Climate:Weather::Traits:States

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The target article by Baumert et al. is an ambitious attempt to combine personality structure, process and development into a coherent whole. We applaud the effort and would like to suggest an analogy that might prove useful when addressing their three questions. The analogy is the physics involved in the climate sciences. Indeed we have suggested that "personality is to emotion as climate is to weather" that is, that what we call personality traits are a long term average of behaviors and emotional reactions that can seem to have different causes than the short term fluctuations known as emotional, cognitive and behavioral states (Revelle, 2007, Revelle and Wilt, 2016).

We have previously discussed the importance of time in any analysis of human behavior (Revelle and Condon, 2015) and believe that it is vital to consider the issue of the temporal dimension in the study of personalty. We also believe that it is possible to provide common explanations for structure, process and development by looking for systematic differences across time. In this short note we elaborate on this idea that the study of personality is the study of affects, behaviors, cognitions, and desires at different temporal levels of analysis. We argue analogically as we consider the advances in the natural sciences of climatology. For we believe that weather and

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climate are powerful examples of seemingly non-ergodic phenomena (Nesselroade and Molenaar, 2016, Revelle and Wilt, 2016) that can be unified by broader theory.

The question one asks about today's weather (will it rain today, how cold will it be) are different than one asks about climate (consider the differences between Warsaw and London in temperature ranges across the year and how they differ drastically from those in Rio or Singapore) much less the long term effects on global climate induced by human consumption of fossil fuels. One thinks about weather when deciding to take an umbrella on a walk, one thinks about climate when visiting Warsaw or Chicago in the summer or winter.

Although the ultimate driver of weather, climate, and climate change is the same: just the difference between energy from the sun minus that reradiated by the earth, the time scales are remarkably different. The daily variation in temperature is the short term response to the 24 hour period of the earth's rotation. Yearly variation in climate reflects the tilt of the earth as it revolves around the sun, changing the distribution of sunlight across the planet. Man induced climate change will persist for millenia.

Local wind conditions reflect local differences between e.g., bodies of water and the nearby land (on-shore winds that start late in the morning because the land is warming more than the water, off-shore winds in the evening when the land is cooler than the water). Variations from day to day are due to local differences in energy absorption and the heat capacity of bodies of water, of forests, savannas and deserts that are transmitted (by wind) between locations. The wind is in turn due to local differences in evaporation in combination with solar heating that lead to the differences in air pressure and the resulting high and low pressure areas charted by Galton (1863) (long before he turned his attention to the lexical hypothesis of individual differences, Galton, 1884). Large scale variations in wind (e.g., the trade

winds versus the doldrums, jet streams and Hadley cells) reflect differences in solar flux as a function of latitude as well as the Coriolis effect.

That temperatures lag the solar flux (hottest temperatures tend to be about 2-4 hours after the greatest sunlight) is due to thermal inertia of soils and water. A similar lag is seen in the seasons, as the coldest and warmest months lag by one to two months behind the winter and summer solstices.

Long term change in climate result from very small differences in the solar-energy budget induced by increasing levels of CO2 that slightly change the balance between incoming and outgoing radiation.

But how does this brief discussion of climatology relate to the target article? It is that we need to address their state-trait-development questions by searching for the commonalities in causes (e.g., solar flux for climatologists, reward and punishment sensitivities, plans and goals for personality theorists) as well as the unique effects at different time scales (days, years, decades).

Just as the temperature varies throughout the day in response to local conditions, people differ in their behavioral states in response to the affordances of the local situation (Rauthmann, Sherman, and Funder, 2017). These differences in state values can seem to overwhelm the differences in averages over the short term, but structural analysis of stable individual differences can lead to descriptive models of the averages. Some of the most obvious differences in states reflect positive and negative affect, likely due to differential sensitivities and rates of change to cues for reward and punishment (Gray and McNaughton, 2000, Revelle, 2008, Smillie, 2014) as well as the cognitive appraisal of the situation (Wilt, Funkhouser, and Revelle, 2011). These appraisals will reflect the goals and plans of the individual as they regulate their behavior (Carver and Scheier, 1990).

Developmental changes occur as every generation is invaded by the barbarians

we know as children. Personality changes over the life span are usually slow and gradual as is the effect of changing levels of CO2 on the global energy balance. These changes lead to changes in mean level such that the likelihood of extreme events, either behavioral or climatical, increases.

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