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Narrative matters for sustainability: the transformative role of storytelling in realizing 1.5°C futures

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Narratives structure human comprehension, and shape our ability to imagine and achieve transformed futures within the 1.5 degree threshold. Examining tensions between narrative as a communication technique and as a spatial-temporal cognitive structure, this paper brings these different understandings together in a conversation for transformative global change. We suggest that filling the 'information deficit' with improved communication of a single, unifying and global narrative about Earth systems is necessary but insufficient: filling the 'narrative deficit' requires engagement with the protagonists, timelines, and places that provide situated agency in identifying and navigating uncertainty and risk. Transformations to sustainability will require recognizing and engaging multiple, diverse experiences of agency, a process that attention to narrative can help facilitate.

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Introduction

The Paris Agreement has set an audacious goal to limit global warming to within 1.5°C. This new target symbolizes an urgent transformation of society, including politics and culture, that requires far-reaching planning, logistics, and technologies for adaptation and mitigation. Given the breadth of the challenge this represents, engagement from across all academic disciplines is required. Yet of the around 90 peer reviewed articles discussing the Paris Agreement and 1.5°C climate change in 2015–2017,[5] the natural sciences dominate, while the social sciences offer about a 10th of these publications [1,2,3•,4•,5–9]. The 1.5°C target and timetable of the Paris Agreement are not descriptive of how such a world would function, nor what it takes to get there. Indeed it can be argued that setting 'long-term global climate stabilization targets has not been a prerequisite but rather a substitute for appropriate action' [10, p. 92]. As researchers and policy makers urgently move from the natural science basis and into practical adaptation and mitigation, this paper offers review of an emerging body of literature that indicates careful attention to narrative is key.

Since the 'narrative turn' among French structuralists in the 1960s, linguistics, anthropology, policy studies, media studies, medicine, psychology, and other humanities and social science disciplines have developed sophisticated insights on the role of narratives and storytelling[6] for societies [11–17]. This literature mobilizes understandings of narrative that span from being a foundational spatial-temporal cognitive structure by which people 'make sense' of, or create order out of experience [11,14,18,19]; to a literary praxis that situates heroes, victims, and villains on a plotline, using particular sensory language and settings [17]. Over the last decade, attention to narrative in academic literature has risen sharply, and for global change literatures this increase stems in part from awareness that scientific publishing communicated through IPCC Assessment Reports and the natural sciences literature is not sufficiently understood or applied among policy-makers and the public. In this paper, we bring these onto-epistemic and methodic dimensions of narrative into conversation over transformed futures, and suggest how better communication of science might beneficially be accompanied by efforts to co-construct narratives that engage with the stories that give meaning and security to people.

[5] A search in Web of Science for (TOPIC: climate OR future) AND (TOPIC: "paris agreement" OR "1.5 degrees" OR 1.5C) Timespan: 2015–2017, retrieved 90 references.

[6] In literary analysis, 'narratives' are overarching accounts of which consist constituent 'stories' that support that narrative.

The paper begins by arguing for the onto-epistemic structure of narrative, before examining some implications for research and action on transformation. We then draw these insights into a review of recent narrative research in the context of global change. We conclude with reflections on *why* rather than *what* (or where or when) narratives matter for the climate change research community: envisioning and creating transformed futures requires a process of opening up to, and engaging with, the coexistence of different ways of knowing and affecting global change.

World-describing and world-making narratives

Cognitive research suggests narratives constitute a common socio-psychological 'infrastructure' [11] that "provides spatial–temporal coordinates for moving through and manipulating the world" [19, p. 2]. That is, narrative structure simultaneously constitutes the basis for knowing how the world can be changed and manipulated (epistemology), while shaping the individual and cultural cognition that engenders a sense of being-in-the-world (ontology) [20]. On the surface, then, 'narrative' is 'about' something, such as neoliberal narratives, science narratives, Indigenous Australian narratives, or global change narratives. On a more fundamental level, the timelines, characters, and phenomena of these narratives provide the 'reference points' that shape and become reworked by the 'stories' we tell about the world, such as about societal transformation or extreme events. This implies scientists, journalists, and other actors alike perform 'storytelling', using written word, images, and figures. Each narrative constrains and enables what is thinkable and sayable about the past, present, and future.

In this way, narratives constitute reality *as we know it* by making sense of observations, leading us to new inferences, and providing models for a path forward [21]. This means that "some kind of reality is out there which gives answers to our questions, but the answers are not out there until we ask" [22, p. 47]. These deeply material implications of cognitive, world-making narratives confirm that conflicts cannot be reduced to deficient scientific understanding, a lack of dialogue, or disagreement as to means. Rather, they suggest ontological disjunctures or schisms [23,24] that go 'all the way down'. This points to an 'ontological normativity' where our understanding of the possible trajectories and impacts of climate change are not universal, but 'real enough' to identify threats and seek solutions. Consequently, "people matter more than they think through an entangled, collective impact" [21, p. 2]. For instance, 'efficacy beliefs' (believing that you can improve your situation) are found to be a stronger predictor of proactive adaptation than demography, risk perception and societal context [25]. Similarly, drawing on a medical case study, Siegel [26, p. 176] argues 'narrative integration' relates directly to how patients recovering from trauma "ma[k]e sense of their lives and create a coherent narrative of their life experiences".

The implications of this ontological normativity is manifold in that it carries with it a capacity to both create and dismantle possible sustainable pathways toward a 1.5°C world. We will address some of these implications in the sections below.

Ontological narratives and their implications

Collective narratives of memory and emotion provide a sense of 'ontological security' in transformational situations [27]. This narrative cognition is an effort to deduce clear spatial and temporal causality between observations, which may lead a person to expect, or insist on certain pattern interpretation [28]. In this way, the climate change story weaves into pre-existing cultural narratives, or metanarratives about how the world works and where it is headed. Therefore, the climate change story will be more acceptable if it 'makes sense' with already narrated experience. If the story is incompatible, it is more likely to be rejected [29,30].

For this reason also, the narrative framing of climate change as a global problem that threatens not only ways of life but life itself [31], the very systems and structures that "make everyday life possible" [32, p. 79], can cause cognitive and emotional disorientation [33]. Such insecurity [19,32,34] can induce 'ontological monism', the perspective that posits the existence of "one world amenable (. . .) to understanding through a single epistemological template" [35, p. 249]. The resulting single acceptable narrative can become destiny, constraining not only imaginable futures, but also (by consequence) the ones that are materially realized.

Dominant and counter-narratives mediate between transformations at the society scale and transitions, values, and identities on the personal level [36]. For instance, while the Anthropocene remains a contested concept, the narratives it invokes allows stories from epistemic communities to connect and debate the meanings of global environmental change [37••]. In the same way, seemingly juxtaposed narratives of energy independence, respect for God's creation, or Indigenous Australian Dreaming can produce transformative material outcomes just as the Anthropocene, human development, or climate change narrative. They each, in different ways, enable and constrain individual and collective agency to shape responses through familiar, meaningful spatial–temporal reference points; and each may or may not have the desired or projected material outcomes. Thus, while better communication of established science is important, the normative implications of ontological narratives suggests a need to attend also to narrative substance and material implications to engage transformative change.

Narratives and communication

The 'information deficit' model has instilled hope that better science communication will incite public response to climate change. In a similar way, it has been suggested that climate change communication "needs to follow narrative rules, with recognizable actors, motives, causes and effects" [38, p. 233], because people learn about and form responses to climate change through their engagement with narrative [38,39•,40••]. For instance, a deficit in the 'cultural availability of visual content and accessible storylines' may have limited the impact of the IPCC's WGIII [41]. For Hillier and colleagues [17], better communication involves writing that uses a setting, narrative perspective, sensory language, conjunctions, and connectivity. Olson [42] suggests employing progressive conjunctives 'and, but, therefore' (ABT) to drive attention forward, while avoiding the rambling conjunctive 'and, and, and' of expository-style scientific analyses and documentaries, which are challenging for non-expert readers. Statistics support their claims: an engaging narrative form boosts the peer impact of scientific findings [17,38]. Yet, we would argue that these cosmetic changes to a single science narrative of climate change do not suffice.

A 'narrative vacuum' limits communication coming from climate science itself [28], where the 'top-down' approach dominates the climate narratives [43], and "most people have not yet heard a story about climate change that sounds like it was written 'for them"' [40••, p. 1]. In the same vein, O'Neill and colleagues [41] find that media reporting on the IPCC AR5 Working Group I overwhelmingly dominates and unhelpfully emphasizes danger and urgency on one hand [44], or uncertainty and conflicting scientific findings on the other [45], while attending less to the more forward-looking opportunities for action published later by Working Groups II and III [41]. While it is arguably not the responsibility, nor the design, of the IPCC itself to publish culturally relevant stories of climate change, there may be a 'narrative deficit' that could be critically addressed by examining the policy implications of cultural narratives being denied, dominating, or producing constructive tensions [46]. Similarly, a narrative approach to IPCC reporting could also include paying more attention to structure by carefully linking and positioning concepts such as adaptation, mitigation and transformation so that their interrelatedness becomes clear, pointing to the potential for and necessity of collaboration across sciences and sectors.

Modeling transformed futures

Scenario planning is a narrative method widely used to engage researchers and the public in deliberating over pathways toward desired futures [47]. Use of narrative scenarios to parameterize climate models may also help envision some potentially transformative pathways. O'Neill and colleagues [48] offer a set of narrative scenarios as a part of the shared socioeconomic pathways (SSP). The SSPs are combined with shared policy assumptions (SPA), and representative concentration pathways of radiative forcing (RCP) in the scenario framework [49•]. The five envisioned SSPs "are not meant primarily as a direct communication tool for climate policy advice, but rather as a tool to enable the research community to produce effective assessments for climate policy makers" [49•, p. 171]. Challenges to adaptation and mitigation are indicated by humanity taking a green road (SSP1), the middle of the road (SSP2), a rocky road of regional rivalry (SSP3), a road divided by inequality (SSP4), or the highway of fossil-fueled development (SSP5) [49•]. Nevertheless, even SSP1, where society transforms toward international collaboration, low population growth, technology development and a shift in consumption, the scenario projects 3°C warming. Indeed, "it is not likely that the 2-°C target can be achieved under the SSP1 storyline alone, without introducing additional climate policy" [50, p. 249].

When developing scenarios for possible futures, there is a risk of "limiting the range of alternatives to more predictable, rather than transformative, changes" [51, p. 11], which the 5 SSPs may illustrate. The focus on danger and uncertainty without much attention to forward-looking opportunities for action signifies a 'future narrative' deficit in the IPCC. Finding safe pathways will depend on both greater resolution of desirable trajectories, and on careful examination of how diverse influences and interests are (differentially) merged into these trajectories. As future model projections explore narratives for 1.5°C futures, it is vital to remain cognizant of pre-analytical assumptions: each narrative formalizes inherently subjective projections of policy choices [52,53]. Indeed, modeling on a single narrative is almost certainly inappropriate [54,55].

Narrative tensions between worldviews

In moving from a story belonging to the science narrative, to a narrative in its own right, stories of climate change often "interact with other beliefs to motivate responses, which in some cases may disrupt notions of 'universal rationality"' [56, p. 113]. For instance, after centuries of sharing cultural narratives, the recent act of granting legal 'non-human personhood' to the Whanganui River in New Zealand [57] goes beyond cultural recognition, and allows the Maori story of the River to reframe legal, technological and biophysical water narratives. By resolving the tension in this way, the river is no longer a managed 'resource', but a more-than-human being with legal rights. This has global ramifications: the Ganges and Yamuna Rivers of India have since been declared 'persons', setting a precedent for other world regions. What transformative narratives might personhood offer for the atmosphere, oceans, or forests?

Narrative and storytelling is a universal method that is not limited to the textual stories of the social sciences or the humanities, or the oral histories of cultures. Mathematical models also structure according to a plotline that aims to imagine, represent or predict worldly processes [19]. Therefore, when we say that diverse narrative-based methodologies have the capacity to render visible other transformative dialogues on global change [58], we wish to call attention to means of bringing these narratives and stories into better conversations. Mathematics as narrative alongside other narratives may be contentious, but we argue that bringing this form of story-telling into the warmth of conventional narrative research can lead to productive tensions. Narrative methods aim to capture the symbolic meaning of observed changes [59], and require attention to the protagonists, time scales, and spatial references interlocutors invoke when presenting their perspectives [23,60].

Narrative tensions can be brought out in 'narrative workshops' that facilitate an arena where participants can develop new stories to shift the climate change story "from a scientific to a social reality" [40••, p. 108], a process that may productively be reversed [48]. Narrative workshops on Yellow River water reforms facilitated a "deliberatory arena in which old and new ideas meld into . . . a 'thick' institutional narrative" [61, p. 445]. These insights extend into faith-based narratives that can link, for instance, "climate change with shamanic belief and pollution concerns" and reveal localized and contextualized explanations for landscape transformation that ecology studies would miss [62, p. 104]. In this way, the tensions between science narratives and faith-based narratives can draw on distinctive understandings of reality to produce fruitful outcomes [63•, p. 2.62,64]. Further, such methods open space for situated approaches that adhere to the onto-epistemic narrative form of research participants, from developing research questions to presenting findings [65].

More-than-fictional stories

How might some experimental and transformative adaptations fictively envisage a 1.5°C future? Fictional narratives can not or should not fill the 'information deficit', but they might fill a 'narrative deficit' that could push the reader to become more curious about real risks and opportunities. The heroes, victims and villains of fiction act as an image of our own world, helping people become protagonists in their own stories by creating meaning around the unfamiliar and non-linear change we struggle to grasp [80]. That Orwell's *1984* reached record sales after the language of 'alternative facts' was used by the administration of the 45th United States president illustrates this point; as does the success of the blockbuster *The Day After Tomorrow* in raising awareness of climate change. Imagined technology from sci-fi TV-series has inspired smart phones, smart watches, and soon medical 'tri-corders'.[7]

Sci-fi "has become a useful critical tool for . . . political work" by offering "a mode of analysis, a way of thinking about alterity and difference" [66, p. 1]. Science fiction specifically related to climate change, so-called 'cli-fi' often underscores the experimental and improvisational nature of transformation. For instance, in Vandana Singh's novella 'Entanglement', human agency and technology intersect with a 'Million Eyes' project that connects multiple protagonists and methane-eating bacteria as a bridging measure to buy time. In Kim Stanley Robinson's new cli-fi novel set in an inundated 2140s New York, a process of rapid global decarbonization has been imagined amid a transitional period of two devastating and decade-long 'pulses' causing sea level rise. Both authors anchor their speculations in known scientific projections. Singh is a physicist and Robinson an environmental activist; each help us envisage what these futures might mean and feel like.

Although still somewhat at the fringe, academic literature is starting to acknowledge the qualities of fictional writing [67–70] and some social science journals are holding fiction contests [71]. Recent anthologies examine an emerging body of climate fiction novels and novellas [72–76], ranging from dystopian heat-affected, drought-blighted and drowned scenarios, to mixed 'pessoptimistic' stories of some adaptation successes and hopeful gains. Each can move the reader to imagine their agency in different ways in enabling or preventing such futures.

Narratives for transformative futures

Transformative futures depend on an ability to story safe and desirable pathways away from dangerous and unjust outcomes, and toward dignified futures. The ability to construct an appealing and understandable narrative progression is part and parcel of this work. Words, characters, events, and phenomena told in an engaging and recognizable order can move people to act. The advertisement industry, political lobbyists, and producers of propaganda ('fake news') continue to use this insight to sway public opinion. To avoid authoritative science stories of climate change becoming authoritarian master narratives (such as through unilateral geoengineering 'solutions' to global climate change, or Ecomodern wilderness denying small-holder farming), there is a need to open up the possibility of a myriad of narratives contributing to material change for 1.5 degree futures. Globally, diverse societies interpret risk and experience agency and belonging according to cultural narratives into which the climate change story may or may not find purchase. This insight urgently requires an unprecedented listening to the alternative spatial–temporal 'coordinate systems',

[7] Albeit with surreptitious effects. It appears Orwell's 'Big Brother' would be rendered possible and desirable by Star Trek's smart devices.

the ontological narratives that provide security, belonging, and familiarity in navigating change.

There is much attention to the need to avoid doom and gloom narratives and focus on agency and opportunity. We are also concerned about tendencies to seek a distinct story unifying "the global environmental change research community", which suggests an unproductive, illusory, and exclusive unity among global change researchers [77••]. The protagonists, discourses and scales of academic communications have, and continue to emphasize or marginalize other narratives of human agency. For instance, there is a need to engage with the deeply troubled history of science in racial, gender and cultural relations and its legacies in today's research on human–environment relations. More fundamental narrative questions — such as how ecological language of invasion, colonization, and extinction shape intercultural collaborations for sustainability; or, how the spatial and temporal scales of climate models and the Anthropocene epoch align with lived experience — need addressing.

Innovative and transformative thought will benefit from laying aside heroic narratives where a single villain (neoliberalism, industry, climate change), is defeated once and for all by a single hero (the environmental activist, the United Nations, the engineer, the consumer), and begin to tell what Ursula leGuin in *Dancing at the Edge of the World* called 'the carrier bag narrative': listening and gathering stories to construct transformative narratives in which we each find agency to 'stay with the trouble' [78] to change our own, and our societies' praxis. In recognizing that global change narratives have an ontologically normative function, this is not just about respecting worldviews and cultural idiosyncricies, but about finding transformative ways of sweeping the material world up in our narratives of causation. Finally, just as the science narrative (or any other narrative) does not posssess universal ability to shape materials and agency, we also need to expect surreptitious effects and new discoveries where material change happens outside any narrative. Narrative is not another technological or methodological fix; its transformative potential lies in co-constructing meaning – with each other and with the material world.

Conclusion

This paper has worked to help resolve the tension between narrative as a skill or technique, and its role as an onto-epistemic coordinate system by which people make sense of experience and navigate change. In this tension, cognitive science meets the cannons of narrative research, from Aristotle to Donald Polkinghorne. Aristotle argued narratives follow a clear structure (a plot through a beginning, middle, and end), and more fundamentally that narratives do not mirror or replicate the world, but produce logical order among otherwise disconnected worldly phenomena. As such, we have represented narrative as a structure inherent *in* all knowledge production, and storytelling as a universal praxis, and therefore relevant *for* all knowledge production. No stories of change are merely abstract or merely objective, but co-constitute the world in transformation. The stories we tell, and the narratives we adhere to 'matter' in real and material ways. Thus, filling the 'information deficit' by achieving skill in communicating narratives, such as in reports, academic climate change publications, or popular science publications may provide for better uptake of, and engagement with, scientific information within the sciences themselves, across the academe, and in public and private forums. Still, these cosmetic changes do not fill the 'narrative deficit' that would attend to the deeper structural issues and implications of narrative. Are the protagonists and events they mobilize relevant and meaningful? How (and where) do the spatial and temporal scales their reports and publications attend to constrain or enable opportunities for altered praxis? [46]. Time spent 'teaching' skeptics might forego the material transformations that could result from engaging other narratives by which people experience agency and belonging, *inter alia*, energy independence, Caring for Country, or caring for God's creation.

In arguing for a transformation in the role of narrative, we have avoided prescribing what, where, and when narratives matter, but rather suggested how they matter. 'The carrier bag theory of narrative' [78] provides a useful metaphor for imagining how science and individual and societal agency can meet to broaden and visualize possible and desirable futures. The 'narrative gap' between our 'now' and visions of the future, between science and lived life, can be imagined by fostering spaces of listening, deliberation, debate, respect, imagination, and trust where the global diversity of culturally cognitive spaces can be drawn into productive tension with each other and the cannons of positivist science. The transformative potential of such approaches will depend on their ability to address ongoing injustices and power discrepancies, and to merge distinct narrative traditions into new 'thick institutional narratives' of transformation [61]. For the world to change with us, rather than against us, we need better stories to pre-empt material changes, and direct social change. Climate change presents wicked — indeed diabolical — problems [79] that cannot be solved through prescriptive approaches. Diverse narrative forms, from scientific reports and scenario planning, to fictional writing, each have a role to play, as they set conditions for imagined and possible futures. A poverty of stories risks trapping us in surreptitious human-natural system dynamics. Narrative matters for sustainability.

Conflict of interest

None declared.

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