Environmental movements in a material world. A relational perspective on single-use plastic in Penzance, UK

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In the discursive battle about the big and important ideas, some topics are considered more important than others and more likely to mobilize society. More recently, marine plastic pollution has become a key topic for environmental movements. In this study, we aimed to contribute to a more detailed understanding of how specific issues of sustainability are brought forth. Conceptually, we argue that recourse to relational theories from science and technology studies might help to strengthen the conceptualization of social movement research. By drawing on the concept of "boundary objects", we extend the range of social movement approaches in order to better understand how the process of framing is put to work materially. The focus on boundary objects can therefore explain the selective formation of environmental discourses and policies when applied to the field of environmental protection and sustainability.

KEYWORDS

environmental movements, boundary objects, materiality, sustainability policies, professionalization, plastics, UK

1. Introduction

Environmental movements have always played a crucial role in bringing sustainability issues to the fore in political arenas (Miller, 2000). Policies in the realm of climate change, sustainability, or environmental protection would not have gained such popularity, without the constant pressure of the subaltern against hegemonic positions (see Uekötter, 2014). Through protests and manifestations, actions and events, movements constantly exert political pressure on local and supra-local governments and fossil regimes. Environmental movements have significantly contributed to the emergence of urban policies (Mössner, 2016; Rosol et al., 2017) that help us to transform toward greener economies, more sustainable consumption patterns, and decarbonized mobilities.

While environmental movements usually address climate change and sustainability in a broader sense, there are specific and sometimes very concrete issues and topics that are more prominently discussed than others. In the discursive battle about the big and important ideas of sustainability (Campbell, 1996), some fields and arenas are considered more important than others, or simply better and more effective in mobilizing parts of society: acid rain in Germany, the ozone hole, the melting of pole ice, and plastic pollution in our oceans. Given the importance of environmental movements for the global sustainability transformation, this raises important questions about how pressure on (local) governments is discursively framed and strategically focused on a few but powerful materialities.

In light of the scientific background of these topics, one might think that each of these issues has developed against a background of rational argumentations and concrete

situations of environmental crisis. Thus today, plastic pollution is seen as a severe environmental problem (see Smith and Vignieri, 2021 in a Science special issue on "Our plastics dilemma")—alongside, for instance, the climate crisis and loss of biodiversity, with which it is also strongly interwoven (Royer et al., 2018; MacLeod et al., 2021) since plastic production and pollution are equally rooted in the exploitation of fossil resources. While some environmental issues are addressed more prominently, others are rather neglected, inviting political oppositions to criticize environmental movements and their interventions as selective and decontextualized.

In this study, we cast a closer look at this question at the urban level where urgent global problems materialize (see Béal, 2012). To do so, we dig into the complex relationships and processes that emerged in the coastal city of Penzance/UK. This relatively small municipality has evolved as a flagship town of the "Plastic Free Communities" scheme, which was launched in 2017 by the British environmental NGO Surfers against Sewage. Since then, several hundred towns across the UK have joined their efforts of regular beach cleans, beach screenings (or park and street cleans when located upcountry), and other high-visibility projects. This NGO successfully brings environmental concerns to the urban political agenda and by doing so increases pressure on political decision-makers to regulate against single-use plastic in supra-regional/national legislation: "Let's Free Where We Live from Single-Use" (SAS, 2018).

In this study, we aimed to contribute to a more detailed understanding of how specific issues of sustainability are brought forth. The question of how social and environmental movements can successfully mobilize resources for political action is rather an old one and originates from early studies in social movement research. Conceptually, we argue that a recourse to relational theories from science and technology studies might help to strengthen the conceptualization of social movement research. By drawing on the concept of "boundary objects", that "may be abstract or concrete" (Star and Griesemer, 1989, p. 393), we extend the range of social movement approaches in order to better understand how the process of framing is put into work materially. Boundary objects "are both plastic enough to adapt to local needs (…), yet robust enough to maintain a common identity across sites" (ibid.). The focus on boundary objects can therefore explain the selective formation of environmental discourses and policies when applied to the field of environmental protection and sustainability.

The following section brings together perspectives from social and environmental movement research and new materialism as well as STS. Section 3 then unfolds the relevance of single-use plastic and its material characteristics, followed by Section 4, which illustrates the research methods and their contexts. In Section 5, we present the city of Penzance and the empirical findings. The study closes with a discussion of the findings and an outlook.

2. Approaching social mobilization against single-use plastic

Single-use plastic has become an important issue for many environmental groups around the world. In numerous places, ordinary people have initiated group action and provided information about the ecological and human health-related risks of single-use plastics. Today's environmental activism has changed significantly from its predecessors that shaped politics around the 1980s (see Johnston et al., 1994; Bosse, 2019): protests are more flexible, mobilization and communication are digitalized and include the use of social media, and heterogenous groups are unified under the identity-shaping fight against climate change (Bosse, 2019).

Social and environmental movement research draws on a long tradition of investigating movements, collective action, and interest groups (Pickerill, 2003, p. 16) as elusive social entities (Roose and Rucht, 2002) that engage and exert power in contested environments (Tarrow, 2010). The history of social movements goes back to the early forms of social engagement that shaped modern industrial societies (Melucci, 1980, 1988). Fighting for the political rights of the working class, among other things, these older movements were usually strongly ideologically grounded and focused on the economic system (Melucci, 1980). With the change in social norms and values in post-industrial societies, "new" social movements occurred as grassroots that contested mainstream public politics in ecological, societal, and political arenas. Consequently, a broad and diverse literature about new social movements emerged that addressed and investigated the plurality of forms, actors, and actions that have accompanied their protests. The question of how and why social movements mobilize around a certain topic became central to social movement research, and the literature has provided a multitude of different perspectives and theories to explain the mobilization of movements under certain circumstances (see Chesters and Welsh, 2011). A significant part of this research has investigated the institutionalization of movements and the relationship between formal politics and different and heterogenous forms of protests (Pickerill, 2003). With their roots in rational choice and game theory, most of these approaches and perspectives understand protests and conflicts in the production of common goods as resulting from rational and collective choice (Kunz, 2008, p. 469ff). In consequence, collective action is often explained by referring to external influences, common interests, and perspectives among the movement, material resources for their mobilization, and factors of internal organization that determine their effectiveness to infiltrate or influence political contexts (Herkenrath, 2011). Central to this branch of research is (among other things) the question of when and how social movements successfully influence politics. In order to address this question, a significant part of this research has investigated the institutionalization of movements and the relationship between formal politics and protests (Pickerill, 2003). In the past, two theoretical approaches have been developed: the "logics of collective action" (Pickerill, 2003; Chesters and Welsh, 2011) and "resource mobilization theory" (McCarthy and Zald, 1977) have proved particularly popular and have long dominated social movement research. Today, both approaches are considered to be of limited use for grasping recent protests and the actions of environmental movements in our times. We argue that these are still helpful approaches to understanding the mechanisms of social movements, yet not fully sufficient to explain the emergence of single-use plastic as the new focus of environmental protest.

In the aftermath of the 1968 protests, alternative approaches emerged in social movement research and beyond, benefitting

from ideas and concepts developed in political philosophy and the social sciences. Post-structural perspectives challenged the mono-dimensional explanations of collective action frameworks and resource mobilization theory. Authors such as Melucci (1980, 1985), Touraine (1983), or Laclau and Mouffe (1985)—although not all of these authors are considered post-structuralists in a narrower sense—directed the analytical perspective in social movement research toward the political negotiation along societal categories such as gender, sexualities, race or, in our case, the construction of a "natural environment" (Herkenrath, 2011, p. 65f; see also Buechler, 1995) that is particularly threatened by single-use plastic. These scholars no longer sought or focused on the solution to conflicts and protests, as former approaches and perspectives had done. Instead, conflicts and protests by social movements were understood as a societal process that reflects the "political" and the constitution of society itself (Leibenath and Otto, 2012). Following this direction, social movements are now defined as networks of groups and organizations that produce a collective identity and pursue substantial social transformation and change by means of public protests (Rucht and Teune, 2017, p. 11). Environmental protest is no longer perceived as "disturbing" tumults and riots (Rucht and Teune, 2017, p. 10ff), but rather as an established and legitimated form of civil disobedience (Willems, 2014) that has an important role in representative democracies. This change in public perception is largely driven by new forms of protest that are able to attract larger parts of the middle class (Novy and Peters, 2012) to participate in (these peaceful) protests. New approaches in social movement research include a new perspective that rejects the notion that protests are a result of rational choice and accepts instead the larger societal complexity of organizational processes, internal structuration, and political contexts (Herkenrath, 2011). They argue that conflicts have increased in complexity, including different spatial scales and constructions of (counter-) hegemonic interpretations of reality. They explain societal consensus by referring to the exclusion of opposing voices in society and the de-politicization of political questions. The strong focus on the discursive production of societal positions, power, and political context, however, tends to ignore the materiality of things that still—as we argue—plays an important role, as the example of single-use plastic shows.

The aim of this study is neither to conceptually criticize approaches and perspectives that have been developed in social movement research over a timespan of more than six decades nor to provide an extensive overview of the plethora of approaches that has been produced in this time. We argue with Vey et al. (2019) that social movement research benefits from post-structuralist understandings of societies that focus on the disjuncture relationships between societies and subjects (Vey et al., 2019, p. 9). The fact that single-use plastic has brought together politicians, civil society, and protest movements in a relatively short time while attracting enormous media attention makes it—this is our premise—particularly interesting for social movement research. Our main concern with traditional approaches to social movements is their inability to recognize the materiality of single-use plastic and to respond to the question of why the issue of single-use plastic prevails over other matters of concern (Latour,

2004). We contend that agency or discourse-related approaches alone cannot explain this prevalence sufficiently.

While the aforementioned perspectives share—in a broad sense—Weber's view of objects as mere tools for social actions performed by (human) subjects [Weber (1972) (1921), p. 1], or conceive objects as semiotic effects, respectively, perspectives developed within science and technology studies (STSs) and new materialism represent promising conceptual extensions. By also granting things and materiality an active role, they contribute to a more nuanced understanding of the formation of social movements in the context of complex environmental problems such as plastic pollution. In a general sense, this basic understanding of things/objects goes back to the classic works of Bruno Latour, Steve Woolgar, John Law, and Michel Callon, widely referred to as actor-network theory (ANT) or material semiotics (Callon, 1986; Latour and Woolgar, 1986; Law, 1992). The latter term is less common, but it is important to mention here because it indicates that ANT is not primarily about assuming that things are able to act sovereignly. Rather it highlights the ideas that firstly social sense emerges not only in the relations between rational beings but in the relations between humans, non-humans, and things as well; and, second, objects/things play a crucial role in processes of knowledge making. This general understanding has also influenced the conceptualization of social movements, which, as Hess et al. (2008) have shown, was extended by the perspectives of STS, in that they bring "a sophisticated understanding of how the knowledge making process works in science and how the politics of expertise and technology design play out in diverse political arenas" (ibid., 473).

By drawing on the work of STS scholars Susan Star and James Griesemer and their concept of boundary objects (Star and Griesemer, 1989; Star, 2010), we want to extend our perspective by highlighting the constitutive nature of objects—here: single-use plastic—in the assembly of social movements. Originally, Star and Griesemer developed the concept of boundary objects to explain cooperation in the field of scientific work. Based on the understanding of scientific work as a heterogenous and complex task, they asked how it became possible that varied actors with varied backgrounds and knowledge could work together smoothly on the relatively complex task of setting up, e.g., the Museum of Vertebrate Zoology at the University of California-Berkeley (Star and Griesemer, 1989). They argued that it is boundary objects (concrete and abstract objects, i.e., specimens and standards), which allow these actors to work together without explicit translations, as these objects are part of each of the social worlds the divergent actors inhabit (ibid., 409). In other words, the boundary object acts as a translation machine in complex settings.

For environmental movements, the pollution of the oceans by plastic is a complex and uncomfortable topic: It challenges our consumption patterns, spatialities, responsibilities, and imaginations and confronts us with the uncomfortable truth of our technical incapacities and global helplessness. Preventing plastic from flowing into rivers and oceans would significantly impact our daily lives. The topic of plastic is rather difficult for environmental movements to address. The opposite is the case when it comes to single-use plastic, which has emerged as a successful topic. This success is linked to its potential to mobilize and gather actors from

different fields, thus reducing its complexity. It enables cooperation because it translates from a complex chemical and societal process to a concrete object of environmental activism. As illustrated above, single-use plastic renders specifically tailored explanations of plastic pollution redundant. On the one hand, single-use plastic can be connected to the plastic pollution problem in many different ways, on the other hand, and at the same time, it relates to the very different affordances and "Lebenswelten" of the stakeholders in plastic policies—consumers can refuse single-use plastic, local businesses can substitute it, communities/local governments can restrict its use and procure less themselves, environmental movements can organize and communicate via single-use plastic events/actions, and scientists can collect larger amounts of data in the context of citizen science projects. In this sense, we understand single-use plastic as a boundary object.

Plastic pollution in our time is best understood as a complex and multi-dimensional problem that operates on different spatial scales. Microplastic in seawater near the shoreline behaves completely differently compared to littered crisp packets on a beach—though they both consist of the same material. "[S]hopping bags or straws are not the same as the marine plastic pollution problem, even if bags and straws are made of plastics, are disposable, and are found in the ocean" (Liboiron and Lepawsky, 2022, p. 45). This raises important empirical questions when applied to the context of plastic-free communities, where single-use is seen as a major cause of marine plastic pollution.

3. The multiplicity of plastic pollution or: what is the problem about the plastic problem?

Plastic pollution, particularly ocean plastic pollution, is regarded as one of the major environmental issues of our time and is therefore most often taken as a starting point for many (individual, state, or non-governmental) initiatives combating it. Reports of garbage patches and plastic currents out in the oceans, pictures of littered beaches, floating plastic bottles, fishing nets, and even animals entangled with plastic fragments or whose stomachs are filled with plastic waste are well known. Represented in this way, the issue at stake seems relatively clear and self-evident. Although the devastating effects of plastic on the environment should not be downplayed, the problem is not quite as clear as it seems, as revealed by a brief outline of the central findings on ocean waste.

Although the first observations on plastics in marine environments go back to the early 1970s (e.g. Carpenter and Smith, 1972), the issue of marine plastic gained major recognition in and beyond academia from the 1990s (De Wolff, 2017; Bergmann, 2019). Media representations remained oriented toward the above-mentioned narratives, but ongoing research led to a more and more differentiated and refined perspective on plastics in the seas (e.g., Thompson et al., 2004; Zettler et al., 2013; Lim, 2021).

One of the most significant outcomes of the growing field of marine plastic research was the discovery of microplastics. Only coined in the 2000s (among others by, e.g., Thompson et al., 2004), the term, and the phenomenon it refers to, has had a remarkable career in scientific discussion and later on also in public debates. This, in turn, has challenged the view of plastic pollution dramatically. Without digging too deep into the matter of microplastics, a brief overview may summarize some key factors. Microplastics are fragments of synthetic polymers smaller than 5 mm, which is composed of primary and secondary microplastics; primary microplastics are, e.g., microbeads in cosmetics or microfibers from clothes, while secondary microplastics result from the breaking down of larger plastic items (bottles and fishing nets) through physical and/or chemical processes. However, these tiny fragments not only have consequences in terms of scale but also have implications that reach far beyond questions of size. For one thing, microplastics are extremely mobile, which makes them nearly ubiquitous—they can move literally everywhere and are therefore found in the remotest parts of the world. Making up more than 90 % (in terms of the number of items) of all the plastics in the seas, the problem of ocean plastics is a problem of "plastic-smog" (Eriksen et al., 2019) rather than of giant garbage patches.

Consequently, it would technically be nearly impossible to remove plastic particles. Beyond this problem of size and physical dissipation, the main issue raised here is one of the classifications—which in turn plays out in two respects. On the one hand, classification may be limited as a matter of identification. While distinguishing a plastic bag from a starfish seems rather trivial, distinctions become more difficult as the observed material becomes smaller. Research shows that with the naked eye, even mesoplastic (> 5 mm) is sometimes hard to identify and can be easily confused with mineral material. In the realm of microplastics or nanoplastics, accurate classification is only possible in a laboratory with adequate equipment. On the other hand, classification is limited "by nature" through the categories and categorizations on which it depends. When the boundaries are blurred, even the best equipment must fail. This happens regularly, as plastic fragments are entangled with living organisms and associated with other pollutants. Zettler et al. (2013) have coined the term "plastisphere" in order to characterize plastic particles not only as pollutants or alien matter in the environment but also as a habitat for microorganisms such as bacteria that settle on the surface. In terms of remediation strategies, this would mean that even if the plastics were removed, parts of the biosphere would also be removed.

This state of entanglement and the ability of plastics to interact with their environment in often uncertain and indetermined ways eventually make it impossible to identify a clear-cut problem that is bound to the sheer material properties of polymers. Or, in other words, the plastic problem is actually many plastic problems.

4. Researching the materialities of single-use plastic

4.1. Methodology

New materialism has emerged as a strongly interdisciplinary field involving "a plethora of contemporary scholars from heterogeneous backgrounds of research" (Dolphijn and van der Tuin, 2012). Since the approach adopted fundamentally affects the ways of doing research, we will give a rough

outline of the new materialism perspective, particularly comparing it with a historical materialism approach and differentiating between them, before moving on to discuss methodological consequences.

In the context of the "old"/historical materialism, the materialist perspective emphasizes that it is the sphere of production and exchange relations, namely: the economic basis, which Marx refers to as "Sein", that determines the social order and people's thinking ("Bewusstsein"), not vice versa. Since in historical materialism things or the environment are conceived of as matter that is altered by (human) labor and thereby affects social relations retroactively, a mere economic determinism cannot be assumed. However, basically the perspective remains humanist/anthropocentric in that matter itself is still seen as external to the social world, in some way "dead matter" awaiting vital human treatment. Regarding the plastic problem, this perspective could explain why plastic, despite its harmfulness, continues to be produced in increasing quantities and ends up in the environment—due to the profit-oriented exploitation of fossil resources by the growth-oriented economies which can currently afford it. More broadly stated, this perspective perfectly explains why besides strategies of "radical techno-managerial restructuring, (…) nothing really has to change" (Swyngedouw, 2019, p. 254). Though a powerful and very helpful approach, this macro-level perspective cannot adequately explain why a certain type of plastic (single-use plastics) has emerged as an intervention target on local beaches.

Here we argue that new materialism offers more useful tools to think about and conduct studies with. Generally, new materialism—as opposed to historical materialism—is characterized by the fact that human beings are decentered and lose their exceptional position. Basically, things are regarded as belonging to the social world. Certainly, there are various strands within the new materialisms, an elaborate treatment of which is not possible here (see, for an extensive discussion, Coole and Frost, 2010). Yet what is important in this context are the ways in which the efficacy of things is interpreted. There are significant differences here, depending on two major currents within the new materialisms. While we do not share vitalist perspectives as paradigmatically represented by notions of "thing power" or "vibrant matter" (Bennett, 2010), whereby things are assumed to have an independent logic of their own, we follow the basic assumption of material semiotics in the wake of actor-network theory and ultimately also (Star and Griesemer, 1989; Law, 2008), whereby the agency of things is interpreted relationally. Things in this way are not to be understood as things with the power to "make do" but rather with the power to enable certain actions. This is also consistent and fitting with regard to methodology: a vitalist perspective would pose the methodological problem that the doing of things cannot be directly grasped, whereas the interactions between things and people as well as the interactions/relations between people made possible by things leave at least traces in verbal expressions and can indeed be directly followed and experienced in the observation of practices.

4.2. Methods

Consequently, the methods used to access the empirical field and to research the relationalities of things are variegated and heterogenous. Adopting first and foremost an ontological perspective, new materialism largely draws on qualitative research methods that have a long-standing tradition in social sciences. More important than the choice of methods themselves, however, is the particular perspective that comes with this theoretical stream and challenges empirical fieldwork. New materialism is about the relationalities and flows of materialities and, consequently, single-use plastic is not considered a dead object. Instead, the empirical approach taken to investigate single-use plastic along the shore of Penzance and during its interactions with environmental movements was grounded in following the single-use plastic on its way to play a vital role in the local community, where it has set up new relations between different stakeholders.

The coastal city of Penzance/UK is paradigmatic for researching single-use plastic. Penzance was the first town in the UK to obtain the status of a plastic-free community. As such, it has a role model character and through its wide media coverage has significant outreach on the topic of local anti-plastic initiatives. In addition, Penzance and Cornwall more generally have a longstanding tradition of marine-related environmentalism (Wheaton, 2007, 2008), which makes it an ideal laboratory for the observation of particular environmental movements. Our study draws on empirical research carried out in autumn 2019 and autumn 2021 in a coastal city in southwest England, before and during the latest pandemic. During two research stays in England, participatory observation and interviews with stakeholders of the city's plastic governance were conducted. The active participation in two beach cleans turned out to be particularly relevant, since not only direct contact to single-use plastic was established but also contact to local environmentalists. The participant observations were documented by means of snapshot-like observation and thought protocols, which were subsequently formulated as continuous text. Subjective interpretations of the researcher are thus already included in the data during the documentation process, a fact that is consciously accepted here in accordance with autoethnographic methods. Moreover, subjectivity and biasedness are not seen as methodological weaknesses, but as consistently reflecting the entanglement of the researcher and the object of research (Ghita, 2019, p. 9; Fox and Alldred, 2015). Furthermore, walking interviews (Finlay and Bowman, 2017), in which the single-use plastic and its collectors were accompanied, served as a special form of qualitative interview. Such "go-alongs", originated from ethnography as a particular access to understanding (Middleton, 2011) and fit very well with the methodological requirements of new materialism. In addition to these mobile forms of researching along the flow of single-use plastic, six more qualitative interviews were conducted with eight persons (three male and five female persons in their 40s to 60s) who were involved in the local setting up of plastic-free Penzance. Instead of exact biographical data, more emphasis was placed on the current phase of life and professional background: two of the interviewees were directly involved in

ocean-related environmental movements, Paula[1] as a "local rep" (representative, the authors) for a UK-wide charity, organizing and running beach cleans, Rita in an umbrella organization of local and regional environmental organizations. Michael was at the time a councilor for the Green party in Penzance and the local administration representative of the plastic-free communities steering group; Emma and Dan were conducting ocean-related research (oceanography/biology) and at the same time providing tourist trips on a commercial basis in the Penzance bay area with their catamaran; Nina and Mick live in Penzance and provide plastic-free holiday apartments; and Tina runs a small business vending plastic-free cosmetics in downtown Penzance[2]. The least-mentioned interview with Tina was conducted in her shop during business hours, so recording was not possible, and the interview was documented by taking notes immediately afterward the interview; the other interviews were recorded and transcribed. They were then analyzed thematically, i.e., special attention was paid to latent meaning in the context of qualitative content analysis (Vaismoradi and Snelgrove, 2019; Baxter, 2020).

The COVID-19 pandemic greatly influenced the way, the time, and the place where empirical data were gathered. Participation in online meetings could only partly substitute for a presence in the field but helped maintain contact with members of the movement and allowed further empirical access to be developed.

5. Penzance: targeting single-use plastic in a plastic-free community

As described above, the relatively small municipality of Penzance is today renowned as a flagship town in the global fight against single-use plastic in the ocean. The city's popularity as the UK's first plastic-free city is linked to activism and interventions by the British environmental NGO *Surfers against Sewage* (SAS). With their roots in the surfer movement of the 1980s, when the privatization and neoliberalization of the "project Thatcherism" (Peck and Tickell, 2007, 26) seriously impacted water quality and maritime environments, the movement has a traditional link to the ocean, water, and environmental protection. The movement's activism against single-use plastic eventually promoted Penzance as a flagship city of the 2017 "Plastic Free Communities" scheme. To date, several hundred towns across the UK have joined their efforts and adopted the SAS plastic-free communities scheme of regular beach cleans, beach screenings (or park and street cleans when located upcountry), and other high-visibility projects and events.

The organization surfers against sewage were apparently paramount for bringing environmental concerns to the urban agenda. Though SAS is not in the foreground in terms of concrete actions, they successfully orchestrate a range of diverse local actors with efforts being channeled and amplified through the plastic-free community scheme. When people involved in plastic-free Penzance were asked exactly what is meant by "plastic free" (since obviously,

whole-urban infrastructures would collapse without plastics in general) and what their problem with plastic is, a number of typical answers were given: it is not plastic in general, it is pointless single-use plastic; single-use plastic is a threat to the environment and to the ocean; the problem is that it is just used once and then immediately thrown away. These are comprehensible comments at first glance. Nevertheless, the answers are somewhat surprising, as a far more complicated plastic problem is caused by microplastic particles, most of which enter rivers and eventually oceans in the form of tire dust or paints and coatings (Gaylarde et al., 2021). While the latter hardly feature in public debates ("microplastic" in general is meanwhile acknowledged but the concrete sources remain vague), the focus on single-use plastic has generated enormous political success in a surprisingly short time.

The empirical research revealed that it is single-use plastic's materiality that offers unique access to the complex matters of ocean pollution. The plastic itself helps to translate the complexities into something that environmental movements, civil society, and politicians can deal with. Despite the complexity of the topic and the diversity of actors, plastic translates their perspective and helps them to work together in successful plastic governance with the aim of erasing single-use plastic from the beach. Single-use plastic is the "boundary object" (Star and Griesemer, 1989, p. 409) that acts as an object of care, allows access to the "plastic crisis", and enables environmentalist action, as shown in the following section.

5.1. Single-use plastic as an object of care

In Penzance, "beach cleans" were among the most important community-building and mobilizing practices in the context of plastic-free communities. So-called "mass unwraps" in front of supermarkets or other more unspecific litter picks in parks or streets are also part of notable anti-plastic events, although beach cleans seem to play a way more crucial role. This has to do with the grade of routinization in the day-to-day practices of the locals. The fieldwork in and around Penzance demonstrated that the practice of beach cleaning took very different shapes, from highly organized events to somehow unspectacular, nearly invisible "by the way" practices that are embedded in daily routines, e.g., walking the dog and picking up litter. Beach cleans are often carried out in larger groups of some 20 persons, but also by individuals in so-called "solo-cleans". Some of the cleans take hours, while others just take a few minutes. Some are planned for weeks, others may emerge spontaneously, just at the moment one person decides to pick up a piece of litter. The collection of single-use plastic perfectly adapts to individual and collective needs, in that it allows people to care for the environment. In this context, interviewees mentioned rather abstract motivations as well as specific goals. For example, Paula explained how she came to lead several beach cleans by referring to a general sense of caring about the environment and particularly to feelings of annoyance and anger when she encountered plastic litter in marine environments:

> So, I've always been kind of..I've always cared about the environment, growing up. And it was [incomprehensible] in my daily life and then I went to the Philippines (...) after the Tayfun Haiyan a few years ago [Nov. 2013, author]. And when

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1   Names of interviewees are aliases.

2   Since this study focuses primarily on the single-use related practices that emerge from beach cleaning, not all interviewees are featured in the findings sections (5.1–5.3).

I was out there, I saw all of the marine plastic, which is a really bad issue in the Philippines [...] it's a huge issue and I might never seen anything like it in my life and it really upset me, and then...and then it was like, "okay", I just registered and that's it; and then, when I came home to Cornwall, to Penzance, it was in the middle of the February storms that year and I saw exactly the same thing on my own home beaches and it's the first time I really noticed there is all of that plastic and pollution everywhere.. so, I organized a beach clean to try and clean up after the storms. And that's how it started really. (Interview Paula, 10/20/2019)

What is remarkable here is the description of the realization that plastic pollution is a ubiquitous problem, which was what finally led to the decision to do something about it. So, while the ultimate eye-opener was plastics on the "own home beaches", the motivation behind cleaning up, especially these beaches could be understood as an intervention directed toward the environment or the planet more generally. However, without using the term care in particular, another interviewee expressed strong notions of "caring for" concretely—Richard, for instance, highlighted that doing something for the environment (by picking up plastics) for him is an act of self-care, as well as a way to care, keeping harm, and suffering from a concrete creature:

Yeah, it is (..) like you have to be comfortable with yourself, that you are living your life in a moral way that fits with.. otherwise, that actually matters with your own mental health and so you have to feel like you are doing the right thing. I also..., things that motivate me to pick up plastic on beaches or...is thinking of an animal being there suffering and being entangled and I can stop that happening with that bit right now by picking it up. And so, so it is preventing injury to animals from it. (Interview Dan, 10/22/2021)

However, the case of care could also be turned upside down: participant observations during several beach cleans revealed how the task of (plastic) litter picking "nurtures" an altruistic sense of doing good but also contributes to gathering people in a fun atmosphere which provides possibilities of maintaining friendship and community:

During the beach cleans the sun comes through again and again, an overall beautiful autumn day, but in between also windy and rough. At the beginning not very many people showed up, together with the local rep, who leads the action, there are 13 people plus a dog. Most of them already know each other and chat about everyday things. There are also children playing with the dog from time to time, but then again very engaged in collecting litter. They also sort of compete with each other to see who can find the most pieces. The spirit among the others is also good, much laughter. I join different small groups, where we also talk about plastic waste – but it's almost never about fundamental issues, but about how and where to best recognize certain types of litter and remove them. The most complicated pieces are parts of old fishing nets that are reaching deep into the sand and are therefore difficult to remove. (...) (based on fieldnotes, beach clean at Marazion Beach (Marazion, near Penzance, 10/20/2019)

This aspect became even more crucial during the pandemic. Though at that time it was unfortunately impossible to collect original data, the following paragraph from a report in the *Guardian* is instructive in this regard:

Beach cleans became a vital way for her family to integrate after they relocated from Staffordshire to Cornwall six years ago. "You start seeing the same faces. And you find out other things going on. It's been a great way of finding a group of buddies and building a community," she says. During the long days of the pandemic, regular cleans were a lifeline for families like hers. Especially at Christmas, as Omicron torpedoed festive plans, beach cleans provided a welcome escape. "We had hot chocolate and mince pies afterwards. It was something to do to get out of the house that felt safe," Collis adds. (Adkins, 2022)

In this way, plastic items can also be understood as both caring *and* cared for at the same time.

5.2. Identifying single-use plastic

The wide range of possible cleaning practices makes beach cleaning a common and open exercise. This is reported by participants of beach cleans during several chats and also reflected by a template form for annual clean-up reports, which an environmental organization hands out to volunteers. This Excel sheet provides columns in which the beach clean organizer has to fill out the date, number of volunteers, duration, and the amount of removed rubbish (fieldnotes, attachment 4). Though in this context rather anecdotal, the above-mentioned newspaper article also suggests that beach cleans meanwhile seem to reflect a sort of common purpose among citizens in Cornwall:

Across Cornwall, community beach cleans have gathered momentum as a year-round activity appealing to all ages. Unlike surfing, dog-walking or cold-water swimming, beach cleans require little equipment or hardiness – just a common goal to keep treasured outdoor spaces litter-free. (Adkins, 2022)

They are tied to the object of single-use plastic in different ways and for different reasons. It may seem banal, but one of the most important characteristics of single-use plastic is that it is comparatively easy to identify. The shapes, colors, and feel of the packaging and disposable plastic are already so familiar from everyday life that participants in beach clean actions recognize them even without further prior knowledge; through their own experience and by reassuring each other, beach cleaners also recognize fragments, scraps, and/or partly weathered single-use plastic objects in a relatively short time and can distinguish them from mussel shells, for example. However, ideal trash—at least at the beach cleans I have attended—was scarce.

Before we start with the beach clean, the local rep gives us some hints: how to look for garbage and plastic; which beach section to search; and how to count the pieces afterwards (here it depends on the number of pieces and on the weight - the bags with the collected garbage are weighed with a kind of luggage scale at

the end). Packaging garbage is not explained further, but small plastic pieces are explained in more detail: nurdles can often be found between seaweed leaves, but they can often be mistaken for small stones or shell fragments. The local rep especially points out the need to use disposable gloves, because especially plastic that has been in the water for a long time can be contaminated with a biofilm and various pathogens. (. . .) From time to time the participants exchange information about the garbage fragments they find. While the bigger bits of rubbish, mostly linked to single-use, are classified tacitly, it is completely different with any pieces that are not linked to wrappers, lids, cutlery and so on: sometimes they are unsure what they have just picked up. I often feel the same way, too. Some rounded small pebbles could be nurdles or vice versa. In general, most of what we find today are weathered bits and pieces.

(based on fieldnotes, beach clean at Marazion Beach (Marazion, near Penzance, 10/20/2019)

On the one hand, this information is important to know before a Beach Clean so that such events are and remain accessible to and inclusive of local people. On the other hand, it becomes clear how important easy recognition during the litter pick is. During the beach cleans I participated in, the first thing that stood out was that the section of the beach looked clean and not particularly littered at first glance—which made the finding of single-use plastic paradoxically gratifying. Particularly for children and younger participants, the beach clean increasingly takes on the character of a plastic hunt, with the effect that easy access to plastic items contributed significantly to a good sense of achievement and staying motivated. This is not to say, however, that a lack of chocolate bar wrappers leads to a "failed" beach clean experience, but the local representatives who lead the beach clean have to explain in more detail where to search for plastic particles and what to keep in mind (at the tideline, entangled between scattered seaweed). This also hints at another aspect of the material implications of cleaning up.

5.3. Collecting/picking up single-use plastic

The materiality of single-use plastics not only plays a crucial role in terms of cognition and classifying but also is even more striking when it comes to the physical demands of cleaning up. So, larger items of single-use plastic, such as cups, cutlery, and straws, have an immediate impact when visible on a stretch of beach as they contribute to an overall negative appearance in terms of aesthetics. On the flip side, however, these items can be removed with (relatively) little effort. Equipped with trash picking tools—in part provided by beach clean organizers but also brought along by participants, picking up "ideal" plastic waste needs a certain level of fitness but is nevertheless an accessible task. What stands out during several beach cleans, however, is that most often the litter and waste are far away from being "ideal", but is contrarily "real" (Figure 1)—it looks like the sample that other participants and I collected on a beach clean at Porthmeor beach in St. Ives, close to Penzance on the northern coastline of the Cornish peninsula. There we found mostly broken down pieces of litter, weathered plastic fragments, and sometimes pieces of pebble-like pyroplastic
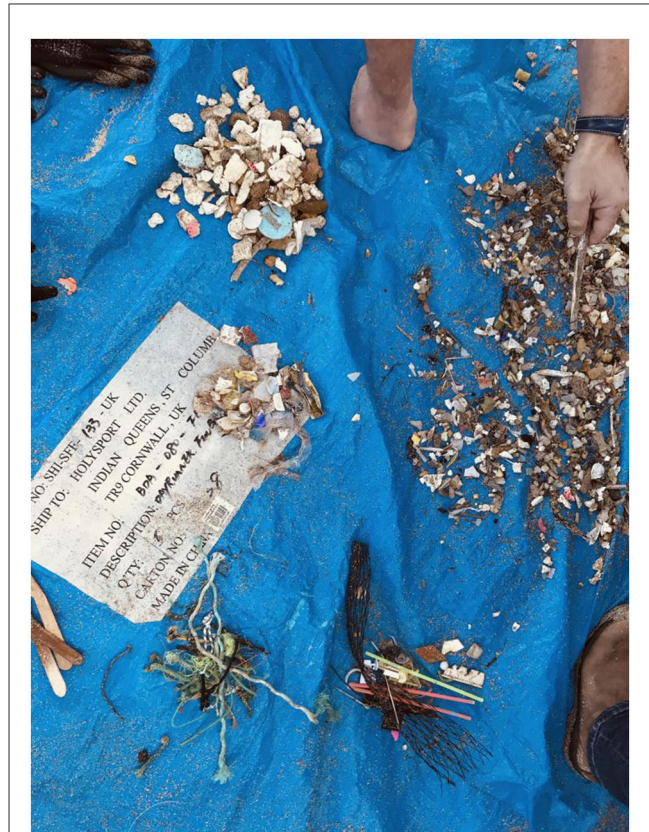

FIGURE 1
Porthmeor Beach: litter collected during beach clean (author's photograph).
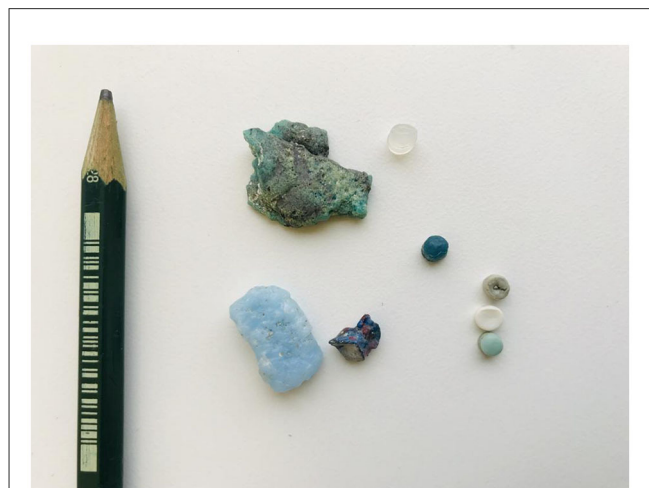

FIGURE 2
Fragments of pyroplastic on the left and pre-production pellets ("nurdles") on the right (author's photograph).

(Turner et al., 2019) or so-called "nurdles"—a commonly used term for pre-production plastic pellets (Figure 2).

Additionally, you can find remnants of fishing nets and ropes, of which bigger parts are often buried too deep in the sand, preventing them from being collected easily. Put in another way, collecting single-use plastic is a reasonably gratifying way of

cleaning up and caring for the environment, while "cleaning up" smaller particles and fragments of plastic—even in a strictly limited area—is quite a hard job, both in terms of detecting and collecting.

> *The weather once again Cornish, when the sun comes out it quickly gets (too) warm under the rain jacket, the next moment again rain showers with cold gusts. The best thing about the rain is that the sand is not whirled up and blown into the face and eyes, like the other day. Under these circumstances, picking up trash is no fun. Especially small fragments like "nurdles" or complicated pieces like the remains of fishing nets require a lot of effort – the constant bending down and getting up again is hardly noticeable at the beginning, but after two hours outside it becomes increasingly exhausting – the sturdy shoes on the mostly soft and yielding ground finish you off.*
>
> *(based on fieldnotes, beach clean at Porthmeor Beach (St. Ives), 10/23/2019)*

After joining several beach cleans, the one thing that stands out is that it is a thoroughly bodily experience.

6. Discussion: plastics as a matter of intervention

A constitutive moment of the environmental movement under consideration is the concern about plastic pollution in general, and particularly the threat to the oceans and the creatures at and in the sea. However, for many environmental movements, distant "plastic islands" or the complex threats of microplastics are too remote or intangible. What is needed, therefore, are concretizations or a framework to enable interventions at the local level. This applies even more to environmental protests, which are often rooted in new social movements that mobilize interests around a particular goal and in particular forms of protest (for "British environmentalism" see Doherty et al., 2000; Wheaton, 2008).

While we do not question the relevance of "Plastic Free Communities", we argued in this study that the selective focus on single-use plastic is not the result of a rational and political decision-making process. Instead, we have shown that it is the result of specific constellations of a range of stakeholders and socio-political relations that mobilize around single-use plastic and not around other equally important topics. Since involved actors—administration, NGOs, citizens, commercial actors, and scientists—are very heterogeneous in terms of their professional backgrounds, their political interests, and the different forms of knowledge, they need to develop a common "collective-action frame" (Martin, 2003, p. 733), which every actor can identify with and which helps build consensus.

Against this backdrop, single-use plastic provides a manner of re-scaling: single-use plastic items "work" because they relate to the global scale of plastic pollution as well as to the local scale of individuals or groups who want to tackle the plastic crisis. On the one hand, this highlights the risk of a "scalar mismatch" (Liboiron and Lepawsky, 2022, p. 40). On the other hand, however, it also becomes clear why this mismatch can hardly be avoided through theoretical debate, precisely because it facilitates the everyday practice of environmental movements.

Furthermore, single-use plastic not only functions in terms of scale but also as a matter of translation. As shown above, plastic pollution is a complex problem. Increasing research into plastic pollution and increasingly diversified public debates about plastic waste have exposed it as a multilayered problem. In this setting, single-use plastic can simplify the issue because everyone "understands" single-use: the example of beach cleans demonstrates the ability of the material to mediate between expert and ordinary worlds. In other words, there is no need to explain at length how to identify single-use plastic and there is no further need to explain that there is a connection between single-use plastic and marine litter. Single-use plastic acts as a boundary object and enables swift, uncomplicated communication across different groups of actors.

The function of single-use plastic is not limited to cognitive accessibility. It can be easily identified and classified, but above all, it facilitates people to physically participate in concrete action. It makes a difference whether larger plastic pieces can be picked up with a suitable tool or whether considerable technical effort is required to remove them from the environment—as far as this is possible at all. In this way, single-use plastic also reveals the fact that social movements in general, and environmental movements in particular, are dependent on the matter of their topic: single-use plastic sets relatively few physical boundaries and is therefore included in the context of everyday actions. It thus also exemplifies that environmental movements can only be understood as bodily and embodied practices.

Beyond the concrete politics and practices of single-use plastics, the case also highlights the relevance of materiality for the examination of social and/or environmental movements in a more specific way. As Hess and colleagues showed convincingly, there has already been extensive research carried out at the intersection of science, technology, and social movements, mapping out three main loci of change (2008, 475ff.). However, technology (and materiality) takes on a rather static, passive role when scientific research refers to reform movements in science, to the "adoption and reconfiguration of technology by social movements" (ibid., 476), or to technology and materiality as subjects of specific movements—as, e.g., in the anti-nuclear movement or anti-GM food movement. In contrast, the example of single-use plastic illustrates how materiality (and technology as well) forms and affects the very self-constitution of social movements, therefore taking on a dynamic active role.

This, in turn, has both conceptual and methodological implications. Theoretically, the case especially contributes to a relational understanding of material agency in that the empirical findings do not argue for an inherent agency of things, but illustrate the importance of understanding materiality always as a materiality *in-relation-to*, as it is formulated in actor-network theory (Law, 2008), in the new materialist notion of intra-action (Barad, 2007) and more recently in relational materialism (Boden et al., 2019). So, approaching the research subject from a (new) materialist perspective is not to wholly reject meaning, discourse, or interpretation, but to foreground the capacity of materials/things to co-constitute them. The methodological consequence of this is that meaning-oriented methods of classical, qualitative social research do not necessarily have to contradict conceptually materialist research, but still have their place. The art of doing fieldwork within

a materialist paradigm then requires the capacity of the researcher to differentiate between events and circumstances that allow for somehow thoughtful/reflected actions on the one hand and more effective actions on the other—and to respond with the respective methodological tools. Thus, tools that involve recording and transcribing interviews, for instance, are not to be seen as being in opposition to observing and producing autoethnographic vignettes, such approaches rather complement each other. This, of course, raises issues and criticism in terms of reliability, generalizability, and validity (Ellis et al., 2011), which have to be constantly reflected upon and taken into account; however, researchers "create" findings in a more classical qualitative research setting as well, when recording interviews and they indeed even do so in a quantitative, hard science setting if the design of questionnaires and samples are understood as the creative processes that they actually are.

With this in mind, we argue that despite its methodological challenges, a materialist examination will pay off as it contributes to a more nuanced understanding of the constitution of environmental movements and of how some environmental topics are highlighted at the expense of others. The subjects of certain movements differ in their capacity to relate to and link groups of diverging backgrounds to each other, in this way affecting environmental movements and policies in terms of matter and material properties. This raises further questions and a need for further research. In particular, environmental issues could be re-addressed that are less likely to make it into the media limelight and thus remain "invisible". If the perspective and the insights gained are taken seriously, boundary objects cannot be arbitrarily forced, created, and shaped, but they can be adapted, configured, and established in certain social contexts. Thus, here lies a potential for further applicable research: the question then is not where, how, and under what circumstances boundary objects emerge, but how they can be made to support movements.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

YI collected and interpreted the data. YI and SM contributed equally to the design of the paper and to the writing of the manuscript and have approved the manuscript before submission.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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