Posthumanism for Sustainability: A Scoping Review

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Abstract

The purpose of this study is to explore the relationship between posthumanism and sustainability and contribute to the interdisciplinary concept of posthuman sustainability. We conducted a scoping review of 45 peer-reviewed journal articles that met our inclusion criteria and employed co-occurrence analysis based on the clustering techniques of the VOSviewer. We identified five themes within the articles: post-humanism, post-anthropocentrism, post-dualism, post-Enlightenment, and post-technologism. Through our analysis, we found that posthumanism can offer insights into ecological issues and help promote alternative sustainable practices. We also identified three immediate concerns for post/humanities scholars: (1) fostering dialogue between critical humanist and posthumanist scholarship based on onto-epistemological plurality, (2) achieving conceptual clarity in the field, and (3) advocating for meaningful engagement with indigenous worldviews in a multidimensional and multitemporal manner. By exploring the relationship between posthumanism and sustainability, we hope to expand our knowledge of the urgent ecological issues we face and contribute to interdisciplinary efforts to address them.

Keywords: *Sustainability; Posthumanism; Transhumanism; Anthropocentrism; Technology*

Introduction

Sustainability has become a key concern for societies as a result of "the post-1950 acceleration in the Earth System indicators" (Steffen et al., 2015), namely the Great Acceleration (McNeill & Engelke, 2014), induced by anthropogenic activities. The importance of achieving the 17 sustainable development goals (UN, nd) has been widely recognized. The pandemic has further highlighted the urgent need for these goals to be achieved. With this, scholars in the fields of environmental humanities (Akbulut et al., 2019; Alaimo, 2012; Kopnina & Shoreman-Ouimet, 2015; Adamson, 2018; Norton, 1992), anthropology (Brightman & Lewis, 2017), political ecology (Peet et al., 2011), geography (M. Whitehead, 2007), business (Yan et al., 2022), economics (Costanza, 1992), science and technology studies (STS) (Healy, 1995; York & Clark, 2010), architecture (Williams, 2007), information and communication technologies for sustainability (ICT4S) and software engineering for sustainability (SE4S) (C. Becker et al., 2016; Joshi & Pargman, 2015; Mann et al., 2014; Penzenstadler et al., 2018) are increasingly addressing issues related to sustainability.

Today, it is widely accepted that these decisions must be taken according to sustainability science, which is to be exempt from values, beliefs, and norms. However, scholars in diverse disciplines have been criticizing the so-called objective nature of sustainability science and practices from multiple perspectives. These studies have so far shown that values, beliefs, and norms held by citizens,

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scientists, policymakers, and corporations shape and are shaped by sustainability research and policy (Adloff & Neckel, 2019; Blühdorn, 2016). In other words, sustainability research and policy depend on various onto-epistemologies. Also, links between sustainability and ethics have been addressed, and some frameworks have been suggested from various organizational and (inter- or multi-) disciplinary perspectives (Arogyaswamy, 2020; G. K. Becker, 2012; Bieling et al., 2020; Bogliotti & Spangenberg, 2006; Earth Charter Commission, 2000; Jordan & Kristjánsson, 2017; Pascual et al., 2017; Reed & Slaymaker, 1993; Sarabhai, 2010; Sinha, 2013). Our research aims to contribute to these works by providing an evidence-based analysis of posthumanist onto-epistemological and ethical sustainability alternatives.

Within this context, there is also an emerging scholarship focusing on posthumanism and sustainability (Alaimo, 2012; Cielemęcka & Daigle, 2019; Smith, 2019). This interest is partly related to the fact that posthumanism is gaining attention in diverse research fields, including but not limited to philosophy (Braidotti, 2013, 2019; Ferrando, 2019), education (Bozalek et al., 2018; Snaza et al., 2014; Taylor, 2021; Taylor & Bayley, 2019; Taylor & Hughes, 2016), anthropology and archaeology (Cipolla et al., 2021a; Herbrechter, 2022), psychology (P. M. Whitehead, 2018), religion and spirituality (Dedeoglu, 2020; Ferrando, 2016a; Graham, 2016, 2021), international relations (Cudworth & Hobden, 2011), business (Gladden, 2016; Kozinets, 2015), and design (Bratton, 2018; Forlano, 2017; Umbrello, 2021). This is a timely concern, given that two lines of critique of humanism and anthropocentrism have converged within the posthuman condition (Braidotti, 2019). Accordingly, current human valuations and experiences can be seen as the results of the ever-lasting co-evolution of culture and ecology shaped through hierarchical, dualist, and colonial pedagogies and practices.

Considering the impacts of sustainability-related decisions on the socio-technical, ecological, and political-economic systems and, therefore, on the acceleration mentioned above, the emergence of new research fields addressing sustainability is significant. Equally important is to develop an understanding of the onto-epistemologies guiding these decisions and business practices, which mostly show humanistic, anthropocentric, and dualist attributes. In this context, posthumanism offers a way to reconceptualize our relationship with the environment, challenging humanistic, anthropocentric, and dualistic views and promoting sustainability. The objective of this scoping review is thus to examine the scholarship in order to explore possible connections between posthumanism and sustainability. To date, various systematic reviews concerning different aspects of sustainability have been published (Bigliardi & Filippelli, 2022; Lieb, 2020; Martins et al., 2022; Rasoolimanesh et al., 2020; Rosário et al., 2022; Sastre et al., 2022). We also included one of them (Walsh et al., 2021) in our selection since it tracks the concept of relationality—an important concept for posthumanist scholarship—in sustainability-related studies and fits our inclusion criteria. To the best of our knowledge, no systematic review of studies specifically linking posthumanism and sustainability has been conducted.

To do justice to researchers' efforts in this neoliberal age of acceleration of knowledge production, our study aims to document what is known about the myriad ways of adopting posthumanism in sustainability research and to identify gaps in our knowledge in a comprehensive and evidence-based way. While doing this, we also seek to contribute to a better understanding of posthumanism with respect to the questions of sustainability. For this, the following questions will guide the paper: (1) What has been said so far in the studies linking posthumanism and sustainability? (2) How has literature evolved in the last decade? (3) What are the emerging themes, potential research gaps, and scholarly issues? The main objective of this research is to scope the related literature and synthesize

the knowledge that may help reduce the risk of relying too much on biased values of humanity in sustainability research. This objective is closely related to the broader purpose of knowledge translation (Health Canada, 2018). We expect that our study will help future efforts by both researchers and practitioners.

Conceptual Background

Sustainability

Many studies attempt to explore and define sustainability. The term appears as early as the 1650s in German—*nachhaltigkeit*—, which was associated with forestry and forest yields (von Carlowitz, 1713). In the past century, sustainability has been associated with environmental impacts caused by humans (Carson, 1962; Goudie, 2000). The appeal for immediate action is continued by Barry Commoner's (1971) work, which focuses on collective awareness to develop a sustainable policy. The term was coined in the 1980s to refer to the integration of the social, environmental, and economic components of sustainability (Atkinson et al., 2007; Rogers et al., 2007). From the late 1990s until today, calls for sustainable action have been increasing. Although these calls share a global vision of contemporary matters, most of them presuppose economic growth.

Various conceptual classifications of sustainability have been made in the last two decades. For instance, Walter Leal Filho (2000) states that the term sustainability may have four different meanings depending on the context, such as the availability of natural resources for future generations, a country-level approach to development, a societal concern of development, and an environment-related concern of development (besides the economic concerns). The author also argues that there is no consensus on the meaning of sustainable development because the views differ depending on factors related to the level and type of knowledge, occupational background, prior experience, perceptions, values, and context (Leal Filho, 2000). It can be said that the onto-epistemologies of sustainability are very much connected with these factors since how individuals perceive life and their own existence (ontology) and how they 'know' specific knowledges (epistemology) are both connected with the understandings and practices of sustainability.

Onto-epistemologies of sustainability shape and are shaped by at least three distinct approaches—status quoist, reformist, and transformationist—(Hopwood et al., 2005), which correspond to three imaginaries of the future: modernization, transformation, and control (Adloff & Neckel, 2019). While status quoists—for example, the OECD in the 2000s and ecological modernizers—resist any sustainability-related changes at the societal and policy levels and attempt to maintain business as usual practices, reformists—experts in government agencies and NGOs—believe that policy and lifestyle changes will be sufficient to achieve sustainability. Transformationists, on the other hand, identify societal structures as the main source of pressing ecological issues and advocate for fundamental changes. Hopwood et al. (2005) further divided this group into two subgroups: those who overlook sustainable development in their calls for transformation and those who advocate for transformation in conjunction with sustainable development. Deep ecologists, for instance, reject sustainable development as an anthropocentric concept that prioritizes economic concerns, and as a result, their interpretation of transformation leaves out the developmentalist position. Though social ecologists and ecofeminists can also be classified as transformationists, their concern for social injustice enables them embrace the transformational power of sustainable development. In the nutshell, the practical implications of these trajectories are not mutually exclusive; instead, those practices go hand in hand through the links between socio-material structures, ethical/moral

imaginations, and actual practices (Adloff & Neckel, 2019)—e.g., geoengineering practices are mostly justified through the praxis of economic modernization.

Even though the concepts of sustainability and sustainable development are contested—and widely criticized—, developmentalism appears to have emerged as the dominant discourse, and institutionalization has been grounded in it. With this, the international sustainable development regime might be viewed from two alternative positions with respect to the dominant sustainability paradigm (Blühdorn, 2016). It may seem like a success story to some because it pragmatically adapts to the demands of modern liberal consumerism. However, it is a failure in the sense that the paradigm in its mainstream interpretation does not yield the expected outcomes for indigenous peoples, people of color, black people, immigrants, as well as more-than-humans. In other words, the politics of unsustainability itself is the success story for status quoists, reformists, and even some transformationists, but not for marginalized humans and more-than-humans. Given that sustainability is the most recent example of the capitalist process of endogenization of social critique (Boltanski & Chiapello, 2007), it may be useful to imagine posthuman sustainability as ethics of sustainability in opposition to this process. This study is an attempt in that direction.

Posthumanism

As posthumanism became more popular in different fields, the question of what it means became more important. Nonetheless, there is no definitive answer to this question. One explanation for this is that posthumanism is tied to the concept of the posthuman, which is interpreted differently depending on one's assumptions. The transhumanist interpretation of posthuman, for example, differs from the posthumanist interpretation. The first interpretations of the word, posthuman/ism, found in internet searches are primarily based on transhumanist assumptions. As a result, various reactions to posthumanism emerge, some of which verge on antagonism. We shall return to the posthumanism-transhumanism distinction later, but the increasing diversification in posthumanism can also be attributed to the fact that ecological issues are at the top of the agenda among academic and activist groups (Bignall et al., 2016; Braidotti, 2006; Daigle, 2022). In short, posthumanism both shapes and is shaped by attempts to change the way most people think about humans and humanity.

The goals of decentering the human and avoiding exclusionary definitions of it in tackling key ecological challenges at various scales go hand in hand with the development of alternatives to both scientific methods and activities in other areas of life. For example, Rosi Braidotti's posthumanism (Braidotti, 2013, 2019) shows feminist, new materialist, anti-humanist, and therefore, anti-theological attributes. In doing this, Braidotti is in constant dialogue with Michel Foucault's anti-humanist, Gilles Deleuze and Félix Guattari's spinozist monist, Vandana Shiva's post-colonial ecofeminist, Donna J. Haraway's cyborg feminist, Achille Mbembe's necropolitical, Judith Butler's queer, Edward Said's critical secular, and Talal Asad's post-secular humanist interpretations. The focus of the dialogue differs according to the questions raised in the author's work. Still, the reconsideration of subjectivity and power positions embedded in the relationality of ecology, biology, and technology remains the central issue. Different posthumanist theories, like Bruno Latour's actor-network theory (1996, 2005), Karen Barad's agential realism (2003, 2007), Jane Bennett's vibrant matter (2010), or Graham Harman's object-oriented ontology (2018), can also be analyzed using a similar genealogical method.

Posthumanisms do not aim to conceal the "true" nature of social phenomena and relations, but to decipher them based on their complexity and relationality. With this, no idea and/or practice can be considered independent of their context, subject, and corresponding power relations. Moreover,

posthumanisms are concerned with exposing prejudices based on race, religion, gender, species, and technology, as well as class and status that dominate social phenomena and relations. In doing so, posthumanist researchers, philosophers, and artists do not aim to create another grand narrative, but rather to develop critiques of the "-isms"—inherited from the modern period—by engaging with the frameworks of anti-humanism, critical theory, post-structuralism, or feminism. In this respect, if ideology is seen in opposition to critical and creative thinking, posthumanist thought aims beyond ideologies. Rather than being a singular theory, we view posthumanism as a vault that integrates diverse sources of worldviews, scientific paradigms, knowledges, and ways of knowing, including those from traditional and indigenous perspectives. In other words, posthumanism is a set of scientific, philosophical, and artistic insights about the posthuman.

The posthumanist posthuman

The concepts of posthumanism and posthuman regenerate each other. However, studies on the posthuman are not only conducted in posthumanist circles. This makes it necessary to distinguish the posthumanist vision from other visions. When the posthuman is defined as "the human being as a non-fixed and changing state" (Ferrando, 2013, 27), the answers to this state, as well as the questions and problems that accompany it, are provided on various grounds, such as anti-humanism, meta-humanism, new materialism, actor-network theory, object-oriented ontology, and transhumanism. In interaction with all these alternative orientations, cultural, critical, and philosophical posthumanisms are also taking shape. In this respect, posthumanist perspectives follow the traces of the revolutions caused by the 'positions' put forward by scientists and philosophers from Copernicus to Einstein, from Darwin to Uexküll, from Marx to Freud, and from Nietzsche to Arendt and Foucault, and their postmodernist and post-structuralist successors. Moreover, they are built upon the foundations created within studies, such as gender studies, critical race studies, post-colonial studies, disability studies, queer theory, ecocriticism, and blue humanities, as well as activist-artistic practices and social movements.

Among all these alternatives, it is essential to distinguish the posthumanist posthuman from the transhumanist posthuman. In addition to an intellectual concern, which has to do with the proper use of the concept, transhumanism's orientation that is fused with the marketing strategies of neoliberal capitalism creates an important reason to make such distinction (Carrico, 2013; Smart & Smart, 2021). With this, there is a need for a posthumanist critical posthuman as an alternative to the transhumanist neoliberal posthuman in terms of criticizing inequalities that remain unresolved in the shadow of neoliberal capitalism. Although both posthumanisms and transhumanisms proceed from an open-ended definition of the human, they take this assumption into account for different purposes. Transhumanists see the open-ended human being as an entity to be enhanced and advanced by technologies. Within a context where biotechnological developments, genetic interventionism or artificial intelligence and robotic applications are abandoned to mechanisms linked to the neoliberal market economy, concerns about socio-economically or ecologically fragile human communities and more-than-human beings are not at the forefront. Posthumanists, however, are interested in cosmologies in which the human is not at the center and onto-epistemologies that presuppose justice both within the human species and between species, and the methodological and ethical-political possibilities associated with this. Moreover, the prefixes of 'trans-' and 'post-' do not require from us to think in terms of order or hierarchies, but of connectivity and coherence towards our digital becomings (Sorgner, 2023).

Following authors such as Rosi Braidotti and Francesca Ferrando, we understand the posthumanist posthuman as an alternative to—and critique of—the transhumanist posthuman: evolution (adaptation), ecology (Anthropocene) and technology (cyborg). The evolutionary model of adaptation helps to better understand the relational transformation of nature and culture—in other words, life itself. In nature, the increase of one population threatens other populations, and not every species is always capable of biological-cultural adaptation. In this respect, for example, climate change adaptation policies may contradict the posthuman condition. Second, posthumanist posthumanism points out that ecosystems have come under severe pressure as a result of anthropocentric activities. In this respect, the Anthropocene cannot be separated from practices such as colonialism and extractivism. The political, ethical, and legal implications of this are that responsibility must be distributed according to the capacity of natural and legal persons to transform ecologies in the posthuman condition. In this regard, we believe that recent international efforts to criminalize ecocide are extremely valuable. The third dimension concerns the way in which human relations with technology lead to a reconsideration of the post/human condition. The concept of the cyborg, beyond being a science-fiction concept that combines the words cybernetics and organism, offers the possibility of grasping the cyber-biological-physical existence of the posthuman condition and the body that engages with it. The cyborg life experience shaped by the internet, robotic systems, smart devices, and cities makes it possible and necessary to evaluate the relationships on the planet beyond human beings. Because humans transform both the planet and themselves with the technologies they create and use. Just as there is no democratic distribution of opportunities, the distribution of vulnerabilities is not democratic at all. Lastly, the feminist interpretation of the cyborg offers the possibility of thinking about earthly experience with and beyond sexual differences and constructed gender roles.

To summarize, the posthumanist posthuman exhibits critical, ecological, inclusive, and post-secular features in expressing both the state of becomings (of bodies together) and the historical and structural situation in which various becomings become possible. To give a human-specific example, posthumanism means, on the one hand, that the human body's journey of becoming always involves more-than-humans (e.g. bacteria, microbes, prostheses, etc.), and on the other hand, that the human experience on earth is shaped by interaction with more-than-humans (e.g. other animals, plants, robots, communication technologies, etc.). This implies that the fundamental premises of the dominant interpretations of both monotheistic religions and humanist Enlightenment sciences are open to criticism. It also implies that the transhumanist vision, built on the assumption of human (in fact, some humans') superiority and integrated with neoliberal 'advanced' capitalist dynamics, needs to be criticized. Because in today's world, new injustices are being added to ongoing systematic ones. Far from solving problems completely, as some claim, techno-solutionism also paves the way for the emergence of new problems and risks. The different reflections of these new problems and risks can be traced from nuclear energy tenders to climate engineering initiatives, from GMO foods to industrial animal husbandry, or from new industrial-military structures and relations shaped by drones or other weapons to efforts of space colonization. Confronting all problems and risks requires play-making—rather than defensive—strategies at different scales. In addition, the heterogeneous structure of those strategies should not be damaged, and from a pluralist onto-epistemological perspective, people's ability to fulfill the requirements of ecological sustainability as citizens, producers, and consumers should be supported. This scoping review therefore focuses on the promise of posthumanisms—the posthumanist posthuman, in particular—for the development of alternative visions of sustainability.

Materials and Methods

In this study, we followed the PRISMA checklist and the related guidelines for scoping review (Page et al., 2021; Peters et al., 2020; Tricco et al., 2016). First, a protocol detailing the research design was prepared and recorded on the relevant platform for the future use of researchers (Dedeoglu et al., 2021). During the research meetings, we discussed the details of the protocol as well as the inclusion criteria. We also asked for the expert opinion of librarians. We agreed on the following inclusion criteria:

- Only peer-reviewed articles that include both keyword chunks (Table 1) were included in the selection.
- Only articles in English, French, Greek, and Turkish were included in the selection (no result were found in Greek or Turkish databases at the time of the search).

Table 1. Search keywords

Chunk 1	sustainability or sustainable or eco-friendly or green or "natural resources"
	AND
Chunk 2	posthumanism or posthuman or transhumanism or anti-humanism or metahumanism or ahumanism or "new materialism" or "object-oriented ontology" or "actor-network theory" or indigenous or "traditional ecological knowledge" or accelerationism or Anthropocene or anthropocentrism or Capitalocene or Chthulucene or more-than-human or non-human or GAIA or "environmental justice" or "climate justice"

To identify relevant articles, a two-level screening was conducted on multiple databases through providers EBSCO, ProQuest, Web of Science, Scopus, Elsevier, BioOne, Encyclopedia of Ecology, Geobase (interdisciplinary), JSTOR, OVID, Philosopher's Index, PhilPapers, and Project MUSE as well as CAIRN and Erudit (for French). The outputs were stored on Zotero. The first level of screening yielded 4474 results. After the removal of duplicates, 4419 records were identified. Then, each researcher independently created their selection list based on those records. The analysis of some articles was more demanding as they did not have an abstract and/or a list of keywords. A consensual decision was taken for those articles. Eventually, based on a cross-check of the individual lists, 45 articles—43 in English and 2 in French—that linked two conceptual constructs were included in the corpus. After that, studies contributing to the debate on sustainability in different disciplines—and often in an interdisciplinary manner—were comprehensively analyzed. In this process, charting forms were also employed to create consistency.

For the analysis, we utilize both quantitative and qualitative techniques (Bigliardi & Filippelli, 2022; Rosário et al., 2022). For the quantitative component, we use VOSviewer to analyze co-occurrences of terms in titles, abstracts, and keywords. The outputs of quantitative analysis can be seen in the following section. The qualitative component includes an in-depth examination of the selected papers to identify the connections between posthumanism and sustainability, as well as prospective research gaps and opportunities. The qualitative findings are presented in the following section as well as discussed in the Discussion section.

Results

To better understand possible links between posthumanism and sustainability, we analyzed peer-reviewed journal articles that were published until June 2021. As Figure 1 indicates, the posthumanism-sustainability nexus is relatively new, except for Braidotti's article (Braidotti, 2005), which is based on excerpts from the book, *Transposition: On Nomadic Ethics* (Braidotti, 2006). The

highest number of peer-reviewed journal articles was published in 2019 (n=10) and 2016 (n=7), respectively. There has been an upward trend since 2013, with a decline in 2020, maybe due to the fact that the COVID-19 pandemic derailed academic pursuits.

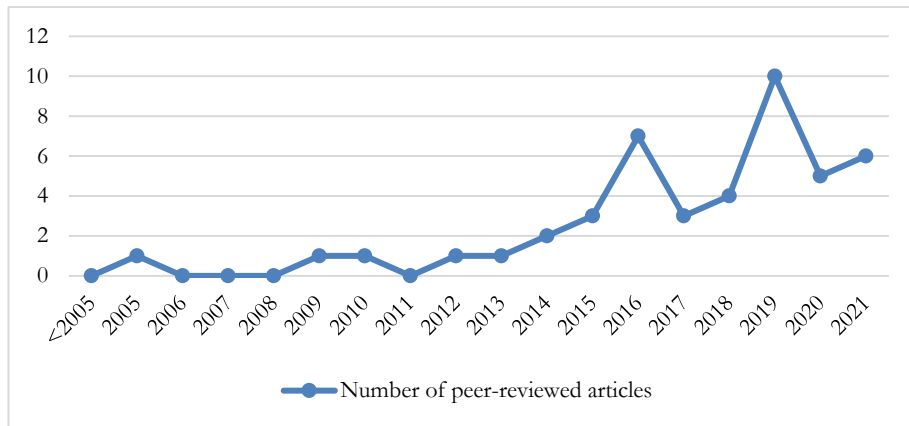**Figure 1.** Number of peer-reviewed articles per year.

Table 2. Content of the selected articles.

Author(s)	Publication title	Journal Name	Purpose(s)	Theoretical/ conceptual framework	Method	Theme(s)
Braidotti (2005)	Affirming the Affirmative: On Nomadic Affectivity	*Rhizomes*	Introduce nomadic affectivity as a philosophical, ethical, and political economic interpretation of materialism	Feminist new materialism (nomadic posthumanism)	Critical posthumanist inquiry	Radically immanent nomadic subjectivity
Girvan (2009)	Re-membering the Posthuman Within/Across Sustainability Paths	*Rhizomes*	Develop an alternative account of sustainability based on a re-coding of complexity	Hayles' digital posthuman and Haraway's nature-culture continuum	Critical posthumanist inquiry & creative writing with vignettes	Re-codification & act of re-membrance
Pedersen (2010)	Education Policymaking for Social Change: A Post-Humanist Intervention	*Policy Futures in Education*	Develop a non-linear account of sustainable society as the fifth pillar of international education policy efforts	Critical posthumanist education and pedagogies	Critical posthumanist inquiry & document analysis	Self-generative non-linear futurism
Alaimo (2012)	Sustainable This, Sustainable That: New Materialisms, Posthumanism, and Unknown Futures	*Modern Language Association*	Develop a posthumanist, new materialist understanding of sustainability	Feminist new materialism	Critical posthumanist inquiry & case study	Entanglement of material self and its ethical implications

Carrico (2013)	Futurological Discourses and Posthuman Terrains	*Existenz*	Review various futurisms with a particular attention to the sustainable technologies	-	Critical posthumanist inquiry & content analysis	Critique of superlative posthumanisms & unsustainable techno-triumphalism
McGregor (2014)	Enhancing Humans and Sustainability: The Reunion of Bioethics and Environmental Ethics	*De Ethica. A Journal of Philosophical, Theological and Applied Ethics*	Develop a bioethic for sustainability in the age of transhumanist technologies	Leopold's land ethic & Van Potter's bioethics	Critical posthumanist inquiry	Biotechnological ethics for sustainability
Sjögren (2014)	Educable Futures?: Managing Epistemological Uncertainties in Sustainable Education	*Resilience: A Journal of the Environmental Humanities*	Develop a new education paradigm that pay attention to the importance of unknowing for sustainability	Feminist new materialism	Critical posthumanist inquiry & focus group interview	Epistemological uncertainty
Doane (2015)	Hyper-Abjects: Finitude, "Sustainability," and the Maternal Body in the Anthropocene	*philoSOPHIA*	Develop an understanding of sustainable body politic in the Anthropocene	Julia Kristeva's abjection & Timothy Morton's hyperobjects	Critical posthumanist inquiry & case study	A body politic for the Anthropocene
Fredengren (2015)	Nature: Cultures Heritage, Sustainability and Feminist Posthumanism	*Current Swedish Archaeology*	Criticize the anthropocentrism of heritage praxes and introduce an affirmative, sustainable alternative	Feminist new materialism (feminist posthumanism)	Critical posthumanist inquiry	Heritage as deep time phenomena
Neimanis et al. (2015)	Four Problems, Four Directions for Environmental Humanities: Toward Critical Posthumanities for the Anthropocene	*Ethics and the Environment*	Examine the potential of environmental humanities as a mode of inquiry in the Anthropocene	Eco-imaginaries	Critical posthumanist inquiry	Future of environmental humanities
Bignall et al. (2016)	Three Ecosophies for the Anthropocene: Environmental Governance, Continental Posthumanism and Indigenous Expressivism	*Deleuze Studies*	Discuss the premise of indigenous knowledge for (posthumanist) ecological philosophies	Guattari's three ecologies & indigenous expressivism	Critical posthumanist inquiry & case study	Indigenous onto-epistemology
Datta (2016)	How to Practice Posthumanism in Environmental Learning: Experiences with North American and	*The IAFOR Journal of Education*	Examine the premise of posthumanist a participatory action research in education	More-than-human geography	Critical posthumanist inquiry (participant action research) & case study	Indigenous onto-epistemology and practice

	South Asian Indigenous Communities				
Ferrando (2016b)	The Party of Anthropocene: Post-Humanism, Environmentalism and the Post-Anthropocentric Paradigm Shift	*Relations. Beyond Anthropocentrism*	Focus on the posthuman turn as post-anthropocentrism and its implications for the practice of existence in the Anthropocene	Feminist new materialism	Critical posthumanist inquiry, creative writing, & image analysis	Post-anthropocentric mode of existence
Kruger (2016)	Posthumanism and Educational Research for Sustainable Futures	*Journal of Education*	Develop an alternative educational research idea that is compatible with sustainable futures	Barad's intra-action and Braidotti's nomadic posthumanism	Critical posthumanist inquiry	Education for sustainable futures
Maggs & Robinson (2016)	Recalibrating the Anthropocene: Sustainability in an Imaginary World	*Environmental Philosophy*	Develop alternative notions of sustainability and the Anthropocene	Flat ontology & regenerative sustainability	Critical posthumanist inquiry & case study	Flat ontology and regenerative sustainability
Malone (2016)	Reconsidering Children's Encounters with Nature and Place Using Posthumanism	*Australian Journal of Environmental Education*	Examine the humanist constructions of child-nature relations and to develop a posthumanist idea of sustainability education	Place-based research & feminist new materialism	Critical posthumanist inquiry & case study	Sustainability education based on nature-culture and human-animal continuums
De Carvalho (2016)	De la fonction du futur en éducation. Pour une critique de l'éducation humaniste	*Le Télémaque*	Highlight the contradictions and limits of humanist conceptions of modernity	Arendtian critical humanism	Critical humanist inquiry (opinion)	Arendtian approach to education
Forlano (2017)	Posthumanism and Design	*She Ji: The Journal of Design, Economics, and Innovation*	Introduce some posthuman-related ideas for a discussion about post-anthropocentric design	A review of posthumanist approaches and their critiques	Critical posthumanist inquiry	Post-anthropocentric design
Griffiths & Murray (2017)	Love and Social Justice in Learning for Sustainability	*Ethics and Education*	Examine the coherency of the Rio Declaration and its approach to sustainable development today	An ethical framework inspired by Hume and Maurice Merleau-Ponty	Critical posthumanist inquiry & case study	Phenomenological approach to sustainability education

Ulmer (2017)	Posthumanism as research methodology: inquiry in the Anthropocene	*International Journal of Qualitative Studies in Education*	Develop a posthumanist research method for scientific inquiry in the Anthropocene	Feminist new materialism	Critical posthumanist inquiry	Posthumanism as methodology
Di Chiro (2018)	Canaries in the Anthropocene: Storytelling as Degentrification in Urban Community Sustainability	*Journal of Environmental Studies and Sciences*	Examine contrasting stories for developing just sustainability	Anna Tsing's concept of the arts of noticing	Critical humanist inquiry & case study / storytelling	Just sustainability and Miner's canary
Ergene et al. (2018)	Ecologies of Sustainable Concerns: Organization Theorizing for the Anthropocene	*Gender, Work & Organization*	Offer an ecological feminist approach to the organization of economy and ecology beyond advanced market capitalism	Eco-feminist new materialism	Critical humanist and posthumanist inquiry (through cartography) & case study	Ecologies of sustainable concerns
Mäntymäki (2018)	Epistemologies of (Un)sustainability in Swedish Crime Series *Jordskott*	*Green Letters*	Show that the Swedish TV series challenges the humanist aspects of mainstream crime narratives	Feminist materialism and queer theory	Critical posthumanist inquiry & media analysis	Hybrid subjectivities
Oppermann (2018)	The scale of the Anthropocene: Material Ecocritical Reflections	*Mosaic: An Interdisciplinary Critical Journal*	Develop a scaled-down understanding of the Anthropocene through the story of matter	Material ecocriticism & eco-imaginaries	Critical posthumanist inquiry	Story of matter
Cielemęcka & Daigle (2019)	Posthuman Sustainability: An Ethos for our Anthropocenic Future	*Theory, Culture & Society*	Develop a posthumanist, in particular, post-anthropocentric and non-linear, understanding of sustainability	Feminist new materialism	Critical posthumanist inquiry & document analysis	Posthuman sustainability
Aka (2019)	Actor-network theory to understand, track and succeed in a sustainable innovation development process	*Journal of Cleaner Production*	Discuss the temporal and relational dimensions of sustainable innovation	Actor-network theory	Critical posthumanist inquiry & interview	Innovation as process and sustainability as process

Bruckner & Kowasch (2019)	Moralizing meat consumption: Bringing food and feeling into education for sustainable development	*Policy Futures in Education*	Criticize how meat and meat consumption topics are engaged in geography education curricula in Austria and Germany	Visceral geography and critical post/humanist education	Critical humanist and posthumanist inquiry & content analysis, large-scale questionnaire, & qualitative interview	Embodied approach to food
Dillard-Wright (2019)	Gaia Theory and the Anthropocene: Radical Contingency in the Posthuman Future	*Sanglap: Journal of Literary and Cultural Inquiry*	Develop a philosophical account of Gaia-centric view of the Anthropocene	Lovelock's Gaia theory & Latour's re-interpretation of it	Critical posthumanist inquiry	Sustainability of Gaia and radical contingency
Engelmann (2019)	Kindred Spirits: Learning to Love Nature the Posthuman Way	*Journal of Philosophy of Education*	Develop an alternative approach to education for sustainable development	A posthumanist reading of Bernhard H. Blasche	Critical posthumanist inquiry	Sustainable learning
Fox & Alldred (2019)	Sustainability, Feminist Posthumanism and the Unusual Capacities of (Post)humans	*Environmental Sociology*	Develop a post-anthropocentric, post-dualist view of ecological sustainability	Feminist new materialism	Critical posthumanist inquiry	Post-anthropocentric ecological sustainability
Lindgren & Öhman (2019)	A posthuman approach to human-animal relationships: advocating critical pluralism	*Environmental Education Research*	Offer a pragmatic account of critical pluralism in environmental education	Val Plumwood's ecofeminism & Rosi Braidotti's posthuman/ nomadic subjectivity	Critical humanist and posthumanist inquiry	Critical pluralism and posthumanism as a post-anthropocentric humanism
Pedersen (2019)	The Contested Space of Animals in Education: A Response to the "Animal Turn" in Education for Sustainable Development	*Education Sciences*	Criticize the idea of animal-for-us through the analysis of two recent articles related to the animal turn in education for sustainable development	MacCormack's posthumanist ethics	Critical posthumanist inquiry	Standing with and standing away from the animal
Schlosberg (2019)	From postmaterialism to sustainable materialism: the environmental politics of practice-based movements	*Environmental Politics*	Offer a new materialist alternative approach to politics and political activism	A dialogue with scholars of lifestyle politics, environmentalism, and new materialism	Critical humanist and posthumanist inquiry	Sustainable materialism
Visser (2019)	Posthumanism Policies for Creative, Smart, Eco-cities? Cases from China	*Environment and Planning A*	Examine the three Chinese cities from a human-centered urban	Guy Debord's idea of integrated spectecular	Critical humanist inquiry & case study	Posthuman city

			planning perspective			
Fox & Alldred (2020)	Re-assembling climate change policy: Materialism, posthumanism, and the policy assemblage	*The British Journal of Sociology*	Develop a policy as assemblage framework for climate change politics	Feminist new materialism	Critical posthumanist inquiry & creative writing	Policy (as) assemblage
Fredriksen (2020)	More-than-human Perspectives in Understanding Embodied Learning: Experience, Ecological Sustainability and Education	*FORMakademisk*	Offer a more-than-human account of embodied learning for ecological sustainability education	A dialogue with Dewey, Haraway, Ingold, and others	Critical posthumanist inquiry & multispecies ethnography	Embodied learning as more-than-human
Gough (2020)	Symbiopolitics, Sustainability, and Science Studies: How to Engage with Alien Oceans	*Cultural Studies / Critical Methodologies*	Examine the premise of a more-than-human science education and curriculum	A dialogue with Stefan Helmreich's (2009) book, Alien Ocean, from a more-than-human perspective	Critical posthumanist inquiry	More-than-human scientific inquiry
Jon (2020)	Deciphering posthumanist: Why and how it matters to urban planning in the Anthropocene	*Planning Theory*	Offer a posthumanist theory of urban planning	A dialogue with feminist new materialist and more-than-human political ecology writers	Critical posthumanist inquiry	Posthuman urban planning
Lazaro (2020)	Le droit et l'animal : sur les traces d'un post-humanisme juridique	*Revue D'Éthique et de Théologie Morale*	Discuss posthumanist legal alternatives from the standpoint of animal rights	A dialogue with posthuman scholars and more-than-human legal scholars	Critical humanist and posthumanist inquiry (opinion)	Purely posthuman law is not possible!
Jeong et al. (2021)	The Anthropocene as We Know it: Posthumanism, Science Education and Scientific Literacy as a Path to Sustainability	*Cultural Studies of Science Education*	Offer a post-anthropocentric account of science education for sustainability	A review of feminist new materialist and posthumanist education scholarship	Critical posthumanist inquiry	Posthuman science literacy
Lynch & Mannion (2021)	Place-responsive Pedagogies in the Anthropocene: Attuning with the more-than-human	*Environmental Education Research*	Offer a place-based pedagogy for the Anthropocene from a new materialist perspective	A dialogue with feminist new materialist, more-than-human geography, and posthumanist education scholars	Critical posthumanist inquiry & multi-case study	Place-responsive pedagogies
MacGregor (2021)	Making Matter Great Again? Ecofeminism, New Materialist and The	*Environmental Politics*	Remind and reemphasize the contribution of	Ecofeminist critique of feminist new materialist writers	Critical humanist inquiry	Ecofeminist materialist contribution

	Everyday Turn in Environmental Politics		(eco)feminist scholarship to materialist politics			
Muhlhauser et al. (2021)	Grilling Meataphors: Impossible™ Foods and Posthumanism in the Meat Aisle	*Humanities*	Discuss the rhetoric (and practices) of a US-based plat-based meat company from a posthumanist perspective	Posthuman rhetoric	Critical posthumanist inquiry & case study	Metaphor
Sadownik & Gabi (2021)	(Re)imagining Entangled Sustainability: A Human and Nonhuman Theorisation of Belonging to Safeguard Sustainability's Holism	*Sustainability*	Offer a balanced approach to (early childhood) education for sustainability based on a posthumanist understanding of belonging beyond social sustainability	Deleuze and Guattari's rhizome & Barad's intra-action	Critical posthumanist inquiry	Entangled sustainability & non-human agency
Walsh et al. (2021)	Towards a Relational Paradigm in Sustainability Research, Practice, and Education	*Ambio*	Present a systematic analysis of the literature that focuses on sustainability from a relationality perspective	A relational sustainability framework	Critical posthumanist inquiry & systematic review	A relational approach to sustainability

The peer-reviewed articles included in the selection can be seen in Table 1. When we stay within humanist disciplinary limits, education (n=17) and philosophy (n=9) appear to be the most productive disciplines. These two fields are followed by ethics (n=3), environmental humanities (n=3), sociology (n=2), urban planning (n=2), politics (n=2), business (n=1), organization studies (n=1), law (n=1), design (n=1), archaeology (n=1), media studies (n=1), and food studies (n=1).

Methodologically speaking, with the exception of two short opinion pieces, theoretical discussion is prominent in these studies. If the theoretical basis is divided into two as critical humanist and posthumanist, four articles tend to rely on humanist assumptions while 36 articles are rooted in the posthumanist ones. Also, five of them can be considered in transition. In nine out of 36 'posthumanist' articles, the theoretical discussion is supported by case studies. In this group, document analysis (n=2), interview (n=2), content analysis (n=1), media analysis (n=1), and multispecies ethnography (n=1) are also employed. Case study is also the most used method (n=3) of the articles with a critical humanist position. Moreover, one study uses a systematic analysis that is similar to what we aim for here. In fact, these alternative methodological choices do not mean that theoretical discussions are excluded; on the contrary, they contribute to the theoretical discussions in terms of different events and phenomena and the views of individuals (teachers or administrators).

Figure 2. Network of linked keywords. The analysis of the available keywords extracted from the selected articles. Each color indicates a different group of relationality.
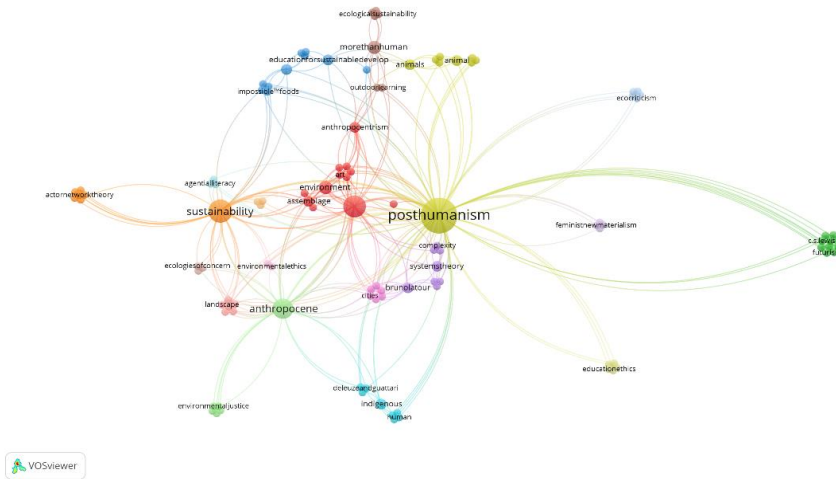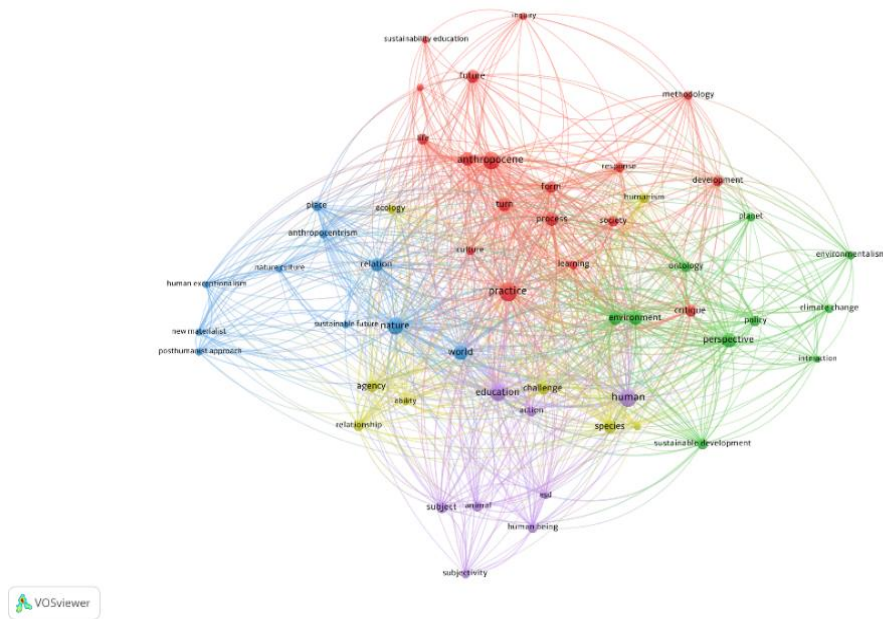

Figure 3. Word co-occurrence network. The analysis of the available abstracts resulted in five clusters that are shown in different colors.

Our evaluation of the articles in terms of their most prominent themes points to significant diversity. Figure 2 reflects this diversity based on the networked links of keywords used in those articles.

In particular, the works that can be considered as building blocks of the posthuman sustainability conceptualization (Cielemęcka & Daigle, 2019) cannot be reduced to a single theme. Braidotti's (Braidotti, 2005) posthumanist feminist approach around the concept of the nomadic subject, and

Alaimo's (2012) critique of sustainability, capitalism, and power around the idea of "sustainability that leads to environmentalism without environment, ecology that excludes non-humans" (562); Neimanis et al.'s (2015) discussion of the four problems facing the environmental humanities and their proposed solutions; or Bignall et al.'s (2016) discussion of the western rediscovery of indigenous knowledge through posthumanism may be counted among such works. Nevertheless, we identified some emerging themes.

In addition to the themes mentioned above; existential and materialist ecological imaginations of the post-Anthropocene, reproductive sustainability based on flat ontology, sustainability of Gaia with a focus on radical contingency, relational sustainability, ecologies of sustainable concern, sustainability beyond anthropocentrism, policy (as) assemblage, body politics, sustainable bioethics, sustainable materialism, more-than-human law, innovation as a posthumanist process, design beyond anthropocentrism, and cities without citizens. In the field of education for sustainability, the themes of posthumanist ethics, subjectivity, nature-culture, and human-animal continuum, standing with and standing away from the animal, learning beyond anthropocentrism, embodied learning, place-responsive pedagogy, indigenous knowledge and ways of knowing, unknowing and uncertainty, more-than-human scientific research curriculum and inquiry, and scientific literacy come to the forefront.

We employed co-occurrence analysis to approach the above-mentioned themes in a systematic way. Obviously, posthumanism (n=18) and sustainability (n=18) are the two most co-occurred terms in our analysis. We extracted them from the data corpus in order to understand what other clusters emerged under these two umbrella terms. Eventually, the VOSviewer analysis identified a network of 45 nodes and 849 links and classified them in five separate clusters (Figure 3): (1) practice (red) (2) perspective (green) (3) nature (blue) (4) species (yellow) (5) human (purple). As can be seen from Figure 3, the practice cluster has strong links with the Anthropocene, process, and turn. The perspective cluster is strongly related to time and environment. Similarly, the nature cluster has strong links with nature and relation, while species are linked with agency and challenge. Finally, education is embedded within the human cluster. In general, the closer the term is to the network's core, the greater its relational complexity. The link between the clusters offers a new way of approaching the terms in posthumanism praxis, and is primarily defined in terms of symbiosis, as both the bio- and techno-spheres are in mutual accord.

Discussion

Since the articles are the product of inter- and transdisciplinary approaches, trying to show each article in a single field may lead to a limited understanding. Rather than taking this risk, we argue that these articles are evidence of the emerging critical posthumanities combined with concerns about sustainability. According to Braidotti (2018, 1), "posthuman times, and the posthuman subjects of knowledge constituted within them, are producing new fields of transdisciplinary knowledge" that can be gathered as critical posthumanities. Our study also reveals that the transdisciplinary knowledge of critical posthumanities prioritizes ecological concerns. Such prioritization, in an interdisciplinary and transdisciplinary way, has also resulted in the emergence of environmental posthumanities (Daigle, 2022). Relatedly, the articles included in this comprehensive review question the idea of sustainable development and related choices in terms of sustainability and/or the Anthropocene. Thus, the onto-epistemological and ethical transformations and political-legal options required by ecological concerns are open for discussion in the fields of education, design, urban planning, law, and so on.

In these works, the study of sustainability in tandem with the narratives of posthumanism shows complexity. And this is true for both posthumanism as a narrative in/for sustainability and sustainability as a narrative in/for posthumanism. The critical perspective provided by the selected articles is apt to prove that these concepts are not perceived in terms of a previous human state or condition which seeks a new one. Instead, we must think beyond binaries, e.g. nature-body or human-cyborg. Accordingly, the idea of sustainability in this body of work corresponds to a cyclic approach of species rather than a linear one, since it is characterized by reproduction dependent on the conditions under which it is shaped (Cielemęcka & Daigle, 2019). Sustainability, in this sense, refers to a quality enabling to sustain itself and "capable of reproducing itself without undermining the conditions for its own existence" (Eriksen, 2022).

It is possible to narrate the concepts and themes prominent in the articles in different ways. Building upon Francesca Ferrando's (2019) tripartite model, we report our findings in five categories: post-humanism, post-anthropocentrism, post-dualism, post-Enlightenment and post-technologism. Post-humanism requires us to consider life and relationships beyond humanism's exclusionary definitions of humanity; that is, some people are not more or less valuable than others. We should resist the regimes of truth shaped by advanced capitalism that also blur the boundaries between humans, goods, and capital. In fact, we need to develop mechanisms that help us transform matters of fact such as disasters into matters of concern, and these concerns must be ecological (Ergene et al., 2018).

Second, post-anthropocentrism is the expression of a vision of life and relationships beyond the human species. In this sense, just sustainability (Di Chiro, 2018), ecologies of sustainable concern (Ergene et al., 2018), or policy as assembly (Fox & Alldred, 2020) reflect both post-humanist and post-anthropocentric visions. Although all the articles refer to various topics and themes, covering a wide research area of the onto-epistemological terrain in the humanities and social sciences, we contend that the overall scope remains the same: the examination of human nature, the relationship between humans and more-than-humans, as well as the future of humans, humanities, and humanist knowledge production.

And thirdly, the post-dualist vision, as a complementary one, is about imagining life and modes of existence, of which human beings are also part, beyond dualities. Seeing the world through symbiotic interfaces of nature-culture, human-animal, and human-machine reflects this vision. Here, the idea of a symbiotic interface refers to the fact that even apparently distinct systems are deeply linked with each other. Thus, an interface is not a place where different systems meet; rather, systems are interfaces both individually and collectively. The idea of interface can and should therefore be applied to sustainability research (Walsh et al., 2021) in general and particularly in the apparently distinct fields of education (Malone, 2016; Malone et al., 2017; Pedersen, 2019), heritage (Fredengren, 2015), and technology (Braidotti, 2005; Girvan, 2009; Hayles, 1999). Furthermore, each interface is closely related to the story of matter at various scales (Di Chiro, 2018; Oppermann, 2018). To avoid myopic analyses of material relations, we, therefore, need to scale down and look at what is going on with local human and more-than-human communities in different regions.

Furthermore, the post-Enlightenment vision reminds us that the discrete, autonomous, free individual of the Enlightenment never existed. The relational interpretation of sustainability (Walsh et al., 2021), embodied learning (Fredriksen, 2020), place-responsive pedagogy (Lynch & Mannion, 2021), and curricula (Gough, 2020) that pay attention to more-than-human beings can be read as reflections of this vision. Following such a post-Enlightenment vision will also have consequences for different areas of sustainability, such as reimagining sustainability policies (Maggs & Robinson,

2016), designing products, services (Forlano, 2017), and cities (Jon, 2020), and conducting scientific research (Ulmer, 2017).

Finally, a post-technologist vision means not to be mesmerized by technology and not to lose sight of its close relationship with socio-ecological injustices. Sustainable bioethics (McGregor, 2014), the sustainable body (Doane, 2015), or cities without citizens (Visser, 2019) can be seen as outlets stemming from concerns related to this vision. However, our analysis also shows that the technological-digital component has not yet attracted enough attention even though sustainability-related problems are taking place in the midst of technological intensification today. That means there is an urgent need for collaboration between the scholars of ICT4S, ICT4D, SE4S, and AI for sustainability and posthumanist sustainability scholars.

Three immediate issues

In response to the question 'What are the onto-epistemological and ethical issues that unite all the works included in the scoping review in terms of a vision of sustainability?', one can speak of a convergence in terms of assumptions and views about humans, their place on the planet, and matter—the relationality of matter and the materiality of relations. The articles examine the humanist and anthropocentric assumptions that underlie ideas about matter, vitality, and the human, as well as humans' (human-human or more-than-human [other animals, plants, or technologies]) relationships with the environments, or lack of those relationships. The common concern in these studies is that humanist, anthropocentric structures, and relations, including those built around the idea of sustainable development, do not serve to establish a sustainable, just, and inclusive model of life on the planet.

Nonetheless, we believe that three issues, in particular, need to be taken into account for posthumanist sustainability studies and, more importantly, for organized academic efforts towards the dissemination of alternative understandings of sustainability. The first is that posthumanist and (critical) humanist circles should listen to each other more. There may be structural reasons, such as the competition brought about by the neo-liberalization of academia and the acceleration of knowledge production, behind this. However, the fact that texts written with similar concerns in different fields do not hear each other is risky in terms of both scientific ethics and political ecological connotations. As Braidotti puts it, we can solve our problems only if we enact "…together, collectively. Because 'we'—who are not one and the same—are in *this* troubled world, in this painful moment, *together*. And the 'we' here includes the non-human" (2022, 241). Adoption of multiple onto-epistemologies may be a solution to the problem of epistemic bubbles. The vision of interdisciplinarity now needs to be complemented by plural onto-epistemological interactions. In this respect, we find Sherilyn MacGregor's (2021) critique of the new materialism from an ecofeminist perspective important, if somewhat provocative. MacGregor asks to what extend new materialist ideas are innovative. Following this, she states, previous ecofeminist ideas should not be left out of the new materialist analysis of everyday politics. Additionally, Adalberto Dias De Carvalho's (2016) turn from Arendtian humanist critique to posthumanist education bridges the divide between critical humanist and posthumanist education. De Carvalho makes a case for sustainability education, which resists the precariousness of life and the destruction of nature. Similarly, Nicklas Lindgren and Johan Öhman (2019) provide a critical, pluralist, and humanist interpretation of education that takes into account more-than-human beings. We hope that adding these articles to the posthumanism vault will help to keep the conversation going.

The second issue, related to the first, concerns the use of concepts. Given that the right dialogue cannot be maintained with the misuse of concepts, it becomes even more important to distinguish the different meanings of the posthuman, such as beyond the human, more-than-human, non-human, and transhuman. The articles in this selection reveal this conceptual richness as well as their risky uses. Robin Visser's (2019) critique, which focuses on the posthuman city, takes into account the transhumanist posthuman while ignoring critical posthumanist contributions. This example shows once again that the posthumanism-transhumanism distinction we mentioned above needs to be taken seriously in and beyond academia as a problem of scientific ethics and due to its political ecological implications for sustainability practices.

A final, related issue is that the 'post' in posthumanism is thought to be only about the present and the future. However, posthumanism is also about the past. It is connected with the past (Herbrechter, 2022), synthesizing it with the 'now' and 'then.' The connections, as already shown in the classics, ethnography, anthropology, archaeology, and so forth, should encourage us to look beyond dominant modes of existence and acknowledge the vast possibilities of becoming in the world. For instance, our thinking about the relationship between posthumanism and sustainability and about possibilities beyond humanism, the Enlightenment, and secular modernity should benefit from knowledges about other ways of being human depicted by posthumanist accounts of archaeology (Cipolla et al., 2021). Moreover, such multidimensional and multitemporal visions of becoming in the world have already been provided by a wide range of indigenous perspectives and traditional ecological knowledge. Nevertheless, the study of those alternatives provides more than a mere incorporation of indigenous worldviews into western post/humanism (Bignall et al., 2016). In fact, this can be envisioned as a way to decolonize various posthumanist geographies from indigenous perspectives.

Conclusion

In this article, we showed what possibilities different posthumanisms offer for alternative views of sustainability, based on a scoping review of relevant literature. We also wanted to open up for discussion some of the issues that we think stand in the way of these possibilities. The results of our scoping review support the posthumanist definition of posthuman that we proposed in the beginning. Although posthumanisms, due to the disciplines from (and through which) they are born and the questions they consider, take different issues into close focus, they, implicitly and explicitly, adhere to the concept of the posthuman, which is critical, ecological, inclusive, and post-secular. In this sense, we define posthumanism as a praxis of and for the posthuman that aims to decenter the human, decipher hegemonic power relations, undo injustices, and affirmatively contribute to sustainable ways of living together in this world, taking inspiration from diverse philosophical, scientific, and artistic traditions, as well as Indigenous worldviews. This is the promise we need to keep if we want to protect the planet and its ecosystems based on a philosophy of life that is sustainable, fair, and includes everyone.

The selected articles in our scoping review not only provide us with alternative onto-epistemologies and ethical positions around human and more-than-human life-forms and relations, but also give us enough proof that concepts and methodologies of sustainability are plural and always in progress. While posthumanism, with its multiple dimensions, creates a rich vault for sustainability, sustainability is a key word to shape, think, and perceive posthumanism and its critical premises for our more-than-human experiences and concerns. These two terms can (and should) be used to

'unite' binaries and lay the ground for a new era of citizenship in which humans will be citizens of the bio- and techno- interfaces that are sustainable.

Acknowledgments

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