

Attributing Human Traits to Other Species as Alignment Work: Exploring Possibilities of a Terrestrial Knowledge Production

Emilie Moberg

Department of Child and Youth Studies, Stockholm University, Sweden/ emilie.moberg@bu.su.se

Abstract

Against the backdrop of human-induced climate change and severe biodiversity loss, feminist technoscience scholars stress the need for movements towards less anthropocentric knowledge production processes. The present paper delves into the alignment work involved in striving to coordinate and align human-centred epistemic cultures and epistemic cultures centring other species. In an early childhood education site, children, teachers, materials, imagination and the attribution of human traits to snails are elaborated on as key actors. In a literary fiction site, also referred to as environmental imagination, texts, choices of literary style, scientific facts and the attribution of human traits to eels, are featured as actors accomplishing alignment work. The paper argues that adding the concept of the terrestrial to the analysis of the alignment work, as proposed by feminist technoscience scholar Donna Haraway, makes other aspects and versions of non-anthropocentric or less anthropocentric knowledge production processes visible. The paper adds to STS-discussions on alignment work through highlighting alignment work processes as political, power-producing processes, which privilege certain interests while downplaying others.

Keywords: Anthropocentrism, Knowledge production, Alignment work, Feminist STS

Introduction

The species richness on earth is acutely diminishing. One million of the earth's 8 million species are threatened; 500 000 plants and animals and 500 000 insects (IPBES, 2019). Feminist technoscience scholars, among others, have pointed out the inherent anthropocentric standards at work in knowledge production on bio-diversity, morphology and inter-species relations (Haraway, 2016; Tsing et. al, 2017; Åsberg, 2017). For example, Anna Tsing and Donna Haraway call for a greater acknowledgement of local knowledge production

in which intimate relations between technology, humans and other species are played out (Tsing et. al, 2017, Haraway, 2016). Similarly, scholars drawing on critical animal studies and post-humanist theories claim that anthropocentric standards in for example educational contexts, contribute to objectifying animals (Geerdts, 2016a; Pedersen, 2021; Spanring, 2017). Pedersen (2021), for example, borrows Haraway's (2008) term 'human exceptionalism' to describe how the infrastructure of Western formal education works through anthro-



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pocentric standards privileging human interests while marginalising other animals and species. In this paper, I will delve into the alignment work involved in coordinating a human-centred epistemic culture and an epistemic culture centred on other species (Knorr Cetina, 1999; Kruse, 2021). In particular, I will focus on the common habit prevalent in early childhood education as well as fiction literature of attributing human traits to other species and examine the question of whether this could be conceptualised as part of the relational work aligning the epistemic cultures.

Two empirical sites are chosen as particularly productive and relevant when elaborating on the attribution of human traits to other species as alignment work. The first site considered is a Swedish early childhood education site. In early childhood education practices, the attribution of human traits to animals is a daily occurrence, whether applied as a teaching strategy or evolving in children's informal encounters with worms, ants and currant snails in places in and around the preschool (Moberg and Halvars, 2022; Thulin, 2011). The second site considered is adult fiction literature mixing scientific knowledge on animal morphology with fictional, personal accounts added by the author. The literary style of applying human traits to animals, and recently also plants, is well-known within the genre of children's books but is also recognised as an adult literature genre, which has expanded in recent years (Candeias, 2021; Carson, 1952, 1952, 1956; Svensson, 2019; Wohlleben, 2016). In the paper, I will focus on the fictional and scientific descriptions of eels in the book 'Under the Sea-Wind' written by marine biologist Rachel Carson (1952). Carson could be seen as a pioneer in the field of literary fiction that has been referred to as environmental imagination (Slovic et al., 2019).

Drawing on feminist STS, I will pose the question of what happens to the analysis of alignment work when adding the concept of the terrestrial to the analysis. Haraway (2020) brings forward the concept of the 'terrestrial', which means 'earthly' or 'earthbound'. The concept points to the way humans have become increasingly alienated from earthly and ecological processes. Moreover, it directs attention to the need for humans to "get down to earth" in terms of considering the unique

and particular living conditions of species other than the human (Haraway, 2020). The concept of the terrestrial is not focused on eliciting what works to keep epistemic cultures aligned with one another, but rather has a feminist, political edge to it. Ultimately, the concept acts to show that alignment work is never value neutral. In the paper, the concept will be used to shed light on the way human needs and viewpoints become privileged in knowledge production processes.

I will argue that the alignment work I analyse, in which the attribution of human traits to other species works as a crucial component, is activated in (at least) two ways in the empirical sites. First, the alignment work is accomplished through *keeping a human-centered position intact*, where the human superiority and the human power to act in relation to other species is stabilised as a springboard for the knowledge production processes. Second, through putting the concept of the terrestrial to work, the analysis shows that the alignment work is performed through *altering a human-centered position*.

The altered human-centered position suggests that human vulnerability and dependence in relation to other species is stabilised as the basis for knowledge production processes. In previous studies, blurring the boundaries between the human category and other species is taken as a necessary component of non-anthropocentric knowledge production. The present paper troubles and expands this argument through claiming that a terrestrial knowledge production rather relies on re-centering the human category while exposing its vulnerability and dependence on the world's ecological systems.

Theoretical framework: alignment work, seamlessness and the terrestrial

The concept of alignment work (Kruse, 2021) will be used in the present paper to shed light on the coordination and formation of infrastructures striving to align a human-centered knowledge culture/world with a world populated by other species. Kruse (2021) draws on the concept of infrastructure sensibilities to grasp the way the criminal justice system supports and enacts the

stability of knowledge objects' across epistemic cultures. The theoretical framework put to work in the present paper relies on Kruse's (2021) conceptualisation of alignment work in terms of sensitivities to infrastructures and what these infrastructures accomplish in terms of the coordination of epistemic cultures. She notes that the stable movement of knowledge "is the result of *infrastructuring*, of its continuous creating of conditions that facilitate movement and create and re-create stability" (Kruse, 2021:14).

Kruse (2021) describes three sensibilities she wishes to focus on. The first is the sensibility to standards. Kruse (2021) argues that standards require work of maintenance and this work of maintenance is what she refers to as 'alignment work'. Along the same lines, Vertesi (2014: 277) emphasises that sites of knowledge production most often turn out to be 'multi-infrastructural environments'. The concepts of seams, seamfulness and seamlessness could then help, she argues, in addressing "actors' work to produce a shared experience of seamlessness, despite each infrastructure's unique and even conflicting distinctions". In order to address this work, Vertesi stresses, the analyst must focus on the micro activities which assembles actors in 'moments of alignment' (Vertesi, 2014: 268). The point of this is not, she notes, to outline stable assemblages but rather to "suggest that there are many possible ways to patch multiple systems together into local alignment" (Vertesi, 2014: 269).

In the present paper, I will conceptualise alignment work as the maintenance work carried out by many different entities to allow for moments of seamlessness or alignment to become produced in relation to different epistemic cultures (Kruse, 2021; Vertesi, 2014). Importantly, as Vertesi notes, when it comes to studying and analysing 'infrastructural seams', "the analyst witness things come together, and apart, and together, and apart again" (Vertesi, 2014: 269). Pointing to the precarious nature of these seams, Vertesi (2014: 277) further notes: "As a guiding metaphor, seams draw our attention to those places where multiple infrastructures are stitched together to achieve fleeting, nonstable, even ephemeral moments of alignment". Vertesi (2014) adds to the theoretical framework of the paper

through her focus on the micro activities, as exemplified in the paper through the two examples of human encounters with other species. The focus on micro activities makes more and other actors visible as part of performing alignment work. Moreover, the focus on micro activities makes it possible to shed light on nuances in the alignment work.

As part of the conceptualisation of the attribution of human traits to other species as alignment work and moments of seamlessness, I will use Donna Haraway's (2020; see also Bruno Latour, 2017, 2018) concept of the terrestrial. The notion of terrestrial means 'earthbound' or 'earthly'. Haraway (2020) argues that humans for a long time have viewed themselves as close to independent of nature, which implies that the whole range of human vulnerability and dependence has been denied. The concept of the terrestrial highlights the need for humans to "get down to earth" in terms of considering and acting from the unique and particular living conditions of species other than the human (Haraway, 2020). The concept of the terrestrial will be used to calibrate how movements *away from* or *towards* the earth could work as components of the alignment work in the specific sites activated in the paper. Thus, Haraway presents the concept of the terrestrial as a methodological tool to point to the ways in which humans could be seen as becoming increasingly alienated from earth. Haraway (2020) notes that the terrestrial involves acknowledging the living conditions of all species, not the least the human species, in relation to questions of life and death. Ultimately, she argues, this makes it necessary for the human species to learn to live with the insights and knowledges about their own mortality and vulnerability in the ecological system.

The concept of the terrestrial has encouraged me to include bodily movements as well as experiences of dependence and relevance as actors that become active in the alignment work through different compositions. Using the concept of the terrestrial in analysing the knowledge infrastructures in the two empirical sites moreover reveals what is produced in terms of (non-) anthropocentric knowledge production in ways that point *both*

to human alienation from earth and movements towards the earth and the terrestrial.

In contemporary versions of feminist theory and feminist STS, the critical studies of categories of man and woman have been complemented with studies of other categories. Categories such as nature and culture help direct critical and analytical attention towards the ways in which animals, plants and fungi are considered as less important actors in relation to the taken-for-granted centered human (Åsberg, 2017). This analytical position allows me to show that alignment work is never value neutral in terms of whose interests and privileges are reproduced or stabilised. This political and feminist edge of the analytical approach also calls for epistemic terrestrial cultures that produce a human position that realises and acts from its vulnerability and dependence on other species (Haraway, 2020). In this sense, the concept of the terrestrial adds to STS-discussions on alignment work through highlighting alignment work processes as political, power-producing processes, which privilege certain interests while downplaying others.

Previous research: pedagogic and literary strategies of aligning epistemic cultures

In relation to the two empirical sites chosen for the paper, I draw on previous research from the disciplines of literature studies and education studies. Previous research in literature and education has approached the study of inter-species relations and the attribution of human traits to animals from different methodological and theoretical angles. The phenomena have been addressed in terms of children's early biological reasoning, children's connections with animals as well as educational strategies for making children 'become-with' animals and other species. The first group of studies presented in this section are performed in an early childhood education context. These studies pay attention to pedagogic strategies in terms of attempts of aligning a human-centred epistemic culture with a knowledge culture where other species are the main protagonists. This group of studies will be referred to as post-humanist studies. Next, I have chosen to include a

group of studies that attend to anthropomorphic descriptions of animals as literary strategies of aligning epistemic cultures in children and adult literature. This group of studies will be referred to as part of the fields of ecocriticism and environmental communication.

Post-humanist studies within early childhood education

Within childhood and early childhood education studies, children's relationships with non-human species have been addressed in terms of political, methodological and pedagogical concerns (Kraftl et al, 2020; Moberg and Halvars, 2022; Sjögren, 2020). Drawing on two multispecies ethnographies within the authors' Common World Childhoods' Research Collective, Taylor and Pacini-Katchabaw (2015) describe encounters among young children, worms and ants in Australia and Canada. The study aims at illustrating the way these encounters involve paying close attention to inter-species relations and the way human mortality and vulnerability is deeply connected to other species, in this case worms and ants. Ultimately, Taylor and Pacini-Katchabaw (2015) argue that these entanglements and vulnerabilities with other species can work as productive starting points for learning *with* rather than *about* other species. This in turn, the authors argue, can assist us as humans in the necessary endeavour of rethinking our place in the world's ecosystems.

Using the extinction of the species of bees as an example, Weldemariam (2020) raises possibilities of children 'becoming-with bees' in his study performed in an early childhood education setting. The study highlights the way the processes of becoming-with the bees trigger children's response-abilities and emotional, affective responses to the extinction of bees. In the study, Weldemariam (2020) argues for a shift in sustainability pedagogy from anthropocentric ways of caring for nature as an external object towards perspectives of 'becoming-with-nature', which foregrounds humans as part of nature. Haraway's (2008) concept of 'becoming-with' is connected to the way she points out that being human is intimately tied to multi-species others. Haraway (2008) describe that we, as members of

the human species, are entangled in a biological and ecological web with numerous non-human species. The concept of 'becoming-with' entails an acknowledgement of these co-constitutive relationships between species. In Waldemoriām's (2020) study, the notion of 'becoming-with' pinpoints the interdependence between humans and non-humans. In this sense, his study points to the way humans and non-humans "share agency and become together while influencing each other" (Waldemoriām, 2020: 395).

Ecocriticism and environmental communication

As an example of a study within the area of ecocriticism and environmental communication, Hübben (2017) investigates the visual and verbal representations of animals in a selection of commercial picture books for preschool children. Using a theoretical framework grounded in Human Animal Studies (HAS), and more specifically literary animal studies, Hübben (2017) analyses the representation of human-animal interactions and relationships in the different literary contexts. She specifically notes the function of anthropomorphism and how it matters for how the reader values the animals in the books. Hübben (2017) concludes her study by claiming the potential of the human features in the books to challenge species boundaries and disrupt human-animal dichotomies.

On a similar note, but in the field of cognitive psychology, Geerds et al. (2016a) have performed a study of children's storybooks about animals and the way these books present animals and biological facts. The study asks whether these books and their depiction of animals may support early developing biological reasoning or support anthropocentrism through human-centred, psychological information. They concentrate on types of causal explanatory information that are provided to children in relation to two biological concepts; biological inheritance and the transmission of illness. Geerds et al. (2016a) conclude, contrary to Hübben (2017), that the information in the books almost exclusively focused on social-emotional experiences as opposed to biological explanations, which they argue may encourage children's anthropocentric reasoning. In an exper-

imental intervention study Geerds et al. (2016b) focus on storybooks featuring animal characters (frog, butterfly, and bird) designed to teach children about camouflage. In this study, however, they conclude that the presentation of anthropomorphic animals that more closely resemble real animals may enhance children's connection with and attention to animals. This, in turn, might lead to an increase in factual biological reasoning.

Also within the research area of ecocriticism and environmental communication, Beudel (2019) presents an analysis of Rachel Carson's mission of conveying scientific knowledge to a broad audience. Beudel (2019) underscores the importance of wonder in the writings of Rachel Carson and delves into what it meant for Carson's texts.

For Carson, wonder was many things: an ethical orientation; a mode of enchantment; a method of analysis demanding a special kind of attention to ecologically driven relations; a mode of critical intervention into more conventional practices of science that separate subject and object in experimentation and have proved environmentally disastrous (not least, atomic science and its ethos of mastery over nature); and a pathway to a sense of individual wellbeing. (Beudel, 2019: 265)

Beudel (2019) notes that Rachel Carson's writing contained a close interrelationship between wonder and scientific enquiry. Her mission was to introduce non-scientific audiences to a world that natural scientists already recognised to "be full of wonder" (Carson, 1953: 95). A vital part of her role as a writer, then, was to not only translate but also facilitate the same mode of curiosity about the world for non-specialist and non-scientific audiences.

If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. ... Once the emotions have been aroused—a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration or love—then we wish for knowledge about the object of our emotional response. (Carson 1952: 95)

Moreover, Beudel (2019: 292) notes that Carson's writings lean towards a mode of 'enchantment'

but also a loyalty with modern science's mission to bring order into the causes of things or to make "investigation into the unknown" (Oreskes, 2003: 699). In this sense, as Beudel (2019: 296) points out, Carson insisted on "a very particular fusion of scientific accuracy and vivid imagination, which was quickened in a strikingly visual way by scientific fact".

To conclude, the above selection of previous research points to different theoretical and methodological ways of studying inter-species relations and the attribution of human traits to animals as phenomena in literature and education. A common theme in the studies is that they in different ways propose more dissolved boundaries between humans and other species (Beudel, 2019; Geerds et al., 2016b; Hübber; 2017; Taylor and Pacini-Katchabaw, 2015; Waldemeriam, 2020). Adding to these above presented approaches to inter-species relations and the attribution of human traits to animals, the current study will address the phenomena in terms of alignment work. Through applying the concept of alignment work together with the concept of the terrestrial, the present study aims to highlight the multiple and seemingly contradictory possibilities involved in the phenomenon of attributing human traits to animals in education and literature. This involves possibilities of *both* promoting and suppressing anthropocentric reasoning.

Methods: tracing the alignment work striving to accomplish the coordination of epistemic cultures

The empirical materials for the present paper consist of examples from two specific empirical sites chosen due to their particular relevance when it comes to activities of attributing human traits to other species. The empirical materials in each site consist of texts, however produced through different means. In the early childhood education site, the empirical material consists of cut-outs from the transcripts from my and two co-researchers' participation as researchers in a group discussion on climate change and didactic strategies in a Swedish preschool context. The group discussion was not arranged by us as researchers but was a part of a series of meetings on the theme of didac-

tics, weather and climate arranged as a cooperation between a university and local preschools. Due to the situation with Covid-19 these conversations took place on the e-meeting service Zoom. The 15 participants were divided into three breakout rooms on Zoom, and me and the two other researchers participated in one room each. Sound recordings of 45 minutes were made from each room and the transcripts made from these recordings add up to 50 A4 pages.

For the literary site, the empirical materials consist of text vignettes picked out from a book written by Rachel Carson. I have chosen cuts from Rachel Carson's (1952) book *Under the Sea-Wind*. There were other potential texts to use as empirical materials, such as Patrik Svensson's book *The Gospel of Eels* (2021), Peter Wohlleben's book *The secret life of trees* (2018) and Matt Candeias book *In Defense of Plants* (2021). For example, in the book *The secret life of trees*, Peter Wohlleben describes trees' abilities to feel, smell, taste and communicate, with the specific help of underground mushrooms and underground branch systems. The particular qualities of Rachel Carson's text in the book *Under the Sea-Wind*, in relation to the aims of the present paper, is that she combines her scientific knowledge as a marine biologist with imaginative, fictitious textual descriptions. This is particularly interesting in relation to the concept of alignment work. Carson's texts provide possibilities of analysing the way these different kinds of knowledge formations, i.e. the scientific and the imaginative, work as effects of this combination.

I am not using the concept of a site to claim an objectively identified place that exists outside of my researcher engagements or outside of the aims formulated as part of the present paper. Rather, the concept of a local site refers to the particular cuts in terms of texts and transcripts that I have chosen to use in order to render the alignment work in relation to the two epistemic cultures in these sites visible (Barad, 2003; Bodén, 2017). In the Swedish early childhood education site, I took an active part of the discussion in my role as a researcher. I was thus present as a researcher in the conversations, through bodily expressions, gestures, mimics and verbal input. In the previous group discussion meeting, the participants had read and discussed texts written from

a post-humanist perspective, troubling anthropocentric forms of knowledge production in an early childhood setting. These texts and the participants' responses and discussions triggered by the text also took part in producing the empirical materials (Moberg and Halvars, 2022).

The first site: snails, children and teachers in Swedish early childhood education

Since 1997 the Swedish preschool institution marks the first step in the Swedish school system, which makes it a key arena for the provision of children's first encounters with science knowledge content. In this context, science knowledge content, unlike disciplinary knowledge, refers to science in terms of a teaching content in Swedish preschools, regulated by the Swedish preschool curriculum (1998/2018) and formed by teachers and children in local preschool settings.

The Swedish Preschool Curriculum (Skolverket, 2018: 15) urges preschools to provide each child with the conditions to develop "an understanding of relationships in nature and different cycles in nature, and how people, nature and society affect each other". In spite of this call for children and teachers to attend to nature and non-human species, the curriculum text is an intrinsically anthropocentric document, due to the strong focus on teachers, children and human learning.

The Swedish preschool curriculum is also a non-standardised document, by international comparison. This means that the broad goals, such as the one referred to above, in the curriculum needs to be discussed, interpreted and enacted by preschool teachers in local preschool settings. Thus, the preschool teachers become crucial actors in this creative work of translating the curriculum text into practical didactic choices and activities (Moberg, 2017, 2018). In the current paper, the Swedish preschool institution will be addressed in terms of a material and discursive site for science subject knowledge production in general and knowledges of the living conditions of snails in particular.

In the group discussions among preschool teachers and preschool leaders that I took part in as a researcher, the question of what seems to be especially relevant issues for children when it

comes to weather and climate, was raised. One of the preschool leaders describes an activity in a preschool that comes to mind.

This makes me think of a project at a preschool that I came to hear of. A group of children were studying and exploring snails. Then they saw that there were snails being run over by cars and started thinking, like how could we save the snails? What can we do? The children were about 2-3 years. And they started thinking about the snails, what could you do and so on. And then the children came up with the idea that they could put up small signs for the snails, because they wanted to make the snails attentive to the danger of the cars. And they made the signs and put them up at the place where they had found the dead snails.

The preschool leader goes on to talk about children's experiences of action competence, about moving from observation to action.

This thing about action competence, to experience that you have action competence, to experience that you are allowed and can make a difference. I think that is an important experience and knowledge that children need. To get the experience as a child that you could do things and make a difference. To feel satisfied as a 3-year-old, I put those signs up, this makes questions about weather and climate become relevant for children. The situation with the snails triggered feelings in the children and made it feel relevant for them. Because I think if children don't find questions of weather and climate and nature relevant, it does not make sense for them to work with these issues in the preschool, it does not feel urgent for them.

Beside the relevance needed the preschool teachers also raise the ability needed by preschool teachers to listen to children's questions and challenge them towards actions:

This is what is so fundamental, in my view, in order to hold on to issues that engage children and get them to understand and so on. Because if it isn't relevant to them, why should they be doing it at the preschool? So, it's really important that we find out and listen to their questions. And then it's also important to note that children get experiences from acting and making a difference. And I'm thinking that is important as they grow

up and become adolescents and encounter all the difficult questions, that you can make a difference in small matters, to bring with you that you have a competence.

Apart from emphasising the ability to listen and respond to children's questions, the quote above also stress children's experiences of relevance and of making a difference.

Alignment work through an intact human position

To begin with, I will focus the analysis on the way the snails in the first excerpt described above become attributed with human traits. The description of the children and the snails above made by the preschool leader could be claimed to illustrate the position of describing nature in human-like terms. When relating to the snails as non-human species, human abilities are used as starting-points - the cognitive, affective and bodily abilities of fear, the ability to read and produce memories.

The description of children's activities of making signs to save the snails could be seen to materialise a distance between humans and non-human species. The ideas and actions by teachers and children involved in attributing the snails with human abilities could be interpreted as keeping the human-centred epistemic culture intact. This means that human-like abilities become privileged in the knowledge production process, which simultaneously renders the unique species-specific capacities of snails invisible. Drawing on Kruse (2021) and Vertesi (2014) these micro activities could be described as achieving an alignment of the human-centred epistemic culture and the epistemic culture centring other species. In this case, the alignment is accomplished through the reinforcement of the human-centred position.

Thus, the attribution of human-like qualities to the snails could be interpreted as aligning the epistemic cultures through allowing the human to remain as the main protagonist. This could be considered as an example of alignment work that reinforces a human-centred epistemic culture while at the same time creating the impression that the position of the snails has been altered

and even centred. The human category and the human agency are still used as the starting point for the actions described in the example. However, the attribution of human traits to other species makes it appear as if the different epistemic cultures work together in a way that make the seams (Vertesi, 2014) between them hard to detect. Consequently, the reinforcement of the human-centered position produces moments of 'seamlessness' (Vertesi, 2014: 277).

Alignment work through an altered human position

Adding the concept of the terrestrial to the analysis forced me to consider other actors and moments as part of the alignment work. This makes for other kinds of effects in terms of possibilities of non-anthropocentric or at least less anthropocentric knowledge production processes. For example, Haraway's (2020) insistence on how bodies and materiality become active in a terrestrial knowledge production becomes important in the analytical work. To start with, teacher's movements of directing their visual, bodily and emotional attentiveness towards the snails need to be considered as actors in the alignment work.

Moreover, children's activity of making the signs for the snails could be analysed as micro activities where actors produce experiences of getting closer to the living conditions of snails. For example, children's bodily actions of placing the signs on the ground level, closer to the earth than needed if the signs were aimed towards other humans, are actors that need to be considered. In this sense, the analysis of the alignment work involves the human attention to and empathy with the snails' vulnerability and living conditions. In the cuts describing children and teacher's engagements with the snails these existential questions of life, death and vulnerability become actualised as part of the alignment work coordinating the epistemic cultures.

However, unlike the alignment work described in the previous section, the aligning efforts by different actors focused in this section changes the human position. This change consists in embracing human vulnerability and dependence on other species. Thus, when adding the concept of terrestrial to the analysis, the attribution of

human-like qualities to the snails could be interpreted as aligning the epistemic cultures through changing the human position.

In addition, the notion of relevance is crucial in the teacher's story of children wanting to save the snail. As the teacher refers to the notion of 'relevance' this could be conceptualised as children's intuitive feeling of being humans depending on the earth and on the snails. This intuitive feeling connects to feelings of vulnerability and dependence, potentially providing the bodily imperatives to rescue the snails. This changes the human position through creating new associations to human agency and the exceptionalism of the human. The concept of the terrestrial directs attention to the possibilities of altering the category of the human into also acknowledging questions of their own vulnerability and dependency in relation to nature and other species. This unsettles the assumption of the human as all-knowing, powerful and the obvious center point of attention.

This could be seen to imply a movement towards a terrestrial science teaching content in early childhood education centring the living conditions and agency of snails while also centring the vulnerability of human actors (Haraway, 2020; Kruse, 2021).

The second site: eels in literary fiction

The attribution of human traits to foremost animals in children's literature is renowned, to such an extent that it is difficult to find a children's book that does not in any way involve human-like animal characters, such as ants sleeping in bunk beds or going to school. However, the same feature in adult fiction literature is not nearly as visible and widespread.

Sometimes referred to as a genre of environmental imagination, the American author and marine biologist Rachel Carson can be said to be one of the pioneers in the genre and in her book *Under the Sea-Wind* from 1952 she depicts marine animal characters in the first person. Carson's literary ambitions are not only to depict animals in human and fictive terms. She uses her marine biological scientific knowledge to try to combine

this knowledge with imaginative accounts of the marine animals. In this sense, she uses anthropomorphism as a literary method.

Svensson (2019: 99) points out that the eel in Carson's book is "a creature that feels and experiences events, who remembers her past, who suffers and loves". Moreover, Svensson (2019: 99) notes that within the scientific discourse of marine biology the method of anthropomorphism is a controversial enterprise. The method is frowned upon by 'real' marine biologists because it is associated with a fear that real and imagined animal traits become mixed up. In the preface to the first edition of *Under the sea-wind*, Carson (1952) writes that even though she has spoken of a fish who is afraid of its enemies, she does not believe that fishes actually sense fear in the same way as humans. However, she writes, in order for the living conditions and behaviours of the fish to make sense to us as humans, we must describe it through words belonging to the psychological state of humans.

In Carson's book the reader is invited to follow animals living in or close to the sea through three different parts. The first part focuses on animals living along the sea shore, the second part focuses on animals living in the sea and the third part on animals living in the deepest part of the sea. Each part introduces a lead animal character and through the narrative the migration habits of these species over the span of a year unfolds. In the third part we are introduced to an eel female named Anguilla. Anguilla is ten years old and lives in a small lake called Bittern Pond thirty miles from the sea. She has lived there for the whole of her life.

The following excerpts from *Under the Sea-Wind* all, in different ways, contain elements of human vocabulary related to human experiences, memories and feelings. The first excerpt I will raise is taken from Carson's (1952) description of Anguilla's journey to the Sargasso sea where the eels reproduce.

Anguilla had entered Bittern Pond as a finger-long elver ten years before. She had lived in the pond through its summers and autumns and winters and springs, hiding in its weed beds by day and prowling through its waters by night, for like all eels she was a lover of darkness. She knew every

crayfish burrow that ran in honeycombing furrows through the mudbank under the hill. She knew her way among the swaying, rubbery stems of spatterdock, where frogs sat on the thick leaves; and she knew where to find the spring peepers clinging to grass blades, bubbling shrilly, where in spring the pond overflowed its grassy northern shore. She could find the banks where the water rats ran and squeaked in play or tussled in anger, so that sometimes they fell with a splash into the water—easy prey for a lurking eel. She knew the soft mud beds deep in the bottom of the pond, where in winter she could lie buried, secure against the cold—for like all eels she was a lover of warmth. (Carson, 1952: 88)

In describing Anguilla's life conditions in the pond, Carson attributes Anguilla with the ability to love and in this case the love is directed towards warmth and darkness. Moreover, Carson attributes Anguilla with the ability of remembering, which makes her able to remember her previous experiences and whereabouts. As autumn comes, Carson notes the way Anguilla is caught by a restiveness.

Now it was autumn again, and the water was chilling to the cold rains shed off the hard backbones of the hills. A strange restiveness was growing in Anguilla the eel. For the first time in her adult life, the food hunger was forgotten. In its place was a strange, new hunger, formless and ill-defined. Its dimly perceived object was a place of warmth and darkness—darker than the blackest night over Bittern Pond. She had known such a place once—in the dim beginnings of life, before memory began. She could not know that the way to it lay beyond the pond outlet over which she had clambered ten years before. But many times that night, as the wind and the rain tore at the surface film of the pond, Anguilla was drawn irresistibly toward the outlet over which the water was spilling on its journey to the sea. When the cocks were crowing in the farmyard over the hill, saluting the third hour of the new day, Anguilla slipped into the channel spilling down to the stream below and followed the moving water. (Carson, 1952: 89)

In this excerpt, Carson attributes Anguilla with feelings of restiveness and intuition. Moreover,

she lets Anguilla be guided by these feelings as Anguilla begins her journey back to the sea.

Alignment work through maintaining the human category

In what follows, I will highlight Carson's literary strategies of featuring Anguilla as a focaliser while attributing her human traits. I will analyse this in terms of strivings to align a human-centred epistemic culture, associated with the scientific discourse of marine biology, and an epistemic culture centring other species.

In addressing Anguilla's state of restiveness, Carson creates associations to the human vocabulary of feeling impatience or uneasiness. As Anguilla enters a shallow pool, Carson describes another feeling triggered in her: fear.

Anguilla came to a shallow pool formed when an oak had been uprooted in a great autumn storm ten years before and had fallen across the stream. Oak dam and pool were new in the stream since Anguilla had ascended it as an elver in the spring of that year. Now a great mat of weeds, silt, sticks, dead branches, and other debris was packed around the massive trunk, plastering all the crevices, so that the water was backed up into a pool two feet deep. During the period of the full moon the eels lay in the oak-dam pool, fearing to travel in the moon-white water of the stream almost as much as they feared the sunlight. (Carson, 1952: 92)

The strategy of using Anguilla as a focaliser in the story adds to the attribution of human traits to the eel, as the main characters in literary fiction are most often human. Carson's choice to describe Anguilla as the leading character acts to create a sense of Anguilla as an individual being, cognitively conscious of the way she moves and where she moves and highly attentive to changes in the stream compared to when she last visited it.

The human written language intrinsically takes part in infrastructures promoting and centring human bodily, cognitive and affective capacities. The use of human written language to describe Anguilla with human features could then be analysed as a strategy of aligning a human-centred epistemic culture with an epistemic culture centring animals. This could be analysed

as activating and stabilising anthropocentric epistemic cultures regarding the morphology of non-human species, which has been critiqued by feminist technoscience scholars (Tsing et al., 2017).

Along the same lines, the genre of environmental imagination and the human written language could be interpreted as actors working to activate and underline the human alienation from nature and the earth. In this sense, the alignment work can be described as becoming accomplished through the reproduction of clear boundaries between species.

Alignment work through a changed human category

As I note above, Carson (1952) has commented on the choice of describing animals as fearful in stating that this choice should not imply that she believes animals to sense fear in the same way that humans do. Rather, Carson uses the genre of environmental imagination as a playful, imaginative method of thinking and writing ‘as if’, in this case ‘as if’ the eel senses fear.

Adding the concept of the terrestrial to the analysis, the genre of environmental imagination could also be viewed as producing knowledges on the living conditions of eels. In turn, this could be conceptualised as infrastructures promoting alignments between human-centred epistemic cultures and epistemic cultures centring other species (Haraway, 2020; Latour, 2018). This points to other compositions of actors and moments producing other versions of alignments between the different epistemic cultures.

In this sense, the analysis directs attention to Carson’s text in terms of infrastructures working beyond the traditional scientific terminology that relies on a separation between humans and other species. In other words, environmental imagination in Carson’s text works as a literary strategy to describe animals and plants ‘as if’ they were resembling humans. In this sense, Carson’s (1952) text about *Anguilla* deliberately causes a clash between the conventional scientific hallmarks of presenting valid and systematically processed information and the literary imaginative method of ‘as if’.

As such, Carson’s literary strategy of attributing human traits to animals could also be conceptualised as alignment work allowing humans to think *with* animals through the means of human-shaped language. Carson’s marine biological knowledge, produced in a scientific context centred on systematic studies of eels, is vital to the literary method of approaching the living conditions of animals with the imaginatively directed question of ‘what if’. Thus, both traditional scientific knowledge and imagination must be considered as actors taking part in producing moments of seamlessness in terms of an epistemic culture promoting terrestrial movements (Haraway, 2020).

When considering the concept of the terrestrial in the analysis of Carson’s texts, the genre of environmental imagination could also be viewed as altering the human position into embracing considerations of vulnerability and dependence on other species. This could also be said to twist the role distribution between humans and other species in a way that recasts other species as powerful and all-knowing. Hence, human-shaped language takes part in changing the human category and forcing the human to consider other species as agentic. This makes room for *Anguilla* as a proper actor along with human actors rather than as a back-drop for human activities.

Concluding discussion

The results of the paper show that the attribution of human traits to other species is part of the alignment work making a human-centered epistemic culture and an epistemic culture centering other species work together. This alignment work, where the attribution of human traits to other species is considered a crucial component, is performed in (at least) two ways. First, the alignment work is performed through *keeping a human-centered position intact*, where the human as all-knowing and the human power to act in relation to other species is stabilised as the starting point for the knowledge production processes. Second, the alignment work is performed through *altering a human-centered position*, where human vulnerability and dependence in relation to other species is stabilised as the basis for the knowledge production processes. The concept of the terres-

trial (Haraway, 2020) has helped in widening the range of actors taking part in the strivings to align the epistemic cultures. Adding the concept of the terrestrial has encouraged me to include bodily movements as well as experiences of dependence and relevance as actors that become active in the alignment work through different compositions.

In line with Taylor and Pacini-Katchabaw (2015) I have argued that encounters between humans and other species can create insights into the human vulnerability in relation to ecological processes and other species. This in turn, can be a productive starting-point in the much-needed endeavour of radically rethinking our role as humans in the world's ecosystems. Focusing on human vulnerability forces humans to not only learn about other species but also learn about and become aware of how our way of living drastically affects the living conditions of other species. At the same time, the paper argues that a non-anthropocentric knowledge production does not solely rely on 'becoming-with' other species (Weldemariam, 2020), or challenging the boundaries between humans as other species (Hübben, 2017) as articulated in previous research. While the concept of 'the terrestrial' highlights the human dependence on nature and other species, it is important to note that the concept calls for humans to learn to live with the insights of their own mortality and vulnerability in the ecological system. In this sense, the concept points to the unique role and responsibility of humans, which is not compatible with the idea of blurring or even wiping out the boundaries between humans and other species (cf. Malm, 2019).

The results of the study supports Hübben's (2017) and Geerdts et al. (2016b) in their argument that the attribution of human traits to animal characters in storybooks sparks children's ability to imagine what animals may be experiencing, as well as creating experiences of empathy with other species. Even though the concept of empathy is not highlighted in the results of the present study, Hübben's (2017) argument could be related to the notion of relevance as experienced by the children wanting to save the snails. In this sense, empathy could be referred to as another way of describing children's intuitive feeling of being humans depending on the earth and on the snails.

In line with this, Beudel's (2019) results point to Rachel Carson's attempts to facilitate fascination and engagement with other species. In these attempts, the role of environmental imagination is to spark a human interest in the living conditions of other species. The results of the study adds to Beudel's (2019) results through highlighting the human in need of gaining insight into their own vulnerability and dependence. The marine biological knowledge about, in this case, eels is of course an important component for humans to gain insights in their vulnerability. However, as the concept of the terrestrial points to, there is also an acute need for humans to develop and act from an insight into how we affect the ecosystem and how that makes us vulnerable. In other words, we need to be able to grasp the way we ourselves act to produce our vulnerability and also embrace our complicity in our own vulnerability.

Adding the concept of the terrestrial to the analysis of alignment work brings a feminist and political edge to the analysis. The feminist approach that comes with the concept of the terrestrial is not primarily aimed at studying categories of gender in terms of how masculine and feminine subjectivities are constructed. Rather, the use of a feminist perspective in the study is motivated by the aim to critically study the knowledge produced about animals as other species in the face of power-producing human-centered norms (Åsberg, 2017). In this sense, the paper contributes to STS discussions of alignment work in terms of highlighting the power-producing forces that always come to be a part of the work invested in aligning different epistemic cultures. Along these lines, the paper points to how alignment work processes are never value-neutral and always act to promote and privilege some perspectives over others. Thus, the feminist STS approach activated works to underline how alignment infrastructures are always political and asymmetric in terms of whose interests and whose interpretative prerogative is reproduced or stabilised. This is articulated as a critique towards the human position as the main protagonist, whose needs and characteristics gets to shape and dominate knowledge production processes.

Even so, the results of the study point to the nuances and contradictions inherent in the power production of a human-centered position. On the

one hand, the study shows how the stabilisation of a human-centered position hides and neglects the unique species-specific capacities of snails and eels. On the other hand, the current paper shows that the stabilisations of a human-centered position does not necessarily exclude the possibility of an altered human-centered position. The altered human-centered position, as argued in the study, recognises human vulnerability and dependence in the ecological system. Such an

altered human-centered position embraces and encourages human bodily movements 'towards the earth' and towards the unique living-conditions of non-human species. In this sense, the study also adds to feminist STS through attending to and even foregrounding the ambivalence and multiplicities inherent in power-producing knowledge practices with regards to inter-species relations (Tsing et al., 2017).

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