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Relational approaches to sustainability transformations: walking together in a world of many worlds

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ABSTRACT

Transformations to sustainability require alternatives to the paradigms, practices, and policies that have generated social-ecological destruction and the Anthropocene. In sustainability science, several conceptual frameworks have been developed for transformations, including social-ecological, multi-level, transformative adaptation, and pathways approaches. There is a growing shift towards recognising transformations as ‘shared spaces’ involving multiple ways of knowing, being, and doing. Diverse relational approaches to transformations are increasingly articulated by Indigenous, humanities, and social science scholars, practitioners, and activists from the Global South and North. Broadly, relational approaches enact alternatives to separable categories of society and nature, emphasise unfolding relations between human and non-human beings, and highlight the importance of ethical responsibilities and care for these relationships. Yet while it is important to recognise the collective significance of diverse relational lifeways, practices, and philosophies to transformations, it is also vital to recognise their differences: efforts to produce universal frameworks and toolboxes for applying relationality can reproduce modernist-colonialist knowledge practices, hinder recognition of the significance of relational approaches, and marginalise more radical approaches. In this paper we explore five intersecting ‘relationalities’ currently contributing to discussions around transformations: (i) Indigenous-kinship, (ii) systemic-analytical, (iii) posthumanist-performative, (iv) structural-metabolic, and (v) Latin American-postdevelopment. We explore how these different relational approaches address key concepts in transformations research, including human-nature connectedness; agency and leadership; scale and scaling; time and change; and knowledge and action. We suggest that their diversity gives rise to practices of transformations as ‘walking together in a world of many worlds’ and support intercultural dialogue on sustainability transformations.

KEY POLICY HIGHLIGHTS

- Transformations to sustainability require alternatives to the paradigms and policies that have generated social-ecological destruction and the Anthropocene.
- Diverse relational approaches to transformations have been articulated by Indigenous, humanities and social sciences scholars, practitioners, and activists from Global South and North.
- Efforts to apply such approaches through universal frameworks or toolboxes may miss the significance of relational approaches, which are often defined by their attentiveness to unfolding relations among particular places, peoples, and ecologies.
- A relevant concept for engaging diverse relational approaches to transformations may be that of the uncommons – interests in common which are not the same interests.
- Relational approaches suggest practices of sustainability transformations as ‘walking together in a world of many worlds’.

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1. Introduction

There is widespread recognition in sustainability research, policy, practice, and activism of the need for radical social-ecological transformations to address inter-linked challenges of social and environmental injustice, biodiversity loss, climate change, poverty, and pollution, among others (O'Brien 2012; IPBES et al. 2019; IPCC

et al. 2023). These challenges have emerged in the context of intersecting processes of modernism, colonialism, and industrial capitalism designed to ‘sever relations between mind, body, and land’ (Davis and Todd 2017, p. 761). Mignolo and Walsh (2018, p. 4) suggest that there is ‘no modernity without coloniality’ and highlight their inextricability with the compound term ‘modernity/

coloniality'. Modernist-colonialist logics and practices are characterised by separable categories of society and nature, the belief in a single real world separable from socio-cultural perceptions of it, and the search for universal explanations and solutions (Hogan and Topkok 2015; Law 2015; Mignolo and Walsh 2018). These logics have shaped efforts to exploit nature through, for example, extractive resource use, as well as efforts to protect it through conservation and protected areas (Plumwood 1993; Büscher and Fletcher 2020). The scoping report for the forthcoming global assessment on transformative change by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) states that transformation will entail 'fundamental, system-wide reorganization across technological, economic and social factors, including [development] paradigms, goals and values, needed for the conservation and sustainable use of biodiversity, long-term human wellbeing and sustainable development' (IPBES 2021). A central aspect of transformations to sustainability therefore involves enacting alternatives to the modernist-colonialist paradigms, practices, and policies that have generated social-ecological destruction and the Anthropocene (Whyte 2017).

In the field of sustainability science, several conceptual frameworks have been developed to understand and advance transformations, including multi-level (Geels 2002), pathways (Leach et al. 2010), transformative adaptation (O'Brien 2012), and social-ecological approaches (Moore et al. 2014). While there has long been dissensus and dispute between these approaches (Geels 2010; Olsson et al. 2014; Stirling 2015) there has also been increasing cross-fertilization (Hölscher et al. 2018; Leach et al. 2018). This has been coupled with a shift away from advancing universal theoretical frameworks towards recognising sustainability transformations as 'shared spaces' or matters of care and concern (Pereira et al. 2020; Pathways Network ed 2021), involving multiple ways of knowing, being, and doing (Martin and Mirraoopa 2003). For example, Scoones et al. (2020) argue for the need to take seriously the presence of plural knowledges, politics, and pathways in pursuit of transformations. This movement towards multiplicity can be understood as an intentional departure from the Western-centric (Lam et al. 2020) and positivist-centric (Lövbrand et al. 2015) nature of much sustainability science and part of broader efforts to decolonize and diversify knowledge and action around sustainability transformations (Chilisa 2017; Temper et al. 2019).

This recognition of multiplicity has been furthered by the growing articulation of diverse relational approaches to transformations as an avenue for Indigenous, humanities, and social science scholars from the Global South and North to inform knowledge and action towards sustainability (Kealiikanakaoleohaililani and Giardina

2016; Chan et al. 2018; Walsh et al. 2021; Gram-Hanssen et al. 2022; Rist et al. 2023). Notions of relationality are used across multiple knowledge and governance systems, scholarly traditions, interdisciplinary conversations, and lived experiences in different ways, for different purposes, with different power relations (Raymond et al. 2021; Gallegos-Riofrio et al. 2022; Gould et al. 2023). Common resonances among relational approaches include (i) the embodiment of, or desire to pursue, alternatives to separable categories of society and nature, (ii) a sense of interconnectedness, reciprocity, and mutuality between human and nonhuman beings, and (iii) an emphasis on ethical obligations, responsibilities, and care for these relationships (Puig de la Bellacasa 2017; de la Cadena and Blaser 2018; Tynan 2021). Intercultural and interdisciplinary conversations around relational approaches to transformations have the potential to create alliances between alternatives to modernist-colonialist approaches in the Global North, land-based resurgence of Indigenous peoples around the world, and Global South communities of scholarship and action (Escobar 2015; Goodchild 2021). Yet a lack of appreciation for the differences between relational approaches can reproduce modernist-colonialist knowledge practices, hinder communication, and marginalise more radical or unfamiliar approaches (Watts 2013; Sundberg 2014; Böhme et al. 2022). This reveals the promises and tensions of working with notions of relationality in sustainability science: how to recognise the collective significance of relational approaches to sustainability transformations while retaining sensitivity to the diversity and context-specificity that constitute their very nature?

In this paper, we address this question by reviewing some of the diverse relational approaches that are currently informing transformations research and practice, focusing on transformations in relation to ecosystem management and governance. Our aim is to highlight the collective value of the diversity of relational approaches to sustainability transformations – not 'closing down' around a single notion of what relationality is, but recognising that relationalities are always situated, multiple, and emerging (Tynan 2021; Staffa et al. 2022). We begin by highlighting the diversity and politics of relational approaches and discuss the intricacies of making connections between those operating in Indigenous, Global South, and Global North contexts (Todd 2016). We continue by reflecting on our own positionality as a group of scholars in the context of the Special Issue to which this paper contributes. We then identify five broadly distinct yet intersecting relational approaches to sustainability transformations which we refer to as differing 'relationalities': (i) Indigenous-kinship, (ii) systemic-analytical, (iii) structural-dialectical, (iv) posthumanist-performative, and (v) Latin American-postdevelopment. We

explore how these differing relationalities – themselves composed of multiple approaches – each enrich understandings of key concepts in transformations research and practice: (i) human-nature interconnectedness; (ii) agency and leadership; (iii) scale and scaling; (iv) time and change; and (v) knowledge and action. We conclude by suggesting that the recognition of multiple relationalities leads to practices of transformations as ‘walking together’ (Sundberg 2014) in a ‘world of many worlds’ (de la Cadena and Blaser 2018), providing examples from our own experiences, and lend our support to initiatives that create spaces for intercultural dialogue and exchange around sustainability transformations (Pereira et al. 2020; Goodchild 2021).

2. Recognising the diversity and politics of relational thinking and practice

Philosophical and practice traditions that identify (or have been identified) as relational are exceptionally diverse, including many different Indigenous (Graham 1999; Wilson 2008; Itsiipootsikimskai et al. 2023), Japanese (Cook and Wagenaar 2012), Chinese (Mesle 2008), African (Chilisa et al. 2017), Latin American (Gallegos-Riofrio et al. 2022), Indian (Shankar 2023), and medieval European philosophies (Marenbon 2016), as well as the thinking and practices of land-based communities such as pastoralists, farmers, and fishers across the Global South and North (Semplici et al. *forthcoming*; Van Oudenhoven and Haider 2015). In the context of (Global North) social sciences and humanities – where the authors of this paper have most experience – relationality is often understood in terms of a relational ‘turn’ or direction in research inspired by philosophers including Dewey (1958), Whitehead et al. (1978), and Deleuze and Guattari (1988), emerging in the 1980s across fields including human, cultural, and economic geography (Whatmore 2002; Boggs and Rantisi 2003), science and technology studies (Latour 1993), sociology (Emirbayer 1997; Donati 2021), anthropology (Ingold 2000), psychology (Hartig 1993), and many others. Among these approaches, understandings of relationality vary and have evolved in many directions, including assemblage theory (DeLanda 2006), social network and complexity studies (Bodin et al. 2011; Weinbaum 2015), the ‘ontological turn’ in social theory (Escobar 2007) including new materialism (Barad 2007) and posthumanism (Panelli 2010), and increasing engagement with Indigenous philosophy and practice (de la Cadena and Blaser 2018). This diversity both across and within knowledge systems highlights that the term relational is often itself used in a relational way, used to distinguish a given approach from the ‘atomistic’, ‘essentialist’ or ‘substantialist’

approaches associated with modernist and Enlightenment European thinking, even though the dimensions of difference signified by the term may vary significantly (Selg and Ventsel 2020).

The diversity of relational thinking produces complex power relations and knowledge politics. Much (Global North) humanities and social science relational scholarship considers itself counter-hegemonic in the sense of critiquing and providing alternatives to still-dominant positivist approaches in science, policy, and practice. However, it can also reproduce Western-centrism, colonialism, and epistemic injustice where concepts of relationality are discussed without proper acknowledgment and engagement with Indigenous and Global South philosophies, scholarship and lived traditions (Watts 2013; Latulippe et al. 2023). Métis scholar Zoe Todd (2016) argues that, when Indigenous relationalities are mentioned in Western posthumanist scholarship, they are often used in support of the (theoretical) endeavour of the author without recognising the distinctiveness of Indigenous knowledge and governance systems or engaging with the political realities faced by Indigenous peoples. This is especially important given that, for many Indigenous peoples, practising and renewing relational knowledge, governance, and legal systems is not only a philosophical exercise but also a lived reality and an everyday struggle for existence in face of enormous ongoing colonial injustices, including those implemented by Western research practices (Tuhiwai Smith 1999). Indeed, non-Indigenous scholar Juanita Sundberg (2014) describes how her use of posthumanism has sometimes reflected a disembedded and disembodied understanding of relationality within a deeply settler-colonial context – precisely what such scholarship ostensibly seeks to avoid. Meanwhile, other research has brought Indigenous relationalities into dialogue with Western relationalities in, e.g. systems thinking (Goodchild 2021) and human geography (Bawaka Country et al. 2016), through respectful and practice-oriented collaboration between Indigenous and non-Indigenous scholars. It is vital to attend to the diversity and politics of relational approaches to transformations, if Global North relationalities are not to simply reproduce modernist-colonialist knowledge practices in new guises (Kaul et al. 2022).

3. Positionality

As an author group we are White environmental social scientists and humanities scholars located in the Global North, including Europe and the settler-colonial states of Australia and Canada. As such we recognise that we benefit from and are implicated in ongoing processes of colonialism and are committed to enacting an anti-colonial ethos in our work and

everyday lives (Liboiron 2021). We have worked closely with colleagues in land-based and Indigenous communities across the Global South and North, who have challenged us, guided us, and continue to teach us about the complexities of anti-colonial work. At the same time, in the field of sustainability science we are part of a transdisciplinary community including natural scientists, engineers, and economists. Consequently, we often find ourselves situated at the interface between multiple worlds, knowledge practices, and audiences, and experience the tensions and contradictions that arise from this position (Gani and Khan 2024; Haraway 2016). We often make mistakes and are committed to learning from them (e.g. Gallegos-Riofrio et al. 2022; Gould et al. 2023) as well as publishing so that the struggle in constantly becoming differently is done ‘out loud’ and in conversation with communities of scholars and practitioners who are also engaging in this work.

4. Methods

Our methodological approach in this paper is a narrative review (Paré and Kitsiou 2017). We searched for journal articles, books, and book chapters that used the terms ‘relational’ and ‘relationality’ alongside ‘transformations’ and ‘sustainability’. We focused on journals considered central to the sustainability science community we are part of, including *Sustainability Science*, *Current Opinion in Environmental Sustainability*, *Ecology & Society*, *Global Environmental Change*, and so on, while also moving beyond that when the articles were particularly relevant to or targeted at this community. We also followed citation chains and spoke to colleagues in search of further articles (sometimes called a ‘snowball’ approach). We were not aiming at an exhaustive list, but rather a selection broad enough to highlight some of the diversity present in the literature (the final selection is listed in Appendix 1). We limited ourselves to a relatively narrow understanding of sustainability science (e.g. Clark and Harley 2020), whilst recognising that sustainability science has many different geographic and scholarly communities, both to limit the number of articles up for consideration and because this is the primary audience we wanted to speak to. We also adopted a relatively narrow understanding of ‘sustainability transformations’ as that indicating deep social-ecological change towards sustainability (Scoones et al. 2020), while recognising that the term ‘transformations’ has been used by many different scholarly communities, including those around ecosystem (Turner et al. 1990) and political change (Price 1991). We acknowledge that there is a huge body of scholarship from Indigenous, Global South and Global North scholars highly relevant for notions of

relationality and sustainability transformations, but that hasn’t yet been articulated directly to a sustainability science audience and would not have been captured by our search terms. We decided not to include this literature as we felt it was more appropriate that these scholars articulate a connection should they choose to do so, although we recognise that this choice may reinforce boundaries that exclude.

We carefully read the selected papers and inductively identified five broadly distinct but also deeply interrelated conversations about relationality in sustainability transformations (‘relationalities’) informed by different traditions of research and action: Indigenous-kinship, systemic-analytical, posthumanist-performative, structural-dialectical, and Latin American-postdevelopment. In deriving these terms, we attempted to use those that scholars themselves are using to describe and situate their work. The first part of each compound term refers to the broad identifier of the research tradition, with the second highlighting a key aspect of the relationalities described. Our identification of these relationalities was also informed by our own experiences of engaging in conversations around relationality (e.g. Raymond et al. 2021; West et al. 2021; Gallegos-Riofrio et al. 2022; Gould et al. 2023). We recognise that because of our inductive approach rooted in our own experiences and positionality, and the inherently interpretive nature of conceptual groupings, these five relationalities are only one way of making sense of a complex set of discussions, and that there are many other ways of doing so. Note also that much work moves between our groupings and could thus be included under multiple relationalities. For example, Latin American-postdevelopment relationalities have evolved through close relationship with Indigenous-kinship relationalities, yet Latin American conversations around postdevelopment engaging Indigenous, afro-descendent, peasant, and student movements, among others, are often presented as a distinctive grouping (Vanhulst and Beling 2019; Gallegos-Riofrio et al. 2022). Finally, we also recognise that the five relationalities we highlight are not the only ones present in sustainability science, and especially not in the academic literature more broadly (for example, traditions of *Ubuntu* in southern Africa or *eco-swaraj* in India).

We then explored the ways that each of the relationalities are addressing key concepts in transformations research, which we identified through an iterative process of reading and discussion as: human-nature connectedness; agency and leadership; scale and scaling; time and change; and knowledge and action. Similarly to our identification of the relationalities, in deriving these concepts we tried to stay close to the ways that the articles discussed their own

contributions, as well as drawing on our experiences of discussions within sustainability science research on transformations (e.g. Hertz and Mancilla Garcia 2021; Moore et al. 2023). This approach is inextricably tied to our positionality and academic training in the Global North. For example, trawlulwuy scholar Lauren Tynan describes how a classificatory approach to understanding that compares across different ‘kinds’ of what is taken to be a broader phenomenon is a peculiarly Western scholarly practice. While classificatory practices can be useful for certain purposes, they are also deeply implicated in modernist-colonialist knowledge and governance and can perpetuate violence if imposed rigidly. Inspired by the work of Tynan and Gamilaroi scholar Michelle Bishop (Tynan and Bishop 2023), themselves drawing on the work of Opaskwayak Cree scholar Shawn Wilson (2008), we attempt to use these conceptual groupings lightly, highlighting connections between relationalities (where scholars themselves have articulated these connections) and letting the articles speak for themselves through direct quotations rather than explaining them in our own words.

5. Multiple relationalities in sustainability transformations

In this section we present five distinct but intersecting conversations about relationality and transformations in the field of sustainability science, which we describe as different ‘relationalities’: Indigenous-kinship, systemic-analytical, posthumanist-performative, structural-metabolic, and Latin American-postdevelopment. We offer these terms as provisional ways of making sense of the multiple and fluid conversations currently taking place around transformations, rather than static containers or homogenised approaches. We describe each relationality through the ways each has engaged with key concepts in transformations research: human-nature connectedness, agency and leadership, scale and scaling, time and change, and knowledge and action. We highlight some of the many ways in which these relationalities have intersected to represent the vibrancy of current conversations and the ongoing potential for new connections (Figure 1). We mainly draw from the literature that appeared in our review but sometimes reference secondary sources referred to by the primary literature to highlight key points.

5.1. Indigenous-kinship relationalities

Potawatomi scholar-activist Kyle Powys Whyte (2017, p. 159) writes that, for many Indigenous peoples, sustainability challenges are an intensification of

interlinked processes of colonialism, capitalism, and industrialization (ongoing since the 1500s) that have severely disrupted ‘human-nonhuman-ecological relationships’ (see also Davis and Todd 2017; Simmons 2013). Māori, Pākehā and Lebanese scholar Meg Parsons, writing with Ngāti Maniapoto, Waikato-Tainui, and Pākehā scholar Karen Fisher (Parsons and Fisher 2020:124), highlight that ‘transformations to sustainability in settler and postcolonial societies must confront, therefore, the effects of colonisation on Indigenous peoples, which includes addressing the exclusion of Indigenous knowledge systems and values and developing modes of governing that meet Indigenous aspirations for the future’. Indigenous approaches to transformations are often situated in Indigenous resurgence, land rights, and sovereignty agendas around particular lands, territories, and peoples, rather than targeted at sustainability in a general sense (Betasamosake Simpson 2014; Woollorton et al. 2020). For example, Gram-Hanssen (2021, p. 525), describing collaborative research with Yup’ik peoples in Igiugig, Alaska, states that ‘transformations [in Igiugig] have come about through deliberate efforts to decolonize and “take back” community systems by shifting them toward enhanced autonomy and self-sufficiency with the values of self-determination and cultural integrity’. Māori scholar Lewis Williams (2018, p. 346), drawing on Spretnak (2011), discusses transformation in terms of a ‘*relational shift* [...] through practices which recultivate the mutual sentience and agencies of all life forms’, echoing Whyte’s (2017, p. 158) description of Indigenous efforts towards ‘renewing relatives’ - restoring ethical relationships and reciprocity between humans and nonhumans.

Human-nature connectedness

Kombu-merri scholar Mary Graham (1999) notes that while different Indigenous clans and nations have different creation stories, knowledge and governance systems defining relationships with land, some shared themes include the importance of spirit or life force, interconnectedness and kinship, and ethical obligations and responsibilities (see also Parsons and Fisher 2020). Apgar et al. (2015), reporting collaborative research on transformation with the Guna peoples of Panama, describes the *Bab Igar*, the cultural spiritual framework that guides engagement of Guna in the world within which ‘all things and beings are part of one system, and all material things have *burba*, i.e. life or spirit. Plants, animals, rocks, minerals, and people all have *burba*. This whole-system view emphasizes a fundamental connectedness and relationship, and promotes continued reflection on identity and purpose in the world’. Native Hawaiian scholar Kealiikanakaolehaililani and Giardina (2016, p. 63) write of the importance of

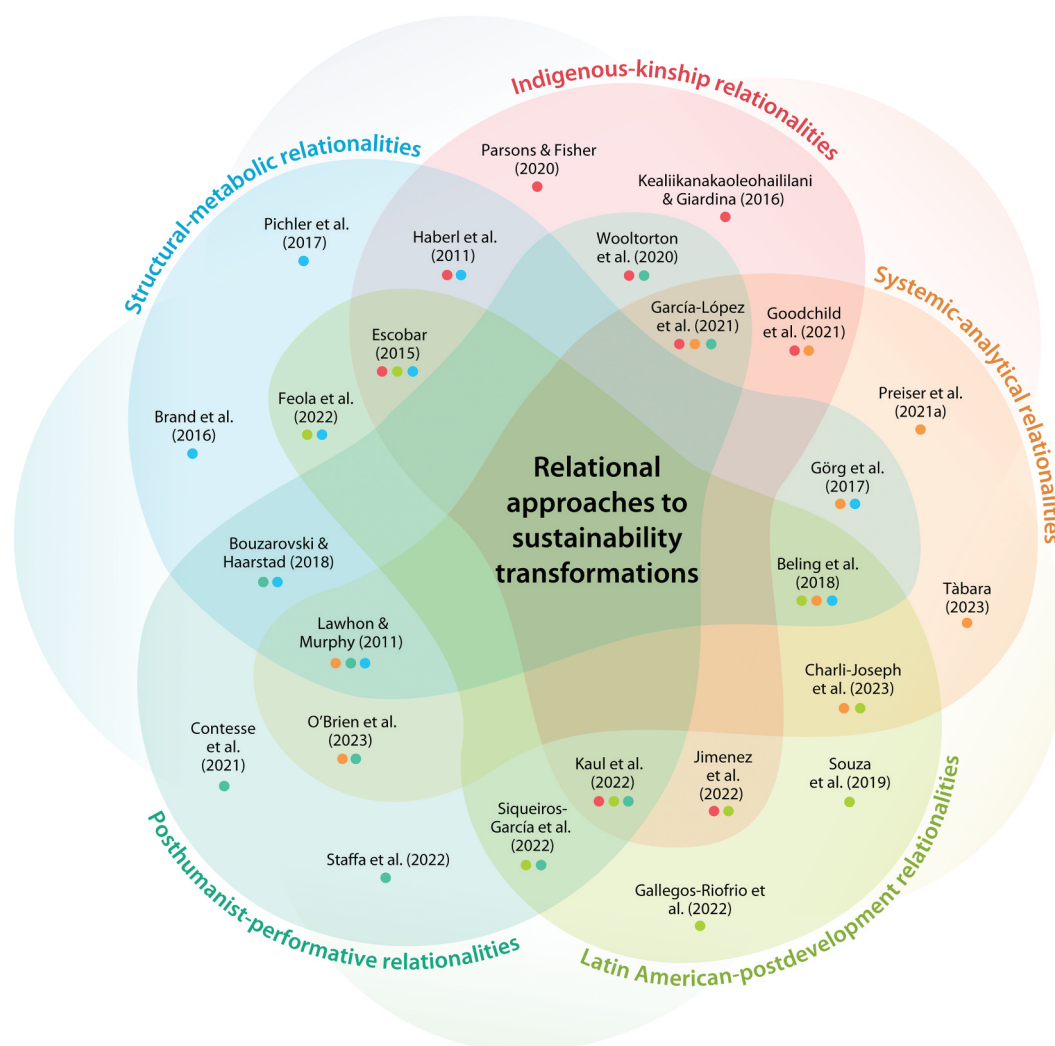


Figure 1. Relational approaches to sustainability transformations in sustainability science. Note that these do not constitute the only relationalities in sustainability science (or in the broader literature) but are rather those that we focus on in this paper. The fainter overlapping shapes in the background are intended to symbolise additional relationalities that are either present in sustainability science today or may be in the future. References are illustrative rather than extensive to avoid cluttering the image.

the term ‘ohana (family) for Hawaiian Indigenous sustainability: “ohana will include, for example, biological and/or adoptive parents, all relatives dead or alive, the ‘iwi bird, the taro plant, lightning, a particular shark guardian, or a particular rock formation”. Wooltorton et al. (2020, p. 925) describe Indigenous-led processes of transformative sustainability education oriented around notions of ‘becoming family’ with place (including humans and non-humans/more-than-humans) which carries ‘deep obligation and responsibility’.

Agency and leadership

Haudenosaunee and Anishinaabe scholar Vanessa Watts (2013, p. 23) notes that in Anishinaabe and Haudenosaunee cosmologies, ‘all elements of nature possess agency, and this agency is not limited to innate action or causal relationships’. Wooltorton et al. (2020, p. 925) describe an Indigenous-led movement involving Nyikina Warrwa scholar Anna

Poelina to recognise Martuwarra in north-western Australia (known in English as the Fitzroy River) as ‘a vital living ancestral being with its own right to life’, recognising further that place – or Country – ‘and all that it embodies, is active as a participant in the everyday ongoing world’ (p. 926). In terms of human agency and leadership for transformative change, Gram-Hanssen (2021, p. 534) writes that in Igiugig, Alaska, while some Yup’ik play prominent roles within the community these people ‘cannot be separated out from the community. Rather, individuals seem to operate within a collective field, defined by community values and culture and influenced by both human and nonhuman phenomena (including past and future generations). What emerges then is a process of “individual-collective simultaneity”, where the act of relating becomes a defining feature of both the individual and the collective’.

Scale and scaling

Kealiikanakaoleohailani and Giardina (2016) highlight the centrality of place in Indigenous approaches to sustainability transformations, writing that ‘only when people are in relationship with place and with resources can there be deepened connections between beings (plant, animal, physical, spiritual)’. This is echoed by Haudenosaunee Elder and Knowledge Keeper Roronhiakewen (He Clears the Sky) Dan Longboat, quoted by Anishinaabe (Ojibway) scholar Melanie Goodchild (2021, p. 98), who states that systems-change comes from ‘connecting human beings to themselves, to each other, to a sense of place, to a physical and spiritual world ...’. Māori scholar Lewis Williams (2018, p. 349) describes efforts in Indigenous-led sustainability education to transform worldviews and cultural practices in terms of the concepts of ‘scaling deep, up, and out’ (initially developed within social innovation and systems approaches, see Section 4.2. below), writing: ‘Scaling DEEP reverberates throughout the other categories as it is primarily to do with transformational approaches to ontology, epistemology, and culture within individuals and collectives in ways that “unsettle” settler colonial relations of place. Foundational to Scaling UP and OUT, it is literally rooted in the genealogy of place and recognizes the intimate connection between unlocking Indigenous perspectives of ecosystems and the well-being and resurgence of Indigenous societies more generally [capitals in original]’. Williams (2018, p. 344) describes scaling up and out in terms of programming and policy change to support Indigenous-led initiatives in-place, an approach echoed in Vijayan et al.’s (2022, p. 2) emphasis on the importance of widespread institutional change to support Indigenous approaches to food system transformations.

Time and change

Indigenous engagements with transformation have often been animated by circular or cyclical rather than linear temporalities (e.g. McGrath et al. 2023). Woollorton et al. (2020, p. 922) describe an education project in the Leschenault Estuary in Western Australia involving Noongar science and concepts, writing that one of the most significant aspects of the project was understanding the estuary through a Noongar ‘cyclical/spiral’ view of time: *‘kura, yeyi, burdawan*: long ago, now and future – all in the present era. In Noongar Country, this Noongar worldview keeps the spirits of place, the ancestors, stories and past events – including colonialism – here in the ongoing present. This is one way in which stories “live” in places. Stories “belong” in places, cared for by *bidiya*, elders: the people who hold knowledge and leadership including knowledge of the *bidi* - pathways’. Gram-Hanssen (2021, pp. 523–

524) highlight that such cyclical and spiralling temporalities are essential for the expression of agency in pursuit of transformation, noting that in the Igiugig Climate Adaptation Assessment Plan, a community Elder states: ‘The grandpa’s and grandma’s spoke to us, what we got coming behind us ... we can remember and we could pass it on, what’s coming behind us’.

Knowledge and action

Goodchild (2021, p. 79) highlights the differences between Indigenous approaches to knowledge and action and Western approaches: ‘Conventional systems-based approaches to tackling wicked problems have epistemological foundations in the Western scientific method that pursues “knowledge” in an analytical way, whereas Indigenous ways of coming to know, as practiced by Elders, is the pursuit of “wisdom-in-action” (Aikenhead and Michell 2011, p. 69)’. Apgar et al. (2015) describe the Guna *war uet* ritual, used infrequently and only in times of crisis or upheaval, as a means of enabling collective reflection for transformative change where a ritual specialist ‘uses chanting to enter the spirit world to engage with the underlying cause of the disruption’, providing opportunities to ‘develop new and innovative pathways forward’. Williams (2018, p. 349) explores transformative educational practices as a means of supporting decolonization ‘through the activation by Māori for Māori of the very localized and intricately interwoven entities of whakapapa, mātauranga Māori, and te reo Māori (Māori genealogy, knowledge, and language; Harmsworth and Awatere 2013)’. Meanwhile, Goodchild (2021, p. 75) explores the importance of cross-cultural dialogues between Indigenous and non-Indigenous peoples as a ‘doorway to healing, transformation and to spiritual understanding’, using the concept and spirit of the two-row wampum belt as a means of creating an ethical space for dialogue between Anishinaabe, Haudenosaunee, and non-Indigenous systems thinkers around sustainability and global systems change.

5.2. Systemic-analytical relationalities

In Western scientific traditions, an emerging body of research and action has brought social-ecological systems research together with various relational approaches to develop ‘systemic-analytical’ accounts of relationality in sustainability transformations (Hertz et al. 2020; Preiser et al. 2021). Systemic-analytical relationalities suggest that sustainability challenges have been generated by, among others, Newtonian approaches to science emerging in the 16th and 17th centuries embedded within ‘policies, processes and institutions that [...] supported the

mechanisation, industrialisation and formalisation of processes of production and modes of organising societal norms' (Preiser et al. 2021, p. 31). Newtonian approaches are premised on the separation of human and natural systems and the assumption that both operate mechanistically in 'orderly, deterministic and predictable' ways, thus enabling extractive resource use as well as 'command-and-control' approaches to environmental management (Holling and Meffe 1996; Preiser et al. 2021, p. 31). Systems approaches argue that the recognition of humanity as an earth system force in the Anthropocene necessitates a shift in mindsets towards recognising social and ecological systems as inextricably intertwined, co-evolving, and characterised by nonlinear, self-organising and emergent dynamics (Bodin et al. 2011; Folke et al. 2021; Haider et al. 2021). Systems scholars have drawn on relational sociology and process-relational philosophy to highlight that the interactions and relations between system components are more important than the components themselves (Preiser et al. 2018; Tábara 2023). Systems-analytical approaches to transformation have emphasised more flexible and adaptive governance approaches (Ernstson 2011), ethics of care and stewardship (Enqvist et al. 2018), and the development of open-ended 'transformative spaces' capable of fostering novel social-ecological innovations and processes of 'relational reconfiguration' (Preiser et al. 2021, p. 630).

Human-nature interconnectedness

While social-ecological systems research has long argued that social and ecological systems are inextricably interwoven and co-constituted, there have been different ways of conceiving of this interconnectedness (Biggs et al. 2021). The predominant approach has been to conceive of systems of co-evolving social and ecological entities connected through relationships (e.g. Moore et al. 2014). As Tábara (2023, p. 2) writes, drawing on Simmelian sociology, 'we live in the natural environment as much as the natural environment lives in each of us'. This is also reflected in Bodin et al.'s (2011, p. 11) social relational approach drawing on the relational sociology of Emirbayer (1997) and rooted in quantitative social network analysis, which conceptualises social systems as 'a collection of nodes (representing individuals, firms, organizations, nations) connected (fully or partially) by lines (social relations)'. Here, relations are essentially treated as links between social or ecological nodes/entities with their own ontological status and causal powers. In Preiser et al.'s (2021:33–35) approach, informed by critical realist philosophy, 'relations and the emergent causal organisational interactions are acknowledged to have real effects on a systemic level of the whole, and we can therefore

say that the relations are ontological (i.e. something real)' and that consequently 'complex behaviour and structures emerge as a result of the recursive and aggregate patterns of relations that exist between the component parts of systems'. Taking this further, Hertz et al. (2020) draw on the process-relational philosophy of Whitehead, Deleuze and Guattari, Stengers, and others, to develop an account of relationality in complex systems where relations and processes (the unfolding of relations through time) are primary and are understood to give rise to or produce entities, nodes, or components in the first place. This processual understanding is proposed to overcome the methodological separation of social and ecological entities in social-ecological systems research (Hertz et al. 2020; Folke et al. 2021).

Agency and leadership

Early social-ecological systems research examined the role of individual (human) leaders and the networks they created – in concert with existing institutions and structures – to catalyse transformative change (Olsson et al. 2004). In the years since, concepts of agency have been broadened into notions of 'systems entrepreneurship' to more explicitly recognise the distributed nature of agency (Moore and Westley 2011; Westley et al. 2013). For example, Ernstson (2011, p. 258) uses social network analysis to explore transformation in the Stockholm Urban Park, Sweden, presenting agency as 'a relational property that is a function of individual skills, the relations among various actors, and on network structures they create'. Meanwhile, Charli-Joseph et al. (2023, p. 1215) examine practices that nurture collective agency in the Xochimilco wetlands in Mexico City, describing a three-step process of '1) questioning dominant narratives about a situation, (2) building capacities to reframe the situation, and (3) enacting new compelling narratives that support the group's transformative agency'. Kok et al. (2021, p. 1) combine complex adaptive systems, relational sociology, new materialism, and actor network theory, to extend agency beyond the human into collectives of humans, material infrastructures, and ecological assemblages, presenting agency as an 'embedded and temporal capacity for reorientation'. Tábara (2023, p. 4) extends the role and relations of the human and non-human even further, describing agency, and in particular, the regenerative capacities needed for sustainability transformations, as 'emergent properties derived from positive synergistic interactions of agents both human and non-human able to influence the multiple social-ecological conditions and processes in which they live and that live within them'. Drawing these threads together, O'Brien et al. (2023) develop a fractal approach to agency, informed by

systems, Indigenous, and posthumanist perspectives, in which agency is framed ‘as both a quality and a capacity to generate patterns that are context specific yet aligned to strategically transform inequitable and unsustainable relationships’.

Scale and scaling

Systemic-analytical relationalities view transformations as multi- and cross-scale phenomena (Moore et al. 2014). In earlier work on transformations scales were understood in terms of nested hierarchies, with ‘smaller and faster systems [...] contained within larger and slower systems’ (Grandin and Haarstad 2021, p. 293). Conceptions of scale and scaling have become more fluid and non-hierarchical since, with network studies situating actors and organisations within shifting and heterogeneous networks across scales (Bodin et al. 2011; Ernstson 2011). Moore et al. (2015, p. 74) argue that social-ecological transformations require complex understandings of scale and scaling, and propose a typology of scaling transformative innovations in terms of scaling out (impacting greater numbers of people and ecosystems), scaling up (changing laws and policies), and scaling deep, which ‘relate[s] to the notion that durable change has been achieved only when people’s hearts and minds, their values and cultural practices, and the quality of the social relationships they have, are transformed’. O’Brien et al. (2023) build on Moore et al.’s (2015) notion of scaling deep to develop a fractal approach to scaling as a way of addressing ‘how human agency can transcend scales to connect individual change, collective change, and systems change’. Fractal approaches ‘shift the focus from scaling through “things” (e.g. technologies, behaviours, projects) to scaling through a *quality of agency* based on values that apply to all, such as oneness and integrity [...] that recursively repeat at all scales’ (O’Brien et al. 2023).

Time and change

Systems-analytical approaches emerged out of non-equilibrium and non-linear thinking, focusing on potentially rapid and unpredictable movement between multiple stable states. This has given rise to frameworks for deliberate transformation presenting phases of movement from one state to another, including ‘triggers/pretransformation’, ‘preparing for change’, ‘navigating the transition’, and ‘institutionalising the new trajectory’ (Moore et al. 2014; Olsson and Moore 2024). Hertz et al. (2020) draw on the process-relational philosophy of Whitehead to highlight that these system states are themselves constituted of continually unfolding processes, thus helping

to bring to life the call by van der Leeuw (2000) for systems thinkers to assume change and explain relative stability, and Folke et al. (2011) notion of ‘dynamic stability’. Preiser et al. (2021, p. 627) write that instead of assuming a world of static objects or states to which change happens, ‘we are prompted to realise that the world is continuously producing newness [...] a relational theory of change suggests that transformation comes about by reconfiguring the relational structure of systems and by creating opportunity contexts that allow new relations to grow’. In addition, systems scholars have increasingly engaged in imaginative processes of narrative and scenario-building in order to generate visions of transformed futures, leading to greater recognition of the multiple ways in which time is experienced across cultures and disciplines, and the need for spaces and heuristics in which diverse temporalities can unfold (Moore and Milkoreit 2020; Terry et al. 2024).

Knowledge and action

Systemic-analytical relationalities have long highlighted the importance of devising ‘flexible institutions and adaptive governance structures that [...] are able to respond to complex dynamics and cope with unpredictabilities’ (Bodin et al. 2011, p. 4). Increasingly, there has been a focus on open-ended ‘transformative spaces’ as spaces for actors to test concepts and develop innovations (Pereira et al. 2020), described by Preiser et al. (2021, p. 630) as ‘spaces in which new relational configurations can be nurtured or strengthened so as to create new forms of agency and transformative potential – that is, they are holding places for relational reconfiguration’. One example of a potential transformative space is the Transformation Lab (T-Lab) trialled in places across the Global South and North (Pathways Network 2018). Charli-Joseph et al. (2023, p. 1229) describe a T-Lab in the Xochimilco wetlands, Mexico City, highlighting that ‘the T-Lab space-process was not only about discussion and verbalisation, but also about experiencing, doing, and affectively relating in new ways’ (see also Siqueiros-Garcia et al. 2022). This focus on experience, affect, and embodiment resonates with Kok et al.’s (2021, p. 9) call for transformations research to work more closely with the agency of materiality and non-human participants in complex systems. Preiser et al. (2021, pp. 627–630) argue that a relational emphasis on continually unfolding processes leads to a reconfiguration of the role of the researcher in transformations, away from designing interventions to ‘bring about

change or mark some abrupt new point of departure', towards roles for researchers as 'process facilitators' or 'curators' of relations already unfolding in particular contexts.

5.3. Posthumanist-performative relationalities

Often in dialogue with systems-analytical approaches, a growing number of scholars have brought perspectives from feminist care ethics, new materialism, posthumanism, and practice theory, among others, to bear on research and action towards sustainability transformations (Hertz and Mancilla Garcia 2021; Walsh et al. 2021; Böhme et al. 2022). While there are substantial differences among these theories we highlight their mutual resonances here with the general term 'posthumanist-performative' (following, e.g. Sundberg 2014). Posthumanist-performative relationalities tend to highlight the string of related dualisms inherent to modernist knowledge practices – including nature and society, mind and matter, subject and object, and knowledge and action – as fundamentally linked to unjust social-ecological relations of patriarchy, colonialism, racism, and environmental degradation (Fox and Alldred 2020; Staffa et al. 2022). Posthumanist-performative relationalities argue that these dualisms and associated assumptions are not given or pre-existing but are enacted or 'performed' through practices or modes of engagement (Cooke et al. 2016). Consequently, posthumanist-performative approaches emphasise the importance of performing alternative practices capable generating realities that are more just and conducive to sustainability, and advance relational understandings that view humans and nonhumans as emerging through their relatedness (Dedeoğlu and Zampaki 2023). Posthumanist-performative approaches to transformation have emphasized contextual and place-based actions (Böhme et al. 2022), ethics and practices of care (Moriggi et al. 2020), support for rights and governance systems of Indigenous and local peoples (Foggin et al. 2021), and arts-based methods and novel pedagogies (O'Neil 2018; Hertz et al. 2020).

Human-nature interconnectedness

Posthumanist-performative relationalities begin from an ontological assumption that reality consists of entangled processes (O'Neil 2018; O'Brien et al. 2023). The unfolding and coming together of processes produce 'events' or 'entities' (where entities are understood as events experienced by a being) (Hertz et al. 2020). Human understandings of the world are therefore produced from how we engage with it (Cooke et al. 2016). In their account of transformation in Baltic Sea fisheries, Hertz and Mancilla Garcia (2021, p. 2) draw on the work of philosopher Karen Barad to identify these forms of engagement as

'material-discursive arrangements' or 'practices' through which 'a "part" of the world becomes intelligible to another "part" of the world'. These practices do not discover a world that is pre-existing 'out there' but actively help to produce it, and are thus 'ontologically inseparable from, or entangled with what they produce' (Hertz and Mancilla Garcia 2021, p. 2). While such practices are exceptionally diverse around the world, the interlinked material-discursive practices associated with modernism – which perform separable social and ecological entities with distinct sets of properties – have become dominant, particularly in the Global North (Fox and Alldred 2020). Therefore, from a posthumanist-performative perspective, 'humans' and 'nature' are not pre-given or inherent categories of the world, but are generated through particular performances of reality (West et al. 2020).

Agency and leadership

In posthuman-performative relationalities the concept of agency is not treated in terms of conscious or intentional action but in the broader sense of the ability to affect or 'do things' – thus expanding agency beyond the human to nonhumans, ecologies, and infrastructures (e.g. García-López et al. 2021; Lawhon and Murphy 2011). For example, Hoffman and Loeber (2016, p. 706) develop a practice-based approach to explore the networked agency around the 'closed greenhouse' in Dutch agricultural transitions. Meanwhile, Contesse et al. (2021, p. 7) draw on actor-network theory to highlight the active role of the *Bagrada hilaris* bug in initiating agricultural transitions in Chile, including destabilising existing pest management regimes and catalysing new relationships and forms of organisation among farmers. Taking this a step further, O'Neil (2018) draws on the work of Barad to argue that agencies do not 'pre-exist' in entities before then interacting with each other, but are only realised through their mutual relating or 'intra-action' as part of the unfolding phenomena itself. In the context of developing transformative climate education, Verlie (2017, p. 569) writes that 'climate as an entanglement foregrounds how climate, climate knowledge, and climate knowers coemerge through intra-action. Rather than focusing on knowing about climate – which implies a disconnected knower and a static world – the focus of an entangled climate pedagogy might be on practices of climating'.

Scale and scaling

Posthumanist-performance approaches do not view scales as fixed or pre-given phenomena – as in hierarchical notions of local, national, and international levels – but rather as an emergent product of material-discursive practices that perform relations in

particular ways (e.g. Schmid and Smith 2021). Consequently, scale in practical transformative processes is understood in a pragmatic sense, open to redefinition in line with unfolding processes of problem-solving and the corresponding evolution of aims and intentions (Hertz et al. *this issue*). For example, Grandin and Haarstad (2021, p. 289) draw on the work of human geographer Doreen Massey to explore scaling processes in the transformation of Addis Ababa's transport systems, developing the concept of 'relational mobilisation' to show 'the interconnections at work in exchanging and negotiating sustainability interventions between cities and across scales'. Likewise, Contesse et al. (2021, p. 10) critique rigid interpretations of niche, regime, and landscape levels in the Multi-Level Perspective on transitions, showing in the case of agricultural transformations in Chile, 'niche boundaries are not so clear cut but fluid, continuously (des)enrolling new actors [...] and redefining the links that hold the network together'. These fluid and interconnected notions of scale, tied closely to material-discursive practices, provide what Grandin and Haarstad (2021, p. 289) and O'Brien et al. (2023) describe as a 'hopeful perspective' that highlights the potential value and significance of supposedly 'small' actions in initiating transformative change.

Time and change

From posthumanist-performative perspectives, time is not treated as a 'container' or a 'backdrop' within which things happen but is rather emergent from relations (Cooke et al. 2016). For example, Barad (2010, p. 162) writes that 'Spacetime-mattering are the ongoing rematerializings of relationalities not amongst pre-existing bits of matter in a pre-existing space and time, but in the ongoing reworkings of "moments", "places", and "things" – each being (re) threaded through the other'. O'Neil (2018) incorporates such understandings into transformative sustainability education around food systems, writing that 'learning is not static nor is it a dualistic, rational process as the predominant Western educational paradigm suggests. Learning is an entangled experiential process of the past, present, and future: it constantly changes'. This intertwinedness of past, present, and future leads to a vision of sustainability as 'interconnectedness that grows in all temporal dimensions rather than in the linear terms of a succession of generations' (Cielemęcka and Daigle 2019, p. 77). Forests, for example, are entangled ecologies where survival depends on 'an ability to live-with and co-depend on other creatures and unfolds against a twisted temporality in which death is a foundation for the future, and the [anticipation of the] future impacts the present' (Cielemęcka and Daigle 2019, p. 77). Posthumanist-performative

approaches suggest that transformations should not be thought of as a linear progression to a 'sustainable state' in a given number of years, but rather as a continual struggle (Stirling 2015) or as Fox and Alldred (2020, p. 124) write, a 'flow of multiple affects that produces capacities and potential in (post) human and nonhuman matter'.

Knowledge and action

Posthumanist-performative relationalities argue against linearly sequential views whereby knowledge is presented as a cognitively derived product that necessarily comes before effective action (West et al. 2019). Rather, knowing is understood as an embodied process situated within practices and inextricably interwoven with governance action and intervention (Stirling 2016). There is less emphasis on proposing specific interventions and more on nurturing contexts and conditions of possibility where innovations and alternatives might arise and be better supported (e.g. Shove and Walker 2010; García-López et al. 2021). For example, Staffa et al. (2022, p. 46) draw on the work of philosopher Maria Puig de la Bellacasa to develop a feminist ethos for knowledge co-production towards transformation, including caring practices of 'thinking-with', 'dissenting-within', and 'thinking-for'. In a complementary vein, Stirling (2016, p. 279) highlights a variety of progressive and reflexive 'knowing doings' that may open-up opportunities for transformative change, including 'talk[ing] about power', 'privileg[ing] direct engagement of the most marginalised interests in analysis and action', and 'highlight[ing] alternative ends'. Meanwhile, Hertz and Mancilla Garcia (2021) advocate for greater use of arts-based methods including storytelling and theatre and O'Neil (2018) describes the importance of developing transformative approaches to sustainability education. Finally, Foggin et al. (2021, p. 11) emphasise the need for 'greater recognition, appreciation, and understanding of local, traditional, and Indigenous' knowledge, governance, and legal systems.

5.4. Structural-metabolic relationalities

A range of scholars have drawn on Marxist political economy and/or structural political ecology to develop 'structural-metabolic' accounts of relational processes in sustainability transformations (e.g. Brand 2016; Haberl et al. 2019; Pichler et al. 2017; Scoones et al. 2020; Bouzarovski 2022). Often motivated by a desire to provide more specific accounts of the 'social drivers' of the Anthropocene, this scholarship has portrayed the interlocking sustainability challenges of climate change, inequality, biodiversity loss, pollution, and poverty, as arising from the relations and contradictions inherent to capitalist

economic systems (Haberl et al. 2011; Malm and Hornborg 2014; Asara et al. 2015). The unequal power relations exerted within capitalism and used to exploit both people and nature are central to structural-metabolic perspectives. For example, Brand (2016, p. 514) writes that within their critical theory of social-ecological transformation, ‘what is being examined is not “the environment” [...], “planetary boundaries”, or even the overuse of resources, ecosystems and sinks. Of interest are the capitalist, imperial and patriarchal forms of the appropriation of nature: i.e. the forms in which such basic needs as food and housing, mobility and communications, and health and reproduction are satisfied. Accordingly, access to and control over nature and/or “resources” are decisive for societal relations’. Consequently, from structural-metabolic perspectives, transformations to sustainability will entail challenging and critiquing capitalist forms of appropriation – or ‘modes of production’ – and supporting alternative societal relations with nature enacted through, for example, workers, citizen, peasant, and Indigenous movements (e.g. Görg et al. 2017; Bouzarovski 2022).

Human-nature connectedness

In Marxist political economy perspectives, labour is the central mechanism of human-nature interconnectedness: ‘when people mix their labour with the resources of the natural world to make a living, nature and society become bound together inextricably’ (Robbins et al. 2014, p. 101). The manner of this mixing or binding together is referred to as ‘social metabolism’, defined by Haberl et al. (2011, p. 3) as ‘the entire flow of materials and energy that are required to sustain all human economic activities’. As Pichler et al. (2017, p. 33) note, ‘society not only acts upon its environment, it also reacts to this (changed) environment in a mutual, reiterative relationship’. Marxist-inspired approaches to transformation therefore retain separable concepts of ‘society’ and ‘nature’ and attempt to capture the continual flow or movement between them, an approach described by Sala and Torchio (2019, p. 235) as dialectical thinking: ‘dialectical thinking seeks to capture a “moving totality”, where each “part” is in internal relation with the “whole”: each part mediates the whole, and the whole mediates each part. For us, this is how a social-ecological system ultimately works’. Social metabolism can be organised and enacted in different ways, reflecting differing relations or modes of production. The concept of modes of production ‘focuses on structures and processes by means of which society organises its material foundations (i.e. its metabolism with nature), socioeconomically, politically, culturally, and subjectively’ (Görg et al. 2017, p. 14). Capitalist modes of production are driven predominantly by the accumulation

imperative, or ‘the insatiable desire of capital to increase profit through more intensive or extensive strategies of investment’ (Brand 2016, p. 509).

Agency and leadership

The focus in Marxist-inspired approaches on structural flows of energy and resources tend to lead to an emphasis on the agency of states, corporate actors, and national and international social movements in driving sustainability transformations. Importantly, however, these are not understood as monolithic actors but as representing relational constellations and ‘structural patterns’ of action (Brand 2016, p. 512; Silvester and Fisker 2023). For example, Görg et al. (2017, p. 10) consider the state as a ‘strategic field and process of intersecting power networks ... [where] different societal and political forces try to promote their interests, norms and values’. Similarly, in developing a political economy perspective on sustainability transformations, Schmitz and Scoones (2019) highlight the role of ‘transformative alliances’ between varying and shifting sets of actors and interests. Bouzarovski (2022, p. 1012) develops a metabolic account of energy transformations in Europe, emphasising the agency of networked social movements such as the European Right to Energy Coalition – ‘a continent-wide movement uniting trade unions, anti-poverty organisations, social housing providers, environmental and health organisations, and energy cooperatives’ – in enacting low-carbon futures. Notably, while such perspectives seemingly emphasise human as opposed to nonhuman agency, the emphasis within Marxist-inspired thought on the inherently metabolic or ‘hybrid’ nature of human socio-economic activity does enable greater consideration of the roles of non-human, ecological and material aspects of sustainability transformations (Moore 2015, pp. 47–48; Bouzarovski 2022).

Scale and scaling

Following on from the networked conceptions of agency above, Marxist approaches to transformations tend to focus on what might conventionally be considered as ‘broad’ or ‘large-scale’ processes of change. In developing an integrative approach to social-ecological transformations drawing on the social and political ecology of the Vienna School, Görg et al. (2017, p. 5) adopt a multi-scale perspective where the national scale is ‘considered dominant due to the density of the national political systems (compared to the international one) and the dominance of strategies of competitiveness that are mainly pursued at the national scale’. This echoes Harvey’s (1999) identification of the ‘spatial fix’ of capitalism, whereby the accumulative logic of capitalism necessitates the spread of social and environmental exploitation

around the world. Nevertheless, Bouzarovski and Haarstad (2019, p. 261) argue that relational approaches in both structural political ecology and poststructuralist human geography demand a reconceptualisation of the very notions of scale and scaling in sustainability transformations, writing that: ‘Non-relational thinking often sees scales as discrete units that are nested on top of one another in a linear fashion, like steps on a ladder. In contrast, relational thinking on scale sees scales as produced through relationships that actors engage and negotiate from the contexts in which they are embedded’. They then proceed to develop a three-stage relational conception of scaling in energy transformations involving (i) politicisation (the disruption of existing power relations in an immediate location), (ii) enrolment (the co-articulation of concerns with actors in different places and networks), and (iii) hybridisation (engagement with and restructuring of material energy infrastructures).

Time and change

Structural-metabolic approaches often hold a long-term view of transformation (captured in the concept of ‘historical materialism’), with Haberl et al. (2011) identifying three ‘socio-metabolic regimes’ with distinct patterns of material and energy use: hunter-gatherer, agrarian, and industrial. Drawing on Polanyi’s notion of ‘The Great Transformation’, they argue that a transformation to sustainability will be just as substantial. The processes that drive transformations between regimes are driven by the internal contradictions and relational or ‘dialectical’ movement within the modes of production central to each regime. For example, Robbins et al. (2014, pp. 103–104) highlights that the accumulative logic that drives the capitalist mode of production – requiring ever more profit and economic growth – generates two contradictions that contain the seed for transformations. The first contradiction refers to the tendency of capitalism to exploit workers in pursuit of profit through, for instance, the reduction of wages and security, to such an extent that the conditions for making profit are undermined and resistance movements grow. The second contradiction describes the tendency of capitalism to degrade environmental conditions to such an extent that it can no longer operate and alternatives gain traction. Consequently, from structural-metabolic perspectives, change, movement, and transformation are always occurring, with the challenge being to shape them in pursuit of sustainability (Görg et al. 2017, p. 15).

Knowledge and action

Marxist-inspired structural-metabolic approaches have often critiqued mainstream transformations research for embracing the very capitalist

mechanisms of enclosure and commodification they hold responsible for causing sustainability challenges in the first place, for example through mechanisms such as REDD+ and ecosystem services (Pichler et al. 2017, p. 34). By contrast, structural-metabolic approaches progress visions of transformations that directly challenge existing power relations and forms of domination and enact alternatives to capitalist logics and practices (Brand 2016; Bouzarovski 2022). For Haberl et al. (2011) such alternatives include the degrowth movement and Transition Towns in the Global North, and the Chipko movement in India, Chico Mendes in Brazil, and Ogoni and Ijaw movements in the Niger Delta in the Global South. Görg et al. (2017, pp. 9–14) argue for the importance of transdisciplinary research as essential to link the strategic-political, analytical, and normative dimensions of sustainability transformations, and to contribute to broader societal questioning of capitalist modes of production in a ‘democratisation of political and social life’. Brand (2016, p. 517), however, highlights the challenge and contradiction that ‘a new – sustainable, democratic, just, and free – world must be realised on the terrain of existing forms of societal (re)production and domination, and must transcend them’. Indeed, Bouzarovski (2022, p. 1012) notes a growing strategic awareness among many energy and climate activists, whereby active resistance is combined with efforts to change the decision-making of established institutions: ‘this kind of political work transcends traditional binaries between disruption and accommodation in the articulation of just transitions, while operating across multiple scales of governance and advocacy’.

5.5. Latin American-postdevelopment relationalities

Indigenous and non-Indigenous scholars, activists, communities, and social movements have highlighted the importance of Latin American relational lifeways and scholarship for sustainability transformations (Escobar 2015; Beling et al. 2018; Gallegos-Riofrio et al. 2022). Latin American relationalities are exceptionally diverse, enacted through Indigenous, afro-descendent, peasant, student, environmentalist, and women’s movements, among others, and articulated by Indigenous and non-Indigenous scholars writing across the Global South and North (Escobar 2015; Feola et al. 2021). Examples include the Zapatista movement in Mexico (Maldonado-Villalpando et al. 2022), peasant movements in Colombia (Feola et al. 2021), Indigenous philosophies and governance approaches such as *Sumak Kawsay* or *Suma Qamaña* (translated into Spanish as *Vivir Bien* or *Buen Vivir*, and in English as ‘living well’) in the Bolivian, Ecuadorian, and Peruvian Andes (Jimenez

et al. 2022), as well as the work of scholars such as Paulo Freire and Humberto Maturana, among many others (Souza et al. 2019). Such approaches often seek to support spaces of territorial and political sovereignty to pursue ways of living through relational ontologies emphasising care, the commons, and collective governance and educational practices focusing on social-ecological wellbeing (Maldonado-Villalpando et al. 2022, p. 1302). Increasingly, diverse Latin American relationalities have been collectively framed as enacting resistance to neoliberal capitalism and extractivism through ‘alternatives to development’ or ‘postdevelopment’ – sometimes in dialogue with structural-dialectical approaches, including the degrowth movement in the Global North – as territorially situated but globally networked movements towards social-ecological transformation (Escobar 2015; Beling et al. 2021; Lang 2022).

Human-nature connectedness

In identifying some of the common threads woven through Latin American postdevelopment approaches, Escobar (2015, p. 459) highlights the importance of ‘communality’ between humans and nonhumans, writing that ‘communal worlds are relational worlds, defined as those worlds in which nothing pre-exists the relations that constitute it (reality is relational through and through), as opposed to the dualist ontologies that predominate in modern worlds, where entities are seen as existing on their own (the “individual”, “nature”, “the world”), prior to their inter-relations’. For example, Feola et al. (2021, p. 7) explore *territorios campesinos agroalimentarios* (TCAs; or agrofood peasant territories in English) in Colombia as an example of sustainability transformation, quoting Daza (2017) ‘We are the water from the mountains, the water from the mountains is in our bodies, because we, our grandparents, great-grandparents, we all have this water and the minerals it contains in our body. We are the land because we eat the products and the minerals that the land gives; they are in our bodies’. Describing the philosophy and practice of *Buen Vivir*, Gudynas (2011) writes that ‘it is a space of well-being in which people, animals and crops live together’, which means that ‘political communities [...] are not restricted to people, and there is a place in them for the nonhuman (in some cases there will be other beings, or elements of the environment, or even spirits)’ [translation by the authors]. Similarly, Jimenez et al. (2022, 1640) explore innovation in the Parque de la Papa (‘Potato Park’) established by the Chawaytire, Pampallaqta, Sacaca, Paru Paru, and Amaru Indigenous communities in the Písaq region in Cuzco, Peru. Leaders of the park explain that that to achieve *Sumak Kawsay*, ‘harmony must be sought between three different

ayllu [collectiveness]: the runa ayllu (humans and domesticated species), sallka ayllu (wild and semi-domesticated species), and auki ayllu (the sacred and the ancestors)’.

Agency and leadership

Latin American relationalities often enact distributed and communal forms of agency and leadership. Mancilla Garcia (2013) writes that Aymara communities around Lake Titicaca are organised with a rotatory leadership that falls on each of the families of the community, typically every year, ensuring that all families reach a position of authority within a short time period. This leadership is understood as provisional and its success is measured by the capacity to mobilise the community. Kaul et al. (2022, p. 1150), in discussing alternatives to development in Latin America, India, Africa, and Europe, among others, suggest that attention to relational collectives unsettles a tendency in sustainability science to reify the agency of either individuals or states. In Latin American relationalities agency also often extends beyond the human. de la Cadena (2022), working with Mariano and Nazario Turpo, highlights the agency expressed by ‘earth beings’ in the Peruvian Andes: ‘co-labouring with the Turpos I learned about “ayllu” as a relational condition whereby runakuna-with-tirakuna emerge inherently together; through such relation they take-place and become distinctly each other [...] runakuna is Quechua for people, and the word tirakuna combines the Spanish tierra, with kuna the pluralising Quechua suffix. I translated tirakuna as earth beings, they can be where/what we call mountains’.

Scale and scaling

The primary scalar reality in many Latin American relationalities is that of the territory. For example, Feola et al. (2021, p. 6), in the context of TCAs in Colombia, write that ‘local peasant communities share a deep-rooted cultural identity defined in relation to territory [...] Due to this strong connection between land and identity, the idea of a *territorio campesino* (peasant territory) [...] was an old aspiration of local peasants’. The peasants’ emphasis on territory is combined with a strong sense of respect for other territorial arrangements, such as those of Indigenous and afro-descendent communities (Feola et al. 2021, p. 7). Meanwhile, Lang (2022, p. 193) describes how the first Indigenous mayor and administration of Cayambe County, in the Ecuadorian Andes, attempted to apply ancestral knowledge and principles of *Sumak Kawsay* at the municipal level, for example through the introduction of the *minga* (communitarian labour) as a way to carry out public works, and issuing a law to ensure the care of the páramo highlands as a commons, recognising that

‘the páramos, forests and wetlands constitute living beings’. The recognition of deep connections between people and places, and the diversity of territorial arrangements, has generated the ‘pluriverse’ as an alternative notion of scaling to the ‘universalism of the [Western] development project’ (Kaul et al. 2022, p. 1149), instead supporting ‘a plural yet interdependent ecology of knowledges and practices, opening up space for alternative socio-cognitive and normative structures for social action towards sustainability’ (Vanhulst and Beling 2019, p. 115). Indeed, movements around *Buen Vivir*, for example, have been articulated by activists and scholars as part of globally interconnected movements towards – as Aymara scholar Mamani (2006; quoted in Escobar 2015, p. 458) puts it – ‘a new civilizational project’.

Time and change

The notion of ancestry and ancestral connections is central to many Latin American relationalities, linking past, present, and future in pursuit of transformation. Escobar (2019, p. 47) describes the ancestry expressed in the song and poetry of La Toma afro-descendent communities in Colombia, noting that ‘far from an intransigent attachment to the past, ancestry stems from living memory that orients itself to the ability to envision a different future – a sort of “futurity” that imagines, and struggles for, the conditions that will allow them to persevere as a distinct world’. In showing how relationality informs the everyday lives and practices of peoples throughout Latin America, Gallegos-Riofrio et al. (2022, p. 480) describe the holiday ‘the Day of the Dead’ as a ‘feast with the ancestors. The conception is that ancestors interact with the living, in time that is spiralling rather than linear’. Feola et al. (2021, p. 9) highlight that temporality can be a site of resistance, describing that the Plan de Vida Digna (community planning) of peasant communities in Nariño and Cauca, Colombia, ‘assumes a long timeframe ranging from twenty to thirty years. This [...] is a key form of opposition to the “short term mentality of capitalist accumulation as a criterion for development” (Iguarán 2018)’. Likewise, Maldonado-Villalpando et al. (2022, p. 1311) describe the transformative educational practices of the Zapatista movement in Chiapas, Mexico, based on ancestral knowledge and ‘involv[ing] the participation of parents and grandparents with the children’.

Knowledge and action

Feola et al. (2021, p. 2) present transformation as a ‘multi-faceted, multilevel process that entails the deconstruction of capitalist modernity or elements thereof, as well as the construction of post-capitalist realities’. Latin American relationalities have challenged dualistic, rationalist accounts of knowledge

and action in many Western traditions and have emphasised the active social and emotional aspects of knowing, working these aspects into transformative pedagogies and educational praxis (Maldonado-Villalpando et al. 2022). Souza et al. (2019, 1608) develop learning-based approaches to transformation rooted in the work of Chilean biologist Humberto Maturana and Brazilian educator Paulo Freire, with Gallegos-Riofrio et al. (2022, p. 479) highlighting Freire’s concept of *conscientização* (conscientization) as ‘critical awareness of the deeply relational realities that surround people’. Gudynas (2011), writing about *Buen Vivir*, argues that such approaches lead beyond epistemological relativism towards ontological pluralism, and grappling seriously with the politics of moving towards a pluriverse where many worlds fit. In terms of the roles of researchers in transformation, Escobar (2019, p. 43) argues that the thinking of those involved in grounded struggles across Latin America ‘are actually more sophisticated and appropriate for thinking about social transformation than most forms of knowledge produced within the academy at present’. Gallegos-Riofrio et al. (2022, p. 481) write that sustainability scientists working on transformations can learn from Indigenous and Indigenist Latin American scholars, ‘by exercising the same degree of respect that these intellectuals have for local sustainability ethics and customary practices, and by employing similar methods to involve communities in co-creation and long-term sustainability efforts’.

6. Discussion: walking together in a world of many worlds

The five relationalities we have explored illustrate the collective richness of relational approaches to transformations in sustainability science. There are many points of resonance and connection between them. For example, Goodchild (2021) describes decolonizing thinking around systems change and transformations through conversations between Haudenosaunee Elders and Knowledge Keepers and systems thinkers, while O’Brien et al. (2023) engage with posthumanism, systems thinking, Indigenous philosophy and quantum theory in developing ‘fractal’ approaches to transformations. Many scholars position their work in resistance to different aspects of modernity-coloniality (including, variously, extractivism, capitalism, and positivism) and pursue more just relations between humans and other-than-humans. Yet there are also deep differences between the five relationalities: the diversity *between* them is further multiplied by differences *within* them. For example, the relations of metabolism articulated by Marxist scholars are different to the relations of performance enacted by posthumanist scholars (e.g. Malm 2019), and the

posthumanist work of Barad is quite different to that of Latour. What emerges from the review is a landscape of multiple relationalities, full of partial connections, shared interests, and deep differences.

We recognise that, especially for scholars and practitioners trained in knowledge traditions that hold an aspiration towards unified or integrated knowledge, this multiplicity might be disconcerting: how can it help to contribute to sustainability transformations in practice? Indeed, a conventional scholarly approach to seeking policy and practice-relevance (particularly widespread in the Global North) would be to treat these relationalities as different perspectives on a universal shared reality, and to develop a synthetic framework of relationality incorporating the relative strengths of each (Law 2015). The resultant synthesis might then be used to develop practical toolboxes, blueprints, or templates to be shared with practitioners and policy actors and 'scaled up' or replicated across multiple contexts (Stirling 2015; West et al. 2019). While such approaches do provide one way of engaging with diversity, they are also often implicitly imperialist and reduce difference in the image of the synthesiser (e.g. Dupre 1994). For example, the very assumption of a singular reality about which different cultures or disciplines offer different interpretations is only possible within knowledge traditions that make categorical distinctions between nature and culture, mind and matter, and subject and object (Watts 2013). Moreover, such 'integration and toolbox' approaches have a questionable record in addressing the material dimensions of sustainability challenges, including pollution and biodiversity loss, with innumerable examples of local differences thwarting the aims of supposedly universal programs (Hulme 2018; Haider et al. 2019), and most sustainability indicators continuing to get worse (Richardson et al. 2023).

An alternative approach, emerging at the intersection of Indigenous thinking and practice, social movements across the Global North and South, and posthumanist approaches, suggests that if sustainability crises are caused by the 'dominant form of Euro-modernity' and its spread around the world, 'it follows that facing the crisis implies transitions towards its opposite, that is, toward a multiplicity of worlds we will call the pluriverse' (Escobar 2019, p. 43). The notion of the pluriverse is often traced to the Zapatista movement in Chiapas, Mexico, which declared that 'many worlds are walked in the world. Many worlds are made. Many worlds make us [...] In the world we want, everybody fits. The world we want is a world in which many worlds fit' (qtd. in de la Cadena and Blaser 2018, p. 1). Pluriversal approaches do not treat different relationalities as different perspectives on a single world, but in recognising the inextricability of knowing, doing, and ways

of living, suggest that different knowledge practices contribute to 'walking different worlds into being' (de la Cadena and Blaser 2018). In pluriversal approaches, transformations will not all look the same, but will be different things in different places, emerging from the unfolding intersections of many different kinds of actions, initiatives, and movements (Querejazu 2022; Trowsell et al. 2022; Kaul et al. 2022; Facer 2023). Escobar (2019, p. 50) provides examples ranging from Indigenous-led *Buen Vivir* movements in the Andes to the Transition Town network in the UK. While some initiatives may find common purpose and make strategic alliances, others may seem in tension or even directly contradictory (Stirling et al. 2023). We find that a useful concept for engaging with this diversity is the 'uncommons', described by Stengers as 'interests in common which are not the same interests' that are committed to 'negotiating their difficult being together in heterogeneity' (qtd. in de la Cadena and Blaser 2018, p. 4).

What are some practical ways of moving towards relational, pluriversal engagements with sustainability transformations? Sundberg (2014, pp. 39–41) draws on the Zapatista movement's 'dialogic politics of walking and talking, doing and reflecting', to propose a three-step process of decolonising Global North engagements with relationality towards the pluriverse: (i) 'locating the self' through analysis of one's own assumptions and values, (ii) 'learning to learn' through serious engagement with other knowledges, and (iii) 'walking with' through active socio-political engagement in support of multiple worlds, such as the land-based struggles of Indigenous peoples (see also Ngurra et al. 2021). Meanwhile, Rembarrnga Bi scholar Otto Bulmaniya Campion, writing with Indigenous and non-Indigenous colleagues (Campion et al. 2023), describes the practice of *balpara* (roughly translatable as 'partnership') as a means of improving Indigenous partnerships with conservation actors in northern Australia. *Balpara* also centers 'walking and talking together' as a means of building the capacities of all actors to engage in multiple knowledge practices at the same time, without integrating one into the other, emphasising the importance of: (i) building mutual recognition and respect, (ii) embracing the possibility of incommensurability between knowledge practices, (iii) investing resources in building trust, (iv) ensuring activities are Country/land-based, and (v) strengthening institutional support for Indigenous-led approaches. Sundberg (2014) and Campion et al. (2023) provide just two examples of how concepts and practices of walking together can bring multiple worlds into being as part of transformations to sustainability.

While pluriversal approaches resist universalism (applicability to everything or everyone) they do not

prevent areas of generalisation or the establishment of common ground between approaches. Rather, they emphasise that such generalisation should be fairly and openly negotiated not assumed – and that such generalisations are themselves situated in specific sets of relations, relative to particular purposes, and subject to certain codes of conduct. For example, Ermineskin Cree scholar Matt Wildcat and Métis scholar Daniel Voth (Wildcat and Voth 2023:478) describe possibilities for careful movement between particular and general concepts of relationality in First Nations knowledge, law, and governance systems, highlighting that ‘inter-Indigenous relationships are not only about different collectivities interacting with each other, but also about how new forms of relating are created when people from different nations engage one another’. In a global and intercultural context, the Bolivian delegation to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) critiqued the notion of ‘ecosystem services’ as representative of a Western, neoliberal approach and articulated an alternative framework based around ‘Mother Earth’ as a means of ‘opening-up space’ for Indigenous and local knowledges (Borie et al. 2021, p. 10). This led to the adoption of both frameworks simultaneously, which can be interpreted as a situated instance of both generalisation (global frameworks) and the uncommons (recognising interests in common that are not the same interests) (e.g. Tengö et al. 2017; Peterson et al. 2018). Borie et al. (2020) propose measures to enhance transformative learning in IPBES, including a dedicated reflexivity task-force, participatory monitoring and evaluation, and an alumni network, recognising the importance of being in relationship regardless of which framework is being used.

We recognise that in this paper we have situated ourselves squarely in the tension of advocating for diversity and pluriversalism through our own practices of generalising, reducing the many differences between relational approaches in sustainability science to a set of five relationalities (and transformations to a set of five dimensions). Yet we intend this as a situated form of generalisation inextricably tied to our own positionalities, where diverse contributions retain their own identities. We hope it serves as a provisionally useful contribution to ongoing efforts to ‘open-up’ sustainability transformations to multiple ways of knowing, doing, and being. We therefore provide this work as an ‘open review’ available online at the following link (<https://relationaltransformations.notion.site/Relational-transformations-2ab79dd7db7547ab8685a5e576f3f547?pvs=4>) and invite others to add to, loosen, rearrange, reject, or transform our conceptual groupings.

7. Conclusion

In this paper we have explored multiple relational approaches to sustainability transformations. Recognising that relationality is situated, multiple, and emerging – enacted in particular times, places, and configurations – we have highlighted five broad and evolving relationalities in the current sustainability science literature: Indigenous-kinship, systemic-analytical, posthumanist-performative, structural-metabolic, and Latin American-postdevelopment. These are by no means the only relationalities in sustainability science (Kaul et al. 2022) and there are many more relational traditions, philosophies, and ways of life that surely have much to contribute (Chilisa et al. 2017; Nordin et al. 2019). Our characterisation of relationalities is not comprehensive but instead provides a limited snapshot of a growing movement in research and action towards transformations. We offer this work as an ‘open review’ to be added to, critiqued, and transformed in the years ahead as discussions around relational approaches continue to evolve. We suggest that relational approaches give rise to practices of transformations as acts of walking together in a world of many worlds, towards futures more nurturing of social-ecological diversity.

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