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RESEARCH ARTICLE

Exploring a process-relational approach to qualitative research methods for sustainability science

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Abstract

1. As sustainability scientists increasingly put forward the relevance of process-relational approaches to make sense of social-ecological phenomena, an inquiry on which methods would fit a process-relational approach is necessary.
2. This paper discusses how a process-relational approach can be applied to traditional qualitative research methods, namely interviews and coding and the tensions associated with it.
3. Process-relational perspectives share commonalities with interpretative approaches but also present specific characteristics, such as the importance of material aspects and the understanding of the phenomenon as a moment in which different elements become defined respective to each other.
4. The paper uses data and researchers' experiences from an action research project seeking to support collective action among coastal communities affected by environmental changes in Kenya and Mozambique.

KEYWORDS
action research, apparatus, coding, interviews, process-relational perspectives

1 | INTRODUCTION

Recent research in sustainability science has engaged with a broad set of process-relational (hereafter PR) approaches drawing inspiration from Philosophy, Anthropology or Education among others (Artmann, 2023; Darnhofer et al., 2016; Eyster et al., 2023; Kaaronen, 2018; Muraca, 2016). These approaches are diverse but share the view that relations are more important than entities to understand social-ecological phenomena (Hertz et al., 2020). The PR research in sustainability science has so far either proposed

conceptual analyses to describe the complexity and intertwinedness of coupled social-ecological dynamics (Mancilla García, Hertz, & Schlüter, 2020); or has used them to describe insights emerging from rich qualitative data, as researchers argue that PR approaches better convey the phenomenon under study than traditional categories of analysis (West et al., 2020). This emerging literature has called for an inquiry on the methods that would be appropriate—and inappropriate—for a PR analysis (Eyster et al., 2023; Fox & Alldred, 2020). This is a fundamental issue if we are to embrace a PR paradigm shift as some sustainability scientists call for (Preiser et al., 2018; Walsh et al., 2021). This paper provides a reflection on methods for sustainability science guided by a PR concept, the apparatus and drawing inspiration from the literature on qualitative methods.

Here we use the term 'process-relational' to convey the link between processes and relations. Within sustainability science some authors prefer to speak of 'process ontologies' (Hertz et al., 2020) while others use the terms 'relational' and 'relationality' (Eyster et al., 2023). As Hertz et al. explain, the two are linked ontologically, that is respective to their hypothesis on what exists: 'these ontologies see the world as composed of interdependent processes, constituted by their relations with many other processes' (2020, 329). These authors argue that such perspective is particularly useful to convey the intertwinedness of social (e.g. learning) and ecological (e.g. pest spread) processes in giving rise to social-ecological dynamics (such as pest management). However, as we will see through the paper, the word 'relational' could be equivocal since the literature on qualitative methods uses it to convey the importance of paying attention to interactions, such as between an interviewer and an interviewee (Holstein & Gubrium, 1995)—without implying a specifically PR ontological position.

The paper contributes to the discussion on what is gained from a PR perspective on methods for sustainability science (Eyster et al., 2023), dialoguing with the literature on qualitative methods, illustrating differences and similarities, but does not provide a systematic comparison between the PR approach and others. We argue that sustainability scientists can find new insights when using traditional qualitative methodologies—specifically interviews and coding—from a PR standpoint. Our argument is based on fieldwork and researchers' experiences within an action research project seeking to understand how environmental changes are perceived in coastal communities in Kenya and Mozambique and to support collective actions to face these changes and their consequences.

We start the paper with a presentation of the concept of apparatus, as understood by philosopher (Barad, 2003, 2007; Juelskjær & Schwennesen, 2012), which is central to our argument. The apparatus serves to grasp how phenomena are produced, including accounting for the inseparability of researchers from phenomena. Then, we provide the reader with the necessary information to understand how different researchers engaged with the PR approach within our project. The rest of the paper is divided into two main sections in which we (1) analyse the process of interviewing and (2) discuss the process of coding, for which we use researchers' narratives and examples of codes. The section on coding is divided into three subsections to facilitate reading. The first presents PR coding categories, the second discusses how to nurture a PR engagement with the coding process and the third disentangles the role of coders' emotions in a PR analysis. The conclusion recaps how PR perspectives relate to other qualitative methodological approaches, why and how they can support the work of sustainability scientists, and proposes other avenues for future work on PR methods.

2 | THE APPARATUS TO CAPTURE ENTANGLEMENTS

PR approaches confront the western modern organization of knowledge into well-contained fixed categories by arguing that these misrepresent the world (Artmann, 2023). This has been considered key for sustainability science as a discipline trying to bridge perspectives from the natural and social sciences (Mancilla García, Hertz, Schlüter, Preiser, et al., 2020). Since the paper does not aim at engaging in how PR concepts might be useful to conceptualize the links between society and nature, which others have done (Mancilla García, Hertz, & Schlüter, 2020), we choose to focus on and deeply engage with the concept of apparatus (Barad, 2003, 2007; Kleinman & Barad, 2012) that we use through the paper to investigate the implications a PR approach has for methods.

Apparatuses are an arrangement of discourses (here understood as ideas, concepts, such as, e.g. the idea of water quality) and matter (here understood as what has a physical existence, such as the laboratory tests to measure diverse components of such quality) that together produce something (here, e.g. a decision on whether water has sufficient quality to be drank). By 'producing something' we mean that an apparatus changes what exists in the world (so in our example, whether that particular water exists as drinking water or not). We speak of an arrangement of discourses and matter because the two dimensions are conceived as entangled and, in fact, only come to exist, that is to be distinguished from one another, by the very act of their encounter.

Barad uses the concept to explain how scientific experimental results are tied to a specific discursive-material organization, that is to an apparatus (2007). She explains that matter, which in a scientific experiment can be, for example a measuring instrument and discourses, such as scientific theories, are only meaningful in relation to each other. She aims at demonstrating that scientific devices are not simply capturing or discovering a reality that preexists an experiment but are part of the production of such reality.

This, as we will see, when applied to making sense of a methodology, helps us set focus on the entanglement of the researcher, the methodology and what is studied as part of the same apparatus and therefore as part of the same phenomenon. Through apparatuses, a certain part of the world—or phenomena—becomes distinct from the rest, from the undetermined flow of processes (Hertz & Garcia, 2021).

When using the concept of apparatus to reflect on PR methods for sustainability research, it is important to understand how we can build on qualitative methodological approaches which offer similar understandings and have inspired studies on the links between society and the environment before the so-called relational turn (West et al., 2020). It also helps distinguish the specificity of a PR perspective on research methods. The method of interviewing, being a dialogue of sorts, has called qualitative researchers' attention on the interactions between the interviewer and the interviewee. For example, Lee Ann Fujii, in her book *Interviewing in Social Science Research*: *A Relational Approach* defines relational interviewing as 'a method for generating data through interactions between researcher and interviewee' (Fujii, 2018, 2). This is opposed to a positivist understanding of interviewing, where the interviewee is the holder of data and the interviewer the person who simply 'collects' it. The definition Fuji offers is characteristic of interpretative research methods, which seek to understand the processes of experiential meaning making, including the role of the researcher. Holstein and Gubrium in their book *The Active Interview* argue that 'the knowledge the respondent calls on is always knowledge-in-the-making' (1995, 31), because as they claim elsewhere in the book, 'what passes for knowledge is itself a product of interaction' (1995, 3). The focus among interpretivist researchers is on knowledge production, while PR scholars are rather concerned with the changes produced in the world, including material dimensions, beyond knowledge production. Although interpretive approaches have been fruitful in sustainability science (Henwood, 2019; Heras & David Tàbara, 2014; Schultz et al., 2018; West, 2016), the focus on change and the attention to materiality that PR perspectives offer is, in our view, particularly appropriate for the study of interactions between society and nature. In fact, if serious attention is to be paid to what is produced at the intersection of social and natural processes, then it is necessary to go beyond human-attributed meanings, that is ideas and concepts, and find tools to include matter.

Therefore, from a PR perspective, research is not only about recognizing that the researcher has a role in the production of meaning and knowledge—which many qualitative approaches do—but rather that the production of phenomena is the result of a simultaneous entanglement between the researcher, the researched, the context, the script, data… This is particularly important for sustainability science since it avoids hierarchies between those seen as capable of creating meaning (humans) and an all-encompassing group of non-humans (such as ecosystem elements).

Besides interpretative approaches, the PR approach also resonates with anthropological perspectives, especially as those have been used to engage in thick descriptions of human–nature relations (West et al., 2020). As Hartigan, describing his own engagement with the study of plants, reminds us 'the anthropological axion that "things" are not independent objects as much as sets of relationships' (Hartigan, 2017, 255) is a key point in common.

In the rest of the paper, we use the concept of apparatus to try and understand what interviews and coding produce, paying particular attention to how they affect different project participants. In the next section, we present the project and team, so that the reader can appreciate the diverse trajectories in engaging with PR perspectives in an interdisciplinary group of sustainability scholars.

3 | TEAM AND PROJECT

The project on which this work is based is an action research project in sustainability science. Action research seeks to produce change in the field where research is undertaken following the idea that the best way to understand something is to try and change it (Cancian, 1992; Lewin, 1946). Recent research in sustainability science has argued that action research is intrinsically relational (Bartels, 2020) because it relies on the relationships between participants in a project, conceiving of them as evolving and thus constantly adapting the project itself (Bartels, 2020; Norström et al., 2020).

The objective of our project was to support the emergence of collective actions to face environmental changes in coastal communities of Kenya and Mozambique. The island of Inhaca was selected for Mozambique and two communities in Msambweni, Kenya, because they hosted the same kind of socioeconomic activities around fishing and farming.

The project investigated which factors perpetuate inequalities and unsustainable exploitation of resources and in which ways environmental change is perceived to be intertwined with those. In parallel, the project explored which relationships and daily practices can support collective action to face such challenges. Participants were explained the project in plain language before being asked to sign a consent form. The ethics were reviewed by the Ethics Committee of the Stockholm Resilience Centre and approved by partner institutions in Kenya and Mozambique, as well as by the Kenyan National Ethics Board.

The project team was made up of 11 researchers, of whom some were present at the beginning and reduced their involvement as new researchers joined the team. Of these researchers, two—among which the PI, MMG—were well-versed in PR approaches. Additionally, a Brazilian master student based in Sweden, TSG, was using the perspective for her master thesis and currently as part of her PhD. She thus progressively became well acquainted with it during the lifespan of the project and writing of this paper. The others had expertise, respectively, in small-scale fisheries, coastal communities, the fieldwork areas selected, the research methods chosen or a combination of these.

We used the PR perspective in three ways. Firstly, research was on relationships (beyond human relationships, that is including relationships with ecosystems or ecosystem elements), social-ecological practices (such as fishing) and the experience of environmental change as intertwined with a multiplicity of other challenges. Second, we coded these through concepts inspired by PR philosophy, conceiving of reality in terms of relations. Third, as an action research project, we explicitly focused on the evolving relationships within the team and in the fieldsites.

Data collection was structured in two phases. The first phase involved a traditional qualitative data collection on social-ecological practices and environmental changes through interviews, observations and focus groups. These data were coded as a basis for the second part of the project, which involved developing plays for theatre workshops. This article exclusively focuses on interviews and coding because these two methods are among the most typical in qualitative sustainability research, and the purpose of the article is to discuss what a PR perspective can bring to the use of traditional qualitative methods in sustainability science.

Two researchers—one per field site—led the analysis with input from the rest of the team. The analytical researchers had not been to the field and it was the first time in their careers analysing data that they had not personally collected.

The initial plan was for the PI to participate in fieldwork in both Kenya and Mozambique to ensure that the PR aspects were well integrated into the data collection instruments. However, her trip to Mozambique had to be cancelled because of personal circumstances, and instead of the PI, the local team (two researchers) together with the master student undertook the first part of fieldwork. A nine-person team, with varying degrees of involvement in the project, designed together the tools to investigate social-ecological practices in Inhaca.

After the first fieldwork session, COVID-19 made it impossible to travel. Data collection tasks were delegated to our teams in the field, who were therefore also responsible for ensuring that the PR aspects be included. This was the source of unease for all of us, but we also decided to take it as an opportunity to observe how this situation affected the research process.

Some of the team researchers felt intuitively comfortable with PR thinking, while others, who had found it interesting when the project was formulated, declared feeling rejection towards the perspective when having to implement it and felt inadequate to complete their tasks. This created a series of frustrations and tensions, which we will dig into later in the paper.

4 | INTERVIEWS AS APPARATUSES

The method of interviewing covers quite diverse ways of collecting information through more or less formal conversations. That spectrum encompasses very structured interviews, close to questionnaire surveys, to very open conversations characteristic of participant observation, all of which have been used in sustainability science. The diversity of approaches covered by the term *interview* might lead to the conflation of fundamentally different methods, which belong to different apparatuses, that is produce different types of change in the world. In this section, we briefly discuss these different approaches and focus on our practice of semi-structured interviews.

The term *interview* might seem counterintuitive when engaging in an action research PR project because it might suggest there is a fixed set of roles where the researcher obtains data by asking questions to researched subjects. From a PR perspective, we could say that structured interviews—and, by extension, surveys—are designed to try and bypass the ever-unfolding reconfiguration of the relation between researcher, interviewee, and contextual elements intervening in the interview such as the setting, by removing the characteristics of an individual interview as a unique apparatus. They seek to prevent deviation from the script by building on a theoretical approach in which the script reveals a phenomenon existing independently of the researcher. This corresponds to a positivist view, long criticized by qualitative methodologists, some of them going as far as to claim that if there is interaction (as opposed to a survey), a positivist approach is simply impossible because interaction necessarily produces unexpected results (Holstein & Gubrium, 1995).

A term such as *conversation* might convey a more open approach, with different participants engaging from equal perspectives. However, there are inherent power dynamics between people engaging in a project (Moreno-Cely et al., 2021). One is that some actors are engaged in the field as part of their daily lives, and others (usually the instigators of the conversation) are engaged because of their research interests.

We prefer the term *interview* to *conversation* because, in our view, speaking of interviews acknowledges that participants have come to encounter each other from different places, histories and motivations and that the research apparatuses are partly defining that encounter. An interview script can be conceptualized as a component of an apparatus, a discursive device that together with the rest of the apparatus calls attention to who and what are becoming determinate through it, including researchers and, in our project, social-ecological practices.

We are aware that *researchers* might be too general to convey different positions when engaging in a project. We experienced those differences, since some of us had never been to the field sites, Msambweni and Inhaca, while others knew them well. As one of our researchers, SB, tells:

> My first encounter with Inhaca, recently renamed Kanyaka (to honor its origin as home to the Nyaka people), was in the early 1980s. This was my very first trip to an island ever. Since then, especially after my first studies conducted on the island, I feel connected with this island. Despite being on the "researcher" side I regard myself as part of the Island.

These differences show how the interview apparatus is constituted by past and present histories that challenge its boundaries and affect what and who become determinate and distinguished from others. This perspective is, in our view, particularly needed in sustainability science for those determinations are not bound to distinctions between the social and the ecological. For SB, the apparatuses activated in this project helped him own his belonging to the island and assume a different role to the rest of researchers, acting as a broker, connecting the project to different people in the island, which was also a different role from his usual one, as a natural

scientist working on marine ecosystems. The perspective of the apparatus allowed him to see his work as part of the social-ecological practices that constituted daily dynamics in Inhaca. The concept of apparatus makes visible how the encounter between researcher and interviewee is inserted in and modifies roles and relations (Figure 1).

Interviews do not necessarily create new processes, but acknowledge that research modifies existing ones (Fox & Alldred, 2020). In Barad's own words: 'Apparatuses are not pre-existing or fixed entities; they are themselves constituted through particular practices that are perpetually open to rearrangements, re-articulations and other re-workings' (2007, 203). As TSG shares:

> At the time of transcription, when I realized that many questions were not aligned with the project's questions or that many pre-selected questions had not been answered, I felt a lot of anxiety. Today I know that the interview-apparatus revealed answers beyond the predetermined questions.

Those 'revealed answers' are what the apparatus produces by rearranging practices, by confronting the interviewees' narratives to researchers' inquiries.

Conceiving of semi-structured interviews through the apparatus helps identify the rearrangements that the interview produced. Apparatuses perform, create something in reality and, to see what that is, it is crucial to set focus on the particular practice of a given interview. The experience of the Mozambican team illustrates this:

> MB: Our experience defied the conventional wisdom about the advantage of conducting research in the language of the interviewee (Xi-Ronga). Despite the legacy of Portuguese colonial domination which set some privileges to white people, having a colleague of light skin from the Global South fluent in Portuguese turned out to be an asset in accessing information. Our interviewees were eager to listen and to learn from a white young lady who mingled with local people and learnt key words of the local language.
>
> TGS: One of my biggest concerns was how to break down the power structures that I carry with me. I am a white woman, a researcher from the South studying in the North, therefore, privileged. I was going to interview Mozambicans in Portuguese and many of them have Portuguese as a second language. Although I had to do my job, determined by the academic research project, my fieldwork was guided by my genuine curiosity for the story behind the participants as part of the island, understanding how the island was part of him/her, and how that relationship happened daily. Talking to them with ease and respectfully, honoring the moment by showing myself vulnerable and empathetic with their life situations, helped in deconstructing my position of power. My goal was not to romanticize any of these situations, the participants' or mine; mine was not an attitude previously thought but one that emerged when performing the interview-apparatus.

The subjectivities and positionalities of the researcher have been recognized as key not only in PR approaches (Davies, 2014; Fox & Alldred, 2020), but also in, for example interpretive approaches. Interpretivist researchers aim at understanding how the researcher impacts the phenomenon, which in our case is the

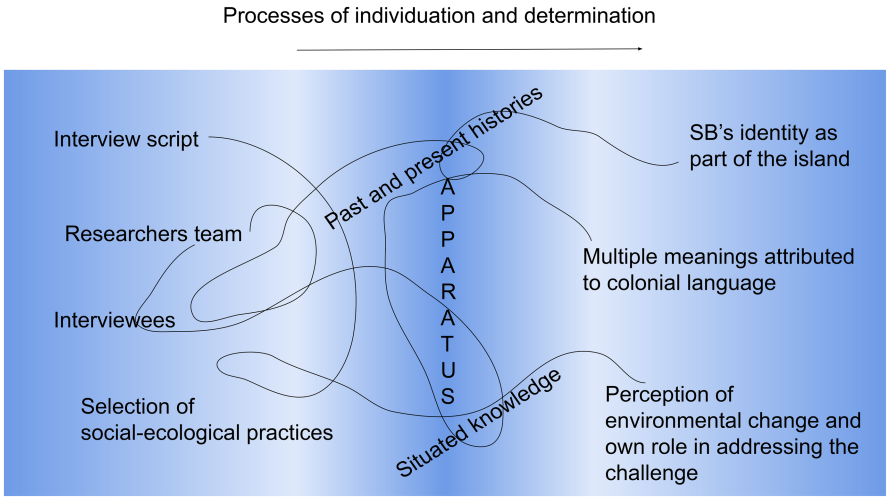

FIGURE 1 Representation of how the apparatus changes which processes are determined and distinguishable from others. We represent the workings of the apparatus as a linear sequence for simplification but is in fact an entangled phenomenon as explained in the text. The scribble between the different elements calls attention to what appear as meaningful processes, that influence what becomes determined and what stays undetermined. In this figure, we select a few examples (such as SB's perception of self) of the working of interview apparatuses, where we separate, for illustration purposes, the processes of 'histories' and 'situated knowledge'.

study of perceptions of environmental change, by obtaining and interpreting data in specific ways (Schwartz-Shea & Yanow, 2012; Smith et al., 2022; Yanow & Schwartz-Shea, 2014). Thus, the phenomenon remains exterior to the researcher, or, at best, the engagement between phenomenon and researcher is sequential: The researcher impacts the phenomenon, and it might be that the phenomenon impacts the researcher subsequently. This implies that the phenomenon would still occur without the researcher. Concretely, an interpretative perspective would require that we be clear about the characteristics of the interviewer, here a white, young lady from Brazil studying sustainability science. This would be seen as having a specific meaning in the context of research on social-ecological practices and perceptions of environmental change in Mozambique, which would be presented as influencing communities' interactions with the researcher. Therefore, those characteristics would be listed as impacting the information *collected*, which is then understood as an object that gets shaped by the characteristics of those analysing it.

The PR perspective instead argues that the very phenomenon is co-constituted by the different elements leading to it, and in the encounter modifies these elements (Figure 1). The co-constitution of the phenomenon does not exclude considering power dynamics or specific characteristics to trace the processes that become determinate in a given apparatus. The point is that there is no separation of the researchers from the phenomenon and that it is in the phenomenon that they become separate, distinguishable from each other and respective to each other. This view is useful for sustainability scientists as it questions boundaries between supposedly pre-existing categories such as what belongs to the social or the ecological, while avoiding the essentialization of social-ecological practices.

In Kenya, some interviews were carried out by university students who only began relationships with the village through these interviews, while more experienced interviewers had continuously engaged in the area for numerous years. The varying relationships and interviewer types led to different responses among the diverse participant base. Indeed, it is important to clarify that not all data collected can be considered as leading to the same type of apparatus. The students who conducted interviews sometimes used the guiding script as a questionnaire, without acknowledging the interviewees' responses, moving on from one question to the next. This questionnaire-type data left the analytical researchers perplexed and frustrated.

This led to conversations within the team about what PR entails from data collection to data analysis, but the type of data we obtained created a frustration that we could not surpass, as we had expected to obtain rich ethnographic data, including descriptions of practices and identities as social-ecological entanglements. However, as Hartigan argues following Visweswaran (1994), 'there is a lot to learn from what did not work well in the field' (Hartigan, 2017, 253). Indeed, we also discovered that adopting a PR perspective to analyse any type of data triggered reflections that would otherwise remain hidden.

The interview apparatuses were conceptualized as having a life of their own that produced a diversity of effects when encountering other processes, such as those created with the analytical researcher (Fox & Alldred, 2020; Jackson, 2013). Therefore, we read the transcripts as snapshots of apparatuses that had been performed at the time of the interviews and that joined a new apparatus at the time of analysis.

5 | CODING

Qualitative analysts have long established that coding can be done in very different ways (Saldaña, 2021): inductively, based on themes found in the data, deductively through previous research or theory (Boyatzis, 1998), searching for logical relationships, such as causality (Maxwell, 2012; Miles, 2014), etc. What these approaches share is that data are organized and placed into categories. As Saldaña summarizes 'To codify is to arrange things in a systematic order, to make something part of a system or classification, to categorize' (2021, 9). For this reason, coding—in general—has been criticized as mechanistic and reductionist, especially if its focus on categories leads to leaving out what does not fit (MacLure, 2013). In her book *The Minor Gesture*, Manning argues (in a chapter titled *Against Method*) that 'method works as the safeguard against the ineffable: if something cannot be categorized it cannot be made to account for itself and is cast aside' (Manning, 2016, 32). The concept of category suggests a container independent of context, something abstract that can be filled with *examples*, where what matters is that such examples fit the category. Braun and Clarke, qualitative data methodologists experts in Thematic Analysis, refer to this style of coding as using 'summary' themes (Braun & Clarke, 2006, 2022).

However, many types of qualitative coding contradict this perspective, such as the reflexive thematic analysis that Braun and Clarke propose, which seeks to tell a story about the data, establishing links between different themes as they relate to concrete, situated experiences (Braun & Clarke, 2021). More generally, Saldaña argues that coding is a flexible heuristic—a tool to make sense of data—that can be used in multiple ways (2021). Indeed, contrary to what Manning argues, if something cannot be categorized, it does not need to be cast aside, and coding can help to avoid casting things aside. As MacLure we see coding as an 'immersion in, and entanglement with, the minutiae of "the data"' (2013, 174). In the following subsections we develop how coding can be used for a PR analysis which Figure 2 partly summarizes.

5.1 | Analytical coding for PR approaches

The first way to make coding more PR is to use categories that focus on relations and processes in the collected data. Coding with PR codes leaves aside actors, ecosystem entities and their well-defined boundaries, challenging divisions between natural and social

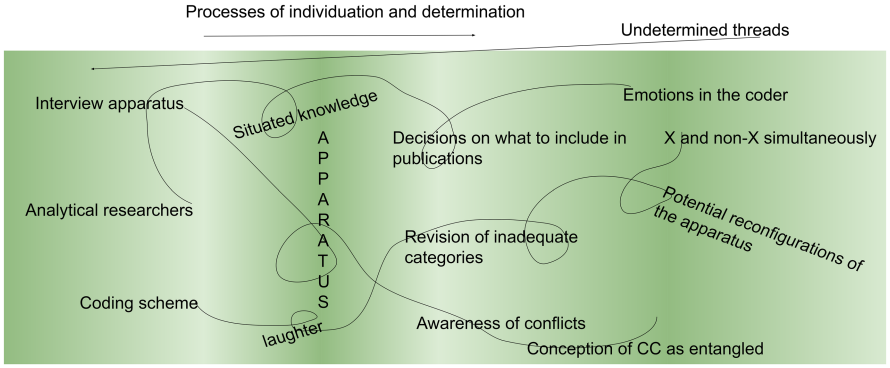

FIGURE 2 Besides following some of the threads of determination, Figure 2 also calls attention to threads that remain undetermined in a given apparatus which then feedback on to what is determined. The cycle implied by the feedback is purely a representational and analytical tool, as the PR approach would claim that it is in fact entangled with what becomes determinate.

processes to think in hybrid terms (Hinchliffe, 2023; Lorimer, 2013; Whatmore, 2023). This is not to say that a PR perspective is the only one questioning categories. On the contrary, there is a long tradition in anthropology and in qualitative methods research challenging the taken-for-granted nature of categories in positivist approaches (Alejandro, 2021).

We adopted the concept of practice as the core coding category, inspired by the literature on PR approaches in sustainability science and particularly by empirical studies taking a PR stand. For example, Koen Bartels', 2020 urban studies paper adopted practice as the main unit of analysis (as opposed to institutions or individual action, which are classical units of analysis). Bartels defines practice as 'the practical activities routinely enacted and improvised, while engaging with concrete situations' (2020, 4–5), which is also the definition we followed.

Some of our coding was suggested in our interview scripts, which aimed to get at social-ecological practices. Qualitative researchers Holstein and Gubrium argue that this is always already at play when interviewing since the questions asked are a type of categorization. They require that the interviewee understands them, putting their experiences in relation with the questions. We required the interviewees to describe different social-ecological practices, such as different types of fishing and farming but tried to remain open as to what those practices would entail. Indeed, when trying to categorize different types of fishing, we faced a productive tension since the interviewers did not necessarily recognize them as distinct from each other.

Apparatuses are constantly rearranged by small differences and details, which can play important roles in analysis. Such rearrangements are moments of possible change or connection of, for example a certain practice with another. The concept of apparatus allowed us to use practices as open categories entangled and depending on each other. For example, trading is a practice that depends on fishing and, as such, becomes itself social-ecological: Traders would not go trade if it was raining heavily (because fishers would not go fish).

Our coding was completed with 'process coding', a form of coding that focuses on actions, as intertwined with the dynamics of time, such as changes, processes of emergence, etc. (Corbin & Strauss, 2015). This focus on time and change borrowed from classic qualitative approaches associated with the idea of practices helped us get at ever-evolving relations characteristic of social-ecological systems (Hertz et al., 2020). This shows how traditional qualitative approaches can support specific aspects of PR research for sustainability science.

Yet, a code such as 'change' was too general for us, and we distinguished between different types of change and coded for 'socio-environmental change', 'generational change', etc. While useful, it did not capture the intertwined nature of social, personal and economic changes. Dimensions of change were not always separate and therefore were difficult to disentangle in categories that made sense across interviews to see the different threads at play. In terms of the apparatus, this means that such threads did not become determinate in some coding apparatus but stayed entangled, leading other threads to become determinate.

While using categories inspired by PR approaches allows one to focus on processes and relations, coding is still understood as a process in which the analysis finds meaning in the data. While the unfitness of some data might suggest a need to change or refine categories, we argue that it is necessary to adopt a particular *attitude* to fully nurture a PR perspective.

5.2 | Engaging in coding from a PR perspective

To avoid crushing data into (PR) categories and, therefore, reproducing the type of coding that we were trying to avoid, the coders documented when they felt tension between coding categories and data. We aimed at identifying potential reconfigurations of apparatuses, that is small changes in a given apparatus that might help understand which categories become determinate and what change is produced. Indeed, as data and coders interacted, different things were produced, such as emotions in the coder or decisions of what would be included in papers, as well as awareness of changes produced in the field that would in turn determine what entered the subsequent

phases of the project, paying particular attention to social-ecological dynamics since we all identified as scholars in the sustainability sciences or environmental humanities.

We also aimed to understand how the project was inserted into a net of relations, either because the team had a long-standing relationship with some of the participants or because the connections between interviewer and interviewee became meaningful. For example, some of the interviewees thanked the interviewer and told them that the project had helped them learn something. This type of meta-reflection on the project was not part of our coding categories, since we worked on socio-environmental practices, but helped us see how the interview apparatus changed something for the interviewees in their understanding of those very practices or their engagements with their environment (Figure 1). This resonates with the need for reflexivity and awareness of project impact that qualitative researchers call for (Alejandro, 2021). The PR approach adds a further note interrogating what material changes have been produced in the real world, which is essential to be able to include non-human (namely, environmental) aspects and their changes as part of the reflexive process. This seems particularly important for action research projects in sustainability science, which aim at understanding phenomena by producing change through creating, maintaining or modifying relations towards more sustainable systems.

Moreover, coding was conceptualized as an apparatus performance that not only would lead to the coder and the interview becoming determinate in certain ways, but that also arranged what became determinate in the apparatus performance of conducting the interview itself, and therefore which elements, besides the interviewee, would be included as worthy of analysis. This created a new tension since the boundaries of the interview apparatus were not easily set. There was of course the interview as such, with the running of the script on environmental changes and social-ecological practices starting with an introduction and finishing with the separation of researcher and interviewee. Yet, the project involved many other moments of contact between interviewers and interviewees, as well as between interviewers and the ecological elements referred to during the interview, through other phases of data collection—observation, focus groups, theatre… Thus, what remained undetermined in a given interview apparatus became sometimes determinate later on. Some of our interviewees did not report certain activities while the interviewer's observations seemed to indicate that the interviewee engaged in such activities (e.g. an interviewee declared fishing only with line and the interviewer saw nets in his house; another declared solely fishing, while the interviewer saw him working in a restaurant…). As researchers, we often expect coherence and try to resolve apparent contradictions by explaining them as the product of mistrust towards the interviewer, or of insufficient information (maybe it was not his net, maybe he was just helping that day at the restaurant…). The concept of apparatus offers a different option: accepting the multifaceted nature of phenomena, which can be at the same time X and non-X because our X category misrepresents what becomes determinate or only captures it at a given point of the process. This does not necessarily mean that we need to find the appropriate category but acknowledge that some threads remain indeterminate (see Figure 2).

Laughter is a good example of this. Interviewees used laughter and humour throughout interviews, indicating moments of unease vis-à-vis the interviewer's categories or with the need to share 'heaviness' in their stories. For example, when the interviewer asked how the interviewees learned to fish, some of them laughed, indicating that 'learning' as a discernible activity did not make sense for their experience. There was not a learning moment, but rather practices inserted in processes. In other cases, it served as a tool to express situations of deep vulnerability, to relativize a grave situation, and put practices in the context of very limited choices of livelihoods (between prostitution and selling fish). In both cases, laughter modifies the interview apparatus in creating bonds of empathy between interviewer and interviewee, signalling how different their experiences have been so far and that yet, having an exchange is possible. For the interviewers, these moments triggered feelings of humility and an opportunity to revise the appropriateness of the coding categories present in the interview script and convey this to the analytic researchers.

When coding is about the end product, that is about well-ordered data into well-contained categories, its PR aspects are reduced. However, when it is about the process of coding and the struggles faced during that process, coding can serve to ask new questions. We argue in this paper that coding is always unfinished and requires accepting that certain threads remain indeterminate in a given apparatus, supporting the points MacLure makes (MacLure, 2013). Furthermore, from a PR perspective, rather than focusing solely on sense-making, we try and trace the changes that are produced in discourses, feelings and material arrangements, an aspect particularly important when working on social-ecological dynamics, which are necessarily at the same time discursive and material. In the last sub-section of this section below we particularly focus on the experiences of the coders.

5.3 | The PR coder

The role of emotions in the process of collecting and analysing data has long been discussed in the literature on qualitative methods and in anthropology (S. Kleinman & Copp, 1993), and we argue here that it has an important role to play in sustainability science. We understand emotions from the perspective of the apparatus as leading to the emergence of the PR coder. We quote one of our researchers' coding diary at length as her experience reflects this, interrupting her voice to illustrate the subtleties of her transformation and the data's:

> EDO: As the analytical researcher for the Kenyan data, a white Irish female based in the North, who had not carried out the fieldwork, I began in a place of deep discomfort and what could be described as

> frustration. Not only was I engaging with knowledge rooted in a place I hadn't been to but I was also attempting to grapple with an entirely new and sometimes, I felt, inaccessible paradigm.

Here EDO expresses her belief that knowledge is situated and context-dependent and that it is challenging for her to access it considering she comes from a very different reality than the one where knowledge was produced. For EDO the idea that knowledge is situated was interiorized and she did not consider it as part of the PR paradigm. Moreover, for her, to think in PR terms was a source of violence, respective to how she was used to think, as the subsequent part of her text clearly shows:

> It was initially unclear to me why I was feeling the way I did as I began to engage with tool development and meet with the Kenyan team to discuss fieldwork. This was my first experience of process philosophy or relationality and it was almost shocking to delve into the concepts and language used by this approach within sustainability science. When I look back on my reviews and comments of the conversation-interview guides for colleagues they seem 'abrupt' or 'sharp' to me. I was not open to the 'indeterminacy' or 'vagueness'. I recognize, only now, I was so deeply rooted in process-reduction or categories it made me emotional with the struggle to make sense of the instruments and see them as "workable". I continued with this almost 'hostility' to the tools and incoming data as I began to code in MaxQDA. Now for almost conflicting reasons- I had begun to embrace the flow (though not explicitly) and the ever-unfolding nature of the interview process as a unique event.

In this section, the text shows how at the time of writing she evolved into someone else and looks at her own comments with a critical eye. Later she says: 'I always had this nagging feeling over these issues but never had it articulated until looking into relationality, and becoming aware of the exact ways in which colonial relations are still present', including imposing categories crafted in academic disciplines onto the field (Trisos et al., 2021). Through the process of coding and the lifespan of the project, EDO indeed changed roles and situated her discomfort in the type of data she was dealing with, as the following excerpt suggests:

> However, I found certain interviewer(s) disrupting this [flow] in a way that removed the uniqueness, questions became repeated and the relation between participant and researcher was, to me, 'choked' in its potential development, in its infancy. This made me frustrated and almost tense, perhaps not open to the nuances or subtleties of the conversations on the first read of transcripts. I decided just to let myself feel during the coding process (noting it down). I found that maybe these emotions were connected to stepping out of my paradigm, and in doing that my own assumptions about the research process, knowledge and 'truth' became clearer or more explicit to me. The disconcertment of moving towards a new tradition became more obvious (which is different from adopting it, because it felt impossible within a few months).

Here she expresses her belief that ethnographic data would be a better fit to PR explorations. The fear that the richness of situated knowledge production would be erased somehow verifies, but not for the reason she had imagined (because she had felt unable to interpret data produced elsewhere), but as a result of the interviewer's attitude.

> With influence from the relational field, I became interested in the epistemology of practice (Rawluk et al., 2020) which led me to reconsider my every move with the data. The way I ordered the information in the coding framework involved assuming a lot of responsibility as I've intervened in these worlds. Whose knowledge and experience might I silence or emphasize in how I presented the data to people? Why do I have the right, through my coding, to dissect and interrogate the lives and businesses of others while preserving my own autonomy, privacy and self? (MacLure, 2013).

In this last section, EDO shows how the change she had experienced through engagement with PR approaches and the epistemology of practice transformed her as a researcher. She also expresses how, with this change, comes also a feeling of responsibility, since engaging from a PR perspective involves producing change in others, a change that is partly oriented by her own analysis. Through this long quote from EDO's coding diary, we can observe how different emotions become determinate in the coding apparatus and produce changes in both her and the analysis itself. A PR reading of EDO's text helps us to see the moving boundaries between the different moments of change, concentrating on the interrelated processes of emotions, relations with other researchers, perspectives on the data and readings of other texts, showing how at some points certain elements become determinate—like certain emotions—respectively to each other.

6 | CONCLUSION

This paper has offered a reflection on the use of interviews and coding from a PR perspective in sustainability science by illustrating, through the concept of the apparatus, what is gained from such an approach and how it can complement other qualitative

analysis approaches. We used the concept of apparatus, which we defined as an arrangement where discourses and matter are entangled and become distinguishable respectively to each other in the act of the encounter. We focused on two types of apparatuses, interview apparatuses and coding apparatuses. The concept of apparatus helped us highlight what became determinate and the changes that were produced through interviews and coding, as well as what remained entangled. We saw for example that SB passed from being part of the data collection team to feeling part of the island and playing a brokerage role. We saw how EDO changed through her engagement with the data and the PR perspective and how the status of the data with which she was engaging also changed through their encounter. We learned to refrain from offering explanations for apparent contradictions between interviews and observations, acknowledging that what becomes determinate in the apparatus does not necessarily respond to researchers' expectations.

As we have seen through this paper, the PR approach has many points in common with anthropological and interpretivist traditions, but insists on the role of matter which is an essential aspect to move beyond discourses when studying environmental change and pay adequate attention to the active role matter plays in crafting perceptions and knowledge. It also insists on the simultaneity of entanglements between researcher, researched, field sites, data, etc. as a way to understand the changes that occur in real-world social-ecological processes, beyond only meaning making.

The article has also discussed the challenges of conducting research from a PR perspective using traditional qualitative methods tools. We have analysed how we navigated those challenges and the tensions that arose as different researchers in our project had different understandings of the methodological tools, and it was not always obvious how to use them from a PR perspective.

The argument of this paper suggests that the link between the PR ontological perspective that is increasingly gaining terrain in sustainability science (West et al., 2020), and methods should not be conceived as a rigid one, which would automatically exclude or include specific methods of data collection and analysis. We saw, for example, that coding for practices and actions was a good first step to show evolving dependences between practices usually labelled as social-ecological (such as fishing) and those which are not (such as selling). However, this was not sufficient for a PR perspective for sustainability science, as we argued for the importance of considering elements beyond what seems to be the phenomenon under study—that is material arrangements key to fully account for social-ecological practices, such as fishing nets, expressions of emotions and laughter—to convey the richness of what gets entangled *and* determinate in the apparatus.

This article has contributed to the debate on how to conduct empirical research in sustainability science from a PR perspective, using methods inherited from qualitative analysis. We invite similar reflections to the ones shared in this paper for other types of methods, including novel methods specifically designed to get at the entanglement of social-ecological processes and relations, such as arts-based methods, or classic quantitative ones. This might help us see elements we do not often pay attention to and nurture a relation with data collection and data analysis that sheds light on neglected processes and connections.

AUTHOR CONTRIBUTIONS

María Mancilla García conceived the ideas, conducted analysis of empirical data and led the writing of the paper. Elizabeth Maria Drury O'Neill conducted analysis of empirical data and edited the paper. Taís Sonetti González, Marlino Mubai, Christopher Cheupe, Caroline Abunge and Halimu Shauri collected the data. Salomão Olinda Bandeira, Dadivo José Combane and Nyawira Muthiga provided insightful comments on the case studies and tools for data collection and analysis. Tilman Hertz and Tim Daw critically edited the paper. All authors commented on the diverse drafts, contributed through the review process and gave final approval for publication.

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CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflict of interest.

DATA AVAILABILITY STATEMENT

The anonymized interview data on which this article is based as well as details on the development of our coding scheme are freely available through this link: https://doi.org/10.7910/DVN/HTAVZM.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supporting Information S1. Interview guide.

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