

University of Groningen

The geography of literacy

Conway III, Lucian Gideon; Van de Vliert, Evert; Chan, Lucian

Published in:
Asian Journal of Social Psychology

DOI:
[10.1111/ajsp.12520](https://doi.org/10.1111/ajsp.12520)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2022

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Conway III, L. G., Van de Vliert, E., & Chan, L. (2022). The geography of literacy: Understanding poleward increases in literacy rates. *Asian Journal of Social Psychology*, 25(3), 586-591.
<https://doi.org/10.1111/ajsp.12520>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

SHORT NOTE

The geography of literacy: Understanding poleward increases in literacy ratesLucian Gideon Conway III,¹  Evert Van de Vliert,² and Linus Chan¹¹University of Montana, Missoula, Montana, USA, and ²University of Groningen, Wehl, The Netherlands

Asian social psychology has often focused on East/West comparisons. However, a *latitudinal psychology* perspective suggests that cultures will vary in predictable ways along north/south (latitudinal) gradients, rather than along east/west (longitudinal) gradients. We apply this perspective to better understand the geographical placement of literacy rates across the world. We find across 206 nations that latitude shows no linear relationship with worldwide literacy rates, but a significant curvilinear relationship, such that as one moves north from the equator, higher latitudes are associated with more literacy, whereas this relationship reverses as one moves south from the equator. No such curvilinear relationship consistently emerged for longitude. To better understand the geography of literacy, we included four potential explanatory socioecological variables (pathogens, climate, national tightness, and wealth). These analyses revealed that increases in literacy as one moves towards the North and South Poles was partially accounted for by all four variables, but a larger portion of the variance was due to pathogens. These results suggest that latitude—which, taken on its own, is just a set of abstract lines on a map—can help us organize and understand global literacy.

Keywords: climate, culture, ecological stress, literacy, latitude, pathogens.

Literacy is associated with a whole host of positive life outcomes (e.g., Stine-Morrow et al., 2015), and yet we know surprisingly little about its distal roots. Although research suggests that proximal factors such as home environment and access to reading materials have been shown to increase literacy (Park, 2008; Zuilkowski et al., 2019), this work largely ignores distal socioecological factors. Indeed, in spite of the clear potential for such factors to shape literacy (UNICEF, 2015), it is somewhat surprising that no large-scale investigation has attempted to more fully understand the socioecology of literacy. Further, prior work on literacy generally includes a relatively small number of Asian nations (see Park, 2008; Zuilkowski et al., 2019).¹ While this work is valuable, larger and more comprehensive national samples are needed to ameliorate WEIRD biases that have underrepresented Asian psychology in past work (Henrich et al., 2010).

To help fill in these gaps, in the present article, we evaluate whether or not literacy is shaped by larger socioecological forces such as pathogens and climate (see, e.g., Conway et al., 2020) in a worldwide study of

206 countries that includes a robust sample of Asian nations. To do so, we use a meta-theoretical framework drawn from *latitudinal psychology* to better understand how latitude-related ecological factors might shape human literacy around the world.

Latitudinal Psychology and the Socioecology of Literacy

The new emergent field of *latitudinal psychology* organizes cultural variation through a culture's global position on planet earth (Van de Vliert & Conway, 2019; Van de Vliert & Van Lange, 2020). Although Asian social psychology has more typically focused on East/West (cultural) comparisons, latitudinal psychology suggests that cultures will vary in predictable ways along north/south (latitudinal) gradients rather than along east/west (longitudinal) gradients. Of course, latitude itself is comprised of lines used to measure global positioning; as such, it does not *directly* affect anything. But north/south gradients predictably vary—in a stable manner over eons of time—on ecological stressors such as climate and pathogens.

In particular, latitudinal psychology suggests that latitude will have a curvilinear relationship with human psychological functioning, such that approaching *both* the North and South Poles produces similar increases (or decreases) that differ as one moves nearer the equator (see Van de Vliert & Van Lange, 2020, for a summary).

Correspondence: Lucian Gideon Conway III, Psychology Department, University of Montana, Missoula, MT 59812, USA. E-mail: E-mail: luke.conway@umontana.edu

Received 20 January 2021; revision 12 November 2021; accepted 14 December 2021.

This perspective has thus far been applied to help better understand cultural differences in governmental autocracy (Van de Vliert & Conway, 2019), creativity (Van de Vliert & Van Lange, 2019), aggression (Van de Vliert & Van Lange, 2019), happiness (Van de Vliert & Van Lange, 2019), and cultural tightness measures such as legal tightness (Van de Vliert & Conway, 2019). For example, north of the equator, increasing northern latitude is associated with less governmental autocracy, while south of the equator, increasing northern latitude is associated with more governmental autocracy—an effect accounted for in part by ecologies (Van de Vliert & Conway, 2019).

In the present paper, we similarly use latitude as a meta-theoretical guidepost for investigating literacy rates around the world. In particular, we use latitude to investigate four different types of variables that might serve as potential distal socioecological agents of literacy: pathogen stress, climate stress, national tightness, and wealth.

Importantly, all four of these variables have played a key role in understanding Asian psychology (see, e.g., Bettache & Chiu, 2019; Chen et al., 2021; Kumar et al., 2021; Talhelm & English, 2020; Zhang et al., 2011). Further, there are reasons to expect these four variables will help explain the geography of literacy in Asia and beyond. First, all four variables are known to show opposite linear relationships above and below the equator (Van de Vliert & Conway, 2019; Van de Vliert et al., 2021; Van de Vliert & Van Lange, 2019). Second, each type of variable likely has strong conceptual ties to literacy. Ecological stress (such as pathogen or climate stress) might directly inhibit literacy because, as basic survival is increasingly threatened, fewer resources will likely be devoted to literacy. Similarly, a lack of wealth should undermine literacy, and indeed, some work suggests that it does (UNICEF, 2015). Finally, national tightness—conceptually, the degree that societies focus on traditional ingroup structures—should be negatively related to literacy. Because national tightness tends to produce rigid societal structures that are hierarchical in nature, this would likely encourage a structure where only a subset of persons are allowed the kind of education that would produce literacy—as opposed to looser societies where the literacy of all persons is more valued.

Method

Literacy Rates

Literacy rates were obtained from the CIA World Factbook (Central Intelligence Agency, 2012, Information Technology Associates, 2012). For each nation, we obtained scores for overall literacy rates (and for males and females separately). As noted in the CIA World Factbook, there is no perfect definition of literacy.

However, the Factbook uses UNESCO's percentage estimates for populations aged 15 years and over, which are generally based on the most common definition: the ability to read and write at a specified age. As noted on CIA's World Factbook literacy page, information on literacy is "valid for international comparisons."

Longitude/Latitude

Nation-level scores for the mid-range latitude and longitude of each nation were obtained from prior researchers (see Van de Vliert & Van Lange, 2020).

Ecological Stressors

We included measurements of two sets of ecological stressors that in prior research have shown reversed linear effects of latitude north and south of the equator (Van de Vliert & Conway, 2019; Van de Vliert & Van Lange, 2020): pathogen prevalence and climate stress. To measure the amount of pre-existing communicable disease prevalence, we used Fincher and Thornhill's (2012) highly validated index. To measure the amount of stress induced by extreme climates, we used Van de Vliert's measurements of hot and cold climate stress (Van de Vliert, 2013).

National Tightness Measures

We included three measurements of national tightness. First, as a legal tightness measure, we included a vertical legal restriction measure (from Conway et al., 2017) that measures the degree that laws reflect strict majority group rules imposed on minority groups. Second, we included a measurement of cultural tightness from Uz (2015; reverse-scored so higher scores = more tightness). Finally, as an additional tightness measurement, we included a measurement of *assortative sociality* (from Fincher & Thornhill, 2012), which is a cumulative measurement of the degree that persons in each nation favour national ingroups over outgroups. Note that the latter two measurements had far fewer nations (64 and 93, respectively) than the main sample. However, all three measurements of tightness were highly correlated with each other ($r_s = .68, .72, \text{ and } .73$, respectively—see Table 1).

Wealth

To measure wealth, we included a measure of GDP per capita (Information Technology Associates, 2012).²

Ethics Statement

All research was conducted ethically within COPE and APA ethics guidelines.

Table 1
Correlations among socioecological variables

| | Pathogens | Heat stress | Cold stress | Legal tightness | Assortative sociality | Cultural tightness |
|-----------------------|-----------|-------------|-------------|-----------------|-----------------------|--------------------|
| Pathogens | – | | | | | |
| Heat Stress | .40*** | – | | | | |
| Cold Stress | –.52*** | –.57*** | – | | | |
| Legal Tightness | .52*** | .51*** | –.54*** | – | | |
| Assortative Sociality | .70*** | .63*** | –.72*** | .68*** | – | |
| Cultural Tightness | .53*** | .51*** | –.42*** | .72*** | .73*** | – |
| GDP/Per Capita | –.60*** | –.25*** | .33*** | –.32*** | –.59*** | –.64*** |

Results and Discussion

Curvilinear Results

To test the global relationship of latitude on literacy, we simultaneously regressed both linear and quadratic latitude terms on each literacy variable (see, e.g., Van de Vliert & Van Lange, 2019).³ In this analysis, the quadratic linear term represents the likelihood that literacy is associated with different relationships above and below the equator (once accounting for its direct linear relationship)—thus, it is a test of the likelihood that the linear relationship between latitude and literacy changes north and south of the equator. We further performed parallel analyses on longitude.

As can be seen in Table 2, the only effect that consistently emerged was the curvilinear effect of latitude on literacy, with the overall curvilinear effect being significant ($\beta = .58, p < .001$). As seen in Figure 1, consistent with general latitudinal psychology meta-theory, this curvilinear pattern reveals that literacy tends to increase as one moves poleward in both directions from the middle of the planet.

What Explains Latitudinal Variation?

To better understand the latitude of literacy, we ran a series of tests using a standard model for testing indirect relationships (Hayes, 2013). We first looked independently at each socioecological variable's indirect effect in explaining the relationship of latitude squared with literacy by performing separate analyses for each of the socioecological variables. We focused these analyses on the overall literacy score for each nation. Higher indirect scores for each variable reveal that the socioecological variable plays a larger role in explaining the latitude of literacy; lower scores reveal that the socioecological variable plays a lesser role.

As can be seen on the left-hand side of Table 3, these results suggested that all socioecological variables except

Table 2
Longitude and latitude predicting literacy

| Outcome Variable | Latitude | | Longitude | |
|------------------|----------|-------------|-----------|-------------|
| | Linear | Curvilinear | Linear | Curvilinear |
| Overall literacy | –.14 | .58*** | –.05 | .12 |
| Male literacy | –.10 | .54*** | .04 | .09 |
| Female literacy | –.18 | .61*** | –.07 | .16* |

Note. $n = 206$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

cold stress showed significant indirect effects in explaining the latitude squared–literacy relationship. The strongest initial indirect effects were by far for pathogens and assortative sociality.

We further explored the potential interdependency of these socioecological variables by performing the same indirect calculations for each socioecological variable while controlling for all the other variables. Because assortative sociality and cultural tightness measures had appreciably less nations and therefore would have caused the other analyses to lose considerable data, we did not control for those two variables while testing for the other variables. As can be seen on the right-hand side of Table 3, these analyses revealed that, of the socioecological variables showing significant indirect effects, only pathogen prevalence remained significant when controlling for the other variables.

It is noteworthy, given that wealth is often viewed as a key driver of literacy (UNICEF, 2015), that it had comparatively little impact in the present study. This is consistent with other recent work revealing that wealth alone may not be the best predictor of literacy because wealth can be selectively used (Zuilkowski et al., 2019). Further, in our work it is clear that the indirect effect of wealth—which was small but statistically significant initially in our study—was subsumed by the effects of

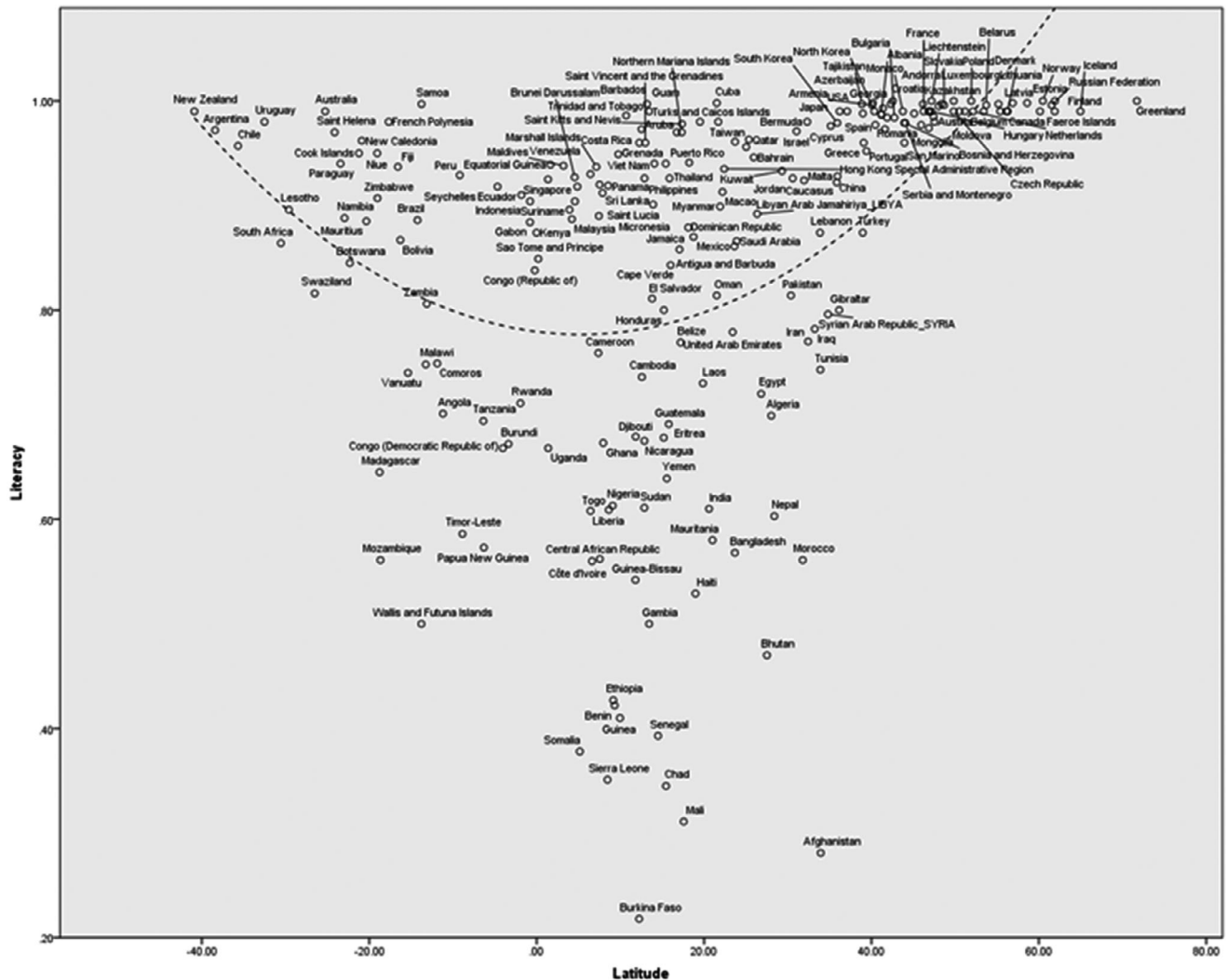


Figure 1 The curvilinear relationship between latitude and literacy around the world.

other ecological stressors. This suggests that wealth might matter more as part of a nested causal chain than as a primary factor that explains the geographical distribution of literacy (for one example, see Van de Vliert & Conway, 2021).

Limitations and Future Directions

In line with a latitudinal psychology perspective, literacy showed an overall curvilinear effect along latitudinal gradients, an effect defined by increased literacy as one moves poleward (in either direction) from the equator. Further, it is clear from our results that the best explanatory variable for understanding the geography of world literacy in our dataset was one particular ecological stressor: the presence of disease.

Of course, no research is without limitations. Although the present research provides the most comprehensive set of nations and socioecological predictors of literacy to date, it nonetheless does not cover many potential socioecological predictors. For example, it is possible that interdependence-related variables such as those pertaining to farming (Uskul et al., 2008) might help us better understand the latitudinal psychology of literacy. Further, the present work does not directly address cognitive-relevant variables that have generally been shown to vary along east/west lines (see, e.g., Minkov & Hofstede, 2012). Thus, although the present results suggest factors outside of typical East/West comparisons that may influence Asian psychology—and thus help us better understand differences *between* Asian nations along north/south gradients—it also

Table 3
Indirect effects of latitude squared predicting literacy through ecological variables

| Mediation Variable | Indirect effect while controlling | | | Indirect effect for other ecological variables | | |
|-------------------------------------|-----------------------------------|------|-----|--|------|-----|
| | Effect | LCI | UCI | Effect | LCI | UCI |
| Ecological Stressors | | | | | | |
| Pathogens (<i>n</i> = 185) | .49**** | .40 | .57 | .20**** | .12 | .30 |
| Heat stress (<i>n</i> = 206) | .16**** | .07 | .27 | -.01 | -.06 | .03 |
| Cold stress (<i>n</i> = 206) | .07 | -.18 | .25 | .21* | .00 | .39 |
| National Tightness | | | | | | |
| Legal Tightness (<i>n</i> = 206) | .19**** | .10 | .30 | .04 | -.00 | .10 |
| Assort. sociality (<i>n</i> = 93) | .40**** | .27 | .57 | .03 | -.01 | .10 |
| Cultural tightness (<i>n</i> = 64) | .18** | .07 | .30 | -.00 | -.09 | .03 |
| Wealth | | | | | | |
| GDP/Per Capita (<i>n</i> = 204) | .13**** | .09 | .20 | .02 | .00 | .06 |

Note. All inferential effects of indirect effects are Sobel tests. All confidence intervals computed using Hayes (2013) bootstrapping method; LCI = lower confidence interval for reported indirect effect; UCI = upper confidence interval for reported indirect effect. All reported *n*'s are for indirect effects without controlling for other mediators; for all analyses controlling for other mediators *n* = 183, except for assortative sociality (*n* = 89) and Cultural Tightness (*n* = 63).

p* < .05; *p* < .01; *****p* < .001.

leaves open many questions for future researchers to explore.

This study was not pre-registered.

Conflict of Interest

The authors declare they have no conflicts of interest.

Funding Statement

There was no funding provided for this article.

Author Contributions

L. Conway was responsible for the study design, data analysis and interpretation, and assisted to write the manuscript. E. Van de Vliert was responsible for data interpretation, statistical consulting, and assisted to write the manuscript. L. Chan assisted in writing the manuscript.

Data Availability Statement

All data for this study are available on the first author's OSF page at <https://osf.io/92wcq/>.

Research Materials Statement

No materials were used for the study, but all summarized data for this study are available on the first author's OSF page at <https://osf.io/92wcq/>.

Pre-registration statement

Endnotes

- 1 For example, Zuilkowski et al. (2019) did not measure national ecological stressors—and their sample included only four Asian nations.
- 2 All data for the study are available on the first author's OSF page at <https://osf.io/92wcq/>
- 3 Van de Vliert and Van Lange (2019) use latitude squared as a predictor both at zero-order and as an added predictor above and beyond ecological predictors. As we find in our data, they also report that latitude squared initially predicts their key variables, but that this is accounted for in large part by latitude's association with ecological factors.

References

- Bettache, K., & Chiu, C. (2019). Why American conservatives and individuals from traditionalist cultures may share a preference for group uniformity. *Asian Journal of Social Psychology*, 22(3), 325–330. <https://doi.org/10.1111/ajsp.12356>
- Central Intelligence Agency. (2012). *Field listing: Literacy*. The World Factbook. Retrieved June 6, 2021, from <https://www.cia.gov/the-world-factbook/field/literacy/>
- Chen, S. X., Lam, B. C. P., Liu, J. H., Choi, H., Kashima, E., & Bernardo, A. B. I. (2021). Effects of containment and closure policies on controlling the COVID-19 pandemic in East Asia. *Asian Journal of Social Psychology*, 24, 42–47. <https://doi.org/10.1111/ajsp.12459>
- Conway, L. G., III, Bongard, K., Plaut, V., Gornick, L. J., Dodds, D. P., Giresi, T., Tweed, R. G., Repke, M. A., & Houck, S. C. (2017). Ecological origins of freedom: Pathogens, heat stress, and frontier topography predict more vertical but less horizontal governmental restriction. *Personality and Social Psychology Bulletin*, 43, 1378–1398. <https://doi.org/10.1177/0146167217713192>

- Conway, L. G., III, Chan, L., & Woodard, S. R. (2020). Socio-ecological influences on political ideology. *Current Opinion in Psychology*, 32, 76–80. <https://doi.org/10.1016/j.copsyc.2019.06.034>
- Fincher, C. L., & Thornhill, R. (2012). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral and Brain Science*, 35, 61–79. <https://doi.org/10.1017/S0140525X11000021>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33, 61–135. <https://doi.org/10.1017/S0140525X0999152X>
- Information Technology Associates. (2012, March 8). GDP - per capita (PPP) 2012 country ranks, alphabetical. https://photius.com/rankings/economy/gdp_per_capita_2012_1.html
- Kumar, P., Kumar, N., & Sarthi, P. P. (2021). Feeling solastalgia: A study of the effects of changing climate in rural India. *Asian Journal of Social Psychology*, 24, 208–220. <https://doi.org/10.1111/ajsp.12473>
- Minkov, M., & Hofstede, G. (2012). Hofstede's fifth dimension: New evidence from the World Values Survey. *Journal of Cross-Cultural Psychology*, 43(1), 3–14. <https://doi.org/10.1177/0022022110388567>
- Park, H. (2008). Home literacy environments and children's reading performance: A comparative study of 25 countries. *Educational Research and Evaluation*, 14, 489–505. <https://doi.org/10.1080/13803610802576734>
- Stine-Morrow, E. A. L., Hussey, E. K., & Ng, S. (2015). The potential for literacy to shape lifelong cognitive health. *Policy Insights From the Behavioral and Brain Sciences*, 2, 92–100. <https://doi.org/10.1177/2372732215600889>
- Talhelm, T., & English, A. S. (2020). Historically rice-farming societies have tighter social norms in China and worldwide. *Proceedings of the National Academy of Sciences USA*, 117(33), 19816–19824. <https://doi.org/10.1073/pnas.1909909117>
- UNICEF. (2015). *The Investment Case for Education and Equity*. UNICEF.
- Uskul, A. K., Kitayama, S., & Nisbett, R. E. (2008). Ecocultural basis of cognition: Farmers and fishermen are more holistic than herders. *Proceedings of the National Academy of Sciences of USA*, 105, 8552–8556. <https://doi.org/10.1073/pnas.0803874105>
- Uz, I. (2015). The Index of Cultural Tightness and Looseness Among 68 Countries. *Journal of Cross-Cultural Psychology*, 46(3), 319–335. <https://doi.org/10.1177/0022022114563611>
- Van de Vliert, E. (2013). Climato-economic habitats support patterns of human needs, stresses, and freedoms. *Behavioral and Brain Sciences*, 36, 465–480. <https://doi.org/10.1017/S0140525X12002828>
- Van de Vliert, E., & Conway, L. G. (2019). Northerners and Southerners differ in conflict culture. *Negotiation and Conflict Management Research*, 12(3), 256–277. <https://doi.org/10.1111/ncmr.12138>
- Van de Vliert, E., & Conway, L. G. (2021). Does perceived governance quality improve toward the North and South Poles for eco-cultural reasons? *Journal of Cross-Cultural Psychology*. Advance online publication. <https://doi.org/10.1177/00220221211051025>
- Van de Vliert, E., Conway III, L. G., & Van Lange, P. A. M. (2021). *Latitudinal psychology: Tightness in non-industrial times forecasts contemporary tightness* [Manuscript in preparation]. University of Groningen.
- Van de Vliert, E., & Van Lange, P. A. M. (2019). Latitudinal psychology: An ecological perspective on creativity, aggression, happiness, and beyond. *Perspectives on Psychological Science*, 14, 860–884. <https://doi.org/10.1177/1745691619858067>
- Van de Vliert, E., & Van Lange, P. A. M. (2020). Latitudinal gradients as scientific tools for psychologists. *Current Opinion in Psychology*, 32, 43–46. <https://doi.org/10.1016/j.copsyc.2019.06.018>
- Zhang, S., Wang, E., & Chen, Y. (2011). Relative deprivation based on occupation: An effective predictor of Chinese life satisfaction. *Asian Journal of Social Psychology*, 14(2), 148–158. <https://doi.org/10.1111/j.1467-839X.2010.01338.x>
- Zuilkowski, S. S., McCoy, D. C., Jonason, C., & Dowd, A. J. (2019). Relationships among home literacy behaviors, materials, socioeconomic status, and early literacy outcomes across 14 low- and middle-income countries. *Journal of Cross-Cultural Psychology*, 50(4), 539–555. <https://doi.org/10.1177/0022022119837363>