

Interconnectedness and the web of accountabilities: Humboldtian approaches to social and environmental accounting

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1529

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Abstract

Purpose – Current accounting practice tends to split environmental complexities into quantifiable, codified elements, producing codified simplifications of the “complex” in pursuit of environmental externalities. This has led to standardization, but has done little to motivate organizations to engage in more environmentally-aware behavior that transcends the coercive dimensions of codification. The work of Alexander von Humboldt (1769–1859) can bring new insights and perspectives to social and environmental accounting (SEA). In discussing Humboldt’s philosophy of understanding the interconnectedness between people, their contexts (cultures) and their environment, the authors contribute to the emerging SEA literature on notions of interconnectedness and the web of accountabilities. The authors also explore how a Humboldtian approach may help break through the current epistemological boundaries of SEA by combining accurate measurement with imagery to make the “complex” manageable whilst embracing interconnectedness and hermeneutics.

Design/methodology/approach – In this conceptual paper, the authors humbly draw on Humboldt’s legacy and explore the underlying philosophical assumptions of Humboldtian science. The authors then contrast these with current SEA approaches in the literature and derive new insights into their intentionality and practical use.

Findings – Re-examining Humboldt’s pioneering work enables us to pinpoint what might be missing from current SEA approaches and debates. Humboldt upheld an “ethics of precision,” which included both measurement accuracy and qualitative relevance, and combined hands-on scientific fieldwork with the aesthetic ideals and interconnectedness of the age of Romanticism. Drawing on Humboldtian science, the authors propose focusing on the interconnectedness of nature and humanity, embracing the qualitative and hermeneutical and including aesthetics and emotion in environmental visualizations.

Originality/value – The paper elucidates why and how Humboldtian science might inform, guide and enhance the emancipatory potential of SEA in the 21st century. Specifically, the authors discuss Humboldt’s approach of linking accurate measurement with imagery to convey a sense of interconnectedness.

Keywords Social and environmental accounting (SEA), Historical accounting research, Humboldt, Interconnectedness, Accountability

Paper type Conceptual paper

1. Introduction

Environmentalists, ecologists and nature writers today remain firmly rooted in Humboldt’s vision although many have never heard of him. Nonetheless, Humboldt is their founding father (Wulf, 2015, p. 7).

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In this conceptual paper, we (re)examine the underlying philosophy of the work of Alexander von Humboldt (1769–1859), a founding figure in environmental accounting and reporting, to learn what perspectives his work might offer for current social and environmental accounting (SEA) theory and practice. In doing so, we seek to “use history to understand and inform today’s and tomorrow’s decisions about policy and practice” (Parker, 2015, p. 153). Accordingly, our focus is on how Humboldtian science might potentially inform, guide and enhance the emancipatory potential of SEA in the twenty-first century.

Historical approaches to SEA research are not new, as evidenced by Parker (2015, 2019) and by Atkins and McBride’s (2021) problematization of SEA intentionality based on John Evelyn’s seventeenth-century accounts of London’s “Fumifugium.” This paper follows an established tradition (e.g., Larrinaga and Bebbington, 2021) of revisiting the early 1990s and discussing the influence of “epistemic communities,” or networks of scientists and experts, who engage with organizations and regulators to generate new ideas about social and environmental responsibility and reporting (see also Bebbington *et al.*, 2021).

German naturalist and explorer, Alexander von Humboldt was one of the most celebrated scientists of his time and part of one of the most influential epistemic communities for the environmental sciences. On the 100th anniversary of his birth and 10th anniversary of his death in 1869, tens of thousands congregated in Central Park, New York City for the presentation of a new bust commemorating his legacy. Posters of Humboldt adorned the streets of Manhattan, and various important people of the day gave speeches praising his accomplishments. Similar ceremonies were held around the world, including in his birthplace, Berlin, where 80,000 people attended a memorial in his honor (Scientific American, 1870; Wulf, 2015).

Today, as Wulf (2015) notes in her biography of Humboldt, over 250 years since his birth, his scientific achievements endure, hidden in plain sight in the names of geographical features, from glaciers and mountain ranges in Greenland and Antarctica to the entire state of Nevada, which was almost named “Humboldt.” Over 400 plants and animals are also named in homage to him (Wulf, 2015). Humboldt’s ideas and scientific approaches were groundbreaking in his time and, as we shall discuss, may provide new perspectives on SEA today. In 2021, his work experienced a revival, as demonstrated by the Smithsonian American Art Museum’s curation of an exhibition on his unique perspective and far-reaching influence (<https://americanart.si.edu/exhibitions/humboldt>). A major contribution to the scientific community and the world at large was his recognition of the whole planet’s “web of interconnectedness,” including human societies, geography and the natural world (Meinhardt, 2019). This notion of a web connects well with Gallhofer’s (2018) debate on the “web of accountabilities” in SEA, and we propose that such an elevated understanding of interconnectedness is overdue (see also Parker, 2014 on social accountability).

Cuckston (2017) argues that the social and the natural are intertwined in social-ecological systems through complex relationships between human and non-human entities; yet far too often, accounting brings visibility to particular things in particular ways, while simultaneously keeping other things hidden (p. 1538). We agree with Cuckston’s argument that when we truly recognize our natural resources and become more aware of our “web” of interconnectedness with nature, organizations will be encouraged to employ notions of stewardship. However, much work is needed to delve below the “superficial,” as corporate environmental reporting discourse tends to embrace a dualistic (Gallhofer, 2018) rather than interconnected approach to nature. This legitimizes companies’ perceived “separateness” from the natural world (Morrison, 2020) and leads to accusations of “greenwashing.” Such separateness counters and de-legitimizes notions and inscriptions of accountability and thus companies’ agency and hinders the much-desired performativity of SEA devices toward transformative change.

Following these debates, we argue that revisiting Humboldtian science allows us to take a more fine-grained and potentially critical look at the philosophical underpinnings of SEA in reflection. Similarly to Cuckston, Humboldt embraces territory (outside and inside), scale (through his representations of reality) and the interconnected notion of entities that collectively acquire new capacities—and thus new agency—to act upon the world (Cuckston, 2017, p. 1547). His work invites us to reconsider the notion of place in SEA, as relational, provisional and emergent rather than static and stable. This would enable exploration of place as a kind of lived experience, allowing us to relate to and drive our agency to sustain the environment. Lehman (2017, p. 31) echoes this sentiment about lived experience and argues for a broader accounting agenda that considers the environment in terms of its “beauty” and “intrinsic value,” rather than its “economic and instrumental value.” As Hines (1991, p. 29) comments:

It seems to me, the best thing I can do for nature, as a person who is an expert in financial accounting—speak, and thus its limitations, is to speak my love of nature; to call attention to the limitations of the planetary-wide financial accounting language and to make an issue of refusing to speak of nature in this language of numbers.

Our history- and philosophy-driven accounting paper also connects well with Russell *et al.*'s (2017) agenda for “accounts of nature and the nature of accounts.” We concur with their view of motivations for SEA research lying in strong normative aspirations to realize ecological sustainability and social justice, a notion dear to Humboldt that he strived to achieve all his life. Revisiting Humboldt's philosophy in this paper thus has the potential not only to offer alternative accounts to the sustainability debate through analysis and focus on his “epistemology of interconnectedness,” but also to present ways of engaging and acknowledging multiple stakeholders in a “web of accountabilities,” to overcome stifling inertia in theory and practice relating to the desired social and ecological transformation of our economy.

Having established the significance of Humboldt for revisiting SEA, in Section 2, we identify and connect with a stream of SEA literature that is revitalizing what accounting can and should be in terms of practical societal relevance. In Section 3, we move to more specific discussion of the ideas behind Humboldtian science and their relevance to SEA. In Section 4 we discuss how and why these ideas might inform, guide and enrich debate in the twenty-first century by combining rationality with emotion, leading to much-desired motivation and action. We do so by calling for interconnectedness between people, their contexts (cultures) and their environment, embracing the qualitative and hermeneutical in Humboldtian visualizations. Finally, we summarize our reflections in three propositions and discuss and further illustrate their implications for SEA theory and practice by looking at the affordances of such visualizations (see Evans *et al.*, 2017, p. 36).

2. Connecting with interconnectedness: a literature review

In this review, we revisit a strand of literature focusing on innovative ontological and epistemological considerations in SEA and more particularly on interconnectedness between humans and nature. We connect with and contribute to this strand and its discourse with this reflection piece on Humboldtian science.

What must be avoided in the future is the myopic, isolated and colorless concentration on descriptive studies of social accounting practices . . . which has dominated research over the last 20 years (Gray and Laughlin, 2012, p. 241).

A fruitful avenue for furthering SEA scholarship is engagement with the Anthropocene debate (Bebbington *et al.*, 2020a), which centers around the idea that human activity has been the major influence on the environment. Bebbington *et al.* (2020a, p. 159) argue that “accounting is one domain in which this can be pursued,” and that “accounting has yet to

develop a stream of work that is motivated directly by the Anthropocene.” Studies of this nature have the potential to enrich the SEA debate by accounting for human activity, which has received very little attention in this domain. The work of an influential group of pace-setting accounting scholars connects closely with these calls. For example, [Larrinaga and Bebbington \(2021\)](#) adopt a constructivist reading of sustainability reporting, [Bebbington et al. \(2020a\)](#) investigate accounting and accountability in the Anthropocene, [Adams and Larrinaga \(2019\)](#) speak of the necessity to engage with organizations to improve sustainability performance, and [Bebbington and Unerman \(2018\)](#) examine how accounting research might help to achieve the United Nation (UN)’s Sustainable Development Goals.

[Bebbington and Larrinaga-Gonzalez \(2008\)](#); later revisited by [Bebbington et al., 2021](#) propose adopting different theoretical perspectives to examine SEA issues. They suggest that much previous research has primarily used legitimacy theory ([Lindblom, 1993](#); [Suchman, 1995](#); see also [O’Dwyer, 2002](#); [Contrafatto, 2014](#); [O’Dwyer et al., 2011](#)) and call for use of other theories to enhance our understanding of social accounting. According to [Phiri et al. \(2019, p. 28\)](#), “Legitimacy theory, for example, is criticised for its inability to explain why, despite the increasing social and environmental impact of corporate activities on nature and society, companies continue to carry out these activities unchallenged.” [Bebbington et al. \(2017\)](#) propose alternatives to the conventional cost-benefit decision models used in sustainable decision-making. They argue that what is needed are “sustainability assessment models [which] are based on an inter-disciplinary approach that recognizes the need for ‘accountings’ that facilitate more participatory forms of decision-making” (p. 224). A closely connected current stream of SEA research is already shifting views on how the practice and role of accounting might contribute to systematic sustainable change. We identify ourselves as being part of this somewhat alternative accounting discourse, and in the next few paragraphs, we acknowledge the episteme on which we build.

In her eco-feminist critique of the Western dualism of humans and nature, [Gallhofer \(2018, p. 2110\)](#) appears to refer to these seeds of change in SEA in arguing that there is “an indication of an emerging global rethinking in terms of how we—humans—interrelate with the non-human world (commonly referred to as the environment or nature).” We connect with [Gallhofer’s \(2018, p. 2126\)](#) call for more research “that investigates the emancipatory possibilities of alternative accounts in terms of their design and production processes and their content and form.” Relatedly, [Tregidga et al. \(2018\)](#) call for “multiple voices” to be heard through the use of discourse analysis, which might produce more critical and reflective analysis in the sustainability debate. [Morrison and Lowe \(2021, p. 820\)](#) conclude that what is needed is a “polyphonic” version of events, and that one way to facilitate this might be through qualitative, contextualized storytelling that acknowledges and brings together the voices of multiple stakeholders.

[Morrison et al. \(2022\)](#) also find that “quantifying nature constructs a metaphorical distance between the company and the natural world which erodes the sense of connection associated with an authentic care for nature.” Overcoming this distance can be seen as a prerequisite for achieving true accountability. As previously argued, corporate environmental discourse all too often emphasizes transcendence, separateness from nature and emotional distance from stakeholders ([Morrison, 2020](#)). [Morrison et al. \(2016, p. 903\)](#) examine how environmental reports are often grounded in “utilitarianism and deontology,” in contrast to the “virtue ethics approach” often expressed by external stakeholders. In their view, this signals failure to meet a primary purpose of preparing sustainability reports—to engage with stakeholders. They emphasize the need for communication and call for further research on how SEA information is communicated, compared with how it is perceived by stakeholders.

This again connects well with [Gallhofer’s \(2018, p. 2120\)](#) reference to the notion of the “web of accountabilities.” She states that “in any attempt to unravel and depict the web of accountabilities a corporation is embedded in, difference within individual elements . . . has to

be an integral part of analysis and communication” (p. 2120). In a similar vein, [Cuckston \(2017\)](#), who examines biodiversity, contends that the social and natural are intertwined in social-ecological systems through complex relationships between humans and non-humans that are perpetually produced and reproduced, rather than being dualistic and static. Recognizing and including nature as an important stakeholder in SEA seems highly important, as the role of accounting in arguing, evaluating, shaping and reshaping organizational sustainability has become apparent ([Thomson et al., 2014](#)). As [Quattrone \(2021, p. 547\)](#) concludes, “Measurement and transparency need to happen in communication exercises, which do not presuppose what needs to be made transparent once and for good but define procedures on how to make fragmented, complex, multiple and volatile notions of value transparent.”

These ontological considerations are also reflected in novel epistemological and methodological approaches in the SEA literature. For example, [Atkins et al.’s \(2015\)](#) study is ground-breaking on many levels. Their self-proclaimed purpose “is to attempt to provide a ray of hope, in the form of a Morris style utopian dream of a sustainable world, as a basis for new forms of accounting and accountability in contemporary society” (p. 651). They argue that adopting an auto-ethnographic approach in conjunction with storytelling enables identification of the limitations of current sustainability projects. This little-used method in the discipline of accounting has the potential to enrich the stories of those involved in the process of reporting and sustainability projects. These ideas might be extended to employ a more transdisciplinary approach to explore the notion of “being” ([Beck and Lehman, 2014](#)). According to [Beck and Lehman \(2014, p. 293\)](#), “The idea is that Being in a place grounds the openness of the world, the heterogeneous space of meaning wherein what there is belongs together within a unity of sense.”

Similarly, [Bebbington et al. \(2017\)](#) provide a highly personal, reflective account of how they have engaged with ideas of sustainable development. Through “appreciative enquiry,” they articulate their own unique, personal “model of change” for their agency (p. 23). They argue that:

Public participation blurs the boundary between the expert and the lay individual recognizing everyone’s gifts, skills and capacity for exploring, analysis, collection of facts and stories and finding ways of representing critical aspects of our existential realities and feasible alternative ways of being ([Bebbington et al., 2017, p. 32](#)).

This may assist in developing individual accountability. The idea of “being” is also connected with the abovementioned notion of a transdisciplinary project for accounting, to which [Bebbington et al. \(2017\)](#) appear to be alluding. [Lehman \(2017\)](#) further argues that the accounting agenda must be broadened in order to fully emancipate accounting and social and environmental research widened to encompass the intrinsic value of beauty and nature. He proposes a narrative of beauty and truth based on the work of [Gadamer et al. \(1975a, b\)](#). This might emancipate accounting from its codified discourse and open up a world of possibilities motivated by the Anthropocene, offering accounts of the impacts of human activity on the environment. This is also reflected in [Byrch et al.’s \(2015, p. 671\)](#) call for a “dialogic accounting that would account for the plurality of perspectives.”

In summary, in much of current SEA practice, the real points of environmental abuse and human-made climate change appear to have been lost, with silence on what lies at the heart of the issue. This silence applies largely to cognitive and emotional perspectives and is manifested in lack of complementarity between the quantitative and the qualitative. From the cognitive perspective, the extant literature exhibits a preoccupation with trying to “account” for the numbers of SEA using some form of reasoned judgment, communicated through language and numbers. The emotional perspective appeals to values rather than actions and fails to acknowledge the interconnectivity of the world and humanity across continents.

Thus, in current debate, what we see emerging, despite some excellent research as previously mentioned, are lack of real emotion and failure to address the interconnectivity of environments and societies around the globe. We argue that neither a quantitative nor a qualitative approach alone will be sufficient to fully comprehend these complexities and interconnectedness, nor enable related SEA devices to provide affordances towards transforming sustainability.

We claim that nature, in a sense that of course includes all living creatures (see [Vinnari and Vinnari, 2022](#)), is a fundamental stakeholder and needs to be truly brought back into the SEA debate, because our “flight from nature” has meant that we have become detached from the “web of interconnectedness,” and have forgotten to acknowledge our “being” in nature. Therefore, we argue for the necessity to move towards giving an “account of nature and nature of account” ([Russell et al., 2017](#)). According to [Gadamer et al. \(1975a, b\)](#), the necessary conditions may now be in place for real change and for accounting research to acknowledge the importance of nature and our being in the world. Therefore, to further the SEA debate, it is necessary to move beyond merely “counting” and “recording” items, to exploring and adopting perspectives that respect other cultural traditions and establish a web of accountability. Based on these insights, we propose that the SEA debate might benefit from the historical insights offered by Humboldt’s philosophy and his rich legacy of beautiful infographics. These might advance and refresh the discussion and provide perspectives and possibilities to help overcome some current limitations on the path towards a systemic transformation of sustainability. In particular, we show that Humboldt provides excellent examples of how to link accurate measurement with imagery to convey a sense of interconnectedness, which evokes emotion, and hence leads to motivation and action.

3. Humboldtian science and its meaning for SEA

Humboldt established the first environmental research institute and pioneered the field of environmental accounting. He has also been credited with introducing the term “ecology” to the scientific community ([Egerton, 2009](#)). Born in 1769, he graduated from medicine and moved to the University of Göttingen, where he studied under renowned natural scientist, Georg Förster. During this time he developed a lifelong interest in botany and geology. He also met Aimé Bonpland, a French botanist, who would become his lifelong friend and scientific collaborator.

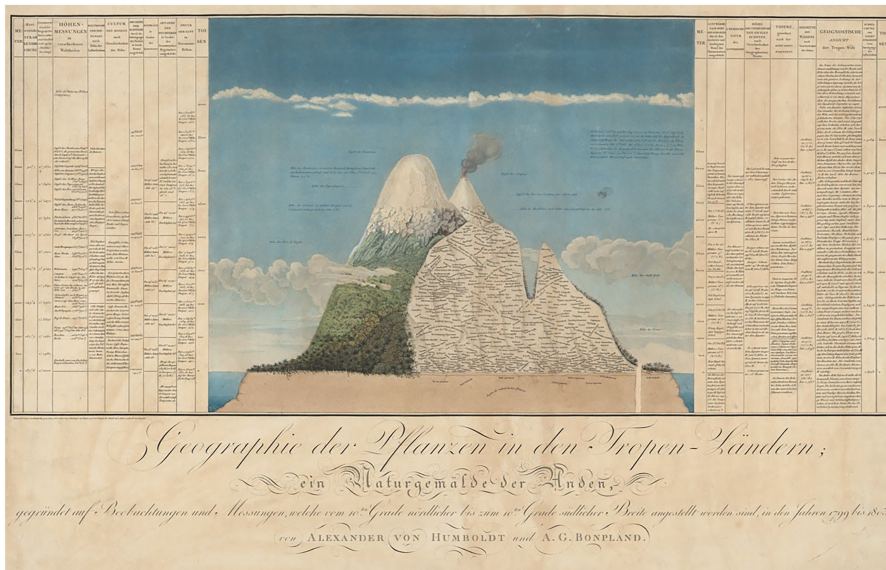
In 1790, Humboldt and Bonpland embarked on a five-year scientific expedition to South America. The pair traveled to Venezuela, where they made extensive observations of the natural world. They also collected over 60,000 plant specimens, which Humboldt later used to produce one of the first comprehensive descriptions of the South American ecosystem. After returning to Europe, between 1799 and 1804 he published his findings in a series of books, including *Personal Narrative of Travels to the Equinoctial Regions of America*, earning him international acclaim. In 1805, he was appointed Prussian minister of mines, a position he held until 1808. He used this position to establish and help found the Prussian Academy of Sciences. In 1829, he published his magnum opus, *Kosmos: Entwurf einer physischen Weltbeschreibung* (Cosmos: A Sketch of a Physical Description of the Universe), which was a sweeping attempt to describe the natural world and the universe as a whole. It was widely read and helped to establish Humboldt as a preeminent scientist of his time. He died in Berlin at the age of 89 on May 6, 1859, and is remembered as one of the most influential scientists of the nineteenth century (see [Eibach and Nehrlich, 2019](#); [Biermann et al., 1983](#)).

Humboldt was a stickler for measurements. Infamous for the dozen mules required to carry his measuring instruments on expeditions, his main goal was always to explain the physical relationships he observed in his immediate environment. On one journey, a strenuous climb up Chimborazo, he took timers, barometers, thermometers, telescopes, sextants, compasses,

magnetometers and even a cyanometer, which he used to measure the blueness of the sky. Humboldt and his traveling companion Bonpland measured, described and, where possible, sketched everything they encountered (Wulf, 2015). This thorough and holistic approach to data collection produced a huge amount of data relating to historical facts, geology, botany and the blueness of the sky, as well as insights into the indigenous people and their mores, all of which he innovatively combined and visualized in order to facilitate discovery of patterns (Anon, 2019; Wulf, 2015). Humboldt was, therefore, one of the earliest creators of what is now termed “infographics” in the “visual turn” of accounting (Quattrone, 2021). He often mapped out data in order to make sense of it, following the ideas and graphs of William Playfair (Costigan-Eaves and Macdonald-Ross, 1990). Indeed, the opening quotation of our paper indicates Humboldt’s fascination with how visual arrangements of data can reveal the complex relations found in nature (Wulf, 2015).

Humboldt’s *Naturgemälde* can be seen as among the first historical examples of an infographic (see Figure 1). It presents an impressive amount of information about the plant species, altitude and topography of South American volcanoes, displayed to emphasize relationships between plants and environmental characteristics (Bonpland and Humboldt, 1805; Magee, 2019). Both elegant and informative and thus appealing to aesthetics, at the sides of this illustration he presents raw scientific evidence pertaining to temperature, humidity and soil, at heights matching relevant details in the drawing. Humboldt himself was relatively uninterested in taxonomy and identifying new species, in which Darwin, who was strongly influenced by Humboldt, would later be engaged. Bonpland recorded the vast majority of plant descriptions in the first of their seven botanical journals (Lack *et al.*, 2009). This is not to say that plants were unimportant in Humboldt’s worldview; rather, he was more concerned with how the environment influenced plants’ ability to live in a specific habitats:

Rather than discovering new, isolated facts I preferred linking already known ones together. The discovery of a new species seemed to me far less interesting than an observation on the geographical



Source(s): Wikimedia Commons

Figure 1.
Alexander von Humboldt's *Naturgemälde* (1807)

relations of plants, or the migration of social plants, and the heights that different plants reach on the peaks of the cordilleras (Humboldt and Bonpland, 1852, p. X).

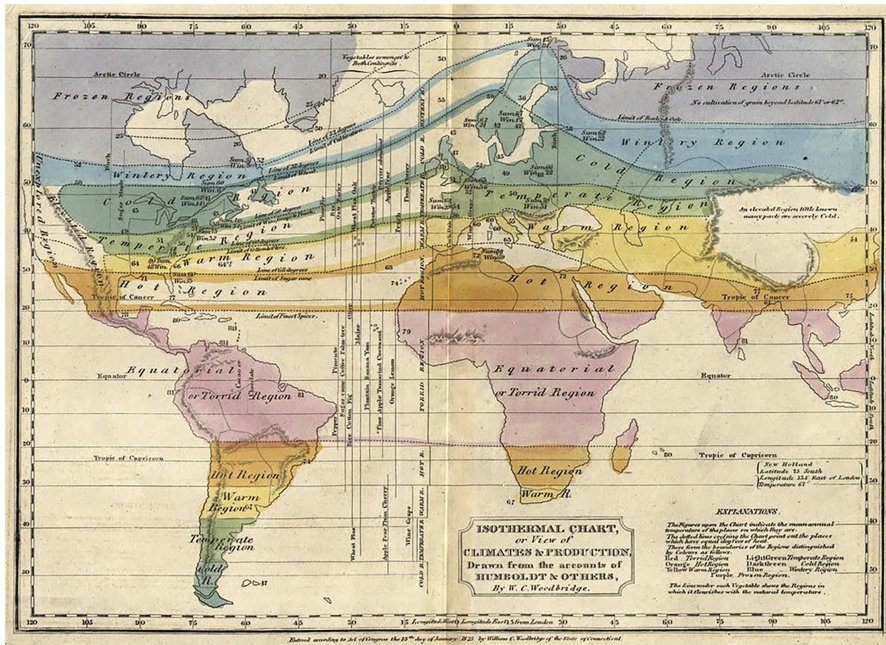
Humboldt's approach to interconnectedness makes a complex ecosystem understandable to a range of audiences and allows switching between aesthetically pleasing, abstract depictions and detailed measures (Jackson, 2009). (Links to high-resolution graphics are given in the Appendix; for a complete, printed collection of his beautiful illustrations, see Lubrich, 2014).

On an interesting side note, in 1824, Humboldt presented an infographic similar to the *Naturgemälde*, in which he changed the altitudes of some of the plants. Moret *et al.* (2019) have re-examined these photos and compared the plants in the schematics with the specimens collected by Humboldt and Bonpland. They have discovered that the majority of Humboldt's primary data above the forest line were actually based on Mount Antisana and not the original volcano. Moret *et al.* (2019) traveled to the collection location and discovered that the tree line has shifted roughly 250 meters in the last 200 years. This is an intriguing investigation into how old data can shed light on current environmental challenges and also on how data were extracted and used in the past. For a more fine-grained examination and critical appraisal of Humboldt as a person and varying receptions during his lifetime, we suggest reading Rupke (2008), who looks at different manifestations of Humboldt's personality in Germany to gain an understanding of him in the context of his political environment.

Looking deeper at the origins of Humboldtian science, we can identify two streams of thought that were merged and forged in the mind of this brilliant scientist by the experiences of and reflections on his journeys. One stream that was almost perfected by Humboldt was the late eighteenth- and early nineteenth-century focus on formal rationalism, which brought, as Buttner (2001) elaborates, "A new insistence on the accuracy of all instruments and all observations," "A new mental sophistication, expressed as skepticism for past theories," "A new set of conceptual tools: isomaps, graphs, theory of errors," and "Application of these tools to a wide variety of real phenomena, seeking laws concerning interrelationships of the physical, the biological, and even the human." The second stream was based on the thought of Goethe, whom Humboldt met in 1774, and perhaps Schiller's ways of experiencing nature as a whole in the Romantic traditions of "Gegenständlichkeit" (an object can only be elucidated in context), "Urphänomen" (need to narrate cause and effects) and "Metamorphosis," with a focus on the becoming of both subject and researcher (Buttner, 2001). This connects well with our notions of interconnectedness and hermeneutics, which we propose as timely and apt epistemologies to drive forward SEA.

Goethe's science exposed subjective components of experiences of nature, highlighting the importance of aesthetic and emotional dimensions in human understandings of nature, ways of living and humanity's relationships with the environment. Goethe had previously also described nature holistically as "Every one thing exists for the sake of all things and for the sake of one" (Naydler, 1996, p. 60), a concept on which Humboldt clearly drew in his own work. Both regarded nature as a unity, despite its apparently chaotic variety. As a result, Humboldt's *Naturgemälde* was ground-breaking in its visual depiction of complicated connections. Even the text and font used can be seen as contributing to an expressive language, a point to which we refer in connection with Lehman (section 4.3). Tellingly, having been presented with *Naturgemälde*, Goethe was full of praise for Humboldt, in stark contrast to his previously critical position on the shallow measurements of science.

Many of Humboldt's other visual representations of data in the style of his *Naturgemälde* have been equally influential, such as his diagram of global isotherms, which gave rise to the contemporary discipline of climatology (Humboldt *et al.*, 1849a, 1871, 1893). Using a table of global mean temperatures (see Figure 2), Humboldt took the simple yet, for the time, revolutionary step of plotting them against latitude and longitude, noting the locations of



Source(s): Wikimedia Commons

Figure 2.
Carte des lignes
isothermes [Map of
isothermal lines]
(Woodbridge, 1823,
based on data from
Humboldt)

important cities. This graphic enabled those using it to quickly see basic differences in climate, through easily comprehensible use of color and just the right amount of aesthetically pleasing abstraction, without losing too much detail. Humboldt also understood the power of visualizing data to advance scientific knowledge. As he noted to himself, “if instead of geographic charts, we only possessed tables covering latitude, longitude, and altitude, a great number of curious connections that continents manifest in their forms and the surface inequalities would have stayed forever lost” (Humboldt, 1817, p. 299, translated from French by the authors; see also Miller, 2019). Accordingly, the importance of connecting different data to identify curious connections, including those of a qualitative nature, was another guiding principle (Anthony, 2018).

This is exemplified in how he recorded lists of measurements based on his trans-areal and trans-disciplinary ideas of science. Rather than creating static taxonomies, his lists often referred to natural entities, allowing space to record their developments from various sources. Humboldt bridged the divide between the “old” and “new” worlds by researching across territorial boundaries and examining their interconnectedness. His records highlight scientific research as a truly itinerant activity that is never finished or perfect. Humboldt’s lists are often purposely contradictory because they are frequently joined into tables to illustrate the multi-relationality and paradoxes of natural existence (Ette, 2022).

Humboldt was also a forerunner of current environmental science, in that he was one of the first to propose the idea of human-induced climate change (Wulf, 2015). Although the concept of greenhouse gas emissions causing temperature rises was unknown at that time, he observed how large-scale deforestation due to mining operations in the Spanish colonies led to soil erosion and droughts. Furthermore, he immediately went on to discuss the potential impact on the local population. Thus, he demonstrated that human actions were modifying

the environment in ways detrimental to sustaining life, long before this link was widely accepted.

Humboldt's continued relevance today is due not only to his pioneering work but also to the prestige he built by promoting his own work and the fundamental ideas behind it to a wide variety of audiences through his visualizations, which have timeless appeal (see [Figure 3](#)). The utility of his early infographics attests to the effectiveness and timelessness of good visualizations, impacting on research centuries later and continually improving our understanding of the world. Other great figures were later inspired by Humboldt, such as German biologist Ernst Haeckel, who developed the discipline of ecology by examining organisms' relationships with their environment (see [Haeckel, 1866](#), p. 149). Haeckel's drawings, which follow a Humboldtian tradition, focus on abstract geometric patterns found in nature, merging form aesthetics with biology. Through this focus on patterns that repeat and form readily accessible mental representations, the viewer's cognitive load whilst deciphering the information in these drawings is greatly reduced, leaving more room for interpretation.

Haeckel's work also attracted global attention following its inclusion in the introduction to the first edition of [Humboldt's \(1849b\) *Cosmos*](#). *Cosmos* was so successful that it was quickly translated into other languages and distributed and reprinted throughout Europe and North America. The introduction explained Humboldt's view of nature as a connected, living whole and climate as an interaction between land, ocean and atmosphere ([Meinhardt, 2019](#)). Humboldt depicted the "breath of life" not as divine, but as earthly and central to all living beings (see [Figures 4 and 5](#)). As can be seen in his *Naturgemälde* (see [Figure 1](#)) and throughout his environmental accounts, Humboldt naturally considered the land use of local populations alongside environmental information, thus already demonstrating the closely interlinked nature of people and climate. This is also well reflected in the late work of [Bunkse \(2007\)](#), in which he reflects on "feeling is believing" on the subject of landscapes by revisiting the work of Humboldt and others.

Close examination of the aesthetics and content of [Figures 4 and 5](#) confirms that "Humboldt effortlessly combined a commitment to empiricism and the experimental elucidation of the laws of nature with an equally strong commitment to holism and to a view of nature which was intended to be aesthetically and spiritually satisfactory" ([Nicolson, 1987](#), p. 180). This combination, which evokes both symbolic (evoking mental representations) and form aesthetics (for a deeper discussion of these types, see [Santayana, 1896](#)), leads to better cognition of potential links and interconnections in the data. In addition, the third type, sensory aesthetics (based on the individual, spiritual), leads to an emotional and motivational

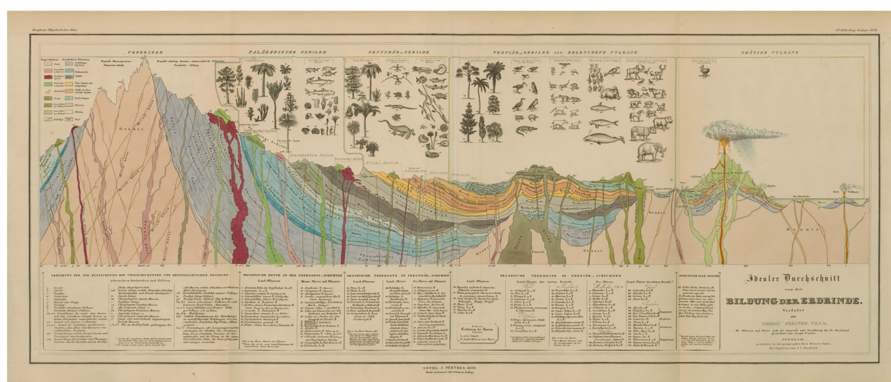
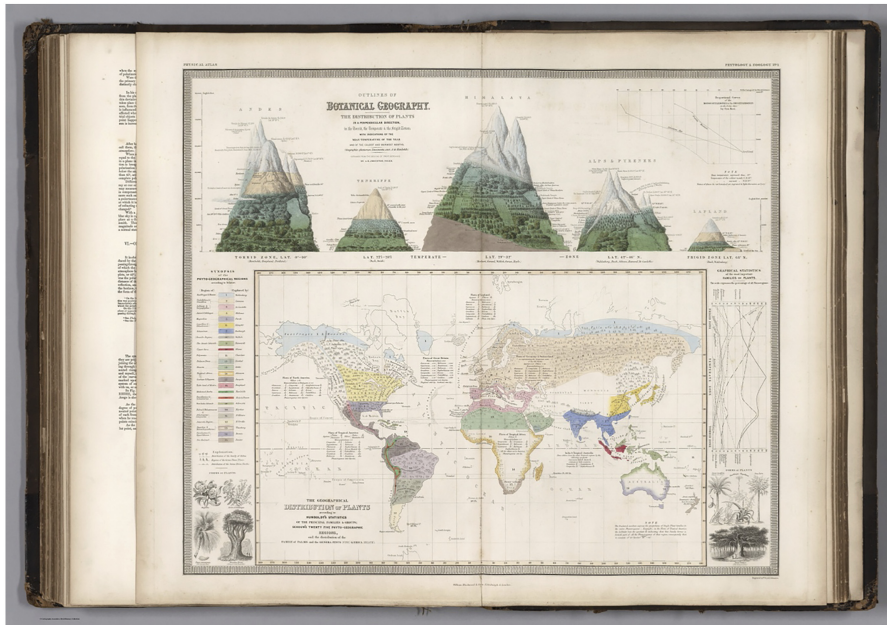


Figure 3.
Diagram of a cross-
section of the
Earth's crust

Source(s): Wikimedia Commons Humboldt, 1850, in Berghaus, 1852



Source(s): David Rumsey Foundation

Figure 4.
Distribution of plants
in a perpendicular
direction (Humboldt
et al., 1850)

response. These three types of aesthetics, together with scientifically robust data from various sources in Humboldt's *Naturgemälde* (and its later derivatives), create a visual accounting device that brings not only high legitimacy, but also numerous strong affordances (Nicolson, 1987), as we discuss in the next sections.

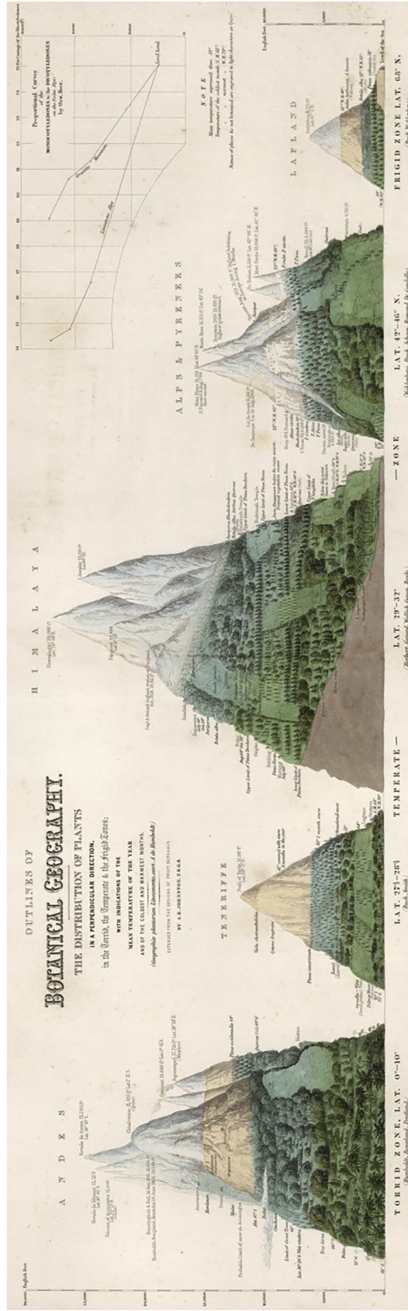
Having discussed Humboldt's legacy, we now turn to considering what else can be learned from Humboldt's scientific method and styles of presentation, by re-connecting with our previous critique of the assumptions and targets of current environmental accounting theory.

4. Discussion: what can be learned from revisiting humboldtian science?

4.1 Toward a holistic turn in SEA

We are strongly convinced that the field needs to expand its "sociological imagination" (Mills, 1959) by offering new visions and suggesting future lines of inquiry. Consequently, we embrace a historical perspective by revisiting the Humboldtian tradition to identify some of these new visions. To summarize our insights and derived suggestions, we make three propositions as food for thought and reflections on SEA theory and practice. With these, we show that Humboldt provides excellent examples of how to link accurate measurement with imagery to convey a sense of interconnectedness, leading to motivation and subsequent action. We are also struck by the fact that Humboldtian science calls for respect for other cultural traditions in scientific inquiries—a truly timely issue.

In his work, Humboldt suggests embracing all types of aesthetics (symbolic, form, and sensory) in visualization and communication, to improve cognition and understanding, and motivate behavioral change. This holistic turn, detailed below in three focused propositions, may help overcome some of the aforementioned fundamental dysfunctionalities of SEA research and practice by challenging their predominant assumptions. For example, the



Source(s): Wikimedia Commons

Figure 5.
Close-up of the
distribution of plants in
a perpendicular
direction (Humboldt
et al., 1850)

forest's ability to fill the atmosphere with moisture and its cooling effect, as well as its importance for water retention and soil erosion prevention, were originally explained by Humboldt. He expressed concern that tampering with the environment might have unexpected consequences for future generations.

Our first proposition from revisiting Humboldt focuses on the interconnectedness of nature and humanity:

Proposition 1. Re-examining Humboldt's legacy as an early model of multi-methodical and holistic SEA that emphasizes the link between climate and local populations and calls for respect for other cultural traditions and contexts will help us move towards research that will drive ethical debates on SEA and open up new avenues for exploration.

Placing due emphasis on people's interconnectedness, context (culture) and environment is likely to create advocacy, and presumably agency, leading to much-desired behavioral change. Such research endeavors must also embrace true interdisciplinarity, for example by including aspects and approaches drawn from the humanities and behavioral sociology, to uncover deeper, contextualized meanings of SEA, and thus move toward more ethical, value-based inquiries (Quattrone, 2021).

4.2 Overcoming undue economicization and reductionism in SEA

This brings us to another important point concerning the assumptions of the current SEA paradigm. Much of its theory, and more so its practice, hide behind positivist thinking, reducing "materiality" to what can be counted and economically measured, while only occasionally hinting at the change necessitated by its application. However, expanding on the concept behind *Naturgemälde* and its relevance to and in SEA, Humboldt upheld a work ethic of precision in his environmental accounts, which combined primary, multi-methodological research in the field with the sensitivity and aesthetic ideals of the age of Romanticism. A contemporary example of such an approach is Unilever's logo, which uses flora and fauna to deliver a deeply qualitative message of the company's relevance and underlying values, based on carefully combined facts. Such an approach will provide an opportunity to move from basic interdisciplinary SEA to a transdisciplinary approach that allows us to raise the question of "what if we imagine?" This will require us to move beyond the discipline of accounting and will call for co-creation of knowledge between accounting researchers and scholars and practitioners from other disciplines to generate new insights and solutions. In such transdisciplinary collaborations, paradigmatic boundaries must be breached and participating scholars must constantly reflect on and traverse empirical and normative aspects of their undertakings.

In addition to insights from Humboldt, we also recognize the contribution of Lehman (2017), who follows Gadamer's *et al.* (1975a, b) hermeneutic-interpretivist approach devoted to the philosophy of understanding and its facilitating conditions. Lehman's (2017) vision is that accountability to beauty and nature is important for emancipating and broadening responsibility. Learning from Humboldt may also enable us to overcome the current dominant stream that economicizes our environment and move toward a more qualitative, holistic narrative that can be emotionally and cognitively understood by the public. Unlike current SEA, it might also be used as guidance in both measuring and acting. Humboldt changed how we think about the natural world. He found connections everywhere. Nothing was to be examined on its own, not even the tiniest organism; no one fact can be regarded in isolation in the huge chain of causes and effects. With this realization, Humboldt created the web of life, the modern notion of nature. As Wulf (2015) comments, thinking of nature as a web reveals how vulnerable it is. Everything has its place. If a single thread is tugged, the tapestry as a whole may unravel.

Building on the structure of this web through language, [Lehman \(2017\)](#) also suggests, following [Gadamer *et al.* \(1975a, b\)](#) and [Taylor \(1992\)](#), the use of “expressive language, whether in the form of written words, speech, or images to convey that nature is more than a standing reserve for consumption” (p. 30). Based on this, we postulate our second proposition, which embraces the qualitative, emotional and hermeneutical:

Proposition 2. Overcoming the economicization of SEA by embracing its radical, emancipatory function while allowing hermeneutic interpretations will lead to a holistic environmental narrative that lends itself to public understanding and agency. Reducing (but not abolishing) aspects of codification and avoiding reductionism by moving from the “quantitative” to the “qualitative” may bring deeper meaning and performativity towards a truly systemic transformation of sustainability.

4.3 Embracing aesthetics and emotions

Our view also resonates with [Baker and Schaltegger’s \(2015, p. 263\)](#) understanding of SEA research as a “heterogeneous space in which various ideas are commonly attributed to the philosophical notion of pragmatism.” They identify tensions in the literature between seeing accounting as a simple but accurate representation of past organizational activities, or viewing it more pragmatically as a supporting device for managerial cognition, sense-making and decisions. Embracing expressive language, as suggested above, may be one way to tip the scales toward this more pragmatic view. Such qualitative expressiveness can also be found in [Brown and Tregidga’s \(2017\)](#) discussion of how the “visual cultural turn” in the social sciences can deepen visibilities, invisibilities and ways of seeing accounting and stimulate new imag(in)ings. Humboldt was enthralled by scientific tools, measurements and observations and was in awe of nature. Of course, nature had to be studied and analyzed, but he also believed that the senses and emotions should play a large role in our responses to it. He hoped to arouse a “love for nature,” and thus believed that nature has to be experienced through sensations, at a time when other scientists were looking for universal laws. Perhaps it is now time to embrace this emotional perspective all the more, to provide room and development spaces for normative accounting approaches to SEA. This leads us to our third proposition on the inclusion of aesthetics and emotion in environmental visualizations:

Proposition 3. Including aesthetic aspects in visualizations of combined environmental and contextual insights as a means of communication in the Humboldtian tradition may help appeal to emotion and signal values. This will generate a normative understanding of the environment, which will lead to motivation and further agency, based on and supported by SEA.

Such a progressive move has implications for the currently renewed “visual turn” ([Davison, 2010](#); [Greenwood *et al.*, 2018](#)) in our literature, which uses visualizations not only to convey complexity and reduce information overload, but also to embrace the qualitative and the aesthetic in its production to achieve agency. This may further enhance our understanding of the “whatness” of SEA devices. Of course, future research must provide coherent methodological and conceptual frameworks ([Shortt and Warren, 2019](#)) and perhaps even a new “epistemology of interconnectedness,” to guide the combination of quantitative and qualitative insights with aesthetics. On a practical note, embracing modern technology in SEA will also enable elements of interactivity, leading to even further engagement and affordances ([Davison *et al.*, 2015](#)).

4.4 Implications for SEA theory and practice

In discussing our implications for theory and practice, we turn to Birkin (1996, p. 234), who uses the notion of “flight from nature” to explain accountancy in terms of a “corollary of a rational, dualistic identity” that has no consideration for nature. He states:

If we are serious about sustainable development, then identifying elements of the Flight within ourselves, our practices and our institutions is an essential exercise . . . accounting has developed within a culture that places little value on Nature and, indeed, may have lost the sensory ability to recognize any such value (p. 235).

This notion of “flight” has other important dimensions essential to the self and the Anthropocene: emotion and intuition (see also Bebbington *et al.*, 2020a). For example, Birkin (1996, p. 244) argues that we need to think like a mountain that is integrated with the world, interdependent, indeterminate and creative. Humboldt’s work enables us to think metaphorically *like a mountain* and indeed about actual mountainous ecosystems and their demise through climate change.

We illustrate the implications of our three main propositions for SEA with an example based on Morueta-Holme *et al.*’s (2015) work, which takes up exactly such a mountain to both visualize and convey the nature of climate change. In studying vegetation elevation ranges, Morueta-Holme *et al.* (2015) revisited Humboldt’s famous visualization, *Naturgemälde*. By comparing current data with Humboldt’s data, they discovered concerning trends, including a retreating snowline and the consequent movement of plants further uphill. This important insight was only possible due to Humboldt’s centuries-old graphics and ample contextual information, placing him well ahead of his time in terms of systematic, visual approaches to data presentation. Morueta-Holme *et al.* (2015) assembled historical information from various details on plant taxonomy recorded meticulously by Humboldt and Bonpland between 1807 and 1838. What is vital and illustrates our insights is the dedicated way in which, for comparison, Morueta-Holme *et al.* (2015) incorporated their newly compiled data into a recreation of the *Naturgemälde*, with a clear focus on its original aesthetics. This practice can be placed in the sociological tradition of Luhmann, who sought to create a detailed description of the world as a set of complex systems, which he applied to ecology (Alexander and Blum, 2016).

This infographic in the Humboldtian tradition combines an aesthetic appeal to emotion with relevant material collected in a robust scientific way. In so doing, it avoids being dismissed as a purely emotional and perhaps deeply ideological, depiction of environmental change. For example, the well-known “polar bear on a single ice shelf” picture widely used to illustrate global warming effects (<https://www.bbc.com/news/science-environment-53474445>) is now regarded by some as counter-performative. Ronzani and Gatzweiler (2022) have recently critically studied the importance of giving due consideration to actual information and its multimodal representation in infographics, in a blend of the visual, textual and numerical/factual. They observe that we lack understanding of what can happen when visuals are so embedded in organizations that they become a key semiotic resource for communicating performance measurement information.

In contrast, because of the inherent materiality of the presented data in combination with aesthetic, visual and emotional appeal, Morueta-Holme *et al.*’s (2015) infographic (Figure 6), based on Humboldtian practice, gains legitimacy (Puyou and Quattrone, 2018). This leads to the desired transformative impact of this accounting device (Faulconbridge and Muzio, 2021) by inducing organizational change and accountability for more environmentally-aware behavior. Following Bowden *et al.*’s (2021) statement that a “performative understanding of how power shapes beliefs is central to combating the failure to address climate change” (p. 1909), we can understand Humboldtian approaches to SEA as discursive empowerment (Gallhofer, 2018) that theorizes performativity, bestows a mutual web of accountability and

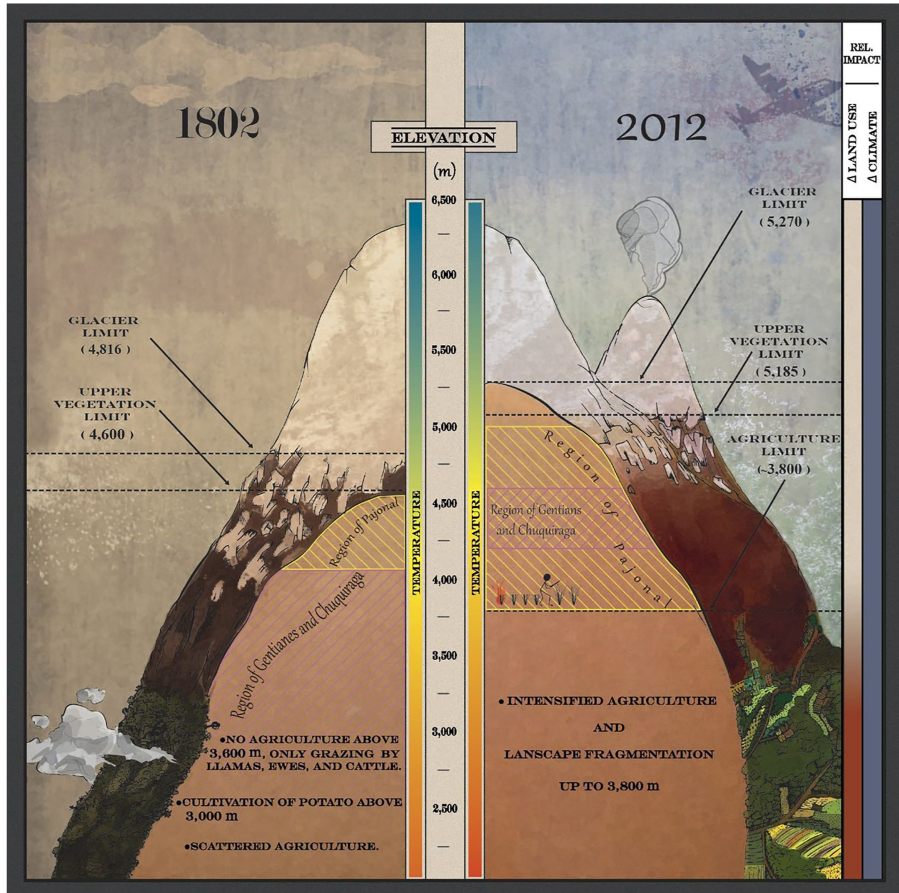


Figure 6. Morueta-Holme *et al.*'s (2015) recreation of Humboldt's *Naturgemälde* displaying the impact of climate change on mountain ecosystems

Source(s): See also Humboldt, 1815; Humboldt and Bonpland, 1807. Reproduction of figure granted by publisher PNAS

gives its users agency. This is because it enables meaning-making and meaning-sharing in and around organizations, through signification, manifestation (how SEA artifacts and their properties relate to affordances) and implication (how SEA practices produce organizational outcomes) (see also Quattrone *et al.*, 2021).

Picking up from these lines of thought, we also argue, following our previous insight on “embracing the qualitative and hermeneutical” or acknowledging audience-specific aspects and inherent values, that such an interpretation of materiality assumptions based on Humboldtian traditions can also be seen as enhancing the affordances (Evans *et al.*, 2017; Meyer *et al.*, 2018) of (visual) SEA devices. Affordances, briefly described as “possibilities for action” (Evans *et al.*, 2017, p. 36), stem from examining the relationship between an object—in this case, visualization as an SEA device—and the user, by scrutinizing in detail how this object either enables or constrains actions and outcomes in a particular setting or context.

The affordances in question in our setting are particularly captivating, spatializing and infiltrating the audience, but also narrating and, to some extent, abstracting the complexities

of the environment. These stem from combining semiotic (materiality and measurement), cognitive (visualization and symbolic/form aesthetic appeal) and cultural and spiritual (integration of nature and humans *in situ*) features in Humboldtian infographics. This is further enhanced by including user-specific (often hermeneutic) qualitative aspects of materiality to enhance legitimacy.

Overall, these affordances allows users, in close collaboration with stakeholders as an audience, to mitigate negative environmental change more actively and successfully, by making effective use of these visualizations as accounting devices. This combination of affordances can also be seen as a precursor to the desired transformative potential of SEA, as it shapes and generates theory. In this, we see Humboldt's *Naturgemälde* and its derivations as an iconic signification that brings the all-important affordance of materializing transformative change.

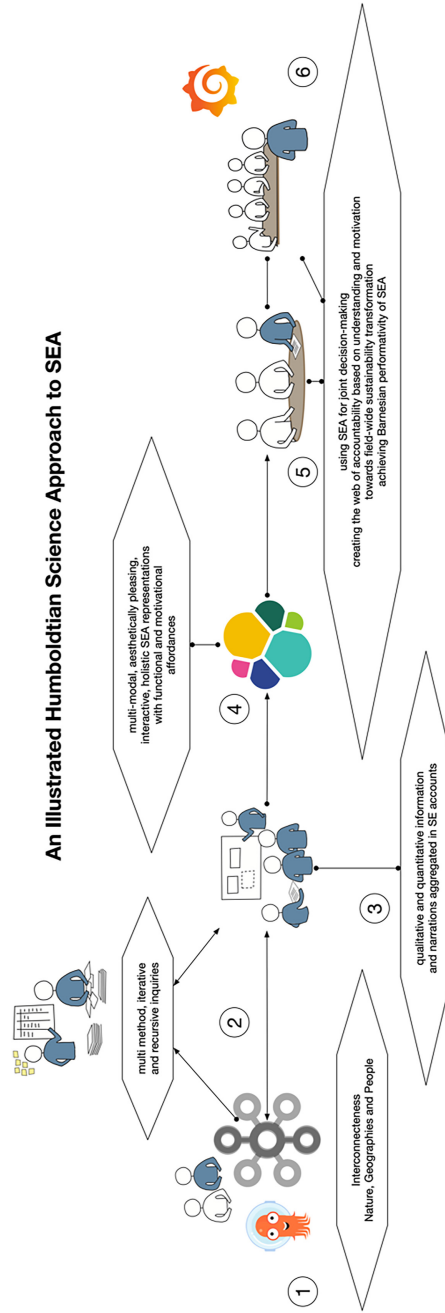
Figure 7 presents a visual summary of our account of how Humboldtian science can improve SEA. In this figure, Steps 1 to 3 call for consideration of the interconnectedness between nature, geographies and people, and consequently use of multi-methodological, iterative, and recursive inquiries to enhance the validity of the outcomes and provide both quantitative and qualitative information and narrations. Step 4 sees multimodal, aesthetically pleasing, interactive and holistic visual representations as SEA devices that provide the necessary functional and motivational affordances for joint decision-making in Step 5, creating a web of accountability. Finally, in Step 6, repeated and institutionalized enactment of these SEA practices leads to a true and deep sustainable transformation of the system (see also Barnesian performativity in [Marti and Gond, 2019](#)), based on the underlying ideology and intentionality.

Following these detailed considerations, we now summarize how we contribute to theory and practice. First, revisiting Humboldtian science fills some gaps in our current understanding of the philosophical underpinnings of SEA. Revisiting the old divide between early nineteenth-century reductionist approaches of formal rationalism, and the Romantic focus on aesthetic and emotional experiences of nature as a whole allows us to identify similarities with our current contestation of the origins and purpose of SEA, located between financial accounting and auditing traditions and more ideologically driven, normative designs ([Schneider, 2014](#); [Bebington et al., 2020a](#); [Parker, 2019](#)).

Second, using the insights gained will enhance the legitimacy of SEA ([Deegan, 2019](#); [Haack and Rasche, 2021](#)), as a Humboldtian interconnectedness approach calls for inclusion of the voices of the many (including Nature) in its setup and measurements ([Killian and O'Regan, 2016](#); [Kaur and Lodhia, 2018](#)) and motivates action by appealing to ethics (see [Morrison et al., 2016](#)) and emotion via aesthetics and a mixture of qualitative and quantitative representation.

Third, our discussion provides a better understanding of what builds the affordances of SEA devices, in terms of both wanting to use the instruments (see also the dynamic legitimacy–performativity nexus in [Faulconbridge and Muzio, 2021](#)) and providing material information at a holistic level ([Begkos and Antonopoulou, 2020](#)), in contrast to the often piecemeal approaches of companies' current SEA materiality decisions. SEA that embraces Humboldtian ideas may therefore contribute to achieving a much-desired transformation ([Marti and Gond, 2019](#); [Baker and Modell, 2019](#)) towards lasting change in companies' environmental behavior, based on aspects of power and distributed agency ([Bowden et al., 2021](#)) in the “web of accountabilities” ([Gallhofer, 2018](#)), which is built through the interconnectedness of all actors.

Finally, in practice, SEA researchers seeking to adopt our propositions and implement truly just, transformative SEA devices will need to start with the context and local populations and identify potential vulnerabilities, using rich, qualitative insights guided by social justice ([Lehner et al., 2022](#)) to carefully spin the aforementioned “web of



Source(s): Authors

Figure 7.
An illustrated six-step
Humboldtian science
approach to SEA

accountabilities.” This must then be sensitively connected with quantitative measures and insights from a multitude of perspectives until theoretical saturation of the overall SEA device is reached. Such saturation can be agreed on when the device in question includes all necessary details, but is also sufficiently motivational to be used as a transformative tool in practice. Thus, materiality can only be judged at the level of the whole, interconnected SEA tool, rather than from an individual perspective. Furthermore, motivation as part of the affordance must be embraced by deliberately designing communicative surfaces of the SEA device (such as visualization and interactive elements) with respect to aesthetics, cognition and emotion.

5. Conclusion

Humboldtian science, with its due focus on a holistic approach and interconnectedness of the environment and people, merges a multitude of precisely measured facts with qualitative, contextual insights in beautiful, combined visualizations to inform, motivate and create agency in a “web of accountability.”

Humboldtian science may also be seen as an inspiration and guiding light for researchers seeking to overcome the current epistemological and methodical limitations of SEA, by transcending the qualitative/quantitative divide and including aesthetics and emotions. Moreover, it connects well with the recent progressive approaches of [Bebbington et al. \(2017, 2020a\)](#), [Cuckston \(2017\)](#), [Gallhofer \(2018\)](#), [Morrison \(2020\)](#), [Morrison et al. \(2022\)](#) and many others. A truly Humboldtian understanding of SEA will require deep reflection on its very nature, inviting us to revisit its philosophical paradigmatic foundations and finally commence long-overdue debate on its origins and purpose. This may be particularly timely, given that some environmental evaluations and justifications already depart from the political and moral requirements shared by all previous orders of worth ([Patriotta et al., 2011](#); [Thévenot et al., 2000](#)), where common humanity is the reference group for evaluation. [Thévenot et al. \(2000, pp. 256–257\)](#) articulate a new “green regime” that extends political and moral concern beyond common humanity to communities of future generations and to non-human entities. They even propose extending this to non-human entities as a reference, moving from “anthropocentrism” to “ecocentrism.” Humboldt may guide us on how to do this in practice.

Finally, returning to [Russell et al. \(2017\)](#), it seems prudent to point out that, even if new forms of SEA have the potential to improve management of biodiversity and sustainability in socio-ecological systems, a single account or an account produced by a single individual will not reflect the diversity of perspectives involved. As [Cuckston \(2017\)](#) argues, although we are all very much part of the accounting entity, we may all have vastly differing opinions, not only on what should occur but also on how the entity should be accounted for and evaluated. Thus, polyphonic accounts ([Morrison and Lowe, 2021](#)), respectfully illustrating and highlighting the importance of the contextual framing of SEA ([Qian et al., 2021](#); [Finau and Scobie, 2021](#)), summarized in beautiful infographics with richly detailed measurements that appeal to rationality and emotion alike, as seen in Humboldt’s legacy, may be especially instrumental in promoting a deeper understanding of the notions of being and interconnectedness, and thereby motivating a true transformation of sustainability.

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Appendix

Links to Figure Sources – these figures are all open access

Figure A1: https://commons.wikimedia.org/wiki/File:Zentralbibliothek_Z%C3%BCrich_-_Ideen_zu_einer_Geographie_der_Pflanzen_nebst_einem_Naturgem%C3%A4lde_der_Tropenl%C3%A4nder_-_000012142.jpg

Figure A2: https://commons.wikimedia.org/wiki/File:Woodbridge_isothermal_chart3.jpg

Figure A3: https://commons.wikimedia.org/wiki/File:Alexander_von_Humboldt_-_Diagram_of_a_cross-section_of_the_earth%27s_crust_-_rectified.jpg

Figure A4: <https://www.davidrumsey.com/luna/servlet/detail/RUMSEY~8~1~308070~90077931:Geographical-Distribution-of-Plants#>

Figure A5: https://commons.wikimedia.org/wiki/File:Alexander_von_Humboldt_-_1850_-_Geographical_Distribution_of_Plants_-_Crop.jpg

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