of CLASH (see Figure 1).

3.2. Proposition 2: Lower temperatures and especially greater seasonal variation in temperature helps individuals and societies evolve as less aggressive and less violent in situations requiring future-orientation and self-control.

CLASH proposes that 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. In this section we discuss research on the link between temperature and seasonal variation in temperature on aggression and violence, along with the mediating roles of life strategy, time-orientation, and self-control (see Figure 1). That is, we advance the proposition that in locations with lower temperatures and greater variation in temperature, aggressive and violent behavior are less likely because individuals have adopted a slower life strategy, a longer time-orientation, and a higher level self-control to adapt to their environment.

There is evidence that time orientation is linked to aggression and violence. Earlier research has shown that "delinquents" are more likely to think about the short-term consequences of their actions than about the long-term consequences (Gottfredson & Hirschi 1990, Pratt & Cullen 2000). Other studies have shown that experimental manipulations of "future-self" reduce cheating in testing situations (Van Gelder et al. 2013, Van Gelder et al. 2015). Also, several studies have investigated the role of time-orientation on human cooperation, selfish behavior,

and aggressive impulses. For example, people who are more prone to adopt a future orientation conserve natural resources (Kortenkamp & Moore 2006), support structural solutions to social dilemmas (Van Lange et al. 2013), and resist the urge to respond aggressively when insulted (Joireman et al. 2003).

The anticipation of future interaction is a powerful determinant of unselfish and cooperative behavior in social dilemmas (Van Lange et al. 2011). Similarly, adopting a long-time orientation in relationships inhibits selfish and retaliatory responses in close relationships (Rusbult & Van Lange 2003). A future orientation is negatively related to trait aggressiveness *(*Zimbardo & Boyd 1999; Joireman et al. 2003), hypothetical aggression in scenarios *(*Joireman et al. 2003), aggressive driving *(*Moore & Dahlen 2008; Zimbardo et al. 1997), and actual aggressive behavior — willingness to administer electric shocks to another person in a laboratory experiment (Bushman et al. 2012). Thus, we conclude that a future orientation reduces selfish and aggressive behavior.

There is considerable research on the association between self-control and aggression and violence. In fact, one of the best predictors of violent criminal behavior is low self-control (see Gottfredson & Hirschi 1990). Indeed, most murders committed in the United States are due to unchecked anger (FBI, 2014). When angry feelings and violent urges become activated, self-control is what keeps them in check. Aggression often starts when self-control stops. Interestingly, experimental research has shown that self-control exercises can decrease aggression. In one experiment, for example, participants who had previously completed a measure of trait aggressiveness were randomly assigned to complete self-control exercises using

their nondominant hand for everyday tasks (self-control-training condition), or to answer math problems (control condition) for 2 weeks (Denson et al. 2011). After 2 weeks, participants were provoked by a confederate in the laboratory and were given the opportunity to retaliate by administering aversive noise blasts to the confederate thorough headphones. The results showed that the self-control exercises decreased aggression, especially for individuals high in trait aggressiveness. Another experiment found that partners who practiced self-control were less aggressive toward their loved one than were partners who did not practice self-control (Finkel, DeWall et al. 2009). Thus, there is strong evidence that self-control can inhibit aggression and violence.

Recent research that has examined nearly all variables included in our model (Figure 1) — measures of life history strategy, time-orientation, self-control, and aggression — found that longer life expectancies are associated with an increase in the willingness to engage in behaviors reflective of a slow life strategy, whereas shorter life expectancies are associated with an increase in the willingness to engage in behaviors reflective of a fast life strategy (Dunkel & Mathes 2011). Shorter life expectancies are also related to short-term mating, less self-control, including greater willingness to engage in aggression, sexual-coercion, and violent criminal acts, whereas the opposite relations are found for longer life expectancies *(*Dunkel & Mathes 2011; Dunkel et al. 2010ab). When facing environmental uncertainty, individuals adopt a present orientation that is reflected in a fast life strategy, which in turn leads to more risk-taking in phenotypic strategies related to reproductive success, such as interpersonal aggression (Kruger et al. 2008). More generally, these findings are consistent with our larger claim that fast and slow life-history strategies are linked to time-orientation and self-control, which are likely to inhibit

aggressive and violent behavior. At the same time, we should note that future research should examine the mediating role of time-orientation and self-control on aggression and violence.

3.3. Conclusions. Individuals and groups developing at warmer climates, where seasonal changes are small and environmental harshness and unpredictability are large, tend to enact faster life strategies, a stronger present orientation, and lower levels of self-control. In contrast, individuals developing at colder climates, where annual seasonal variation is large and the environment is highly predictable from year to year, tend to enact slower life history strategies, a stronger future orientation, and higher levels of self-control (see Figure 1). These mechanisms are essential to the development of aggression and violence. We are not suggesting that orientation to the future, and high levels of self-control, serve to inhibit all forms of aggressive behaviors or all forms of violence. Our CLASH model focuses on "hot," impulsive forms of reactive aggression and violence for which longer-time orientation and self-control are especially relevant.

4. CLASH: The ubiquity of climate (and latitude)

Our model CLASH is not the first to emphasize the important role of climate in affecting human thought, affect, and behavior. Indeed, climate is increasingly considered a powerful determinant of human behavior across a variety of scientific disciplines, including biology and evolutionary sciences (e.g., Epstein 1999), economics (e.g., Burke et al. 2015) and psychology (e.g., Van de Vliert 2013). In these disciplines, several topics are now studied (e.g., health, welfare, happiness). Likewise, the empirical relationship between higher temperatures and increased violence has been demonstrated in many settings. For example, a meta-analysis found substantial

effects of temperature increases on the likelihood of interpersonal and intergroup conflict around the world (e.g. Burke et al. 2015): One standard deviation increase in temperature was associated with a 11.3% increase in intergroup conflict and a 2.1% increase in interpersonal conflict. Examples of interpersonal conflict include spikes in domestic violence in India and Australia, greater likelihood of assaults and murders in the USA and Tanzania, ethnic violence in Europe and South Asia, and civil conflicts throughout tropical climates. Hence, we conclude that it is both differences in average temperature *and* differences in seasonal variation in temperature that help explain cross-national differences in aggression and violence around the world.

As noted earlier, distance from the equator can be used as an approximation of higher temperatures and smaller seasonal variation in temperatures. In adopting that proxy, note also that the term equator can be defined not only geographically (at 0° latitude), but also by different standards. The meteorological equator is located north (at 6° N) and what has been termed the "biological equator" even more north of the geographical equator (at 10° N, see Aschoff 1981, p. 481). The biological equator is characterized by maximal ground temperatures, converging winds, and maximal cloudiness and rainfall. Although it is logical to use the biological definition of the equator (because of maximal ground temperatures), it is not entirely clear whether the biological definition is superior in terms of seasonal variation in temperature. Future research should consider all three definitions of the equator (see Douglas & Rawles 1999). Further, although distance to the equator can serve as a proxy, more precise predictors would be average annual temperature and seasonal variation in temperature. These sources are readily available and would help test the predictive ability, validity, and generality of CLASH across life strategies, time-orientation, self-control, as well as aggression and violence.

From an evolutionary perspective, hot and cold climates have posed divergent problems to human survival, which required distinct psycho-behavioral adaptations (Murray 2013; Van de Vliert 2013; Van de Vliert & Tol 2014). The adaptive problems posed by very hot and very cold climates vary in their immediacy. In the colder climates farther away from the equator, the major challenge is to "heat and eat" (e.g. Van de Vliert 2009), each of which requires coordination and planning in terms of timely harvesting and producing goods, and keeping track of stock and supplies. In countries closer to the equator, people face different and often more immediate challenges. As noted earlier, in warmer climates, it may not only be the heat itself that poses a challenge to survival, but also the dangers following from pathogen stress and high predation risk (e.g., Epstein 1999; Fincher & Thornhill 2012; Schaller 2006; Thornhill & Fincher 2011). Pathogen stress is strongly related to the distance from the equator because temperature is an important determinant of diseases transmission. In climates closer to the equator, with less seasonal variability, there are more viruses and bacteria that are not killed by cold winters (Schaller & Murray 2008).

Cold winters not only kill viruses and bacteria—they also kill the hosts that transmit them, such as the mosquitoes that transmit malaria to humans (Blanford et al. 2013). Infectious diseases, which proliferate in hotter climates, are an important cue of environmental harshness and unpredictability because they have caused more deaths in traditional equatorial cultures than predators, natural disasters, and wars combined (e.g., Gurven & Kaplan 2007; Inhorn & Brown 1990). Because Southern environments are characterized by harsh and unpredictable conditions, Life History Theory predicts that in hotter climates individuals should value the present more

because they have lower life expectancies due to more viruses and bacteria. Predation risk is another cue to environmental harshness and unpredictability prevalent in hot climates with less seasonal variation in temperature. As noted earlier, in warmer locations, there are more dangerous animals, especially venomous animals, which can lower life expectancies and motivate individuals to adopt a faster life strategy, along with a stronger present orientation and a weaker focus on self-control.

5. CLASH: Caveats and future directions

As a model, CLASH is parsimonious because it focuses on two climatological variables (i.e., average temperature and seasonal variation in temperature). It is also a general model because it generalizes across socio-economic and political-historical variables. Of course, this is not to imply that socio-economic and political-historical variables do not influence aggression and violence. Indeed, some socio-economic and political-historical variables are themselves (strongly) influenced by climate, so that they become "bad controls" for cleanly examining the causes and effects on aggression and violence (cf. "bad controls", see Burke et al. 2015). Nevertheless, we suggest the relevance of some key variables that might enter our CLASH model. We call them "other key variables" because it is logically impossible to assign them the exclusive status of moderating variables, because they may be influenced by climate as well. For example, it is possible that a variable (e.g., wealth) can both mediate and moderate the effect of variable *x* (e.g., seasonal variation in climate) on variable *y* (e.g., time-orientation) (for a discussion, see Hayes, 2013).

5.1. What about the role of wealth? Do all people respond and adapt in similar ways to climate differences? There is some evidence that people from lower social classes, who typically have fewer resources, are more likely to adopt a fast life history, such as the desire to reproduce sooner. Consistent with Life History Theory, a key variable is whether people grew up in a resource-scarce or resource-rich environment (e.g., Griskevicius et al. 2011). It is possible that people who faced high levels of seasonal variation in temperature have adapted in ways that made them more resourceful by devoting effort to preparing for the future, individually and collectively. When seasonal variation in temperature is small, less preparation and planning are needed, which may result in less building for the future, individually and collectively. This reasoning is consistent with CLASH, and suggests that over time cultures have evolved such that economic growth and prosperity is smaller to the degree that one is closer to the equator. Also, this reasoning may help explain the existence of what has been described as the equatorial grand canyon, the hot belt several thousand kilometers around the equator, characterized by an exceptionally large concentration of lower-income countries (e.g., Landes 1998, Parker 2000). Thus, violence and poverty often operate in concert because they are both rooted in traits such as fast life strategy, an orientation on the present, and little self-control.

A complementary line of reasoning may be derived from the Climate-Economic Theory of Freedom (Van de Vliert 2009, 2013), which emphasizes the combination of demanding climates and monetary resources. One especially relevant prediction of this theory is that monetary resources matter more in demanding climates: The rich can cope well because of their resources, and even come to view demanding climates as challenging, but to the poor demanding climates pose a genuine threat at the level of survival needs, as well as social and growth needs. There is

good evidence for this model in other social domains. For example, a longitudinal study involving 123 countries found that generalized trust in strangers is determined by climate, primarily among the wealthier countries (Robbins 2015). Another study involving 74 countries found that adults in increasingly demanding cold or hot climates value cooperative enculturation of children if their society is richer, but value egoistic enculturation if their society is poorer (Van de Vliert et al. 2009).

These findings are in line with the Climate-Economic Theory of Freedom (for more evidence, see Kong 2013; Van de Vliert 2011, 2013), and underline the importance of climate and wealth for issues that are linked to self-control and aggression. On the basis of this theory, one might predict that traits such as fast life strategy, time-orientation, and self-control may have evolved or developed especially among those who have plentiful resources. Those with fewer resources are not only more likely to adopt a faster life strategy, a stronger present orientation, and develop less self-control, they may also be more strongly faced with conflicts over resources that might even trigger aggression and violence.

5.2. Linear or curvilinear? A classic issue in research in temperature and violence is whether the relationship between temperature and violence is linear or curvilinear (e.g., Baron & Bell 1975, 1976; Bushman et al. 2005; Hsiang et al. 2013). This debate is quite complex, and becomes even more complex in CLASH, which focuses on both average temperature and seasonal variation in temperature. When focusing only on temperature, there is support for a curvilinear relationship. There is considerably more aggression and violence in warm climates than in cold climates, yet there is somewhat less aggression and violence in hot climates –

climates with average annual temperatures that exceed 24 °C (75.2 °F), which often are located inland and very close to the equator (see Van de Vliert et al. 1999, Van de Vliert 2013). Although one finds a curvilinear relationship for comparisons between countries around the world, one finds a linear relationship for comparisons within countries.

For within-country comparisons, which is the stronger focus of the manuscript, it is important to note that many countries do not exceed the inflection point of 24 °C (e.g., 60 countries of the 136 countries examined by Van de Vliert et al. 1999; see also Bushman et al. 2005). As a case in point, for comparisons within the USA, or within European countries (such as Italy, or even within Europe as a continent), the parsimonious linear model is to be preferred over more complex, curvilinear models. Of course, for countries where the annual temperature exceeds 24 °C, a different model should be advanced (see Van de Vliert et al. 1999). We recognize that it remains a challenge to CLASH to specify how seasonal variation in temperature helps to account for any deviation from linearity in the relationship between temperature and violence at the global level. Also, it is possible that variables other than average temperature and variation in temperature might complicate the picture. Examples are differences in elevation, rainfall, distance to the ocean or sea, wind patterns, and variables that might be linked to these geographical and climate differences such as possibilities for agriculture, population density, and economic opportunity. For example, agriculture challenges planning and self-control, and "harbor cities" also challenge planning, self-control and organizational skill. In our view, this challenge is both theoretical and empirical, and therefore in need of future research.

5.3. Future tests of CLASH: Many roads to Rome

5.3.1. From equator distance to direct tests of CLASH. The extant literature on the link between temperature and aggression has emphasized the distance from the equator as an important variable. Distance from the equator is only an approximation of average temperature and seasonal variation in temperature. Both temperature and seasonal variation are determined not only by distance from the equator, but also by distance from the ocean or sea. The smaller the distance from the ocean, the less continental the climate, and therefore the less the variation in seasonal temperature. Oceans make the climate milder. Because continental climates have very hot summers and very cold winters, these climates may have the strongest influence on time-orientation, resulting in slower life history, stronger focus on the future and self-control, and therefore lower levels of aggression and violence. Further, differences in geometric height, or elevation, are also linked to climate. More extreme, cold temperatures are found at higher elevations. Although other variables that are correlated with climate also call for planning and self-control (e.g., seasonal precipitation), they are less strongly related to aggression and violence (see Burke et al. 2015). Thus, other geographical variables determine climate, and they may serve as important variables in CLASH.

In most research, it is possible to adopt a bottom-up (“data-driven”) approach or a top-down (“theory-driven”) approach. The bottom-up approach seeks to include many variables as predictors (“causes”) and criterion or dependent variables (“effects”). The technique is a regression-analytic approach (or a variance-accounted-for approach, Batson et al. 2003) that helps to organize the predictor variables economically to optimize their joint ability to account

for as much variance in aggression and violence as possible. This bottom-up approach allows one to get the broader picture of the world of aggression and violence, and also allows one to derive precise estimates of the variance accounted for by various predictor variables (e.g., see average cold and heat demands for 232 countries, see Van de Vliert 2013). For example, through this bottom-up approach, we know that temperature, rather than rainfall, is the more important climatological determinant of aggression and violence. This bottom-up approach is exceptionally useful to test CLASH.

But we recommend that the bottom-up (data-driven) approach be complemented by a top-down (theory-driven) approach. With a top-down approach, one pre-selects locations on the basis of average annual temperature and seasonal variation in temperature, while controlling for other variables (e.g., wealth, religiosity). This top-down approach has some empirical costs. One would only compare some countries that can be schematically organized in a 2 x 2 framework of temperature (high versus low) and seasonal variation (high versus low), while controlling for other variables. This top-down approach allows one to illuminate the mechanisms (i.e., the mediating power of life strategy, time orientation, and self-control) underlying the presumed effects of climate on aggression and violence. Thus, there are "many (paradigmatic) roads to Rome" and how to deal with "bad controls" (i.e., variables that are plausibly by themselves influenced by climate, see Burke et al. 2015; Van de Vliert 2013). In the final analysis, we recommend a combination of the bottom-up and top-down approaches to test key aspects of CLASH. Because most prior research has used the bottom-up approach, we emphasize the added value of the top-down approach.

5.3.2. What types of aggression and violence? As noted earlier, CLASH focuses on reactive forms of aggression and violence that are largely due to poor self-control. Thus, CLASH seems especially relevant to the various forms of aggression and violence that are caused by "honor" threats (Nisbett 1993; see also cultural masculinity, Van de Vliert et al. 1999). Informed by a recent meta-analysis, we also suggest that many forms of aggression and violence that are climate-related operate not only between individuals, but especially between groups (Burke et al. 2015). Within psychology, there is strong evidence that aggression is easily activated between groups. For example, relative to individuals, groups trust each other less, and exhibit stronger tendencies to mutual exploitation (e.g., Reinders Folmer et al. 2012; Wildschut et al. 2003).

This raises several intriguing topics for future research. One topic is whether it is regional differences, religious differences, class differences or other "cultural" differences that yield conflict. If so, the name CLASH also applies to these situations (Markus & Conner 2013). Another topic is whether distrust underlies many forms of climate-related aggression and violence. The reason is that people and especially groups may be more easily provoked if they immediately attribute a negative act to aggressive intent. Distrust breeds misunderstanding and conflict, which leads to the types of situation that can activate climate-related aggression and violence. This line of reasoning is plausible, because research has shown that general trust in others is weaker in countries closer to the equator (e.g., Balliet & Van Lange 2013; Robbins 2015). Further, we noted earlier that pathogen stress contributes to the harshness of countries closer to the equator (e.g, Guernier et al. 2004). However, pathogen stress is also closely associated with tendencies toward collectivism including tendencies to think and act to protect and serve the immediate social group rather than the entire collective (e.g., ethnocentrism,

Fincher et al. 2008). A strong orientation to one's own group often can be at conflict with other groups, especially when resources are scarce. This line of reasoning too helps illuminate why the climate is more strongly related to intergroup conflict than to interpersonal conflict.

6. Concluding remarks

Several useful theories have been proposed to explain differences in aggression and violence between those who live in warmer and colder parts of a country or the world, including the General Aggression Model (Anderson & Bushman 2002), Routine Activity Theory (Cohen & Felson 1979), and Culture of Honor Theory (Nisbett & Cohen 1996). The purpose of CLASH is not to replace these theories, but rather to offer another possible explanation of these relatively large differences in aggression and violence that exist between and within countries around the world. CLASH focuses on differences in average temperature and seasonal variation in temperature as two key climate variables that account for differences in aggression and violence, and it reserves a key role for fast and slow life strategies, time-orientation, and self-control.

CLASH helps account for differences in aggression and violence both within and between countries around the world, regardless of the size of those countries. It is a society-level model that uses differences in the climate (a key aspect of the "physical" environment) as a starting point, and then bridges psychological processes within individuals (emphasizing life strategy, time-orientation, and self-control) with social processes and outcomes at the level of groups, cultures, and societies. Most past theories of aggression and violence tend to focus on psychological process or societal differences. Thus, we believe that CLASH provides a logical and internally consistent theoretical framework, which include propositions that integrate

psychological processes and societal differences that have evolved, and ultimately are rooted in geographical locations that underlie strong differences in climate.

Although the merit of CLASH is primarily theoretical, we close by outlining some important implications for society. Assuming CLASH is accurate, it is interesting to consider that people's thoughts and behaviors may be quite different, based on the physical circumstances their ancestors faced and that they face themselves. The world is getting smaller and smaller. Electronic and social media (e.g., WhatsApp, Twitter, Facebook, email) connect us to people all over the world. Yet, people coming from differing ancestral histories and living in different locations face challenges of self-control in a variety of ways. A businessperson from London may expect a response the next day, but the alliance in Nairobi may want to take at least an extra day. If CLASH is correct, the same pattern should hold for within-country differences between a businessperson working in Chicago and the alliance working in New Orleans, or between a businessperson working in Melbourne and the alliance in Brisbane or Cairns (with London, Chicago, and Melbourne being relatively more remote from the equator, and facing greater variation in climate). Although people may have an implicit, or even explicit understanding of some cultural differences in time-orientation and self-control, it is likely that such differences may contribute to misperceptions and misunderstandings in cross-national communication. This is important because a perceived lack of self-control may pose a serious threat to interpersonal trust even in ongoing relationships.

The implications of cross-national communication processes are potentially far-reaching, and may help illuminate challenges and problems in business transactions, in international

negotiations about climate change, and even in many interactions between Northern Europeans and the refugees coming from various countries closer to the equator (e.g., Syria, Afghanistan, Somalia). Turning back to within-country variation, consider the regional differences in attitudes and communication styles even within a (large) country as the USA (e.g., Andersen et al. 1990; Nisbett 1993). Because communicating "honor" is especially important to people living in Southern states, it seems advisable to adopt a respectful style of communication for business and effective negotiation with individuals from Southern states. Reserving judgment and giving benefit of the doubt is probably an effective mindset, because provocation may be more quickly elicited in individuals from Southern states than in individuals from Northern states, and, once elicited, more quickly translate into aggression and perhaps even violence. According to CLASH, these differences are ultimately rooted in climate differences, and therefore should be relevant to understanding important differences in aggression and violence among many countries around the world.

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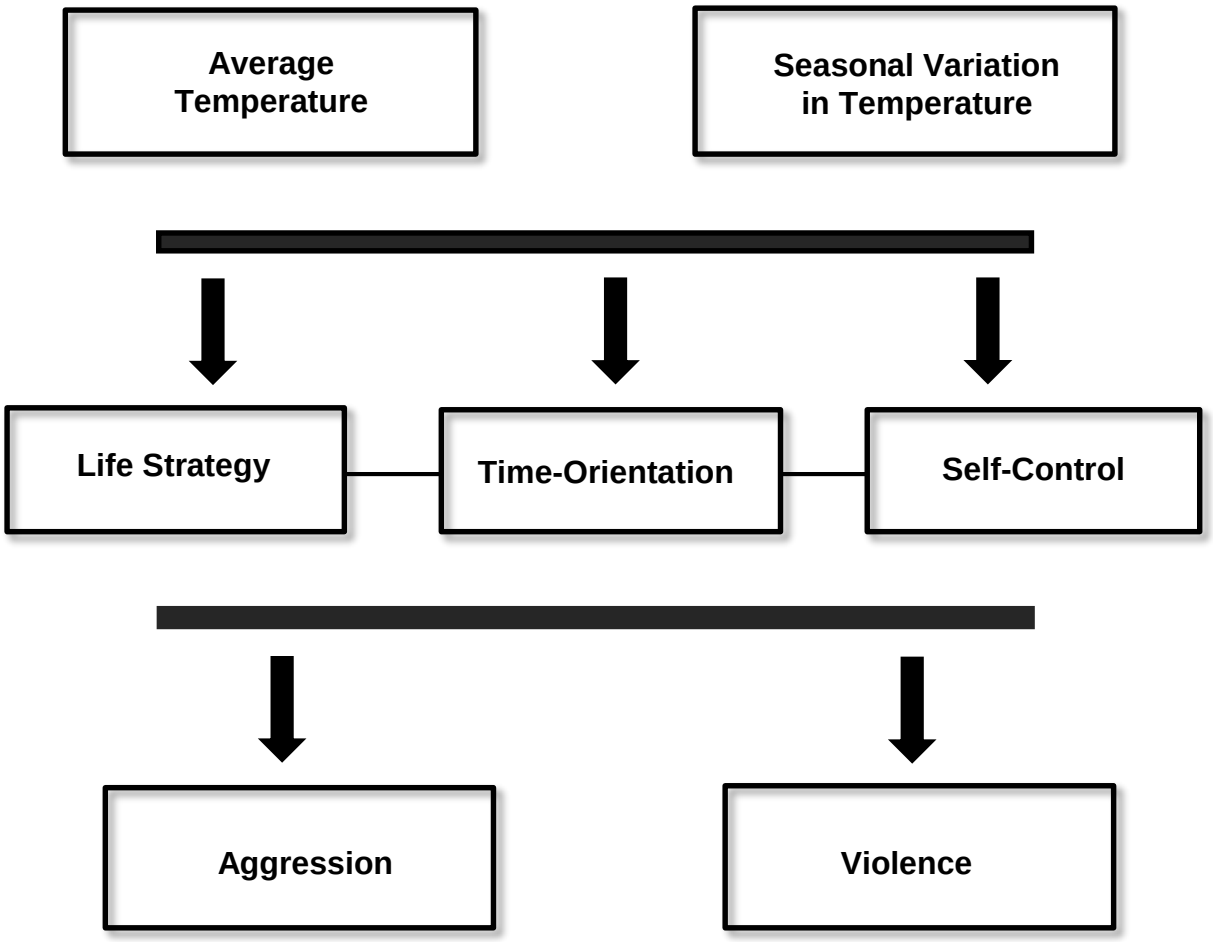

Figure 1. *A model of CLimate, Aggression, and Self-control in Humans (CLASH)*