

The Logic of Climate and Culture:

Evolutionary and Psychological Aspects of CLASH

*(Author's Response)*

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### **Abstract**

A total of 80 authors working in a variety of scientific disciplines commented on the theoretical model of Climate, Aggression, and Self-control in Humans (CLASH). The commentaries cover a wide range of issues, including the logic and assumptions of CLASH, the evidence in support of CLASH, and other possible causes of aggression and violence (e.g., wealth, income inequality, political circumstances, historic circumstances, parasite stress). Some commentaries also provide data relevant to CLASH. This response article clarifies the logic and assumptions of CLASH, and discusses its extensions and boundary conditions. We also offer suggestions for future research. Regardless of whether none, some, or all of CLASH is shown to be true, we hope it will stimulate future research on the link between climate and human behavior. Climate is one of the most pressing issues of our time.

## R1. Introduction

Our target article advances a theoretical model of Climate, Aggression, and Self-control in Humans (CLASH). CLASH was inspired by the broad scientific assumption that climate is an important determinant of culture and human behavior. Although most of the critical empirical tests have yet to be conducted, CLASH was inspired by several general findings that are well-documented in the scientific literature. First, there are pervasive differences in aggression and violence within and between countries around the world. Second, aggression and violence differences are generally not randomly distributed across the planet — they are strongly related to both geographical latitude and temperature; the warmer the climate, the higher the levels of aggression and violence, especially intergroup conflict (see Burke et al. 2015). Third, in regions with warmer climates, people seem to adopt faster life strategies (e.g., women become mothers sooner and have more children). Fourth, in regions with warmer climates, time matters less; there is a stronger emphasis on the present and a weaker emphasis on the future. Fifth, self-control, which is strongly related to future orientation, may be associated with climate in a similar fashion. Sixth, self-control is one of the strongest predictors of aggression (e.g., Baumeister & Tierney 2011; DeWall et al. 2011) and violence (e.g., Pratt & Cullen 2000), especially violent crime (Gottfredson & Hirschi 1990; Henry et al. 1996). Seventh, there is some evidence that future orientation can reduce aggression (Joireman et al. 2003) and violent crime (Van Gelder et al. 2013; Van Gelder et al. 2015). These seven general findings can help solve what might be labeled as “the aggressive-behavior-culture puzzle: **the ABC puzzle**“. We believe that the tools used to solve this important puzzle should be empirical, logical, *and* theoretical (see Van Lange, 2013).

There are two general themes in the commentaries: (1) climate should be viewed in light of social-economic or political-historic variables (e.g., wealth, income inequality, governance), and (2)

aggression and violence should be viewed in light of proximal and ultimate mechanisms. In response to the first theme, we discuss the logical properties of climate, concluding with a brief outline about the relative stability of climate (see section R2), and provide a discussion of the evidence for CLASH (R4) and extensions of CLASH (R5). In response to the second theme, we discuss our perspective on cultural evolution, which serves as a conceptual backbone of CLASH (see section R3). The commentaries discussed boundary conditions (R6) and other issues (R7) relevant to CLASH. We conclude with some avenues for future research (R8) to test hypotheses and implications derived from CLASH.

## **R2. Logical Properties of Climate**

An important feature of climate is that it offers objective parameters such as temperature, which relate to aggression and violence levels (Burke et al. 2015). CLASH is based on the simple fact that any measureable theoretical concept has two statistical properties: (a) a measure of central tendency (e.g., mean), and (b) a measure of dispersion (e.g., variance). Most previous work has focused on average temperature, and has ignored variation in temperature. CLASH focuses on both.

The interesting aspect of seasonal variation is that it is predictable, and therefore to some degree “controllable”. We do not mean that climate (or weather) can be controlled, but that it calls for anticipation, foresight, and long-term planning. For example, future orientation can help one mentally prepare for cold winters (e.g., clothes, food, heat source). Self-control is involved because it often takes effortful and costly action in the present to be prepared for the future. To illustrate, in agriculture one needs to plant the seeds in the spring, and not eat them all in order to benefit in the early fall.

In addition to the statistical properties of “average” and (predictable) “variation”, there is another objective property of climate — *long-term stability*. There is indeed evidence that climate has been exceptionally stable for the past ten thousand years (because the Earth’s orbit around the sun has not changed during this time period). However, since about 1950, a new era began, often referred to as the “the human epoch,” in which humans started to have a profound effect on the climate by directly contributing to global warming (Richardson et al. 2011). Therefore, CLASH is based on the assumption that people living in different parts of the world, and even different parts of a country, adapt to different yet stable climatological circumstances. The long-term stability of climate is important to many commentaries discussed in this response article, because it implies that climate is unlikely be strongly influenced by other variables, such as social-economic or political-historic variables. Instead, CLASH assumes that climate itself causes aggression and violence, and other variables may serve as mediators (e.g., wealth, income inequality, governance, parasite stress). In short, the link between climate and other variables should be largely unidirectional in terms of causality.

### **R3. Culture: Evolution and Adaptation**

One key assumption of CLASH is that people create and maintain cultures (e.g., norms, institutes, and markets) that help them adapt to relatively stable climatological circumstances, which, in turn, increases their survival and reproduction. Most tasks for survival and reproduction can only be accomplished by a group or society, not by individuals alone. Thus, it is plausible that individuals adapt “through culture” – by developing norms and rules, informal networks, and institutes that favor long-term planning and self-control. Humans are “cultural species” (Henrich 2016, p. 3; see also Baumeister 2005; Boyd & Richerson 2005, 2009; Carleton & Hsiang 2016). That is, humans

have adapted to their environments by many cultural practices, from preparing food to building complex institutes. (Carleton & Hsiang 2016). Temperature is the key factor, and humidity may magnify of the effects of temperature (**Burke, Sulikowski, Stephan, & Brooks (Burk et al.)**).

We emphasize *cultural* evolution because the threats and opportunities relevant to survival and reproduction can be primarily “addressed” by groups rather than by individuals. That is, individuals are strongly *interdependent* in adapting to the threats and opportunities posed by both average and seasonal variation in temperature (Balliet et al. in press; see also Kelley et al. 2003; Van Lange & Rusbult 2012). Examples are collective hunting, food sharing, agriculture, industry, and institutions. Because most tasks are interdependent (rather than independent), individuals adapt to climate not only as individuals, but also as groups and even societies. Thus, it is reasonable to assume that climate, like other features of the physical environment, shapes *cultural evolution*.

We emphasize culture from two distinct processes – “ultimate” *and* “proximal,” which help clarify some of broad issues raised by several commentators, most explicitly by **Cabeza de Baca, Hertler, and Dunkel (Cabeza de Baca et al.)**, **Campbell** and **Daly and Krupp**. First, CLASH adopts an *evolutionary* approach to culture. We acknowledge that cultural evolution should not be regarded as completely independent of genetic evolution, as there is strong evidence for culture-gene coevolution. Second, we adopt an *interdependence* approach that complements a classic evolutionary one, by highlighting the “proximal” role of the current environment as a key ingredient to psychological adaptation (Kelley et al. 2003; Van Lange & Rusbult 2012). However, interdependence can lead to conflicts of interests with other families or groups. Therefore, climate may a powerful ultimate property of the environment that shapes features of interdependence that people, as individuals or groups, face in the here and now, as well as in the future.

It is also possible that people adapt in a proximal manner to longstanding differences in culture. These may or may not be ultimately caused by climate differences. For example, societies may differ largely in terms of social-economic variables, such as income inequality. Societies with large income inequality are characterized by low trust, high corruption, and high violence. In contrast, societies with small income inequality are characterized by high trust, low corruption, and low violence. How is one to adapt psychologically to these differences in terms of proximal causes? We believe research on immigrants is informative. There is evidence that first-generation immigrants that move from lower-trust countries (e.g., Turkey, Poland, Italy) to higher-trust countries (e.g., Denmark, Germany Switzerland) are strongly affected by the high levels of trust in the destiny country (Dinesen, 2012). They quickly become more trusting, regardless of length of stay (which varied from 1 through 7 years). These findings illustrate the influence of culture on general trust – and why genetic differences may be modest (see Van Lange et al. 2014). These findings also illustrate the intimate connection between individual characteristics and group-level characteristics, which is key to cultural evolution (e.g., Henrich. 2015; Van Lange 2015). People are likely to develop trust through social learning and own direct experience in groups or cultures where it make sense to do so – for example, if the level of corruption is low and if income inequality is not very high.

In summary, our framework provides an overview of the key assumptions of CLASH, the logic of climate as a determinant of culture, and how culture helps us understand the proximal and ultimate causes of fast versus slow life strategies, future orientation, self-control, and ultimately aggression and violence. This discussion should provide general answers to the many interesting issues raised by the commentators.

#### **R4. Extensions of CLASH**

Because climate has not received much scientific attention as a determinant of human behavior, we attempted to provide a simple and parsimonious model by focusing on climate and less on other broad variables, such as wealth. Indeed, in the target article, we discussed the role of wealth as an important variable, because the wealthy are better able to (a) protect themselves against the dangers and harshness of climate, and (b) engage in various behaviors inspired by future orientation and self-control (e.g., to save money for the future). This reasoning is in perfect agreement with **Van de Vliert and Daan**, who note that “climatological determinism” is an oversimplification and that other variables (e.g., wealth) could extend, improve, and enrich CLASH. The inclusion of other variables should enhance the breadth, accuracy, and general interest of CLASH.

We see at least four broad extensions of CLASH (see Figure R1, which also acknowledges more extensions, such as religiosity). First, it is plausible that climate in combination with **wealth** determine future orientation and self-control. One especially relevant prediction is that monetary resources matter more in demanding climates (e.g., the rich can cope with harsh climates better than the poor can). There is good evidence for this model in other social domains, such as the development of trust in strangers and cooperative enculturation of children (Van de Vliert et al. 2009). These findings are in line with the Climate-Economic Theory of Freedom (Van de Vliert 2013), and underline the importance of climate *and* wealth for issues that are linked to self-control and aggression. Also, we agree with **Orosz, Zimbardo, Bóthe and Tóth-Király (Orosz et al.)** that wealth can be a consequence of climate. Especially with seasonal variation causing a culture of planning and self-control, milder climates with seasonal variation can yield more resources and

wealth. Thus, wealth can serve as a potential mediator between climate and aggression and violence.

Second, in addition to wealth, there is strong evidence that **income inequality** is a powerful determinant for a wide range of variables, including aggression and violence (Kenrick & Gomez Jacinto 2013; see Wilkinson & Pickett, 2009). We agree with the commentary by **Krems and Varnum** on the importance of income inequality. Whether income inequality outperforms climate as a causal agent is to us a secondary issue. For us, the primary issue is whether income inequality influences life strategy, future orientation, and self-control, which, in turn, influence aggression and violence. Above and beyond climate, income inequality is likely to exert direct effects on aggression and violence because people are inequality-averse (e.g., Van Lange 1999; Fehr & Schmidt 1999).

Third, we also share the view that **political and historic circumstances** can shape aggression and violence in critical and enduring ways. It is possible that these circumstances, such as degree of democracy, or history of colonialism, are partially shaped by differences in wealth and income equality. Countries around the world differ considerably in terms of wealth (Dohmen et al. 2015). This has been true in the past, is true now, and will likely be true in the future. Climate may be one of the ultimate causes of wealth and income inequality because the development of productive and sustainable agriculture is partially conditioned by high temperature and lack of water. One might also argue that differences in wealth and income inequality are responsible for political circumstances, such as the historical geography of colonialism (**Roscoe and Van Voorhees** and colleagues).

Of course, the determinants and especially the consequences of colonialism are complex. What does it do to a culture if it has faced a history of power imbalance and intergroup conflict?

Although answers to this complex yet important question are challenging, we agree that it may well be the history of intergroup conflict that underlies the types of aggression and violence that are so strongly associated with temperature (**Burke et al.**). We also agree that power relations can be a source of conflict and aggression, as **Weick et al.** suggest. Further, **Weick et al.** suggests a close association between climate and power distance. It is possible that power distance, future orientation, and self-control go hand in hand within the same culture. Thus, although historic and political circumstances represent numerous different facets, it is possible that they are at least partially rooted in climatological differences (see also Van de Vliert & Tol 2014).

Finally, one natural circumstance that is closely linked to climate is the threat of parasites.

**Parasite stress** is a concept that is often used in reference to the threat of infectious disease, which is a major source of morbidity and mortality (e.g., Guernier et al. 2004; Schaller, 2006, 2016).

According to the evolutionary Parasite-Stress Theory of Sociality, humans and other animals adapt to parasite stress by dividing into in-groups and out-groups (Fincher & Thornhill 2012). This leads to ingroup favoritism and out-group hostility (Fincher & Thornhill 2012; see also Murray & Schaller 2016; Schaller 2016). Parasite-Stress Theory of Sociality has also been applied to the classic cultural dimension of individualism versus collectivism (Fincher et al. 2008; Hofstede 2001) — a dimension that is strongly linked to crossing in-group and out-group boundaries (e.g., Gelfand, 2012; Gelfand et al. 2004). For example, intergroup stress is far more intense in collectivistic cultures, which are more prevalent in warmer locations with less seasonal variation.

### **R5. Evidence for CLASH**

Climate is one of the most stable and far-reaching features of our physical environment that shapes the natural, the social, economic, and political-historic world around us. Indeed, one could argue that climate is an ultimate cause of culture. Yet wealth, income inequality, the political-historic circumstances, parasite threat, and perhaps other broad variables (e.g., religiosity, age) could all be ascribed the conceptual status of mediators. Therefore, as **Mell et al.** suggested, it is theoretically possible that the direct (unmediated) impact of climate is negligible. It is also possible that even when numerous mediators are included, climate still has a direct influence on culture. These are empirical questions. But even if any effect of climate completely “desintegrates” (as **Mell et al.** stated) when other variables are included as predictors of aggression and violence, it is still important to understand the causal role of climate. Climate can serve as a conceptual starting point for many processes at the level of culture and society. As noted by Burke et al. (2015), to control for variables such as wealth or income inequality are “bad controls”, because they may well be shaped by climate.

If climate is irrelevant, then CLASH is a theoretical exercise of no detectable scientific value other than perhaps serving a heuristic (idea-inspiring) function. The same would be true if there is a third variable that influences all the variables in CLASH. These issues are empirical and testable. In our view, they are worth testing, not only because the role of climate on human behavior has received little empirical attention, but also because the topics of fast life strategy, future orientation, self-control, aggression, and violence, are essential to the functioning of individuals and societies.

A few commentaries contain new data relevant to CLASH. For example, **IJzerman et al.** describe data of 14 countries and find that equator distance is significantly associated with self-

reported self-control (Tangney et al. 2004), and strongly correlated with hot daily weather ( $r = -.90$ ). Finding a significant correlation in an analysis in which the variation is rooted in 14 countries can be impressive, even though it may not be robust even if only a few countries are added to the sample (for related complexities, see Pollet et al. 2014). That equator distance as not a competitive predictor (ranked as 14<sup>th</sup>) may come from limited variance of the 14 analyzed countries in terms of climate, and climate-related variables (e.g., parasite stress).

As noted earlier, we do not think that climate should outperform these broad variables – CLASH is developed to acknowledge the role of climate. Moreover, we want to examine extensions of CLASH to test whether the effects of climate will be mediated by other variables (see section addressing Extensions of CLASH). We share the view of **IJzerman et al.** that CLASH could be enriched by a greater appreciation of social influences (see the later discussion of the role of social development in our response to commentaries by **Bulley, Pepper, and Suddendorf (Bulley et al.)**, **Frankenhuis, Fenneman, Van Gelder, and Godoy (Frankenhuis et al.)**, and **Simpson and Griskevicius**.) Finally, we think that most commentaries, with or without data, point at the potential importance of boundary conditions, which we discuss next.

## **R6. Boundary Conditions of CLASH**

**R6.1. Only the Northern hemisphere?** In their commentary, **Fuentes, Kissel, Oka, Sheridan, and Piscitelli (Fuentes et al.)** make the important point that archaeological and paleoanthropological data are conflicting with CLASH. They note that this evidence suggests that in ancestral times, poverty was not stronger in countries closer to the equator. We acknowledge that the logic and availability of data for understanding climate in combination with other broad variables in ancestral times pose a serious challenge to the evolutionary aspects of CLASH. What we regard as equally puzzling is that **Fuentes et al.** provide some evidence that CLASH receives

support on the Northern hemisphere (accounting for 10% of the variance in homicide) but not at the Southern hemisphere. We limited CLASH to the Northern hemisphere, because of a lack of data (in a relative sense) and because there is more land and people in the Northern hemisphere. Although there is already some evidence for CLASH in both hemispheres (e.g., see commentary by **Van der Vliert and Daan**), we need more research to determine if CLASH applies to both hemispheres. The two hemispheres differ greatly in terms of population density. People and groups do need to interact to aggress, and high levels of density and crowding are associated with high levels of aggression (e.g., Lawrence & Andrews, 2004; Russell, 1983).

**R6.2. Only humans?** As the name conveys, CLASH is developed as a theoretical model of aggression and self-control in humans. **Tops and Van der Linden** note that CLASH may not be generalizable, or reconcilable, with other animals. From an evolutionary perspective, this may indeed pose challenges. As we outline in the target paper, animals are highly responsive to climate – hibernation, migration, and hoarding are among the most well-known examples. Other animals might also have some “foresight.” One crucial difference between humans and other animals is that aggression is a means to survival and reproductive outcomes for many carnivores, but generally not for humans.

**R6.3. Only young males?** **Marsh** correctly note most aggression and violence is committed by young people, especially young males. We do not know how strong the relation is between age and distance from the equator (or more precisely, average temperature and seasonal variation), but even a small relation could serve as a moderator – or perhaps as a mediator if climate somehow caused this age difference. **Krems and Varnum** discuss the importance of sex ratio. **Simpson and Griskevicius** note that survival and reproductive success is determined by competition for status and resources among young men. Although there is an emerging psychological literature

showing that men and women may differ in their expressions of aggression, most forms of physical aggression and violence, especially in intergroup settings, are committed by young men. Thus, CLASH may be especially relevant to young men. In our view, this constitutes a promising topic for future research.

**R6.4. Only some parts of the world?** In their commentary, **Prudkov and Rodina** report evidence that violent crime in Russia is more prevalent in colder climates with more seasonal variation, which contradicts CLASH. We can think of three possible explanations for their findings. First, Russia excludes latitude areas lower than Madrid or Rome (areas where parasite threat is weak or absent), whereas it includes areas with extremely harsh winters in the north (Yakutia has in January an average temperature of  $-38.6^{\circ}\text{C}$ , or  $-37.5^{\circ}\text{F}$ ). Perhaps this level of harshness overshadows the influences of predictable seasonal variation. Second, although we agree that within-country comparisons allow for some control for socio-economic and political-historic variables, one might speculate that the poverty may overpower the role of climate in the North of Russia — with its history of communist values and strong governmental control, from centralized power in Moscow. Third, it is also possible that (harsh) climate needs to be viewed in combination with differences in wealth to understand aggression and violence (see Van de Vliert 2013).

**R6.5. Suicide.** The connection between aggression and suicide is an interesting one (**Van der Linden**). Suicide rates do tend to be higher in countries with high latitude and more seasonal variation (see also White et al. 2014). Although suicide is sometimes portrayed as “impulsive,” it may also be planned, often following one or more suicide attempts (Hawton 2007). Thus, the link between self-control (or future orientation, in a more spiritual sense as in an afterlife) and suicide is not entirely clear. Self-harm also differs from other-harm, because other-harm is often

motivated by self-protection. Thus, we do not expect parallel results for aggression and self-harm, but consider it interesting that climate might ultimately help us understand yet another big issue — suicide.

**R6.6. What about prosocial behavior?** Konrath argues that warmer climates with less variation may also be the climates where one might see more prosociality and helpful behavior. Indeed, there is research showing proximal influences of physical warmth on trust and prosocial behavior (e.g., Williams & Bargh 2008; IJzerman & Semin 2009). We suggest that aggression does not exclude prosociality or closeness. Burke et al. (2015) note that intergroup conflict that is more prevalent in warmer cultures. It is possible that a strong sense of “in-group love” may sometimes go hand in hand with some “out-group hate”, because an emphasis on collectivism tends to lead to a sharper differentiation between us and them (see also Gelfand et al. 2004; Yamagishi & Mifune 2009). Thus, it is possible that warmth is predictive of intergroup hostility, but with a simultaneous tendency to help those that belong to the in-group, tend to be similar to the self, or are otherwise psychologically near.

**R6.7. Prediction, propection, or both?** In their commentary, Baumeister et al. thoughtfully argue that predictable seasonal variation can lead to propection rather than prediction (Baumeister et al. 2016). The idea is that people not only want to predict the future, but they also want to “prepare” for the future. This is an important complement to CLASH. Although climate is generally predictable, we agree that people may also “mentally prepare” for the future. For example, in some countries far from the equator, people may consider reserving some money now so that they can afford flying to sunny places, especially if the winter is characterized by clouds and rain, rather than some sunshine. We agree that prediction *and* propection are both important

and complimentary, and may be related in similar ways to a slow life strategy, a future orientation, and high self-control.

To conclude, we agree that the evidence for or against CLASH is hard to evaluate at this point. As with most new programs of research, one starts by developing the logic, specifying the model, and outlining extensions and boundary conditions. We do not think it is essential to examine the competitive status of climate relative to other determinants of life strategy, future orientation, self-control, and aggression and violence. The first goal is to provide tests of the hypotheses that can be derived from CLASH and its extensions, which we discuss at the conclusion of this response.

## **R7. Remaining Issues Raised by CLASH**

**R7.1. Which climates are harsher?** We have assumed that extreme climates, both hot and cold, are harsh. Some commentaries raise the possibility that warmer climates are generally less harsh (**Baumeister et al., Burke et al., Orosz et al.**). Humidity can also magnify the effects of harsh climates (**Burke et al.**). One parsimonious model is that extreme temperatures are aversive, exhausting, and taxing. One important question is how well people can protect themselves from harsh climates –cold *and* hot. Importantly, CLASH also explicitly considers other climate-related features of the environment that may be harsh, especially parasite threat (e.g., Fincher & Thornhill 2012; Murray & Schaller 2016). Warmer and hotter climates cause much more parasite stress than do milder and colder climates, because seasonal climates reduce survival of many parasites. Infectious diseases caused by parasites may also make the environment harsh in a more proximal sense. In addition, coping with seasonal cold and its consequences (e.g., anticipation of food shortage) calls for more planning and self-control than does coping with heat and its consequences (e.g., parasites).

**R7.2. Cultural evolution, genes, intelligence, narcissism, and Machiavellianism.** We highlight the role of culture, both in an “ultimate” and a “proximal” sense. Evolutionarily, we assume that climate influences culture (e.g., institutes, norms, beliefs). We agree that social development is important to consider when talking about culture, as noted in some commentaries (**Bulley, Pepper, and Suddendorf; Frankenhuis et al., Simpson & Griskevicius**). Culture is strongly embedded in social development, as parenting, school and education, are strongly guided by relatively local institutes, norms, and beliefs. Here too, we believe there are ultimate and proximal influences. As noted by **Simpson and Belsky (2016)**, children growing up in harsh and unpredictable environments are likely to receive less sensitive parenting, and will adapt by adopting a faster life strategy (e.g., earlier sex and parenthood). Proximally, institutes such as schools differ in terms of how much investment in the future is communicated and valued, and so culture may also provide many “nudges” for slow versus fast strategy, future orientation, and self-control. **Frankenhuis et al.** discussed internal Predictive Adaptive Responses (PAR) with a focus on those who have been exposed to similar environmental conditions, but differ in their somatic age. Even under similar conditions, those with a higher somatic age tend to adopt a faster life strategy. Thus, life strategy can also be triggered by internal processes. Even if somatic ages are older, on average, in warmer climates, somatic age differences can still be explained by life history theory.

It is also interesting that CLASH receives support from cross-national research on bullying (**Volk**). It may be that power distance and honor (Nowak et al., 2016, **Weick et al.**) play an important role, and that such cultural influences may occur early in life. **Wiessner** provides several cultural illustrations to make the point that “cultures matters for life history trade-offs.” Societies also sometimes transition to democratic institutions, which is likely to bring greater

equality in income and opportunities. We agree that these transitions are important because they make the environment less harsh and more predictable for the most vulnerable members of society.

In their commentaries, **Boutwell and Winegard**, **Campbell** and **Daly and Krupp** suggest that we overlooked past work by Rushton, which proposed a strong link between genes and intelligence, and that this would account for race differences. However, Rushton devoted relatively little attention to cultural evolution or proximal processes, which are central tenets of CLASH. Rushton also focused on intelligence, whereas CLASH does not explicitly address intelligence, even though we acknowledge that intelligence is related to future orientation and self-control. And finally, we are not aware of any strong support for the idea that genes explain differences in intelligence *between* and within the races (see Henrich 2016).

**Sternberg** asks whether the concepts of life strategy, future orientation, and self-control could be parsimoniously replaced with (state) general intelligence. We think not. Although intelligence may be related to future orientation and self-control, they are distinct concepts. Self-control can be trained, is contextual (e.g., being silent at a funeral), and is state-related (e.g., influenced by exhaustion), whereas general intelligence tends to lack these characteristics. We do think that this point deserves future research, not only because parsimony is important, but also because state intelligence may be linked to climate, or at least heat. For example, heat poses serious challenges to neurocognitive functioning (e.g., Mazloui et al. 2014).

It is fascinating that narcissism is higher in countries closer to the equator (**Jonason & Schmitt**). It is plausible that warmer climates, food shortage, and high narcissism go together, because narcissists are prone to put their own needs ahead of others, which could enhance their survival

and reproduction. Jonason and Schmitt's reasoning extends CLASH by offering the intriguing possibility that aggression may be more quickly activated in warmer climates with less variation as a means of survival, with enduring food shortage as one of the more important "triggers". Thus, we suggest that CLASH can be extended in important ways by examining individual differences, including narcissism as well as other traits related to conflicts of interests and situations of scarcity, such as empathy, trust, and prosocial orientation (for a review, see Van Lange et al. 2013).

**R7.3. Life History Theory Concepts.** CLASH is partially rooted in concepts of Life History Theory. We agree with **Barbaro and Shackelford** that Life History Theory is described in somewhat different ways in the literature, which can lead to differences in understanding (and perhaps misunderstanding). Also, the concepts of harshness and unpredictability are perhaps in need of further specification and clarification, especially when applied to the complex human behaviors such as aggression and violence. The perspective of CLASH is that harshness and unpredictability are relatively independent constructs. However, in our characterization of climates we described warmer and colder climates as harsh (see above), but colder climates with seasonal variation as being also predictable. This aspect of predictability of seasonal differences in temperature is essential to CLASH because it provides the basis for slower life strategy, future orientation, and self-control. If cold climate was completely unpredictable, CLASH would anticipate that people would adopt faster life strategy, shorter-term orientation, and less self-control. According to CLASH, future orientation and self-control are only adaptive when there is a threshold level of predictability of the future, which ultimately provides the basis of some "control" over the environment.

**Cabeza de Baca et al.** clarified their position with the following summary: “Climatic variation ultimately causes evolved biogeographical LH (Life History) variation, that proximally explains a complex of biological and behavioral LH traits, among which are future orientation, self-control, violence, and aggression.” This position is quite consistent with CLASH, except that CLASH explicates the power of culture (in an ultimate and proximal manner) in shaping future orientation, self-control, and the likelihood of aggression and violence. We also noted that heat can exert direct effects on all these variables.

### **R8. Future Avenues of CLASH**

We regard the focus of CLASH on climate, as a stable feature of the natural environment that includes the logical properties of a central tendency (mean) and dispersion (variance), as a novel theory. We should also note that research on climate is challenged by the fact that many broad variables may be associated with climate, such as wealth, income equality, parasite stress, and governance. Rather than providing competitive tests of predictive value of each variable, we recommend an approach that examines whether (a) climate is associated of aggression and violence (along with life strategy, future orientation, and self-control), (b) climate is associated with several broad variables, and (c) these variables might mediate the effects of climate, which we conceptualize as a long-term stable feature of the natural environment that may shape individuals and culture in very important ways.

One major issue is to explore the role of life strategy in being shaped by climate, and being a causal agent in our understanding of aggression and violence, especially at the intergroup level. We have emphasized future orientation and self-control as an outgrowth of slow life strategies, but there is more to it. The tendency to prioritize risk over safety, and to prioritize short-term risky gain over longer-term safety, is one central aspect of fast life strategy (e.g., Frankenhuis et al.

2016). Clearly, morbidity and mortality risks are often strongly involved in intergroup aggression, and especially intergroup violence. It may be that in heated conflicts, individuals adopting fast life strategies are the ones who are especially likely to initiate conflict, to never “back off,” and perhaps to favor honor over death (e.g., Cohen, 1998; Nisbett 1993; Nisbett & Cohen 1996; Nowak et al. 2016). And as discussed earlier, young men might be especially sensitive to excessive risk-taking in various life domains, including intergroup conflict (see also Van de Vliert et al. 1999, see also **Barbaro and Shackelford, Simpson and Griskevicius, and Wiessner**).

Second, although we have reviewed some evidence for CLASH, it is clear that the key mediators – fast versus slow life strategies, future orientation, self-control – still need to be empirically addressed. The link between climate and self-control is one that is most strongly in need of empirical investigation. Although self-control can be measured in various ways, we suggest that it is potentially important to focus on the behavioral aspects of self-control. For example, paradigms such as the “marshmallow test” seem very suitable to assess the development of self-control (Mischel, 2012; Mischel et al. 1988). Generating adult versions of behavioral self-control, as well as behavioral measures that address self-control in intergroup contexts, are clearly important ways in which key hypotheses of CLASH can be tested. Also, inspired by several commentaries (e.g., **Çampbell, Sternberg, Cabeza de Baca et al., Jonason and Schmitt**) we suggest that cross-national research on personality, such as assessments of conscientiousness (De Vries & Van Gelder 2013), along with measures of (state) intelligence, “dark” personalities (narcissism, Machiavellianism, psychopathy, sadism), trust, and prosociality, may help illuminate whether the mediators of CLASH need to be refined or revised.

Finally, to broaden implications of CLASH beyond aggression and violence, it may be promising to examine other cultural expressions of life-strategy, long-term orientation, and self-control. For

example, in recent research we found that professional soccer coaches are more quickly fired and hired in warmer countries with less seasonal variation (Van Lange et al. 2016). Further, **Volk** finds evidence in a sample of 40 countries that the severity of bullying may also be related to climate. We agree with **Volk** that it would be interesting to examine what the ultimate and proximate mechanisms might be, whether they are related to ingroup and outgroup differences, and whether bullying, and the escalating forms of it, are a matter of “thoughtful” action or impulse. It is possible that self-control failure accounts for the more severe forms of bullying.

Future research might also assess various expressions of life strategy, future orientation, and self-control. For example, commitment to insurance and financial planning (e.g., retirement packages), longer-term health goals (e.g., successfully dieting), long-term commitment to large organizations (Solinger et al. 2008), tendencies to resist bribes and corruption (Köbis et al. 2016) as well as commitment to other collective goals (e.g., environmental issues; Parks et al. 2013).

### **R9. Concluding Remarks**

CLASH provides a novel theoretical basis for understanding climatological influences on culture and human behavior to help understand the differences in aggression and violence around the world. Empirically, CLASH is young. Only time will tell whether CLASH, and its extensions, will be substantiated, modified, or replaced by alternative theories. At the very least, we hope it is a fertile theory that will spawn future research so that CLASH has the potential to grow and mature. We greatly appreciate the thoughtful comments of those who have responded to our target article about CLASH. Their comments have helped identify potential weaknesses of the model, gaps in the model that need to be filled, important boundary conditions, and topics for future research.

CLASH also addresses one of the most pressing topics of our day — climate change. When people think about the consequences of climate change, they normally think about things such as the weather, crops, islands sinking, glaciers melting, and polar bears losing habitat. People rarely think about increasing levels of aggression and violence as a consequence of climate change (Plante et al. in press). Between the years 1880 and 2015, the 16 hottest years have been the last 16 years, with 2015 being the hottest ever (National Centers for Environmental Information, 2015). As time goes on, temperatures are likely to increase further, whereas variation is likely to decrease further. This is bad news for the planet, and not just for the crops either. Climate-related aggression and violence levels in humans are likely to also increase.

CLASH is novel by its focus on climatological influences, its link with psychological concepts such as time-orientation and self-control, and in the ambition to extend to socio-economic, political-historic, and climate-related environmental variables. As the title conveys, CLASH emphasizes how climate might shape culture, how culture in turn shapes individuals and groups, and how individuals and groups sometimes behave in an aggressive and violent manner. Clearly, cultural differences are all around us, from language, cognition, and affect to norms, institutes, and markets. Climate provides a broad and new scientific perspective that helps us understand, and perhaps appreciate, cultural differences. We believe that understanding aggression is one of the most important steps to reduce hostility and conflict as well as to promote trust and cooperation between “we” and “them” in a world that is getting smaller and smaller – and warmer and warmer.

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