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REPRESENTING CLIMATE: LOCAL TO GLOBAL

Scale, Climate Change, and the Pedagogic Potential of Literature: Scaling (in) the Work of Barbara Kingsolver and T.C. Boyle

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This article discusses recent work in the environmental humanities on the role of scale and what Timothy Clark describes as 'scale disorder' when encountering imaginative engagements with the Anthropocene. With readings of Barbara Kingsolver's *Flight Behaviour* (2012) and T.C. Boyle's *The Terranauts* (2016), it suggests that the 'scaling of perspectives' is a viable and productive way of dealing with the representational and interpretive challenges of climate change (and) fiction. Drawing on the notion that literature can be seen as a specific form of cultural ecology, as developed by Hubert Zapf, it presents a concept of transcultural ecology that thrives on the tensions inherent in scale disorder and climate change imaginaries. These findings will be described with regard to the pedagogic potential of reading fiction as an attempt to come to terms with climate change.

Introduction: On Scientific Exactitude and Literary Relationality

In a 2012 article, Timothy Clark begins by introducing a pervasive little thought experiment (148, see also Marland, 2018: 56):

You are lost in a small town, late for a vital appointment somewhere in its streets. You stop a friendly looking stranger and ask the way. Generously, he offers to give you a small map which he happens to have in his briefcase. The whole town is there, he says. You thank him and walk on, opening the map to pinpoint a route. It turns out to be a map of the whole earth.

The 'friendly looking stranger' apparently wanted to be of help but wasn't—but the problem with his map was not that it did *not* include the town, but that it included so much more. It was, as Clark concludes, simply '[t]he wrong scale' (148). In the quoted essay and elsewhere, Clark makes the point that current literary and cultural studies concerned with climate change are grappling with exactly the same problem; a problem he describes as 'derangements of scale' and that he understands as one of the core challenges of thinking (through) the Anthropocene, not least because a number of other such derangements—of norms, proportions but also meaning—come in its wake (2015).

The thought experiment with a map that reminds one of the overly exact cartography in Jorge Luis Borges's 'Del rigor en la ciencia' has particular meaning when discussing the emergent scale imaginary of the Anthropocene, since, as Clark goes on to argue, '[t]o move from a large to small-scale or vice versa implies a calculable shift of resolution [...], a smooth zooming out or in' (2015: 72). While Google Earth might trick us into believing that there is no problem in doing this, Derek Woods reminds us of the intricacies of scaling in the Anthropocene because the assemblages identified as geological forces are by no means reducible to 'Man' alone but 'large-scale, horizontal patterns of relation among ontologically different entities' (2014: 139). In other words, '[t]he scale-critical subject of the Anthropocene is not 'our species' but the sum of terraforming assemblages composed of humans, nonhuman species, and technics' (134). The challenge of thinking scale is thus not

aptly described by any sloganized demand for thinking 'big' or 'globally' but rather consists in thinking across the scales on which 'terraforming assemblages' and earth others dwell. With regard to the idea that we simply zoom out and move scales upwards, he pithily concludes: 'we have a map whose scale includes the whole Earth but, when it comes to relating the threat to daily questions of politics, ethics or specific interpretations of history, culture, literature or other areas, the map is almost mockingly useless' (2015: 71). This essay sets out to think about some alternatives.

As the image of the map attests, the importance of scale, scaling, and the adjustments of scales points to the fact that scale is a relational concept whose appropriateness depends on context, aim, and user. This is why I will discuss the potential use of scaling as a technique to be aligned with these factors in the context of literary studies and pedagogies. Through a brief reading of selected scenes from novels that helpfully illustrate the notion of scale as I understand it, I will outline what I think are basic insights for an interdisciplinary take on literature in the environmental humanities; and for teaching literature at university and higher secondary level. The derangements of scale Clark identifies at work in the Anthropocene will therefore be reconceptualised as moments of imaginative confusion and, possibly, resistance; and thus as productive affordances and opportunities for learning and understanding.

In current environmental humanities research, hardly any publications on climate change imaginaries can do without direct or at least indirect references to scale: literary studies grapples with the challenge of scale for perspectivation and traditional forms of narrative (besides the work of Clark, scale features prominently in Heise, 2008 and, somewhat differently, in Nixon, 2011); the implications and quandaries of a global scale are at the centre of contemporary environmental, or climate change, ethics (Morton, 2013; Callicott, 2017); and in classrooms of universities and schools, teachers of English and Anglophone literatures wonder what the implications of 'scale disorder' (Clark) might mean for pedagogical practice (D'Arcy Wood, 2017; Figueroa, 2017; Foote, 2017; Siperstein, Hall & LeMenager, 2017; Slovic, 2017; Sze, 2017). Indeed, when Clark refers to derangements of scale as one of the central challenges of contemporary global ecocriticism and cultural

studies on climate change, his ideas concerning scale disorder can be brought into direct and fruitful tension with the educational value ascribed to reading fiction. Through poetic licence, fiction allows for imaginary explorations of relations 'across ontologically different entities', but also points to the limits and conflicts of thinking everything at once, as the Anthropocene allegedly forces us to do. While this essay will therefore argue that climate change forces us to (re)think scale and to find new ways of describing scale effects as imaginative quandaries, as my readings seek to illustrate, I will also use the larger context of interdisciplinary endeavours within the environmental humanities to situate a claim for greater collaboration between literary studies and literary pedagogies, the reasons and benefits of which I will outline in the following sections.

From Scale Disorder to the Ordering of Scales

The Anthropocene is a troubled and troubling concept and has had a mixed reception across disciplinary fields. While some see it as just another manifestation of human exceptionalism or humanist hubris (Crist, 2016; Haraway, 2016) and others accuse it of obscuring the more pressing, or fundamental, conflicts of capitalist exploitation (of nature) at work in Western modernity (Chakrabarty, 2012; Moore 2016), Clark simply describes it as the 'dark moment in humanity's realisation of its own nature' (2013: 8). 'Dark' or not, much interpretive potential lies in the suggestion that 'humanity' realises 'its' nature. This phrase not only points to the distinction between nature and culture (as a supposedly uniquely human domain) but also, and more importantly, highlights the politically and ethically touchy question of the general singular 'humanity' and what or whom this term incorporates (and excludes).

Understood as 'a name for that moment in the history of the earth at which humanity's material impact and numbers become such that the set of discrete and once unconnected individual acts across the globe transmogrifies itself into an entity that is also geological and climatological' (Clark, 2013: 5), the Anthropocene or, more specifically, climate change, leads to a state that Greg Garrard describes as the 'Unbearable Lightness of Green': 'human population simultaneously magnifies the cumulative impact of our actions and dilutes my individual agency. The heavier

we get, the lighter I become' (2013: 185). This equation becomes more complicated when we try to take into account that 'humans' aren't variables but historically and politically situated (some humans are heavier than others, so to speak). In literary contexts, all of these deliberations seem to beg the question how to represent 'a concept at once wholly abstract and alarmingly material in aesthetically, rhetorically, and ultimately politically efficacious ways' (Garrard, Handwerk & Wilke, 2014: 149; cf. Bartosch, 2015).

Identifying this question of representation as one of the central challenges of climate change research in the environmental humanities requires seeing it as part of a larger interrogation of the capacity of reading and writing that ecocriticism has been concerned with more or less from its conception (Head, 2008); and that has led to the development of various theoretical proposals concerning the role of form and fiction in the 21st-century (Trexler, 2015; Vermeulen, 2018). Talking about ecological imaginaries (rather than the more disruptive notion of climate change), Dominic Head suggested in 1998 that 'the logic of this requirement may contradict the way in which the novel's role as a social medium is usually articulated' (2008: 237); and we can see a direct response in Adam Trexler's formulation of literary fiction and criticism not as a site for presenting human subjectivity and interiority but as a means of analyses of 'wider groups of human beings, plant and animal species, geophysical events, weather, and technology' (2015: 74; cf. Bristow, 2015 on poetry in the Anthropocene). A similar tendency to find new ways of theorising novelistic forms and functions can be found in a special issue of *Studies in the Novel* whose introduction addresses prevailing 'pessimistic assessments ... of the novel's ability to meet the representational challenges posed by the pressing planetary problem of climate change' (Craps & Crownshaw, 2018: 1).

In his contribution to this journal, Pieter Vermeulen (who has recently presented a compelling argument for formal(ist) readings [2015]) begins by stating that it is by now 'a commonplace that climate change constitutes a formal challenge to the customary rhythms, patterns, and scales of the novel', arguing that this challenge may be met by returning to 'the question of form' (2018: 9). For me, it is most

interesting that in 'returning' to the question of form, Vermeulen also returns to the basic axiom that reading 'for form ... implies a commitment to reading the elements of a literary work as parts of a totality' (2018: 10). Organic unity and the autonomous totality of the artwork have of course had a hard time in literary studies recently, and it might be for good reason that scholars have begun looking for alternative ways of formal(ist) readings (see Bartosch, 2017 for a more detailed discussion of form and the alternatives to totality). One of the challenges of climate change might be that literary scholars are not only forced to look at the parts/whole-interrelation within a specific text but at the larger (cultural) ecology of meanings and environmental change as a new, and challenging, form of totality.

Still, I fully agree with Vermeulen and others that the way to arrive there is to theorise '*through* literature', as Shlomith Rimmon-Kenan avers, using 'novels as, in some sense, the source of theory' (2010: 143, emphasis in original) and not its passive object. It is from this vantage that I want to address the challenge of representability, outlined above, as well as the concomitant challenge—and potential—of literary pedagogies that seek to understand the intricacies of climate change and the Anthropocene. For Trexler, the Anthropocene 'necessarily transforms generic conventions' so that 'climate novels must change the parameters of storytelling, even to draw on the tropes of recognizable narratives' (2015: 14). This brings us from an ontology of the Anthropocene—what *is it*, really?—to the epistemological conundrums of literary engagements with character, plot, setting and, most importantly, scale in literature and literary pedagogies. My point in the next two sections is that 'scaling' can and should be understood as both a textual and a reading practice. While 'scale critique' as it has been formulated by Clark and others points to the disorder brought about by climate change, I want to suggest here that the framework of cultural ecology, revised slightly so as to become 'transcultural ecology,' can help us address—and, as it were, 'order'—the confusion of reading different scales in fiction.

'Scaling' as Textual and Reading Practice

Although the Anthropocene seems to require a thinking of 'large-scale, horizontal patterns of relation among ontologically different entities,' as Woods, quoted above, puts it, when it comes to literary engagements with scale we can identify two

characteristics that I think are advantageous. The first is connected to what we can describe as poetic licence, the second as productive readerly inference. The first is easily explained: despite the fact that terraforming assemblages are paradoxically distributed *across* scales, literary fiction often makes productive use of scaling in a way that helps understand these very scales in the first place. Take an obvious example from Ian McEwan's novel *Saturday*: Henry Perowne, the focaliser, watches the London sky at night and sees a strange light moving across it:

He doesn't immediately understand what he sees, though he thinks he does. In this first moment, in his eagerness and curiosity, he assumes proportions on a planetary scale; it's a meteor burning out in the London sky ... It's a comet, tinged with yellow ... and he feels again the same leap of gratitude for a glimpse, beyond the earthly frame, of the truly impersonal ... Of course, a comet is so distant it's bound to appear stationary. Horrified, he returns to his position by the window. The sound holds a steady volume while he revises the scale again, zooming inwards this time ... Only three or four seconds have passed since he saw this fire in the sky and changed his mind about it twice. It's travelling along a route that he himself has taken many times in his life ... east to west, along the southern banks of the Thames, two thousand feet up, in the final approaches to Heathrow. (2005: 13)

Perowne here cannot at first pin down what it is that he sees, and he goes through several perceptive frames, all of which lead him to assume a different object with different political and personal implications, connected with different affective yields. He begins on a 'planetary scale,' assuming the phenomenon to indicate a shooting star and feeling gratitude for 'a glimpse, beyond the earthly frame, of the truly impersonal.' The planetary scale, notably outruling the 'truly personal,' is soon replaced in his imaginary, however, because of the political context of the story: as a post-9/11 novel, *Saturday* also engages with the threat of terrorism, and this is why Perowne is suddenly '[h]orrified,' 'zooming inward this time.' Only after he has recalibrated for a third time and realised the object moves along a familiar trajectory does he understand he is watching an airplane approaching Heathrow; in other words, a mundane situation he does not have to worry about.

It is of course possible to call into question the neat distinction between the three perceptive frames Perowne applies because these scales are by no means entirely separate: air traffic has obvious planetary consequences, terrorism is not disjunctive with personal, everyday actions of ordinary people, and so forth. But my point is that there is a heuristic value to each scale adopted here and that this needs to be understood before more intricate questions of naturalcultural entanglement can be addressed. This point and its epistemic and also ethical implications is what underlies Clark's notion of scale disorder as well:

The larger the scale, the more thing-like becomes the significance of the person registered on it ... Plots, characters, setting and trivia that seemed normal and harmless on the personal or national scale reappear as destructive doubles of themselves on the third scale [that is, the planetary, transnational one]. (2015: 161)

By distinguishing a primarily personal, primarily cultural, and a primarily planetary scale, Clark shows how each scale leads to different reading outcomes and suggests that 'most given thought about literature and culture has been taking place on the wrong scale' (Clark, 2012: 152).¹ He also shows how reading in the Anthropocene can deal with this complexity without overtaxing novels—or novelists for that matter—with the task of representing the unrepresentable in any neat and exhaustive way: '[n]o finite piece of writing', he argues, 'can encompass a topic that seems to entail thinking of almost everything at once—climate, culture, politics, population dynamics, transport infrastructure, religious attitudes' (2012: 78). But it can point to the relevance of scales even on the level of focalisation and diegesis, and thus bring home to readers a sense of scaling as a cultural technique of getting a grasp of the Anthropocene.

¹ I am aware that not only the neat distinctions of scales but most importantly the suggestion that there is a 'national' one will be contested. While Clark—not altogether unreasonably—accuses much contemporary and political criticism of 'methodological nationalism' (2015: 54–56), I suggest that it is possible to make use of the idea of scales beyond national(ist) frames and with regard to communal cultural patterns and, most importantly, anthropocentric meanings (a point I elaborate in Bartosch, forthcoming).

Clark's most important point is that identifying scales must not lead us into assuming a teleology of scales that induces us to move upwards: think about the map that shows the whole world but is useless precisely because of its all-encompassing scale. In order to make productive use of scaling, the 'emergent unreadability' of the Anthropocene can be interrogated from different 'scale framings' (Clark, 2015: 47). Clark asks:

[h]ow would it be to read and reread the same literary text through a series of increasingly broad spatial and temporal scales, one after the other, paying particular attention to the strain that this puts on given critical assumptions and currently dominant modes of reading?' (97).

To illustrate this point, let us now look at Barbara Kingsolver's *Flight Behaviour* (2012). At its centre, we find the narrative of Dellarobia Turnbow, a struggling and frustrated housewife who is part of a rural village community in the Appalachians. The novel starts as she is about to throw herself into the arms of a younger, unpromising love who she agreed to meet on the mountain belonging to her husband's family. As she walks up the mountain, she witnesses a surreal spectacle that, because she had decided not to wear her glasses, she mistakes for a biblical revelation: a host of monarch butterflies that appears to her as a mountain on fire whilst covered in a sublime silence. People love the sight of these butterflies and they quickly become a local attraction, although the ecologists who soon appear on the Turnbows' doorsteps express serious concern that the butterflies' arrival is a clear sign of environmental disaster and climate change (which aligns them with the biblical references on a much more realistic level, as does the novel's ending, in which a flood purges the land).

The novel has been discussed as one of the most successful attempts at describing climate change (and so much more), and I believe this is partly because it not only engages with environmental disaster and global changes of climate with their ecosystemic consequences. It can also be read, as Sylvia Mayer puts it, as 'a female *bildungsroman* ... that provides direct insight into the development of a specific subjectivity in the world risk society' (2016: 217) and thus links individual

flourishing and crisis with societal and eventually global conflict. It is also a highly political—and thus highly topical—text that goes a great way to presenting class struggles in US-American culture, especially those of disadvantaged rural people mocked by self-righteous, cynical-satirical TV formats. Quite clearly, it does not incorporate the global scale haphazardly but as a self-conscious textual and compositional strategy. As Christopher Lloyd and Jessica Rapson point out, it ‘scales from the ground up’ (2017: 913), thus presenting a ‘creative derangement’ of scales that already in its chapter titles suggests scales such as ‘The Measure of Man,’ ‘Family Territory,’ ‘National Proportions’ and ‘Planetary Ecosystems’ (Chapters 1, 2, 5 and 9, respectively) but also moves ‘back’ (or down) to ‘Kinship Systems’ (Chapter 12) and the ‘Perfect Female’ (Chapter 14) in a productive troubling of personal, social and ecological boundaries.

By thus charting ‘interactions between local and planetary environments, prompting readers to contextualise the micro ... within the macro context of the Anthropocene’ (Lloyd & Rapson, 2017: 911), the novel ‘urges us to see ourselves within a planetary perspective without leaving our very human, localised attachments’ (913) and offers ‘a vision of climate fiction that clearly emphasises both the importance of place ... and a sense of planet’ (917). This is evident even on the level of phrasing and metaphors: ‘[t]he trees had lost their leaves early in the unrelenting rain. After a brief fling with coloration they dropped their tresses in clumps like a chemo patient losing her hair’ (Kingsolver, 2012: 67). While the text thus brings together environmental perception and human-centred imagery, it suggests a highly productive ‘oscillation between these scales’ and ‘produces its own “scale effect” in the structural signposting of transitions from one scale to another’ (Lloyd & Rapson, 2017: 918).

In fact, one of its most important assets seems to be not so much the representation of biodiversity loss and environmental disaster, but its deliberate linkage of these ‘large-scale’ problems with the plight and perceptive frames of the rural disenfranchised. This can be seen in its linking of Dellaboria’s initial vision with a religious subtext that is not completely discarded, but proves productive and

powerful throughout the narrative as a motor of change and conflict. When Dellarobia returns home after her epiphanic encounter with the monarch butterflies, she has:

[n]o words to put on a table as Moses had when he marched down his mountain. But like Moses she had come home rattled and impatient with the pettiness of people's everyday affairs. She felt ashamed by her made-up passion and injuries she'd been ready to inflict ... They built their tidy houses of self-importance and special blessing and went inside and slammed the door, unaware the mountain behind them was aflame. (Kingsolver, 2012: 30–1)

While Dellarobia comes to grips with this estrangement, the novel does not opt for a general shift of perspective but painfully returns to the uneven political and cultural capital of its rural population. This can be seen when Dellarobia responds to the 'Sustainability Pledge' that urban-type climate activist Leighton distributes on flyers to visitors to the butterflies. It suggests that diners should '[b]ring [their] own Tupperware to a restaurant for leftovers, as often as possible', to which Dellarobia states 'I've not eaten in a restaurant in over two years'; and suggests that people '[t]ry to reduce the intake of red meat in [their] diet', to which she responds: '[a]re you crazy? I'm trying to increase our intake of red meat' (451–2).

Increasingly ashamed of his off-the-mark and class-blind suggestions and reduced to a 'rushed monotone' (453), Leighton suggests not carrying on with his list but Dellarobia insists: "Okay, this is the last one," he said. "Fly less." "Fly *less*," she repeated. He looked at his paper as if receiving orders from some higher authority. "That's all she [the leader of the environmental group] wrote. Fly less." (454). So much for 'humanity' bringing about climate change as one unified geological force. Although we might conclude with Timothy Morton that environmental disaster and biodiversity loss are indeed 'caused by humans—not jellyfish, not dolphins, not coral' (2014: 260), the point of scaling is the very idea that such distinctions cannot make sense in and of themselves but have to be thought together in different readings of scale, which pay 'particular attention to the strain that this puts on given critical assumptions and currently dominant modes of reading' (Clark: 97).

This leads us to the second, and surely interrelated, notion of scaling that I suggested above. Scaling can also be understood to be primarily located on the level of reception, rather than composition (Garrard, 2016: 310). As Clark's dig at 'methodological nationalism' as an assumption that is 'all-pervading in many critical readings' and that takes 'the nation-state and its boundaries [as] a natural or at least self-evidently justified context' (2015: 54) suggests, it is by and large the choice of the reader and her critical interest whether to foreground a certain scale for political or ethical reasons (from the literary-historical interest in national literatures to the politics of postcolonialism, for example). But to state that a reading in times of climate change has taken place 'on the wrong scale' doesn't imply simply shifting the scale of reference. Rather, as Stef Craps and Rick Crownshaw caution, 'the critical emphasis placed on the scaling up of the literary, and interpretive, imagination risks distracting from issues of mediation' (2018: 4). As I want to suggest, another option lies in the conscious process of scaling without going for one or the other option and by instead cultivating a perspective that deliberately constructs contrapuntal readings along the lines of differing scales.

I want to turn to T.C. Boyle's *The Terranauts* for a discussion of this more reception-oriented approach. In stressing the latter, I do not mean to suggest, however, that the novel lends itself more readily to such a reading because of some inherent features or its design; nor do I want to insinuate that a clear-cut distinction between both ways of approaching scaling is ultimately tenable or useful. In fact, *The Terranauts* employs scaling and moments of scale disorder quite deliberately and openly in its setting alone. It tells the story of eight pioneer ecologists partaking in the widely discussed 'E2-project', seeking to recreate earth systems in order to research ecosystemic interplay and development; and to potentially find ways to create liveable ecosystems on other planets. Its thinly disguised references to comparable real-life projects—most obviously the US-American Biosphere Project—arguably turns it into an effective and political satire. However, for a reading of scales its most important aspect lies in the fact that the very setting in an artificial and condensed world ecology is already a scaled mise-en-scene that relates planet, community and, eventually, personal drama.

Thus, while the E2 crew constantly work towards maintaining ecosystemic autonomy and seek to 'keep closure' above all else, it is because of the novel's deliberate mixing (up) of the very large and the very small that comic and scalar effects come to fruition:

... nothing artificially scented was allowed inside for the simple reason that any chemical whatever would constitute a recycling poison in a closed system. The [preceding] Mission One crew had kept getting skewed readings for trace gases until somebody discovered an open tube of silicone sealant in the machine shop which another somebody had been using ... to seal tiny pinprick holes in the seams of the spaceframe – that's how sensitive it was inside. [...] [O]ne day you're wearing Dune or Angel and the next day you're eating it. (Boyle, 2016: 74)

While in this passage and elsewhere, the stress is on the difference between the artificial and the natural ecosystems and therefore on closed versus open systems, it is of course clear that the connection between waste and poison and an eventual feeding back into the food cycles are phenomena far from exclusive to billion-dollar research projects in the desert. A focus on scaling helps understand the peculiar interconnectedness of the planetary and the localised, just as this passage neatly presents a very specific entanglement constitutive of the Anthropocene. What happens in the scaled-down, and thus more easily understandable, world of E2 is but a small-scale model of environmental change more generally. The 'tiny pinprick holes' are exemplary: they lead one anonymous person to do something which, together with the random actions of another anonymous person, slowly but surely become a truly terraforming assemblage.

That *The Terranauts* novel points to such connections but allows readers to draw their own conclusions is the reason why I suggest taking into account readerly agency as a deliberate interpretive act when it comes to scaling. This allows for a re-interpretation of seemingly 'neutral' narrative decisions from a perspective that thrives on the tension between the all-too-human dramas of infatuation, greed and boredom, bodily desire, and, eventually, pregnancy; and the planetary proportions

of the project's scope (for example, to make use of three focalisers who tell the story from their respective perspectives and permit direct access to their minds; and thus take effect on scale one). The novel is, in the end, a rather conventional marriage plot; and it is the complications of having a baby in a hostile environment that determines the course of the experiment—granted, however, that it has indeed become a 'human experiment' (231) in which humans are watched as if they were specimens in a zoo.

That the human factor has been neglected in the devising of E2 turns out to be a spanner in the works, but this cannot be called a flaw in the narrative. Quite the reverse, in fact, for it is this tension that comes to the fore through scalar framings. When, as readers, we work through these conflicts and the disorder of scales involved, we indeed become, in the act of reading, 'very much equipped to notice when easy technological fixes to our problems get wrapped in utopian thinking' (Ramuglia, 2018: 83). River Ramuglia therefore rightly concludes that the 'novel derives much of its humor from juxtaposing the absurdity of life within the back-to-basics ecological madhouse of E2 with what the character, Ramsay, describes as "the corruption of the outside world"' (2018: 69). But in doing so, the novel carefully draws on the implications of different scales that are being brought together in the act of reading and can thus be understood as different yet entangled.

Ramuglia recalls another scene I find helpful for underlining how the novel's self-conscious bringing-together of different scales can be read as an exercise in scalar framing. In it, 'an intoxicated truck driver far away from E2 crashes into a utility pole, causing a wildfire that cuts off E2 from its power supply, in turn shutting down the temperature-regulating mechanisms of E2' (2018: 78). It is exactly the mundane and banal that causes existential crises across scales, just as the crew try to operate in reverse terms when they 'scale down' the species they live with in terms of their nutrient value. When it is time to slaughter a pig, the character, Dawn, reminds herself that 'a dead pig equalled meat and meat equalled calories and protein and essential amino acids' (Boyle, 2016: 230, also qtd. in Ramuglia, 2018: 81). This is why it would be wrong to conclude that only '[a]t first glance, *The Terranauts* seems to use E2 as a staging ground for the irreverent, often bathetic drama of its human characters' (Ramuglia, 2018: 83)—the connection and scalar disproportion constitute the heart

of the matter. Accordingly, the novel culminates in a scene of personal betrayal and disappointment that purposely seems to have ambivalently dystopian overtones of endless darkness. In the last paragraph of the novel, a hurt and disillusioned Linda, the former best friend of Terranaut Dawn, is waiting outside the E2 compound in the hope of 'catching up' with Dawn and also of meaningful connection: 'I don't know how long I sit there, just dreaming—a long time, a very long time. I hear the echo of voices, watch the play of lights. The night deepens, deepens again, and Dawn never comes' (Boyle, 2016: 508).

Transcultural Ecology as the 'Scaling of Perspectives'

The brief analyses of the novels above point to the potential for narrative fiction to illustrate some of the intricacies and environmental changes in the Anthropocene. Thus, I whole-heartedly agree with Greg Garrard's description of fiction—and *Flight Behaviour* in particular—as 'a *cognitive technology* that shapes our comprehension of climate change' (2017: 120, emphasis in original). This points to the educational potential of fiction and links the environmental humanities with the aims of sustainability education and ecocritical pedagogy. Drawing on the work of Mitchell Thomashow in *Bringing the Biosphere Home* (2002), as well as that of Clark, Garrard concludes that '[w]here Thomashow wants to *re-orientate* learners by alerting them to knowledge ... of other temporal and spatial scales, Timothy Clark stresses the necessary instructive *disorientation* brought about by precisely the same kind of knowledge' (2017: 119, emphases in original). I believe that analyses of narratives and their potential reception can alert us to the fact that, indeed, there is no need to choose orientation over disorientation, or vice versa, but that both mechanisms are relevant and can be described with regard to the cultural-ecological potential of fiction.

In Hubert Zapf's understanding of literature as a specific form of cultural ecology, the underlying model is one of the ultimately balancing functions of fiction that draws its epistemic and ethical energy from a dialectic in which 'critical metadiscourses' and 'imaginative counterdiscourses' articulated in narrative establish a 'reintegrative interdiscourse'; a form of narrative conciliation through which 'literature brings together the civilizational system and its exclusions in new, both conflictive and

transformative ways' (Zapf, 2016: 114). With an eye on the potential problem that in the Anthropocene agency and exclusion are distributed across ontologically different scales, and that simply demanding new and easily palpable 'fictions of the global' (Barnard, 2009) will not do the trick, I suggest that we understand climate fiction in terms of a transcultural ecology; an ecology, that is, which simultaneously locates cultural-ecological potentiality across different scales as well as in their interplay. Zapf writes that '[b]etween an anthropocentric cultural studies perspective ... and a radical ecocentrism,' cultural ecology ought to look at 'the living interrelationship between culture and nature, without reducing one to the other' (2016: 3). I agree and believe that such interplay can be found in the orientating as well as disorientating potential of scaling, where a planetary scale demands an ecocentric perspective; while a second one points to the anthropocentric dimension of culture, community, and local politics; and yet another one successfully mediates this conflict through a personal perspective.

The pedagogical potential, in other words, does not lie in privileging one scale over another but in the cultivation of the ability *to scale*, and to orchestrate scales (see Bartosch, forthcoming, for a detailed account of these processes in educational settings). In her work on the writerly attempt at balancing potentially conflictive scales, Pippa Marland calls this 'Thinking Big, Then Thinking Small Again' (2018: 61) and concludes: '[o]nce you have zoomed out in order to see the big picture, you might find, upon zooming in again, that your perspective on the human and on the earth, and on the place of the mortal human upon that earth, has subtly changed' (62). By 'advocating reading simultaneously through multiple and contradictory interpretive frameworks' (Craps and Crownshaw, 2018: 3), Clark and others have pointed to how such zooming and scaling might take effect, and the pedagogical potential of environmental humanities research lies in exactly this awareness of the ongoing dialectic between scales and their unending recalibration of meaning(s).

In his critique of new materialist accounts of narrativity, Hannes Bergthaller writes that 'natural processes do not present themselves in a form of narrative, but as an open-ended, unbroken series of occurrences' and that '[t]o configure a

set of events into a narrative is to endow them with a meaning that they do not possess as long as they are merely considered as a temporal sequence' (forthcoming). This is equally true for naturalcultural processes because, as Bergthaller rightly observes, reality 'contains a surfeit of features, but lacks inherently binding criteria of relevance' (forthcoming). But if we replace the technical term 'narrative' with the more ambiguous notion of 'meaning', we see that the scaling of perspectives and the necessary reading and rereading of 'the same literary text through a series of increasingly broad spatial and temporal scales' whilst 'paying particular attention to the strain that this puts on given critical assumptions and currently dominant modes of reading' (Clark, 2012: 97) yields relevant insights into the complexity of naturecultures in an age of climate change. Exploring 'the human ability to shift between, connect, and make sense of multiple, interconnected dimensions' (Alaimo, 2017: 31) as the central pedagogic objective in the environmental humanities might show in which ways the terranauts explore artificial ecosystems as well as earth and kinship systems. It allows for a reading of monarch butterflies as 'literary figures that demonstrate the interrelations of place and planet in the Anthropocene in more tangible ways than cross-stitches or alliances' (Lloyd & Rapson, 2017: 917) by bringing together butterflies that in the novel are called 'King Billies' and Hillbillies; and so much more in one shared, and unendingly ambiguous, flight behaviour.

Competing Interests

The author has no competing interests to declare.

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