# Enhancing Powerful Geography with Human-Environment Geography

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## Abstract

GeoCapabilities and Powerful Geography are advancing the conversation related to improving the relevance and status of geography within K-12 education during the so-called Third Enlightenment. Credibility and success of geography's contribution to K-12 education will be increased with the addition of capabilities provided by the human-environment identity, such as adapting to emerging circumstances, thinking in systems, and adopting a sense of timefulness. Traditionally, human-environment geography has encompassed three substantive areas: human impacts on the environment, the environment as hazard, and environmental perception. Each of these areas has implications for Powerful Geography's fundamental premise: to help teachers generate bottom-up curricula that better align diverse student aspirations with the knowledge, skills, and perspectives employed by professional geographers. Contemporary K-12 teachers are members of teams who attempt to integrate curricular activities across their subject areas, which include science, technology, engineering, and mathematics. Human-environment subjects, such as climatic change, environmental pollution, sense of place, drought, or flooding, provide useful interdisciplinary subjects for integrative teaching. Using an understanding of how K-12 geography education has addressed human-environment issues since the introduction of the five themes in the 1980s, this paper discusses how a marginalized aspect of geography can greatly assist Powerful Geography.

## Geography Education in the Third Enlightenment

> Think of humanity in this century, if you will, as passing through a bottleneck of overpopulation and environmental destruction. At the other end, if we pass through safely and bring most of the rest of life with us, human existence could be a paradise compared to today. And a long geologic lifespan, essentially immortality, for our species would be possible (Wilson, 2017a, p. 162).

We are entering a Third Enlightenment, one in which the sciences and humanities will combine to "serve as leaders of a new philosophy, one that blends the best and most relevant from these two great branches of learning" (Wilson, 2017b, p. 198). That Enlightenment is not only desirable, it is necessary for human survival amid global change. The bottleneck seems like a five-lane interstate reduced to a single lane highway with no frontage roads for an escape. Unifying knowledge represents a form of creativity essential to moving society and the environment through this constriction (Wilson, 2017a). Combining creativity and consilience has yet to be fully achieved; scholars and educators are deprived of capabilities to unify knowledge in response to 21st century problems (Wilson, 2017b, p. 190-191):

> Although humanistic arts and analyses superbly capture details of history, they remain largely unaware and uncaring about the evolutionary events of prehistory that created the human mind, which after all created the history on which the humanities focus. […] In their own way, scientists are equally unprepared for collaboration with creative artists and scholars of the humanities.

No topic depends on knowledge unification more than human-environment relations. Powerful Geography and GeoCapabilities are 21st century ideas to improve K-12 geographic education in response to major challenges accumulating due to misguided human-environment interactions.

Curriculum approaches designed by geography teachers for geography teachers have the real-world wisdom and intellectual merit necessary to produce powerful and capable geographic knowledge. Strengths lie in their international perspectives, as well as their applied and theoretical foundations. A capabilities approach to education addresses how a student gains agency to lead a life that s/he values (Unterhalter and Walker, 2007; Campbell and McKendrick, 2017). GeoCapabilities represents the European argument that students will develop greater potential to lead a valuable, fulfilling life if they acquire knowledge that enables them to think geographically (Solem *et al.*, 2013; Lambert *et al.*, 2015). Powerful Geography embodies the American effort to train geography teachers on how to tailor course content to student aspirations and workforce applications. According to Solem and Boehm (2018, 195), Powerful Geography involves "applying the capabilities approach pioneered in GeoCapabilities to research the design and development of new geography curriculum standards and programs." These efforts link to the idea of powerful disciplinary knowledge (PDK).

Powerful disciplinary knowledge needs to help a student think, analyze, determine, and explain, or to 'think the not yet thought' (Young and Muller, 2013). Building off the ideas of Michael Young (2008), Alaric Maude (2016, p. 75) wrote that the concept of powerful geographic knowledge "does not lead to a list of content that must be taught, but only to ways of thinking that should be developed through whatever content is selected." New emphasis in K-12 education shifts attention away from "the acquisition of literacy skills: simple reading, writing, and calculating" (NAS, 2000, p. 5), and transitions toward helping students find and use information rather than repeating something that has been remembered (Simon, 1996). Teachers now are tasked to help students "to think and read critically, to express themselves clearly and persuasively, to solve complex problems" (NRC, 2000, p. 4). According to Maude (2016), powerful geographic knowledge includes: (1) new ways to conceptualize about the world, (2) strategic ways to analyze, understand, and share knowledge about the world, (3) student recognition of the knowledge they have gained, (4) the information and confidence for students to engage in debates at scales ranging from the local to the global, and (5) improved global system understanding.

Despite accelerating human-induced impact on the global system (Steffen *et al.*, 2004), much of the emphasis to-date in K-12 geography education derives from the five themes introduced in 1984 by the Joint Committee on Geography Education. Themes included the importance of (1) place and (2) location as a grounding for activities, changes, or differences; the idea that similar places are logically integrated into (3) regions; recognition of the importance of (4) movements of goods, services, and ideas from place-to-place or region-to-region; and the concept of (5) relationships within places. Relationships within places, as a way to discuss nature-society relationships at the local scale, may have made sense in the 1980s. But the cumulative human imprint on the planet has

changed dramatically since 1984. Part of Harper's (1990, p. 28) critique of the five themes suggested that "the five themes are spatial in nature," spatial to a fault. Geography educators doubled down on the spatial-chorological pathway in a human-environment world filled with more-than-spatial meanings, changes through time, ethical implications, and ways of knowing (Turner, 2002). Given the implications of global climate change, ocean acidification, and the sixth extinction (Orr, 2016; Kolbert, 2014), no longer can the human-environment tradition be interpreted as the marginalized 'other' sitting in the backseat, while space and place drive the discipline.

In the following sections, we look at how the theme of integration in place (human-environment geography) has morphed over the last 30 years. Examining this backstory, we discover writers using different terms to label this marginalized aspect of K-12 geography. We then summarize major ideas in human-environment or nature-society geography, followed by addressing the value of human-environment geography within the context of Powerful Geography, powerful disciplinary knowledge, and GeoCapabilities. Bringing a greater emphasis of human-environment geography to the Powerful Geography effort, we produce two figures that help summarize integrative aspects of geography and powerful thinking. We also introduce and describe three capabilities that can lead to the bottom-up development of powerful geographic knowledge: adapting from the inside-out, thinking in systems, and adopting a sense of timefulness.

## From Relationship within Places to Human-Environment Geography

During the 1990s, the theme first identified as 'relationships within places' was discussed in a number of ways. Gersmehl (1992) labeled this theme 'Interaction' as he discussed points and counterpoints relating to the five themes. Interaction included how humans modify the environment and how environmental conditions impact human behavior. His counterpoint addressed how place influences environmental perception, recognizing that relationships within places encompass more than humans modifying and adjusting to local settings.

While discussing ideas that influenced the five themes, Natoli (1994, p. 3) mentioned Pattison's (1964) four traditions of geography, suggesting that the "Pattison's 'man-land' tradition provided transition from the subjectivity of place to the theme of relationships within places." These words illustrate the spatial thinking emphasis within the five themes. They conveyed that the theme which is now labeled the human-environment geography was initially local in scale and dealt with "relationships within places" and "the intricate interactions between people and their physical and cultural environments" (Natoli, 1994, p. 3). 'Environmental' represented another label used in the 1990s for human-

environment thinking (McKeown-Ice, 1994). In documenting the geographic aspects of environmental education, McKeown-Ice (p. 40) listed: human impacts on the environment, environmental influences on human behavior, differing cultural perceptions of the environment, and studies of the natural environment or physical geography. 'Relationships within places' appeared insufficient to characterize a fragmented assortment of human-environment descriptions. Employing other terms in lieu of 'relationships within places' exhibited an ongoing struggle to operationalize the theme.

Meanwhile, Boehm and Petersen (1994) discussed the five themes listing 'human-environment relations' as parenthetically equivalent to 'relationships within places.' According to Boehm and Petersen (1994, p. 212), the geography consensus group of the National Assessment of Educational Progress (NAEP) moved away from the five themes and "chose to organize the content of geography into: (1) space and place; (2) environment and society; and (3) spatial dynamics and connections." Although the human-environment identity became more explicit, using the connector 'and' to link 'environment' and 'society' presents a dichotomous view, separating society from nature. Use of a hyphen to link humans with their environment (*e.g.*, human-environment geography) can subtly reinforce student comprehension of the complexity and linkages involved in the coupled global system.

In *Geography for* Life, six essential elements link together 18 standards, and the 'environment and society' label was used for the essential element that groups standards pertaining to human-environment relationships (Geography Education Standards Project, 1994; see also Heffron and Downs, 1992). Both the spatial-chorological and human-environment identities ascribed to geography (Turner, 2002) appear in the 1994 volume documenting the then new national geography standards, *Geography for life* (Geography Education Standards Project, 1994). In the K-12 geography education realm, appropriate knowledge and skills involve a spatial perspective paired with "the ecological perspective" (p. 32). In discussing the thought processes associated with geography's ecological perspective, the authors of *Geography for life* indicated (p. 58):

> Understanding Earth as a complex set of interacting living and nonliving elements is fundamental to knowing that human societies depend on diverse small and large ecosystems for food, water, and all other resources. People who regularly inquire about connections and relationships among life forms, ecosystems, and human societies possess an ecological perspective.

Note that the ecological perspective in geography education involves complexity, (eco)systems, connection and/or interaction between the biotic and abiotic, and resources. Unfortunately, the word choices for labeling the ecological perspective differ from other available options to characterize this major aspect of geographic thought.

As geographers struggled with how to label the content that is included within human-environment thinking, the decade of the 1990s saw a rapid expansion of students enrolled in geography classes in universities (NAS, 1997) and the growing popularity of geographic information systems (GIS) (Goodchild *et al.*, 2000). GIS education has attracted numerous new students to geography and has expanded the spatial geographic perspective outside the classroom with an emphasis on applied spatial thinking. It can be argued that the spatial-chorological hegemony of the second half of the 20th century (Turner, 2002) is exemplified by the NAS publication, *Learning to Think Spatially* (2006). Perhaps we have lost sight of the human-environment baby, with an overemphasis on the spatial thinking bathwater in K-12 geography education.

It is interesting that geography education scholars have a history of linking human-environment thinking with geography (see Murphy, 2018). For example, Gregg and Leinhardt (1994, p. 313) indicate that a late 20th century rationale for separating geography out from integrated social studies and putting geography back into the K-12 curriculum was "acquiring competence in geographic reasoning, a competence that is built by learning and applying the tools of spatial analysis to problems associated with human interaction with the environment." Turner (2002) reinforces the case for the importance of geography for addressing human-environment content using spatial analytic methods.

In his discussion of the two major geographic identities, Turner (2002) identified human-environment interactions as the 'other' and marginalized major geographic identity. Writing about the same topic in the *Annals of the American Association of Geographers*, Zimmerer (2010) referred to the subject matter as nature-society geography. It likely does not help with K-12 teacher understanding of the value of the human-environment identity in geography, when those who write about the topic use a plethora of names to label the subject.

## Human-Environment Geography

Geography has been regarded as the human-environment discipline and signifies a core tradition in geographic thought (Pattison, 1964; Turner, 2002; Yarnal and Neff, 2004; Murphy, 2014). Generally defined, human-environment geography encompasses geographic ways of understanding, approaching, and synthesizing ideas and questions about the complex relationship between people and the places they inhabit (Zimmerer, 2010, 2017). It addresses a broader task that extends beyond geography, the process of "seeking lessons about society and

nature taken from the study of the relationships between the two" (Turner 2002, p. 60).

Geographers possess a direct bloodline to studying the human-environment relationship. Alexander von Humboldt has been identified as the forefather of human-environment geography, and the writings of George Perkins Marsh in the 1800s helped triangulate the ways that humans were modifying their environment (Turner, 2002). Geographers played a fundamental role in the two major stocktakings related to human-induced planetary change (Thomas, 1956) and modifications to Earth systems (Turner *et al.*, 1990). From modifying to changing to transforming, human-environment thinking includes more than just anthropogenic impacts on the system. Glacken (1967) synthesized the character of human-environment geography up to the end of the 19th century. His analysis outlined three major ideas in the history of human-environmental thought: the idea of a divinely designed earth (environmental perception), the idea of environmental influence on people (hazards), and the idea of human influence on the environment (human impacts).

Human-environment geography's influence has increased through time. In an analysis of geography presidential addresses covering the period 1940-1999 using Pattison's (1964) four traditions, a greater percentage of the addresses covered aspects of the human-environment tradition (Datel, 2000). Zimmerer (2010) examined the frequency of articles on human-environment topics appearing in the *Annals of the American Association of Geographers* and found a generally upward trend over ten decades. Writing about nature-society geography in *Geography: Why it matters*, Murphy (2018, p. 90) observed that "geographical work on the subject has blossomed in recent decades" and "of the traditional disciplines, geography today is the one that arguably is most centrally concerned with looking at the interrelations between natural and human processes on the Earth's surface." Murphy (p. 8) asserted that geography is a "critically important window" into "the environments and patterns that exist on the ground or that humans create in their minds," as well as "the interconnections that exist between the physical and human environment."

Global-scale planetary conditions at the end of the second decade of the 21st century present new K-12 education challenges, such as climate change, ocean acidification, and species extinctions. Classroom teachers are challenged to connect human actions which students can see at the local scale with their global footprints. Since the introduction of the five themes in 1984, there have been a number of new ideas developed to address changing human-environment conditions, with many concentrating on conditions at the global scale. In his book, *The end of nature*, McKibben (1989) attempted to alarm readers to the fact that one could find evidence of humanity at every spot on the Earth's surface. By 1997, it became clear to Vitousek *et al.* (1997, p. 494) that we live on a "human dominated planet." One decade later, Kareiva *et al.* (2007, p. 1866) indicated that

"we have domesticated landscapes and ecosystems in ways that enhance our food supplies, reduce exposure to predators and natural dangers, and promote commerce." Two years later, Rockström *et al.* (2009) introduced the idea of planetary boundaries, suggesting that humanity should have greater concern about the cumulative effect of activities that were pushing the planet beyond the safe operating space for biodiversity loss, global freshwater use, change in land use, ocean acidification, climate change, chemical pollution, atmospheric aerosol loading, biogeochemical processes, and stratospheric ozone depletion. Kolbert (2014) presented evidence that humanity was the primary agent of change producing a sixth major planetary extinction.

The Great Acceleration is a label that has been applied to the rapid changes in physical and social conditions following World War II (Steffen *et al.*, 2004). The rate, magnitude, and scales of human-induced changes have been profound. Proposing a new time period for the geologic timeline began as an utterance at a scientific conference (Crutzen and Stoermer, 2000; Crutzen, 2002) and morphed into a proposal to add the Anthropocene as a new epoch documenting an Age of Humans (Zalasiewicz *et al.*, 2015). By the second decade of the 21st century, geographers were transforming the Anthropocene idea to address physical science, social science, and humanistic perspectives related to the human imprint on the planet (Ziegler and Kaplan, 2019).

Human-environment geography has a lengthy tradition among prominent geographic writers and a growing societal relevance. Zimmerer (2010) identified six major aspects to the area of study: (1) environmental governance and political ecology, (2) environmental hazards, risk, and vulnerability science, (3) land use and cover change science, (4) human-environment interactions, (5) environmental landscape history and ideas, and (6) scientific concepts and environmental management. Clearly, human-environment geography encompasses geographic ways of understanding, approaching, and synthesizing ideas and questions about the complex relationship between people and the places they inhabit (see Zimmerer, 2017).

## Human-Environment Geography is a Critical Component of Powerful Geography

The contemporary relevance of human-environment geography for K-12 teachers suggests that this geographic identity should have a prominent place in any framework of geography made available to teachers. Boehm *et al.* (2018, p. 132) suggest that such a "simplified content framework" should limit the number of "overarching synergistic content areas" and present a figure that identifies: Places and Regions, Environment and Society, Physical Geography, and Human Geography as four meta concepts (see Figure 6 in Boehm *et al.*, 2018).

We agree with the thought of limiting the number of meta-constructs that are the building blocks of a solid geographic understanding and provide a figure

with three major geography topics or identities: Cartography and GIScience; Place and Region; and Human-Environment (Figure 1). The three major meta concepts build from the two identities, spatial-chorological and human-environment, advocated by Turner (2002). Our use of three meta constructs echoes Turner's (2002) ideas that Human-Environment is a content area (addressing an object of study or dealing with a 'what' question – what is the character of the human-environment interaction?). What is new in our figure is the suggestion that Turner's spatial-chorological identity (an approach) can be separated into a Cartography and GIScience approach (which we think of as similar to the spatial chorological identity) and a Place and Region object of study, wherein the 'what' question pertains to the characteristics of a place or region.

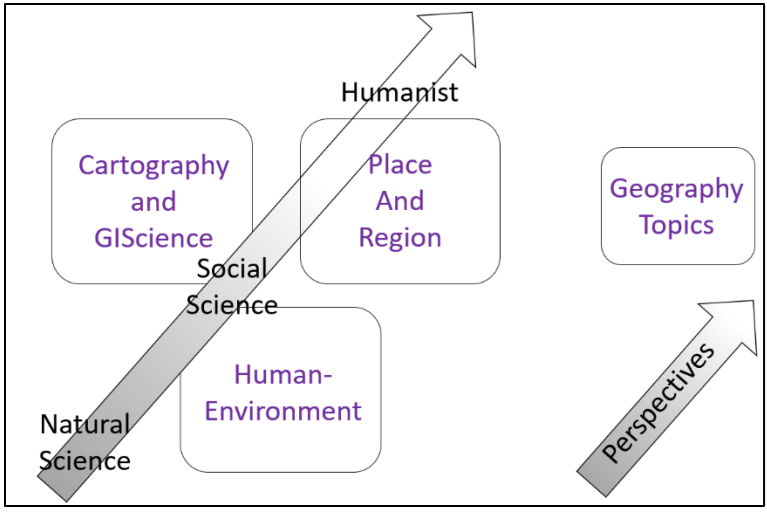


**Figure 1.** An alternative powerful geography framework diagram for teacher education. A legend is provided in the lower-right hand corner indicating perspectives (arrow) crosscutting major geography topics (boxes). Three meta-constructs for geography are presented in the boxes and three dominant scholarly perspectives are presented along the arrow that cuts across the diagram from lower left to upper right.

In designing Figure 1, three dominant branches of the Academy (the Physical Sciences, the Social Sciences, and the Humanities) are included to signal perspectives of which teachers will have an awareness. A real-world grounding of a meta-construct and a perspective can be illustrated with the issue of anthropogenic climate change (using the Human-Environment construct). Within the Physical Sciences, an outcome of increasing greenhouse gas emissions will be the impacts on temperature and extreme rainfall. In the Social Sciences, students might critique institutional responses and examine attitudes toward taking

environmental precautions in the midst of ongoing environmental transformations. From a Humanities perspective, students can share their ideas about global climate change with music, paintings, and verse.

Recognizing the need for students to gain agency, we add Figure 2 that connects with ideas from the arc of GeoInquiries developed at ESRI (2003)—concepts incorporated into the National Council for Social Studies Inquiry Arc (NCSS, 2014), and advocated more recently by the National Geographic Society as the Geo-Inquiry Process (Oberle, 2020). Figure 2 is designed to articulate some of what we think is intended in the gray area (geographic knowledge, skills, and perspectives) of Figure 6 in Boehm *et al.* (2018). The process depicted in Figure 2 aligns with ideas put forward by Maude (2016) related to powerful geographic knowledge. Inquiry will enable students to better understand the systems under consideration as they analyze and better understand their world, find new ways to conceptualize and visualize their knowledge, gain an appreciation for what they are learning, and contribute to conversations about making things better at local to global scales.

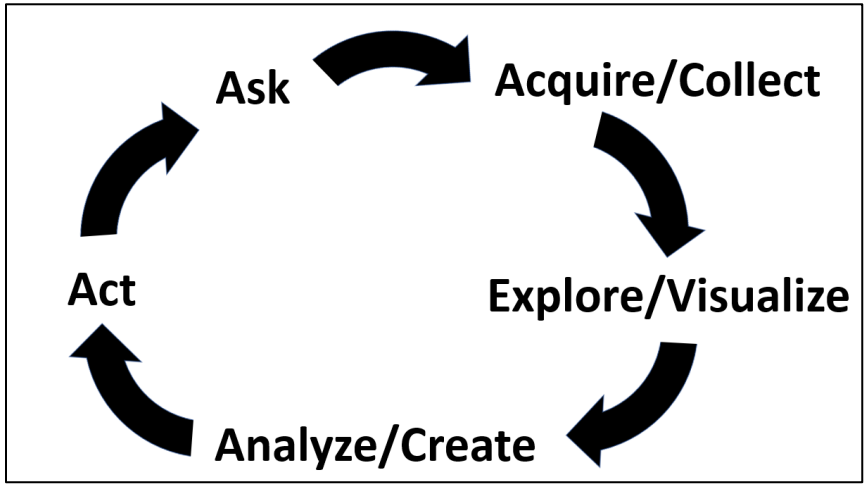


**Figure 2**. A five-step process for students to use as they inquire about a subject. The process begins with **asking** a geographic question and proceeds through geographic data **collection** and **exploration**, to geographic data **analysis** and creative suggestions that can be **act**ed upon. In many cases, the process can lead back to asking an additional geographic question, so that the process advances in a constructive manner. Modified from ESRI (2003).

## What Constitutes Capabilities and Powerful Knowledge in Human-Environment Geography?

> Great knowledge sees all in one.
> Small knowledge breaks down into the
> many.
> – Chuang Tzu (Merton, 1965, p. 40)

Waking up in the Third Enlightenment, geographers have a chance to leverage the human-environment identity to advance powerful geographic knowledge that enhances student capabilities. Geographers are already considering geography education's role in seeking solutions to problems relating to the Anthropocene (Pawson, 2015). Interlinking Powerful Geography with human-environment relations will look differently across educational contexts. Yet, powerful disciplinary knowledge can be produced by cultivating three human-environment capabilities: adapting from the inside-out, thinking in systems, and adopting a sense of timefulness.

### Adapt from the Inside-Out

A capabilities approach to human-environment thinking builds 'from the inside-out,' in terms of an ability to "examine the individual and collective values, beliefs, and worldviews that support the behaviors, institutions, and systems that create and perpetuate the problems to which we have to adapt," such as climate change (O'Brien, 2013, p. 307). Since the introduction of the five themes in 1984, our need to appreciate environmental problems has expanded from the local to the global. Thus, there is a need to help students understand environmental phenomena and their interdependencies among multiple scales. According to *Rediscovering geography* (NAS 1997, p. 31), this way of looking at the world "enables geographers to examine the impacts of global changes on local events and the impacts of local events on global changes."

Spatial-chorological approaches, like spatial thinking, are useful in working with and identifying patterns in data that challenge our preconceptions about the world (Gersmehl and Gersmehl, 2007). Factfulness has been heralded as a way to crunch numbers to challenge conventional wisdoms about the world, such as humans' instinct to cast blame, expect negative results, make generalizations, and approach problems with a single perspective; when quizzed about basic facts about global population demography, a sample of global leaders did worse than a sample of chimpanzees (Rosling *et al.*, 2018)! Adapting from the inside-out involves the capability to exorcise our tendencies to make judgements not based on the evidence. Relying on instincts or gut feelings rather

than facts can produce powerfully harmful knowledge, in the sense that the ignorance can lead to potentially dangerous decisions.

From the perspective of human-environment geography, enhancing the capabilities of students does not mean training students to be cogs in the existing wheel, nor is it limited to merely meeting the individual needs of diverse students. It involves preparing students to meet the challenges and uncertainties of a rapidly accelerating society (Epstein, 2019). American communities and the students they cultivate are already becoming displaced because of global changes; Kivalina, an island off the coast of Alaska, represents one such place facing major transformations in native ways of life because of sea level rise (Shearer, 2011). Adapting from the inside-out helps student cultivate foresight about the consequences of environmental decisions and how they are communicated.

Students must have the ability to discern grave impacts mistaken for progress, such as when physicists J. Robert Oppenheimer offered up his retrospective thoughts on building the atomic bomb, "When you see something that is technologically sweet, you go ahead and do it, and you argue about what to do about it only after you have had your technical success" (qtd. in McKibben, 2019, p. 199). According to McKibben, technological dependence poses an environmental gamble, a high-stakes game in which bets are rising and humanity is doubling down, at risk of losing everything if it doesn't cash in its chips in time. Powerful geographic knowledge, in the words of poet Wendell Berry, calls on teachers and learners to "do something/that won't compute" (qtd. in McKibben, 2019, p. 229).

Spatial-chorological approaches can only take us so far. Under the human-environment identity, powerful geographic knowledge can prevent students from becoming ensnared in alluring, yet unwise beliefs about how the world works (Frankfurt, 1986; Pawson, 2015). Misinformation about human-environment relations abounds among digital media outlets and can deceive even the smartest citizens (Pawson, 2015). Having intelligence, according to David Robson (2019), is similar to having a high-end Maserati or Ducati. More intelligent people can get from point A to point B quickly, but results are disastrous if the wrong move is made. Intelligence traps are varied, some of which include:

- *Bias blind spot*: the ability to point out the flaws of other people, while being inept at reflecting upon one's own intellectual limitations
- *Contaminated mindware*: having a foundational knowledge that leads to counterproductive behavior, such as preferring pseudo-scientific remedies over medical treatments based on scientific evidence
- *Earned dogmatism*: the idea that we have acquired enough expertise that we have the right to close our minds off to other viewpoints

- *Functional stupidity*: the tendency to avoid self-reflection, questioning preconceptions, and having the foresight of the ramifications of our actions
- *Motivated reasoning*: the habit of applying one's intellectual energy toward conclusions that only support a preconceived objective
- *Pseudo-profound bullshit*: seemingly credible statements that appear true but are hollow when critically examined

Humans too often default to trusting the word of strangers and the credibility of media they consume; even the Central Intelligence Agency (CIA) struggles with identifying counterspies within its own organization (Gladwell, 2019). When things go awry, rather than blame strangers, people ought to "accept the limits of our ability to decipher strangers" and inform ourselves as much as possible (p. 343). Adaptation requires the ability to separate truth from nonsense and avoid mistaking one for the other. Adapting from the inside out enables citizens to better understand a rapidly changing world.

## Think in Systems

Another human-environment capability is thinking in systems—not just social systems, but how humans interact with the surrounding world at various scales (Pawson, 2015). Systems thinking helps students recognize that the planet is more than the sum of its parts, and that it functions in complex ways through stocks and flows; feedback loops; shifting dominance, delays, and oscillations; constraints; resilience, self-organization, and hierarchy; and nonlinear surprises (Meadows, 2008). Mastering systems knowledge means students will "have to be able to learn from—while not being limited by—economists and chemists and psychologists and theologians" (Meadows, 2008, p. 183). Geographers have confirmed that powerful thinking depends on teachers and students practicing "the art of moving between and combining types of knowledge continuously in their dialogue" (Béneker and van der Vaart, 2020, p. 4). While adapting from the inside-out involves distinguishing between evidence and opinion, systems thinking entails piecing relevant disciplinary knowledge together to form a larger and complex picture, like seeing Gaia through the forest (Lovelock, 2019).

Models for moving forward like the Oberlin Project offer bottom-up opportunities to develop powerful geographic knowledge in higher education. Founded by David Orr (2016), the Oberlin Project represents a joint university-community collaboration to advance a more sustainable local future. Among its many purposes, the Oberlin Project acts as "an educational experiment that engages students in the design and development of a model of integrated sustainability that pertains to virtually every department and discipline" (Orr,

2016, p. 229). This model has been developed in response to the costly problems of "bureaucratic fragmentation" by incorporating "systems-based knowledge and extending the time horizon by which we judge our successes and failures" (p. 224). Clearly, aspects of an effort to develop local resilience can be part of the curriculum at K-12 levels. Systems thinking has implications for both powerful disciplinary knowledge and the production of that knowledge where geography teachers contribute to integrated curriculum efforts.

## Adopt a Sense of Timefulness

Going beyond space and place, powerful geographic knowledge necessitates an intimate understanding of change through time (Pawson, 2015). More than that, students must expand their "time horizons" to consider how systems are altered in the long- and short-terms (Meadows, 2008, p. 182). One capability is timefulness, which represents "an acute consciousness of how the world is made by—indeed, made of—time" (Bjornerud, 2018, p. 5). Speaking from the perspective of a geologist, Bjornerud (p. 178) argued:

> an attitude of timefulness could transform our relationships with nature, our fellow humans, and ourselves. Recognizing that our personal and cultural stories have always been embedded in larger, longer—and still elapsing—Earth stories might save us from environmental hubris.

Timefulness encapsulates human potential to stimulate the act of *remembering*, which philosopher Merleau-Ponty ([1945] 2012, p. 23) described as "to plunge into the horizon of the past and gradually to unfold tightly packed perspectives until the experiences that it summarizes are as if lived anew in their own temporal place." If the present day is an ark, then the past is a deep, unruly, anarchic ocean of human-environment ideas and events that drive us in different directions (Cohen, 2017). Comprehending global environmental change "is indispensable as part of the basis for guiding future environmental management" (Dickinson, 2000, p. 483). Timefulness can contribute toward the act of *upstream thinking*, solving problems before they occur (Heath, 2020).

One bottom-up way of cultivating timefulness is to encourage students to develop an environmental history of their town and use that knowledge to propose resilient and upstream solutions for local governments. Knowledge produced can be conveyed through a variety of ways, such as museum exhibits developed by students (Stine, 2002). Historian Michael Lewis (2004) challenged university students to participate in writing a book on the history of human-environment relations along Maryland's Wicomico River. Lewis (p. 607)

explained how the river's site and situation—a short walk from campus—were ideal for stimulating students' agency and curiosity within the community:

> It is intimately tied to the local economy, and the Salisbury port is the second largest in Maryland in terms of tons of materials received and shipped (following Baltimore, but ahead of cities such as Annapolis). The river has a long history of human use, from the Wicomicos who gave the river its name, to the English settlers who established Salisbury in the 1740s, to the farmers and timber barons who used the river to ship goods to Baltimore and beyond in the nineteenth and twentieth centuries. It has seen resource overuse, as its once vibrant fishery has been decimated in recent decades.

Pursuing timefulness and powerful human-environment knowledge calls on teachers to take a critical look at community decision-making through time and encourage students to follow suit. Geography students can further enhance this localized approach by integrating changes happening at the global level (Wilbanks and Kates, 1999).

## Powerful Knowledge in the Age of Humans

Powerful geographic knowledge benefits from an emphasis on the human-environment identity. Not only does geography serve to integrate academic disciplines, it also equips students with the capabilities to adapt from the inside-out, think in systems, and adopt a sense of timefulness. Like professional geographers, students are producers of planetary knowledge, and that capability enables equal proportions of power and responsibility (see Lehman, 2020). Further inquisition may yield new ideas—such as an Age of Reckless Humans, the Age of Irresponsible Humans, an Age of Feckless Humans, or the Age of GeoEngineering—suggesting that an Anthropocene, or Age of Humans, is perhaps too neutral to characterize the enduring environmental emergency faced by society (Alley, 2011; Orr, 2016).

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