

Datafied Encounters as Representational and Relational: A more-than-human Perspective on the Biodiversity Citizen Science Project Artportalen

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Abstract

To tackle the climate crisis and current biodiversity loss, scientists and citizens collaborate through citizen science projects. In the Swedish species observation system Artportalen, species sightings are turned into data and thereafter drawn upon in environmental governance and other official decision making. While this approach suggests that Artportalen's data is representative of reality, this article takes a more-than-human approach that considers existing data and nonhuman others as social participants beyond humans to explore in how far encounters surrounding the project can be understood as relational instead of representational. Drawing on the concept of encounters to interrogate these relationships, we conducted and analysed nine semi-structured interviews and identify four themes: an anthropocentric data-driven perception on a 'representational' digital map; an ecocentric worldview shaped by 'relational' encounters; the shaping of data through the 'science' context; and the assemblages of nonhumans, data, and humans that create motivation and interest in biodiversity citizen science. We conclude by discussing the tensions emerging through the different perspectives that shape encounters.

Keywords: citizen science, more-than-human approach, data journeys, encounters, Artportalen

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Introduction

Nowadays, engaging with environmental monitoring has become more accessible, with multiple and diverse data practices often emerging outside of the scientific community (Ekström 2024; Gabrys et al. 2016). This citizen-generated data might not always reach the same level of scientific validity or sensor-accuracy as researcher-led science, but can be "good enough" to have a societal impact on environmental governance (ibid.). Citizen monitoring offers possibilities to engage with environmental problems in a more democratic way, such as to use

“good enough” data to start conversations with policymakers or to request official environmental inventories (Gabrys et al. 2016). While citizen data enable contesting or questioning regulation practices and decision-making, they are often not deemed similarly credible as scientific data (Ekström 2023). In Sweden, however, citizen monitoring of biodiversity is an integral part of municipal decision-making processes and happens via digital infrastructure of the Swedish species observation system Artportalen (Swedish compound for Species Portal).

Artportalen is a platform to register observations of nonhuman encounters such as specific plants, animals, and fungi (Ekström 2022). Maintained by the Swedish Species Observation Centre Artdatabanken at the Swedish University of Agricultural Sciences in Uppsala, Artportalen offers real time data access to municipalities, NGOs and environmental organisations and agencies in matters concerning nature protection and environmental governance (Ekström 2023). The database therefore is linked to research, citizen science, and governmental work. This makes the platform different from related biodiversity citizen science platforms as it is accompanied by regulations highlighting its status regarding restoration and species protection, and thus for any decision-making on land-use and land-use change. Further, with over 80 million registered observations per year, Artportalen is one of the biggest biodiversity databases in the world (Kasperowski & Hagen 2022; Peterson et al. 2023), and its’ data is globally connected through other databases.

As a citizen science infrastructure, the public, volunteers, and organisations can collect and examine data for Artportalen, as non-professional users might also use it to identify recent observations of specific animals or locations of plants. Thus, Artportalen can be considered a boundary object, being shared with various actors and accompanying diverse practices, expectations and interests (Horst 2022; Star & Griesemer 1989). As such, the variety of ways in which Artportalen is used means that there exist many different data practices related to data generation, processing, use, and its implications for environmental governance.

Often, citizen science data like much other data is assumed to be broadly representational of a reality when considering its biases (Jönsson et al. 2024), but it is also deeply contextualized by its modes of production (Ekström 2024; Peterson et al. 2023), which seldom makes it into databases. Both approaches tend to be focusing on humans and their agency (e.g. von Essen et al. 2022). In this research, we aim to conceptualize and thereafter explore empirically a perspective on biodiversity citizen science, which highlights the role of organic *and* digital nonhuman others in this process. Accordingly, this article addresses two questions within the context of biodiversity citizen science: First, what are the implications of including datafied nonhuman others (e.g. observation data, infrastructure) in an analysis of encounters with organic nonhuman others? Second, how does such conceptual shift influence our interpretations of narratives of knowledge production? This research will thereby contribute to understandings of the role of data and citizen science in environmental governance. To achieve this, we use the concept of encounters, primarily focusing on how encounters are facilitated and mediated by Artportalen as a database and with little attention to the affordances of its connected citizen science observation app. Following Tsing, we conceptualise encounters as moments of interactions where humans and other humans or nonhumans inevitably shape and are shaped by one another (Tsing 2021). Empirically, we build on a series of interviews with people who use and contribute to Artportalen both professionally and privately.

In the next section, we outline Artportalen as our research field before introducing the conceptual framework for this article. Thereafter, we outline the research methods—interviews with people related to Artportalen as contributors and users, and how they correspond to data journeys—and introduce four themes emerging from the analysis. Finally, we respond to the research questions and return to representational and relational understandings of data within biodiversity citizen science.

Research Field

Artportalen is an extensive long-term database for Sweden's fauna and flora (Ekström 2022), where previous encounters have become datafied and thereby prefigure future encounters. Species, including those labelled protected or invasive are datafied, which heightens their salience and urgency in fields like law or ecology. Any datafied encounter is required to have an author, timestamp, location, and taxonomic details, while data on amount, developmental stage of the species, or similar are optional. Often, datafied encounters are used to either justify, condemn or foster human actions towards nature, environments and nonhumans dwelling in them (Ekström 2022; Ekström 2023; Kasperowski & Hagen 2022; Peterson et al. 2023). Such data requires constant negotiations regarding the data's validity and trust between (key-)participants (Ekström 2023; Kasperowski & Hagen 2022). Since Artportalen's data is public, various participants monitor others' observation entries regardless of their interest in the database, leading to a co-created validity (Ekström 2023). However, accessing sensitive data in Artportalen, such as information about red-listed or protected species, is restricted and only handled confidentially (Peterson et al. 2023). Therefore, only a few participants have real-time access to sensitive data. Depending on credibility and trust, some actors earned access through their professional positions. Others may request such information e.g. for research projects which are then transferred manually (*ibid.*). Moreover, Artportalen needs to be understood as a tool with biased data (Jönsson et al. 2024). These varying data practices depend on the participants' expertise and learning processes, giving rise to a lot of uncertainties or inconsistencies in the data (Ekström 2023). Technically open to everyone, imbalances within participating citizens exist; including differences in age, gender, and which species are datafied through participation (see Jönsson et al. 2024). Natural scientific researchers using Artportalen therefore are implying that such biased data needs to be identified and mitigated (*ibid.*). In this article, however, we view such 'biases' as culturally interwoven — a complex outcome of multiple past and present encounters of humans and digital and organic nonhumans (Tsing 2021; Airoidi 2022).

In the context of biodiversity citizen science, Artportalen's participants are diverse and engage in multifaceted information practices. Choosing Artportalen as a research field therefore allows us to examine multiple more-than-human encounters in a digital infrastructure and citizen science context with a diversity of professional, official, and private use cases for the data. This facilitates the exploration of how diverse actors understand environments. To do so, we combine concepts within the realm of STS and anthropology (see e.g. Barad 2003; Gabrys 2016a; Tsing 2021; Airoidi 2022; Beaulieu & Leonelli 2022).

Conceptual Framework

When focusing on encounters of humans and nonhumans in a more-than-human world, Anna Tsing's (2021) ecocentric perspective offers an alternative to shift the anthropocentric understanding of a subject–object relation. Her conceptualisation of encounters widens the definition of identity and criticises the idea of a singular and linear history. Instead of being self-contained individuals with humans at the peak of the hierarchy, all beings encounter each other in space and throughout multifaceted histories, culminating in diversity. Such diverse encounters lead to ever-shifting assemblages, rather than fixed communities. Beings also depend on collaboration to survive. Yet not all encounters end up being fruitful collaborations; sometimes encountering each other can be destructive (Tsing 2021). Any organism is thus part of what Tsing calls "contaminated diversity", which describes assemblages shaped by disturbance and historical entanglements (ibid.). Such perspective focuses on relations rather than representations (Tsing, in Harvey et al. 2020).

Tsing argues that "lively encounters *among nonhuman beings*" do not have to start and end with humans (in Harvey et al. 2020: 222); nevertheless, in our context, humans and their use of technology mediate any encounters of technical and organic nonhumans. However, digital nonhumans, or data, even if not excluded, are treated differently in the context of more-than-human relations. For example, through the "progress-as-expansion" narrative, Tsing (2021) critiques how scaling up data in hopes for never-ending progress can foster harmful anthropocentric perspectives, narratives, and practices in line with techno-positivism. Nevertheless, we argue that digital nonhumans and data should be included when considering encounters. Although her framing differs, Gabrys (2016a, 2016b) explores similar dynamics. As humans encounter big data, algorithms, softwares, and interfaces in everyday life, they thoroughly shape the way how the world is perceived and interacted with (Airoldi 2022; Beaulieu and Leonelli 2022). Data is relational; they are created through complex encounters of humans, datafied and organic nonhumans and their environment (Beaulieu and Leonelli 2022). Considering data as 'biased', however, implies that objective data existed in the first place, effectively replacing relationality with representation (Airoldi 2022; Beaulieu & Leonelli 2022).

The concept of encounters allows us to consider the constitutive role of more-than-humans instead of focusing only on human actors. Further, it emphasises the relational nature of all engagements. Data has no memory of its past encounters except through the data and metadata related to its inception, and therefore it appears to lack the contaminated diversity of more-than-human encounters. Reading Tsing's reflections on the stripping of relationships of 'production' (i.e. alienation) of matsutake mushrooms in global supply chains (2021) through the lens of data, we suggest that even when datafied, an encounter retains some or all relational qualities and memories seen from the context of their generation (i.e. for the people, communities, and infrastructures explicitly connected through specific datafied encounters). Conversely, when all semblances of relationships are removed and the datafied encounter is recontextualised with other data, it becomes alienated: more flexible and malleable in future encounters because any contexts, certainties, and uncertainties are removed. But even then, data can be seen as relational and engaged in encounters as they are re-related to other data or related in other contexts. Accordingly, we conceptualise datafied encounters in Artportalen as transformed past encounters, which travel within and beyond Artportalen as data — ready to encounter and be encountered again in their transformed state and thereby be contextualised into new relations.

As mentioned, humans are not the only ones influencing and being influenced by interfaces, algorithms and data. Organic nonhumans encounter technology in many ways, too, for example when being assessed, registered, and studied (Ekström 2024). Hence, data practices and the datafication of encounters not only impact humans' worldviews but also non-human worlds. In this context, there is a diverse array of nonhumans involved: Artportalen, the user interfaces for citizen scientists, the birdwatching community, a person watching birds as well as digital infrastructure, and a bird constitute each other. A person can only be understood as a birdwatcher and possibly a citizen scientist through the presence of birds, a community, and its means of organising and recording experiences. In this context, views on Artportalen as a "social" or "scientific" information infrastructure, including ideas about knowledge creation, expertise, and the nature of data, are constantly renegotiated through such (non)human encounters (Barad 2003; Tsing, in Harvey et al. 2020). Regardless of this, any data found on Artportalen is both a result of past encounters and a context for future encounters. We therefore propose that big data and technologies should be accounted for as actors, considering that data are not neutral self-contained information entities but a result of "contaminated diversity" (Tsing 2021), of individual lifeworlds shaped by previous human and nonhuman encounters. In a more-than-human perspective as well as in multi-species approaches, humans, nonhumans, including digital actors, should be considered.

Methodology

The concept of data journey helps to investigate how data travels across and between different sites of data practices (where data is produced, processed, distributed, and used) which are embedded in time and space (Peterson et al. 2022). Considering data as actors, data encounters different audiences for diverse purposes, which one can notice well in a citizen science project (Leonelli & Tempini 2020; Airoidi 2022; Ekström 2022). Furthermore, when data moves it is often transformed, even "thinned" (Porter 2020).

Data journeys in context of Artportalen have been vividly illustrated by Peterson et al. (2022) who follow what started as an observation of a lapwing through one's full senses becomes a "flattened bird" through filters, ready to travel through computers and networks (ibid.). To be able to travel not only between said audiences but also between various biodiversity observation networks (BONs), these databases, such as Artportalen, "[...] copy, borrow, and feed information back and forth to each other" which overall leads to an accumulation of data of humans and nonhumans, travelling within- and between these networks (Peterson et al. 2022: 293). Even though materiality is still intertwined with travelling data, the movement also influences how its 'truth' is understood, as it is constantly de- and recontextualised (Kasperowski & Hagen 2022; Peterson et al. 2022). In the case of Artportalen, travelling datafied observations have different meanings depending on differing contexts, given that meaning and truth emerge when datafied observations are encountered by other participants in the field. Focusing on encounters between humans, nonhumans, and data allows a widened lens and shift away from human agency. However, by applying the concept of encounters and inspired by data journeys, all are considered to shape one another—here explored at the example of biodiversity citizen science and its use.

Informed by our conceptual framework and the aim to collect insights into encounters at different stages of data journeys related to Artportalen, we decided to conduct interviews with people who are both professional users or contributors to the project—many also use or contribute to Artportalen privately. Interviewees often engaged with Artportalen

throughout their work by using the lists of red-listed species, long-term datasets or Artportalen as a map. Concretely, the interviewees are connected to Artportalen through various professional roles, including working for a Swedish municipality, the Swedish Agency for Marine and Water Management, an NGO, or for Artdatabanken, but also researchers. Moreover, as Artportalen is a public database, where everyone can contribute, most interviewees also engage with it privately, such as for birdwatching. All interviews took place in February and March 2024 in the context of Malin's master's thesis (Nemeth 2024). In the remainder of this article, interviewees are referred to as I1 to I9. The interviews focused both on how interviewees used datafied observations in their profession, such as environmental planning, as well as how they registered their nonhuman encounters, such as with invasive species, as data during their free time as part of the citizen science project.

Through these interviews and creating the data through an interplay of engagement and reflection in form of thematic analysis (Braun & Clarke 2022), Malin identified four themes called *'Gridded Nature': Datafied Encounters as Representational*, *'Nature Without a Grid': Datafied Encounters as Relational*, *Encounters as 'Science': Classification and Care* and finally, *Why Encounters Become Datafied*. The first two introduce perspectives regarding nature, environments, humans, and nonhumans, which influence perception and practices surrounding Artportalen. The third theme presents the narrative pervading throughout each theme. Finally, the fourth theme focuses on motivations and interests leading to specific actions which are embedded in the formerly introduced perspectives. Overall, these themes outline different ways of engaging with and making sense of environments.

As only one author conducted the interviews and collected the data, we write in a first-person narration throughout the results to accurately represent the data collection process. In the discussion section, we return to using "we" to account for the shared interpretation of the findings.

Results

'Gridded Nature': Datafied Encounters as Representational

As mentioned, I named the first theme 'Gridded Nature' since nature is seen through the grid of a map. Maps divide landscapes into grids and coordinates, and even though Artportalen is understood as a tool and data storage, the idea of Artportalen rests on citizen scientists and others continuously datafying their encounters with nonhuman others. Viewing Artportalen as a map, interviewee 8 reflects: "It's a map. And you get a dot on a map. It presents nature in a not-so-dynamic way" (I8: 7). Hence, in that context, data journeys neither start through encounters with nonhumans nor reach their endpoints as results of, for example, research. Situated somewhere in between, insights of past observations are followed by new observations, which again lead to more insights. This creates a feedback loop of datafied observations and aligns with Tsing's (2021) understanding of progress narratives within science.

Many people report for their pleasure, following their passion embedded in a long tradition to map their environment, or to communicate with other like-minded people (I3–I9). This leads to diverse reports as "[...] people will report differently" which creates difficulties (I2: 2; I5; I8). Such unsystematic data is seen as valid by Artportalen's administrators and scientists who use the data for their research yet understood as incomplete or incohesive.

Diverse data indicate diverse practices which can be a hindrance for data to travel smoothly. Not only do researchers struggle with incohesive data, but people working on city development, forestry, or restoration projects do, too. Cities grow, roads are built, and forests are used by their owners—requiring data about what might potentially be protected. ‘Gridded Nature’ plays a big part in any law inquiries and development projects. Be it for species protection in the context of EU laws regarding red-listed species, or future clear-cutting projects. And “[...] as soon as money is involved it can cause a lot of trouble in people’s lives” (I5: 6). To validate any project, nature, environments, and habitats are mapped and gridded. When protected species and clear-cutting projects meet, it is crucial to know exactly on which side of the border the species can be found. This is highlighted by interviewee 5, who explains the importance of accurate GPS data when registering observations: “The fear is that if you give too much accuracy it will lead people to find these nests to collect eggs, for example. But to be able to use it, the accuracy [has] to be high” (I5: 8). Datafying and mapping nonhuman encounters can therefore prefigure future nonhuman encounters and settle the fate of entire nonhumans’ habitats. Mapping registered observations additionally exceeds professional practices, affecting one’s overall understanding of nature. As interviewee 5 outlines:

“[...] when you are sort of [a] beginner with using maps, you tend to look too much at the map. And eventually, you realise that the map is only a picture of reality. And the reality is all around you. In all maps, there will sometimes be a mismatch between the map and the reality.” (I5: 4)

Artportalen as a map thus serves as a metaphorical sense of guidance and structure, rather than depicting reality. Considering this, what is the map of Artportalen revealing? Even though it is handled as a map of datafied nonhuman encounters, Artportalen reveals how humans trace nonhumans they consider particularly interesting and thus worthy of datafication (I1; I3; I9; more on this related to the final theme). The mapped and gridded data points are then constantly (re)contextualised, and views of data as representational or relational are continuously negotiated. Finally, it discloses human actions to either validate their arguments or to prevent projects in the name of the law (I1; I2; I8; I9). This tension between mapping humans, nature, and nonhumans leads to constant negotiations when using Artportalen as a map. Yet thinking through a grid is not the only way to encounter the world. ‘Nature Without a Grid’ presents an alternative which differs from but is closely connected to the ‘Gridded Nature’ perspective.

Nature Without a Grid: Datafied Encounters as Relational

‘Nature Without a Grid’ is another theme, this time however constituting an ecocentric perspective. As an alternative to putting humans in the centre, ecocentrism highlights the importance of nonhumans, humans, and their environments. As interviewee 9 reflects: “The human being has put her, or himself on the top of it. Of everything. And thinks we are something else. But we aren’t” (I9:13). Being in nature here is more about just being and actively trying to take a break from technology (I1). Experience is in the foreground, or as interviewee 3 explains: “You feel the nature more than you think about it” (I3: 4). Instead of fostering their competitiveness by comparing their listed datafied encounters with the lists of others, interviewees often encounter nature alone or with their family to unwind and feel connected to nature (I3; I4; I5; I6; I9).

When it comes to online and offline communities, their connection and shared interest are emphasised which also influences how data from nature and nonhuman encounters are shared and distributed (I3; I4; I6). Interviewee 3, for instance, shares their nonhuman encounters on their personally managed local Facebook group:

“I have a Facebook group [and] sometimes post things about birds or fun things in the woods that I’m seeing. And I see that it’s hundreds of people that live just around here. That are glad to see what I have seen.” (I3: 7)

Artportalen’s map fades to the background while other affordances, such as the shared news of research projects with datafied observations, become more salient. Artportalen as a platform is consequently also treated differently. It is encountered and cared for as well as perceived to be more than the sum of its parts (I6). In place of treating Artportalen as a mere tool to reach one’s goals, it is understood through its community and entangled connection between communities and other BONs. This is highlighted by interviewee 6, who states that “Artportalen was a system. Now it’s also part of a family” (I6: 15). The emerging diverse data practices therefore offer spaces where data can travel between, in and out of.

Considering the rationale of the theme, ‘Nature Without a Grid’ leaves room to critique the ‘Gridded Nature’ perspective by building on curiosity and experience. Contrary to focusing on datafication processes, this call for curiosity emphasises encounters with organic nonhumans over accumulating data. Additionally, travelling data is more deeply embedded in local contexts as datafication is a side effect of encounters. The theme not only allows for critique but also for emotions such as worrying and mourning. These emotions can be identified when talking about people’s hopes and fears regarding the future of nature, environments, and nonhumans. The worry that accepting landscapes with fewer nonhumans dwelling in them due to distinction and environments lacking biodiversity will be accepted as a new “baseline” creates a different urgency to inventory nature than Sweden’s long Linnéan tradition (I2; I3; I7; I9).

Finally, both themes do not oppose each other but are multifaceted and at times complementing one’s perspective. Interviewees often switch between them, which makes both themes dynamic. For instance, interviewees argued that the datafication of nature may lead to a more holistic understanding of nature and environments as more knowledge leads to an overall better understanding. A holistic approach was at times more related to practices I identified within the ‘Gridded Nature’ theme than when focusing on connections and experience, like in ‘Nature Without a Grid’ (I1-I3). The need for a deeper understanding of nature and biodiverse environments aligns with the narrative presented in the following theme.

Encounters as ‘Science’: Classification and Care

Throughout all interviews, there is a narrative suggesting that deeper caring would emerge through more abstract species knowledge or applied species recognition skills. Interviewee 3 explains this position by stating: “Some people, they can see: ‘Oh, there was a bird!’ But they don’t really see it because they have no name [for] it, and it doesn’t mean anything [to] them” (I3: 5). Talking about species identification, they further note: “You see it’s not just a green blur, it’s actually a species” (I3: 2). Put differently, many interviewees suggest that genuinely caring for encounters with organic nonhumans depends on the ability to identify and recognise them. This indicates that recognition and thus care is often afforded to entities

as species, meaning as an abstract classification, rather than an organism encountered without a grid. The idea that determining species dwelling in nature is a starting point stems from narratives arising during the Enlightenment and is an integral part of Sweden's history and tradition. The Swedish naturalist Carl Linnaeus not only shaped how nonhumans are categorised and inventoried to this day but also influenced Sweden's BONs (Peterson et al. 2023). Interviewee 6 explains that "[...] after Linnaeus [it] was more and more a tradition that it was important to know species. We have the starting point with Linnaeus and all of the books that he has [written]" (I6: 11). However, interviewee 3 reflects on various other kinds of knowledge. Before the "Linnéan tradition", people knew about nonhumans and nature, "maybe even more, in some ways" (I3: 6). Interviewee 3 reflects that prior to focusing on species classification: "[People knew] how to use nature and species for food or medicine", however, "nowadays, knowledge about nature starts with naming" (I3: 6). These practices of utilising plants, fungi and nonhumans as medicine and food do not fit today's linear narrative and are therefore rejected. Nowadays quantifying nature is required to "see" and to understand (I3; I6).

Nevertheless, as datafied information does not always travel freely, such knowledge is not universally accessible. Increased knowledge and understanding are suggested to lead to more caring about the 'values of nature' (I1; I2; I4; I8). This seems less straightforward when one aims to trace endpoints of data journeys, as some scholars suggest (c. f. Leonelli & Tempini 2020). This issue is highlighted by interviewee 5:

"[...] sometimes we had opinions from people owning forests that to be able to [consider] what species you need to protect; you need to be allowed to get the information what's there. If it's a secret, there's a very specific bird here. It's very important that you protect it. But you don't tell the landowner. It's very difficult for him or her to take needed caution, of course." (I5: 8)

Not all data is accessible to everyone (I2; I4; I5; I6; I8; I9). "Not knowing" therefore can create tension between different interests and motivations, ultimately leading to conflicts, and restricted journeys of datafied observations can lead to clashing meaning-making processes (I5). In this particular situation, forest owners feel frustrated, either because they feel overlooked by the environmental policies in place, or because they feel hindered from following these policies.

Many different understandings of Artportalen's role and tasks are present which all are interwoven into Artportalen's data. Given the "exponential" rise in registered observations, it is important to consider the diverse motivations behind participation (I6). By no means exhaustive, the final theme presents some motivations and interests related to the practice of registering.

Why Encounters Become Datafied

Motivations and interests are the driving force of practices relating to collecting observations as data. Whereas motivations give people a reason to carry out practices or, for instance, participate in projects, interests in this context indicate why one focuses on one aspect over another. Different motivations and interests can lead to seemingly the same practices, and one person often acts on multiple motivations and interests simultaneously. Building on the previously discussed narrative, being more aware of and caring for the environment leads

to collective action. Instead of being solely dependent on experts for services such as conducting inventories, “everyone can do it” (I1–I3; c. f. Gabrys et al. 2016). Communities can instead use their collected data to advocate for inventories and even policy changes in favour of nature protection in court (Gabrys et al. 2016). Additionally, these inventories can support communities when requesting financial aid from official institutions for such projects (ibid.). Some people go as far as to use Artportalen as a form of environmental activism. Activists utilise Artportalen to fight against urban development or clear-cutting projects by trying to reframe specific areas through an increase in registered observations of protected species in the designated areas. Most of the time such actions are detected and prevented through Artportalen’s validators. Quality assurance is conducted by a network of specially certified people who focus on “spotting anything unusual” (I4; I6). In these instances, motives and practices clash as do understandings of these natural areas. This leads to tension and conflict, occasionally even discussed in public media (I5). Nonetheless, Artportalen “[...] is a very important tool to unify the community” (I2).

But it is not the only motivation that has been defined. Many people also become motivated by comparing their lists of registered observations with others. In this context, Artportalen’s *Checklista* is a gamified element, meaning that it enables a game-like notion regarding registering nonhuman encounters as observations to the database. Like some games, it fosters comparison and to some extent competitiveness between users. Initially part of birdwatching, keeping track and connecting through these lists are an integral part of the hobby (I9). As birdwatchers developed Artportalen and initially did not see it as the big citizen science project it became, lists were included to continue this practice just for fun (I6). Another interest stemming from the birdwatching tradition is tracing rare species throughout the country, either by checking registered observations in the database or following the bird in hopes of encountering it (I2; I3; I5; I6; I9). As mentioned, Artportalen is then used as a map to trace the bird, yet ultimately these are traces of humans tracing nonhuman others that are motivated by datafying and listing their encounters.

Considering nonhumans, I identified three areas of interest that determine whether people register the encounter as an observation or not. The decision in favour of the registration often depends on the nonhuman’s rarity, looks, or behaviour. Almost all interviewees emphasised that rare species are far more likely to be registered in Artportalen (I1; I2; I3; I4; I6; I9). This underlines Artportalen as a map representing human practices over nonhuman dwellings in an area. Species are not only more interesting when they are rare, but their looks also play a significant role. Common and ordinary-looking nonhumans are less interesting and more likely to be dismissed (I1; I4), as “charismatic species” get more attention (see e.g. Fordahl 2024). However, the species’ behaviour may attract one’s notice, sometimes leading to a broader focus. Interviewee 2 told me that during an observation, they sometimes notice how nonhumans encounter each other, which can increase the interest in the observation itself. Encountering species during an encounter can shift one’s focus from particularities to entanglements.

Discussion

The empirical analysis outlined here suggests that interviewees use both relational and representational understandings of data to discuss their use of Artportalen, and that they have some understanding of the ways in which encounters with nonhumans co-constitute their engagement. The ‘Gridded Nature’ and the ‘Nature Without a Grid’ themes showed how

perspectives shape perceptions of environments and what datafication processes can emerge when encountering nonhuman others. Both themes were dynamic and constantly negotiated as interviewees switched between their ways of reasoning, and their understanding of how data and observation related and what they represented. They were also influenced by embedded narratives and practices. The narrative of 'Encounters as 'Science'' bore aspects of both previously mentioned themes. For example, the interviewees' concern with unequal access to sensitive data seems to emphasise the relational preconditions and consequences emerging from data assumed to be representational. In line with narratives of progress and the tradition of species classification, alternative ideas of knowledge creation and historical entanglements were excluded (Tsing 2021). All of these practices returned to questions of distinguishing encounters into those that ought to be datafied, might be datafied, and are unlikely to be datafied even if the data practices might appear similar, which the last theme, 'Why Encounters Become Datafied' discussed further.

We now return to the two questions that must be addressed. The first concerned the implications of including datafied nonhuman others (e.g. observation data, infrastructure) in an analysis of encounters with organic nonhuman others. We conceptualised this as data being encounters stripped of their relationships, but both able to retain relations with their context of production, and of becoming re-related and thus contributors in subsequent circulation, thereby leading to more encounters. For example, in interviewees' accounts of gamification, shared family or neighbourhood experiences, or tracing birds through the country, data retains relationships to individuals, is contextualised within community relationships, and shapes encounters of others. Our approach thus enabled us to see the complex and messy entanglements, where data is nested somewhere in between encounters with nonhuman others, past encounters, and future encounters—thus data, despite its inherent lack of memory is both a product of and a source for contaminated diversity. Accordingly, the digital citizen scientific infrastructure is an essential influence in shaping more-than-human encounters: it contaminates diversity as it takes part in encounters of multiple agents. When humans, organic nonhumans, and data encounter one another, the encounter needs to be acknowledged, and its relevance for datafication or other use established. This has implications on the larger scale: While Artportalen is often considered to be only a mapping of non-human participants, such as animals, plants, and fungi dwelling in their habitats, our research suggests that Artportalen's map reveals which encounters humans consider meaningful and where humans trace such encounters, which are then transformed into data—it is not a map of biodiversity but of encounters of humans who squeezed some of their encounters into a database.

Our second research question concerned how such a conceptual shift influences interpretations of narratives of knowledge production. As suggested above, the narratives of our interviewees had clear traces of a relational understanding of data. However, interviewees often resorted to representational understandings when reflecting on knowledge production: Ideas of knowledge production were regularly systematised, either into the 'Gridded Nature' of maps and GIS systems, or of the taxonomical system in the Linnéan tradition that renders 'Encounters as 'Science''. Knowledge in the context of our research thus appeared to be one of naming, classifying, mapping, inventorying and thereby datafying the environment in established spatial and taxonomic classifications. Re-related into these classifications, a scientific-managerial and anthropocentric perspective on environments and nature emerges where encounters were seen as representations of species existence that need to be navigated in managing nature and land-use (von Essen et al. 2022). Based on our interviews,

this notion is challenged in a few places, such as when interactions of different species appear more interesting than their mere presence, but without possibility or incentive to capture this adequately in the datafication enabled by Artportalen.

This representational understanding of data sometimes even conflicts with a relational view, for example when environmental activists are said to seek to influence what future encounters should be possible by reporting endangered species in specific areas, whilst data verification systems seek to protect a representational logic: the idea of a representation of nature appears to require notions of science that prohibits humans being interested in nature beyond taxonomy. This systematisation of experience contributes to divisions between nature, culture, human, and nonhuman, sorting every agent or place into self-contained entities that rejects alternative narratives and histories (Tsing 2021). Within these systematised, representational views, there is a need for ever more datafied observations, which is part of the anthropocentric progress idea. However, Artportalen served not only as a mapping tool but also as a platform for a passionate and curious community. Datafication processes were sometimes understood as support for such curiosity. Curiosity, as Tsing (2021) argued, is essential to break out of anthropocentric narratives and to shift the focus towards a more-than-human world.

Conclusion

In this article, we conceptualised biodiversity citizen science infrastructure as surrounded by encounters, and data in the tension of relational and representational understandings. The context of biodiversity citizen science was a convenient starting point to explore the frictions and implications of the proposed more-than-human approach, held together by a digital infrastructure, in this case Artportalen. While we used encounters with nonhuman others in a biodiversity context as a starting point, our understanding of data—its origins, contexts, and circulation—is relevant for diverse fields of knowing about nature and the environment, including weather or climate data (Bates et al. 2016). In our example, diverse and at times contradictory practices were framed to be in the best interest of nature or knowledge about nature. For instance, caring for the environment meant utilising Artportalen for environmental activism for some, and focusing on research for further insights for others. Since maps are an integral part of citizen science and policy making (cf. Berti Suman & Alblas 2023), future research could follow up by exploring Artportalen's map through a relational lens, rather than focusing on it as a representation of reality. This, then, could allow a shift from an anthropocentric towards an ecocentric understanding of how humans encounter nonhuman others, taking these encounters more seriously. More broadly, our research underlines that in environmental governance, it is necessary to understand what interests, motivations and meaning-making processes lay behind practices that appear similar. Exploring the ways in which data is relational in its diverse encounters (and not just representational) helps to identify the “contaminated diversities” at play (see Tsing 2021).

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