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Articulating encounters between children and plastics

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Abstract
In the context of global concerns about plastics, this paper sets out and exemplifies a research agenda for articulating children's encounters with plastics. The paper analyses data co-produced with 11–15 year-olds through interviews, app-based research and experimental/arts-led workshops. It moves beyond scholarship in health and environmental sciences, and in environmental education research, to outline a far richer range of ways to conceptualise children's encounters with plastics, based in children's everyday, embodied and emotive interactions with plastics.

Keywords
Environmental education, interdisciplinary research, popular culture, everyday life, new materialism, posthumanism, arts-based methods

Introduction

Plastics are on the agenda, in all kinds of ways. Globally, plastics are virtually ubiquitous. They are present in tap water, circulate through hydrological systems, appear within soil and rock strata, and are found in the bodies of many organisms – including humans (Huang, 2017; Koelmans et al., 2019). Plastics represent a 'sticky' and often indeterminate problem (Liboiron, 2016). Many aspects of contemporary human lives around the world would need to change without plastics, but even if humans stopped creating plastics today, their slow decomposition rates would mean they would be present within earthly systems for centuries to come. Moreover, the impacts of plastics on environmental and human health are complex and not always straightforward. For instance, some plastics may simply pass through human bodies without any ill effects; however, certain plastics (and the plasticisers that afford them certain properties) do pose a significant risk to particular groups of people in particular places. Notably, children are especially

vulnerable as a consequence of prolonged exposure, with (possible) health outcomes including future obesity, the development of mental health conditions, and reduced brain development (Belontz et al., 2019; Davis, 2015). With some plastics emitting "chemicals of concern" (Aurisano et al., 2021: unpaginated), children's diverse everyday encounters with plastics – from playing with toys to working on waste recycling sites – could place them at particular risk of exposure.

Accompanying increasing scrutiny by academics, health and environmental organisations (World Health Organisation, 2019), debates about plastics were – at the time of writing – also prominent within political, media and public milieux. In the UK, for instance, a key factor in raising the profile of plastic pollution was the broadcast in late 2017 of the *BBC* series *Blue Planet II*, whose final episode highlighted the plight of the world's oceans given plastic pollution. However, concerns about plastic pollution predated the media furore of the late 2010s: from the efforts of the *O Fundo da Folia*[1] surfers in Brazil who in 2010 founded schemes to clean up the country's beaches, to an innovative programme in the Ivory Coast[2] that converts plastic waste into bricks used in school buildings.

This paper offers a starting point for understanding the diverse ways in which plastics are *encountered* by children and young people. In so doing, it complements but extends beyond the key ways in which scientific and public debates have thus far drawn associations between plastics and childhoods. Firstly, the possible health implications of plastics are set within views that contemporary childhoods – especially in the Global North – are becoming increasingly 'artificial', 'toxic' and/or 'disconnected' from natures (Kraftl et al., 2019). Indeed, plastics take on a symbolic power as they become synonymous with the apparently insidious effects of globalising consumer cultures. Secondly, fears about plastic pollution are set within wider generational logics of discourses about environmental change. That today's and future generations of children will have to live with the effects of environmental degradation are powerful drivers of environmental debate (Nolas, 2021; Raby and Sheppard, 2021). A third and arguably consequent association between childhoods and plastics is that *children* are a key group targeted by interventions, particularly in terms of education about plastics. For instance, the past few years have witnessed a range of programmes designed to educate children about plastic pollution and induce positive behaviour change, including the production of resources for primary-aged children and the *Plastic Clever Schools* initiative[3].

We do not aim to take a particular stance on these different associations between plastics and childhoods. Rather, bearing in mind these associations, we seek to analyse children's own *encounters* with plastics in the course of their everyday lives, which may articulate or may extend beyond the concerns outlined above. As the next section of the paper demonstrates, scholarship about children and plastics is fairly limited. A particular contribution of this paper is, then, to develop both conceptual and empirical agendas for researching the often banal, embodied, material and emotional dimensions of such experiences. Moreover, it does so in a way that pays due regard to the deleterious effects of plastics whilst recognising that there may be other, perhaps (even) 'positive' ways of living with plastics as chemical 'kin'. For example, what about the multiple plastics that keep children alive (literally) – from inhalers, to life support machines, or car seats?

More broadly, the paper also intervenes into conceptual debates in interdisciplinary childhood studies – principally informed by feminist new materialist, posthumanist approaches – about children's entanglements with/in more-than-human, environmental processes (e.g. Horton and Kraftl, 2018; Spyrou, 2019; Taylor and Pacini-Ketchabaw, 2018). Attending particularly to children's encounters with matters that are hard to identify as singular, bounded 'objects', and perhaps in tension with some renderings of a posthuman childhood studies, the paper highlights a range of stories, knowledges and dilemmas about plastics, expressed by children aged 11–15. After reviewing these literatures we provide an overview of the research upon which the empirical analyses in this paper are based. The subsequent sections draw together children's encounters with plastics into a number of key themes, which might in turn prompt further reflection and research about the associations of plastics with childhoods.

Children's environmental interactions and knowledges (about plastics)

This paper is situated within burgeoning and diverse approaches to children's interactions with, and knowledges about, 'the environment'. The latter term is presented in scare quotes to recognise that its status is contested within these literatures, being treated rather differently in scholarship on environmental knowledges (and particularly environment education), compared to that drawing on materialist and posthumanist approaches. These literatures are reviewed in turn below to highlight the paper's key contributions, with particular attention to (in some cases scant) analyses of encounters between children and plastics.

A key starting point for understanding environmental knowledges is literatures on environmental education, wherein children hold a prominent position. Centrally, it is assumed that environmental learning during a person's 'formative' years can lead to environmentally-relevant behaviours, habits and actions that last a lifetime (Ardoin and Bowers, 2020; Maurer and Bogner, 2020). Although diverse in its theoretical orientations, a founding principle of much environmental education research and practice – especially in countries in the Global North – is that children have lost meaningful connections with nature and that those connections need to be restored through interventions such as Forest Kindergarten or Forest Schools (Walker, 2017; Harris, 2021).

Notwithstanding the benefits of nature-based interventions, and to gloss over important differences in approaches to environmental education, three observations about those approaches are pertinent to the present paper. Firstly, much environmental education is adult-led and, specifically, didactic: focused on the transfer of (largely Western, 'scientific') knowledges about environmental change to children (Rousell and Cutter-Mackenzie-Knowles, 2020; Taylor, 2020; Trajber et al., 2019). Importantly, children's experiences of 'the environment' may be highly variegated and so didactic approaches to environmental education may ignore the knowledges and forms of 'connection' that children already have with 'natures' (Collins, 2021; Kraftl et al., 2019; Skovdal and Benwell, 2021). Moreover, such approaches may also gloss over their encounters with matters (like plastics) that are deemed to put such natures at risk – as in the present paper.

Secondly, a significant proportion of research and practice in environmental education continues to position the Western proposition that the environment or 'nature' is 'out there': separate from humans. As we outline below, these assumptions sit in tension with diverse indigenous, (eco)feminist and new materialist perspectives that are rapidly gaining traction in childhood studies. Thirdly, there is increasing recognition that a focus on children – and their education – should be a central pillar of efforts to mitigate or reduce environmental damage (UNICEF, 2019). Strikingly, and despite the more-or-less global furore around plastic pollution charted above, *plastics* are not particularly prominent within environmental education research. Indeed, there exist just a handful of research papers about plastics education, some of which focus on adults rather than children, and which tend to hone in on the relationship between knowledges about plastics and (very specific) behaviours (Kovács et al., 2020; Rudman and Rudman, 2021). Moreover, most papers focus on the capacity of different plastics education programmes, in schools, to disseminate knowledge about plastics pollution in a rather didactic sense (Schiffer et al., 2019; Soares et al., 2021). Nonetheless, and in line with recent systematic reviews of environmental education (Roussell and Cutter-Mackenzie-Knowles, 2020), isolated papers identify programmes that extend to more inclusive, participatory, inquiry-based forms of plastics education (Dalu et al., 2020; Mironenko and Mironenko, 2020). Extending this work far further, this paper uniquely analyses children's knowledges about plastics as they emerge from and are embedded within their *everyday* experiences, routines and mobilities – within and, crucially, beyond school environments.

Feminist new materialist and posthumanist theorisations of childhood have offered very different understandings of children's engagements with 'natures'. Indeed, they have problematized the term 'nature' to narrate how children inhabit Common Worlds with animals, plants, technologies and a range of environmental processes (Taylor and Pacini-Ketchabaw, 2018; Hadfield-Hill and Zara, 2020). Rather than being conditioned by adult-driven forms of education, or necessarily the product of children's 'agency', environmental engagements, knowledges and actions emerge through complex, more-than-human entanglements of children with, in and as the worlds they inhabit (Nxumalo et al., 2017). Children are decentred or move in and out of focus – but are, crucially, not ignored – in attempts to witness how humans (of whatever age) are inextricably products and productive of the many ecological, technological, hydrological and geological processes that go on around and through us (Kraftl, 2020). In what could probably be described as a material and nonrepresentational 'turn', childhood and education studies scholars have begun to grapple with, and evidence, the many opportunities and challenges of such forms of decentring (Mannion, 2020; Petersen, 2018; Spyrou, 2018).

The present paper contributes not only empirically but conceptually to a growing but important subset of the above scholarship that attends to material processes that are slippery and elude easy definition (compared, for instance, with objects, animals or technologies that present themselves in a more bounded way for analysis) (e.g. Pollitt et al., 2021). Like 'weather', plastics may take specific forms – such as toys – but when considered as a material category or set of processes, are far harder to circumscribe. Plastics constitute what Morton (2013) terms a 'hyperobject': they are virtually globally ubiquitous whilst taking forms that are micro- or nanoscopic. Hence they are both too

large and too small for humans to sense or represent fully (unlike more obviously 'object-like' material stuff – like toys).

Despite the above caveat, childhood and education scholars have begun to grapple with different ways of conceptualising, empirically investigating, and narrating encounters between children and plastics (Kraftl, 2020). One particularly exciting and innovative area of work has been in staging creative interactions between children and plastics (Penfold and Odegard, 2021) – whether through a small-scale experimental 'plastic city' (Molloy-Murphy, 2020), or in articulating how discarded plastic dolls might inspire reflections on sustainable practices and ideals (Domingues, 2021). Elsewhere, efforts to witness the "vibrant lives of plastics" in rivers centre around the cultivation of everyday learning experiences (Berry et al., 2020), whilst in research with a less overtly pedagogic emphasis, plastics figure somewhat more patchily and obliquely in discussions about children's environmental views, actions and lifestyles (Nilan, 2021; Patwary et al., 2012; Wilson et al., 2010).

Notwithstanding the associations between childhood and plastics outlined in the paper's introduction, it is notable that scholarship on children's encounters with plastics is fairly nascent. A key reason for this may be plastic's elusive, slippery and multi-scalar constitution as a hyper-object that is difficult to deduce empirically – although this paper makes the case that, even with a new materialist framework, fairly traditional interviews, alongside more experimental arts-based approaches, may enable insight into children's encounters with plastics. Thus, for all of the reasons cited so far, we argue that there is considerable scope for a more concerted research agenda around childhood and plastics. A particular contribution of this paper is to foreground the voices and experiences of young people, although cognisant of the limitations of 'voice' that Common Worlds and other scholars have highlighted. Nonetheless, the opportunity to work with older children, and in a research project concerned with diverse everyday (and not only 'educational') settings, afforded an opportunity to broaden consideration of how children articulate their encounters with plastics.

Methodology

This paper is based on a multi-faceted, interdisciplinary research project that sought to interrogate multiple entanglements between children and plastics. Taking place over an 18-month period, the project was led by a human geographer but involved collaboration with environmental nanoscientists, social media analysts, teachers, artists and children themselves. Two parts of the project (not discussed in this paper) involved analyses of millions of Twitter and eBay posts, and the sampling of water, soil, breath and urine collected from children for the presence of plastics (Kraftl, 2020; Kraftl et al., 2021). Here, however, we focus on an intensive programme of research in a secondary school located in Birmingham, a large city in the English Midlands, with a group of 13 children aged 11–15. Although not purporting to be representative, it is nonetheless useful to note that eight of the children identified as girls and five as boys, and that – reflecting the school's diverse catchment – they came from diverse socio-economic and ethnic backgrounds.

The research centred upon a series of workshops that were co-designed with a geography teacher (also one of the paper's authors). The workshops enabled children to discuss their knowledges, experiences and everyday interactions with plastics in different parts of their everyday lives. Compared with other previous studies involving children and plastics, the ages of the children worked to our advantage – for, at least in the context of Birmingham, older young people have greater levels of independent mobility, higher levels of control over what they consume, and, crucially, longer-term exposure to and interactions with social and other media debates about plastics. Indeed, some sessions comprised guided discussions around the environmental effects of plastics, about which the children were highly knowledgeable, because they had spent considerable time researching plastics, watching videos online, and had watched what were (at the time) recent television programmes about plastics in the world's oceans. Others facilitated different kinds of embodied interactions with plastics – for instance, a session where children were challenged to explore the properties of different kinds of plastics by attempting to bend, break and otherwise manipulate them. Extending other more experimental work about plastics (Molly Murphy, 2020), the final session involved a workshop, co-delivered with some local artists, where children worked in groups to create 'sculptures' from 'waste' plastics found in various sites around the city. Although impressed by children's knowledge about plastic pollution, we nonetheless wanted to disrupt what had been largely negative discussions by prompting them to think about how we might 'live well' with toxic kin. Varying from clothing to gardening equipment and from toys to protective equipment, each object had a hole drilled into it so that children could place them on 1.5 m-high metal spikes. They then created sculptures based on different instructions from the artists – from one showing the different values of plastics, to another that was aesthetically 'pleasing'.

Whilst in the broader project, the interdisciplinary nature of our approach (particularly the biosampling element) lent plastics a kind of agential capacity that material objects would rarely have in childhood research, in the workshops, there were nevertheless moments where plastics had a kind of agency that was both enabling and constraining. As with the app (discussed below), the plastics 'selected' for the workshops by the artists were *encountered* rather than chosen in a purely rational way. This is not to downplay the care with which the overall selection of items was curated; nevertheless, the artists collected a bewildering range of plastic items through rifling through items on their own property, in skips, recycling centres, charity shops and elsewhere so that there was an element of the plastics 'selecting' them, too. Moreover, as we discuss later, the plastics had, in the workshops, emergent affordances – particularly in terms of their aesthetic capacities (when children made sometimes quite arbitrary and humorous decisions about which of the ostensible items of junk looked 'best') and their material properties (practical decision about whether sculptures would work, physically, with some top-heavy structures having to be supported by arm whilst being photographed). In all senses, however – and aware that it was the artists who brought the plastics to the classroom – the plastics acted as *disruptors* of conventional social (and social research) interactions. For, their appearance in the classroom, and the tasks children were set to perform with them,

veered significantly from the ways we generally encounter plastics – especially in school settings.

Alongside the workshops, the children also worked with a bespoke mobile phone application (app). The app enabled children to take photos and enter some short text every time they encountered plastic stuff over a period of a couple of weeks, using three broad thematic prompts: 'food', 'water' and 'leisure time'. The entries were all georeferenced so that we could generate maps (using a Google Maps base layer) showing where children encountered plastics. Building on recent research using apps to research children's mobilities (Hadfield-Hill and Zara, 2018) and more generally as part of a multi-method toolkit (Jones, 2020), we conducted semi-structured interviews with the children after they had completed the app activity, manipulating images from the app on a large sheet of paper and a large printed base-map. Children selected key images both to tell us in more detail about particular encounters with plastics and to begin the process of co-analysing those encounters by grouping them thematically and identifying (dis)connections between them. These discussions, and the workshops, were recorded using a digital Dictaphone and/or written notes, and analysed iteratively through discussion in the interviews and workshops, with subsequent thematic coding by the lead author. The project underwent ethical review at the authors' University and, given the inclusion of biosampling methods, entailed the development of a new series of ethical protocols (see Kraftl et al., 2021).

Articulating encounters between children and plastics

The rest of this paper examines key themes from the interviews, mobile phone app and workshops discussed above. It opens out a number of interconnected themes that might offer key starting points for a research agenda that articulates children's encounters with plastics (in particular) and other materials like them (more broadly). We draw out three themes: children's knowledge about plastics and, especially, the consumer cultures in which they are embedded; embodiment, touch and everyday routines; and, the merits of 'fun', aesthetic judgment and speculation in imagining 'other', perhaps hopeful, ways of living with plastics. By starting with 'knowledge' we demonstrate that questions of pedagogy remain important – but only when understood in the context of often banal, embodied, everyday and emotional dimensions of children's encounters with plastics (Horton and Kraftl, 2006).

Knowing plastics, knowing consumer cultures

> The students are creating sculptures showing how 'useful' different plastic objects are – the higher up the sculpture, the more useful. Brian mentions that the plastic container for a toy found in a Kinder Surprise Egg is useless as you crack it open, breaking it, and then have a pointless container that has been broken in half. But he then says that the containers are useful to him because he plays games with them. Brian then suggests that the containers are banned in the USA because they are a choking hazard. The main debate, though, is about a mobile

phone. Leila was adamant that it was one of the most useful objects, but the others kept trying to move it to the bottom.

We also had a long conversation with Brian, Leila and Melike about some small squishy 'orbeez' that they had found around the school and particularly in the bathroom – which look like marbles and have the texture eyeballs (might) have. We all took it in turns feeling and squishing the orby, rolling it across the table and taking pictures of it. Leila and Melike described how if you put them in water they expanded, that people immersed their feet in them as a sort of massage and that kids were obsessed with them. We also all speculated about what we thought they were made of (some sort of permeable plastic filled with water we concluded) how they had got there (none of us knew) and what would now happen to them (they'd burst and end up in the environment). We, as the adults, had no idea what these things were. But they were very obviously in the children's popular cultural frames of reference, which they educated us about.

The moments above came from our observations of the final sculpture workshop. Both vignettes illustrate how knowledges about plastics emerged through the very process of manipulating, discussing and speculating about the plastic items brought for the activity. As such, they reinforce the message that environmental educators are increasingly seeking to convey – that learning about the environment (and plastics, specifically) needs to be embedded in multisensuous, experimental forms of pedagogy (Penfold and Odegard, 2021). Yet the vignettes signal more than this. They neatly demonstrate the interweaving of the diverse thematic frames that we introduce in this paper: of embodied, haptic interactions with plastics; of how apparently 'useless' plastics are used, valued or played-with within everyday lives; and, of speculation about the properties and presence of plastics in more-than-human worlds.

Moreover, and consequently, the vignettes also indicate how environmental (plastic) knowledges are embedded in and contextualised by the specific ways in which children are positioned in respect of the consumer cultures and economies through which plastics circulate. As we argued earlier, this paper is not specifically concerned with environmental education, although learning about plastics is an irrevocable and important part of how children encounter plastics. The point, however, is that children's everyday, embodied encounters with plastics – and the sculpture exercise itself – enabled knowledges and conversations about (children's) consumer cultures that were complicated, contested and critical. We are, in other words, more interested in the nature of those knowledges and conversations rather than what was being learned, or how – in particular because some of the things that children 'knew' were themselves highly subjective, context-specific, contested and (likely) went 'under the radar' of formal, adult-led kinds of environmental education.

Importantly, our argument is not that these knowledges and conversations somehow matter less because they are highly specific, personal or subjective. Indeed, as Horton (2010) argues, these kinds of knowledges matter as much or more as more formal knowledges transmitted by adults as, like the encounter with the Orbeez in the school, they illuminate how children engage with the world, often playfully, in ways that might

seem opaque or meaningless to adults. Moreover, the collaborative nature of the sculpture task, and the conversations that it enabled, illuminated how knowledges about plastics are contested in several ways, perhaps 'beyond' the question of how humans should deal with plastic production and wastage: in how Brian could simultaneously frame plastic containers as useless in general, useful to him, *and* a health hazard in the USA; in how the children couldn't decide (literally) where to 'place' mobile phones in terms of their relative usefulness, despite the apparent centrality of these devices to young people in countries like the UK; and, in how children were both drawn to the Orbeez (bringing them into the classroom) and somewhat dismissive of other young people who were 'obsessed' with them.

Similar kinds of knowledges and critiques of children's popular cultures were evident in the interviews, and were particularly prompted by photographs that children had taken of plastic objects in their homes. In the following extract, for instance, Melike discussed what she saw as the risks of the (then) current fad for making slime.

> Interviewer: Hmmm, what's this? (referring to a picture Melike has picked up of a blue spongey-like substance)
>
> Melike: So my best friend's, she, she, like, she made this slime shop. So she's a really big slime fan. Yeah, it's like online, if you've been watching the news and everything, they've been saying what they've been adding into slime, so like micro beads […] And um, normally when people play with slime, they play with it once or twice, and then they throw it away and like that's a bit of a problem.
>
> Interviewer: so is that an issue?
>
> Melike: Well, and then like how you make slime, the most popular way is um using borax […] It's like a really dangerous chemical, it can burn your skin […] And like the fact that they're making a lot more than usual is a bit troubling and everything.

This encounter is also particularly interesting for how Melike uses the interview to demonstrate her intimate knowledge of the plastics-based composition of slime, being critical of the prominence of single-use plastics and exhibiting a clear concern about the potentially 'dangerous' nature of these toys.

Embodiment, touch and everyday routines

Beyond the implications for children's critical and contested knowledges about popular consumer cultures, experiences like Melike's also afford a sense of how everyday and embodied encounters with plastics themselves matter, more instrinsically. Importantly, those encounters might matter because of the apparently pernicious effects of plastics; but they may also matter in far more prosaic senses that, often, seem too banal to articulate. Sometimes, in the interviews, we (researchers and children) struggled or stuttered, with frequent, slightly embarrassed, bemused silences as we worked through image after image of plastic bags, containers, and everyday household objects. Why on earth were we spending time talking about these?!

> Philip: Um, so we just went to Tesco and they like – because when we go shopping, we normally forget to bring our own bag, we have like a whole storage of them, which we store them and since we always forget, we always have to buy a bag.
>
> Hadassah: So at the time, I took these pictures during Ramadan, but as a general routine it's like normally getting up, brushing my teeth, getting changed and then, so like, I come down and then early in the morning I have to wake up my new cat.
>
> Basirat: (Viewing an image of a drawer full of plastic clothes hangers) Yeah, my mum keeps hold of hangers like there's no tomorrow!

It was telling of how plastics have become so unspeakably, habitually entrained with/in everyday lives that even children who were highly knowledgeable about 'the plastics problem' struggled to articulate their presence. It was also telling that there was a certain arbitrariness to the selection of *specific* plastic items in several senses: the children themselves told us they were not always sure which plastics to photograph, or why (despite them understanding the task well); upon viewing the photographs together during the interviews, we were confronted with an array of plastic 'stuff', making it hard to know how to focus on any one item; and, in the telling of different stories about that stuff (Phillip, the forgetting of shopping bags; Hadassah, discussing her routines during Ramadan, but quite noticeably *not* referencing plastics; Basirat, with a wry smile, recalling his mother's penchant for collecting clothes hangers). We were particularly interested, then, in how children negotiated these kinds of contradictions that surround the ubiquity of plastics as a hyperobject (Morton, 2013). Moreover, our interest here is not so much in plastic's impossibly tiny-yet-enormous presence on earth and its concurrent slipperiness in our phenomenological frames (Kraftl, 2020). Rather, it is in the ways in which children *grappled* with how plastics are so routinely present in our lives yet so routinely absent from our notice, disrupting the normative frames we might have for articulating or explaining our material worlds (Molloy Murphy, 2020).

The contradictoriness of plastics was further compounded by the ways in which children narrated more intentional or noteworthy encounters. Most talked about intricate, family-specific routines that they had developed to separate rubbish: the practicalities of separating plastics from other rubbish; the allocation of tasks to different family members; and so on. Throughout all of this, however, children questioned whether they were, in the course of their lives, actually *using* or *consuming* plastics. In light of the previous section about popular cultures, this was a striking observation:

> Basirat: Okay, it depends though...do I use the plastic wrapper or do I use the kitchen roll?
>
> Emma: Like, it depends - do I see these everyday, do I touch them everyday or do I use them everyday? Cuz some of them you can't necessarily use, like you can't use all these, can't use this (pointing on images she took in the school including plastic door number, plastic door frame), can't use that but I see them and sometimes touch them or I bump into them or trip over them or they fall on me out of a cupboard.

> Leonard: (Talking about an image of an empty smoothie bottle with the label removed) I sometimes take it [the wrapper] off but I don't think my parents do, like sometimes I'll take it off when I'm drinking it [smiles] I don't know why, I just don't like the feel of it on my hands, like it's all like rubbing, like I would rather it just is the normal bottle.

Basirat and Emma's questions open out several perhaps often hidden debates about what the 'use' of plastics actually entails. Moreover, their questions encapsulate part of the problem of plastics and materials like them – how they envelope, constitute part of, or are otherwise inextricably implicated with other material objects that we *actually* use in a more obvious, intentional sense. Meanwhile, Leonard's discussion of a plastic smoothie bottle similarly questions notions of 'consumption' as he speaks of the almost sensuous caress of his hands on the bottle. Or, perhaps the bottle is caressing *his* hands? As with Emma's description of 'bumping' into plastics or them falling on her, it is hard to make sense of the agency and affordances involved in the phrase 'it's all like rubbing', as material stuff as banal as plastics take on a certain animacy or vibrancy (Bennett, 2010; Chen, 2011; Kyttä, et al., 2018). Perhaps his is a common experience; perhaps many of us stroke (or are stroked) by plastic bottles; but likely few of us verbalise this (Leonard told us he hadn't ever done so previously).

Plastic bottles also played a starring role in one of the earlier school workshops. During the workshop, we wanted the group to question the properties of different types of plastics by physically interacting with them.

> We moved onto an activity where students were given a minute try to break up a plastic water bottle; we would see if it would still retain water at the end of that time. Bottles were twisted, crushed between hands, stomped on, put underneath table legs and (allegedly) stabbed with pens and scissors. The students then queued up to pour water in and see what happened. Most retained the water despite their mangled shapes, with only those who had 'broken the rules' seeing water pouring out. Whilst they enjoyed the challenge the students didn't seem particularly surprised by the results.

Compared with the reflective, discursive nature of previous workshops, this one was far more energetic. Children's attempts to break the bottles were replete with shouting, laughter, sneaky attempts to subvert our instructions, and overt displays of masculinity as the older boys tried to demonstrate their physical prowess (with little success). Clearly, this was staged as a pedagogic encounter; yet, the children did not really *learn* much, if anything. Yet we – with the children and the bottles themselves – also staged perhaps uncanny encounters where the usually overlooked, unspoken materialities and affordances of plastic bottles came to matter, just for a few minutes. With the above interactions in mind we turn, in the final part of our analysis, to questions of 'fun', storying and how else we might inhabit worlds of which plastics are an unavoidable part.

'Fun', speculation and 'other' ways of living with plastics

> Plastic flowers were an interesting discussion point whilst making the sculptures – both because they were 'useless' in practice, but also had high symbolic value as they represented

> love and, poignantly, were placed on graves where people couldn't visit regularly enough to place real flowers. After some discussion, the plastic flowers were therefore placed at the top of the sculpture representing the 'value' of plastics.
>
> In the exercise where the team had to pick items without any further instructions, the boys first seemed to go for objects which they recognised and were amusing to them (e.g. 'ah yeah we've got to have the body wash, can't go without the body wash'). They then seemed drawn to the more colourful plastics (the elephant watering can, the fluorescent cup, the clothes), whilst also making sure they had a variety of different forms, textures and shapes […]. The sculpture was named 'plastic Christmas' owing to its Christmas tree-like appearance.

As the previous sections highlighted, the mobile phone app activity and interviews highlighted diverse ways that children co-habited worlds filled with often banal and unremarkable plastics. In a slightly twisted sense, plastics represent a (strange, chemical) 'companion species' (Taylor and Pacini-Ketchabaw, 2018) whose presence often goes unnoticed and unspoken, except to deride it as a polluting 'problem' that must be addressed. Yet the interviews also highlighted how children – like many of us – live *with* plastics: as a form of hyper-object so entrained in our everyday lives that it can, in many ways, be unimaginable to think of life *without* plastics (Morton, 2013).

The final sculpture workshop afforded an opportunity to push this observation further: to continue to defamiliarise children with both the everydayness and perceived 'problem' of plastics. Indeed, the process of sculpting was – if only momentarily – one during which children re-valued plastics, imagining new and other ways of relating to them. They engaged in moments of play, experimentation, humour and irony. Akin to a process of 'speculative fabulation', children engaged in acts that were 'seriously playful and so curious, inquisitive and risky' (Haraway, 2011: 6). In the first extract above, the group explored the possible value of plastic flowers, rather poignantly deciding that they could hold particular emotional value. In the second, the boys staged a number of playful, even silly encounters with plastics yet entered into a different relationship with them, judging their immediate aesthetic properties in creating a sculpture resembling a Christmas tree. Perhaps these encounters were, ultimately meaning-less; we have no way of knowing whether the boys' amusement at their choices of objects had any lasting impact on their attitudes to or practices around plastics. Moreover, they did not necessarily promulgate the kinds of intimate, critical or responsible relations with land that Haraway (2011) argues may emerge from forms of speculative fabulation. However, they did – even if in the moment of sculpting – promote other ways of being-with plastics that were enjoyable, fun and imaginative.

The above encounters with plastics do not provide anything approaching a 'model' for how we might live otherwise or better with plastics as a queer kind of toxic kin. But neither were they totally pointless or value-less. Rather, they represented what Taylor (2020: 344) terms a "[h]eading off leftfield with minor players". Taylor does not mean this pejoratively; rather, in contrast with the grand, human-centric, masculinist and universalising discourses of the Anthropocene (and of adult Western knowledge about the environment, which is then translated to children), children themselves may engage in

experimental, speculative acts with material worlds. Hence, although acts of sculpting may not suffice to construct more socially- or environmentally-just futures, they offer an important point of articulation for the *multiple* ways in which humans do (and could) relate with plastics. In a rather different way from the interviews, they enable the diagramming or listing of plastic objects such that their unremarkable ubiquity in (English children's) everyday lives is, if only briefly, thrown into sharp relief (Bogost, 2012).

Conclusions

This article has sought to open out a range of ways in which children's encounters with plastics might be articulated. Its key contribution is to complement but extend beyond scholarship about children's environmental (and specifically plastic) education by emphasising the manifold, diverse, banal, complex, contested and often critical ways in which children interact with plastics during their everyday lives (Berry et al., 2020; Molloy Murphy, 2020). It has added to a rapidly-growing body of work that has deployed new materialist and posthumanist approaches to examine children's entanglements with/in material, more-than-human worlds, but with a focus on those socio-materialities that – like plastics – are hard to identify as discrete 'objects' (Horton and Kraftl, 2018). It has also illustrated the value of a range of methods that draw both on fairly traditional, child-centred techniques (like interviews), and a combination of more experimental methods (like apps and a sculpting workshop) to stage encounters with plastics that may be emotive, haptic and embodied.

As such, the paper has developed a series of conceptual-methodological-empirical thematics that may offer starting points for future research about children's encounters with plastics (and other similar kinds of material stuff/processes). Firstly, it explored the range of ways in which children's *knowledges* about plastics were embedded within a range of contexts that extended beyond explicitly 'educational' experiences (whether formal or informal). Specifically, they foregrounded aspects of (children's) consumer cultures in which plastics were entangled, which are often 'hidden' from the view of adults (Horton, 2010), and which were often complex, contested (if not contradictory) and critical. Extending the ways in which children themselves made connections with global political, economic and cultural processes, often in highly critical and satirical ways, further work might build on analyses by Liboiron (2016), Huang (2017) and others to co-construct with children and young people a critical sense of how their encounters with plastics are entangled with/in other (neo)colonial, capitalist forces in ways that have only remained implicit in this paper. Secondly, and consequently, the paper demonstrated how plastics are entrained in banal, routine aspects of everyday life that seem so mundane that there is (sometimes literally) nothing to say. Yet by pushing a little harder, and using a range of techniques to articulate *everyday lives of/with plastics*, it became possible to articulate how children's everyday encounters with plastics might matter – from questioning what is actually used when plastic packaging envelops another item, to the ambiguous affordances and agency of plastics as they present themselves for (non-)use. Finally, the paper examined how moments of 'fun' and speculation may be equally powerful in illuminating and defamiliarising our (and especially children's) habituated,

apparently unremarkable encounters with plastics. Taken together, these thematics may prompt further reflections about the ways that humans may live (otherwise) with plastics as they stick with us for many generations to come.

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Notes

1. https://en.unesco.org/courier/2021-1/latin-america-declares-war-plastic, last accessed 22nd October 2021
2. https://www.nytimes.com/2019/07/27/world/africa/recycled-plastic-school-building-conceptos-plasticos.html, last accessed 22nd October 2021
3. See, for instance: https://www.wwf.org.uk/get-involved/schools/oceans-and-plastics and https://www.kidsagainstplastic.co.uk/learn, both last accessed 22nd October 2021

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