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Lingering with Multispecies Kin: Re-Turning to Encounters between Children, Invertebrates and Amphibians

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(Received 24 November 2023; revised 21 April 2024; accepted 21 April 2024; first published online 16 May 2024)

Abstract

Based on an ethnographic study in a Finnish primary school, we explored lingering as both a pedagogical approach and a methodological concept for multispecies education research and practice. Through this conceptual thinking, we “re-turned” to the multiplicities that unfolded from noticing rhythms, enterings and different lifeworlds to show how children’s lingering encounters developed into speculative inquiries about how invertebrates and amphibians generate polyphonous affects and temporalities. In our study, children’s “attuning-with” clay, waste materials, photographs, and stop-motion animation opened up the unfamiliar worlds and temporalities of invertebrates and amphibians, involving active silences, slow rhythms, and awkward becomings. Overall, the study highlights that children’s attuning-with the uncertainties of today’s socioecological world create new avenues for thinking about multispecies relationalities.

Keywords: Affect; children; education; lingering encounters; multispecies relationalities; rhythms

Entering lively multispecies encounters

One of the “wicked problems” of education is considering the relationality of affective and temporal rhythms in the lifeworlds of small animals and humans, which are often fraught with tension, contradictory, and are hard to grasp (Hohti & Tammi, 2023; Hohti & MacLure, 2021; Rautio, Hohti, Tammi & Ylirisku 2022; Van Dooren & Rose, 2012). Lively multispecies research is crucial for bringing together the affective and temporal landscapes of humans and animals (Van Dooren, 2023). As Malone and Crinall (2023) stressed, listening to children’s stories about their awkward and challenging encounters with socioecological worlds can create pedagogical opportunities for healing, enchantment, and care, making room for a non-anthropocentric approach to environmental education that extends beyond human ways of sensing the world. We need to give young children space to encounter and notice the invertebrates and amphibians that are often ignored in environmental education to rebuild appreciation and care for these small beings (Malone & Crinall, 2023; Van Dooren & Rose, 2012; Van Dooren, 2023).

Noticing and considering multispecies relationalities in the era of climate crisis means “attuning-with” (Riley & White, 2019) new relational forms of caring in multispecies education. Previous researchers have investigated the transformative potential of silence during zoo visits (Rice et al., 2023), facilitated being attuned with wasps’ lifeworlds by focusing on wasp ecology and

developing affirmative narratives (Santaoja *et al.*, 2023), or fostered penguin and flying fox multispecies storytelling in urban environments (Van Dooren & Rose, 2012). At present, research into the interactions between children's and invertebrates' lifeworlds, especially from children's perspectives, is scarce (Tammi, Hohti & Rautio 2023). One such study, by Nxumalo and Pacini-Ketchabaw (2017), examined children's care for Vietnamese stick insects in an early education classroom based on a pedagogy that embraced frictions and complexities as important dimensions of child-animal relations (see also Tammi *et al.*, 2023). Previous studies have shown that education can raise awareness of multispecies relations and engage children and their teachers in ethical acts of imagining and feeling *with* the world (Haraway, 2016; Van Dooren, 2023).

In our study, we aimed to contribute to an environmental education that can reimagine the strangeness and uncertainty of multispecies relations by centralising the lingering encounters between children and small animals. The Merriam-Webster online dictionary (n.d.) defines "lingering" as "being slow in parting or in quitting something," "remaining alive although gradually dying," "being slow to act," and "moving slowly." According to Rautio *et al.* (2022), unlearning through non-anthropocentric and re-storying requires temporally nonlinear research practices of "adding, complicating, slowing down and hesitating" (p. 223) during animal encounters that often generate affective intensities of conflict or awkwardness but also spaces for speculating on new futures. Similarly, Rousell and Peñaloza-Cacedo (2022) conducted research on "speculative immersion" with young children in Birrarung Marr in Melbourne, Australia to emphasise the importance of listening experiences and of letting more-than-human rhythms "lead the way" in pedagogical practices. In our study, the idea of lingering prompted speculative inquiry into what slowness, silences, and the affective rhythms of invertebrates and amphibians can teach us in environmental education.

We drew our pedagogical and methodological ideas from our previous research, which culminated in storying with children and teachers, about how invertebrates and other small animals sense their environments. Drawing on empirical examples from our one-year (2021–2022) ethnographic study in a Finnish primary school, we explored lingering as both a pedagogical approach to multispecies education and a methodological concept. Applying a relational ontology of "attuning-with" (Riley & White, 2019), we approached lingering as embodied and embedded mutual becomings of noticing and speculating that engaged with children's narratives regarding, as MacLure (2022) stated, "living, material things with force in the world" (p. 217). To do this, we re-turned to slow, lingering encounters between children, amphibians (caecilians and axolotls), and invertebrates (slugs, snails, and earthworms) that emerged during our research and asked: *What can lingering encounters between children, amphibians, and invertebrates perform or create, and what can we learn from the polyphonous affects and temporalities in these encounters?*

Next we will discuss the theoretical underpinning of our research grounded on lingering multispecies encounters and methodological inquiry of re-turning. In our study, re-turning involved an over-and-over becoming and intra-action with diffraction through autoethnographic multispecies re-storying and "slow" scholarships (Barad, 2017; Van Dooren *et al.*, 2016)—to reimagine and extract patterns of lingering. To underline research as materially entangled practices bound to complex flows of agentic movements, Barad (2007; 2014) defined diffraction through using the metaphor of water, sound and light waves that bend, overlap and spread out as diffractive patterns when encountering an interference or opening. Barad's analytical thinking around diffraction was influenced by Haraway's (1992) previously theorised understanding of diffraction as differences that affect and create relational patterns towards something new in the world. Similarly, re-turning as a recursive diffractive analytical practice, an intra-action with diffraction, directed our pedagogical and methodological focus on lingering with the interconnectedness between human and nonhuman phenomena (Barad, 2014; Murriss & Bozalek, 2019). After our theoretical section, we will discuss the context of our study that enters into amphibian and invertebrate lifeworlds. Lastly, we will re-turn to lively multispecies encounters as "lingering with temporal rhythms and life cycles" and "shifting embodied events" of children, researchers, teachers, amphibians, and invertebrates.

Lingering as attuning-with multispecies encounters

Recently, there has been a shift in research towards acknowledging the importance of embodied and embedded ways of knowing that expand anthropocentric methodologies and reach beyond human-centred inquiries (Rautio et al., 2022). Massumi (2015) defined attunement as an event that catches our attention through direct embodied reactions that enliven the event with which we are attuning. Attuning is therefore always affective and co-created despite us experiencing the same events differently. According to Haraway (2016), changing the storied reality around multispecies encounters is a process of “becoming-with,” which unfolds when bodies meet other bodies and linger in the current reality of living and dying on a troubled earth. Becoming-with is therefore a risky process of speculative fabulation—an ongoing narrative process of re-making and being open to the unknown and unexpected (Haraway, 2016). Each of these perspectives positions affective attunement within the vulnerability of human–nonhuman encounters and careful listening to the complexities created by ecosystems.

In this article, we relate lingering to the concept of “attuning-with” (Riley & White, 2019). Riley and White (2019) stated that attuning-with is an ongoing process of unconscious and embodied affective *enterings* that envelops different bodies and materialities and pulls them together. Deleuze (1995) described these enterings as a flow of movements and multiplicity. Therefore, although we perceive lifeworlds “through ourselves,” affective enterings are only possible through relationality, which pushes us to look and act beyond ourselves in relation to ecosystems. In our study, we conceptualised lingering as an embodied approach to attuning-with speculative spaces, frictions, and awkwardness in children’s narratives about more-than-human worlds (Byman et al., 2023; Renlund et al., 2023), but also as a sensuous experience that captivates children and prompts their attunement with materialities in local surroundings (Renlund et al., 2022).

We found lingering encounters with amphibians and invertebrates to be helpful in broadening our analytical focus to acknowledge the polyphony of temporal rhythms in more-than-human worlds. Hackett (2022) explained that understanding time as progress in education is a paradoxical, anthropocentric way of denying the rich relational and affective narratives that define children’s lifeworlds. Deleuze and Guattari (1987) claimed that all beings are becoming through assemblages of “longitude and latitude, a set of speeds and slownesses between unformed particles, a set of nonsubjectified affects” (p. 262). Thus, both human and nonhuman bodies are constantly becoming within affective encounters and rhythms of slowness and speed. Tsing (2015) emphasised that “each living thing remakes the world through seasonal pulses of growth, lifetime reproductive patterns, and geographies of expansions” (p. 21). Thus, thinking about temporal rhythms as relationally co-created affective enterings rather than as progress can make room for noticing new worlds in myriad presents (Hohti & Tammi, 2023) to foster a “nurturing and enriching” (p. 7) process that piles up messy middles and temporal re-turns during the research process. Child–animal stories always encapsulate multispecies relations through affective encounters that reach across ecosystems and include rivers, lakes, forests, plants, microbes, and other species. As Malone & Young (2023, p. 1206) emphasised, this thinking about connections and unbounded openings rather than progress extends the understanding of kinship and affective responses “across geographical time.”

Based on the idea of “lingering,” we re-turned (Barad, 2014, 2017) to the multiplicities that unfolded from noticing affective rhythms, enterings, and different lifeworlds that emerged when children, teachers, and researchers attuned-with invertebrates and amphibians. Re-turning acknowledges past, present, and future and how these parallel presents entangle when we remember mundane research events with multispecies kin. In our autoethnographic study (Hohti & Tammi, 2023; Malone, 2018), activities such as video recording, photographing, and storying allowed the researchers and children to linger with the diffractive patterns of knowing, not-knowing, and unknowing that they created. Thus, our creative inquiry was helpful for unsettling the anthropocentric, linear approach to the affective landscapes of invertebrates and

amphibians. Our article proceeds by looking back on and turning over and over our own research inquiry about lingering encounters (Malone, 2018).

Inquiring into amphibian and invertebrate lifeworlds

In our study, children aged 9–10 years old, with teachers and researchers, investigated and storied how invertebrates, amphibians, and other small animals sensed and were affected by their environments. Our pedagogy involved speculative inquiry about what the slowness and affective rhythms of small beings could teach children and us to notice, listen, and imagine in more relational ways (Deleuze, 2005). This inquiry took place in the children's local surroundings and classrooms and during school visits to a zoo. The project was conducted in a primary school in an urban area of Helsinki surrounded by forests, streams, and hills. We began the project in the late summer of 2021 by inviting the children to explore the local natural areas and to imagine and story the lifeworlds of invertebrates by taking videos and photographs of the various invertebrates they encountered near the school. We aimed to draw attention to the places and surroundings that invertebrates inhabit. A week later, the children revisited their video recordings/photographs with their teacher and us, the researchers. During these returns to the earlier events, we interviewed the children about their thoughts and previous encounters with invertebrates based on questions such as "Describe the event during which you took the picture or video of the invertebrate: what is happening in the picture?" This prompted attuning-with the invertebrates' experiences, such as the feelings the children imagined the invertebrates were having in the photos or videos. The children also attuned-with invertebrates' entanglements across ecosystems, including how they connected to other living beings and environments or the ways in which they were important for the environment. However, the children's storying was also entangled with other small animals, as our inquiry continued and new lines of flight emerged.

In October 2021, we visited Korkeasaari Zoo to give the children further time and space to dwell on embodied encounters with different invertebrates and small animals during a season when Finnish invertebrates generally hibernate for the impending winter. During the visit, we asked the children to imagine how the invertebrates and amphibians they encountered might sense, feel, and perceive their surrounding world. Korkeasaari Zoo houses 150 animal species and is situated in a unique Baltic Sea location on an island that is close to the Helsinki city centre (Korkeasaari Zoo webpage, 2023). The zoo was founded in 1889 and is one of the world's oldest zoos. The invertebrates at the zoo live in the Amazonia and Africa–Asia tropical houses and include the desert locust, nerite snail and Madagascar hissing cockroach. These houses also contain other small, often endangered amphibians, such as Mexican axolotls and caecilians. Inevitably, this visit and the other encounters during our ethnographic study with both invertebrates and amphibians required all of us to enter a space in which we attuned-with and learned from unfamiliar species and their lifeworlds. As Rautio *et al.* (2022) emphasised, multispecies ethnographic fieldwork is always entangled with this kind of "unknowing" and re-storying through previous experiences, obliging researchers to enter "low theory" spaces and diverse materialities.

After a week, we invited the children to fabulate about the invertebrates they had encountered in their local forest or other nearby places and linger with the small animals' ways of sensing and experiencing by working with clay, waste materials, digital tools, and other materials while reflecting on specific questions intended to provoke speculation about the invertebrates' lifeworlds. Following the teachers' guidelines to focus on invertebrates during the classroom activities, the children did not create stories around the amphibians that they had encountered during the zoo visit. However, our re-turning methodology revealed how the storying events during the zoo visit became crucial for us researchers, the teachers, and most importantly, the children. Therefore, our inquiry is directed into the lingering encounters of both invertebrates and

amphibians. Overall, “being slow” with the affective and sensorial movements across all these different phases of storying during our study invited the children to imagine, linger, speculate about and story the lifeworlds of invertebrates and amphibians. In the next section, we re-turn to the lingering encounters with invertebrates’ and amphibians’ temporal rhythms and life cycles to consider the shifting embodied events that manifested in the children’s storying practices.

Re-turning to lingering multispecies rhythms and encounters of children, invertebrates and amphibians

At the very beginning of the project, we interviewed the children in small groups. Many children spontaneously put emphasis on their awkward feelings regarding invertebrates, such as how invertebrates gave them shivers or their experiences of them as odd creatures who must be very afraid of other beings and how easily humans can kill them. Many children also emphasised the importance of invertebrates as pollinators or as part of an ecosystem, such as predators of other invertebrates and prey for other animals. We began to gather recent research showing that ‘beetles navigate by watching the stars’, ‘honeybees have feelings of happiness’, and ‘wasps can recognise faces’.

Exploring the invertebrates’ lifeworlds and affective landscapes that are frequently hidden from human understanding (Hohti & MacLure, 2021; Van Dooren, 2023) with the children obliged us to become comfortable with speculative and awkward atmospheres. Our first speculation about re-turning and re-reading as a diffractive methodology meant being touched by and touching the other-than-human world our research practices were entangled with. By giving space and time to re-turning to and re-writing research events as a process of intra-action with diffraction (Murriss & Bozalek, 2019) and acknowledging that on each occasion, we were facing the events anew, disrupted our assumptions about temporality, ethicality and different lifeworlds (Barad, 2019). Riley (2023, p. 51) explained diffraction as a deep-rooted spatiality in environmental education: “We know because our skin has met the porosity of Other(s); and thus, through this collaborative endeavour set in co-implicated entanglements, we are at the same time a little bit more and a little bit less.” Our study revealed glimpses of how attuning-with a multispecies education by photographing, video recording, and modelling the unfamiliar worlds and temporalities of invertebrates and amphibians constructed messy middles of knowing and not-knowing, resulting in affective responses to nonhuman species. In these encounters, we sensed rich and productive rhythms of silences and movements that provoked re-turning to and lingering with the strangeness, awkwardness, and grievance of encountering multispecies kin. Lingering with the hatching of Spanish slug eggs, a caecilians’ skin shedding, or an axolotl’s lifecycle to animate the sensorial world of invertebrates and amphibians attuned the children and researchers with the vitality and active openness of more-than-human timespaces.

Lingering with temporal rhythms and life cycles

In the following, we re-turn to events that invited the children and us to linger with the more-than-human nonlinear temporal rhythms of slugs and snails, after one of the children, named Kalevi (pseudonym) encountered and took a picture of a snail during the school visit to the local forest:

Kalevi, sitting next to the researcher, is working on his personal OneNote page and explains that one of his most memorable encounters with an invertebrate was finding a red slug under a bridge. This is followed by a long silence, during which Kalevi quietly makes notes and draws a

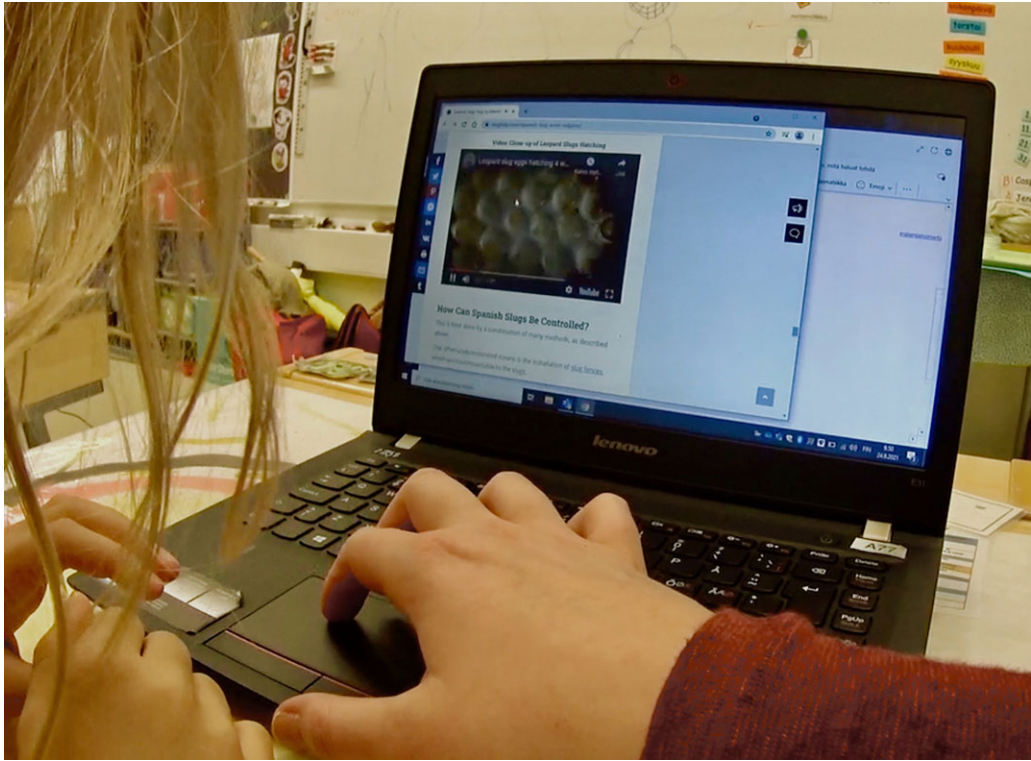


Figure 1. Delving into how Spanish slugs hatch.

picture of the encountered snail, picturing it with its shell. After this long silence, Kalevi erases the shell from the drawing and tells the researcher that he knows about an invasive species called the Spanish slug.

This event fostered an atmosphere of awkwardness, as the Spanish slug is an invasive species that has adapted to Finland's cool climate. Spanish slugs (or *Arion vulgaris*) threaten native ecological ecosystems by feeding on ornamental plants and other snails, and they are capable of self-fertilisation or crossbreeding. The snail is also widely described as a “pest,” and the measures for preventing its spread are to kill living snails or destroy their eggs. However, the main reasons for the species spreading are humans transporting soil and climate change, which have favoured its survival in northern Europe (Zemanova *et al.*, 2018). Van Dooren (2011) studied invasive species in Australia, stressed the risks of uncritical “too easy killing” of invasive species, and highlighted the problematic lack of research and understanding connected to these phenomena. Similarly, Mazhary's (2021) study showed that the language used to describe invasive species constructs a narrative that makes the invasive species less “grievable.” Furthermore, Gibbs (2020) and Mazhary (2021) claimed that building a deeper understanding of human–animal encounters, which are often entangled with killing, would mean further attuning-with a more-than-human perspective connected to death. Thus, closeness rather than distancing seems to be crucial in interactions with invasive species in multispecies research and child–animal practices in educational settings.

This lingering event was entangled with the current problems connected to climate change. However, during this event, Kalevi referred to a webpage he knew well that provided extensive information about Spanish slugs. During the event (Figure 1), the first author (JB) and Kalevi jointly explored the webpage about Spanish slugs, and his curiosity lingered on a short video of slugs hatching from eggs. Neither JB nor Kalevi knew how slugs or snails were born. Kalevi was



Figure 2. The figure is based on the authors' video recording "Rhythms of Woodlice, Ants and Jelly Fish" which can be viewed at journals.cambridge.org after publication.

excited and explained, "You can see small snails there [inside the eggs]. Look, they are getting bigger and hatching." Returning to the event and our field notes also raised an ethical question for researchers regarding the event. Leaving room for Kalevi's wonder, rather than summarily directing the discussion, might have left space for him to follow the beyond-human senses and feelings that usually remain hidden in child–slug encounters. Therefore, sometimes the uncertainties and awkwardness we face with children can become performative forces.

Re-turning to Kalevi's lingering with slugs hatching encouraged the researchers to further attune and linger with details, movements, and rhythms that could teach about more-than-human life cycles. JB lingered with moon jellyfish near the shore of Asplundet Island in the Sipoo archipelago in southern Finland in autumn 2022. She was fascinated by their movements and rhythms and stayed there for a long time. In September 2023, when the jellyfish returned to the same shore, JB re-turned to them by video recording them. By coincidence, and without being aware of the JB's storying, the third author (JR) explored, during the same period, the various invertebrates on a familiar beach on Lauttasaari Island in Helsinki. She placed her phone on record at different places and sat down to wait, curious to see what invertebrates turned up. The video recordings showed an ant and a couple of woodlice. Re-turning to and staying with these video recorded moments (Figure 2) together opened up vivid, diverse dimensions of lingering that helped us to attune-with the shifting temporalities of more-than-human life cycles:

First, while observing, JB lingers for a long time with the calm movements and rhythms of moon jellyfish. The differently sized jellyfish move with the rhythms of the sea and push to swim close to the rock surface. The colourful horseshoe-shaped gonads can be seen through the jellyfish's transparent skins. However, in JR's video, the woodlice and ants move more swiftly and determinedly among the vegetation on the ground, sometimes stopping and moving their antennae to observe the surface carefully.

As we further lingered with these encounters through our videos, we also found that the moon jellyfish gathered to reproduce during a couple of weeks between August and September and

Mauno: [Looking silently at the caecilian and then directing attention to a floating object on the right side of the aquarium.] What is that?
Juho: Is that plastic?
Researcher: What is that? Oh, it's quite peculiar! [excited tone of voice]
Juho: What is that? Perhaps it's plastic?
Researcher: Or is it some kind of jellyfish? Very strange; it does not quite look like plastic.
Juho: Well, no!
Researcher: A bit like something living. Or is it some kind of skin?
Juho: Or perhaps it is the caecilian's skin? [pointing with finger]
Researcher: Yes, I think it may be something like that?
Juho: [Longer silence while Juho reads the descriptive text on the side of the aquarium.] Nothing is written here [about skin shedding].
Researcher: How peculiar!
Juho: [Walks to the nearby sign about caecilians, reads it, and then moves in front of the aquarium and looks at the creature quietly for a moment.]



Figure 3. Children attuning-with and speculating about the strangeness of a caecilian's skin shedding.

were thus at the end of their life cycles, which affected JB's encounter with them. Jellyfish first enter a larval phase and thereafter develop into free-swimming polyps that eventually settle upside down on the slopes or undersides of stones, rocks, or other solid surfaces. For many years, Finnish biologists did not think that these jellyfish lived year-round in the Baltic Sea. We also explored the peculiar and individual rhythms of woodlice and ants. Woodlice hatch from eggs and grow inside a brood pouch in which the female woodlice carries them around until they are a few months old. Ants' offspring, on the other hand, go through a full metamorphosis, from egg to larva to pupa and then to adult ant, which takes up to two months. Thus, there are many aspects of invertebrates' childhoods that remain hidden from humans, and we seldom notice that each animal has a unique temporal rhythm.

Attuning-with invertebrates' lifecycles and movements in local environments allowed us to attune-with what Riley & White (2019, p. 268) described as events that "illuminate the lived existence of Other(s) through ourselves, in ways that discursive practices within the discipline could not." Reading these encounters through each other taught us the importance of entering multispecies education about more-than-human lifeworlds and childhoods through unique encounters.

A strange small animal's skin shedding can pull bodies together and push our thinking about lingering as an active informality and openness to more-than-human life cycles. The following seemingly minor event occurred in one of the tropical houses at Korkeasaari Zoo. Prior to the visit, we asked the children to think about how different small animals in the terrariums or aquariums sensed their environments and what was especially important for them in these environments. However, the children lived in the moment and let the events, the animals' movements, and the details lead their discussions. During this event (see Figure 3), Mauno and Juho encountered an endangered amphibian (a caecilian that had probably moulted). Together, the children and the researcher speculated about the origin of the transparent blue material floating in the water. The children first suggested that it might be plastic, but through discussion with the researcher, they concluded that it must be the skin of the caecilian:

The children also speculated about and entered affective spaces while video recording axolotls and pondering about the endangered animals' specific habitats and peculiar life cycles. Many of



Figure 4. Video recording an axolotl's movements.

the children were extremely excited to witness a moving and living axolotl in real life, as they were familiar with the small animal from the Minecraft game. The spontaneous movements and rhythms of the axolotl also helped the children enter affective dimensions. Two children, Kalevi and Samuel, first lingered in silence as Samuel video recorded the axolotls' movements. Thereafter, the axolotl (see Figure 4) swam up to the surface. Samuel stopped video recording and told the researcher, "They make this little sound when they go to the surface. They take a little breath there." After a while, Santeri, who had just joined the other children, shouted excitedly, "The axolotl lives in an eternal larval phase!" In this fleeting encounter filled with an intense atmosphere, the children were caught up and enchanted by the movement of an axolotl swimming past and going up to the surface to breathe. The event made the children linger for quite a long time with the animal and generated a discussion—a thinking-in-movement—with the axolotl's life cycle. Thereafter, the researcher and children together discovered that the natural habitat of axolotls is in a specific lake near Mexico City. Kalevi spontaneously expressed his desire for adult action to protect the animal: "They should expand the lake and quit building!" Thus, he highlighted the challenges that axolotls face when their lifeworlds entangle with human lifeworlds.

During these events which emerged from lingering with Spanish slugs in the classroom and encountering amphibians during the zoo visit, the children examined and attuned-with both invertebrate and amphibian lifeworlds through videofilmed material. For fleeting but intense moments, the children were attuning-with how different an amphibian's or invertebrate's childhood was from a human's childhood. Our re-turning to these lingering encounters with invertebrate and amphibian metamorphoses and childhood landscapes resonated with Malone and Crinall's (2023) claim that transformative spaces for critical hope and caring for natural worlds can be formed from the small and often unnoticed moments in children's encounters with nonhuman lifeworlds. Thus, these events posed critical questions about giving space to these lingerings by showing how combining lived experiences with video recording and storying can enrich our consideration of nonhuman childhoods in multispecies education (Tammi et al., 2023).



Figure 5. (Below) Kalevi creating a “dream landscape” for an earthworm and a snail; (Right) Kalevi’s created props for his stop-motion film from the school art exhibition; (Left) Liam and Oliver constructing the landscape and characters for the story about purpra, the hybrid earthworm.

Shifting embodied events

Next, we will re-turn to shifting embodied events when the children created habitats for their invertebrates that got entangled with places in the local surroundings they valued. During this phase of the project, the children used storying and stop-motion applications to create short stories about invertebrate adventures in the children’s personally valued local places. Prior to this phase of our project, the children had delved through drawing and modelling, with the fine details, characteristics, and sensuous landscapes of specific invertebrates that had captured their attention during the project. These sessions were filled with long silences and tinkering that enabled them to carefully imitate and move with the shapes and finer details of invertebrates. Between the sessions the children were also introduced more broadly by the teachers to the taxonomy of invertebrates, but during the actual sessions the main focus was on open-ended explorations around more-than-human lifeworlds and landscapes. However, the children’s taxonomic learning was indirectly supported during these sessions through information-gathering from books and internet resources and noticing specific invertebrates in their local environment. Both the researchers and teachers were also having spontaneous critical discussions and gave helpful advice to the children from where to look up information about different invertebrate animals.

Our understanding of different species and taxonomic science, draws on previous research within critical animal studies and multispecies ethnography (see Kirksey, 2015; Moore & Kosut, 2014; Rautio, 2017) which underlines all species as diverse, social and agentic beings. Thus, in this specific context of our study we wanted to underline encounters between humans, invertebrates and amphibians as mutual becomings which can reveal glimpses of an ontology in which non-humans act and perform (Kirksey, 2015; Barad, 2007). Furthermore, working with invertebrate landscapes with the children during our research in the classroom and during the short video filming events of amphibians during the zoo visit taught us how lingering as a pedagogical approach could support complexities rather than human/animal divides in multispecies research and practice. In the following event (Figure 5), Kalevi continued his project with slugs and earthworms and simultaneously discussed his experiences with the researcher:

Kalevi explains, while crafting the props for his stop-motion film, that his mother brought an empty Roman snail shell home from Estonia, which he found enchanting. As he tells the story, he placed the Roman snail into the habitat of an earthworm. Kalevi explains that similar snails can be found in Finland as invasive species because people originally brought them here as food snails. He explains excitedly that because of this, the snail is now part of the Finnish natural habitat. Long silences and tinkering fill the space between discussions. The discussion circles around topics such as how earthworms feed on dead animals, but mostly on soil, and that Kalevi wants to make his imaginative earthworm different—make it hunt for food. After finishing the project, Kalevi jumps excitedly a few times and explains that the earthworm could peek inside the snail's shell, which is the way many invertebrates seek food. In the stop-motion film, Kalevi made the earthworm playfully peek from the soil, picturing the earthly surroundings of the animal's lifeworld.

As Haraway (2016) has argued, affirmative ways of co-living and attuning-with can be crafted in multispecies research and practice without proximity (see also Malone & Crinall, 2023). This is also emphasised in the crafting events of our study. The children in our study seemed to value letting go and not touching living invertebrates. For a short period, one of the teachers, Emma, gathered invertebrates (mainly snails) in glass jars that were placed in the classroom for the children to observe. The teacher's pedagogical aim was to give the children time to observe invertebrates slowly inside the classroom. However, the children, including Kalevi, were most excited about releasing the invertebrates back into the habitats where they initially found them and observing the snails without interrupting their movements. In the teacher's video, Kalevi carefully places the snails on individual leaves and studies their movements. These events show the importance of multispecies education in fostering a non-anthropocentric approach that does not intentionally or unintentionally disrupt the natural movements and temporal rhythms of invertebrates, thus supporting more liveable-in common worlds.

The children in our study were also eager to create speculative storylines, such as in the following event, when Liam and Oliver were creating a storybook about a "hybrid earthworm" named Purpra. Liam eagerly explained how important he found the trees in his former backyard and how he became familiar with a specific tree named the "Liontree," which he liked to visit when he wanted to relax. The Liontree was also important for Liam the last time we interviewed him in 2020, when he showed a strong attachment to this specific place. Oliver, however, found the hills close to the school important because earthworms can live under rocks where there is porous soil. Liam and Oliver's co-creation project was situated in an imaginative landscape that combined the children's important places in the local environment. By attuning-with both important local places and the sensory details of earthworm's lifeworlds, the children co-created an imaginary environment that entangled what Haraway (2016, p. 130) described as the narrative practices of "visiting." In such practices, space is given "to venture off the beaten path to meet unexpected, non-natal kin, and to strike up conversations, to pose and respond to interesting questions, to propose together something unanticipated, to meet the unasked-for obligations." Thus, when Liam and Oliver were given the freedom to create an imaginative story situated in a landscape that was important for them, their story entangled the children's understanding of complex phenomena, such as the ongoing COVID-19 pandemic, human struggles and risks in "controlling ecosystems," and the diversity of different ecosystems:

One night, a previously unseen earthworm hybrid was noticed near the school, so the humans returned it to the natural environment using special equipment. Six years later, everyone had forgotten about it, and the earthworm continued to hunt for smaller animals, but one old man did not forget about the animal, because he was the one who released the creature. He looked for the hybrid earthworm for two hours. He took it home and learned that it did no harm, so they became best friends.

Unlearning and reconfiguring attunement through lingering encounters

In this study, we have re-turned to slow and lingering encounters between children, amphibians, and invertebrates that emerged during our ethnographic research in a Finnish primary school. Using the dual lens and multi-point consideration of lingering as a pedagogical and methodological approach, we wanted to explore the possibilities of a multispecies education that delves into the polyphony of affects and temporalities in child–invertebrate–amphibian encounters and discover what these encounters revealed. In our study, lingering was also a way to bring pedagogical practices of attuning-with to the centre of multispecies research and practice. In this study, we drew on previous research, including our own, emphasising that children’s noticing and collective care for the uncertainties of today’s socioecological world can open up new avenues for thinking about multispecies relationalities (Kumpulainen *et al.*, 2021; Malone & Tran, 2022; Malone, 2018; Rousell & Cutter-Mackenzie-Knowles, 2022).

Re-turning to encounters of lingering opened up avenues for us as researchers to unlearn from children’s attentiveness and creative worlding practices. The children’s attuning-with invasive species and endangered amphibians pushed us, in Barad’s (2017, p. 86) words, to realise that “what makes us human is not our alleged distinctiveness from – the nonhuman, the inhuman, the subhuman, the more-than-human, those who do not matter—but rather our relationship with and responsibility to the dead, to the ghosts of the past and the future.” In line with posthuman research (Jukes, 2021; Van Dooren, 2023), we want to invite educators and educational researchers to unlearn and story differently and creatively with children around such difficult and complex questions. We acknowledge that invasive species have a diverse impact on endangered species, biocultural loss and that these animals always become entangled with a unique situatedness of specific ecosystems and places (Jukes, 2021; Van Dooren, 2023). Thus, as educators and researchers in environmental education we need to notice more and dare to listen to the awkward topics and dimensions that arise from children’s spontaneous willingness to speculate and to attune-with ecosystems as unique and complex landscapes and entanglements (Jukes, 2021). These ethnographic observations and spontaneous discussions with children also connect to what Nixon (2011) calls the “slow violence” that is entangled with the extinction of animals. The children in our study reacted to violent phenomena that entangled to “the long dyings” of species across generations (Nixon, 2011, p. 2). These narratives challenge us to call for further research on how we can push the dialogue in a thriving or unlearning direction rather than an invasive and threatening one.

The fine details unfolding in the children’s speculation on more-than-human life cycles, childhoods and sensuous landscapes raised awareness and reconfigured attunement with invertebrates and amphibians that did not emerge through linear temporalities. Rather, these events emerged through shifting embodied events that encompassed encountering the strange anew. The crossings of different lifeworlds in these encounters resonates strongly with previous multispecies research that defines multispecies kinship as “reciprocal, situated, tying human beings to other kinds of animals and plants . . . and to the wider seasons and patterns of Earth and the cosmos” (Van Dooren & Chrulaw, 2022, p. 2). Lingering as a pedagogical and methodological approach in this study has meant that the researchers and the children both explored more traditional taxonomy, relying on books and online resources, and moved with and within embodied, affective and open-ended relational practices. Our autoethnographic re-turning with children’s storying also reveals glimpses of what Lloro-Bidart (2018, p. 29) underlines, how “it seems contradictory, after all, to teach students that they should care for the environment and other living entities while simultaneously labelling some nonhuman others as completely outside our spheres of care.” Kirksey (2015) has previously acknowledged that there are many unknown dimensions of how our human lifeworlds are affected by and affect other species, which holds a potential to further unlearning from and attuning-with those more-than-human beings and human–nonhuman interdependencies that seldom are given attention or voice in environmental

education and research. Importantly, re-thinking and re-storying child–invertebrate–amphibian encounters became in many ways in our study a storying of more-than-human childhoods and metamorphosis, such as when Kalevi lingered with the hatching of snail eggs. Thus, the children’s stories about invasive and endangered species, introduced a critical edge and affirmative questions that expanded human and nonhuman childhoods as moving, connected, and co-created (Tammi et al., 2023). These events show the opportunities, novelties, and challenges that emerge when we embrace multispecies research and pedagogical practices that considers beyond-human childhoods and lifeworlds. Currently, in both research and educational settings, the more-than-human childhoods of invertebrates are seldom valued or examined in detail (Tammi et al., 2023). Through our research, we invite and encourage education researchers to linger with and closely observe the multiple, unique, and interwoven stories that each small animal has to tell.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/ae.2024.20>.

Acknowledgements. We warmly thank all the children and adults who participated in this study. We are also grateful to the researchers Vilma Lehtoranta and Noora Oksa for their contributions to the data collection.

Financial support. This research was funded by the KONE Foundation, grant number 202008316 (Kumpulainen, Byman, Wong, and Renlund); the Maj and Tor Nessling Foundation, grant number 202100303 (Renlund); and the Academy of Finland, grant number 339458 (Kumpulainen, Byman, Wong and Renlund).

Ethical standard. This study follows the ethical standards of the Finnish Advisory Board on Research on Integrity (<https://www.tenk.fi>) and was reviewed and approved by the Education Division of the City of Helsinki (HEL 2019-008574 T 13 02 01). Informed consent was obtained from all participants and the children’s guardians. Pseudonyms were used for all participants.

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Cite this article: Byman, J., Kumpulainen, K., & Renlund, J. (2024). Lingering with Multispecies Kin: Re-Turning to Encounters between Children, Invertebrates and Amphibians. *Australian Journal of Environmental Education* 40, 157–171. <https://doi.org/10.1017/aee.2024.20>