Development and Postdevelopmentalism in Studies *on, to, with, for, by* Young Children

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PREFACE

Hillevi once heard an interview with a Swedish author – Sara Stridsberg – who talked about why writing novels was more difficult than writing anything else. She said something along the following lines: "A novel is a piece of writing, not specifically wished for or invited, nor requested by anyone. Not even the author herself. It just requires being written." Although this book is not a novel, it nevertheless has seemed to us to be, not specifically wished for or requested, but nevertheless intensely required to be written.

Hillevi, who launched this book project, sat on a pile of thoughts about research and science theory, accumulated over a career starting in the mid-1990s in educational philosophy, theory, and early childhood education. The developments in the field of education and childhood studies had sprouted diverging offshoots over the years, as if rooted in incompatible soils, but also growing into surprising ontological convergences. Some of these would flower as creative and sometimes unlikely cyborgian accounts of knowledge productions. As Hillevi became increasingly self-critical about her own work, she initiated and led (as PI), but in a co-leadership with Tove Nilsson Gerholm, a large-scale interdisciplinary intervention project. It was a project that engaged multiple forms of inquiry framed by an intervention randomized controlled trial. It involved 17 researchers and assistants from 5 disciplines and more than 400 children, their parents, teachers, and educators. It proved to be a challenging journey of learning that constitutes the context and backdrop of this book. This is a book about how to understand children's development in different ways while dealing with the possibilities and obstacles of doing

inter- and transdisciplinary collaborative inquiry in studies that concern young children.

Hillevi invited a younger brilliant mind – Linnea – to think together about this book. Linnea had been an important co-researcher in that large-scale project and assigned the task of exploring the experiences of children as the main agents in this project. Therefore, the children's experiences and ethics in relation to children in research receive three chapters in the book. Without Linnea's relentless encouragement and creative imagination, this book could not have materialized.

First, we would like to extend our warmest gratitude to all the children who participated in the project "Enhancing Preschool Children's Attention, Language and Communication Skills: An Interdisciplinary Study of Socio-emotional Learning and Computerized Attention Training." In short we call this project the Enhancing Children's Attention project (ECA), and we would of course equally thank all the children's parents, teachers and educators for their consent and the learning journey we took together before, during, and after the research. Second, and with great affection, we want to thank our co-researchers in this collaborative endeavor, first and foremost the researchers in the core team: the co-leader Dr. Tove Nilsson Gerholm (linguistics), who led half of the team with excellence and professionalism, and the others, in alphabetical order: Dr. Sofia Frankenberg (developmental psychology and early childhood education), Dr. Petter Kallioinen (cognitive neuroscience); Dr. Susanne Kjällander (didactics and early childhood education), Dr. Anna Palmer (early childhood education), and Dr. Signe Tonér (linguistics). The core members of the team all had the opportunity to read the manuscript of the book at various stages of the writing process and gave their consent to publish our story in this final version of the manuscript. Some of the team members also contributed constructively and with great insight to the manuscript. In particular, we want to extend our warmest gratitude to Sofia Frankenberg and Anna Palmer for their rigorous and constructive commentary.

The project could not have been performed without the research assistants who conducted the testing with children: Mikaela Broberg, Sofia Due, Paulina Gunnardo, Linda Kellén Nilsson, and Matilda Löfstrand. Thank you! We are also grateful to the contributions to the research by the extended team of researchers: Dr. Teresa Elkin Postila (early childhood education), PhD student John Kaneko (early childhood education), Dr. Thomas Hörberg (linguistics), and Dr. Tatjana Rosén (statistics), but

also to Dr. Susanne Garvis, Dr. Karin Lager, and Dr. Panagiota Nasiopoulou, who performed the quality Early Childhood Environment Rating Scale-3 evaluations. Last but not least, we wish to extend our thanks to Dr. Eric Pakulak (cognitive psychology and linguistics), who welcomed and educated us at the Brain Development Lab, University of Oregon with members of the lab's team of researchers and Head Start teachers. Sincere thanks go to all of you for the sometimes bumpy but immensely constructive journey of collaborative learning and great fun!

The first manuscript was also sent for commentary to colleagues within and beyond our own department. We wish to extend our gratitude to individuals in the friendly and critically constructive community of colleagues in the Department of Child and Youth Studies at Stockholm University: Dr. Lena Aronsson, Dr. Danielle Ekman Ladru, Dr. Tanja Joelsson, and PhD students Maria Hylberg and Sara Ohlin. Warm gratitude is also extended to Dr. Hanna Sjögren at Malmö University and Dr. Lina Rahm at KTH Royal Institute of Technology, who both read and commented on several chapters in very constructive ways. Thank you all for important feedback!

Wholehearted thanks go to professional artist and illustrator Mari Want for the illustrations in several of the chapters and on the cover. She approved all illustrations for publication. Dr. Ned Hall has approved for his previously published drawings of the so-called bucket model appearing in Chap. 2 to be redrawn for the purpose of this book. The new versions were drawn by Mari Want. Earlier versions of Hall's drawings can also be found in Evelyn Fox Keller's 2010 book, *Mirage of a Space between Nature and Nurture*, published by Duke University Press.

Finally, our thanks go to the anonymous reviewers of our proposal and draft manuscript for their constructive feedback and to Linda Braus, Chandralekha Mahamel Raja, Eliana Rangel, and Roberta Mistretta at Palgrave New York and London for their guidance on all editorial matters.

We acknowledge that the two research projects on which the findings and experiences reported in this book partly rely have been vetted by the National and Regional Ethics Committee in Sweden. This includes a

rigorous vetting of all the materials and information distributed to educators, parents, and children, including instructions on how to obtain children's in situ iterative consent to testing, video recording, and interviews, for example. The written consent from educators, school directors, and parents also include consent to publish materials from these two projects in journal articles, books, and popular science magazines.

We also acknowledge that Chaps. 6, 7, and 8 contain previously published contents from original research papers, authored by Linnea Bodén independently, with permissions to publish obtained from *Children's Geographies*, *Contemporary Issues in Early Childhood*, and *Journal of Early Childhood Education Research*, respectively.

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The Problem, the Context, and the Project

Introduction

> [T]he traditional separation between the biological and the social has become increasingly difficult to define: biology has become porous to social and even cultural signals to an unprecedented extent' … and the genome is also "reactive" to social and cultural influence … William James … point[s] out that "*the brain does not exist in isolation*".

We open up with quotes from social scientists Felicity Callard and Des Fitzgerald,[1] as they bring together words from the contemporary social science theorist Maurizio Meloni and the nineteenth-century cognitive psychologist and philosopher William James[2] in their book on interdisciplinary collaborations with the neurosciences. This is because an important goal of the book you have just started is *not* to put nature and nurture, or nature and culture, up against one another. Instead, we will argue for the possibilities of a more constructive relationship between the developmental sciences[3] and studies in the humanities and social and educational sciences for future forms of inquiry that concern young children.

Our main overall interest is in the question of what different forms of knowledge, produced in different scientific or other knowledge practices, might *do together* to better understand young children's development, learning, and lives. This also applies to critical and *post*developmental approaches in this field and explains the book's title: *Development and Postdevelopmentalism in Studies* on, to, with, for, and by *Young Children*. While the book addresses readers interested in the broader field of child,

childhood, and early childhood education across multiple disciplines, it was written with particular attention to readers interested in the critical, posthumanisms and new materialisms trajectories in the field.[4] These should be understood in the plural although we will abide to the editors recommendation of writing them in terms of posthumanist and new materialist throughout the rest of the book. This is the field of theory and inquiry where the two of us mainly, but far from only, situate ourselves as scholars. We share a profound interest in participate in the emergent development of these trajectories, to become increasingly creative, and multiple in terms of methodologies, which is why we have written this book.

We have a specific interest in the *multiple* for several reasons. We will repeatedly raise the importance of considering multiple forms of knowledge practices and multiple kinds of knowledge[5] in inquiries of various phenomena that concern young children. This is because the phenomena we study can be understood as multiple. That is, they are knowable, in this view, not from different perspectives or discourses,[6] but as knowledge derived from different ways of *being* in the world: ontologies. That is, there are multiple realities of a phenomenon. It is made up of different ecological networks of relations between different forms of knowledges, as well as other forms of knowing, experiencing, and articulating something about the phenomenon. These varying ways of being and knowing that make up a phenomenon can be represented by different scientific knowledge practices that pursue very different methodologies to enact their inquiries of phenomena and that can then be put in a relation and productive friction or other forms of relations with one another.

Take, for instance, children's olfactory (sense of smell) development, studied in an intertwined relation with language development (see more in Chap. 2). The phenomenon of olfactory development has been a topic of some inquiries involving methodologies in the disciplines of linguistics, anthropology, biology, and neuroscience, which are then placed in a constructive knowledge-producing encounter. When researched or considered together, they show that children's olfactory development is intertwined with their linguistic and conceptual development. Moreover, it can be argued that children's development of smell is coconstituted across multiple realities of an embodied neuro-interactivity with local species and plants, in specific climates, and with cultural behavior, traditions, and place-specific conceptual representations. The development of

children's olfactory senses and their conceptual development in relation to various forms of smells or odors can thus be understood to emerge as a *natureculture coconstitutive*[7] process, over time, across place and space, in different ways around the globe so as to make some children, in some local spaces, significantly more skilled "smellers" than others.[8]

The preceding example points to our interest in the contemporary desire for reciprocal and bidirectional learning collaborations across different disciplines and fields of research, in what is often referred to as inter- or transdisciplinary[9] studies. Or, in the form of inquiry where scholars simply engage with knowledge produced in disciplines other than the one in which they situate themselves. They might also involve other forms of nonscientific knowledge practices, such as art, or experience-based knowing from lived practices, which is not produced as an academic form of inquiry.[10] Although the readers of this book are, like us, most likely situated in a discipline in the humanities or social or educational sciences, our argument self-evidently extends to scholars in disciplines of other faculties, including the various disciplines engaged in what today is called the developmental sciences.[11] We seek for them to take an equal interest in the knowledge produced in various kinds of qualitative and postqualitative inquiries in the humanities and social and educational sciences.

Research collaborations across disciplinary borders have been pursued and advocated for decades, but they have never had the importance they do now, when polarizing ways of thinking and living seem to dominate in academia and in the public discourse at large.[12] Nevertheless, Callard and Fitzgerald, quoted earlier and to be quoted again subsequently, summarize, on a discouraging note, their experiences from their interdisciplinary collaborations as social scientists working with neuroscientists. Unfortunately, they are not alone in their experience.[13] Callard and Fitzgerald write that interdisciplinarity is "*produced through* structures of power that position different people, and objects, and ideas, in very specific ways" and that "interdisciplinarity is entangled in much thicker structures of power than either its promoters or its practitioners are willing to recognize."[14]

To some extent, the two of us share such experiences of disciplinary power production, operating in many directions, as the reader of this book will learn.[15] But more importantly, as members of an interdisciplinary research team working across disciplines and methodologies, we have tried to actively confront some of the mechanisms, including power mechanisms, of interdisciplinary relations in our own collaborations.[16] We also

believe that collaborations that involve stakeholders and are performed in in situ societal practices can open up to more reciprocal collaborations than interdisciplinary collaborations performed only inside the walls of academia (Chap. 9).

In this book, the inter- and transdisciplinary Enhancing Children's Attention (ECA) project[17] will constitute either the backdrop or the main protagonist of the various discussions presented. This includes a discussion that aims to challenge the historicity and mechanisms of academic relations across the divides and borders that seem to keep us apart. To achieve the articulated desired bidirectional and reciprocal communication traversing differences that nevertheless runs pervasively through the literature, we need to, as biologist and science theorist Donna Haraway[18] has suggested, "stay with the trouble," to work the frictions.[19] Or, as the transdisciplinary scholars E.J. Renold and Gabrielle Ivinson[20] have suggested, referring to Haraway's expression: we need to collaboratively and creatively "make with the trouble" so as to become actively productive of the differences and transformations we desire.

Thus, in one important sense, this book is about "making with the trouble" and working within and traversing across multiple disciplinary practices of knowledge production with the frictions that inevitably will emerge in their encounters[21] – and doing so, not only together with colleagues from other academic disciplines, but also with children, parents, and stakeholders as collaborators in a large-scale research endeavor. As principal investigator (Lenz Taguchi) and postdoctoral fellow (Bodén), the two of us were deeply involved in the aforementioned ECA project. This project entailed collaborations between scholars across the humanities and the social, educational, and cognitive neurosciences. It was set up as an inter- and transdisciplinary project using multiple forms of methods and methodologies but framed as an intervention and randomized controlled trial (RCT) (Chap. 5).

Equally important for the writing of this book is another research project, led by Bodén, which builds on the data produced in the ECA project. This project aimed to conduct multiple forms of analysis using the already collected data from the previous project and focused on children's experiences as participators in interdisciplinary research that included extensive testing, including brainwave measurements.[22] Due to our engagements in these two projects, we have spent the last decade trying to understand, not just our own experiences, but also the issue of interdisciplinary collaborations and participation at large, in the vast, heterogeneous field of inquiry

that involves young children. This urge to "make with the trouble" of the frictions we experienced is what led to the writing of this book.

Three Major Aims

Building on what was said in the preceding section, this book has three major aims: (1) discuss the challenges and the possibilities of inter- and transdisciplinary collaborations across scientific knowledge practices while attending to (2) the complex historicity of the academy and its different disciplinary divides, theories, and lexica of concepts and language use, so as to (3) argue for the importance of understanding phenomena, such as the child, childhood, and education, as multiple and, thus, natureculture coconstituted by a multiplicity of situated and specific knowledge practices and other forms of knowing. At this point, these three aims might be perceived as intriguing in their combination and stand out as difficult or abstract. They will, however, eventually be made more concrete and embedded in a productive relation in the discussions contained in the nine chapters and the conclusion, the latter of which will hopefully tie together the three aims.

From the outset of our shared experiences of working across disciplines, we will try to fulfill the first aim by providing a broader understanding of the challenges and possibilities of conducting inter- and transdisciplinary inquiries in studies that concern young children. And we will be doing this from the point of view of as many of the involved agents as possible. Although, later on, we will discuss language, words, and metaphors as agents in all forms of inquiry,[23] at this point, we simply wish to point out the human agents involved. First, we take the point of view of scholars who came out of different disciplinary training, with the reservation that our own situatedness in the social and educational sciences will unavoidably be privileged in this book's analysis. Second, we will attempt to understand more about the point of view of the stakeholders involved in the ECA project, a project involving some 17 researchers and assistants from 5 disciplines,[24] 432 children, their parents, and 98 educators at 29 preschool units. Most importantly, three chapters will feature texts based on research with or about the experiences and participation of the children involved in the ECA project, to the extent that this is possible to do. After all, these four-, five-, and six-year-olds constituted the most important agents in this large-scale intervention project. Without the children, there would have been no research.[25]

For the second aim of the book, we will push the ECA project more to the background as we sketch some aspects of the complex historicity of the academy and how it operates by way of different disciplinary divides, theories, and conceptual lexica. This is because we take an interest in why concepts such as nature, nurture, culture, and development have been so controversial to scholars interested in the development, lives, and education of children. What are the frictions concerning these concepts about, in the relation between, on the one hand, the natural sciences and, on the other hand, the humanities and social and educational sciences? More specifically, what are the tensions within and between the developmental, cognitive, and neurosciences, doing naturalistic forms of inquiry, and the disciplinary fields in the humanities and social and educational sciences? The latter indulge in a vast heterogeneous array of knowledge productions, or that which we call epistemologies, with internal conflicts within disciplines.

An important reason for discussing these issues is that, historically, the focus on the constituting effects on children's lives has been on *either* nature *or* nurture, or nature *or* culture. Nurture refers to upbringing and care and the education of a child in a specific culture. We pay attention to the tendency to get stuck on either side of what can be understood as a binary construction of *nature* and/or *culture* as well as *nature* and/or *nurture*. These shifts have fluctuated within the discipline of psychology over more than a century to arrive at a more unifying theory in what is called a *biopsychosocial* developmental systems theory.[26] This is also the case in the evolutionary sciences, where cultures, language, art, and architecture, for example, are understood to be equally constituted in an entangled relation with nature and biology.[27] Thinking in terms of natureculture coconstitution has, in fact, been occurring for centuries and millennia, if we include historical knowledge of ancient philosophy and indigenous knowledges.[28]

Hence, we pay specific attention to the biological, evolutionary, *and* developmental sciences in psychology that today operate on the basis of ideas and knowledge about the coemergence and coconstitution of nature and nurture,[29] or what the biologist and science theorist Haraway[30] articulated in terms of natureculture already in the 1980s. This was actually taken up early on by childhood studies scholars, such as Nick Lee and Alan Prout.[31] Moreover, in the parallel and partly overlapping trajectory, it was taken up by a still emerging new materialist and posthumanist scholarship, such as the scholarship of Karen Barad and Rosi Braidotti, to name two

other important scholars apart from Haraway.[32] Their ideas about nature-culture coexistence and coemergence have been used extensively in different disciplines within the humanities and social and educational sciences.

It is important to note that individual scholars in different disciplines have dealt with the relations between nature and nurture and nature and culture in very different ways. It is, however, possible to observe that the biological materiality of the body itself is seldom taken into account in the social and even educational sciences, even in studies that position themselves as new materialist or posthumanist.[33] That is, we argue with reference to the historicity of academic divides that will be discussed in Chaps. 2 and 3.

Hence, despite the previously described natureculture interests among scholars from very different disciplines, emphasis is still placed on the word *and* or *or* in the old binary constructions in much of the media discourse and sometimes in the academic discourse as well. Why do so many continue to focus on what keeps nature and nurture apart, rather than emphasizing the processual dynamics of adaptability and plasticity of a child's embodied being? This can partly be explained by the fact that there are bodily traits that are not so easily changed or affected – *but* that are nevertheless differently (epigenetically) embodiedly, socially, and culturally expressed in situated ways as behavior, personality, or something else. As the science theorist Evelyn Fox Keller concludes: "Given how *inter*dependent the effects of each of these is on the other, we cannot separate their respective influences on the final outcome".[34]

We have already used a lot of words up to this point introducing the second aim and the different discussions that are involved in fulfilling it. This is because all of these discussions are central to our different arguments throughout the book. The first three chapters will take a deeper look into these issues in ways that we have found productive and interesting. Thus, these chapters might be of specific interest to readers who, like us, take an interest in the history of ideas, scientific theory, and philosophy around questions that concern children's development and the many different forms of related inquiry. How all of this played out in practice will be discussed in the remainder of the book.

In the book's conclusion, we will tie together what we have learned and take aim at the third aim of the book. The aim here is to argue for the importance of understanding phenomena such as the child, childhood, and education as multiple, transformable, contingent, and situated. In this, we refer to the theories of knowledge (epistemologies) and being

(ontologies) that underpin the aforementioned possible spaces of future inter- and transdisciplinary collaborations. That is, either collaborations between scholars with different disciplinary training or (merely) involving knowledge derived from different knowledge practices and methodologies. Hence, this is about producing knowledge based on an epistemological and ontological relationality. This necessarily also means that we take nature and nurture, and thus nature and culture, to be coconstitutive of one another – *naturenurture* and *natureculture* coconstitution – in line with the theorizing and empirical studies we exemplify throughout the book.

So What's the Problem, Again?

The problem that this book takes as its point of departure is the interdisciplinary frictions and tensions in academia that we have experienced ourselves and that frequently appear in the discussions in the extensive literature on interdisciplinary collaborations across qualitative and quantitative methodologies, and thus what we will refer to as naturalistic and idealistic[35] ontologies to make things easier (Chap. 2). Let us elaborate some more on this issue for readers who are unfamiliar with these frictions and tensions. We turn again to the writing of Callard and Fitzgerald. They describe their experience of collaborating across the social sciences and neuroscience on a realistic note as follows[36]:

> [W]hat we have learnt, instead, is sometimes to subjugate (or at least accept the subjugation of) our work and our interests to the neuroscientific interests in which we seek to entangle them. [p. 157] … [W]e remain intensely aware that we need to narrate our own research interests in ways that make sense to our collaborators, without much expectation that they will do likewise. If we often know more about cognitive neuroscience than any of our collaborators do about geography, sociology, the history of science, and so on – this is not because we find ourselves diligent, but because we find ourselves weak [p. 105].

Why are research collaboration and interdisciplinary research in the social sciences with scholars trained in natural science methodologies, such as cognitive psychology and neuroscience, so difficult? This is the immediate question prompted by the preceding quote. In addition, it appears that interdisciplinary research involving more than one discipline, even within the humanities and social sciences themselves, often proves to be a difficult

endeavor. Or so it seems when comparing this to research collaborations in various natural sciences, engineering, and medicine, for example.[37] Here, new so-called transdisciplines, which combine two or more fields of study, emerge, one after the other. The result of these transdisciplinary collaborations across academic disciplines and faculties is that they continually present us with new technical innovations, artificial intelligence, medication, and so forth, for better or worse.

Does this mean that collaborations between engineering and computer and natural sciences are easier to achieve? Perhaps driven by ideas of profit and/or because there is a concrete problem to be solved that might improve life for many? We don't know. But issues concerning children's development and childhood and a good education are indeed also shared matters of concern. These matters constitute values almost as universal as those surrounding human rights. And yet, this doesn't seem to be enough to gather very many scholars across disciplines, faculties, and, especially, methodologies, at least not in the context of Scandinavia and especially in Sweden, where such projects are rare. We will argue that one reason for the comparatively low frequency of interdisciplinary studies in this particular field has to do with *other* values that are not as easily shared. We are talking about values tied to theories of scientific knowledge production and, more specifically, about concrete methods and methodologies.[38] Ultimately, these divergences seem to depend upon key convictions, between whether phenomena depend upon the human mind or are independent of humans. Or, to state it in terms of ontology, whether or not a scholar relies on idealistic *or* naturalistic methodologies.

The social sciences and humanities involve many different theories of knowledge production. Multiple and competing methods and methodologies operate in these disciplines that can all be understood as important for inquiries concerning young children. However, they are also often understood as opposing, and not compatible, or as a value-based choice made by the individual scholar. And most certainly, the methods related to the "harder" natural science are often seen as adversarial counterparts to those in the supposedly "softer" social sciences and humanities (compare Chaps. 3, 4, 6, 8, and 9). Here we are referring to the still lingering effects of the *science war* between the natural sciences and the humanities,[39] to start with, and then adding on the social sciences.[40] Although this war has been ongoing since the late 1950s, it was more extensively articulated and debated in the 1990s,[41] and it continues to lurk in the undercurrents of academia at large (Chaps. 2 and 3).

In writing this book, we wish to challenge the "state of affairs" just outlined by exploring the possibilities of the *multiple* in academia while traversing across disciplinary boundaries that make up academic faculties. "One is too few, but two are too many"[42]: This paradoxical quote by Haraway constitutes our companion[43] throughout the writing of this book. It keeps us on our reflective and self-critical toes as we strive to avoid the risks of constructing the *one* better and superior way of knowing a problem over another, something that would only recreate another polarizing binary construction and yet another source of conflict. A conflict arises because a difference *from* something is created in a binary construction that takes for granted that objects, things, organisms, and other phenomena are fixed and have stable properties. An example of this is *the child*, understood to be a fundamentally different from and independent of *the adult* as is a human from an animal, nature from culture, and so forth. The meaning of the concept on one side of the binary depends on the other by exclusion and difference from, which at worst is understood as less than.[44] This is when binaries become asymmetrical in terms of power. This is why Haraway says that two, as in the binary construction, become *too* many. Or, to state it differently, the one and the binary are just as bad.

We therefore align ourselves with the growing crowd of scholars in several disciplines, mentioned earlier, who in their work experiment with thinking about, not the one or the binary, but the multiple and who also think about difference as a difference-in-itself, or a self-differentiation.[45] This means a willingness to transform in the frictions of a relation.[46] A difference-in-itself constitutes an ontological shift in relation to how a thing, phenomenon, body, or organism will differentiate as an effect of its relations with other bodies, matter, or environments: as in a mutual ongoing process, as theorized in process philosophy.[47]

It is thus possible to approach the multiple realities of a phenomenon (such as childhood) or a human practice (such as early education and care) as historically, culturally, and materially located and enacted – *crafted* – in various forms of volatile material-semiotic practices, as Annemarie Mol Suggests. The child, as a phenomenon, is *not* of *one* kind and, thus, not *not* an adult in a binary understanding as a difference from (adult-child). Rather, it is a multiple doing and/or enactment in multiple realities.[48] This means that the desire and notion of the one, and a monist[49] interconnected whole (immanence), doesn't make much sense. "One is too few, but two are too many," to repeat our Haraway companion-quote once more.[50]

Let us now move on to introducing ourselves and the ECA project as the main protagonist and shared reference point throughout the book.

THE CONTEXT OF THE BOOK

As educational and social science scholars, we both share an interest in the *multiple* in terms of different ways of knowing. This likely has to do with our heterogeneous undergraduate and graduate backgrounds. Individually and across both of us, this multiplicity involves studies in and experiences from many different disciplines. Our backgrounds have led us to undertake very different forms of research practices throughout our careers, going back to the late 1980s, across disciplines in the humanities, behavioral, gender, and multiple social sciences, and working with many different forms of methods and methodologies.

These experiences made it possible for us to take on the risks of doing unexpected forms of research. We were thus not altogether intimidated to set up and take part in an inter- and transdisciplinary research project framed by an experimental RCT. This is a methodology used mostly within medicine, the natural sciences, psychology, and economics, as what is sometimes referred to as the *standard epistemology*. That said, let us provide more details here on the ECA project that aimed to put to work multiple research methodologies in different forms of inquiry with preschool children. We will briefly present this project by jumping right into the context of parental meetings in the municipality where the project was later conducted.

In the role of principal investigator of the ECA project, one of us (Lenz Taguchi) together with the co-leader (Tove Nilsson Gerholm) arranged to meet with parents of all children aged four to six years old in the municipality preschools in the area. We informed them about what we were planning together with the educators at twenty-nine preschool units, from whom we had already obtained informed consent to participate. Then we asked the parents to give their consent to perform individual testing on their children, before and after either of the two pedagogical interventions, or as control groups doing preschooling as usual.[51]

We informed the parents that the overarching aim of the project was to evaluate an enhanced version of a well-established and recommended group-learning pedagogy, in terms of how it affected children's development and learning. This group-based investigative learning practice had never previously been scientifically evaluated. We explained that there

were studies in fields like economics showing that high-quality preschool experience with well-educated staff could have long-term positive effects on educational and professional choices later in life.[52] However, in Sweden, there are very few examples of evaluations of what educational practices might work better for individual children and how they work. One reason is that RCTs, which is understood as the evidence-based way to do scientific evaluation, are very rarely carried out or given funding in Swedish preschool settings. Qualitative and praxis-oriented forms of collaboration with educators are, on the other hand, very common.[53] As a matter of fact, the ECA project would be one of the first RCTs in Swedish preschool history to evaluate an everyday learning activity such as this group-learning pedagogy and the first to do brainwave recordings in situ at the participating preschools (Chaps. 5 and 8).

It was no coincidence that the ECA project was initiated in this particular municipality. A few years before these meetings with parents, researchers at a department at Stockholm University had been invited to this municipality to form a network for the exchange of knowledge and practice-based experience with municipality preschool staff members. This network-based collaborative effort featured children's language development and neuroscience, and after a year or so the researchers introduced the possibility of doing a RCT together. A grant to do a large-scale interdisciplinary RCT was approved in 2014 to evaluate the possibilities of enhancing preschool children's focused attention, language, and social-emotional development while testing an upgraded version of what was called socioemotional and material investigative group learning. To have a comparison with the main intervention, a contrasting individual and digital form of learning intervention was also constructed (Chap. 5).

In preparation for the research, a lot of network time was spent discussing RCT as a largely unfamiliar research methodology, which also prompted some suspicion and criticism, especially in relation to the testing of children. In terms of ethics, it was of great importance for the team members to meet with educators to gain more knowledge, share experiences and fears, dispel concerns and test averseness, create transparency, and instill trust. This was also true of the relations among research team members (Chaps. 9 and 10). The communication with educators entailed a repeated invitation to actively participate in the negotiations of how to best perform all the different parts of the research, which produced a sense of transparency, community, agency, and control.[54] Since the testing was the most unfamiliar part of the project, information included detailed

descriptions of how the testing would be carried out with the in situ consent of each child during testing. But most importantly, the communication conveyed that testing in this kind of research was performed to evaluate, *not* individual children *or* educators, but the educational practices used as interventions on the group level (Chap. 5).

What we wish to get at here is the fact that the frictions and/or resistance between scientific paradigms of theory and methodology in the academy does not entirely overlap with the concerns of stakeholders and their expectations, views, conceptions, and experiences. In general, parents and educators are much more affirmative of the practices of a RCT and everything it involves, such as surveys and testing of children, especially more so than the average educational and social science researcher in Sweden. Moreover, the RCT was presented as an overarching methodology and framework, within which several other and more familiar methodologies were to be performed. However, new to everyone were the interviews with children, along with emergent collaborative inquiries with some of the children, to learn about their experiences participating in the research. This will be described in the second part of the book (Chaps. 7 and 8).

Although RCTs and testing of small children might be common in the reader's own cultural context, you might also be aware of some of the criticisms and resistance to RCT research in the social sciences.[55] In the Swedish context, this resistance is probably more deeply embedded than in other cultural contexts due to developments in both the Swedish preschool system and social science in academia. Impetus for this strong resistance in academia has mainly come from critical psychology and education in the UK, the United States, and Australia, emerging in the late 1980s and early 1990s, featuring scholars such as Erica Burman, Gale Canella, Bronwyn Davies, Glenda MacNaughton, Nikolas Rose, and Valerie Walkerdine, to name just a few. Their texts have been of immense importance to a wider critique of the relation between psychology, pedagogy in general, and early childhood education and care in particular. This critical influence has made preschool research and practices in Sweden more or less test-averse. As a consequence of the foregoing critique, testing preschool-aged children's abilities has become a task performed only by psychologists, specialized pedagogues, and speech therapists, and only when a child is identified as having some sort of special need. It has also meant a widespread skepticism toward performing any kind of testing of

children in social sciences research and a skepticism toward experimental and evidence-based forms of research at large.[56]

Internationally, the field of research in connection with young children constitutes a much more extensive and varied field in terms of methodologies and evaluations compared to Sweden. We wish to point to the possibilities of reading about experiences made in a context like Sweden, which is dominated by sociocultural and critical theories and methodologies. This can help simultaneously provoke and inspire readers to view issues concerning young children and their education in new ways, irrespective of one's own background and previous experiences.

Lastly, this book is situated and written from the point of view of social and educational science scholars and cannot be generalized even to all members of our team. It can, however, nevertheless be generalized, or at least likened to, many local inter- and transdisciplinary environments across the globe.

Part 1. The Problem, the Context, and the Project

The first four chapters frame and discuss the context of this book, some central concepts, the field of child, childhood, and early childhood education studies, and the ECA project. As previously indicated, the first three chapters are of specific relevance to readers interested in the history of ideas, philosophy, and scientific theory while presenting the concepts of development, postdevelopment, nature, nurture, and culture and providing a discussion on disciplinary collaborations in the form of a series of sketch work. The first and second chapters go together, in that the first chapter aims to introduce some central issues while the second chapter provides more examples and make things more concrete. It is, however, possible to read all the chapters as standalones.

Chapter two is titled "On Development, and Nature, Nurture, and Culture Relations." The main focus of the chapter is to introduce different ways of understanding development and explain why the concept of development has been an issue of societal and academic dispute. We discuss the concepts of nature, nurture, and culture, as well as their relations to one another and to the issue of development. Moreover, we provide an introduction to updated debates within what today is called the developmental sciences. Some of the developmental sciences can be seen to *somewhat* ontologically overlap with certain theories in the humanities and social sciences, such as posthumanism and new materialism. The developmental

sciences are nevertheless critically understood by childhood and early childhood education scholars in terms of their normalizing *developmentalism*. To counteract developmentalism, a *post*developmentalism in early childhood education and child studies has evolved. First, it is presented in its emergence as a critique of developmentalism, as it is also entangled with postdevelopmentalism within critical economics. Second, we point to some of the points of ontological overlap between the developmental sciences and postdevelopmentalism.

"The Emergence of Postdevelopmentalism and a Coconstitutive View of Development" is the title of the third chapter. It shows the influence on postdevelopmentalism of critical economic theories, which are concerned with the economies in the Global South, especially in South America. The subsequent discussion draws upon the postdevelopmental critique of child development theory and research by presenting a case study about the unhappy marriage between the disciplines of psychology and pedagogy during the twentieth century in Sweden, which ended in a finalizing divorce in the 1980s. The last section of the chapter focuses on meta-theoretical thinking about development in the developmental sciences, which view development as the result of a processual *natureculture coconstitutive* dynamism. By highlighting these similarities, we argue for the possibilities of a more constructive relation between the developmental sciences and the postdevelopmentalist critical approach in future collaborations.

Chapter 4's title is "'Whose Science Is It?'" The Field of Child, Childhood, and Early Childhood Education." In this chapter, we present the vast field of child, childhood, and early childhood education inquiry together with a number of sketches of possible ways of making sense of this field. The first sketch is about the unproblematized idea of a desired integration between different scientific approaches to inform first most early childhood education. In the second series of sketches, we take on the discussion put forward by cognitive psychologists on the need for a translational bridge over a presumed gap between the neurosciences and educational practices. Cognitive psychology is thought to take on the role of translator on a bidirectional bridge. For the third sketch, we move to include a wider array of inquiries from the humanities and social science disciplines. For this section, we constructed a sketch of two circles with movable positionings to illustrate new possible relations and encounters between different ontologies and epistemologies in this field.

Chapter 5 is called Those Whom the Research Concerns: Conducting Intervention Research as Inter- and Trans-disciplinary Inquiry." The aim

of this chapter is to describe the protagonist of this book, the intervention project Enhancing Children's Attention and some of the context surrounding it. It sheds light on why we decided to conduct a RCT to evaluate a widespread group-learning pedagogy, using extensive testing, including brainwave recordings, in Swedish preschools, that is, doing evidence-based research in an academic and preschool setting that is probably more test-averse than most. The chapter provides basic information about the project that is central to understanding the discussions and details in other chapters. For example, some basic information is given about how the RCT was planned and conducted and how the interventions and testing were carried out and the ethical nature of the project was established.

PART 2. THE CHILDREN

The second part of the book is all about the children, their experiences as participants in the research project and issues of ethics.

Chapter 6, "Troubling Ethics in Developmental and Postdevelopmental Inquiry Involving Children," provides an analysis of how ethics is discussed in the literature in the field of child and childhood studies and early childhood education. Inquiry that involves children is often discussed in terms of whether the research is conducted *on*, *to*, *with*, *for*, or *by* children. The starting point is thinking in terms of scale. It is often persumed that the more the research is done *with* or *by* children, the greater the likelihood that the research practice can be considered more ethical. In the chapter, we problematize this more or less taken-for-granted f value scale, where research *on* children is positioned at the negative end and research *by* children at the positive end of the scale. In contrast, we will look at how prepositions become entangled with certain philosophical assumptions on ethics: *ethics as social justice and fairness*; *ethics as inclusion, participation, and empowerment*; and *ethics as producing potential new worlds*. We argue for *multiethical* perspectives, where different ethical underpinnings are laid side by side to strengthen research practices.

Chapter 7 is titled "Standardized Tests: Children in the Middle of a 'Dangerous' Research Practice." The chapter focuses on children's experiences taking part in the standardized testing that was designed to measure the effects of interventions enacted by children and educators in the ECA project. The critics of standardized testing usually describe it as an objectifying practice, where children have little or no possibility of affecting the

practice. This critique is often presented in sweeping terms, as something problematic in general, leaving the locality and the specificity of particular test situations out of the story. By analyzing video recordings of children and adults during the pre- and posttesting situations in the ECA project, this chapter investigates the concrete, local, material, relational, and other specific circumstances of what it might mean, as a young child, to take part in standardized testing.

Chapter 8, "Children and the EEG Cap: Exploratory Research to Investigate Children's Experiences and Participation," describes and theorizes on how one of the authors, Bodén, worked collaboratively with a group of children to explore their experiences taking part in brainwave recordings that entails wearing an electroencephalogram (EEG) cap. Inspired by new materialism and posthumanist emergent onto-epistemological forms of inquiry, the children and the researcher together made what they called their own EEG hats to play with. What became a collaborative exploratory construction of EEG hats and other accessories important during the testing shows how the children's individual and varied interests were closely tied to each of their worldly (extra)ordinary ways of understanding the EEG caps and the testing itself. To understand the children's experiences, it was necessary to create methodologies that could include all of the various relations that the children had with the EEG caps and the testing practice. The chapter argues that to investigate children's experiences taking part in research, we need more and emergent kinds of research methodologies.

PART 3. THE RESEARCHERS AND A DISPLACED POSTDEVELOPMENTALISM

In the third part of the book, the aim was to write from the perspective of collaborating researchers, in inter- and transdisciplinary inquiries. We will take the position from the educational and social science perspective, which the two of us embody and represent. This means that our account of the collaborations will not claim to do justice to the researchers that position themselves as developmental and/or cognitive psychologists, or linguists, as in the collaborating disciplines of the ECA project.[57]

Chapter 9, titled "Gendered Trouble in the Interdisciplinary Bakery as a Shared Space for Research Collaborations," discusses the challenges and possibilities for the research team of doing interdisciplinary research in the

Swedish context of the "divorced" psychology-pedagogy couple. Inspired by Callard and Fitzgerald, we theorize on the figuration of the interdisciplinary bakery as the space of conflict and possibilities while baking different forms of interdisciplinary layer cakes. We show how the ECA project meant baking at least three versions of different kinds of interdisciplinary layer cakes. As we achieved more reciprocal, respectful exchange and learning, it was possible to construct a shared relational research ethics for the research. A one-pan layer cake, where disciplinary knowing was shared reciprocally, could then be baked. We also discuss the gendered disciplinary character of interdisciplinary collaborations in the encounter of various forms of knowing at different scales.

Chapter 10, "The Problem of Words and Language in Interdisciplinary Collaborations," provides a more comprehensive discussion of the problem of language, concepts, and metaphors in interdisciplinary collaborations. The chapter relates back to Chap. 2 and the discussions there on development to discuss some of the problems and possibilities concerning language practices that involve researchers from different ontological and epistemological backgrounds. Outlining the discussions around words, metaphors, and language use in the ECA project, the chapter shows how all researchers in interdisciplinary collaborations need to learn more about what their collaborators take for granted in terms of ontological, epistemological, and political taken-for-granted notions in their respective disciplines. Further, they also need to learn more about the ontological, epistemological, and political obstacles and biases inherent in their own disciplinary research practices.

The book's conclusion (Chap. 11) grapples with the question of whether or not a natureculture coconstitutive approach to what can be understood as postdevelopmentalism is possible. What might such a displaced form of postdevelompentalism entail, and how might it be characterized when enacted as an inter- or transdisciplinary collaborative inquiry *on*, *to*, *with*, *for*, and/or *by* young children? To answer these questions, we first discuss some ways in which the concept of postdevelopmentalism can be displaced. We then suggest some possible ways of thinking about what a displaced postdevelopmentalism might entail. We introduce Isabelle Stengers' account of a *slow science* and Anna L. Tsing's *patchy epistemic piling practices* and show how these might connect to the ECA project. The book concludes with a discussion of what happened following the completion of the ECA project and what was learned. We present the new inter- and transdisciplinary research collaborations that emerged, with a

specific focus on one project. It evolved and was enacted together with children and stakeholders in ways that can be understood in line with post-developmentalism as a processual natureculture coconstitutive framework *for* the future benefit of the locally involved children.

NOTES

1. Callard and Fitzgerald (2015), pp. 49–50, quoting Meloni (2014), p. 594. Italics added.
2. William James (1842–1910) is often seen as the first cognitive psychologist, but he was also a recognized philosopher alongside the mathematician pragmatist Charles Sanders Peirce (1839–1914) and the educational philosopher and practitioner John Dewey (1859–1952).
3. An excellent introduction is provided in the various articles of an edited volume, Anthony Steven Dick and Ulrich Müller (eds.) (2017) *Advancing Developmental Science: Philosophy, Theory, and Method*. For a description among others describing the developmental sciences, see the web page of the Center of the Developing Child at Harvard University. https://developingchild.harvard.edu/resources/inbrief-science-of-ecd/
4. For example, Mazzei and Jackson (2024), Lenz Taguchi and Eriksson (2021), Murris (2016), Pratt and Rosiek (2023), Ringrose et al. (2020), and Taylor and Hughes (2016).
5. e.g. Haraway (2016b); Mol (1999); Stengers (2018); Tsing (2015).
6. See Mol's (1999) instructive way of formulating this.
7. This expression, which we will use frequently, can be referred to scholars such as Haraway, Barad, Mol, Tsing, Braidotti, and Stengers but is, as we will show, just as inspired by evolutionary biology and the meta-theories of the developmental sciences.
8. More skilled as individuals also within a group, and specifically across geo-cultural groups. For example, Majid and Levinson (2011) and Chap. 2 for more references.
9. The meaning of these two labels points to a desired collaboration in one way or another across disciplines. However, in practice, this collaboration ranges from a mere "on paper" construction to complex mutual practices of reciprocal learning across and traversing sometimes vast differences. Moreover, these labels do not reveal whether collaborations entail those whom the research concerns or whether inter- or transdisciplinarity is taking place in the mind and writing practices of a single inquirer or among multiple bodies of inquiry (including stakeholders) or multiple forms of knowing.

10. For example, Kimmerer (2013), Mol (1999), Rosiek et al. (2020), and Tsing (2015).
11. For example, biology, including a variety of transdisciplinary approaches within it, such as evolutionary biology, the neurosciences, and cognitive psychology.
12. The argument about the need to overcome polarizing disagreements in academia has been made over many decades, for instance, by Edward O. Wilson, who proposed how to get away from academic polarizations in his 1999 book *Consilience*. Consilience literally means "jumping together," which in this context refers to the natural sciences and some of the social sciences, i.e., cognitive psychology and economics working together across their differences. Consilience was first introduced by William Whewell (1794–1886) in a book from 1840 and published again 2014 called *The Philosophy of the Inductive Sciences.*
13. For example, Ansari and Coch (2006), Beauchamp and Beauchamp (2012), and Coch and Ansari (2012).
14. Callard and Fitzgerald (2015), p. 98 (italics in original).
15. See especially Chaps. 3, 9, and 10.
16. See the collective writing we did as a research team about our interdisciplinary collaboration in Frankenberg et al. (2019). See also Frankenberg (2018).
17. The longer name of the project is "Enhancing Preschool Children's Attention, Language and Communication Skills: An Interdisciplinary Study of Socio-emotional Learning and Computerized Attention Training." This project has been reported, first, as a protocol article featuring the pilot study (Gerholm et al., 2018) and, later, reporting the main study (Gerholm et al., 2019).
18. Haraway (2016a, 2016b).
19. The word friction is here used in line with Anna T. Tsing's concept friction rigorously discussed in her book *Frictions* from 2005.
20. Renold and Ivinson (2022), p. 123.
21. For example, Haraway (2016b); Mol (1999); Tsing (2015).
22. Both of the projects received funding from the Swedish National Research Council, the first in 2014 and the second in 2018.
23. See especially Chaps. 3, 4, and 10.
24. The core research team consisted of – in alphabetical order – Linnea Bodén, Sofia Frankenberg, Tove Nilsson Gerholm, Petter Kallionien, Susanne Kjällander, Hillevi Lenz Taguchi, Anna Palmer, and Signe Tonér. Associated researcher was also doctoral student John Kaneko. Hired accredited Early Childhood Environment Rating Scale-3 evaluators were Susanne Garvis, Karin Lager, and Panagiota Nasiopoulou. Research assistants were Matilda Löfstrand, Linda Kellén Nilsson, Paulina Gunnardo,

Sofia Due, and Mikaela Broberg, without whose work the project would not have been possible. We would also like to thank Professor Tatjana von Rosen and Thomas Hörberg for invaluable assistance with the statistical analyses of the main questions and Teresa Elkin Postila, who acted as supervisor at some of the SEMLA intervention units with Anna Palmer.

25. See Chaps. 5, 6, 7, 8; Bodén (2019, 2021, 2024); and Frankenberg et al. (2019).
26. Sameroff (2010), p. 8.
27. For example, Nicholson and Dupré (2018) and Richerson and Christiansen (2013).
28. For example, Heraclitus, e.g., Kimmerer (2013) and Rosiek et al. (2020).
29. For example, Cantor et al. (2019), Overton et al. (2015), Lerner et al. (2019), and Osher et al. (2020).
30. Haraway (2016a, 2016b).
31. Lee (2005) and Prout (2004).
32. Barad (2007) and Braidotti (2013, 2019).
33. See review in Lenz et al. (2021); see also Bodén and Joelsson (2023).
34. Fox Keller (2010) p. 74, italics added.
35. A naturalistic ontology refers to a concrete material world that can be studied and measured independently of the inquirer, whereas an idealism ontology refers to the notion that what exists depends above all on how the human mind perceives it and represents it. Naturalism has developed quantitative methodologies primarily in the natural sciences and in experimental psychology and economics. Idealism has inspired the development of a vast array of what is most often referred to as qualitative methodologies.
36. Callard and Fitzgerald (2015), p. 157, and p. 105.
37. Archibald et al. (2023).
38. Compare Pontoppidan et al. (2018).
39. Snow (1959).
40. Kagan (2009).
41. Gross and Levitt (1997).
42. Haraway ([1985]/2016b), p. 60.
43. Haraway (2016a) has coined the term *companion species* to encourage us think with other species and not put ourselves unproblematically at the center of attention and as the point of departure of any kind of knowledge production. As Haraway also does, we recognize concepts, metaphors, paradoxes, and figurations of different kinds as important companions for thinking.
44. The lesser value of women as a structural and/or discursive practice in most social settings has been the most important point to make for feminist science theorists when deconstructing the binary of man–woman. See Braidotti (2013).

45. Lenz Taguchi, H. (2017). "This Is Not a Photograph of a Fetus": A Feminist Reconfiguration of the Concept of Posthumanism as the Ultrasoundfetusimage. Qualitative Inquiry, 23(9), 699–710. https://doi.org/10.1177/1077800417732644

46. For example, Braidotti (2019), Colebrook (2014),and van der Tuin and Dolphijn (2012), who are all indebted to the philosopher Gilles Deleuze on this particular matter of difference and differentiation. His doctoral thesis, published in 1968, was titled (in English) *Difference and Repetition*. Deleuze developed the concept of *difference in itself*, which is metaphysically prior to any concept of identity.

47. Theorists in many different disciplines have been taking an interest in process philosophy. This philosophy entails challenging a mechanistic view and an Aristotelian substance ontology while abandoning thinking about essential and stable properties of discrete objects, things, and organisms. It opens up to thinking, which was already articulated by the Presocratic thinkers, of things as flows of change of different durations. The most cited philosopher within the emerging field of process philosophy is, however, Albert North Whitehead (1861–1947).

48. Mol (1999), p. 77 ff. Mol puts an emphasis on the idea that the multiple is not the same as plural perspectives or views (perspectivism).

49. Edward O. Wilson called his idea about a gene–culture coevolution a monist ontology of *consilience*, to which the humanities and social scientists would be reconciled, while adapting naturalistic epistemologies. See his book *Consilience: The Unity of Knowledge* (1998).

50. Haraway ([1985] 2016b), p. 60.

51. Parents were also asked to participate in a survey about their children. See Gerholm et al. (2018, 2019) and Chap. 4 for more information about the testing and survey and about the enactment of the ECA project.

52. For example, Chetty et al. (2011), Cunha et al. (2006), Havnes and Mogstad (2011), and Sylva et al. (2011).

53. Pontoppidan et al. (2018). However, a few intervention projects have been carried out to evaluate special programs, for example, Eninger et al. (2021), Klingberg et al. (2005), and Thorell et al. (2009).

54. See a joint publication describing this: Frankenberg et al. (2019).

55. For example, Cartwright and Hardie (2012).

56. Lenz et al. (2020).

57. Frankenberg et al. (2019).

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On Development, and Nature, Nurture, and Culture Relations

Questions about children's development often appear to be entangled with values and strong emotions in the public discourse. "We have to start with the youngest!" This has been expressed as a political mantra in Sweden, since the construction of the welfare state began in the 1930s with a class-integrated universal preschool.[1] The urgency of focusing on how the youngest citizens are cared for and educated typically concerns some major political issues, ranging from job availability, gender equality, higher tax revenues, and public health to education.[2] In Sweden, one important way to achieve such goals has been a "universal" whole-day preschool of care and education. The explicit aims, as expressed in the national preschool curriculum, have been to foster equal rights, gender equality, nondiscriminatory behavior, and a continued and strengthened democracy.[3]

During the last decade, some of the issues that had been emphasized in the 1930s have reappeared as an echo from the past. A healthier body and mind (brain) have become issues in the contemporary debate, while toddlers and young children spend more and more time on computer, iPad, and smartphone screens. News media report that children can no longer stand on one leg or do cartwheels or somersaults.[4] Enhancing children's declining physical and motor skills and limiting their use of screens in preschools and schools have become central issues on political agendas and the focus of curricular reform.[5]

There is also an increased interest in the need for enhanced socioemotional development as part of overall cognitive development, to prevent future problems in a continued schooling experience, both academically and socially.[6] These issues are often related to situations of unequal housing in and around Swedish cities. Structural disadvantages for some groups are thought to lead to social exclusion, poor health, and risks of criminal behavior.[7] An increasing number of children from some of these disadvantaged areas do not learn Swedish before they start school at age six.[8] In Sweden, all of these problems seem both new and difficult, in what used to be a comparatively homogeneous society interested mostly in fostering gender equality, individual sovereignty, and democracy. Hence, arguing for starting with the youngest children in preschool is once more on the agenda, with suggestions of making preschool mandatory from an early age.[9]

On the international scene, these issues have been emphasized for many decades already, accompanied by expressions such as the "need for early intervention" in programs such as the Perry Program Head Start, and in social emotional learning (SEL) practices.[10] The expression *Intervene! …* and as early as possible is more or less taken for granted internationally and is becoming more and more accepted in Sweden as well.[11] But how are we to understand intervention in the development of young children? And how should we to understand what development even means in the first place? The word and concept of development is not an innocent one in the field of inquiry that this book is concerned with. Rather, the concept has caused a lot of friction and created a rift between what we in this chapter will talk about in terms of developmentalism and postdevelopmentalism.

In her book the *Mirage of a Space Between Nature and Nurture* (2010), the biologist and philosopher of science Evelyn Fox Keller writes about the relationship between research on children's development and intervention. She rhetorically states the following:[12]

> Insofar as our ability to intervene in them [i.e., the dynamics of developmental biology] depends on our understanding, it should be obvious that such work has immense practical significance. And insofar as our social interest is in optimizing the development of individual human potential, it should be equally obvious that this is where our research dollars should go.

In Fox Keller's account, the overarching purpose of knowledge production that concerns human development seems to collapse scientific

goals into social values and politics. For Fox Keller, this is because, in her account of development, it is in no way deterministic. Rather, the thought that we might be able to socially and culturally intervene in a child's development builds on her conviction that we need to free ourselves of the illusion of separation, or space, between nature and nurture, to allude to the title of her book.

The core message conveyed by Fox Keller's quote– i.e., intervening to optimize children's individual development – is of interest to a wide array of scientific researchers in a variety of disciplines concerned with children. However, that interest is most likely not always phrased in that exact way. In fact, there has rather been an intense critique of the way the phrase implies a betterment of the individual, as part of a modern progressive society.[13] But despite the differences in how scholars might think about human development, we argue that there is nevertheless an underpinning value consensus when it comes to studies that in some way or another concern young children. This is a consensus that refers to the fact that we, after all, are living beings and are, thus, inevitably invested in the ancient philosophical problem of how to best live, and *live well*,[14] that is, to live well with others – whether human or nonhuman – and, possibly, with as little suffering as possible for all those involved. The political and scientific ways of thinking about how to achieve this are many. Nevertheless, the value of living well needs to be given attention and weight as we discuss different ways of scientifically and politically examining ways to collaborate across disciplinary knowledge and political convictions in getting as close as we can to this shared goal.

How, then, can child development be understood? This chapter and the next one, Chap. 3, are devoted to discussions of different ways of understanding development in ways that we find relevant for scholars and other interested parties both within and outside academia. One reason for dedicating two chapters to this topic is the fact that so much has happened in the broader field of development. New forms of meta-theorizing around issues that concern development and evolution have evolved. Most of this scientific theorizing has taken place in the natural and developmental sciences. These meta-theories have, however, been found to partly overlap with meta-theories emerging in the humanities and social and educational sciences. That said, we are not suggesting that such overlap might lead to the formulation of the one best way of understanding issues of development. Quite the contrary.

What we wish to show in this and the next chapter is that there are, necessarily, *multiple* ways of theorizing and understanding issues of development, in and across different disciplines. This, we argue, can open up possibilities of interdisciplinary connections, relations, and, perhaps, future collaborations, as well as thinking in more creative ways. This aligns with the overarching aim of the book, which is to impact future scientific inquiry to spur relevant forms of investigation for the benefit of children, whether the research is done *on*, *to*, *with*, and/or *by* children in many different disciplines while honoring and productively taking into account multiple forms of knowledge.[15]

The aim of this chapter is to introduce some different ways of how to understand development. In the upcoming section, we present an extensive discussion on development as an issue of societal and academic dispute. The following section will introduce ideas of development in evolutionary, biological, and developmental sciences. We will reveal some important differences in the ways the concept of development is scientifically handled in these disciplines. Nonetheless, with respect to the social sciences and humanities, developmental and biological sciences are most often discussed in terms of what is critically called *developmentalism*.

The critique of developmentalism centers on claims that a focus on development leads to practices that subjugate children. This has led to an articulation of what has been called *postdevelopmentalism*. Postdevelopmentalism will be presented, first, in the context of its emergence as a critique of developmentalism, which has actually taken place both in economics and in the field of critical child studies and early childhood education. Second, postdevelopmentalism is presented as ontologically, in part, overlapping one major way of understanding development described in the section on developmentalism. This is due to a shared understanding of development as an emergent process of dynamic natureculture interaction and coconstitution. The chapter ends with concluding reflections.

A Story of Development as an Issue of Societal and Academic Dispute

What is the relationship between nature and culture and nature and nurture[16] in relation to child development? In this section we will trace this issue to different historically situated conflicts in society and, of course,

especially within the space of academia. Bear with us, as we tell a story that will take us hundreds of years back to lay out the landscape of the frictions or disagreements around the issue of child development into our time. However, these disagreements have to do less with disciplinary alliances and more with ontological worldviews and methodological preferences, as we will try to untangle.

In terms of ontological worldviews, the friction can be traced to the way a scholar thinks about bodies, agents, and matter in the world as either *in*dependent (discrete units) or as *inter*dependent. An interdependent body is unable to exist, evolve, develop, or thrive without intimate relations with other bodies, like the baby and the symbiotic relation to a significant adult or, as the biologist Lynn Margulis has called this relation when referring to the relations in nature at large, *symbiosis*.[17]

What about methodological preferences? Here, the disciplinary conflicts have to do with whether a scholar might also understand the value of forms of knowledge production other than those provided by their own discipline. At the risk of polarizing, this might be a value-based choice between any kind of naturalistic epistemology, such as RCT and statistical analysis, and any of the subjectivist idealistic epistemologies, such as phenomenology or sociocultural theory, which take the perspective of an experiencing human being. However, these contrasting ways of producing knowledge are both valid and important when it comes to inquiry concerning young children. It is, in fact, possible to treat them as an intertwined relation when taking the view of the child as constituted by multiple realities.

In the book mentioned earlier by Fox Keller,[18] she describes a still ongoing debate about whether or not nature and nurture can be understood as separate entities, that is, development understood in terms of nature *and/or* culture (*or* nurture), depending on what the discussion revolves around. When arguing that nature and culture (or nurture) must be understood as separate, there is a taken-for-granted notion that states that what is innate and given (nature) is constituted as *prior* to culture. Nature is thus thought to affect the development of a child independently of how culture affects development, that is, by means of its precedence to human culture (nurture). In this view, both nature and nurture are unarguably influential, but they influence development more or less separately.

The foregoing view can be referred to as what the historian Lorraine Daston discusses in terms of nature's authority.[19] However, it turns out that the authority of nature is a messy notion. Daston shows that the

authority of nature is not merely ascribed to what is material or embodied. It is also extended to the pattern of eternal values: that is, to *the Good*, *the True*, *the Beautiful*, and, thus, to *God the Creator*.[20] What is considered good and beautiful are values that are generally ascribed to culture. Hence, notions involving nature and culture are not just entangled in this curious way but will appear to be even messier when we bring into the discussion the body/mind dualism.

A more widespread idea of a split between the body and the mind can be traced back to the seventeenth-century philosophers René Descartes and John Locke. This discussion revolved around what is possible to know for certain about the world and our existence in it. Indeed, this is an epistemological question. For both of these philosophers, the materiality of the body was something one could never have any certain knowledge about since the materiality of the body was constantly being transformed. What one could, however, be certain of was the existence of one's own consciousness. This was the conclusion reached from Descartes' famous statement "I think therefore I am."[21] It meant identifying the human mind with the power to objectify and distance itself from the features of material substances of potential change: a power that is given only to the human consciousness, according to the philosopher John Locke.[22] Anthropologist Marilyn Strathern writes about this as a radical form of self-objectification.[23]

This notion of the self as an independent human subject gave rise not only to political movements of individual rights during the eighteenth-century Enlightenment but also to claims that knowledge can (only) be constructed from the point of view of human consciousness. That is, with Descartes came the idea of the ability to objectify, not just the material world, *but also oneself*, and thus make oneself the object of study. These forms of objectifying, of both oneself and other species and matter in the world, have produced many very different forms of epistemology. What was made possible was a split between doing studies from the viewpoint of the human, our social life, society, language, and culture and doing studies of the bodies and matter of material nature. That is, a split was constructed between a materialist and realist *natural* science and an idealistic subjectivist (i.e., nonmaterialist) *humanist* and *social* science. The former was given the task of studying the materiality of nature, while the latter took up the task of studying human culture and sociocultural relations. A modern academy evolved, where scholars basically have assigned themselves the study of the one rather than/or the other.[24]

Let us now discuss in a bit more depth the nature–culture split that concerns human development. Fox Keller illustrates how this either-or thinking concerning nature and/or nurture described above makes sense in one way of thinking, but not in another. She illustrates this by referring to the so-called bucket model, as adapted from the philosopher Ned Hall.[25] It goes like this: Two children, each with a hose of their own, are filling water in a shared bucket, which represents development. Billy fills the bucket with forty liters of water. Then Suzy fills it with sixty liters. This means that forty percent of the water in the bucket can be attributed to Billy and sixty percent to Suzy. Or, as is sometimes, according to Fox Keller, erroneously expressed: innate qualities (or genes) fill the bucket to a height of x, whereas personal and acquired experiences (or environment/nurture) add an amount of y (Fig. 2.1).[26]

This effort to separate, according to Fox Keller,[27] is sometimes expressed in this very fashion, as if nature (the biological environment) and nurture (sociocultural environments) were alternatives taking turn, first one and then the other. This insistence on separating nature from culture has more
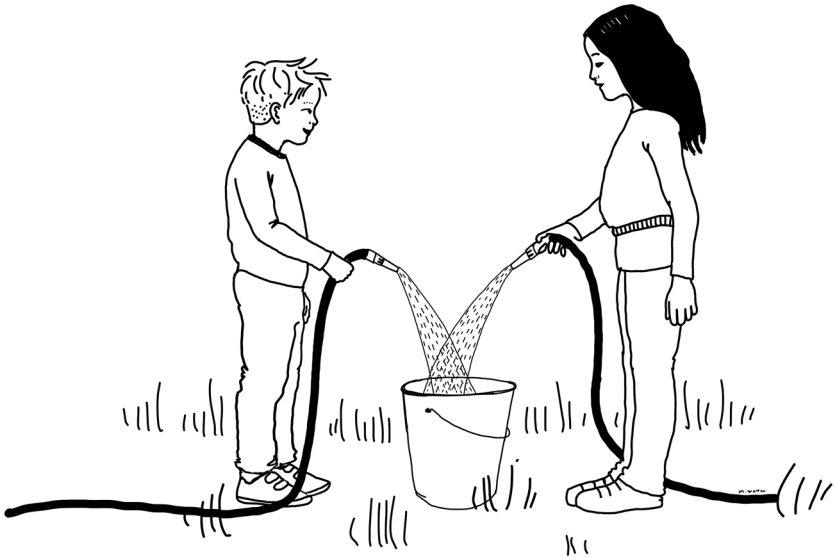
Fig. 2.1   An adaption of the "bucket model" (nature *and/or* culture), from Ned Hall, in Fox Keller (2010)

or less caused the already mentioned divide in modern academia. Furthermore, this split was simultaneously political.

In 1950s academia, talk about biological differences would become highly suspect, writes the anthropologist Annemarie Mol in her 2002 book *The Body Multiple: Ontology in Medical Practice*.[28] Questions were raised about how to do research ethically after the "murderous eugenic" scientific and political practices performed during the Second World War, foremost in the Nazi death camps, but also in other contexts of colonialism in the Global South. Moreover, academia was, and still is, intertwined with financial and political issues, both external and internal to the academy itself. While biological differences were downplayed or even ignored altogether, talking about social and cultural differences between humans was made into a social science and humanities privilege, writes Mol.[29]

Mol takes medicine and health care as an example of the above point. Medicine was tasked with representing what was going on *inside* the body, while the social sciences were developed to inquire into the *social life* of humans, where care is performed. Theoretical and methodological tools were crafted from the 1950s onward to study social and cultural life in ethnography, sociology, social work, pedagogy, and strands of constructivist psychology by means of interpretive forms of analysis. This was understood as a more or less explicit turn to epistemology, says Mol. That is, these scholars made no ontological claims while performing sociocultural and constructivist knowledge productions.[30] In terms of methodology, the interest shifted toward analyzing different perspectives and social constructions of, for instance, being a patient, doctor, teacher, parent, preschool child, or child, *per se*.

Moreover, according to Mol, the space between biology and culture was manifested and articulated with a growing attention to other binary constructions, such as those between race and culture, sex and gender, and biological parenthood and kinship systems. The point here is that all of these issues directly or indirectly refer to the nature–culture divide. Mol concludes that the developments in academia during this historic period of the mid-twentieth century cannot be described as if the social sciences were "handed" issues of the social and/or cultural. Rather, as Mol writes, "the social sciences delineated their own objects *alongside* those of biology, with arguments of warding off racism,"[31] sexism, and other power-producing social practices.

The sociologist Talcott Parsons took the lead in this separation of research problems. According to Mol, Parsons was inspired by Edmund Husserl's phenomenological philosophy and method articulated during the nineteenth century. Parsons claimed that it was crucial to study the personal and social as *different from* the biological. This is in line with Husserl's idea of a science from the lifeworld horizon of the human that includes the mental and social wellbeing of a human being.[32] In this way, Parsons actively advocated for the separation between the social sciences and medicine, as well as the natural sciences. In line with Parsons' ideas and the aforementioned bucket model, in 1948, the World Health Organization would state, regarding human health, that "*It is thus partly biological and partly socially defined.*"[33] Mol comments: "A whole tradition of sociological thought can be traced back to this single sentence."[34]

Eventually, critique of the described foundational divide in academia would slowly evolve, both from within biology and in sociology. Scientific theorists in these disciplines examined the practices of the natural and social sciences themselves in trajectories of research called science technology studies (STS), social science studies (SSS), and actor network theory (ANT). Feminist biologists in the 1980s, such as Donna Haraway and Anne Fausto-Sterling, argued that racism and sexism could be founded in intricate entangled natureculture relations. Haraway very early on warned about the problems that might arise if the social sciences were to merely supplement the natural sciences. Rather, these different sciences need to collaborate and invent new methods together, according to Haraway.[35]

This brings us back to Ned Hall's bucket model and a possible second version of when Billy and Suzy are filling a bucket with water in collaboration. Whereas the former image supported the divide, this second version contests it. Now the image instead illustrates Billy while turning on the water tap as Suzy holds the hose over the bucket to fill it. It becomes impossible to say how much of the water is due to Billy and how much to Suzy, since the question makes no sense, says Fox Keller.[36] In other words, the image shows how development is natureculture coconstituted (Fig. 2.2).

If this second image is the better representation of what biologists in general hold to be true of development, why then are there still arguments of division and separation between nature and nurture and, thus, nature and culture? One answer, says Fox Keller, as to why the divide remains is due to the statistical, and thus methodological, interests in wanting to produce knowledge about variations within populations. This requires an assumed separation, according to Fox Keller.[37]
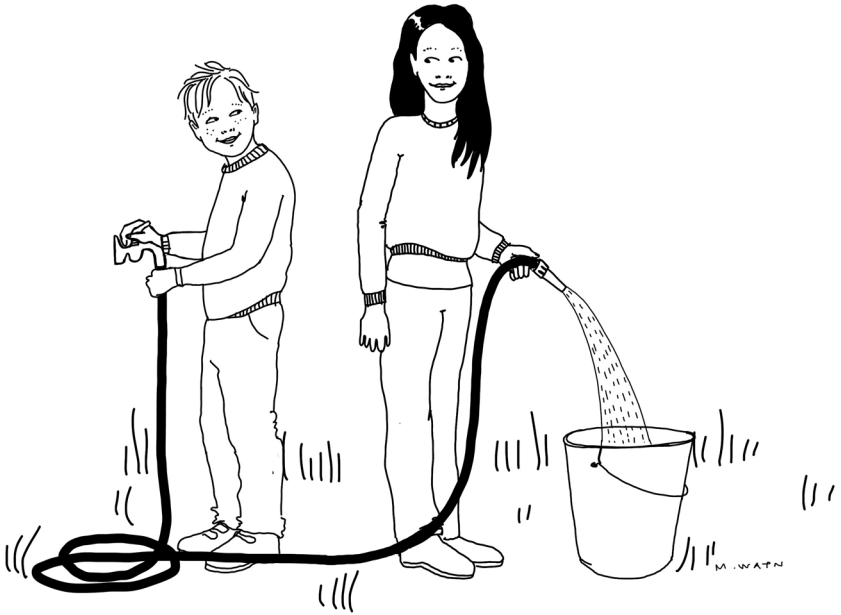
Fig. 2.2 Adaption of bucket model (*natureculture*), from Ned Hall, in Fox Keller (2010)

INTRODUCING TWO WAYS OF VIEWING DEVELOPMENT AS DEVELOPMENTALISM

When we think about a child's development, at least in early childhood education, we tend to talk about it in terms of following universal developmental "stepping stones" and "windows of opportunity."[38] These "stones" and "windows" are usually described as appearing in a linear progression and emerging according to innate, structural patterns inscribed in the child's DNA. However, according to Fox Keller and others, the biological development of all species has for decades been described in terms of a nonlinear dynamic system: dependent on a mix of environmental, cultural, and social contexts.[39]

These two seemingly contradictiory ways of describing the process of development can also be articulated as two different questions: First, can development be seen in terms of predictive universal stages for parents and

teachers to detect and nudge toward a predicted outcome? This is what some critical scholars have chosen to call a *developmentalist* approach.[40] Or, second, can development rather be understood as a highly complex contextual adaptive process in the cultural and material environment, that is, circumstances that necessarily take part in molding an individual's plastic development? The latter constitutes a view of development that is necessarily situated, malleable, and flexible: a process during which children, parents, and educators can act and respond both actively (intentionally and consciously) and passively (an unreflective or unconscious response).

If the former description of development can be identified as a developmentalist approach, can the latter be understood as a displaced postdevelopmentalist understanding? No, it cannot. Instead, as Usha Goswami,[41] a leading scholar in the developmental sciences, shows, both of the foregoing descriptions are simultaneously true. They are to be thought of as being in an entangled relationship. This will complicate subsequent discussions somewhat. We need to, so to speak, make a provisional differentiating cut within the developmental sciences between two positionings, which are at the two ends of a continuum, in order to make a point about how they are different but nevertheless entangled.

We will make a temporal cut according to some specific factors referred to in the science theory literature.[42] According to these factors, it makes a difference whether a scholar of the developmental sciences will subscribe primarily to what can be called a naturalistic *mechanistic* view of development or a naturalistic *process and dynamic* view, respectively. Importantly, they are both forms of naturalism. That is, they do scientific work, using experimental and other naturalistic methodologies. However, because of their different positionings on that continuum between mechanistic and dynamic views, their research projects might be very differently composed. While the latter scholar might engage in complex interdisciplinary research projects, the former might stick to a clear-cut standard experimental epistemology in their inquiry.

If both of the approaches just discussed are to be considered as representing developmental sciences, this leaves us with the question of what constitutes a *post*developmentalist approach in studies concerning young children. We will return to this question in a later section. For now, we will dig a little deeper into how to understand the two developmental scientific approaches sketched above on the continuum between a naturalistic mechanistic and a naturalistic process and dynamic view, respectively.

A naturalistic mechanistic view emphasizes generalization and causality by unveiling the average development that can be described in terms of general predictive stages or windows of opportunity. A naturalistic process and dynamic view places the emphasis instead on malleable individual and lifelong processes. Although advocates for both of these positions will fully recognize the knowledge produced by the other, their differences are still a reflection on how they are more or less attached to different meta-theoretical (ontological) and methodological underpinnings. These might affect what kinds of inquiry they choose to pursue, all of which are important to the joint knowledge production in the field, but in different ways. They are, if you will, different realities of the phenomenon studied.

Philosophically, a mechanistic view of the world can, in a scientific theo-retical view, be understood in terms of a substance ontology. This had already been proposed by the ancient Greek philosopher Aristotle.[43] This means that things, matter, and phenomena are understood to have a sta-ble, fixed, universal character or a kind of building blocks that can be adjusted to produce a specific outcome. In an extreme positioning of a mechanistic way of thinking, the term developmentalism refers to a devel-opment that proceeds in a progressive, irreversible, and universal manner, caused by innate genes, as discussed earlier.[44] For instance, genes are seen as discrete entities with causal relations to certain behaviors or specific learning outcomes; however, this might be a stance merely taken for doing a specific inquiry. However, although genes are articulated in this view as discrete objects of more or less stable properties, the environment for these genes to express themselves is nevertheless inevitable for the out-come of their expression.[45] That is, the embodied environment is inevita-ble for these genes to do their work on that transformation we call development. On this particular matter there is no conflict: a naturalistic mechanistic view is in agreement with a naturalistic process and dynamic view when it comes to issues of what is known as epigenetics.[46]

However, the meaning conveyed in a mechanistic view is that develop-ment constitutes a result of nature *and* culture, as basically separate phe-nomena in interaction with one another: as in the one (nature) preceeding the other (culture). Let us phrase the foregoing statement in yet another way. It's not that an innate maturation is seen as being undisturbed by, for example, environment, culture, or nurture in this mechanistic view. Rather, as discrete material building blocks, DNA is seen as *preceding* culture and

nurture to be mechanistically identified as *causing* a specific outcome.[47] A mechanistic view thus produces media headlines such as the discovery of the gene for voting for a specific party or committing a specific crime, or when someone claims to have targeted the *one* mechanism for learning, which can "optimize," in general, children's development in that specific respect. An example from education is when media reports on that one specific attention-training exercise by itself, in a decontextualized situation, can boost cognition with long-time effects on future education for all children.[48] Studies that engage in this line of mechanistic research also sometimes point to how innate cognitive dispositions seem to be boosted by training and scaffolding, so as to make the skilled even more skilled, and thus limiting the desired compensatory training for the less skilled.[49]

Although the aforementioned mechanistic view produces important knowledge that represents one reality of children's learning and development, a contrasting view in the developmental sciences instead articulates issues of development in terms of a processual, relational, and dynamic development. This development is also thought to be individual to each agent's specific environmental life conditions. This means that it is determined both by biological, material, social, cultural, and emotional factors.[50] *Everything Flows* is the title of an edited volume of texts that explain this view in several versions, written by biologists and biological theorists.[51] In the field of child development, the title of a corresponding book is *Lifespan Developmental Systems*.[52] These views on development have challenged the mechanistic view, both in biology and in the developmental sciences concerning children's development, in ways that will also make a difference in how they might choose to carry out research or how results from studies are interpreted. Hence, what we are getting at is that there are very different ways of understanding what constitutes development, despite shared naturalistic methodologies in the developmental sciences. However, as already indicated earlier, these extremes are drawing increasingly closer to one another, as studies of mechanisms of learning are showing increasing interest in individual differences and variability. However, differences in how development is ontologically understood influence how research problems are formulated and how inquiries are methodologically performed and results interpreted.

Here is an example of interdisciplinary studies exploring the development of children's olfactory abilities, or sense of smell, and how it is tied

to their language development. One overarching hypothesis for this kind of research has been that children in various ecological and cultural environments around the world develop their olfactory senses with very different sensibilities to various odors/smells. Moreover, the question has been raised as to whether or not these environmental differences are also connected to differing linguistic conceptual developments to match the different senses of smell that these children are developing in their different environments.[53] That is, and in the words we want to put forward in this book, that there might be a natureculture coconstitution of the, in this case, embodied olfactory development and a cultural language development due to specific environments of both nature and culture. A number of interdisciplinary research projects involving scholars from either linguistics, neuroscience, genetics, anthropology or psychology have collaborated in these projects. Each of which can contribute with a part of what can be systematically tested in future and larger interdisciplinary studies to test this overarching hypothesis.

The research so far done shows that olfactory development depends on entangled conditions in the natural (ecological) and cultural practices in local populations, which also affect linguistic representations.[54] These conditions enable natureculture coemergent abilities to both identify various kinds of smells and linguistically name and categorize them. Ethnographic data has been combined with laboratory testing and suggest that this ability is learned through social practices as very young children in specific natureculture environments. These environments vary to a significant degree in terms of geography, number of species and objects to smell, and cultural practices, for example.[55] Children of communities living and practicing a degree of hunter-gatherer lifestyle in ecological environments of rainforests develop olfactory abilities that considerably (in terms of numbers and quality) surpass those of peoples growing up in the British Isles, whether in the countryside or in urban areas of all sizes.

The preceding example illustrates well what the biologists John Dupré and Daniel J. Nicholson[56] talk about as a processual and dynamic view of development. They write as follows

> What we identify as *things* are no more than transient patterns of stability in the surrounding flux, temporary eddies in the continuous flow of process.

According to Dupré and Nicholson, the world around us can in a dynamic worldview be seen as a "manifold of nested and interrelated processes that collectively constitute a dynamic continuum."[57] In summary, in ontologically articulating development, they assert that it is dynamism, rather than substantialism, that constitutes the fundamental principle of an organism, a thing, and an object.[58] This dynamic thinking about development, evolution, and change had first been articulated thousands of years ago by both indigenous and presocratic thinkers, who theorized about things, bodies, and matter as flows of change with different duration,[59] or, as Dupré and Nicholson suggest, when referring to the different rates of renewal of skin, bones, livers, and kidneys. We can think of this in terms of a "hierarchy of processes, stabilized and actively maintained at different timescales."[60] Development is hereby understood in terms of natureculture coconstitution.[61] This view is valid for studies conducted in the realm of brain plasticity[62] at large and, more specifically, in neuroconstructivism, as well as lifespan developmental systems theories studying the development of children. But what about that third way of looking at development? What is *post*developmentalism all about?

Introducing a Postdevelopmentalist View

The concept of *postdevelompentalism* emerged in two very different, but still interconnected, academic fields. It first emerged in developmental economics, after the Second World War, during the time of postcolonialism when former Western colonies broke loose from their colonizers and established their own states. We will expand somewhat on this in a later chapter since it is connected to what has happened in child studies and early childhood education. For this chapter, we will limit our introduction of the concept to how it has appeared in this latter context of child development and early education, in terms of a resistance and contrast to a developmentalist view of development.

In the late 1980s, some scholars in critical psychology and postcolonial studies started to use the word *developmentalism* in a critical fashion, while referring to development in terms of determining "universal stepping stones."[63] The critique was meant to show how developmental theory had become translated to normative and normalizing practices in child care and preschools. The argument was that practicing such developmentalism

risked subjugating individual children to norms with oppressive effects.[64] In contrast to this, the *postdevelopmentalist* approaches that were later developed[65] advocated for more inclusive ways of seeing children in terms of "becomings" while enacting care and educational practices.[66] The critique of developmentalism also involves a critique of individualism and of interventions in individual children's lives to optimize their potentials. In other words, postdevelopmentalism has responded critically to Fox Keller's call for an optimization of children's development, as quoted in the introduction of this chapter. Such intervention has rather been understood as an individualizing monitoring of individual children, according to norms that may have harmful consequences.[67] We will expand on this in a subsequent chapter.

We will now turn to the development within this trajectory of postdevelopmentalisms, from being dominated by critical psychology and post-colonialisms toward a move into a more ontologically driven framework within posthumanism and new materialism.[68] In posthumanist and new materialist studies – sometimes labeled postdevelopmentalist – a definition of child development can be summarized using the (most often) hyphen-less expression *natureculture coconstitution* adopted from Haraway.[69] This terminology highlights the way nature and culture can be understood to be intricately entangled in all aspects of development. Here, it is obvious that there are ontological overlaps with what was described in the previous section regarding the processual view of development. However, within posthumanism and new materialism, this view has mainly evolved from another philosophical realm.

In the humanities and social sciences, natureculture coconstitution and intra-action – with reference to Karen Barad – have evolved from the realm of critical, postcolonial, and feminist poststructural claims of the power of language, culture, and discourse as constitutive of the body. However, as both Barad and Haraway have noted, this was often done without taking the biological body into account: There seems to be a limit at the skin.[70] For a decade or more, the criticism of paying insufficient attention to the body and materiality has, however, opened up to what posthumanist and new materialist scholars have claimed to be the mutual coconstitutiveness of matter (body) and meaning (discourse).[71] This important shift implies that matter has an equal constitutive power on culture, as culture and discourse have on the body and matter. This shift toward the coconstitutiveness of matter and discourse is sometimes conceptualized in terms of a so-called *turn to ontology*, in contrast with the earlier epistemological focus of inquiry.[72]

An ontological turn and thinking about the coconstitutiveness of the human body was, however, established as early as the 1980s in feminist biology and scientific theory and science and technology studies. Why didn't this knowledge take hold in feminist social science and humanities academic discourse until almost 30 years later? This, as Mol and others have argued, has to do with the difficulties of dealing with the biology of the body during the latter part of the twentieth century.[73] Some scholars have stated that the time – 1980s and 1990s – was not yet ripe to deal with the biological and social coconstitutiveness of these topic, especially sex/gender.[74] During this period, claims of the constitutive force of culture, meaning, and discourse were still struggling to become more widely accepted. The dominant way of thinking at that time has been described as a biological determinism, or biologism.[75] For feminist scholars, resisting being essentialized as different from men by nature, and thus "less" than men as a given,[76] it was necessary to tread carefully when talking about women's biological bodies. This was true irrespective of views on sex/gender that they might embrace, both in academia or as feminist activists.

What about the consequences for methodology in studies involving children? The shift from epistemology to ontology – i.e., natureculture coconstitution – can also be expected to produce significant shifts in how postdevelopmental studies are epistemologically enacted. Although this is sometimes attempted in postdevelopmentalist studies, there remains the problem of how the physical and material body of the child can be engaged empirically, and/or with knowledge derived from the developmental sciences. Although a few attempts have been made,[77] this still seems to be a difficult obstacle to overcome, in terms of both methodology and the politics of bringing biological matter into play.[78] On the other hand, there are several examples of empiric engagement with the embodiedness of affect/emotions. For such studies, scholars such as Lisa Blackman, Kathleen Stewart, Erin Manning, and others have relied on the philosophies of Henri Bergson, Gilles Deleuze, and Baruch Spinoza. There are, however, empirical developmental studies that would basically claim the same thing as these philosophers. The interdisciplinary scholar Margret Wertherell has commented on this, saying that this so-called affect theory misses some crucial points by infamously avoiding engagement with the sciences of psychobiology and social psychology.[79]

Mol has stated that the difficulties that the social sciences have with engaging with embodied materiality have meant that "the physical body stays untouched."[80] This is perhaps particularly true when it comes to

inquiries that concern young children. Perhaps engaging with knowledge, in simultaneously affirmative and critical ways, from recent developmental sciences is only a matter of time. What has been called the environmental humanities[81] have for a decade already involved multiple forms of knowledge and knowing in their studies, focusing on environmental issues of different kinds.

SUMMARIZING AND CONCLUDING THOUGHTS

To summarize and conclude this chapter, we wish to discuss two words that make a lot of difference when thinking about development: the *individual* and *interaction*. How we use and understand these words has everything to do with the first two introduced ways of understanding development as either underpinned by a mechanistic worldview that makes separations or a processual and dynamic ontological worldview of entanglement. Last but not least, being conscious of how these words can be used in different ways is important if we are to engage in interdisciplinary collaborations and relations, as we will show in upcoming chapters.

The words individual and interaction are, in their taken-for-granted usage, adjacent words that produce meaning when put together in a relation. To make meaning about things, researchers have looked for differences and specificities to separate out units, bodies, and matter and sort them into separate categories. This method has borne much fruit. However, all along there has been this other theory of evolution and development, based on the notion of symbiosis, first articulated by Lynn Margulis.[82] According to this latter view, which is embraced by the biologist Scott Gilbert and his coauthors, "all classical conceptions of individuality are called into question by evidence of all-pervading symbiosis."[83] Symbiosis, for Margulis and others, strongly opposes a competition-oriented view of evolution, instead emphasizing a reciprocal and cooperative relation of transfer and coconstitution.

Symbiosis as a concept displaces that of interaction, both in biology and in the social sciences and humanities. In the following quote, Fox Keller disqualifies the taken-for-granted understanding of interaction as something that takes place between two separate, discrete, and detached entities, as a mechanistic view outlined in this chapter. She concludes as follows[84]:

Indeed, the notion of interaction presupposes the existence of entities that are at least ideally separable – i.e., it presupposes an a priori space between component entities – and this is precisely what the character of developmental dynamics precludes.

When Fox Keller displaces the concept of interaction by ridding it of something taking place between two entities, how can it be understood differently? The shift becomes a matter of understanding any kind of body or organism as *always already* in a codependent, coemerging, intertwined relation of mutually transformative interactions, as an in-itself body of multiple relations with permeable borders. This is what in this chapter has been described in terms of a processual and dynamic view of development. Although this view can be claimed to belong to the developmentalist theories of development, it is nevertheless a view that has much in common with scientific theories within the posthumanist and new materialist (social science) forms of thinking about development, that is, theories that, at least theoretically, guide a *post*developmentalist view of learning. Pointing out this ontological overlap has been the main message of this chapter.

Notes

1. Lenz Taguchi and Munkammar (2003).
2. e.g. Andersson (1994).
3. e.g. Broström et al. (2018); Emilson and Johansson (2018); Pramling Samuelsson and Sheridan (2009).
4. e.g. Lopes et al. (2021), as one of the studies referred to in Sweden's largest daily newspaper Dagens Nyheter in January 2024, just to give one example.
5. In Sweden, the preschool curriculum has formerly stipulated the need to enhance children's digital competences, which has led to Swedish schools using digital devices in preschools and schools as an aim to foster equal access to such skills.
6. e.g. Gulz and Haake (2024); Tonér and Nilsson Gerholm (2021).
7. e.g. Tajic and Bunar (2023); Bunar and Ambrose (2016).
8. Lindgren and Puskás (2024).
9. Various political parties have suggested the age of 2 or 3.
10. e.g. Durlak et al. (2011); Nix et al. (2013).
11. Lindgren and Puskás (2024).
12. Fox Keller (2010), p. 82. (italics added.)
13. Rose (1989); Burman ([1994] 2016).

14. Colebrook (2017).
15. Compare Bruun Jensen and Morita (2019); Haraway (2016b); Pickering (2019). Stengers (2018).
16. There are indeed traits that are innate or inborn that are difficult to radically change albeit situated and coconstituted expressions. However, as Fox Keller (2010) writes: "Given how interdependent the effects of each of these is on the other, we cannot separate their respective influences on the final outcome". (p. 74)
17. Margulis and Fester (1991).
18. Fox Keller (2010), p. 84.
19. Daston (2019).
20. Daston (2019), p. 3.
21. Descartes (2008), p. 178.
22. Locke (1690).
23. Strathern (2019).
24. See Chap. 3 and Mol (2002).
25. Fox Keller (2010), p. 8–9.
26. Fox Keller (2010), p. 8.
27. Fox Keller (2010), p. 10.
28. Mol (2002), p. 17.
29. Mol (2002), p. 21.
30. Gergen & Gergen (1991). Gergen K and Gergen M made explicit in their chapter of the book *Research and Reflexivity*, edited by F. Steier and published 1991, that the idea of social constructivism as epistemology refrained completely from discussions about ontology. What concerns the body, we cannot know about as social scientists, so what we are dealing with are issues of social interaction, was their argument.
31. Mol (2002), p. 18.
32. Mol (2002), p. 10.
33. Mol (2002), p. 10.
34. Mol (2002), p. 10.
35. Haraway (2016b).
36. Fox Keller (2010), p. 9.
37. Fox Keller (2010), p. 15–20.
38. These two expressions have been the most common taken for granted way of talking about child-development for many decades in basically all kinds of texts on the topic. They can thus be seen as generic metaphors for talking about development in a developmentalisms view.
39. Fox Keller (2000), and edited volume by Nicholson and Dupré (2018).
40. e.g. Burman ([1994] 2016).
41. Goswami (2019).
42. Dupré et al. (2018); Fox Keller (2010).
43. West-Eberhard (2003); Dupré et al. (2018).

44. Skinner et al. (2019).
45. Jablonka and Lamb (2006).
46. Jablonka and Lamb (2006).
47. This is indeed a fact for some traits and sicknesses, but not for the overall development as we will discuss more later.
48. This is how studies by for instance Klingberg (2012) are sometimes presented.
49. Klingberg (2014); Sauce et al. (2021).
50. Mascolo and Bidell (2020).
51. Nicholson and Dupré (2018).
52. Skinner et al. (2019).
53. Henrich et al. (2010).
54. Majid et al. (2018) SCIENCESI.
55. Burenhult and Levinson (2008); Majid and Levinson (2011).
56. Dupré et al. (2018), p. 3. Italics added.
57. Dupré et al. (2018), p. 3.
58. Nicholson and Dupré (2018), pp. 5–14.
59. Osborne and Rowett (2004).
60. Dupré et al. (2018), p. 3. See example provided on this page.
61. Skinner et al. (2019), p. 129.
62. Some of the most important empirical findings of brain plasticity was produced in the early 1960s by one of the first women neuroscientists Marian Diamond. (Diamond et al., 1964).
63. e.g. Bloch et al. (2006); Burman ([1994] 2016); Cannella and Viruru (2004); Swadener and Mutua (2008).
64. e.g. Dahlberg et al. (1999); Pacini-Ketchabaw and Pence (2005).
65. e.g. Blaise et al. (2020); Edwards et al. (2009); Lenz Taguchi and Eriksson (2021). Pacini-Ketchabaw (2011).
66. e.g. Kocher et al. (2015).
67. Burman (2016); Dahlberg et al. (1999); Taylor (2013).
68. e.g. Murris (2016); Osgood and Sakr (2019).
69. Haraway (2016a, 2016b).
70. See Haraway (2016a); Barad (2007).
71. Barad (2007), has probably put more effort into theoretically describing this mutual co-constitutive process than any other scholar.
72. Hekman (2010).
73. Mol (2002).
74. Fausto-Sterling (2020).
75. Lewontin et al. (1984).
76. Braidotti (2013).
77. Youdell and Lindley (2018); Lenz Taguchi (2016); Lenz Taguchi et al. (2020).
78. Bodén and Joelsson (2023).

79. Wetherell (2012).
80. Mol (2002), p. 20.
81. e.g. Bird Rose et al. (2012); Emmett and Nye (2017); Neimanis et al. (2015).
82. Margulis and Fester (1991).
83. Gilbert et al. (2012), p. 327 in Strathern (2019), p. 16.
84. Fox Keller (2010), p. 6. Italics added.

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The Emergence of Postdevelopmentalism and a Coconstitutive View of Development

The title of this chapter gives away its two overarching aims: (1) to go a bit deeper into the reasons for the emergence of a postdevelopmentalist approach in the field of childhood studies and early childhood education and (2) to exemplify in more detail what thinking in terms of a natureculture and naturenurture coconstitutive view of children's development might entail.

Postdevelomentalism emerged as a critique of what was called a developmentalist view of childhood. The postcolonial early childhood scholars who articulated this critique were directly or indirectly connected to or inspired by another field of research, which has also been concerned with development. That field is not primarily concerned with the development of children but rather with economic preconditions for developing industry and welfare in societies in the Global South, from the postwar period onward. The overlapping problem of concern for both of these trajectories of theory and empirical inquiry is asymmetrical relations of power, more specifically, power relations between the economies of the Global North and South and power relations between ideas of development in psychology and pedagogy.

We will discuss the core aspects of how these asymmetrical relations have been understood and contested in the second section of this chapter. This will be followed by a section with a case study describing the story of the unhappy relationship between the disciplines of psychology and

pedagogy during the twentieth century in Sweden.[1] The taken-for-granted pairing of these two kinds of knowledge production did not, as we will show, endure but ended in divorce. But perhaps the time is ripe for a new respectful encounter in the space of meta-theoretical thinking about development. Making the case for doing so is at least our hope and intention, as in the last section of the chapter we provide a more substantial view of development as a result of a natureculture coconstitutive dynamism. Our hope is that this notion of a coconstitutive view of development can become a productive space for starting to build a new and, hopefully, more constructive relationship.

The first section, however, will provide an introduction to later discussions by posing the question of *what*, in Western cultures, historically has been viewed as constituting a child and the development of the child? This is in no way a comprehensive discussion but merely a way for us to enter into the complexities that have contributed to the emergence of a postdevelopmentalist way of thinking and conducting inquiries about young children.

What Is the "Nature" of the Child?

How can the "nature" of the child be understood? When trying to answer this question, one might juxtapose the concept of the child with what has been taken for granted when thinking about children as in terms of a difference from an adult, in modern Western cultures, since at least the Enlightenmen. That is, the child as *not* an adult, not a full-grown human being, nor yet a culturally civilized, responsible, and accountable citizen, for example. The child has historically instead often been thought to have more in common with nonhuman animals in the context of an uncivilized nature.

The civilized adult as culture and the child as uncivilized nature may now be outdated views and expressions in most cultures. However, in studies of childhood, they are not unfamiliar notions, especially in historical studies[2] but also in the posthumanist critique of developmentalism[3] that this chapter takes an interest in. Moreover, although nobody would publicly liken children to animals by saying that they are equally subordinate to animals, as untamed beasts, and need to be tamed, the historical traces of such notions are sometimes still echoed in some public debates around school violence and bullying, for example. Though we stop short of a comprehensive account, let us present some of the historical traces of

these notions. This can shed some light on the critique against developmentalist views of children and childhood that we wish to discuss.

Cultural studies scholar Monica Flegel[4] has shown how the image of the child as an untamed animal-like being was openly held 150 years ago in England. This can be seen from public discussions about possible anti-cruelty acts for both animals and children that Flegel has found in archives. The anti-cruelty-to-animals movement aimed to include children into their activist work, by saying that children and animals are simply equally "helpless" and "at the mercy of those they happened to belong to."[5] And yet, in England, anticruelty laws protecting children were enforced much later (1889) than the first anticruelty laws to protect animals (1822). However, as the historian Linda Pollock[6] has shown, parents and guardians who physically punished or abused their children were correspondingly considered unnatural and their acts as untamed and barbaric. This example, which concerns the view of the child and childhood, shows how nature, and what was considered natural or unnatural, was used in this respect as an authority, for both proponents of child abuse and their opponents.

A more familiar reference to children and nature is the eighteenth-century philosopher J. J. Rousseau. He wrote about childhood as a natural state, featuring the boy-child Émile's upbringing in close relation to nature, to become an independent enlightened agent and citizen.[7] In the same book, however, he recommended that Sophie's upbringing be explicitly constrained so that she becomes a docile and subjugated spouse to Émile. Moreover, Friedrich Fröbel's ideas about nurturing children in kindergarten features children as plants that grow in accordance with their innate trajectory as a species, which cannot be interfered with or speeded up.[8]

So why do human beings, across cultures and epochs, tirelessly refer to nature as the ultimate source of authority for social norms in this way, and specifically when it comes to children? In the shadows of historical events throughout human history, historian Lorraine Daston[9] poses this question in her book *Against Nature*, mentioned already in Chap. 2. She turns to what has been recorded in documents, drawings, and artwork across the globe. Daston shows that nature has been a configuration and a pattern for all kinds of values, not least the human core values of what is essentially good, true, and beautiful.[10] The authority of nature as a meaning-making authority and symbol for what is considered natural and normal has been

used equally by reactionaries and revolutionaries, by the devout and the secular, as Daston remarks.

Daston's core message is that nature has been used to invoke both emancipation and enslavement. It has constituted the foundation of various forms of racism, sexism, classism, and social exclusion of culturally defined abnormalities. *Childism* as a systematic undervaluing of children was added to this list by psychoanalysist Elisabeth Young-Bruehl.[11] This is why Nature and "nature's authority,"[12] as Daston calls it, together with its opposite, culture, become such important concepts in discussions about development. As the reader has probably understood by now, the binaries of nature—nurture and nature—and culture constitute together a main undercurrent to be contested, transgressed, and reimagined in the writings of this book.[13] As we showed in Chap. 2, this is also an important element in the theorizing of a postdevelopmentalist approach.

We now turn to a more careful discussion on the emergence of the concept of postdevelopmentalism, as it appeared, first, in the discipline of developmental economics after the Second World War and, second, soon after that in studies of, primarily, postcolonial early childhood education. These two academic fields that use the concept of postdevelopment might seem to be very different, but they overlap in more ways than one.

The Emergence of Postdevelopmentalism

We start in the field of early childhood education and return to the very first pages of Chap. 2, where we suggested an overarching and shared matter of concern in terms of children *living as well as possible*. During the last century of modernism, a mechanistic view of child development became entangled with notions such as living a life well lived by optimizing children's development. To begin with, such notions were exclusively tied to hopeful and positive intentions about how knowledge of development might enhance the life of each individual child. But with the rise of a larger movement of societal critique starting in the 1960s, a great deal of suspicion became attached to notions like optimization and intervention in children's lives. Critique was articulated by social science scholars and in critical psychology, postcolonial studies, and feminist pedagogy. What was referred to as *developmentalism* would thus be understood with a strong derogatory meaning. But why, exactly, is it that expressions such as developmentally appropriate practices and a development-enhancing education with aims of promoting a "warm, individualized, age appropriate, health

promoting, culturally inclusive, and academically challenging"[14] have instead been perceived as a provocation, and even as something to contest and diverge from in the field of early education?[15]

The critique of developmentalism concerns issues operating on two entangled scales.[16] The already introduced critique of developmentalism mainly refers to practices on the scale of face-to-face interactions in families, preschools, and institutions of care. Individual children are, according to this critique, subjected to practices of self-regulation to become normalized for the benefit of the whole, that is, to become proper and well-adjusted citizens on a societal scale.[17] Hence, the idea of this critique is that there are self-regulation practices that aim to produce docile citizens at the face-to-face scale but that will ultimately benefit capital growth on the scale of the nation, extending to international business corporations on a global scale. This might appear to be a conspiracy theory, but it is nevertheless a discourse very much alive in critical studies of education, especially those investigating the impact of new public management on education and care practices.[18] In Sweden, this is a hot topic, because forty-two percent of preschools and schools in the country are privately owned, with permission to share profits with shareholders from tax-revenue-financed practices.

In economics, the concept of developmentalism takes on a partly different meaning in the context of post–World War II developments of capitalism in the Global South and issues of colonialism and postcolonialism across the globe. Hopeful ideas in developmentalist theories were articulated by development economics scholars after the war. Huge efforts were put into articulating new theories of economic development, pursuing economic growth for multiple countries around the world at this time. The aim was a future of mutual prosperity, shared between investors from the North and the developing countries in the South. Another objective was to prevent another world war, as well as domestic conflicts. One of the key theorists of this affirmative form of developmentalism was Walt W. Rostow.[19] Rostow constructed theories about different stages of economic growth development.[20] In the United Nations, Amartya K. Sen[21] would complement this idea of economic growth by putting equal emphasis on the improvement of human well-being, health issues, and education.

However, an explicit critique was offered by other economists and sociologists, such as Andre Gunder Frank,[22] Celso Furtado,[23] and Autoro Escobar.[24] Gunder Frank articulated the so-called dependence theory.[25] This critique points to the evolving unequal dependencies: the

dependence of former colonized nations on their former colonizers and other Western/Northern economies. The overall and joint critique concerned the lack of sensitivity to conditions in local contexts or, more specifically, the lack of respect for cultural diversity and problems of achieving social justice for all groups in these societies. According to the aforementioned critical scholars, economic growth in the Global South has been shown to produce as much inequality and injustice for some groups, most often the already poor or otherwise marginalized, as it has produced wealth for others. Some readers can probably already sense the theoretical overlaps and influences from the critical postcolonial economy to critical and postcolonial studies of childhood and early childhood education.

It is to Escobar we can attribute one of the first usages of the concept of postdevelopment. He first used this concept while critiquing the concept of development on a general basis.[26] Postdevelopmentalism in this meaning is used to go against what in this context is understood as developmentality, or developmentalism, as the seductive nature of a development rhetoric across virtually all countries around the globe, Global North and Global South alike, according to Escobar. To move forward from this state of potential and repeated oppression, Escobar and his colleagues have put together a *Post-Development Dictionary* (2019). It comprises both critique and transformative initiatives. In the foreword, Wolfgang Sachs[27] makes the following claim:

> [T]he idea of development stands like a ruin in the intellectual landscape … It was the geopolitical program of the post-colonial era … "Development" is a plastic word, an empty term with positive signification … billions of people have made use of the "right to development", as it is stated in the resolution of the 1986 UN plenary assembly … That era is over: everyday life is more often about survival now, not progress … [and] irreparable environmental damage.

The authors of the dictionary all argue for a need to transition to a postdevelopmental world, a world that accepts the state of what they call the *pluriverse*.[28] The pluriverse is about accepting a multiplicity of human worlds that differ from one another. This means acknowledging a varied collective of human configurations that populate and produce the world under diverse norms, with different material local consequences, and with equal rights to exist without one group exploiting another. The idea of the pluriverse, according to these authors, means avoiding producing new binaries, while instead pushing for the diverse and multiple. We are inspired

by the notion of the pluriverse for our displacement of postdevelopmentalism in connection with studies of young children, in terms of a methdology where a multiplicity of epistemologies and ontologies are put into relation, or friction with one another (see conclusion).

In outlining the concepts of developmentalism and postdevelopmentalism, in both economics and early childhood education, we can follow their historical and geographical traces to the continent of South America. It was here that scholars first critiqued developmentalism in economic development theory. Furthermore, this critique was entangled with critiques of educational practices in coalitions with political and financial power in South America around the same time during the 1960s, as already noted previously. Paolo Freire provided such a critique in his book *Pedagogy of the Oppressed*.[29] This book can be understood as a starting point for the growing trajectory of critical pedagogy within the educational sciences, primarily in North America and in the Anglo-speaking world, but also, and profoundly, in the Nordic countries.

It was, however, feminist pedagogy, in an alliance with critical and post-colonial pedagogies, that would form the basis of the critical meaning of postdevelopmentalism in the field of early education and child studies. Feminist pedagogy was formulated during the 1980s and 1990s. The best known scholars among these include Deborah Britzman,[30] Erica Burman,[31] Bronwyn Davies,[32] Elizabeth Ellsworth, Patti Lather,[33] and Valerie Walkerdine.[34] They all published texts that changed the field in substantial ways, with effects on preschools and schools around the world. Here we'd like to mention the classic edited volume *Feminisms and Critical Pedagogy* from 1992.[35] Feminist pedagogy combined equal rights issues and feminist issues in education. The burning issue for the feminist movement on the whole was the need to theorize in new ways on issues such as equality, sexist violence, and sexuality. Drawing on this, feminist pedagogy invested specifically in issues concerning what a developmentalist educational system did, and still does, to girls and women.

Moreover, the previously mentioned influence made possible the feminist and queer poststructuralist movement in educational research and practices, around the world and in Sweden.[36] In Sweden, the feminist and the so-called norm-critical pedagogy gained strength in the school system on the whole during the first decade of the twenty-first century. All preschools and schools were, for a few years during this period, required by government initiative to hire or educate so-called gender pedagogues. As Mia Liinason[37] writes, the Swedish context during this period was a

success story: "an institutionalization of feminist ideas in public policies, state regulations and academic practices has taken place."

In Burman's early work from 1994, *Deconstructing Developmental Psychology*, and her later work, *Development, Child, Image, Nation*,[38] she ties together the connections between ideas about children, women, humans of different social statuses, and international developments in the Global South and North. Burman links psychological, cultural, social, and economic models and practices in her account of how an idea of development turns into a capitalist and subjectifying oppressive developmentalism at different scales. For instance, she describes the Global North as profiting from the labor of children, women, and the socioeconomically less fortunate in the Global South.

Moreover, Burman[39] describes what happens inside nations of the Global South, where development becomes a subjugating developmentalism of indigenous populations, such as in the case of national and international companies acquiring natural resources from land previously constituting indigenous peoples' habitats. At this scale, indigenous children have, by force, been socialized and normalized into the dominant culture and language use, at the cost of their own identity in those realms. In a Swedish context, the indigenous *Sápmi/Sami* children in the north of the country wanted education for their children, but to achieve this, their children were instead literally forced to attend boarding schools far from home at an early age and only permitted to use Swedish.[40]

Developmentalism, in terms of developmental promises of growth and restoration of prosperity, says Burman,[41] has always been motivated by transforming children through childhood and education for a new future society. According to critical psychology scholar Nikolas Rose, there is always a risk involved when seemingly neutral scientific findings about children's development and learning are implemented across educational practices.[42] The critique thus concerns developmentalisms on both an overarching and a personal individuating scale of an individual child's development in everyday pedagogical practices. It is in relation to what was described in the preceding discussion that the critical way of using the concept of developmentalism should be understood.

The concept and practices of *post*developmentalism have been articulated to counteract what in this critical field of research is thought to be a continuing oppressive developmentalism. This concept can be traced to the early childhood education scholar Mindy Blaise[43] and her work with Veronica Pacini-Ketchabaw, as well as to Affrica Taylor.[44]

Postdevelopmentalism, in these scholars' way of conceptualizing it, constitutes critical and postcolonial feminisms that turn against an essentialist idea of the child as nature and, thus, nature's authority, global and local capitalism, colonialisms, and the marginalization of children, women, and other marginalized groups. The meanings of these terms thus overlap with how postcolonial studies in early childhood education have articulated their critiques for more than 30 years, as seen in the works of such scholars as Mimi Bloch, Gale Canella, and Beth Swadener.[45]

The term postdevelopmentalism has been increasingly used in the field of early education in the last decade.[46] In the studies of childhood art education and art-based research, Mona Sakr and Jayne Osgood[47] introduce their book *Postdevelopmental Approaches to Childhood Art* (2020) in the following way:

> [C]hildhood art unfolds according to a predictable series of stages … [as a] basis for the majority of arts curricula and pedagogical approaches to art-making across the Western world. Within this paradigm, educators see children's art-making according to a set of developmental milestones that ultimately lead to the achievement of visual realism.

The conflict sketched here, which is articulated in different but similar ways in all Anglo-speaking contexts, is perhaps especially interesting to study in the outlier context of the Swedish academy. In Sweden, critical forms of theories and methodologies for research, with and in relation to young children, have become common and even dominant in virtually all social science disciplines, apart from psychology itself. In the following discussion, we will therefore take some extra space to discuss how, in the area of child and early education research, this dominance can be traced to the divorce between the disciplines of psychology and pedagogy in Sweden, that is, disciplines that in other countries might seem to form a self-evident academic collaborative couple.

The Psychology–Pedagogy Divorce

Internationally, and especially in North and South America, Australia, and Asia at large, the psychology–pedagogy couple is manifested in the joint discipline of pedagogical psychology. This precise disciplinary label actually also preceded the divorce of the disciplines of psychology and pedagogy at Stockholm University in 1986 that this section aims to discuss.[48]

In what follows, we will tell the story of a conflicted relationship between developmental psychology and pedagogy in Sweden during the last century, and specifically at Stockholm University.

A close relationship between psychology and pedagogy has been, more or less, taken for granted in most countries, which was also the case in the very early twentieth century in Sweden as well. Interestingly, the first professorial chair to be installed in Sweden in either of these emerging disciplines was in pedagogy in 1910 at Uppsala University, Sweden's oldest university. At this time, pedagogy as a discipline was significantly informed by German and Austrian experimental child psychology. At Lund University, the first professorial chair was installed in 1912 in a joint discipline: psychology and pedagogy. This would become the disciplinary label at Gothenburg University as well, when that chair was installed in 1919. The last chair to be installed was at Stockholm University in 1938. The chair was in pedagogical psychology. Nevertheless, it was in Stockholm that the most definitive divorce between the two disciplines would take place some 50 years later.

The appointed professor in Stockholm in 1938, David Katz,[49] was an expert in phenomenology and conducted experimental inquiries into human perception. The mention of this fact is of importance to the developments described in what follows. Whereas phenomenological methods today are mostly underpinned by idealistic epistemologies, their early development was based on Edmund Husserl's experimental methodology. It was designed to match naturalistic empirical methodologies to uncover knowledge about the world from a human lifeworld perspective and experience.[50] This experimental kind of phenomenological investigation thus followed what we would call a standard naturalistic epistemology, with essentialist knowledge claims.

To understand the split between the disciplines 50 years later, it is important to understand what was taken for granted in the partnership between the disciplines. Psychology was understood to construct knowledge about the mechanisms of development and learning, knowledge that the pedagogical partner would then theorize about, empirically test, and then apply in schools. The description of the 1938 chair in pedagogical psychology in Stockholm will stand as our example of how this partnership was first construed. It shows the reason why physionomy was a dominant aspect of pedagogy during this historical period[51]:

[T]he study of the relations between the laws of nature and man's moral and physical nature, with special regard to the growing generation's educational for spiritual and bodily health.

This quote recalls what was said at the beginning of this chapter about "nature's authority" as the guiding principle for academic inquiry at large and the moral compass of human beings historically. In one sense, what is expressed in the preceding quote is actually a taken-for-granted relationship between nature and culture. The problem for science is to know nature, for it to inform culture.

During the time of Katz's appointment, pedagogy and psychology were mostly dominated by German and Austrian psychologists.[52] However, with the growing influence from North America, and definitively after the Second World War, there was a shift toward American theory and the philosophy of John Dewey and William James and the behavioral quantitative forms of empiricism under Arnold Gesell, among others. With this change in the main influences, experimental research and methodologies of testing were strengthened. On the other hand, the influence of educational philosophy and its American counterparts on phenomenology, for example, Harold Garfinkel's ethnomethodology and George Herbert Mead, Herbert Blumer's and Ervin Goffman's versions of symbolic interactionism and/or social psychology would slowly but surely become influential in the Swedish social sciences at large, and specifically in pedagogy, on the way in which the discipline evolved following the split in 1986.

In 1953, professor Katz's chair in pedagogical psychology[53] was divided into two different chairs, one in psychology and one in pedagogy and pedagogical psychology, in what can be conceived of as a trial separation. But it wasn't until 1986 that the chair in pedagogy and pedagogical psychology was finally changed by dropping the second part to narrow it down to a chair in pedagogy. The divorce was finally completed with the establishment of two chairs: one in psychology and one in pedagogy. At this time, an Institute of Education had already been created for teacher education with its own research department. Here, the interest was in teaching and pedagogy, with a strong influence from pragmatist philosophy, Pierre Bourdieu, Michel Foucault, critical and feminist pedagogy, educational sociology at large, and educational history. Moreover, there was a growing interest in participative action research (PAR) and didactics, tied to different teaching subjects in school. In this way, the research conducted in the Department of Pedagogy at Stockholm University was

devoted, not to teaching in educational settings and children's development and learning, but to the "study of the function of change in all its appearances in a human society."[54] Such changes were studied in professions and institutions other than preschools and schools, especially institutions of health care. This development led to a cutting off, from the subject of pedagogy, of inquiries about the mechanisms of development, learning, and the brain. This became the business of another department: psychology. During this postdivorce era, the discipline of psychology strengthened its trajectory on the path of experimental research.

As was already mentioned, the divorce between psychology and pedagogy described in the preceding discussion is primarily a methodological concern. This methodological conflict extends to what can be described as the test-averse context of Swedish early education, child research, and child practices at large.[55] Testing of children, as is done in experimental research, is very rarely done in educational research in Sweden, apart from research in medicine, psychology, or special education, where it is expected. The result of this test averseness in the academy among educational researchers is reflected in a similar test averseness among teachers and educators.

Returning to what was described earlier in the section on the emergence of postdevelopmentalism, this aversion to testing does not appear to be entirely irrational. At worst, the idea of the true nature of the child, that is, the normal child, might work in oppressive ways to subjugate children and their families by means of their own self-regulatory normalization practices, according to the previously mentioned postdevelopmentalist and critical psychology scholars. Thus, as long as advocates of the developmental sciences do not take to heart the reasons why educational researchers and some educators sustain this aversion to engage in bidirectional communication and learning, this fear and aversion will continue feeding the disciplinary split. As a consequence, the conflict and lack of connection between the fields will keep on seeping into childhood practices.

Another possibility, however, is for scholars from both pedagogy/education and developmental psychology to negotiate some common ground for possible collaborations. In the following discussion, we wish to simultaneously challenge and invigorate the postdevelopmental discourse in studies of children, childhood, and early childhood education by providing more information and thoughts on a coconstitutive view of development. The aim is to introduce the process and dynamic view of development to fields of inquiry that concern young children.

Toward a Coconstitutive View of Development

In this last section, we address those readers who desire to know just a little bit more about the theories of developmental and evolutionary plasticity that can be understood to offer somewhat of an ontological overlap with posthumanism, new materialism, and, thus, with postdevelopmentalist thinking. The possibility of such an ontological overlap was argued for already in Chap. 2.

Biology and psychology have seen parallel developments of what is called *developmental systems theories* (DSTs). DST in biology offers a new conceptual framework to overcome the binary constructions between nature and culture.[56] Correspondingly, applications of similar nonlinear dynamical systems theories have also been made in cognitive psychology, as well as in the neurosciences, to overcome the dichotomous nature–nurture construction.[57] As we discussed in Chap. 2, DSTs understand development in terms of a processual, relational, and dynamic development. This development is individual to each agent's specific environmental life conditions, both in terms of the biological-material and sociocultural and emotional environment.

To recapitulate: Development is individually and historically situated; it is socioemotionally and culturally, as well as biomaterially, situated and contextualized for each and every child, while *nevertheless* (individually) shadowing some general principles of development belonging to the species *Homo sapiens*. Or, in other words, the development of an individual (child) body can take many directions and shapes but cannot go anywhere or be anything. Hence, it is not a fact that "*we do not know what a child/ body can do,*" as if it could do anything and everything.[58] We just do not know what a specific body can do, given its specific life circumstances, being a body of that specific species. Unsurprisingly, this corresponds to important features in the theories of posthumanist, new materialist, and actor network theory scholars, who are often scientific theorists trained in the natural sciences or philosophers, such as Karen Barad, Evelyn Fox Keller, Ian Hacking, Donna Haraway, Sandra Harding, Bruno Latour, Helen Longino, Andrew Pickering, and Isabelle Stengers.[59]

In Fox Keller's understanding of development as natureculture coemergence,[60] development can be described as cumulative and aggregated. This is because stuff builds on other stuff, though not in a perfect, linear fashion or following a single, precise trajectory or a smooth and normal path. And yet, what is considered a generalized development for a species

can nevertheless be described as following species-specific general stages. These are stages that will successively transform the individual, depending on the space of evolvability during evolution. Development thus moves in spacetime, but in a fashion that might rather be described as sudden leaps from plateaus of continual aggregations of experiences, depending on the overall environmental conditions, rather than an uninterrupted predictive flow, equal to all individuals.[61]

To pick a random example of an issue of development, let us ask ourselves what happens when a fetus develops limbs that turn into either a foot for a human baby or a hoof of a foal in the womb of either a woman or a mare. Development of the human or horse fetus respectively unfolds in a spacetime movement as an effect of a natureculture entanglement, an entanglement of biological matter coconstituted with the lived sociocultural experiences that each unique child or foal is having.[62] Influence refers to the coemergence in the various active environments: the embodied and the external. Hence, both on the cellular embodied scale of inherent potentialities of, for instance, what will turn into a foot rather than a hoof and what goes on in the internal environment external to the mother or mare.

Natureculture coconstitution thus means that *neither* nature nor culture is considered to be prior to the other.[63] This means that there is a "genetic programming" that continuously interacts with the inner and outer environments. This collaboration will determine when and how that foot or hoof will be able to balance the body to stand, walk, and run: according to developments during a phase of developmental opportunity in specific spacetime life conditions. In species-specific terms, a foal is expected to stand more or less minutes after it is born and a human baby approximately between the ninth and fourteenth month depending on multiple natureculture coconstituting factors.

For human development, knowledge of these natureculture coemerging possibilities to stand and walk have been called either *windows of opportunity* or expected *milestones* (see also Chap. 2). They are articulated in this way because there is consistent knowledge about approximately when specific abilities and changes can be expected to occur, based on mean values. There is also consistent knowledge about the fact that they generally build on one another, cumulatively moving into the future, albeit with sometimes quite major variations at the individual level. That variation depends upon the internal and external coconstituting interaction work of environments with molecules of DNA in millions of cells.[64]

Based on the foregoing discussion, it is not possible to contest the fact that one ability or skill builds on and, thus, constitutes a part of the new environment that can make the next development of a skill or ability possible. There is a specific trajectory of development for human beings, just as there is for horses. This trajectory of development can be described as having windows of opportunity and milestones around which important individual variations are materialized. These variations depend on the coconstituting entanglement work of embodied ("inner") and sociomaterial ("outer") environments. These are variations that in time will transform our being as *Homo sapiens* in an evolutionary perspective, as the variations in horse environments will change the variations of horse beings over spacetime.[65]

Development in this way of representing it has been put forth by many biologists for more than 50 years but only more recently has become a more widely accepted theory known as *phenotypical plasticity*.[66] Barbara McClintock, Mary Jane West-Eberhard, Eva Jablonka, and Marion Lamb, as well as, of course, the previously cited Fox Keller, Fausto-Sterling, and Haraway, have all argued that the DNA molecule, and the genes within, have been designed to "take their cues" in the given environment of each cell, organ, body, family, society, and so forth.[67] This is because all of these interacting environments shape together the information of how that potential inheritance in the (transformative) gene can, and will, be expressed and materialized. All the while, the DNA molecule, with all its genes, is simultaneously reshaping and reconstituting itself as an effect of all this interaction. Without the complexity of environments interacting across different scales, genes in the DNA molecule cannot be expressed, modified, or materialized as a living organism – as life. Fox Keller expresses this in a statement that points to the ontological overlaps we want to make visible in this section. She says[68]:

> By themselves, the entities we call genes do not act; they do not have agency. Strictly speaking, the very notion of a gene as an autonomous element, as an entity that exists in its own right, is a fiction. In order for a sequence of nucleotides to become what is conventionally called a gene requires that the sequence be embedded in a cellular complex that not only reads, translates, and interprets that sequence, but also defines it, giving it its very meaning.

Phenotypical plasticity (that which shapes the human foot or hoof of a foal) refers to the different kinds of expressed and materialized traits of a

living organism of a specific species. It is a result of *dynamic interactions* taking place in cells, tissues, and organs. Phenotypical plasticity is thus what will ultimately make up a living human being. Fox Keller[69] concludes that the main research question for human development should accordingly be formulated around the *malleable dynamic*, which is going on in each cell of all organisms, and the degrees, circumstances, and intensity of that process. This means formulating questions about the *how* of plasticity, adaptiveness, and ongoing change in, for instance, human development at specific points in time: *given* the situated internal and external environments, in other words, how plasticity and temporality interact and work together in environments at different scales from the moment of conception to death. As you might guess, to do such complex contextual forms of inquiry, many different kinds of data or forms of methodologies are needed.

In terms of the developmental plasticity of children, the points made in the foregoing discussion mean that it matters whether or not an infant is exposed to various chemicals or hormones in water or air. It will be more affected than an adult,[70] or it will matter for the socioemotional, linguistic, and cognitive development of infants or toddlers if during longer daily periods they are exposed to adult caretakers who do not bodily, emotionally, or verbally respond to the child in an affirmative and comforting way. The effects are decisive for a child, compared to the effects of the same behaviors on an adult. The malleability of toxic stress is extremely strong during infancy and early childhood and can spur the development of the embedded-embodied brain that will make it very difficult for the child to learn new cognitive skills that require focused attention.[71] This has been shown in extensive and repeated brainwave studies of preschool-aged school children.[72] The brain adapts as to shield off fear and stress and by developing specific brain connections and not others, which might then be repeatedly activated and successively automatized.

As a consequence of the foregoing points, development for a biological organism isn't good or bad. It is simply malleable, flexible, adaptive, and plastic to allow for the organism to survive as "effectively" as possible, given the environmental embodied and sociomaterial circumstances. As part of the development of an embodied brain, brain plasticity is a *double-edged sword*, as cognitive psychologist Courtney Stevens and neuroscientist Helen Neville have written.[73] Whether the plastic changes of that brain are to be considered good or bad development can only be judged according to what is valued in terms of good or bad in a specific culture and

context. If a cultural behavior persists over generations, it will have embodied material effects involving the molecule we call DNA.[74] This also means that what we value as good or bad practice as parents, preschool teachers, or significant others for a child in a specific culture will have material and embodied effects on that child and, eventually, on our society and the material environment at large.

We end this section and chapter on a note of how human beings are truly *of* this natureculture world of continuous differentiation. The way we understand it, this constitutes an opportunity for discussing an ontological overlap between what is presently going on in the developmental sciences and in postdevelopmentalist theorizing based on posthumanist and new materialist ontologies.

Notes

1. See Hultqvist (1990).
2. For example, Hawkes and Egan (2016).
3. For example, Murris (2020).
4. Flegel (2009).
5. Flegel (2009), p. 58.
6. Pollock (2017).
7. Rousseau [1762/2003].
8. Johansson (2018).
9. Daston (2019).
10. Daston (2019), p. 3.
11. Young-Bruehl (2012) argues that prejudice exists against children, i.e., childism, as a group and that it is comparable to racism, sexism, and homophobia. John Wall (2010), contrary to this, uses the word *childism* as he uses feminism in terms of an emancipatory movement for children.
12. Daston (2019), p. 3.
13. In the feminist literature, especially after Karen Barad's publication of *Meeting the Universe Halfway* (2007), there has been a discussion of whether or not to use a hyphen while still aiming to dissolve a binary such as nature-culture. The use of hyphens can be actively applied to make specific statements, as Barad shows. In this book, we have made it as simple as possible for our argument to keep the hyphen as long as we refer to a binary divide and omit the hyphen when referring to the coconstitutiveness of naturenurture and natureculture, whether or not a specific theorist can be identified at a place on the continuum where they nevertheless maintain an aspect of biological givens.
14. McDevitt and Ormrod (2019), p. viii.

15. For example, Dahlberg et al. (1999); Edwards et al. (2009).
16. The concept of scale here refers to Smith ([1984]/2010), who also inspired Barad (2007) and Tsing (2015).
17. Rose (1989, 1998, 2001).
18. Jarl et al. (2012); Lunneblad and Garvis (2019).
19. Rostow (1971).
20. Rostow (1990).
21. Sen (1977).
22. Frank (2004).
23. Furtado (1964, 1976).
24. Escobar (1992).
25. Chew and Lauderdale (2010).
26. Escobar (1992, 2000, 2007).
27. Sachs (2019), p. xi, xiii.
28. Acosta et al. (2019); Escobar (2020).
29. The book by Freire was first published in Portuguese in 1967 and translated to Spanish in 1968. The first English translation came out in 1970 and has had an enormous impact on different strands of critical thought.
30. Britzman (1991).
31. Burman (1994, 1996, 2016, 2020).
32. Davies and Harré (1990); Davies (1989, 2000, 2003).
33. Lather (1991).
34. Walkerdine (1988, 1998a, 1998b).
35. Luke and Gore (1992).
36. Lenz Taguchi et al. (2011).
37. Liinason (2011), p. 2.
38. Burman (2020). The first edition came 1994.
39. Burman (2020).
40. O'Dowd (2015).
41. Burman (2020).
42. Rose (1989, 1998, 2001).
43. Blaise (2005, 2014); Edwards et al. (2009).
44. Blaise et al. (2020).
45. For example, Bloch et al. (2006); Cannella and Viruru (2004); Swadener and Mutua (2008); Viruru (2005).
46. For example, Adriany (2019); Winangsih et al. (2023); Robinson and Davies (2015).
47. Osgood and Sakr (2019), pp. 1–2.
48. Nystedt (1989). The various texts in a collection of essays in the following volume has been the source of a lot of the facts for this section.
49. Nystedt (1989).
50. Zahavi (2003).

51. Daston (2019), pp. 1–3.
52. Nystedt (1989).
53. Nystedt (1989).
54. Nystedt (1989), p. 187.
55. Frankenberg et al. (2019).
56. Oyama et al. (2003).
57. For example, Dick and Müller (2017); Mascolo and Bidell (2020); Skinner et al. (2019); Lerner and Overton (2020).
58. The notion of "nobody knows what a body can do" is often quoted from Gilles Deleuze (1988) in his writings on Spinoza and often taken up by posthumanist early childhood education scholars.
59. See Hekman (2010) for overview.
60. Fox Keller (2010, 2016).
61. Oyama et al. (2003); Fox Keller (2000, 2003).
62. Oyama et al. (2003).
63. Fox Keller (2000).
64. Barad (2007); Fox Keller (2010, 2016).
65. Fox Keller (2016).
66. Fox Keller (2010), p. 75.
67. Ridley (2003) in Fox Keller (2010), p. 2.
68. Fox Keller (2010), p. 6.
69. Fox Keller (2010), pp. 4–13.
70. Bearer (1995); Dourson et al. (2002).
71. For example, Shonkoff et al. (2012, 2021).
72. For example, Pakulak et al. (2018).
73. Stevens and Neville (2006).
74. Fox Keller (2000).

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"Whose Science Is It?" The Field of Child, Childhood Studies, and Early Childhood Education

This chapter opens up with words written by the North American early childhood education scholar Barbara T. Bowman[1] in her foreword to a recent book called *Scientific Influences on Early Childhood Education*.

> From the child study movement, to the ethological studies, to neurological scans, *science* has added immensely to our understanding of children and their later educational achievement and social accomplishments.

Why is there a need for a book with the obvious mission of convincing scholars in the field of early childhood about the importance of knowledge from developmentalist epistemologies in a book about children's development and learning, especially in the North American context where it is written? This need reveals underlying discussions, perhaps even disputes, around what kinds of knowledge "belongs," are more or less "legit," or are considered to have a higher status in various contexts of the heterogeneous field of child, childhood, and early childhood education studies.

The task of this chapter is to somehow present this heterogeneous field. It is a field that includes knowledge from evolutionary theory, the developmental sciences, including the neurosciences, and the heterogeneous social and educational sciences. Moreover, numerous interesting forms of inquiry exist on issues that concern children in disciplines that fall within the humanities. Methodologically, these feature everything from randomized controlled trials (RCTs), including brain scans, to historical, literary,

art-based, and anthropological studies on childhood and comprise all conceivable kinds of theoretical and methodological approaches, not least new materialist and posthuman, postqualitative forms of inquiry.[2]

Against this backdrop we will not try to make a comprehensive outline of this vast field of inquiry concerning young children. It is simply too difficult to do all of this research justice. Instead, we have chosen to present a few sketches of possible ways of making sense of this field that have been important to our own process of understanding inter- and transdisciplinary collaborations in this field. By introducing these sketches, we want to bring to the surface a series of more or less already existing desires, ideas, and images about the problems and possibilities of collaborations between different kinds of inquiry in this field. Our intent is to engage in a discussion on the meta-level, rather than to exemplify with different studies.[3] Ideally, the sketches will provoke some constructive and reciprocal dialogue among scholars of different epistemological interests, so as to undermine any frictions, conflicts, or polarizations between developmental and cognitive (including neuro-) psychology and studies, above all in early education (pedagogy and didactics), which is specifically addressed in this chapter.

We start in what follows by discussing what can be understood as a rather vague idea about the integration of different forms of knowledge practice in the field of early childhood education and the developmental sciences in general. However, a discussion has also been going on for at least two decades on the need for a bridge over a presumed gap between the neurosciences and everyday educational teaching practices. We present three different sketches as a way to contribute to this discussion. We then move to a sketch that aims to address a wider array of inquiries from the humanities and social science disciplines in the fields of child, childhood, and early childhood education.

A Heterogeneous Field: Integration and/or Application?

The field of early childhood education constitutes a "kaleidoscope" of different kinds of inquiries, writes early childhood professor Dominic Gullo,[4] one of the editors of the book cited earlier. Because of the great variety of ideas, theories, research questions, and methods in this field, he asks a legitimate question: "*Whose science is it*?"[5] Given the plurality of

epistemologies at work in this field, Gullo asks whether or not it is even desirable to try to construct a joint and "new integrated scientific body of knowledge."[6] Gullo does not, however, question the direct relationship between the developmental, cognitive, and neurosciences in academia and the lived teaching practices of preschools and schools. The questioning of integration that he ponders rather concerns the possibilities of successfully integrating researcher colleagues from the educational sciences in collaborations or a new discipline together with the developmental sciences. In the international literature, the issue of including educational scholars in collaborations across disciplines seems otherwise to be of little interest. For the most part, there seems to be a taken-for-granted link between the developmental and neurosciences to everyday educational practices, but without any reported involvements of educational scholars.

Does the preceding observation also apply to the Swedish context, where qualitative and critical postdevelopmentalist methodologies dominate the field? The answer is both yes and no, when considering the few RCT projects that have been pursued and that involve the developmental and neurosciences and education in the last two decades. Yes: All but one project have been led by psychologists and/or neuroscientists in a direct engagement with educational practices.[7] And no: There is a series of interdisciplinary studies conducted by a successful research group at Umeå University. Here, at least one educational scholar was seriously involved in various lab-based neuro-educational studies on mathematics and language acquisition, constituting somewhat of an exception to the rule.[8] Moreover, the Enhancing Children's Attention (ECA) project, the main protagonist of this book, has also established new collaborations between educational scholars and cognitive psychologists at Lund University on the issue of early math acquisition.[9] The ECA project, which also involves brainwave measures, is, however, the first interdisciplinary randomized controlled study of its kind to be formally led by an educational scholar.[10]

Whether or not an effort to attain an integrated discipline should be a prioritized goal is a central question, not just for Gullo, who was quoted above, but also for this book. The following chapters, however, will illustrate our own ambivalent relation to such an endeavor, swaying between a hopeful eagerness and disappointed disillusionment. The answer provided in the conclusion of the book constitutes, again, a kind of "yes-and-no" answer. Another way of answering the question is that the possibilities of an integration depend on the involved individuals' desire and willingness to learn from one another and respect each other's differences. This will

be discussed in different ways in the last two chapters of this book and in the conclusion.

In recent decades, the question of the need for an integrated or trans-discipline, with labels such as *educational neuroscience* and *neuro-education*, has been posed by many different scholars, especially in North America and the UK.[11] Some of these scholar themselves have been engaged in interdisciplinary studies, involving different methodologies, underpinned by different kinds of ontologies: realism, naturalism, idealism, subjectivism, constructivism, and critical perspectives.[12] Depending on whether the scholars posing the question of a possible integration or transdiscipline situate themselves in the "camp" of standard epistemology, in the qualitative social sciences at large, or in the critical and postperspective realm, the answer will differ. In the Swedish context, a new integrated field, or trans-discipline, or even a professorial chair in educational psychology, has so far not been a top-priority goal at any university.

In international discussions, it is scholars in the naturalistic epistemological territory, or "camp," who will usually extend an invitation to education while stating that "Yes, we need an integrated discipline." As we already pointed out, the invitation to an integrated discipline really extends from the developmental and neurosciences directly to educational *practices* in preschools and schools, which leaves out educational scholars and their research. On the other hand, when scholars in the qualitative epistemological "camps" *are* occasionally invited to participate in a research project or to construct an integrated discipline, the invitation is usually declined: "Thanks, but no thanks." Our understanding is that this response can indeed be informed by aversion, but most likely by fear. Such fear concerns the power relations between different kinds of inquiry and how they are perceived in academia and in society at large. That is, an integration would mean that the *lesser* (qualitative) epistemologies risk being consumed by the more powerful naturalistic standard epistemologies.[13]

The fears and risks perceived by scholars from disciplines considered by others and/or themselves as "lesser," as in lesser-valued forms of knowledge productions, aren't too far-fetched, especially when one considers the proposals on how to resolve the conflicting relations between the humanities and social sciences, on the one hand, and the disciplines relying on naturalistic epistemologies, on the other hand. For example, one solution for peace and integration in academia during the 1990s science war discussions was provided by the biologist E.O. Wilson. He proposed a "unity of knowledge" with his vision of *consilience*.[14] The concept refers to

the gradual integration of different forms of inquiry around specific topics. The essence of consilience is having the humanities draw gradually closer to the methodologies of the natural sciences as they simultaneously bring to the integration their expertise in ethics and moral guidance. In this thinking by Wilson, it was thought that an interdisciplinary consilience would reach ultimate truths about both natural and social issues. A hierarchy of methodologies is neither denied nor hidden in this suggestion.

Hence, even when scholars from different epistemological camps might wholeheartedly agree in theory on some issues, it's a whole different ballgame to actually do scientific work together. Take, for example, the famous statement by William James (1890)[15] about how the brain and the formation of a consciousness cannot exist in isolation, since this would be completely dependent on cultural and social interaction. This is a statement of theory that any scholar would find easy to rally around.[16] Difficulties arise, however, in discussions about how those coconstitutive relations of the sociocultural and the biological are to be theoretically articulated and methodologically translated into empirical inquiries that can inform and support one another. This was also illustrated in Chap. 2, where two ontological trajectories within the developmental sciences were presented. Some of the meta-theories presented in that chapter have been in place for several decades now. And yet the construction of interdisciplinary forms of inquiry that match those meta-theories has proven more difficult to achieve, although there are also some encouraging examples of success (Chap. 2).

So what's the history on interdisciplinarity regarding issues of children's development and learning? A century ago, knowledge production on the child's developing body and mind, in a cultural, value-based, sociohistorical context, constituted a taken-for-granted integrated scientific endeavor. Studies carried out involved educational philosophy and theory, praxis-based observations, and experiences of teachers, as well as smallscale empirical studies. Historically, these studies would sometimes merely involve the researchers' own children as subjects of study, as in the case of Jean-Jacques Rousseau, Jean Piaget, and Charlotte and Karl Bühler. Other scholars, such as John Dewey, Paolo Freire, Célestin Freinet, Elsa Köhler, Maria Montessori, Rudolf Steiner, and Lev Vygotskij, however, materialized their respective philosophies and theories of learning as pedagogical practices for schools to be evaluated in praxis-based forms of study. As a result of such experiences of interconnected praxis-based observations and construction of theories of learning and development, *pedagogical*

psychology was developed as an integrated academic discipline at many universities around the world in the early twentieth century (cf. Chap. 3).[17]

Nevertheless, although the disciplines of pedagogy and psychology can be said to have emerged in a close and interdependent relationship, psychology is often viewed and defined as constituting the necessary foundation for education to be informed by, as shown in Chap. 3. Or, as Gullo writes: "Education, including early childhood education, can be characterized as an applied science."[18] This means that knowing derived from experimental methodologies in psychology and/or the neurosciences is understood to precede and be treated as foundational to educational theories for teacher training and educational practices. This way of understanding integration risks disqualifying a long tradition of praxis-oriented inquiry performed in lived educational practices and connected to university research and higher education of preschool teachers and teachers. The educational sciences are indeed, as Gullo[19] himself has said, a kaleidoscope of different perspectives and methodologies.

A Need for a Bridge: Or Not?

The idea of bridging the gap between the neurosciences and education became more widely known in an article published in 1997 in the North American journal *Educational Researcher* written by cognitive psychologist John Bruer.[20] A decade later, he confirmed his earlier argument about a need for a bridge, reaffirming that it is "cognitive psychology, not neuroscience, [that] is the strongest current candidate for a basic science of learning."[21] Bruer claims that cognitive psychology constitutes the foundation for a bridge and the bridge itself. Let us untangle what he means by this.

In the last two decades, a growing body of educational neuroscience literature has emerged in Anglo-speaking contexts around the world, and especially in Britain and the U.S. Aspirations to construct a new transdiscipline, rather than working in multi- and interdisciplinary studies, have been frequently discussed for more than a decade.[22] Serious initiatives have been launched to construct an educational neuroscience transdiscipline.[23] The shared point of reference and the main concept in this "movement" toward a transdiscipline is *plasticity*.[24] Central to this desire for interconnectedness between neuroscience research and everyday educational practices is talk about a "translational bridge".[25] These writings convey the idea of building a direct bridge connecting educational practices in preschools and schools to the neurosciences. The most sought-after goal is, after all,

as the cognitive psychologists Henry Roediger, Bridgid Finn, and Yana Weinstein write, to disclose "what neural circuits underlie the cognitive processes that are linked to instructional practice."[26] More commonly, the bridging image contains cognitive psychology as constituting and playing the central role of the translational agent (see image below) (Fig. 4.1).[27]

The image illustrates a direct bridge between the neurosciences and educational practices, with cognitive psychology acting as the translational mediator. The image also illustrates the kaleidoscope of scattered educational studies as boats on troubled waters, but also critical waters when one considers the discussions on postdevelopmentalism in Chaps. 2 and 3. However, the teacher Sally Featherstone[28] supports the image of psychology as the bridge in her book on how to make sense of neuroscience in the early years. She writes as follows[29]:

> "[W]ithout the bridge between neuroscience and educational practice supplied by psychology in its various forms, we risk continuing the mistakes of the past running down blind alleys or applying too soon the half-understood messages of pure science."
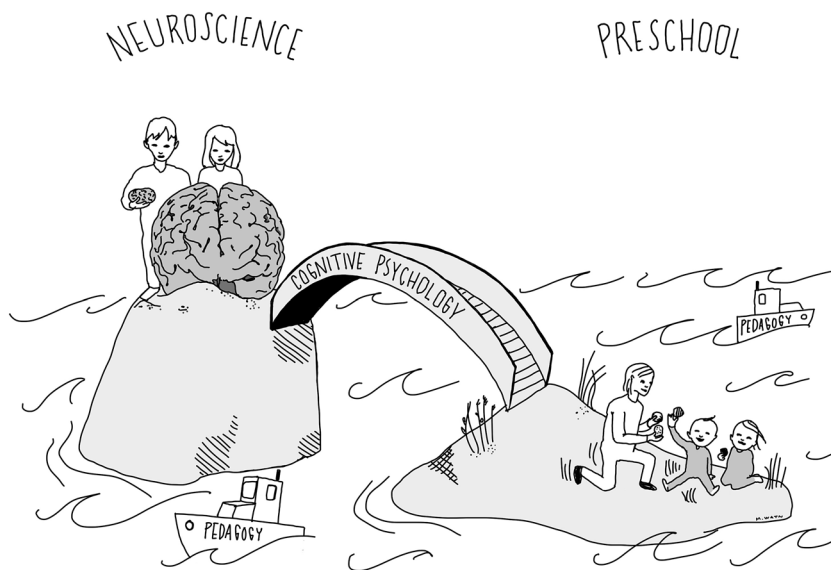
Fig. 4.1 Scenario 1: Cognitive psychology as the translational bridge over troubled educational science waters

This quote, mentioning blind alleys and potential misunderstandings, echoes the perhaps too great attention paid to a problem identified in the relation between the neurosciences and education, that is, the problem of "use and misuse," "not getting the science right," and teachers and practitioners being lured into upholding old or spreading new "neuromyths."[30] This is an issue we will not dig into any deeper here. We will merely point out in conclusion that this discussion reflects a notion of distrust and problematic sense of superiority vis-à-vis the "lesser" educational practices to which scientific knowledge is to be applied.

For Bruer, who remains skeptical about the direct implications of neuroscience for education, this issue can be resolved if cognitive psychology takes on the role of translator. This is because any connection between neuroscience and education will, as he puts it, "have at least one pier on the island of psychology."[31] The image he provides now consists of three islands, with the island of cognitive psychology in between the islands of the neurosciences and education, which still remain, as it were, *too* far apart from one another in Bruer's account, that is, if it weren't for the fact that psychology could provide that combined territory and act as a translational bridge.[32] In the following image, Bruer's position is made even stronger while providing connecting bridges in both directions. The educational sciences are still in troubled and critical waters around islands and bridges and only rarely involved (Fig. 4.2).

Whether there are two or three islands or whether psychology is considered an intermediating centrally located place or constituting merely the bridge itself as in the first image, the goal is the same: to find schools and teachers willing to collaborate with the leading cognitive neuroscience and psychology researchers. The aim is to apply findings from either experimental lab studies or intervention studies in schools that can produce knowledge about the causal mechanisms of learning.[33] Again, the studies we are talking about here are performed without necessarily involving researchers from any of the educational sciences. Another critique that has been raised is that although the results provided by the neuroscience and cognitive science might reflect some components of learning in the complex situated context of the schools, it is nevertheless difficult to generalize the results to other populations.[34] The highly desired external validity that makes generalizations for policy possible are more difficult to achieve than you might think, even when using so-called gold standard RCT designs.[35] Most often, results can only be seen as valid – in terms of
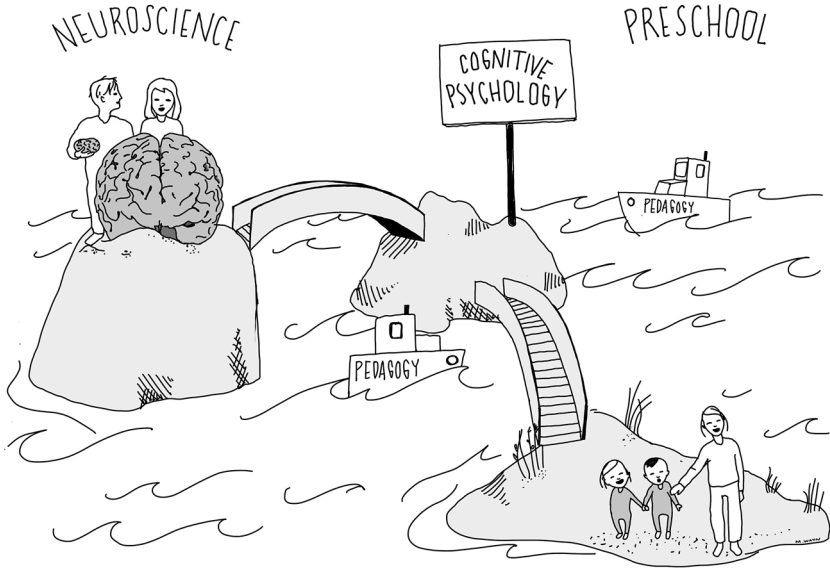
Fig. 4.2 Scenario 2: Cognitive psychology with its own territory and as translational bridge over troubled educational science waters

evidence-based knowing – for the situated context and school where the study was performed,[36] which is not unlike many qualitative studies.

In response to the desire to bridge the gap between the cognitive neurosciences and teaching practices in schools, the educational theorist Howard Gardner has emphasized that a direct bridge between either the neurosciences, or cognitive psychology, and educational practices is, in fact, impossible.[37] His argument is that science of the naturalist kind and lived educational practices are entirely different enterprises. Educational teaching and learning practices, he asserts, constitute an art form and should not be understood as science-based practices. As an art, it is also philosophical in nature and necessarily value-based and political.

We do not agree with Gardner that education, play, and learning cannot be considered science-based practices. Moreover, all research practices are entangled in both values and politics in one way or another (Chaps. 2 and 3). Perhaps teaching, play, and learning can indeed also be considered to be art forms? Scientific inquiry of the qualitative and postqualitative kind has, in fact, already shown how play and the relationship between

play and learning can be understood as a form of artwork in different contexts involving children.[38] Educational research, not least in early childhood education, has for decades yielded substantial and very important knowledge about different realities of children's play, learning, and the teaching and caring practices of teachers and other educators. At the same time, this research has also revealed how societal norms, values, politics, and ethics play into teaching and learning.[39]

Despite Gardner's view, direct bridges have already been constructed as part of multiple projects around the world and, thus, made real, as in both of the two images already presented earlier. So what can scholars from the educational sciences do to get involved in what is already going on, for their knowledge to matter and make a difference? How can knowledge produced by scholars in the field of child, childhood, and early childhood education come together with other forms of knowing in order to matter?

We now wish to return to what was said about praxis-based forms of educational research in the previous section. Much educational research engages in the complexity of social, historical, economic-material contexts in the practice and performance of pedagogical strategies. This kind of knowledge is of great significance, not merely on its own, but also when put in relation to sometimes decontextualized kinds of knowledge about the mechanisms of learning. We want to point to the possibility of putting different forms of knowing into productive encounters in creative collaborations. Such collaborations might thus make possible the articulation of new knowledge that can combine different forms of knowledge and experience-based knowing so as to make connections between what goes on at the molecular scale to what goes on at the face-to-face scale of student–teacher relations in material preschool and school environments. Moreover, these environments are situated in a specific neighborhood, suburb, town, and country, as well as, of course, what goes on at the scale of educational policy and in the financial-political system. For decades, educational research has produced significant volumes of knowledge about these aspects of children's development and education.

Hence, from our point of view as educational scholars, if we are to engage in knowledge production with others from the neurocognitive, psychological, and developmental sciences in an encounter with educational knowledge and experience-based knowing and practices, not only does the bridging need to be bidirectional, but the flow of traffic needs to constitute a reciprocal exchange in multiple ways and creative directions while traversing scales of scientific knowledge and praxis- and

experience-based knowing.[40] This is why we will argue that the educational sciences – *in all their kaleidoscopic diversity* – must first, like all research fields, come to terms with some of their own biases, prejudices,[41] fears, and aversion to be able to step up on that translational and connecting bridge and take up the role of negotiating translations between different forms of knowledge and knowing.

What we are saying is that educational researchers need to both *stay with* and *make with* the trouble, as suggested already in the introduction to this book.[42] We thus need to *either* get over the notion of being the "lesser" discipline or, as educational researcher David F. Labaree[43] explicitly says, learn how to *live with* this "lesser" form of knowledge in order to play a more productive role. Educational, and especially scholars of pedagogy with deep knowledge of science theory, need to explore a translational vocabulary *and* provide critical and value-based knowing in the discussions of how neuroscientific and developmental and cognitive psychology *matter* in lived educational teaching and learning practices. The following image illustrates this imagined possibility of collaboration, on terms other than those in the two previous images. In this image, cognitive psychology still constitutes a provider of important knowledge derived from naturalistic forms of inquiry. What differs is who is playing the role of making networking connections and establishing relations with educational practices and between different forms of knowledge practices and experience-based knowing of other kinds (Fig. 4.3).[44]

Perhaps yet another way of imagining this image of islands and bridges is to think of any of the previously presented meta-theories of development and learning[45] (Chaps. 2 and 3) in terms of one large and still expanding territory or borderless sea, that is, skipping the metaphor of the gap and the bridge altogether. All of these meta-theories as presented in Chaps. 2 and 3 rely on notions of diversity, heterogeneity, and flows of processes, regardless of what discipline they are articulated within. Most of them can therefore be understood to displace the dominant desire to formulate that *one* best theory of everything. In this way, these meta-theories can be understood as making the question in this chapter's title – *Whose science is it?* – seem redundant.
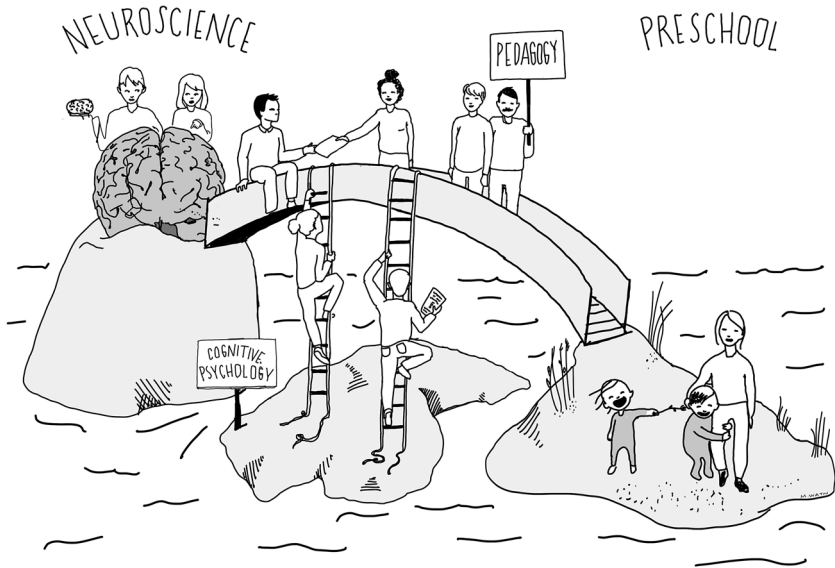
Fig. 4.3 Scenario 3: Pedagogy stepping up to collaborate as translators

A Circular Sketch of Divergences and Overlaps of Inquiry

We now move to include a wider array of inquiries from the humanities and social science disciplines, but we start in the educational sciences, that is, the field Gullo, cited earlier, described as a kaleidoscope of different forms of inquiry. Engaging in teachers', educators,' and children's interests and inquiring into children's wellbeing and education is a longstanding tradition in participatory action research (PAR). This methodology aims at direct transformations of practices while working together with practitioners and children.[46] This means that PAR, perhaps ironically, somewhat overlaps with experimental intervention studies, such as RCTs.[47] These all aspire to intervene and interfere to make changes and transformations for the sake of the child, albeit using different methodologies.

The fields that this book concerns itself with also include the vast areas of childhood sociology, geography, ethnography, anthropology, and historical studies. The overall declared aim of this body of work is often to take the perspective of children, like childhood scholars Pia Christensen

and Alison James describe in their anthology *Research with Children: Perspectives and Practices*.[48] More importantly, this body of work is interested in what constitutes the ideas of the child, childhood, childhood education, and institutions for children in sociohistorically situated contexts in wider societal and social perspectives. This will sometimes mean studying the phenomenon of childhood in the field at a critical distance to preschools, schools, and services. However, some of these forms of inquiry also engage directly with children themselves, or with their educators, teachers, and others. This brings us to the last sketch in this chapter, which will be illustrated in two versions; one version is two-dimensional, whereas the other will illustrate an ongoing movement in different directions.

The sketch is constructed following three sets of logic. The first logic is the taken-for-granted logic of three basic approaches or perspectives in fields of inquiry that concern young children: the *developmental perspective*, the *political and economic perspective*, and *the social and cultural perspective*.[49] The developmental perspective refers to the physical and psychological growth and maturation of the child. The political and economic approach aims to translate knowledge from the first into social and educational interventions, policy, and practices. This is also where we find studies in economics that seek to develop "simple economic models for skill formation" that "can organize evidence from psychology, education and the neurosciences,"[50] the overarching aim being to predict future earnings, citizens' wellbeing, and a more peaceful society.[51] The third approach is constituted by a social and cultural perspective that encompasses a wide array and diversity of studies.

The second logic of the sketch features the prepositions *on*, *to*, *with*, *for*, or *by*,[52] as in the book's title. The prepositions represent the main problems of concern around which ontologies, epistemologies, and methodologies circulate. In this regard, the preposition *for* has a specific position in the center, as it is more or less the aim for all others. Whether the inquiry is done *on*, *to*, *with*, or *by*, it is done *for* the benefit of the child and, in addition, *for* the enhancement of childhood education provisions. Or it could be done *for* the betterment of a future society by means of new understandings of what childhood is, for example (see also Chap. 6). Let us expand on the foregoing points to explain the logic of the sketch.

The preposition *on* is used to describe studies underpinned by classical realist and naturalistic ontologies. The problem of concern in these forms of inquiry is, for instance, knowing more about the mechanisms of development and/or learning in children. For example, the statement "this is a

study *on* children's focused attention" is meant to inform readers about the aim and content of the inquiry (focused attention). However, as we showed in Chaps. 2 and 3, inquiry on children conducted in the developmental sciences might very well be based on an ontological understanding of naturenurture coconstitution. This, as we will soon see, makes it relate in specific ways to the left-hand side of the circle, of studies done with or by children.

We now turn our attention to the relation between the developmental (on top of the circle) and the sociocultural perspectives (on the right-hand side). It would be possible to position them against one another, referring to the first logic of developmental studies *on* children versus sociocultural inquiry aiming *to describe* the perspective or experiences of children so as *to know more about* the child's perspective, or to give the child a voice and/or to know more about childhood. Keeping the circles still and fixed, the divide between *on* and *to/about* can be translated in such a way as to manifest a split or space between nature and culture, with the former producing knowledge on children to know about the *nature* of children's development and the latter producing knowledge about our *cultural* ideas, discourses, and dominant power-producing child and childhood practices. Among the latter, there might be some critical discourse analysis. Critical studies, however, *also* belong to the realm of the political at the bottom of the circle in the sketch.

When turning our attention to the political perspective at the bottom of the circle, we can differentiate between at least three different kinds of political forms of inquiry. In one version of the political, this can be about economic policy studies that are produced from (survey or register) data more or less *on* children. In another version of the political, it is about studies doing critical discourse analysis based on thinking *with* the child while engaging theoretical concepts from poststructural theory. In yet another kind of inquiry is of the pragmatic and collaborative-transformative kind, as in PAR. PAR conducts inquiries involving children, that is, *with* children in practices of change and transformation in, mostly, childhood and early education and care settings. Many of these studies are of a critical kind and can be positioned as postdevelopmentalist, and perhaps even new materialist, posthumanist, and postqualitative forms of inquiry, to make things a bit messy.

What about the left-hand side of the sketch – the preposition *by* – and the relationship between the developmental perspective (at the top of the circle) and the postdevelopmental, which is also to be found on the

left-hand side together with, *again*, new materialist and posthumanist, as well as postqualitative, forms of inquiry? All of these kinds of inquiry generally argue against developmental studies and while doing inquiry either *with* or *by* children (cf. Chap. 6). However, given the ontological overlaps we have identified between developmental and postdevelopmental inquiry, referring to the meta-theories that overlap in terms of their arguments about a processual *natureculture coconstitution*; it would be possible to acknowledge how *on* and *with* or *by* are trajectories of inquiry that can actually work together in the production of knowledge while using multiple forms of inquiry *for* children, that is, producing knowledge of different kinds and on different scales that can be related to one another based on a shared ontological meta-theoretical thinking.

Whereas studies *on*, *to*, and *with* children translate more easily to how we understand inquiry, research done *by* children need to be explained briefly. Children, in these studies, are invited to generate new questions for the given line of inquiry, and data, and on the children's own initiative. The research done by Bodén presented in Chap. 8 can be understood in this way. It differs from merely doing research *with* the agency or voice of the children involved, which is done using multiple methodologies. In both accounts, the researcher remains the agent who puts the process of inquiry into play and who is responsible for what emerges and how it is articulated.

The following sketch shows a two-dimensional image of a circle to the left. To the right is a sketch that articulates the three-dimensionality of this image. Imagine how the circles to the right are moved and turned in some way and in different directions, perhaps while producing friction or overlaps, so as to illustrate the third logic of a processual movement. This processual movement might cause new relations, overlaps, and transformations as different forms of knowledge practices (methodologies) or kinds of knowledge encounter one another (Fig. 4.4).

In the foregoing sketch of the two circles, we have identified some "main territories" in the field of inquiry that concern young children. They are pursued based on their respective main problems of concern, represented in this sketch by the prepositions *on*, *to* (about), *with*, and/or *by*. However, we have shown how these problems of concern and methodologies nevertheless shift while traveling and moving about.[53] As the circles in the sketch move just a bit, so does our thinking around the meaning of *object* and *subject*, *participant* and *researcher*, *epistemology* and *ontology*, which become problematized or blurred. Such problematizations also occur in the very enactment of various methodological undertakings, as
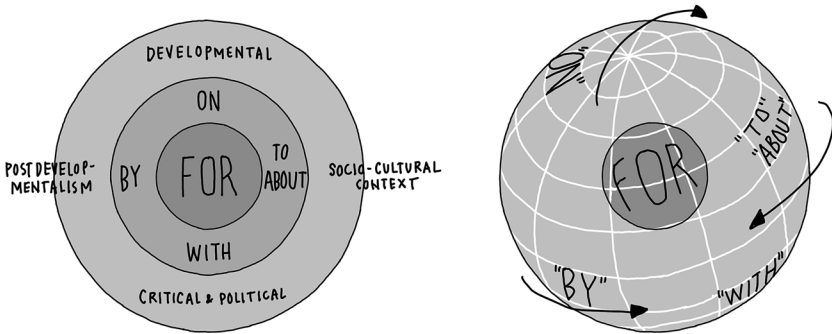
Fig. 4.4 Moving circles of ontologies and epistemologies in child, childhood, and early childhood education inquiry

shown in Chaps. 6, 7, and 8. In these chapters, it will become evident that what it means to be a child or a researcher in the process of research is constantly being (re)defined throughout the process. Hence, it is never really taken for granted that a study *on* is not also a study *with* and *to/about*, for example (cf. Chap. 6). Nevertheless, as illustrated in the right-hand sketch of the swirling globe of prepositions, all forms of inquiry we do in this field still make central the idea of somehow making a difference *for* the child. This is because all accounts of inquiry in this field would most likely subscribe to the philosophical aim of finding ways of practicing a *life well lived* for children.

CONCLUSION

This chapter has provided a series of sketches as a way of discussing the complexities of a field of research that involve multiple forms of epistemologies and ontologies. An important goal of this book is, however, to trouble positionings and polarizations between taken-for-granted ways of understanding what is going on while enacting a specific kind of epistemology. Hence, we have tried to trouble some taken-for-granted ideas about the integration of disciplines and building bridges across alleged gaps and differences between those disciplines. We have twisted and rotated various epistemologies and ontologies in search of frictions and overlaps. However, the result has provided no clear answers regarding what would be the better course of action when conducting inquiries into

young children's wellbeing. On the contrary, the content of this chapter set out to show that there may exist unexpected possibilities for collaboration and overlap; above all, if anything, there are multiple ways of inquiring into the multiple realities of children's development, play, and learning.

Notes

1. Foreword by Barbara T. Bowman, p. 1 (italics added), in Gullo and Graue (2020).
2. For an overview see Yelland et al. (2021), the *SAGE Handbook of Global Childhoods*, and Cutter-Mackenzie-Knowles et al. (2020), *Research Handbook on Childhoodnature: Assemblages of Childhood and Nature Research*. These are only examples of handbooks featuring a wide collection of scholars, including Sonja Arndt, Claudia Diaz-Diaz, Iris Duhn, Nikki Fairchild, Riikka Hohti, Linda Knight, Karen Malone, Karen Murris, Fikile Nxumalo, Jayne Osgood, Ann Merete Otterstad, Jonas Qvarsebo, Pauliina Rautio, Jennie Richie, Kylie Smith, Margret Sommerville, Marek Tesar, and Radhika Viruru.
3. Studies illustrating different ontologies and epistemologies in research in this field has been conducted elsewhere, e.g., Lenz Taguchi and Eriksson (2021). See also previous note.
4. Gullo (2020), p. 1.
5. Gullo (2020), p. 8.
6. Gullo (2020), p. 8.
7. For example, Bergman-Nutley and Klingberg (2014); Gulz and Haake (2021); Gulz et al. (2020a, 2020b); Klingberg et al. (2005); Spencer-Smith and Klingberg (2015).
8. For example, Jonsson et al. (2014, 2020); Karlsson Wirebring et al. (2015, 2022).
9. Gulz et al. (2020a, 2020b).
10. Hillevi Lenz Taguchi was the primary investigator (PI). However, we made it an important point to have a co-leader from linguistics, Tove Nilsson Gerholm, who led the team that did the EEG/ERP imaging and pre- and posttesting of children. The reasons for this will be discussed in Chaps. 5 and 9.
11. For example, Battro et al. (2008); Bruer (1997, 2006); Howard-Jones (2010); Howard-Jones et al. (2016); Sousa (2010).
12. See further discussions on this in Aronsson (2020), Lenz Taguchi (2017), and Youdell and Lindley (2018).
13. Callard and Fitzgerald (2015).
14. Wilson (1998).

15. William James, in Callard and Fitzgerald (2015), p. 50.
16. For more updated and comprehensive discussions on research on consciousness formation in humans and other species, see Birch et al. (2020) and Ginsburg and Jablonka (2019).
17. See Chap. 3 for a discussion on the relationship between psychology and pedagogy in Sweden and the subsequent divorce in the 1980s.
18. Gullo (2020), p. 2.
19. Gullo (2020), p. 2.
20. Bruer (1997). The journal is widely read since it is the journal tied to the American Educational Research Association (AERA), which organizes teachers and educational researchers.
21. Bruer (2006), p. 104.
22. Fischer et al. (2007, 2010); Ronstadt and Yellin (2010).
23. For example, Fischer et al. (2007), Knox (2016), and Youdell et al. (2020). Kurt W. Fischer is probably the scholar who has done the most to bridge the gap between cognitive psychology and education and contribute to the idea of a transdiscipline. He brought the initiative to the journal *Mind, Brain, and Education* in 2007 when the first issue came out. Moreover, he has contributed greatly to the development of a dynamic systems theory, an epigenetic approach to learning, and much more. See the edited volume in honor of Fischer: see Fischer, Mascolo and Bidell (2020).
24. García Carrasco et al. (2015).
25. For example, Stafford-Brizard et al. (2017), p. 157. See also Coch and Ansari (2012).
26. Roediger et al. (2012), p. 129.
27. Roediger (2013).
28. Featherstone (2017).
29. Featherstone (2017), p. 2.
30. For example, Howard-Jones (2014) and Della Sala and Anderson (2012).
31. Bruer (2006), p. 109.
32. Compare Bruer (1997).
33. See Perry et al. (2021). In this extensive meta-study of both kinds of research and how they might apply to educational practices performed with British state funding at the University of Birmingham, the conclusions show that although there is some evidence from lab studies in relation to some educational strategies, such as retrieval learning (test effects), RCT studies in live practice often show no or very weak effects of interventions, due to the complexity of live educational situations.
34. Perry et al. (2021).
35. Cartwright (2009).
36. Simpson (2020), pp. 1–6.

37. Gardner and Immordino-Yang (2013), conversation at University of Southern California, February 11, 2013.
38. For example, Hickey-Moody (2016); Hickey-Moody et al. (2021); Irwin and Springgay (2013); Ivinson and Renold (2021); Renold (2024); Renold and Ivinson (2022).
39. Cutter-Mackenzie-Knowles et al. (2020); Jones et al. (2016); Yelland et al. (2021).
40. Aronsson (2020); Youdell et al. (2020); Youdell and Lindley (2018).
41. Compare Callard and Fitzgerald (2015).
42. Renold and Ivinson (2022), p. 123 (italics in original).
43. Labaree (1998). The title of his article in the journal *Educational Researcher* is "Educational Researchers: Living with a lesser Form of Knowledge."
44. Compare the conclusions provided by Perry et al. (2021).
45. For example, Bjorklund (2020); Bjorklund and Ellis (2014); Cantor et al. (2019); Fischer and Bidell (2006); Mascolo and Fischer (2015); Nicholson and Dupré (2018); Overton (2014); Oyama et al. (2003); Richerson and Boyd (2006); Richerson and Christiansen (2013); Van Geert and Fischer (2009).
46. Kemmis (2006); Kemmis et al. (2014).
47. Fisher et al. (2020).
48. Christensen and James (2017).
49. Gullo (2020), pp. 4–6.
50. Cunha and Heckman (2007), p. 31.
51. Cunha and Heckman (2007); Chetty et al. (2011).
52. First appearing in Linnea's article, Bodén (2021).
53. Compare Mol (2021).

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Those Whom the Research Concerns: Conducting Intervention Research as Inter- and Transdisciplinary Inquiry

The aim of this chapter is to describe the protagonist of this book, the intervention project called the Enhancing Children's Attention project and some of the context around it. This project constitutes an inter- and transdisciplinary research project, with an overarching evidence-based methodology – a randomized controlled trial (RCT). In the context of Sweden, and even in the Nordic countries at large, experimental research is far from being as prevalent as in, for instance, the UK or the United States.[1] As researchers in education, who are especially critical about any kind of research that involves testing of children, why did we decide to undertake such a study to evaluate a pedagogical intervention using extensive testing, including brainwave recordings, within the context of Swedish preschools?

Let us say a brief word about the shared problem of concern among researchers and participating stakeholders. In Sweden, group-based learning is the norm. One very popular form of this is known as investigative learning, which is carried out in smaller groups of children. It was inspired by practices in Reggio Emilia municipal preschools in Northern Italy. These kinds of practices have been implemented since the mid-1990s across Sweden but have never been evaluated, other than in small-scale qualitative forms of research.[2]

Thus, the stakeholders and researchers shared an interest in understanding how this popular form of group-learning affects children's

language acquisition, their skills of focused attention, and other socioemotional and communication skills, as well as early mathematics. As part of an already established network collaboration, the researchers discussed with teachers and educators how it would be possible to evaluate this preschool practice in an updated and scientifically enhanced version, a version that would also involve more of an individual teacher–child scaffolding as part of the group-based activities. Eventually, the choice landed on an overarching RCT. Within this framework, it was also possible to enact a number of qualitative methodologies to inquiry into various phenomena, among which were the experiences of the children participating in the research (Chaps. 6, 7, and 8).[3]

Setting up intervention research on practices of education requires extensive preparation and planning. For most of the details that are important when setting up an interdisciplinary project framed by an RCT, we encourage readers to consult the open-access publications on this topic, as well as reporting on and discussion of the results of the RCT.[4] However, some of these details are important for readers of this book, which is why this chapter is included. We will write this chapter to the extent possible from the point of view of those whom the research concerns, that is, the stakeholders. The chapter thus starts by describing the process of emergence of what would eventually become the Enhancing Children's Attention project (ECA project).[5]

The chapter then moves on to a section on the more specific situated context and the multiple aims of this kind of research. The subsequent nine sections describe sufficient details on the preparations and performances of all the aspects of this RCT. The different tests and methodologies of the ECA project will be presented but not explained or discussed. For such discussions, see the already published peer-reviewed articles. Thereafter there is a section on what we came to call a *relational ethics* and some of the different ethical protocols that were planned by the team members. We discuss informed consent and the possible reasons for low attrition rates in a section of its own. The concluding section discusses the possible mutual gains between the academy and educational practices and the conditions that would allow collaborative projects like this to continue.

Emergence of an Interdisciplinary Collaborative Research Endeavor

When initiating the ECA project, the spirit among team member and the network of teachers and educators[6] was the shared objective of working together to evaluate a well-established pedagogical practice that had never before been evaluated and, in doing so, engage in a strong mutual commitment of collaboration, before, during, and after the performance of the research project, which necessarily had a formal beginning and end. In a nutshell, the overarching RCT was designed to evaluate the effects of pedagogical interventions at preschool units whose participation was randomized, *either* in an enhanced version of an already well-established group-based learning strategy – socioemotional and material learning paradigm (SEMLA) – *or* in a contrasting individualized attention-training intervention focusing on early mathematics. Test results were compared between the two groups and with groups of children whose preschool units had been randomized to continue with their regular preschool practices. The latter preschool units are referred to as controls. The design required the participation of over 400 children, and the total number of children came in at 432 children. They were enrolled from twenty-nine different preschool units at eighteen schools in a large municipality outside the capital of Sweden. In total, ninety-eight teachers and educators were involved in the research to some degree. In all, seventeen researchers and research assistants from five academic disciplines performed various tasks in the research, with a core team of eight members.[7]

The period of research and data collection at each preschool was ten weeks, enacted as three waves of ten-week periods. Each period consisted of an intervention period of six weeks and testing two weeks before and after the intervention. A short in-service training of staff was also performed during the weeks preceding the intervention. To repeat: During the six weeks of intervention, the randomized groups of children did either the group-based investigative learning or individualized self-regulating and digital learning, or their regular activities in the control-group units. The frequency and duration of the interventions were set at one hour, four days a week. The research also included a set of qualitative methodologies, including video ethnographies of the two interventions, focus-group interviews with teachers and educators after the interventions, and participative emerging methodologies with children on their ongoing experiences of the research during the whole ten-week period of

research, carried out by Bodén. Apart from these data collection events, the RCT also required videotaping of all the testing situations for judging the fidelity to the interventions and for ethical evaluations. As will be discussed in Chap. 7, these recordings were also analyzed with a focus on children's experiences taking the tests. In addition, randomized videotaping was performed at all units during the six-week intervention period for fidelity evaluations. Lastly, quality evaluations of the preschool units were performed using Early Childhood Environmental Rating Scale (ECERS-3) evaluation, performed by accredited and licensed evaluators from Gothenburg University.

This was the first research project in Sweden to use *in situ* – in each preschool unit – brainwave recordings, testing children's selective auditory attention, as one of the tests to evaluate the interventions. These brainwave-test measures were generated in a movable, *in situ* lab at each preschool unit and performed by two researchers on the main team. All tests and surveys used in the ECA project were well established and commonly used by both the linguists and trained psychologists on the team. Four of these researchers were responsible for the pre- and posttesting procedures (see following section on testing). The group of educational researchers designed the two interventions together with, or with support from, the developmental psychologist. This group of five researchers (the psychologist in the two groups) was responsible for the interventions, training of teachers and educators, implementation, and qualitative methodologies of the video ethnographies, focus-group interviews with teachers and educators, research on children's experience, and pedagogical quality evaluations with ECERS-3. The pilot study and the final research were reported and described in peer-reviewed articles[8] and in three PhD article-based dissertations in linguistics,[9] cognitive science,[10] and early childhood education.[11]

What is required of an interdisciplinary research team to perform this kind of research? About one-and-a-half years before writing the research grant proposal, the educational researchers on the main team were involved in a network in the municipality where the research was later performed. The network that comprises Stockholm University – Department of Child and Youth Studies – and this particular municipality was established based on previous engagements with researchers doing lectures and meeting up with teachers and educators and other staff around specific questions by invitation from the municipality. The teachers and educators were especially interested in how to enhance children's language development and how to understand children's brain development at large and in relation to

learning. The latter interest in brain research seemed to reflect a general interest in media at the time around 2010. Neuroplasticity and epigenetics were also concepts discussed in the public debate during this time. Network meetings took place Friday afternoons once a month and eventually led to a decision to do the ECA project together.[12]

Trusting relationships between academics and stakeholders take as their starting point a genuine interest on the part of researchers about what is going on in daily preschool practices and a desire to support teachers and educators in enhancing their practices. The dominant practice at these preschools was definitely group-based learning and activities in accordance with the preschool curriculum.[13] However, in line with a decentralized system, these were organized in different ways and with different local aims. Building strong and sustainable network relations means not merely delivering lectures and doing Q&As. Rather, the strategy was for the researchers to actively engage in and respond to documentation of practices that teachers and educators sent the researchers in advance of meetings. These consisted of observations, narrations, images, and video recordings from daily practices surrounding an issue of specific interest to discuss. When specialists on language and/or cognitive development or neuroscience, for example, were invited, they also needed to engage in the problems of concern articulated by the teachers educators before they attended the network. They were asked to reflect on the practitioners' daily practices as materialized in the documentation sent to them. This documentation was then displayed and discussed by the guest and the participating educators and researchers during the network interactions.[14]

The previously mentioned media and public interest in brains and genes most likely contributed to the fact that in 2013, the Swedish National Research Council issued the first ever call for educational neuroscientific research. This was the call that the PI Lenz Taguchi aspired to answer with an application written together with the linguist and subsequent co-PI, Tove Nilsson Gerholm, both at Stockholm University. The call yielded only a very small number of applications and would not be repeated, contrary to what had been announced. This likely attests to the hesitant and even test-averse context of educational research in Sweden at that time and/or the difficulties in establishing a collaborative project across the field of educational research and the cognitive neurosciences, as discussed in Chap. 4. Although the context has been transformed to some extent during the past decade, there remains a deep running divide between pedagogy and psychology,[15] preventing scholars from the field of education and cognitive psychology from finding ways to collaborate (Chap. 3).

The Situated Context and the Motivation of the RCT

The ECA project was performed in municipality-run preschools in a large community with housing areas of very different socioeconomic-status situations. Although some preschools are owned and led by private companies but financed by state subsidies, most preschools in this municipality are run by the municipality itself. All services are regulated by the school law and state curriculum and overseen by the Swedish Schools Inspectorate. Let us continue with our outline of only the most important facts to know about the context of Swedish preschools, since this will eventually lead to what caused the mutual interest in performing the first large-scale RCT in a regular preschool setting.

In Sweden, preschool has historically constituted an EduCare full-day service already established in the 1930s, although not including a majority of children in all social classes until the 1980s.[16] For the last couple of decades, the services are heavily subsidized for all families and carry a maximum fee that is affordable to any family thanks to generous child benefits. Moreover, it has also been a service clearly separated from the school system in terms of its divergent learning culture, embracing a holistic and integrative approach to development, care, and learning, a model developed as early as the 1930s.[17] In Sweden, full-time (three to ten hours) preschool is offered to all children one to five years old and enrolls up to ninety percent of one- to three-year-olds and ninety-five percent of four- and five-year-olds.[18] The services enjoy a persistently high level of satisfaction among guardians/parents, as well as compared with other services provided by the municipality. This level of satisfaction is sometimes attributed to dependence on the services rather than an informed satisfaction, since both the process and structural quality have severely degraded over the last decade.[19] Moreover, the teachers and educators working in these services have themselves raised frequent criticisms in relation to their working conditions and the welfare of the children. The university-educated preschool teachers and high school degree educated educators/child-minders, as well as uneducated staff working in preschools constitute together the employment categories with the highest rates of sick leave in the entire Swedish workforce.[20]

Recent studies of preschool quality, based on standardized ECERS-3 measures, point to significant quality variations among services in Sweden, not infrequently at the same school but in different units.[21] The quality

variations are connected to the educational level of staff, a finding of research also reported in Denmark.[22] This has been confirmed by the Swedish Schools Inspectorate, which further highlights significant quality differences and shows that over forty percent of services do not provide adequate EduCare in the area of language development. In addition, they do not they provide a basic understanding of the science, technology, engineering, and mathematics (or the so-called STEM subjects), in line with curriculum goals based on an approach to pedagogy that is based on group learning and socioemotional values. Evaluations have concluded that preschool teachers, with responsibilities regulated by school laws, generally have difficulties describing when and how teaching toward the goals specified for the "orientation of the education" and "goals to strive for" are actually performed. Moreover, the evaluation points to a lack of documentation of the effects of such teaching efforts, especially on the level of individual children.[23]

Evaluating the preconditions for learning, rather than focusing on individual children's growth and learning, is a development that started with the launch of the first national curriculum for preschool (ages birth to six) in 1998. The focus of such self-evaluations is teachers' and educators' approach to children and learning, group-level activities, and the material environment. The goal of this first curriculum was, thus, to place less emphasis on individualized developmental goals and milestones, which posed a risk of subordinating and normalizing children, as suggested by critical and postdevelopmentalist research studies (Chap. 3).[24] The new curriculum, influenced by sociocultural theory, critical postdevelopmentalism, and social constructionist pedagogy, articulated an idea of a "competent child" for whom teachers and educators would provide playful and experimental challenges, guided by children's own interests, rather than being objects of transferred knowledge in teaching practices.[25]

Two and a half decades later, this remains the taken-for-granted idea of what preschool education should be all about. This is manifested in the reluctance and difficulties reported by the teachers and educators in our network (see subsequent discussion) of engaging in any longer teaching sequences of face-to-face interactions with individual children, even when they are part of a smaller group-based activity. In other words, the aim informed by the, at the time, only two early-childhood education professors in Sweden was to steer attention away from the individual child's development as a way of better developing group-learning activities. This shift was possible during a sociohistorical period of relative homogeneity

and general rising economic prosperity in Sweden. Two decades later, the national evaluation of preschools reported deficiencies in quality that affect the development and learning of those children with different individual needs, including when it comes to language development.[26]

It is from within this context that the motivation arose to evaluate the effects of the aforementioned group-based preschool practices. In the network collaboration, questions and problematizations surfaced with respect to ongoing practices. Why don't we know more about what each child thinks, does, discovers, and learns? Why is it so difficult to find the small spaces of time to give individual children focused attention and support and scaffold their learning and language development?

The Design of the RCT

The main pedagogical intervention to be evaluated is the socioemotional and material learning paradigm (SEMLA). This name captures the main focus in the curriculum on the socioemotional goals and the importance of pedagogical environments in preschools, but also the material in terms of the embodied brain and reactivating the socioemotional aspects of developmental scientific findings about interrelational neurocognitive development. Thus, the intervention drew simultaneously from already dominant sociocultural, critical theory, gender-pedagogical, and new materialist theories, as well as overlapping knowledge from recent developmental scientific findings.[27] With the addition of the latter, the main intervention was designed to enhance children's attention, language, communication, socioemotional, and early mathematics skills on the individual level as part of a group-based learning activity.[28]

The research design also included a contrasting pedagogical intervention, set up as an individual digital learning paradigm. It focused on early mathematics, combined with a set of attention-enhancing physical and cognitive exercises for self-regulation. This intervention was called Digital Individual Learning for Body and Mind (DIL). Before the project started, the 432 children were randomized in their regular preschool units to either of these two interventions or to continue their regular preschool practices as control units.

CONSTRUCTING THEORIES OF CHANGE
FOR THE INTERVENTIONS

Although the ECA project has generated a number of very different kinds of studies and inquiries – qualitative, evaluative, theory-creating, and quantitative – we will focus on the intervention design, since it is probably less well known to many social science and educational scholars and readers of this book. Without getting into too much methodological detail, we nevertheless would like to describe the process of deciding upon and articulating a clear program theory and theory of change (ToC).[29] Within a naturalistic research framework, this is a taken-for-granted way to design a study. You need to articulate a sound theory of producing a difference as a hypothetical effect of an intervention. You specify the mechanisms of change aimed at affecting, in this case, children's linguistic, socioemotional, and attentions skills.

A ToC thus formulates how a particular iteratively performed learning practice might affect a child's development of a skill or enhance a specific learning of linguistic skills and concepts, for example. Such a theory builds on earlier empirical findings.[30] In the case of the ECA study, it also relied heavily on documented practices from early-childhood education practices in Sweden – the Reggio Emilia inspiration practices of investigative group-learning and multimodal-learning practices[31] – and in the U.S. – socioemotional learning experiences.[32] The theory of change is then transformed (operationalized) into a program theory that outlines how the theory, mechanisms of change, and practices are linked. It needs to be negotiated with teachers and educators in order to be enacted with as much fidelity as possible. Optimally, it will be enacted in a fashion that outlives the six-week intervention, that is, allowing for incorporation of the program into regular practices following project completion. The program activities need to be clearly linked to tests that measure the hypothesized effects of the practices. For this research, we aimed to use only well-established tests that have a track record of producing reliable results (see following discussion).

In other words, constructing a theory of change and a program theory for two different and previously unevaluated interventions entails engaging in a challenging scientific puzzle. The details of this are provided in previously published peer-reviewed articles.[33] Theoretically, as well as instructionally, the intervention with SEMLA meant an improved group-based learning, in line with the Swedish curriculum, which also aimed to

enhance individual children's attention, linguistic, communication, collaboration, and socioemotional skills. The intervention was based on seven main components, which were operationalized to have the desired effects tested before and after the intervention.[34]

THE SOCIOEMOTIONAL LEARNING GROUP-BASED LEARNING INTERVENTION

Consider this question as a five-year-old child or as an adult: "How might we live and transport ourselves in another 100 years from now, living here in this community?" This investigative problem and question of concern was used as the entry point for collaborative thinking and group-based learning and explorations – the SEMLA intervention – with the four-, five-, and six-year-olds. The design of the intervention was built on group-based investigative pedagogy, inspired by what in the North American context is referred to as STEAM (Science Technology Engineering Aesthetics and Mathematics) learning practices, SEL (Social Emotional Learning), and from Reggio Emilia-based learning.

Children's explorations featured constructions of buildings in treetops or under the surface of the Baltic Sea. Some children designed and built elevators to reach those homes, whether on land or under water and constructed cable transports across these lands and waters, after flooding or other climate-change-induced alterations in the landscape. For such exploratory work, a lot of creative materials were needed. The children were divided into smaller groups (about four to eight) with one or, preferably two teachers or educators to do these SEMLA practices four mornings a week for at least an hour in an undisturbed room in the preschool for the six-week period.

For the teachers and educators to be able to explore the overarching problem of concern with the children, they were asked to do the exact same kinds of explorations during the preparations for the in-service course. The adults then used the same kinds of materials as they would offer the children and posing – as it were – basically the same questions and formulating basically the same kinds of imaginaries as the children would later do.[35] This way, they would be better prepared for what might emerge in the explorations conducted by the children in smaller groups. But most importantly, they would have a similar experience of wonder in relation to questions that arise when investigating problems of construction or what might happen in the future.

In terms of scaffolding children's learning and language development, the teachers and educators would understand more about what kind of vocabulary might be needed to enhance language development in the STEAM subjects, with an emphasis on math.[36] They would also experience how to practically measure and calculate problems having to do with construction and architecture, such as balance, durability, and strength, that the four- to six-year-olds would encounter in the same way they themselves did during these sessions.[37]

Digital Individual Learning for Body and Mind

To contrast the group-learning strategy, the RCT paradigm included a contrasting pedagogical intervention focusing on enhancing the individual child's focused attention, self-regulation, and early math development – the DIL intervention. Before the children used the math software, they completed a series of physical exercises in the group with an educator. These exercises, adapted from the program at Head Start schools in Oregon, were intended to have the children relax, breathe, focus, and, hence, enhance self-regulation and meta-cognition focusing on embodied learning.

The interactive child-sensitive and adaptive digital early-mathematics software was developed by researchers at Lund and Linköping Universities in Sweden, in collaboration with Stanford University in Palo Alto, California. The aim was to practice number sense, such as the numbers one through nine: addition and subtraction. Theoretically inspired by a Vygotskian tradition, the game included a strategy known as "teachable agent," whereby the child picks a digital friend to scaffold and teach math.[38] The ToC for the DIL intervention was developed based on a growing body of research supporting the claim that executive functions and early math skills are foundational for learning and mutually interdependent and that they should be used in tandem to complement each other.[39]

For teachers and educators, DIL entailed setting up an activity room with a reliable Internet connection and a workspace with headphones for eight to ten children at a time, working individually about thirty minutes, four days a week. Teachers and educators were trained and supervised in how to support children with attention or number-sense difficulties and to overcome other forms of motivational resistance.[40]

RCT Research Questions

The research questions for the RCT were as follows:

1. What are the effects of the two different pedagogical methods (SEMLA and DIL) on language and communication, executive functions, socioemotional comprehension, and early math skills?
2. How do any observed effects in these areas differ between the two interventions?
3. To what extent are any observed effects mediated by language and/or EF (executive functionings)?
4. To what extent are any observed effects moderated by background variables like sex, age, and preschool start, for example?
5. To what extent are the background variables related to the outcome variables?
6. To what extent are the outcome variables related to each other?
7. Do any observed effects of the interventions differ in terms of strength and variation?[41]

The Tests

The RCT design was implemented to answer the foregoing questions based on differences in the test results from children. The intervention study is technically described as a three-armed, cluster-randomized, controlled study implemented in three waves during a period of ten months (September 2016 to June 2017).[42]

The testing procedure can be outlined as follows. The pretesting of the children commenced two weeks prior to the intervention start, and the posttesting followed immediately after the intervention, as noted earlier. Trained research assistants (speech-language pathologists, psychologist, and social scientists hired for the project) came to the different preschools and conducted the testing in a secluded room chosen by the preschool. The testing was divided into two session for pretesting and posttesting, each session being approximately thirty minutes. This was done to avoid fatigue and boredom on the part of the children. Each test took approximately seven minutes (see also Chaps. 7 and 8).

The following tables show the order of these well-established tests, as well as what the tests aim to measure and the tasks the children perform, where the first session consisted of five parts (Table 5.1).

Table 5.1 Summary of tests, first test session

Test	What is measured?	What children do
Dimensional Change Card Sorting	• Executive functions (cognitive flexibility) • Communication (interacting in an age-appropriate manner)	Sort figures – trucks, rabbits, elephants, balls, and boats – on a digital tablet, based on color and shape[a]
Test of Emotion Comprehension	• Emotional comprehension	Choose the most suitable facial expression among four options after listening to a short story[b]
Bus Story (pretest)[c] *Frog Story* (posttest)[d]	• Communication (lexical diversity, syntactic complexity)	Retell or generate stories by looking at pictures in wordless picture books
Number Sense Screener	• Early mathematics skills	Engage with pictures and objects and answer "How many are left if I remove…?" and so on[e]
Head, Shoulder, Knees, Toes	• Executive functions and self-regulation (inhibitory control, working memory, task shifting)	Respond to instructions like "touch your shoulders" or respond with an opposite movement[f]

[a] For example, Zelazo (2006, 2015)

[b] For example, Pons and Harris (2000)

[c] For example, Renfrew (1969)

[d] For example, Mayer (1969)

[e] For example, Jordan et al. (2012)

[f] For example, McClelland et al. (2014)

The first test session consisted of five parts:

The second test session, usually performed the day after the first test session, consisted of four parts (Table 5.2):

The particular order of the tests was chosen based on the experiences with the pilot study.[43] All test sessions were video recorded in order to acquire data on language and communicative behavior, but also to check fidelity in test assessment.

Table 5.2 Summary of tests, second test session

Test	What is measured?	What the children do
Flanker Fish Task	• EF (suppress inappropriate responses)	Identify on a tablet the fish in the middle and press the arrow pointing in the same direction as the fish[a]
Peabody Picture Vocabulary Test	• Receptive vocabulary skills	Point to the picture, from among four, that corresponds to the word the assistant gives verbally[b]
What's Wrong Cards	• Communication	Point at the mistakes added to pictures describing everyday situations[c]
The Digit Span	• EF (short-term and working memory)	Memorize and repeat a series of digits, forward and backward[d]

[a] Rueda et al. (2005), p. 584

[b] For example, Dunn and Dunn (2007)

[c] For example, Speechmark ColorCards: What's wrong? (n.d.)

[d] For example, Gathercole and Baddeley (1996)

BRAINWAVE RECORDINGS/
ELECTROENCEPHALOGRAM (EEG) TEST

A subgroup of children was sampled to participate in a brainwave recording test, in which brainwaves were recorded. This brainwave recording technique has been extensively used by linguists to study linguistic operations, but also to measure selective attention in programs aimed at social justice.[44] The test in the ECA project, a *selective auditory attention* test, was performed in a mobile lab in a separate and quiet room on site at each preschool by two researchers, who made the recordings. During the test, the children sat in a chair, and a cap with twenty-two electrodes was placed on their head. A gel was used to establish a stable electrical connection between the electrodes and the skin. Each session lasted thirty to forty minutes, during which time the children heard stories from two loudspeakers at each side of their body. In front of them, images were shown on a computer screen from one of the stories. As the name of the test suggests, it assesses a person's ability to focus, select, and direct their attention to, in this case, one of the stories and ignore the other. The child simply sits and listens, and the attached electrodes record the brain activity so as to assess the brain's aptitude for inhibition – in ignoring disturbances – at moments when beeping noises disturb the readings of the stories.[45] The

measure of inhibition at these moments of disturbance is what measures focused attention. Put another way, this recording of brainwaves makes event-related potentials (ERP) visible as changes in the ongoing brain (EEG) activity.

All guardians of the 432 children in the ECA project gave their written consent for their children to be part of all the different research activities in the project, including the EEG tests. The project aimed at including approximately 150 children in the EEG test. In total, 185 children were allotted spots to participate in the tests to account for possible attrition. The children were randomly selected, with the only criterion that the sample would include an equal number of boys and girls, regardless of age or the family's socioeconomic status.

An important part of the ethics protocol was that all children were repeatedly asked to give their *in situ* consent to participate or not, independently of the written consent given by their parents, in relation to all activities. For the EEG testing, out of the 185 randomized children, 139 gave their consent to participate in the first round of pretesting (77 girls and 62 boys). Forty-six children (sixteen girls and thirty boys) either declined verbally or expressed a negative or ambivalent attitude toward participating by other communicative means. These children did not participate in the testing. Six children (two girls and four boys, mean age five and a half years) declined to participate in the posttesting after having participated in the pretesting. Another ten children were not part of the posttesting because they were absent from preschool on the day(s) of testing. In Chaps. 6, 7, and 8, we provide thorough discussions on ethics in relation to all the various forms of testing in the ECA project.

ECERS-3 QUALITY ASSESSMENT

To estimate preschool quality, the ECERS-3 was used.[46] ECERS is an internationally recognized tool for measuring preschool quality and has shown to be more predictive of children's learning than factors such as group size and staff-to-child ratio, i.e., structural quality measures. The third edition of ECERS measures thirty-five items organized into six different subscales: space and furnishing, personal care routines, language and literacy, learning activities, interaction, and program structure.[47] The assessment was conducted by accredited evaluators who were not involved in the project in any other way and blind to the interventions and aims of the study.

Qualitative Methodologies

In the ECA project, the RCT methodology was complemented by qualitative forms of data collection commonly used in educational research.[48] These methods, together with the generated data, are shown in the following table (Table 5.3).

A Relational Research Ethics

The ECA project can be understood as a "bottom-up" relationship starting with stakeholders and educational researchers in a joint network, who then invited linguists, cognitive neuroscientists, and a developmental psychologist to help evaluate and produce new forms of knowledge about specific educational practices. The research necessarily called for a formal evaluation of an ethics protocol that was sent to the, at the time, Regional Ethics Committee in Stockholm, which was approved in November 2015.[49]

As educational neuroscience scholar Paul Howard-Jones reminds us, the sociohistorical and economic context of educational-neuroscience research always entails contemplating possible ethical risks.[50] However, the sociohistorical experience of brain-related and other forms of testing is an ethical aspect that contemporary neuro-education research seldom addresses, according to Howard-Jones. The application for ethical approval

Table 5.3   Summary of qualitative methodologies and data

Method of data production	*Data material*
Twenty interviews with children about interventions and about being filmed, observed, and tested	Approx. 10 hours of video and audiotape
Thirty focus-group discussions with teachers and educators about children's understandings and experiences	Approx. 30 hours of audio
Two focus-group discussions with the researchers performing the tests	Approx. 3 hours of audio
Long ethnographic video recordings of interventions and controls	Approx. 350 hours of video
High-fidelity recordings from intervention groups and control groups (randomized 7-minute clips)	Approx. 10 hours of video
Video recordings from test situations with each individual child	Approx. 1,000 hours of video
Emergent new materialist/posthumanist collaborations with children	Field notes, photo Approx. 5 hours of audio and 3 hours of video

for the ECA project did therefore include a passage on the risks of testing children in preschools. As will also be discussed in Chap. 6, the sense of being objectified in research applies to all forms of research practices that involves humans, be it RCT studies or studies using ethnographic observations, interviews, focus groups, or collaborations with stakeholders of other kinds, such as different forms of action research.[51] With this in mind, we made a big effort to emphasize the positioning in the role of the stakeholders of this study. We made it explicit that the task was to "test the effects of educational practices" rather than to test the children or the teachers' and educators' regular practices. Information about the project and the research ethics tied to it consisted in its main objective, which was to "help the researchers do the research," that is, to evaluate the two pedagogical interventions while opening up ethics strategies for teachers, educators, and children that would allow them to, *in situ*, withdraw their consent to be filmed or participate in testing using both verbal and bodily signs.

The success of the aforementioned strategies was frequently noted in the focus-group interviews. Some teachers and educators compared the situation to when the guest researchers performing the quality ECER-3 evaluations came to visit. On these occasions, teachers and educators were not actively invited by the evaluators to give their *in situ* consent, due to the contract negotiated with evaluators. This merely gave them only a two- to three-hour time slot to complete their evaluation as mandatory for each preschool to accept. Their presence in the room, as they evaluated activities and the environment, was, according to some of the teachers or educators, experienced more as an objectification and intrusion, compared to the activities performed in the rest of the ECA project, following transparent plans and with *in situ* consent at all times. The contrast thus made them experience a difference in terms of agency and control.

The relational ethics protocol for the ECA project was based on identified shared interests and aims, transparency, and, to the extent possible, a sense of control and agency. Moreover, negotiations with educators and guardians were done in relation to the testing and ethics protocol. For instance, some parents requested that the children be tested by the same person for the pre- and posttests to avoid having their children interact with too many new adults. This was an easy request to honor, even if it violated somewhat with the quality criteria of our research design.[52]

INFORMED CONSENT AND POSSIBLE REASONS FOR LOW ATTRITION RATES

For a study like this, we could only include preschool units in which basically all children's guardians had provided written consent to participate. Apart from written information to guardians in three languages (Swedish, English, and Arabic), we offered several open evening meetings with the PI, Lenz Taguchi, and co-leader Nilsson Gerholm. Other members of the research team visited preschool units during daily morning greetings to children to inform, chat with, and answer questions from guardians and staff. Obtaining written consent from both of the children's guardians was easier than anticipated. Out of all the enrolled children at the twenty-nine chosen units, only guardians of twenty children did not provide their consent to have their child participate in the pre- and posttesting and/or to be videotaped. Withdrawal from the study after it started happened with only one child. In total, 432 children participated in the research.

In the subsequent focus-group discussions with teachers and educators, we learned that the low attrition rate could be attributed to the slow and rigorous information-sharing process. Especially important was the information that researchers and research assistants had to continually inform and ask the children *themselves* for their consent, in the *in situ* moment of being asked to step into the room for testing or as the camera was switched on, for example. We thus asked guardians to give their consent for their children to participate, given that they might trust that their children would, in their turn, give *their in situ* consent at the moment the research activities that required consent would be taking place. The guardians also trusted the staff to be present and available to the children at all of these occasions and ensure that this happened, that is, ensuring the ethics protocol concerning the children was followed as they "helped the researchers do the research" of evaluating the pedagogical interventions as the object of research.

The phrase "I am helping the researchers do the research" actually became an expression often used among the children and often clearly underscored with a sense of pride. As the teachers and educators attested to, during the focus-group interviews, the vast majority of the children showed enthusiasm and enjoyment during both the intervention time and the testing. Getting children to do one-hour sessions (split into two parts) of pretests and, six or seven weeks later, another hour of posttesting, and in some cases another two hours in the *in situ* EEG lab, did not seem to

be a problem for most of the children. This was a surprise for the test-cautious educational researchers on the team, who were concerned about the test-averse attitudes in their field. Moreover, in relation to participating in the pedagogical interventions, comments from children like "now we are going inside to do research" were frequently heard, as was the question posed to teachers or educators: "When is it my turn to do research today?" The children thus referred to their participation in the pedagogical interventions as "doing research." Moreover, echoing the information given to the guardians, a couple of children were overheard saying, "There is not going to be any research without me!"

Among staff, no attrition was observed in the group of ninety-eight teachers and educators. However, we later became aware that some of the teachers and educators from three of the twenty-nine units had likely submitted their written consent forms as a result of group pressure. We became aware of this during supervision of the interventions, as some of the staff showed reluctance to do what had been negotiated. Rather, they resisted the demands put on them by their colleagues and superiors, but they nevertheless supported the children according to the plan during the testing and interventions. Undoubtedly, this might nevertheless have affected the results. More importantly, this taught the research team to be more observant and, in relation to future projects, interview teachers, educators, and other staff individually to determine whether or not a given unit should be included in the research.

According to the focus-group interviews, it was the shift away from a project that evaluated them and their ongoing practices to instead do research on negotiated "new" pedagogical interventions that inspired the teachers and educators to participate in conducting the research. For them, this constituted a learning process. Moreover, helping the researchers doing these negotiated practices and the testing to evaluate them legitimized the research by emphasizing the fact that the researchers depended on children and staff to accomplish the research in a bidirectional channel of communication about what was working and what wasn't, rather than being evaluated while trying to do business as usual. The sense of dependence on the stakeholders thus seemed to produce a feeling of empowerment among the educators. Simultaneously, this humbled the researchers in their relationship with the stakeholders. In fact, it was the success of gaining the trust of the stakeholders that resolved most of the tension around the testing among the members on the interdisciplinary research team (Chap. 11). And yet, there were, as indicated earlier, educators who,

in the focus groups, let us know that they hadn't really been on board from the start of the project. Thus, there were important lessons to be learned from all of these experiences.

CONCLUSION

To conclude this chapter, we'd like to say a word about the potential gains from the ECA project for both researchers and stakeholders. The gains for members of the research team with respect to their teaching practices and future research were manifold. Another important effect has been that more findings from the developmental sciences that have been absent in the last two decades have been incorporated into the early childhood education teacher program. In addition, the ECA project inspired a number of new research projects and collaborations with other municipalities (see Conclusions). More importantly, though, is how the research affected children, teachers, educators, and stakeholders going forward.

The project was situated in a municipality that during the time of the COVID-19 pandemic would change its political and administrative leadership after the project was finished. Even if preschools and compulsory schools in Sweden were open during the entire period of the pandemic, this seriously affected the further continuation of the network collaborations, which were closed down during the pandemic. But before this happened, several new preschools that had not been randomized to the main SEMLA intervention signed up to participate in workshops led by the same researchers who had supervised SEMLA during the ECA project, together with teachers and educators who had been involved in the SEMLA interventions. Municipality evaluations attested to the great effects on preschool quality at units that had adopted the SEMLA pedagogy during the three-year period after the main project was finished. Moreover, teachers and educators changed jobs and so shared their experiences from the project and interventions at their new workplaces (Chap. 11).

When discussing mutual and reciprocal learning in relation to larger interdisciplinary research projects, especially those involving thoroughgoing research practices requiring extensive preparations, planning, and ethics protocols such as in the ECA project, we wish to emphasize that the effects of learning ripple far beyond academia. What this kind of research is about can be thought to be much less connected to issues of validity, applicability, and the scope of universal generalization as effects of interventions and more about building a community of collaboration around

children's development and learning. standard. This is more about what knowledge production actually produces in terms of knowledge, knowing, and collective experiences across different scales in the community. That is, what extends from what actually happened in the enactment of new forms of child–adult interactions, new kinds of documentation of the group and individual children's learning, and what was experienced in the collaborative investigations among children and among teachers and educators. Evidently, this has spread far out into the communities around Stockholm. This will be discussed at greater depth in the conclusion of the book.

NOTES

1. Pontoppidan et al. (2018).
2. For example, Dahlberg and Elfström (2014); Emilson and Pramling Samuelsson (2014); Lenz Taguchi (2000, 2009); Lindgren (2012).
3. Bodén (2019, 2021, 2024).
4. Frankenberg et al. (2019); Gerholm et al. (2018, 2019).
5. Enhancing preschool children's attention, language, and communication skills: a randomized controlled trial to evaluate the effects of two pedagogical interventions. The project was funded by the Swedish National Research Council VR 2014–2018, grant number 721-2014-11786.
6. In Swedish preschools teachers with a higher education degree of 3 1/2 years, usually work together with high school educated educators in teams of three. At best there is one teacher per team who is the responsible person for pedagogical documentations, planning, and development. If there are more than one teacher, the responsibility is shared equally.
7. The core team: Head PI Hillevi Lenz Taguchi (Education, Child and Youth Studies), Co-PI Tove Nilsson Gerholm (Linguistics), Signe Tonér (Linguistics), Susanne Kjällander (Didactics, Early Childhood Education), Anna Palmer (Early Childhood Education), Sofia Frankenberg (Developmental Psychology, Child and Youth Studies), Petter Kallionien (Cognitive Psychology), Linnea Bodén (Education, Child and Youth Studies).
8. Frankenberg et al. (2019); Gerholm et al. (2018, 2019).
9. Tonér (2021).
10. Kallioinen (2024).
11. Kaneko (2022); Kaneko and Frankenberg (2022).
12. The network was collaboratively led by Hillevi Lenz Taguchi, Susanne Kjällander, Sofia Frankenberg, Lena Aronsson, and Anna Palmer, all from

the Department of Child and Youth Studies, and was supported by the department as part of the third-strand activities for senior lecturers.

13. Curriculum for preschool in Sweden, which is referred to as Lpfö18 (n.d.).
14. Examples of cognitive psychologists invited to the network were Agneta Gulz, Torkel Klingberg, Åsa Nilsonne, and Eric Pakulak.
15. See Chap. 2 for more on the historical divide between psychology and pedagogy in Sweden.
16. Lenz Taguchi and Munkammar (2003).
17. Lenz Taguchi and Munkammar (2003).
18. Swedish National Agency for Education (2024).
19. Swedish Schools Inspectorate (2017).
20. Counted in full-time positions, forty-one percent are educated preschool teachers (Swedish National Agency for Education, 2024).
21. For example, Sheridan et al. (2019).
22. Slot et al. (2018).
23. National Schools Inspectorate 2017 evaluation.
24. For example, Burman ([1995]/2016); Walkerdine (1998).
25. For example, Lenz Taguchi (2008).
26. National Schools Inspectorate 2017 evaluation. Sheridan et al. (2019).
27. For example, Lerner et al. (2014); Overton (2013); Stevens and Neville (2006).
28. Frankenberg et al. (2019); Gerholm et al. (2018, 2019).
29. Funnell and Rogers (2011).
30. For example, Rueda et al. (2005); Stevens and Neville (2006).
31. Kjällander (2011); Lenz Taguchi (2000, 2008, 2009).
32. Durlak et al. (2011); Gormley Jr. et al. (2011).
33. Frankenberg et al. (2019); Gerholm et al. (2018, 2019).
34. Lenz Taguchi and Palmer (2017).
35. Frankenberg et al. (2019); Palmer et al. (2023).
36. Palmer et al. (2023).
37. De Freitas and Palmer (2016); Palmer (2016).
38. Haake et al. (2015).
39. For example, Clements et al. (2016); Diamond and Ling (2016); Axelsson et al. (2016).
40. Kjällander and Frankenberg (2018).
41. Gerholm et al. (2019).
42. Gerholm et al. (2019).
43. Gerholm et al. (2018); Tonér and Nilsson Gerholm (2021).
44. Pakulak and Stevens (2022).
45. Gerholm et al. (2018).
46. Harms et al. (2014).
47. Garvis et al. (2018); Mayer and Beckh (2016).

48. Frankenberg et al. (2019).
49. The project was reviewed and ethically approved by the Regional Ethics Board DNR number 2015/1664–31/5.
50. Howard-Jones (2012), p. 338.
51. Bodén (2021); Mayne and Howitt (2015); see also Chap. 6.
52. Gerholm et al. (2019).

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The Children

CHAPTER 6

Troubling Ethics in Developmental and Postdevelopmental Inquiry Involving Children

This chapter discusses the question of children's participation in the Enhancing Children's Attention (ECA) project, with a focus on ethics, by analyzing how ethics are articulated, produced, and sometimes also performed in scholarly texts that discuss children in research.[1] A major portion of the scholarly works examined are from the areas of childhood studies and early childhood education as these areas have thoroughly discussed children's participation in research. These discussions often take qualitative small-scale studies as a starting point. To learn more about how ethics are discussed in studies working with methodologies similar to those applied in the ECA project, the analysis will also lead to a discussion of studies that engage with children in randomized controlled trial (RCT) studies, that is, methodologies that involve standardized testing described in more detail in Chap. 7 (see also Chap. 5), including brainwave recordings (EEG[2]) (Chaps. 5 and 8).

The prepositions *on*, *to, with*, *for*, and *by* will guide us in our review of the texts in this chapter. We will thus return to the prepositions already discussed in Chap. 4, but this time with a new mission: to understand how each preposition becomes entangled with specific understandings of ethics.

Why are we as authors so fond of these prepositions? And why do we think that they can help us to better understand ethics in inquiries involving children? One answer lies in the simple fact that these prepositions have often been what scholars turn to when trying to understand

children's experiences participating in research. We as the coauthors of this book are thus certainly not the first to discuss children in research by highlighting prepositions like *on*, *to*, *with*, *for*, and *by*. For example, when childhood scholars Pia Christensen and Alison James looked back at the first edition of their groundbreaking 2000 anthology *Research with Children*, they described how "the focus was on research *with*, rather than *on*, children, in a desire to position children as social actors who are subjects, rather than objects of enquiry."[3] They put the prepositions in italics so as to properly emphasize the conflict in meaning making. Others, like childhood scholar Mary Kellett and child and youth scholar Nigel Thomas, have further elaborated on the meaning that prepositions have and also open up for research *by* children.[4] Apart from being connected to ontological and epistemological presuppositions, as described in Chap. 4, prepositions reveal specific relations to the children involved in research, such as whether children are being treated as objects or subjects in the process of inquiry.

Other scholars have tried to define how the prepositions relate to one another. Social anthropologist Emma K. Clavering and sociologist Janice McLaughlin have described the different prepositions as being on a continuum: "from research done on children, to that which is carried out with children, and finally that which is by children."[5] However, when we started to dive deeper into the meaning making of these prepositions, it became obvious that the prepositions were not on some value-free, neutral continuum. Instead, it became apparent how certain ways of understanding each preposition were embedded in value-based descriptions of them. For example, a repeated statement in almost all the reviewed literature was that research should be done *for* children and contribute to improving children's life conditions. As described in Chap. 4, the preposition *for* centers on the question of how research can enable a betterment of a future society for all children, for example, through an enhancement of childhood education or through new understandings of what childhood is, might be, and can become.

Moving on to the other prepositions, the literature argues how there is a risk that children are treated as objects if research is performed *on* them and more likely that they are treated as subjects or social actors if the research is performed *with* or *by* children. Such statements and descriptions are connected to different methodologies. That is, standardized testing is understood as being conducted *on* children,[6] while interviews, or participatory action research, is understood as being conducted *with*

children.[7] More recent and innovative methodologies position children as coresearchers, meaning the research is done *by* children.[8] Doing research *with*, rather than *on*, children is even compared to a paradigm shift,[9] where the next step is research done *by* children, as for example anthropologist and childhood researcher Spyros Spyrou suggests.[10] Furthermore, research can be done about or *to* children (later on we will return to how we understand the preposition *to*) or, as described earlier, *for* children, with the focus on the benefits of the research.

But what does this have to do with ethics? Childhood and early childhood education researchers have long argued that the more involved the children are in shaping the research – the more the research is done *with* or *by* children – the greater the chances that the research will reflect an ethical research practice. In these descriptions, the prepositions thus seem to be holding different possibilities and values connected to ethics. This way of understanding the prepositions under discussion differs from thinking in terms of a continuum, like the one described by Clavering and McLaughlin. It also differs from the more or less straightforward description Christensen and James offer. What we instead will show in this chapter is that stories about prepositions are not neutral. Instead, the prepositions when taken together form a *value scale* that "measure[s] or contrast[s] 'goods' and 'bads,'" as actor network theory scholars John Law and Annemarie Mol have theorized regarding scales.[11] On this value scale, research *on* children is positioned at the "bad" end of the scale and research *by* children at the "good" end. In our minds, this gradually progressing scale of ethics is best understood as a linear musical rhyme, where the counting goes: *on*, *to*, *with*, *for*, *by*, instead of, one, two, three, four, five.

We ask the reader to keep humming this rhyme with us throughout the chapter as we trace the prepositions in the reviewed literature. While doing so, we aim to unfold the context, history, and discourses that underpin the arguments surrounding the prepositions because, as we see it, the value scale has not only become a *de*scriptive thinking tool to reflect upon ethical work with children; it has also become *pre*scriptive, that is, research *should* be as close to the "good" end of the scale as possible. Thus, research should be done *with* or *by* children. Otherwise, we run the risk of preforming unethical research.

These discussions reveal that some of the methodologies enacted in the ECA project, such as standardized testing and brainwave recordings, would definitely be positioned on the "bad" end of the scale. These methodologies would be thought of as being at risk of objectifying the

participating children and, hence, as ethically questionable. However, in this chapter, we will try to challenge the idea of thinking in terms of a value scale from *on* to *by* and that contrasts "goods" and "bads." Instead, we will look at how the prepositions become entangled with certain philosophical assumptions about ethics, which we have come to term *ethics as social justice and fairness*; *ethics as inclusion, participation, and empowerment*; and *ethics as producing potential new worlds*. This becomes a way of "flattening out" the scale and enabling a detailed look at the nuances that each preposition holds in relation to ethics.

Selection of Literature

The meaning of the prepositions was culled from a selection of research papers, books, overviews, anthologies, and handbooks that discuss ethics and children's participation in research. We chose to focus on works that discuss these questions broadly rather than empirical studies that, so to speak, "put ethics to work." This was a deliberate decision. Our interest has been in larger trends in the literature rather than the choices and practices of specific research projects or researchers. Almost all the literature we found can be characterized as falling within the areas of childhood studies and early childhood education research, building on sociocultural or critical perspectives, and putting to work qualitative or postqualitative forms of inquiry.

Examination of the prepositions started in the middle of some of the most cited works in childhood studies and early childhood education, and from there we worked our way to other literature. This meant that we started with the three classic editions of *Research with Children: Perspectives and Practices*, edited by Christensen and James[12]; *Rethinking Children and Research*, by childhood scholar Mary Kellett[13]; *Listening to Young Children: The Mosaic Approach*, by early childhood education scholars Alison Clark and Peter Moss;[14] and *Ethics and Research with Young Children: New Perspectives*, edited by Christopher M. Schulte,[15] who is associate professor in art education. A number of special issues and research papers on ethics in childhood journals and on children in journals on ethics constituted other starting points that had us follow new trajectories of studies. An example is the special issue of *Children's Geographies* titled "Interdisciplinary Perspectives: Ethical Issues and Child Research," edited by Peter Hopkins and Nancy Bell,[16] and a couple of special issues of *Contemporary Issues in Early Childhood*.[17] In total, the literature amounted

to approximately fifty research papers and twenty books on children in research. This means that many papers and books not quoted or referenced in this chapter have nonetheless been crucial for our analysis.

For the analysis, the books and papers were read carefully while paying special attention to the aforementioned prepositions. Examples of the types of questions we asked are as follows: How is research *on* children described? What does the literature say about research *for* children? Where is research *by* children discussed, and why?. This tracing of the prepositions resulted in long summaries filled with quotes from the papers and books, as well as with thoughts and reflections, where each preposition was as comprehensively described as possible. Eventually, some final questions were asked: How does this particular preposition articulate ethics? How do the prepositions relate to developmentalism or postdevelopmentalism?

At this point of the analysis, it was apparent how the selection of literature affected what we were able to say about ethics. The empirical material from the field of childhood studies and early childhood education is strongly influenced by the new paradigm for the study of childhood.[18] As described in previous chapters, it is no surprise that harsh criticism is directed at developmentalism, which underlies research *on* children. This includes reasonings and notions about where research *on* children should be placed on the value scale. The critique of research performed *on* children emerges from an idealistic ontological realm. The critique is then applied to the ontological realm of naturalistic and developmental forms of studies, consisting of intervention RCTs and other forms of experimental research, that in turn make other philosophical assumptions about ethics. The notions and critique thus reflect what kind of philosophical assumptions on ethics the research builds on. This led us to also include studies within the naturalistic form of standard epistemologies, like RCT methodologies, in order to analyze how ethics were discussed in these studies. However, we found no handbooks, special issues, anthologies, or other works that addressed working with children within the "camp" of standard epistemology. Instead, we chose to focus on a selection of empirical studies enacting experimental and intervention methodologies. What happened when the analysis of these studies met the value scale will be shown in the final part of the analysis.

Unfolding the Ethical Underpinnings of the Prepositions

In the following analysis, we will unfold the philosophical assumptions about ethics that underpin the prepositions *on*, *to*, *with*, *for*, and *by*. We argue that, in the literature, the prepositions under discussion are not only related to specific methodologies or specific ways of working with children in research. The meaning making of the prepositions is also part of forming what we have identified as three lines of thinking, entangled with the value scale, that are core to what ethics are all about in relation to children. These lines of thinking construct three different ways of understanding that are underpinned by certain philosophical assumptions: first, *ethics as social justice and fairness*; second, *ethics as inclusion, participation, and empowerment*; and third, *ethics as producing potential new worlds*. We will unfold each of these assumptions in what follows.

Ethics as Social Justice and Fairness

We will start with the preposition *on*. As described earlier, the preposition *on* has been thoroughly criticized by childhood and early childhood education scholars who write on ethics. A meta-analysis of journal papers in early childhood education, however, shows that the majority – 96.6% of 506 analyzed papers – position children as nonparticipant objects or semi-participant subjects, where inquiry is described as done *on* them.[19] What are the philosophical assumptions about ethics that, despite the criticism, nevertheless make this form of inquiry the most dominant in the Western academy (apart from the Nordic countries)? We believe that this has to do with the philosophical assumptions of *ethics as social justice and fairness* that underpin developmentalist kinds of inquiry.

To understand what *ethics as social justice and fairness* entails, we need to make a detour to the preposition *for*. Recall what we said in the introduction to this chapter (and in Chap. 4): there is a consensus in the literature that all inquiry involving children should be done *for* children and in various ways contribute to better lives for all children. To contextualize developmentalist perspectives and ways of conducting research *on* children, we must carefully look at the ethical standards that developmental research rest upon. Sofia Frankenberg, one of the team members in the ECA project, has published an overview of ethics in childhood research, where she specifically addresses what she calls the "raised eyebrows and

bolded question marks in relation to developmental test methodology."[20] Frankenberg shows how research that departs from developmental perspectives on children are connected to knowledge claims focusing on effects, predictability, and generalizability. This strand of research, which uses experimental test designs, will inevitably be treated as research *on* children in the reviewed literature. What nevertheless is emphasized in research designs like RCTs is how the results and the outcomes of the research can trump the interests of individual children participating in a specific research project. In other words, the fact that individual children might be thought of as being subjected to objectifying practices of testing is outcompeted by the benefits *for* the entire population of all children. Consequently, when identifying the philosophical assumptions about ethics underlying research *on* children, it is necessary to also relate it to the preposition *for*.

When research *on* (individual) children is understood in relation to research *for* (all) children, ethics thus becomes articulated as focusing on the benefits of the research *for* children in a future-oriented view on a general level, where social justice and equal opportunities are among the primary goals.[21] Accordingly, we argue that this builds on strong philosophical claims about ethics, where this can be summarized as the assumption of *ethics as social justice and fairness*.

Ethics as social justice and fairness brings to the fore ethical tensions between the goals of the research and researcher and the goals of the participants. Questions emerge about whose interests should take priority. Should the goals of the research or the interests of the individual children participating in the specific study be put first? Or should it be the general interests of all children? Or perhaps the interests of caregivers, educational institutions, or the interests of society at large? Or, put differently: Is it the interest of children in the here and now or a future-oriented perspective that should serve as the guide for ethics? The "harm-versus-benefits dilemma" helps us understand these tensions. In their paper on participatory research with children, childhood researchers Antonia Canosa, Anne Graham, and Erica Wilson describe this dilemma.[22] They show how discussions on harm often dwell on the here and now of the research in relation to the participating individual children, while discussions on benefits more often focus on children as a social group and on future gains for society. However, in the handbook *The Ethics of Research with Children and Young People*, childhood researchers Priscilla Alderson and Virginia Morrow ask: "Might there be harms in not doing the research, or in not

involving children but instead listening only to adults?"[23] which points to the complexities of the harm-versus-benefits dilemma. Hence, depending on whether the purpose is to create knowledge on the participating children's views or perspectives, to examine a product or service, or something else, different things will emerge as harmful or beneficial *for* children.[24]

When research *on* children is questioned in the literature, it is nonetheless often due to the fact that this type of inquiry is thought of as actually doing harm to the individual participating children. This criticism goes hand in hand with the criticism of developmentalism. In research conducted under these terms, with the main goal of transforming children's lives through science and educational practices, the critics claim that the agency of the children is low or even nonexistent. It is described as including the participating children only in superficial and nonparticipatory ways.[25] Kellett even writes that "the relationship between researcher and researched in some circumstances is nothing short of abusive, where adults use their absolute power over children to perpetrate cruel and damaging research *on* children."[26]

With this in mind, it might not be surprising that few, if any scholars, within the major portion of the reviewed literature describe that they themselves conduct research *on* children. Instead, the texts focus on how research *should* be done, and that is definitely not *on* children. It is thus difficult to determine from the literature how research *on* children and ethics can be enacted in practice within the fields of childhood studies and early childhood education research. The tracing of research *on* children thus becomes the work of a detective, where clues are found in short descriptions or subordinate clauses in the reviewed literature. Childhood historian Harry Hendrick, for example, claims that research *on* children is guided by adult-centric perspectives, where the experts are parents, teachers, health professionals, and researchers that deny the children agency, as they are viewed as lacking rational capacity.[27] Research *on* children is thus described as "filtered through multi-lenses of adult-orientated concerns,"[28] according to Clavering and McLaughlin. The descriptions are, hence, largely in line with how research attributed to developmentalism is narrated. Although it is repeatedly stated that the level of children's participation in this research is limited, some critics nevertheless try to bring nuance to their critique. For instance, they highlight that much has been learned about children and childhood through developmental perspectives, especially in the early days of research focusing on children.[29]

As the reader now might have understood, the description and critique of research *on* children is primarily described in terms of what this research does *not* do or what it is *not*. To sum up: First, research on children does not acknowledge the agency of children but turns them into objects of adults' research questions and experimental research designs. Second, it does not recognize the complexities of childhood and the complexities of doing research that involves children. Third and last, it merely includes children on superficial terms, thereby ignoring their agency in the enactment of the research.

However, and to summarize this first part of the analysis, we argue that the critique of the preposition *on* can, and should be, problematized. This problematization extends to when research *on* children, underpinned by *ethics as social justice and fairness*, is understood together with the preposition *for*. Rather than focusing on the participating children here and now, this is a philosophical assumption about ethics that strives for future gains of children in general. This means that doing research *on* children might be as ethical – or as unethical – as research *with* or *by* children, as we will show in what follows.

Ethics as Inclusion, Participation, and Empowerment

We now move on to the preposition *with* and include a discussion of the preposition *to*. We show how doing research *with* children is underpinned by philosophical assumptions about *ethics as inclusion, participation, and empowerment.*

Even if, as described earlier, Mayne and Howitt have shown that most research that in some way includes young children is actually performed *on* children,[30] the absolute majority of the literature we have reviewed is focused on describing, discussing, and arguing for research *with* children. This calls for an in-depth discussion. However, before diving in to this discussion on research *with* children, we need to address research *to* or *about* children.

The preposition *to* not only describes a motion toward something, or the direction of movement, but also represents an older means of expressing a relationship, and has synonyms like *with respect to*, *concerning,* and *about*.[31] It is in this regard that the preposition *to* will be discussed in what follows so as to address research about children and conducting research *to* them. In terms of ethics, in the reviewed literature, doing research *to* or about children is placed somewhere in the first part of the value scale. It is

not as bad as research conducted *on* children, but nor is it as progressive as research performed *with* them.[32]

According to Hendrick, doing research *to* children can include almost all disciplines: education, sociology, psychology, medicine, and so on. From a historical perspective, it can be said to have dominated the field of childhood research together with research *on* children.[33] Doing research *to* children is often described as connected to quantitative studies, working with test methodologies or questionnaires. However, childhood scholar Kirrily Pells describes how doing research *to* children can also include ethnographic methodologies or interviews. When discussing individual interviews and focus-group discussions, she quotes a child who says: "They come, talk with us, leave, then we never hear from them again."[34] The relationship between children and researchers must be built on trust, as the researcher needs something from the children but is not necessarily going to give something back. This can be interpreted as research performed *for* the researcher. Rather than research being conducted together *with* the children, the research is about them. The level of participation on behalf of the children is thus described as low. Accordingly, and as described by Canosa, Graham, and Wilson, this means that participatory methods do not eliminate harm and ensure ethical practices per se. Even if child-centered and participatory approaches try to reduce hierarchies, these methodologies can still be harmful if "children's 'voices' or 'perspectives' are rendered inauthentic or meaningless."[35] What is argued, however, is that even if doing research *to* children started from the adult's point of view, newer and more child-oriented agendas try to focus on empowering children to influence the research about them.[36] In later years, research *to* children might move closer toward becoming research *with* children.

Let us now move to the much talked-about research *with* children. In the literature, research *with* children is discussed in several ways. First, empirical examples are presented showing how this research is conducted. Second, the means and scope of collaborations between adults and children are described. Third, doing research with children is discussed on a theoretical level, where the ontological and epistemological principles as to why one should be collaborating with children are outlined. According to social-work scholar Claire O'Kane, something that defines research *with* children is the partnership and collaboration between the researcher and the children. Moreover, it is characterized as striving to provide opportunities for children to both speak and be listened to.[37] As such, inquiry conducted *with* children is often described in terms of the

researcher's recognition of the children as competent research partners and looking for ways to interact "horizontally" with them. Studies engaging in research *with* children would, however, rarely claim that the research is in fact child-led. Rather, the aim is to position the children as contributing to the research with valuable and valid data and making the children – to the extent possible – aware of why they are involved in the research.[38] This means that a starting point for research *with* children is that children are competent within different research contexts and able to engage with researchers if the researcher respects and values the children's views and perspectives.[39]

When outlining what research *with* children entails, it is also easier to understand from where the critique of the preposition *on* emanates. We will again turn to the three editions of the anthology *Research with Children* by Christensen and James, mentioned earlier, to show how research *with* children is juxtaposed with research *on* children. The concluding sentence in the introduction to the first edition reads: "Only through listening and hearing what children say and paying attention to the ways in which they communicate with us will progress be made towards conducting research *with*, rather than simply *on*, children."[40] Research *with* children is thus both a critical and political project (see also Chap. 4).

In the third edition of *Research with Children*, the introduction is somewhat rewritten. Nonetheless, the concluding sentence[41] of the introduction remains exactly the same. This shows that this kind of thinking about children in research continues to have relevance twenty-five years later. In the quote, action verbs such as *listening*, *hearing*, and *paying attention* are used as signifiers of methodological means to enable ethical research *with* children. Furthermore, *with* is described as something to strive toward, in terms of a progression from *on* to *with*. The word *us* serves to include the reader to form a potential *we*. The description is thus directed to other childhood researchers – "we who do research *with* children." Implicitly, what is revealed is that this progress from *on* to *with* is something that all of us childhood researchers are expected to desire and agree upon. The predominant description, that research *on* children is problematic, converges with and is reinforced by the equally strong articulation that doing research *with* children is preferable.

To summarize this analysis, it shows that early childhood education researchers and childhood scholars have continually endeavored to challenge objectifying practices and striven to conduct research *with* children, that is, inquiry where children's voices and opinions are listened to.[42]

Ethics is defined by ways of acknowledging the children as subjects and social actors who are capable of speaking for themselves, and researchers should listen to, pay attention to, and really hear what children have to say. The role of the researcher is thus to open up possibilities for involving children in the research process and to collaborate with children to make their voices heard.[43] Understanding children as competent social actors has thus been viewed as perhaps the most important ethical issue.[44] Accordingly, this is also why we argue that research *with* children can be described as building on the philosophical assumption of *ethics as inclusion, participation, and empowerment*, where involvement, agency, subjectivity, and the contesting of power imbalances are the guiding principles.

Ethics as Producing Potential New Worlds

In this final part of the analysis, we turn to the preposition *by* and discuss how this preposition often goes hand in hand with the philosophical assumption of *ethics as producing potential new worlds*.

As shown in the preceding discussion, research *with* children has almost become the taken-for-granted way of working with children, at least for researchers working within the political and economic perspective or the social and cultural perspective (cf. Chap. 4). In later years, a wider concern of a "user perspective" (i.e., how the research affects the involved participants) has, however, led to a proliferation of research *by* children. Spyrou describes how, among childhood researchers, research *by* children has been thought of as "the most empowering from among participatory approaches to research and the one which respects and promotes children's rights the most."[45] Research *by* children can thus be described as placed on the last step on the value scale of ethics.

The preposition *by* is often used in research, where children are understood to be investigators equal in importance to the adult researchers and involved in shaping all parts of the inquiry, from the identification of the research problem to the presentation of results.[46] This means that the involved children are expected to take part in, as well as influence, every stage of the research process and even set the agenda for the inquiry.[47] Research *by* children is thus continually articulated as an enhancement of children's involvement in research and thereby also described as – in a more elaborate way – respecting children's rights. What is distinctive about these studies is that the role of the adult is that of supporting the child researchers rather than trying to control or manage them.[48] Ethics is

thus often highlighted when research *by* children is discussed, for example, through arguing that less involvement or refinement by adults could offer new and more ethical ways of acknowledging the perspectives of children. However, this can also result in ethical dilemmas as adults may not see the strategies employed by children as "proper research."[49] Moreover, it also highlights the dilemma that children are not ethically responsible for the research and that there might occur ethical dilemmas in children's relations with one another and in relation to other species, for example.

Thomas highlights how it can be argued that children in their situated and everyday context perform research all the time when testing and exploring what is possible in both the social and the physical worlds.[50] In line with this, Alderson and Morrow[51] describe how children and young people

> … use questionnaires, focus groups, interviews, participant observation, mystery shopping, and other research methods, although they may not use those terms. But they also use other informal methods, in adult-free spaces, to generate research evidence. Using the "talk to people and write things down" approach they have developed a significant body of rich research data that is purposeful and focused on action.

As indicated previously, research *by* children is often connected to new research approaches, where traditional humanist frameworks are problematized. This situatedness and partiality is articulated as one of the benefits of research *by* children.[52] These approaches are often informed by feminist new materialist or posthumanist frameworks, where the inseparability of children from their material environment and from the nonhuman is emphasized.[53] These have, as previously discussed in Chaps. 3 and 4, recently been more tightly connected to postdevelopmental approaches. When it comes to inquiry that involves children, postdevelopmentalist approaches are keen to highlight how the agency of children emerges in *relations* with other humans, as well as with nonhumans.[54] Ethics becomes articulated as acknowledging the relationality and the situatedness of the participating children. As Spyrou writes, the perspectives "highlight more nuanced accounts of children's worlds which reflect both the messiness and complexity of their lives in general and their participation in research in particular."[55]

In the postdevelopmentalist framework, with its connections to new materialism and posthumanism, the aim is to be more inclusive of differences and produce new possible "becomings" of the child. This is also connected to an enabling of new realities, new childhoods, and new ways of being a child, by means of the inquiry itself. Accordingly, inquiry is viewed as a world-producing practice, or practices of *worlding*, as Donna Haraway would say (see also Chap. 8).[56] In this worlding approach to scientific inquiry, ethics is about enabling the emergence of a multiplicity of realities. It thus becomes crucial to conduct inquiries in close collaboration with the participating children. Research *by* children thus often goes hand in hand with viewing children as *coresearchers*, with a focus on how research should acknowledge the agency of children, as well as improve their situation.[57] This builds on a "vision of social justice as critical, respectful and life-enhancing," where the researched becomes an active participant in all parts of the research.[58] These ethical underpinnings thus prompt research problems that demand the inquiry to be performed with children as active participants, in relations with active materials.[59]

In summary, the preceding discussion shows that research *by* children that builds on postdevelopmentalist approaches can be traced back to a philosophical assumption of a specific theoretically informed *ethics as producing potential new worlds*. This thinking builds on the work of feminist scholars like Haraway, Karen Barad, and Isabelle Stengers, where ethical concerns are understood as an integral part of a research process, because values are an integral part of knowing, being, choosing, and producing research.

THE ECA-PROJECT AND REARRANGEMENTS OF THE SCALE

In tracing how the prepositions *on*, *to*, *with*, *for*, and *by* are articulated explicitly or inexplicitly, we have observed how they continually either diverge from one another or support and inform one another. In the following text, the value scale and the different philosophical assumptions about ethics will be related to the practices performed in the ECA project. This will further displace dominant understandings of what ethics in a research project that involves children could be.

As described earlier, as far as we know, nothing has been written about children's experiences of participating in RCT studies. To learn more about how practices of ethics were articulated in studies working with methodologies similar to those of the ECA project, we found a number of

RCT studies that had been conducted with young children. At first glance, in the publications outlining these studies, almost no children were found. It was as if the participating children were stuck somewhere in the background and merely represented by figures and numbers, i.e., n = XX. If these studies were placed on the value scale, they would most certainly be characterized as research *on* children and, as such, understood as less interested in the participating children themselves.

However, if these studies were instead understood as developmentalist projects underpinned by the philosophical assumption of *ethics as social justice and fairness*, one could claim that many children are to be found in them. However, only not the children of the "there and then" of the studies. Rather, the studies refer to a generalization of *all* children, represented by mean values of the children involved in the studies. Owing to the aim of the research, studies employing RCT methodologies are focused on describing the outcomes of interventions rather than the participants. The research problems that guide these studies are, for example, the improvement of language abilities in children with poor oral skills,[60] the evaluation of programs for an enhancement of physical activity in preschools,[61] the measurement of the effects of a method for improving preschool quality for children in general and for children from disadvantaged families,[62] and the improvement of teachers' emotionally supportive practices in classrooms. In some cases, the adults' experiences as participants in studies are discussed. However, little is said about the participating children, as the focus is on how the outcomes might affect all children in the future rather than on the children participating in the given study.

Nonetheless, what definitely *is* missing in these publications are detailed discussions of ethics. In studies departing from developmentalist perspectives, *ethics as social justice and fairness* is the taken-for-granted way of viewing ethics. It is self-evident and, therefore, not explicitly stated as an ethical stance at all. *Ethics as social justice and fairness* is, so to speak, embedded in the formulation of a research problem such as, for instance, a "method for improving preschool quality for children in general" described earlier. In the actual research papers reviewed, ethics is instead described in the following ways: "Prior to the commencement of the study, university ethics approval was gained,"[63] and "Informed written consent was obtained from the parents of all participating children."[64]

These studies emphasize an aspect of ethics that has not been discussed so far in the chapter: ethics as standardized guidelines connected to committees and Institutional Review Boards (IRBs). These are sometimes,

somewhat derogatorily, described in terms of "standardized ethics." In a paper that focuses on the work of ethics committees in research with children, the childhood geographer and founding chair of Save the Children UK Research and Evaluation Ethics Committee, Elsbeth Robson, states that formal ethical approval is routinely asked when papers are published in biomedical journals but has until recently been less common within the social sciences.[65] It is highlighted how ethics committees are important for ensuring good ethical research that includes informed consent (mainly from caregivers), confidentiality, storing of empirical materials, and so on. However, these guidelines seldom emerge from child-centered perspectives.[66] Therefore, it is emphasized that research within the social sciences should not blindly follow the ethical guidelines and standardized ethics of medical research, as the approval through IRBs could turn into mere box checking, which hinders detailed discussions on ethics that include children.

The general notion among social science scholars that RCT studies are lacking detailed discussions on ethics also needs to be understood in light of what was highlighted in previous chapters: the conflict between scientific paradigms in the academy. To challenge these notions, the absent children and the missing ethics of the RCT papers need to be understood in a different way on the value scale. Let us return to the ECA project to untangle what we mean by this.

Disagreements and conflicts arose in the interdisciplinary research team of the ECA project due to an embodied, strong resistance among the educational researchers toward developmentalist approaches and methodologies of testing individual children (Chaps. 9 and 10). Even if the project had been carried out using a number of different methodologies, with video ethnography, child interviews, and explorative activities alongside the standard epistemologies, the RCT gave the project its overarching structure. It could be claimed that the ECA project's main methodology was literally doing research *on* children in that, as part of the pre- and post-testing, we placed small EEG caps covered with electrodes on the heads of the children (Chaps. 5 and 8). The discussions around the ethics connected to these methodologies led to an articulation of what was called a *relational ethics* (Chaps. 5 and 9). A relational ethics was built on the overall conclusion that mere consent from guardians could never be enough. Rather, a relational ethics included multiple ways of obtaining children's *in situ* consent or disapproval of participating in all parts of the research. As a consequence of this, the ethical vetting application for the

ECA project took up forty-eight pages. It was a direct outcome of the discussions, conflicts, and agreements within the research team, or the "emulsifying agent" that would hold us together as a team, as will be further described in Chap. 9.

As also discussed by Robson,[67] the limited space publishers allow in research articles makes it virtually impossible to, at least in detail, describe the ethics protocols that were applied to guide the relationship between the children and the researchers, that is, discussions on, say, when and where to participate, when to be filmed and interviewed, and whether or not to perform the tests or participate in the play activities. For example, in one paper describing the main results of the ECA project in a psychological journal, all these discussions were condensed into five sentences under the heading "Ethics approval and consent to participate":[68]

> All participating adults and parents of participating children have signed an informed consent form allowing for project members to publish results on the group level. No analyses of individual children have been performed and individual scores cannot be released, not even to parents. All data is coded and depersonalized. All data is kept in accordance with the regulations of data handling from the Swedish Research Council. The project was reviewed and ethically approved by the Regional Ethics Board DNR no.: 2015/1664–31/5.

The ethical discussions and the protocol we had agreed upon, stating that ethics always needed to start with the participating children themselves, was "lost in translation" to what could be published in a major journal. Nevertheless, a myriad of ethical decisions were continually being made in the project, in relation to both the RCT methodologies and the other methodologies implemented,[69] for instance, the children's repeated *in situ* consent to participate, the introduction of the "stop hand" to help the children decline to participate, and the construction of a picture book and a video about the testing to prepare children for this part of the research. Other ways of ethically including the voices of children were the child interviews or the explorative practices that will be described in Chap. 8. Anne Graham, Mary Ann Powell, and Julia Truscott[70] highlight how microethical moments within larger research projects can provide benefits for the children participating in a given study, as well for children more broadly considered, in other and in future studies. An example of this in

the ECA project was the stop hand spreading within preschools for children to signal breaches of their integrity.

Within the ECA project, research *on* children most often became intertwined with practices of *with*, underpinned by an *ethics as social justice and fairness,* as well as *ethics as inclusion, participation, and empowerment.* This was due to the ongoing discussion on ethics among the ECA project team member and a consequence of the multiple methodologies – with multiple ethical discussions – continually spinning around the research team. This shows how it is almost impossible to separate the different prepositions from each other in the actually practices of performing inquiries involving young children. However, this also affects how the practices we will describe in Chap. 8, about explorative collaborations with children, can be understood. The practices described in that chapter can be thought of as research done *by* children, where the children were engaged with as coresearchers. *Ethics as producing potential new worlds* clearly underpinned this particular methodology that aimed at acknowledging the worlding processes of the children's explorations and the joint possibilities of producing new realities and new ways of understanding the children's participation.

The practices performed in these explorations, such as working with creative materials without any instructions other than "explore as you wish!," are very similar to everyday activities in Swedish preschools. Relating this to ethics, it can be argued that the free rein and the playlike activities that were enacted among the children and the researcher in these explorations made it difficult for the children to know what was expected of them, perhaps above all to be aware that they were part of a research methodology during the explorative play. It was not always clear that the playlike activities that the children and the researchers performed together were also the researchers' means of producing empirical material on the children's experiences of participating in research. In one way, the explorative activities can thus be understood as research *on* children that turned them into objects for research, as the power relations between researcher and children became more or less hidden to the children. In contrast to this, the well-prepared ethics protocol and the structured explicit practices of repeatedly asking children for their consent and encouraging them to signal when they did not wish to be talked to or included during, for example, the standardized testing or the brainwave recordings made it quite easy for the children to participate in the project on informed terms,

creating transparency, interdependent relations, and another type of inclusion altogether.

Thinking about research *by* children in this way shows that research *on* children – with ethics as standardized guidelines and box checking – can also be understood otherwise. Rather than a problematic practice that hides the complexities of working with children, the standardized guidelines can also represent a means of including children in the research in a transparent way, where power relations become more visible and therefore easier to challenge.

Research for Children

In conclusion, we wish to emphasize that this chapter sought to challenge notions that some methodological practices, and some ways of working with children, are per se more ethical than others. Highlighting the philosophical assumptions of *ethics as social justice and fairness*; *ethics as inclusion, participation, and empowerment*; and *ethics as producing potential new worlds* and relating these assumptions to the ECA project shows how participation and ethics are much more complex than that. Assumptions that RCT studies are necessarily unethical and should be placed at the "bad" end of the value scale can be challenged, as can assumptions that qualitative and participatory practice are "good" and more ethical. The scale from *on* to *by* thus becomes inefficient as the actual practices of performing research that involves children are always much more complicated than a two-dimensional scale can accommodate. Perhaps this is the time to stop humming the tune we introduced at the beginning and instead sing something like "ontowithforby" or a "boytwothirnof," where the value scale is always messy and mixed together, living and dynamic, changing and evolving. As such, it might not be enough to simply rearrange the scale, as the previous section of the chapter suggested, but rather to resist the practice of placing research on a value scale entirely.

What becomes obvious is that the restrictive conditions of academic publishing, in which authors are asked to reduce discussions on ethics due to strict word limits, undoubtedly constrain careful dialogues. This might in turn have consequences for how much effort is actually put into discussions on ethics in research projects. However, we, still argue for multidisciplinary collaborations, as in the ECA project. In thet project, researchers from different fields needed to review each other's questions from the perspective that all questions were potentially equally ethical. We are not

suggesting that this is an easy task, as the discussions in this book reveal. But we do argue that unexpected collaborations or engagements can contribute to new forms of discussions on ethics and on children in research.

To conclude, we wish to emphasize that an openness to the unexpected need not entail an exclusion or avoidance of standardized ethics guidelines. Moreover, an interest in future gains for children in general, like the assumptions that often underpin developmentalist forms of inquiry, does not mean that it is impossible to take an interest in microethical events. Hence, what we want to emphasize, and that has also become an important part of the ECA project, is the importance of *multiethical* perspectives, where different ethical underpinnings are laid alongside one another to strengthen a research project. This can also be understood as research *for* children, that is, research that engages the norms, values, and ethical acts of children, the children that the research concerns itself with and hence the children who are indispensable for the research to be performed at all.

NOTES

1. The chapter builds on previously published contents from the research paper: Bodén, L. (2021). "On, to, with, for, by: Ethics and children in research." *Children's Geographies* (2021): 1–16.
2. Abbreviation for electroencephalogram.
3. Christensen and James (2017), italics in original.
4. Kellett (2010); Thomas (2017).
5. Clavering and McLaughlin (2010), p. 604.
6. Kellett (2010); Mayne and Howitt (2015).
7. Christensen and James (2000, 2008, 2017); Clavering and McLaughlin (2010).
8. For example, Thomas (2017); Schulte (2020).
9. Christensen and James (2017).
10. Spyrou (2018).
11. Law and Mol (2002), p. 84.
12. Christensen and James (2000, 2008, 2017).
13. Kellett (2010).
14. Clark and Moss (2011).
15. Schulte (2020).
16. Hopkins and Bell (2008).
17. Other examples where special issues and papers in *Children and Society*, *Childhood,* and *Ethics, Place and Environment.*
18. James and Prout (1997); James et al. (1998).

19. Mayne and Howitt (2015).
20. Frankenberg (2018).
21. Frankenberg (2018).
22. Canosa et al. (2018).
23. Alderson and Morrow (2011), p. 18.
24. Clavering and McLaughlin (2010), p. 604.
25. Kellett (2010).
26. Kellett (2010), p. 84, italics in original.
27. Hendrick (2015).
28. Clavering and McLaughlin (2010), p. 606.
29. Mayne and Howitt (2015).
30. Mayne and Howitt (2015).
31. *Oxford English Dictionary.* 2021. https://www.oed.com/dictionary/
    to_prep?tab=meaning_and_use#18197893
32. Kellett (2010), p. 86.
33. Hendrick (2015).
34. Pells (2010), p. 198.
35. Graham et al. (2016), p. 89.
36. Clavering and McLaughlin (2010), p. 606.
37. O'Kane (2008).
38. Frankenberg (2018).
39. Alderson and Morrow (2011); Guillemin and Gillam (2004).
40. Canosa et al. (2018).
41. Alderson and Morrow (2011).
42. Frankenberg (2018).
43. Alderson and Morrow (2011), p. 18.
44. Hopkins and Bell (2008), p. 3.
45. Spyrou (2018), p. 162.
46. Kim (2016); Clavering and McLaughlin (2010).
47. Christensen and James (2000), p. 7.
48. Thomas (2017).
49. Alderson and Morrow (2011).
50. Thomas (2017).
51. Alderson and Morrow (2011), p. 60.
52. Thomas (2017).
53. Spyrou (2018), p. 162.
54. Esser et al. (2016); Murris (2016).
55. Spyrou (2018), p. 8.
56. Haraway (2008).
57. Mayne and Howitt (2015).
58. Giugni 2011, p. 12.
59. Kind (2020).

60. Haley et al. (2017).
61. De Bock et al. (2013).
62. Jensen et al. (2013).
63. Neumann (2018).
64. De Bock et al. (2013).
65. Robson (2018).
66. Skelton (2008).
67. Robson (2018).
68. Gerholm et al. (2018), p. 25.
69. Frankenberg et al. (2019).
70. Graham et al. (2016).

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Standardized Tests: Children in the Middle of a "Dangerous" Research Practice

Testing of individual children as part of research practices is common from an international perspective. In some countries, children are also tested by their teachers on a regular basis as part of preschool practices. However, how these testing practices are understood and experienced by the children themselves is virtually never a point of discussion. In this chapter, we have therefore made it our task to discuss children's experiences based on analysis of videos made during standardized testing.[1]

In a Swedish context, the testing of young children is, as we previously discussed, thought of as a practice that should be performed only for very compelling reasons. As a research practice, testing is consequently viewed with suspicion at best and as a dangerous and unethical practice at worst (cf. Chaps. 3 and 6). This general test averseness was something that affected the planning and enactment of the Enhancing Children's Attention (ECA) project in a number of ways. This does not, however, mean that Sweden is unique in this sense. Rather, the performance of standardized testing is discussed as a matter of concern among childhood and early childhood education scholars worldwide, as this chapter will show (cf. Chap. 3). However, the scholars who criticize testing in the international context, primarily present this in sweeping terms, as something problematic in general. The locality and the specificity of particular test situations are left out of the story. This makes it difficult to evaluate

whether the critique of standardized testing is justified or not. And it makes it difficult to respond.

To invite a more nuanced discussion of standardized testing, this chapter focuses on what was happening in actual test situations when testing was performed in Swedish preschools as part of the ECA project. As indicated above, the discussion revolves around the analysis of video recordings of children performing a series of standardized tests in the pre- and posttesting situations during the ECA project. We will investigate the concrete, local, material, and relational circumstances of what it might mean as a young child to take a standardized test. For the analysis of this chapter, we will switch back and forth between global scientific and political discussions on standardized testing, the locality of the Swedish preschool setting, and the specificities of the ECA project.

To be fair, there are some exceptions to when the actual practices of standardized testing is described in the international literature in more detail. In the book chapter "Subjects, Objects or Participants? Dilemmas of Psychological Research with Children" from the 2008 second edition of *Research with Children*,[2] childhood researcher Martin Woodhead describes his experiences to his coauthor, developmental psychologist Dorothy Faulkner.[3] Woodhead tells her how he, as a novice researcher in the 1970s, was part of a project where he carried out psychological tests with four-year-olds at a nursery school. To get to know the children and the routines of educational practices there, Woodhead describes how he spent the days preceding the tests at the nursery school, trying to get to know the children while also observing their behaviors. A small room was made available to conduct the testing. Woodhead tells the story of what happened next: He explains how he invited the first of what he calls his new friends to the room and to the set of games designed to test the children's cognitive style. The first child completes the tests but seems uncomfortable and wants to leave the room as soon as possible. The next child refuses to even enter the room. A third child seems very anxious while doing the tests, which worries Woodhead.

Woodhead describes his unpreparedness for these reactions. He could not think of anything from his methodology textbooks that might explain why the children were reluctant to do the tests. He vividly describes his feelings of failure at the likelihood of returning to the research office with only one completed dataset. But he receives reassurance from the head teacher. She explains that the hesitancy of the children in this particular test setting was probably due to the children's newfound description of

the small room. They called the room where the testing was carried out the "naughty room." She suggests using another room for the remaining tests.

This 50-year-old anecdote can be used as a springboard to highlight important aspects of practices of research with young children today. What do children themselves understand and experience while taking part in research, whether in the research lab or in their own homes or at the preschool? The anecdote tells us that it is important to understand how children are affected by a particular research context, the tasks performed therein, and the power relations between researcher and child. These aspects of research might in turn give rise to a number of ethical dilemmas. Woodhead and Faulkner arrive at the conclusion that these kinds of tests belong to a "scientific discipline primarily concerned with the description and explanation of psychological and developmental processes through objective observation, experimentation and explanation,"[4] with few opportunities for children's own agency and, hence, ability to affect the research practices.

For this chapter, the anecdote and Woodhead and Faulkner's discussion are used as the point of departure from which to discuss how testing is often described by childhood and early childhood education researchers and what is perceived as the major problems with this practice. The anecdote will also help to illustrate that, in the last fifty years, many things have changed in research practices with children, while some things remain the same.

Testing in the Context of Swedish Preschools

The extensive measurement or assessment culture in early education has received much attention. However, in the Swedish cultural context, testing has not been implemented in the preschool system to any significant degree. Swedish preschools have a long history of not performing assessments of children's individual skills. The preschool curriculum rather emphasizes evaluations of the *conditions* for development and learning that the preschool can offer.[5] However, the curriculum has, in recent decades, become more focused on instruction and knowledge in different areas, such as mathematics, language development, sustainability, and equality, but without assessments of individual children's achievements.[6] Accordingly, this means that standardized tests designed to assess children's individual skills are virtually nonexistent in everyday activities conducted by preschool teachers.

The testing performed as part of the ECA project was thus a new and unfamiliar event for the participating children, unless they had been tested by a speech therapist or psychologist for some reason. Despite the test-averse context in Swedish preschools, neither children nor teachers and educators talked[7] about the room where the testing was to take place as a "naughty room." Still, this did not prevent adults and children from being nervous in relation to this new practice being introduced into their preschools. To make the experience as convenient and comfortable as possible for the participating children, the tests took place on the premises of each of the preschools rather than in the university lab, for instance, in teachers' and educators' offices or lunchrooms, reading rooms, painting studios, play areas, and storage rooms. All testing was performed by trained research assistants or a trained member on the core research team. Each session was video recorded to evaluate whether the tests had been performed according to the standardized test instructions, including the ethics protocol, as well as to produce linguistic data on the communication and interactions between the children and the adult during the testing.

The tests were designed to evaluate the effects of two contrasting pedagogical interventions: socioemotional and material learning paradigm (SEMLA) and Digital Individual Learning for Body and Mind (DIL) (see also Chap. 5). All tests were staged and performed in a predetermined manner, where the participating children were asked to solve similar tasks under similar conditions. The test battery consisted of nine different tests in all, in a combination of tasks complex enough to adequately measure the effects of the interventions. Simultaneously, the tests were designed to be easy and fun enough for the adults and children to do together.[8] Chapter 5 outlines the interventions and routines around the pre- and posttesting. In follows, we also provide a short summary of the specific tests that we will be discussing in this chapter.

In the *Flanker Fish Task* test, performed on a digital tablet, the children were asked to identify the fish in the middle of a row of five fishes and press the arrow pointing in the same direction as the middle fish. During the *"What's Wrong?" cards* test, the children were instructed to point to the mistakes added to pictures describing everyday situations. In the *Peabody Picture Vocabulary Test*, the children were told to point to the picture from among four that corresponded to the word the adult gave verbally. Further, in the *Digit Span* test, the children memorized and verbally repeated a series of digits, both forward and backward. In the *Number Sense Screener*

test, the children engaged with pictures and objects and answered questions posed by the adults like "How many are left if I remove…?" and so on. Finally, in the *Dimensional Change Card Sorting* test, the children sorted figures, like trucks, rabbits, elephants, balls, and boats, by color and shape on a digital tablet.

In what follows, we will introduce an example written up from a video clip of one of the testing situations. The purpose of this example is not to conduct an detailed analysis of it but rather to invite the reader to get a sense of how the testing usually played out. The example is meant to show how the relations between child and adult often looked, what tools appeared in the setting, the appearance of the test location, the test duration, and so on.

> The video clip shows Serena,[9] a four-and-a-half-year-old girl, and the trained research assistant Maria. They are in the second part of posttesting and, thus, in their fourth session together. By now they know each other quite well. This is also apparent in the video clip; rather than facing the camera opposite the table, they look at each other attentively, often smiling. They are sitting at a desk in a teacher's office, and the light from the window illuminates their faces. Behind them stands a bookshelf with folders and maps, and on the wall hangs a notice board with papers. The desk in front of them is rather empty, as Maria has just put the digital tablet to the side and placed the big book used for the *Peabody Picture Vocabulary* test on the floor. All that is left on the desk are the cords attached to their microphones.
>
> After twenty-four minutes, the test session is just about to end. Maria holds up a pen and paper; the test protocol with a description of the different tests that make up part of the posttesting. Now it is filled with Maria's notes. She shows the paper to Serena: "Look at this, we have done all these things," she says pointing at the paper. Serena moves closer. "We did those last time, and today we played the game [the *Flanker Fish Task* test] and the cards with the funny pictures [*"What's Wrong?" cards* test] and the book [Peabody Picture Vocabulary test] and the numbers [*Digit Span* test]. We did it all!" Serena hums as Maria leans toward her sweater and takes off Serena's microphone, which marks the end of the testing session.

Relations, Relations, Relations

Already in the example above, of one of the more than 1,700 recorded test sessions, which amount to approximately 700 hours of recorded material, it becomes obvious how the locality and specificity of the test situation

affect the events taking place, like the relations between the child and the adult, the test protocol, the tools used for the test, the room, and the furniture, and much more. The example shows an environment where recognizable relations emerge along with more unexpected relations. As has been thoroughly discussed in studies addressing children in research,[10] the relationship between child and adult becomes important for children's experiences participating in research and, as a consequence of this, for the results obtained from both testing and other research practices.

The example also offers a glimpse into other, more unexpected, relationships that enable these interactions to play out in certain ways. One such unexpected relationship in the example above is the one between the paper Maria is holding and the structure of the whole session. The paper structures the order in which the various tests will be performed and when the tests will be completed, which prompts the assistant to exclaim, "We did it all!" Another relationship is that between the camera and the human participants, where the camera seems to be forgotten as soon as the assistant and the child become engrossed in the testing on the digital tablet. Yet one more relation involves the microphone, where its removal from the sweater seems to have become a ritualized way of ending this fourth testing session. Thus, in this chapter, we are interested both in relationships between adults and children and all other relational aspects and matter in the testing setting.

When researching children's lives, childhood and early education research scholars commonly think of all these different sorts of relations as something that define childhood, and sometimes even regard relations as the ontological grounding for childhood studies.[11] These kinds of studies, often inspired by the relational sociology of Pierre Bourdieu and others, the symbolic interactionism of George Herbert Mead, and the pragmatism of John Dewey, tend to focus on the social aspects of relations that characterize human interactions. In line with the overarching subject matter that is this book's central concern, we are interested in an extended view of the concept of relations as being inclusive of more than just human interactions. Donna Haraway asserts that "[s]ubjects, objects, kinds, races, species, genres, and genders are the products of their relating"[12] by pointing to how relations are not only social but always natureculture coconstituted. This, as we discussed in Chap. 2, calls for a problematization of the division between nature and culture, mind and body, discourse and matter when analyzing relations and interactions. Accordingly, if analyses of children participating in research have tended to focus mainly on the relations

between children and adults, an extended and modified approach to relations means that the attention "shifts from matter or subjects and subjectivities in themselves, to the relations and the networks from which they emerge and within which they are constituted" (cf. Chap. 2).[13]

We thus see ourselves as being aligned with a feminist new materialist and posthumanist relational approach to understanding the testing situations and as inspired by scholars such as the aforementioned science technology studies scholar Haraway and anthropologist Marilyn Strathern. In fact, Haraway often builds her theorizing on relations on the work of Strathern, for example, when arguing that we need to accept "the risk of relentless contingency, of putting relations at risk with other relations, from unexpected worlds."[14] We will return to this quote in the upcoming analysis, where we discuss how testing invited new and unknown scientific relations to Swedish preschools.

What does this extended way of approaching relations mean for the analysis of the testing situations? A focus on relational aspects enables an understanding of the testing on different scales. It connects the locality and specificity of particular test situations to discussions on the global scale, like political trends in the field of education, globalized research traditions, discursive understandings of children and childhood, and the other way around. Building on Haraway's understanding where "[a]ll of the actors, human and nonhuman alike, in these knowledge practices are situated in dense, worldly webs,"[15] it thus becomes an assembly and analysis of the webs of relations that make the testing what it is. By putting the relations in the test situations at the center of attention for the upcoming analysis, we hope to displace both the Swedish and parts of the international discussions on the question of whether testing is a dangerous research practice.

Analysis of Ongoing Relations of Test Situations

For the analysis presented in what follows, a stratified sample was made from the thousands of hours of video recordings. The sample was made so as to include both boys and girls, children of different ages, and mono- and multilingual children. The selection included both pretesting and posttesting sessions and recordings from the first and second half of these, respectively. As described in Chap. 5, the children did only about thirty minutes of testing in each session, two half-hours before the interventions and two half-hours after the interventions six to seven weeks later.

As we watched the recordings for this analysis later on, we took detailed notes that included the activities, actions, and reactions that the tests and testing practices evoked. Notes were also taken of what was said and done in relation to the performance of the tests. Further, words spoken about occurrences surrounding the tests, for example, when microphones, cameras, or notebooks were turned on or off, were also written down. The room in which the test took place was also described in these notes. Notes were taken on how children and adults were seated and when the children started to talk about, for instance, their birthday, asked about an adult's earrings or piercings, or needed help with blowing their noses. The contents of the notes make it clear that the test setting consisted of a myriad of things and events. This will become even more evident in the following description and analysis.

Testing Encounters Swedish Preschools

In the following situation, a five-year-old boy named Olle sits beside an adult named Hanna in a reading room at Olle's preschool. They are surrounded by books, both on bookshelves and in large plastic boxes on the floor. They both sit on children's chairs at a low blue table. On the table, in front of Olle, sits the book for the *Peabody Picture Vocabulary* test. Before Hanna is the test protocol and some cards from the *"What's Wrong?" cards* test. Olle is taking the *Peabody Picture Vocabulary* test and points to the pictures corresponding to the words Hanna says. In the following exhange, Hanna shows Olle pictures of four different animals:

> "Hyena," says Hanna. "Do we have hyenas in Sweden?" asks Olle. "No, we don't," Hanna replies. "But where are they?" Olle continues. "Ehhhhmmm...," Hanna says hesitantly. "South America?" Olle suggests. "I don't know, I think in Africa. Or India maybe?" Hanna replies. "Noo," Olle says assertively. "Maybe Africa?" Hanna tries again. "Yes," Olle confirms. Hanna also says, "Yes." "South Africa, there you have hyenas," Olle decides upon. "Plumber." Hanna has turned the page and moved on to the next four pictures.

This example shows something that commonly occurs during testing: the child poses unexpected questions that "disturb" the predefined route of the standardized test. Such unexpected disturbances are sometimes given significant time during testing. As the example shows, the adults

often try to combine the child's questions with the different tasks. Hence, the structure of the test gets interrupted to take a detour, as Olle and Hanna together try to figure out where hyenas actually live. The test continue on to the next part of the *Peabody Picture Vocabulary* test, when Olle is supposed to point at an image of a plumber.

In relation to the foregoing example, we would like to point to an interesting friction between Swedish preschool discourse around the agentic and investigative child and what occurs in testing situations with Swedish preschool children. To listen to children's questions and take them seriously is often described as key, by both childhood and early childhood education scholars.[16] Swedish childhood discourse is very explicit when it comes to this point, which is mentioned several times in the Swedish preschool curriculum. Listening to questions without offering predefined answers stems from the idea that the child is competent, and teachers or educators should provide playful and experimental challenges to children guided by children's own interests, rather than simply imposing their own ideas or knowledge on the children. Like all Swedish preschool children, the children of the ECA project were well aware of this practice. In the foregoing example, Olle just seems to be doing what he normally would do if he were wondering about something: ask a question. During the test, it thus seemed as if preschool practices, like asking questions, punctured the bubble of the world of research and destabilized the standardized procedures of the test protocol, at least to some extent. The difference between the situation just described and the "regular" way of handling questions is the necessity of turning the page and continuing to the plumber, in line with the test protocol. Swedish preschool discourses would probably recommend continuing the conversation on hyenas.

Olle was not the only child to ask questions during the test. Usually, the children were curious about both the tests and the different tasks and a lot of other things that came up during testing. In other recordings, children ask about the assistants' notebooks ("Why are you making all those marks?"), about the test battery ("Are we doing all these parts?"), and about the video recording ("Why is the camera recording?"). As described above, children in the Swedish preschool are not used to taking tests, so the questions probably reflect the unusual situation of testing. Their lack of experience with testing was reflected in the difficulty of actually talking to the children about the research. Therefore, the ECA project members put a lot of effort into sharing age-appropriate information.

There are many examples of information-sharing strategies used to boost children's awareness and participation in the ECA project. A book with pictures of a child being tested was given to both children and parents to familiarize themselves with what would happen during testing. A two-and-a-half-meter-long "calendar" displayed who from the research team would be coming and what would happen every week during the ten weeks of testing and doing either of the interventions or business as usual for the control units. This calendar was taped to the floor or on the wall at children's height in the hallway where children changed clothes to enter the preschool. It spurred everyday conversations among the children, parents, teachers, and educators about being part of the research and what the research meant to the children. Moreover, the researchers and assistants wore blue T-shirts saying *Brainways in Preschool: Ongoing Research* so they could be easily identified by children and staff. As also described previously, children and staff were instructed to raise their hand as a stop sign or turn their shoulder or back on the researcher with a blue T-shirt if they did not want to be filmed or otherwise observed during the interventions (Chaps. 5, 6, and 9).[17]

Despite all this, the children's questions still kept on coming to the researchers in the ECA project. Some scholars have highlighted that even with great efforts to be transparent, the information shared with children participating in research will always be partial for the simple reason that it is difficult to fully explain what participation in a research project entails.[18] The following event from one of the testing sessions shows how the children of the ECA project asked questions not only about hyenas or cameras but also about why we were doing the research project in the first place.

Halima, a five-year-old girl, is thirteen minutes into the fourth testing session, which also means that it is her last session of testing. Swedish is her second language, which sometimes becomes noticeable in the transcript from the recording. The time display on the video player shows that nine minutes remains until the end of the test:

> "Why you have researched?" Halima says, while pressing the arrow again on the tablet during the *Fisher Flanker Task* test. In the events preceding the question, Halima tried to explain to the assistant Maria what is incorrect in the *"What's Wrong?" cards* test. She also took two other tests, where she looked at thirty-seven pictures as part of the *Peabody Picture Vocabulary* test and counted both forward and backward, as part of the *Digit Span* test. All this while occasionally yawning. "I do a lot of research," Halima says to

Maria. "Yes, we do," Maria replies. "But you say that we need to do research only two times." Halima raises her hand and shows two fingers, as if to form a victory sign. "Yes, two times a long time ago, and two times now," Maria explains. Here, Maria is referring to the fact that she and Halima met twice about six weeks earlier for the pretesting and are now meeting again to do the two parts of posttesting. "Let's finish playing first and then I'll tell you why [you do research]."

With her hand still in the air, Halima raises her other hand and starts finger-climbing the itsy-bitsy spider song in the air with both hands, while at the same time pressing an arrow on the tablet. Halima moves her body closer to Maria as they hear singing coming from the hallway outside of the playroom. "I can sing in that language!" Halima tells Maria, and they start talking about Halima's first language. Six minutes later, after Halima has gone through the *Flanker Fish Task* test, Maria turns to her and says: "Do you know why we do so much research, Halima? It is because we want to know how you learn things when you go to preschool."

Halima and Maria are sitting in the preschool playroom. At this particular preschool, it is a comparatively small room. They are sitting at a low table with child-sized chairs, which causes Maria to sit in a rather awkward position. Mirrors are placed along the floor for children to play in front of, and the room has a thin door that lets sounds of other children's singing seep through from the hallway. In this test setting, it becomes apparent how connected the practices used during the tests are to the context in which they are played out. It is a room for children to play in, located in the middle of a preschool. The relationalities of this room, the preschool milieu, and the testing practice make itsy-bitsy spiders seem as reasonable as anything else during the testing.

Nonetheless, Halima yawns and points out that she has been doing "a lot of research" and that Maria said "that we need to do research only two times." This reveals that the work performed during the testing is rather exhausting, perhaps especially if Swedish is not your first language. Still, the routine practices of the testing seem familiar to Halima during this fourth session. She is well aware of the defined temporal circumstances of the testing. For Halima, ✌ is not a sign of victory, even if she forms her fingers like that. Instead, it is the sign for the number 2, to visually illustrate and point out that she knows that testing during this period of the project (posttesting) should only be performed twice, and no more. As discussed in Chap. 6, the structured practices of the testing can make it easier for the children to participate on informed terms but also to

question the research practices. Halima turns the ✌ into a two-handed climbing spider, even if it the spider is disturbed in its climbing by the testing procedure, which calls for Halima to press an arrow on the tablet.

The locality of Swedish preschools, as particular places, rooms, and milieus, produces specific relations that affect the test settings, which is also affected by the particular preschool culture, which is supposed to enhance children's competencies and encourage asking questions. For Halima, and for Olle in the previous example, familiar relations seem to enter the practices of the testing as they repeatedly find ways of combining the testing procedures with play and conversations that are common to the children's everyday preschool experience. It can thus be argued that scientific practices become intertwined with preschool practices and that these practices, together with the children's doings and actions, actually challenge and disturb the neutrality and strictness of the scientific practices of testing. This means that the local circumstance is intertwined with how the testing sessions are enacted and how they subsequently need to be analyzed, understood, and discussed among researchers, something rarely found in the literature. Hence, the doing of standardized testing is played out in this particular way because of what the Swedish preschool setting brings to the administration of testing. Correspondingly, to understand the critique of testing, both in this and other situated contexts, the local circumstances during testing practices need to seriously be taken into account if we are to understand, not just children's experiences of testing, but also the scientific results they produce.

Olle and Halima, or any of the other children who will be introduced below, had rarely or ever had an assessment done of their skills, let alone a test of any kind in a preschool setting. The unfamiliarity and oddness of the tests themselves and being tested in the locality of Swedish preschools seemed to turn the testing into something that could even be described as exciting for the participating children. The interviews with both children, teachers, and educators made us aware that children actually made a fuss if they were *not* going to take part in the testing. This allows for understandings whereby the research can be seen as an attractive offer for the children to participate in something meaningful, interesting, and special. Early childhood education scholar Lena Aronsson has addressed this and described the possibilities for preschool children to, perhaps for the first time, identify themselves as potential researchers after having spent time with researchers during the testing.[19]

Cheating on Science and Education

As described in Chaps. 4 and 6, standardized tests are often viewed as research done *on* children rather than together *with* them. Hence, testing is understood as a less ethical research practice than alternative methodologies. A critical examination of the video material would possibly come to the same conclusions: that the children were being monitored by a video camera and must follow a preplanned research route, where the focus was on how children handled and performed pregiven tasks. This is of course a true critical assessment of the situation, as the adult's task was to steer both Olle and Halima away from, for example, the animals in the images in the test and toward an answer as part of the testing. However, the examples discussed above hopefully showed that there are more nuances to a situated reading of these testing situations than such a perspective implies. That is, these situations in Swedish preschool practices do not merely reflect a practice that transforms children "into a de-personalized object of systematic enquiry," as Woodhead and Faulkner[20] warn the testing might do. Let us return to Halima to further examine the testing sessions.

When Halima asks, "Why you have researched?" she mixes up the Swedish word for research – [*fårs'ka*] – with the Swedish word for cheating – [*fus'ka*] – and actually asks, "Why you have cheated?" In the recorded test situation, the slip of the tongue passes without further notice, as Halima and Maria, as shown above, continue to talk about why they are doing the research. This brief exchange is easy to gloss over while viewing hours of video recording. However, Halima's accidental question to the adult about "why you have cheated" can also allow for an understanding of how the globalized critique of testing enters Swedish preschools. We will look further into this in what follows.

As described in Chap. 5, the test battery was carefully put together based on knowledge from the fields of linguistics and behavioral and neuropsychology. The ECA project included expertise in all of these fields. This initially did not help to diminish the critique among the educational researchers on the team, quite the opposite. To transfer methodologies from the disciplines of psychology or special education to a general population of children was met with "raised eyebrows and bolded questions marks," as the team member Sofia Frankenberg described it (see also Chaps. 6 and 9).[21] Since the divorce between the disciplines of psychology and pedagogy was completed decades ago in the Swedish academic

context (Chap. 3), administering these kinds of tests in early childhood settings was treated almost as "cheating" or doing something "inappropriate" as opposed to what should take place as a research practice in early childhood education research in Sweden.

In relation to the preceding comments, it is possible to understand the welcoming of new and unknown scientific relations into the realm of the Swedish preschool as putting preschool relations "at risk with other relations, from unexpected worlds," to quote Haraway.[22] This is also reflected in the national ethical application submitted for the ECA project, where Haraway's words were more or less unconsciously inserted to the ethical vetting application under the risk assessment. Hence, on the one hand, the risks can be considered high in terms of reintroducing extensive testing as part of the randomized controlled trial, as was stated in the ethical vetting application. On the other hand, and as the foregoing analysis shows, the unfamiliarity of being tested as a child, in this situated context where children's participation and competencies are enhanced as part of the curriculum, made testing seem unharmful.

However, it is important to note that in both purposes and methods, testing as a research methodology and testing for educational assessment differ significantly. Nonetheless, these two practices of testing are treated as one and the same by critics. That is, they are relationally associated rather than disassociated. Thus, the aversion the critics express is directed at *all* kinds of testing. Young children should not be validated in relation to predefined and normalizing categorizations, because tests in themselves, as powerful agents, are designed to downplay the role of circumstantial factors. This applies regardless of how the testing practice is locally performed and conceived by children and adults. Accordingly, the inviting of test methodologies into the realm of the Swedish preschools does appear to be a betrayal of business as usual when conducting research. The particular ways in which the ideas about tests become associated with scientific debates and discussions, and with historical and discursive understandings of childhood, produce the tests themselves and the testing practices in particular as a materialized cheating on the most central figures of all: the children.

Let us end this section of the chapter with yet another example of the situatedness of the ECA project and testing methodology. The analysis of the test sessions with both Halima and Olle has already shown that research methodologies and standardizations are never merely transferred from one practice to another. However, when the test methodologies become

part of a new setting and encounter the everyday lives of both children and the preschool in this situated context, the standardization of testing as usual is often and continually disrupted. This means that even if new and unknown scientific practices such as extensive testing of children are invited to the preschool, these methodologies also change through the new relations they become part of at the preschools. Actions and notions in the situated context have the power to revise the course of the testing, as well as the positioning of the adults doing the testing, as we will illustrate in the following example.

> Sebastian, four-and-a-half years old, is three minutes into the second post-test session: "But I don't want to look at crazy pictures ["*What's Wrong?" cards* test]." "I have some ordinary pictures [*Peabody Picture Vocabulary* test] too," the assistant Andrea replies. "And I have the fish game [*Flanker Fish Task* test]!" she continues. They prepare the tablet for the *Flanker Fish Task* test, but Sebastian finishes it before the game is over: "I don't want to continue anymore." Andrea asks him if he thinks the game is boring and continues: "We can, I can show you one of those crazy pictures. And you can tell me what you see. This one is really crazy!" Sebastian looks at a picture, bursts into laughter while at the same time saying, "But I don't want to look at another one." He rises from his chair. "I just want to go." "Okay, thanks for the help, Sebastian!" The camera is shut off and the session is over after six minutes.

The recording shows how Andrea tries to follow the rigid structure of the test sessions as far as possible to create a test result that can be used to measure the effects of the pedagogical interventions. It is easy to think about Woodhead and how 50 years ago he also tried his best to return to the office with completed datasets. The situation just described, however, shows in detail how Sebastian withdraws his participation and that both he and Andrea are well aware of the ethics protocol that states that the children can leave the test setting immediately if they do not want to finish (see also Chaps. 5 and 9). Accordingly, in line with the *in situ* ethics of the situation, Sebastian expresses his resistance to this research practice and rises from his chair. Andrea's approval of this, and the ending of the recording, dissolves the standardization. Hence, the tasks are done in the wrong order and finished before they are completed, and the session is almost over before it started. The situatedness of each specific testing situation thus transforms and alters the testing methodology. Rather than regarding this as a justification of the testing or as the opposite of how

critics of testing usually describe this practice, the video recording from the test setting shows that multiple conditions obtain at the same time. The testing constitutes a practice whereby children like Sebastian are gently asked to subject themselves to the structure and task *and* – simultaneously – where they, in a split second, feel agentic enough to simply rise from their chair and leave.

Children and Researchers in the Middle of the Testing

When looking at the video footage from the testing sessions, the relations between the children and adults – researched and researcher – are impossible to ignore, centered as they are on the screen as well as in the literature on children in research:

> "Now we will do some math!" says Emma, the research assistant. Alice, a six-year-old girl, starts counting, as part of the *Number Sense Screener* test. "One, two, three, four…," and when she gets to sixteen, she says, "And by the way, I can count to one hundred!" "Wow, that was far, we can stop there," the assistant says smilingly. They continue by looking at a picture of five stars in a row. Emma asks: "How many are there if it is one fewer?" "If one goes away, you mean?" asks Alice. "If it is one fewer," Emma replies. With a surprised look, Alice asks, "If it is one more?" "Neee…" Emma looks puzzled and finally says, "If it is one less." "Ehh… then it's four," Alice answers her, looking satisfied.

As in all of the testing sessions, the research assistant guides the child through the tests and makes sure that the tests are performed in a specific and consistent way. But also, she ensures that the different tasks are solved with as little help as possible from the assistant. To be able to analyze the effects of the two contrasting pedagogical interventions, all testing should be as similar as possible. In the example of Olle, Hanna, and the hyena, this standardized way of handling the situation is demonstrated when Hanna returns to the book and the plumber in the middle of the hyena conversation. In the preceding example, the same consistency is enacted when Alice is told to count "far" but gets interrupted before she gets too far. Or, when Emma says that stars are "fewer" rather than "less," even if this wording makes it difficult for Alice to grasp what Emma means.

This way of achieving reliability in the testing is also shown when Emma and Alice meet for the posttests and the Peabody Picture Vocabulary test six weeks later:

> Among four pictures of different outfits, Alice undecidedly points at the one she thinks represents the word "uniform." They continue with the test, and Alice points at the picture representing "gigantic." However, she also looks at Emma and asks: "Was that uniform?" "I can't tell you, you know. It is a secret," Emma answers.

In the context of the Swedish preschool, this is an unusual answer from an adult. In scholarly work on how researchers should interact with participating children, it might even be characterized as ethically questionable. As a way of doing research *on* children, this attests to the inability of attuning to children's interests or the lack of acknowledgment of their agency. Instead, children become objects for adults, whether for the researchers or for the research (cf. Chaps. 4 and 6). Acknowledging these hierarchies and unequal power relations, and the strategies for resisting them, is central for both childhood and early childhood education research. But in testing situations where layers of scientific knowledge have formed the protocol and where globalized standardized criteria are part of the practices, Emma's answers make perfect sense: no solutions or answers should be revealed to the child during testing. This might ruin the reliability of the methodology, as the children might discuss the testing between testing sessions. This also downplays the relationship between the adult and the child to instead move another relationship to the foreground: an alliance between the adult and the research testing results. In these particular moments, when this alliance between the adult and the RCT methodology is left uninterrupted, power asymmetries emerge in their strongest forms and the critique of testing rings as the true analysis of the adult–child relation. However, as we previously showed, this alliance is most often disturbed by the local and situated practices of testing, which shake up and even displace hierarchical relations that might appear as given.

Nevertheless, both children and adults are equally but differently guided and handled by the structure of the tests, at least in the situatedness of Swedish preschool practices. During the *Dimensional Change Card Sorting* test, Edwin, a four-and-half-year-old boy, tells Andrea that he "can't handle more games, I can't do more fishes or elephants" and

tries to press the tablet with his toes instead of his fingers. Moments later, the sorting part of the test session is done and Andrea says, with a sigh: "You're done, there was only one question left. Nice, right?" This reveals not only how children resist the testing practices but also the relief of the adult in the same testing session. The fact that the tests require a consistent way of handling the children is something that both children and adults need to attune themselves to.

Hence, the adults are *also* guided and handled by the tests in the test battery. This reveals how the scientific relations from behavioral psychology, linguistics, mathematics, and preschool pedagogy are connected through tests and affect them all. This makes the tests themselves as important as any of the other (human) participants or agents/actors in the test settings. "You get tired of this," six-year-old Erik sighs in one of the recordings, and the assistant Hanna agrees: "Yes, that's really true." The fact that the children and the adults "team up" against the tests and together problematize them emphasizes yet another layer of relations.

The taking of the tests in togetherness becomes even more visible as Hanna meets five-year-old Alfred, who takes the *Flanker Fish Task* test:

> The room is quiet, except for the Swedish word "mitten" [the middle], repeated by the research assistant to remind the child to look at the fish in the middle. Since there is no available Swedish-speaking tablet version of the test, Hanna needs to give verbal instructions. "Mitten." "Mitten." "Mitten." "Mitten." Alfred turns to Hanna: "You say that all the time." She responds: "It's only to remind you. I have to say that." The test continues for another minute. "Mitten." "Mitten." After pressing the arrow once again, Alfred echos Hanna: "MITTEN." Alfred and Hanna look at each other and burst out laughing. "MITTEN." The next time Alfred is quick to the draw and says it before Hanna: "Mitten."

The bringing together of children and adults that the test and the instructions for testing call for inevitably affects the power relations and forms new alliances. The tests and testing situation, which is critically thought of as something that turn children and adults apart from one another, can in the everyday localized practices also become what brings children and adults together.

Should Tests Be Performed with Young Children?

What the foregoing analyses show is that standardized testing with young children is much more than standardized. Attention to the situated details of the testing enables a problematization of understandings where testing, no matter what, can be seen as suspicious practices that might even be dangerous for children. If the existing literature critiques testing methodologies from a distance, a closer look at children actually taking tests shows that no research methodology is either ethical or unethical, neither "good" nor "bad" per se (see also Chap. 6). Standardized testing may be as safe or as dangerous as any other research methodology that involves children. It all comes down to how a given research methodology is enacted in practice, in tune with all the relational aspects that affect the practice.

Moreover, as we have shown, the situated local space of early childhood education will also greatly matter. Understandings of testing that do not engage with the specificities of how the research methodologies are put to work *are* at risk of cheating on children in the research. However, this does not mean that we, in this chapter or in the book in general, are arguing for more testing. Nor are we trying to present a success story on behalf of the ECA project and its testing practices, as if that were all a matter of merriment and joy. As described in the chapter, the testing sessions *were* sometimes hard on the children: "You get tired of this," complained Erik, and "Why you have researched?" Halima asks. But they were also steeped in an environment of excitement, play, patience, and accomplishment. Perhaps because this was indeed a new and unfamiliar practice for these children. The question, however, remains: At what point in testing small children might a shift occur from playful challenges and/or possibilities of being the center of attention and interactions with an adult to yet another potentially harmful oppressive test, as is the critique in other contexts where tests are frequently performed?

The analyses in this chapter show that for testing to be an ethical practice, engagements with scientific relations and procedures unknown to the preschool setting are important. Equally important are the essential engagements with children's questions that might disturb the rigidity of those procedures. The adults conducting the testing must temporarily ally themselves with the tests, while repeating "mitten," for example, so as to acquire reliable data from the testing. But it is just as necessary to form new emerging playful and humorous alliances with the children for the

duration of testing. Without all of these elements coming together, standardized testing would be impossible. Even when structured procedures are followed, each of the testing sessions is twisted by unexpected associations and connections emerging in the situatedness of the specific setting. This contributes to an understanding of standardized testing with young children as something filled with situated details, which in turn highlights how the atypical, the ongoing, the overlapping, and the negotiated are, in fact, often the "standard" of standardized testing.

From what we have learned from the ECA project, the questions of whether or not we should perform testing with young children is certainly not an easy yes or no question. The same goes for determining whether or not this is a dangerous research practice. Instead, one might ask: For whom or for what is it a dangerous research practice? For the participating children? For the preschool practices? For the educational researchers who have divorced their developmentalist spouse? Or maybe dangerous in the sense that it might affect an understanding of how research with children should be done? All of these questions and more may be clues as to why some scholar might still think of standardized testing with young children as something that belongs in the "naughty room."

Notes

1. The chapter builds on previously published contents from the research paper: Bodén, L. (2024). In the middle of a standardized test: The emerging relations of young children in research. *Contemporary Issues in Early Childhood, 25*(1), 62–79.
2. Christensen and James (2008).
3. Woodhead and Faulkner (2008).
4. Woodhead and Faulkner (2008), p. 11.
5. Alasuutari et al. (2014); Aronsson and Lenz Taguchi (2018); Einarsdottír et al. (2015).
6. Karlsudd (2021).
7. In Swedish preschools, preschool teachers with a 3 1/2 year-long higher education degree work together in teams with high-school-educated educators, who are sometimes also called child-minders. Often there is only one educated teacher per group.
8. Tonér (2021), p. 53.
9. All names are pseudonyms.

10. Alderson and Morrow (2011); Christensen and James (2017); Clark (2017); Einarsdottír (2007); Kellett (2010); MacDonald (2013); Mason and Watson (2014); Schulte (2020); Thomas (2021).
11. Alanen (2020); Bodén and Joelsson (2023).
12. Haraway (2003), p. 7.
13. Bodén et al. (2019), p. 4.
14. Haraway (2016), p. 34.
15. Haraway (2004), p. 4.
16. Olsson (2013); Månsson (2008).
17. Frankenberg et al. (2019).
18. Ericsson and Boyd (2017); Pinter and Zandian (2015).
19. Aronsson (2022).
20. Woodhead and Faulkner (2008), p. 14.
21. Frankenberg (2018).
22. Haraway (2016), p. 34.

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Children and the EEG Cap: Exploratory Research to Investigate Children's Experiences and Participation

This chapter tells the story of how one of the authors (Linnea) collaborated with six five-year-olds to investigate their experiences participating in the Enhancing Children's Attention (ECA) project. The focus of these exploratory collaborations was chosen by the children. In contrast to adults, they did not discriminate when it came to what practices in the ECA project they considered "difficult" or "problematic" but rather what was interesting to them. Therefore, the focus emerging as the most interesting to these particular children was to explore more about their understanding and experiences of the brainwave recordings/electroencephalogram (EEG) testing.[1]

These exploratory forms of collaboration, which would run over a period of six weeks, were informed by and performed in alignment with new materialist and posthumanist emergent onto-epistemological inquiry.[2] They were performed with a group of children after a decision was made to stop the preplanned and ongoing child interviews that both of us authors were conducting at the time. In other words, enacting these kinds of emergent exploratory collaborations with the children was not a preplanned methodology in the ECA project. Rather, the decision to shift from participative interviews with children to exploring other ways of producing knowledge together with the children in the ECA project – to make EEG caps! – surfaced as a possibility offered by the children.

To tell this story, the chapter starts by outlining some of the necessary background. In the following section, we describe why the two of us decided not to continue to do the interviews with the children but to shift to a more explorative and interactive way to learn more about the children's experiences from the project. The section that follows describes the essence of the brainwave recording practice, as a background to better understand the explorations going on among the children while making EEG hats. Then comes a section that gives a theoretical point of entry for doing an emergent kind of exploration and knowledge production with children, starting with Donna Haraway's theorizing on *becoming worldly with*.[3] We also highlight some of the work that other scholars in our network were doing at the time, whose emergent forms of research with preschool children helped inspire Linnea's explorations with the children. The rest of the chapter is devoted to describing and theorizing on the collaborative production of the EEG hats.

What Was the Problem with the Child Interviews?

Interactive interviews[4] were planned with a number of children at different units. They were held on an ongoing basis during the project and conducted by the two of us separately at different preschools. The focus of the interview was on the children's experiences taking part in a large randomized controlled trail (RCT) study with multiple forms of methodologies, testing, interventions, and so forth (Chap. 5). Mainly we wanted to know what it was like to be a child in a large-scale interdisciplinary research project like the ECA project. Although the interviews did, of course, produce interesting data about the lives of the children in and outside of preschool, what was learned basically confirmed what we had already come to understand about the children's reactions and experiences within the research project, which was that the children were generally very excited about being at the center of attention while playing the role of a "*child helping the researchers doing research, and without whom there would be no research.*"[5]

The attitude expressed above, of the impossibility of doing RCT research unless the children individually helped out to take an active part in it, had become a more or less general part of the project culture while the research was going on in this municipality (Chaps. 5, 7, and 9). Consequently, when asked to be interviewed, the children showed great interest in talking to the interviewing researchers, in the same way almost

all of them had shown an interest in performing other tasks related to the research. During the interviews, some children dutifully answered questions, saying that doing the tests or taking part in the interventions or other activities was fun and exciting. Others occasionally stated that testing was difficult, tiring, and "sooo long." However, more often the interviewed children preferred to play tag or just speak with an adult about anything but the research tasks. This meant that we learned a lot about siblings, cousins, birthday parties, and all kinds of other stuff that were important to the children but, at least at first glance, that was barely related to the experiences of participating in the ECA project. The interview questions simply did not seem to engage the children or engage with the children or their questions. Early childhood education scholars Piia Roos and Niina Rutanen[6] highlight the fact that children often respond to things other than the questions raised by researchers. They describe the risk this presents that the interviewer will become too controlling. To avoid this, they suggest that it might be more productive to think of interviews with children as conversations, where the main objective is to listen to the children rather than getting them to answer preprepared questions.

After having performed a number of interviews, we concluded that the core message the children articulated, in different ways, was an enthusiasm for talking to another adult one on one. Moreover, the children expressed excitement about taking part in a "preschool-*not*-as-usual," that is, they were excited over the prospect of taking part in various aspects of the research and becoming the center of attention as individual children. Having a handful of grown-ups enter their preschool on a regular basis, telling each of them how important they were for the research, was something very different from the group-based practices they were used to. Group-based practices, to them, basically meant having to interact and relate above all to other children in their age group in different activities (see Chaps. 1 and 5). This response from the children seemed to us to both distort and bias the findings from the interviews. Let us explain.

At first, the children's excitement about lining up and doing the pre- and posttesting struck us an unexpected reaction, especially against the backdrop of what we in this book frequently have referred to as an aversion for testing practices and experimental research practices. However, we soon understood it to be a direct effect of how we had designed the research ethics for the project. An important aspect of the *relational ethics*[7] that we had designed was the idea of convincing parents, teachers, and educators[8] that as long as they gave their initial written informed consent,

the children would repeatedly be asked to give their *in situ* consent to participate in the different activities (Chaps. 5 and 9). The relational ethics meant that we would explicitly and repeatedly articulate and express the importance of each individual child's contribution to the research. Hence, when asked to be interviewed, most children perceived this as yet another chance to be the center of some adult's attention. Continuing individual interviews, we reasoned, risked producing a biased success story about doing an RCT in Swedish preschools. Our preprepared questions would furthermore yield us few answers about the children's experiences of what was going on in the ECA project.

Against the backdrop of the Swedish RCT-averse and test-averse preschool culture, we thus wanted to know more about some of less obvious experiences evoked by the project's various research practices. A more overarching question, in line with the discussions in Chap. 6, was whether or not an interdisciplinary intervention project, framed as an RCT, with extensive testing, combined with video ethnography and observations, for example, could be ethically justified. There was no doubt that the research practices significantly encroached on children's everyday lives in preschool during the ten-week period when the 29 units were engaged in the research. Hence, we wanted to know more about the different ways that individual children made sense of what was going on.[9] Guided by the interests of a group of children at one of the units, this caused us to take note of their interest in the EEG caps, the "bathing hats," as the children called them, that they wore during the brainwave testing. This interest, in turn, caused Linnea to turn her attention to the controversial brainwave testing performed in the ECA project. Because of this decision and what we are about to discuss, we need to provide some necessary details about this kind of testing and what it entails before describing the exploratory work performed by Linnea and six of the children.

The Brainwave Testing Practice

During brainwave testing, the children put a tight-fitting EEG cap on their heads and had to sit still and listen to stories for a total of thirty to forty minutes,[10] and that was all they had to do. But this demanded a great deal of focus from a four- or five-year-old child.

An EEG test registers brain activity, whether the person wearing the cap is awake or asleep. The brain is always active, and it is possible to register

where the activity is most intense as some sort of stimulus is provided. The billions of neurons in a human brain are in constant activity to a greater or lesser degree in different areas of the brain. When the electrical fields of these neurons are oriented in the same way and are aggregated into larger fields, the electrical activity of these neurons can be recorded. The EEG recording thus measures the electrical fields, whose sources are, in fact, a mixture of both neurological brain activity and other biological potentials, like eye movements, for example.[11] To enable the recording of activity, the EEG caps are made of a thin nylon net, with electrodes spread across it. The children wore small caps in different colors depending on the size– yellow, red, red-yellow, or yellow-green – covered with 22 electrodes. The cap made it possible to spread out the electrodes so most of the scalp was covered, and the electrodes were the actual devices recording the activity of the brain (see also Chap. 5).

In the ECA project, as noted previously, an *in situ* mobile "lab" was set up at each preschool in a separate and quiet room. Two researchers made the recordings on the children individually (see image below). The *in situ* EEG lab could be any room large enough to set up the EEG testing equipment. During the tests, the children were seated in a chair wearing the EEG cap with the electrodes. To get a stable electrical connection, a gel was placed between the electrodes and the scalp using a plastic syringe (without a needle). For some children, the sight of the syringe became the most difficult part of the test, as they related the syringe to being in the hospital. Having the gel in the hair was another thing several of the children disliked, as they knew that this would also entail washing their hair that night.

Even before the parents had given their consent for their children to participate, the children had been given an opportunity to look at an informational booklet about the EEG testing. Copies of this booklet were also given to the families to read. As the research proceeded, the children were again told about the testing while reading the booklet with their teachers and educators at each of the preschools. The booklet contained illustrations and photos of a testing setup with a child. They could also watch a short video of an experimental setup to familiarize themselves with what was about to take place ahead of their scheduled day of testing.

During the actual testing, the participating children were asked to listen to two simultaneously played stories, as well as some occasional beeps

when the brainwaves were recorded. The child's task was to pay attention to one of the stories and ignore the other. Images from the "focus story" were simultaneously displayed on a laptop in front of the child. The recordings produced brain-activity data of the child's inhibitory skills to obtain a measure of their focused attention. Each session lasted thirty to forty minutes (Fig. 8.1).[12]

Since this was both an expensive and time-consuming testing activity, a smaller number of children (185 out of the 432) were randomly selected and offered to participate in this testing. The word *offered* is central here. Even if the parents had given their consent, it was up to each individual child to give their *in situ* consent when the time came to do the test. Of the 185 children, 46 either declined verbally or expressed a negative or ambivalent attitude toward participating when asked to do the test. Some of the children participated in the preparations but then decided to terminate their participation when they realized they did not wish to continue.

The large number of children who declined to do the brainwave recordings, compared to the other kinds of testing that all children were asked to do, can be understood as evidence that the ethics protocol worked as planned. It was always the children who had the final and *in situ* decision concerning their participation (see also Chap. 5 for a more detailed discussion on attrition and Chap. 6 on ethics). In total, 139 children performed

Fig. 8.1   A child during brainwave testing

the pretests (seventy-seven girls and sixty-two boys). Only a few of the children, four boys and two girls, declined to participate in posttesting after having completed pretesting. A major reason for declining to do the posttesting was not wanting to have another round of sticky gel in their hair. Ten children did not participate in the posttesting because of absence due to illness or other reason on the scheduled day of testing.

No doubt, and as previously noted, the EEG testing was the most controversial research practice in the ECA project. The various arguments against developmentalism in early childhood education practices and experimental research that includes testing were already discussed in Chap. 3. Here, we want to highlight some of these arguments again. One argument is that researchers should refrain from applying methodologies from disciplines such as psychology and medicine that are otherwise used to identify deviations and/or sickness when doing research involving healthy children. Methodologies of these kinds, and perhaps especially brainwave recordings like EEG, are simply seen as unsuitable for use in preschools. Furthermore, these methodologies are also described by critics as downplaying the role of circumstantial factors. The strongest critical notion is that this kind of testing turns children into objects.[13] Hence, critics underscore the idea that educational practices, including research on those practices, should not and cannot be compared to clinical contexts. This was also a concern that the research team articulated in the ethics vetting application but that was found to be outweighed by the knowledge that the testing could produce (cf. Chap. 6).

All of the preceding critical arguments constitute reasons for why in Sweden childhood and early childhood education researchers chose to conduct their research inquiries on the basis of social constructivist, sociocultural, and critical and/or poststructuralist theories and promoting ethnographic and participatory methodologies. In the last 15 years, posthumanist and new materialist postqualitative studies can be added to the list of dominant research practices in this field. The critique of what was described in Chaps. 2 and 3 as a developmentalist approach in research has affected not only early childhood research but also teachers, educators, and thus the early childhood practices themselves.[14]

Having realized that the interviews with the children had merely underscored the unexpected success of the large-scale intervention, the question was how to proceed. How would we learn about the experiences the children had as a result of participating in the research? This is when the children's interest in the EEG cap emerged and was noticed by Linnea at one

of the preschools. This led to a collaborative and playful exploration of EEG caps between a curious researcher and six children. The chapter now turns to some of the theoretical underpinnings of this collaboration.

Becoming Worldly with Baboons or Young Children

Let us start by pondering the conditions for doing an emergent kind of inquiry with young children. Without in any other way comparing children to baboons, we nevertheless want to turn to what Donna Haraway says about the methodological experiences of the primatologist Barbara Smuts and her research with baboons. Haraway's example illustrates the general approach that Linnea would take to collaborate with children to learn about their understanding of and experience with EEG testing and, more specifically, the EEG cap itself.

Haraway argues that "the practice of 'becoming with' rewove [as in weave/wove/woven] the fibers of the scientist's being."[15] Outlining the whereabouts of Smuts, who in the 1970s studied baboons in Kenya, Haraway describes how a transformation of both the researcher and the research apparatus became necessary for knowledge to be produced in this project. As a PhD student, Smuts was advised that a successful natural scientist who wanted to study another species must hide herself, so that the animals being studied, baboons in this case, could go on with their lives as if the human was not present. The way to accomplish this was to act neutral – "to be like a rock, to be unavailable, so that eventually the baboons would go on about their business in nature as if the data-collecting humankind were not present."[16] However, Smuts soon realized that the baboons seemed unimpressed by her attempts to act neutral. The more she ignored them, the less convinced they appeared to be about her presence. Instead, they became highly suspicious of her, wanting to get away from her threatening self. When Smuts instead began to modify her behavior in accordance with the baboons' ways of acting, that is, appropriate social behavior learned from the baboons, they started to relax. Gradually they started treating her as a trustworthy social being around whom they could safely go about the everyday business of a baboon.

Haraway points out that "[i]gnoring social cues is far from neutral social behavior."[17] Moreover, it is far from a neutral *scientific* behavior. Instead, the process of doing research needs to be thought of as a "becoming with" those who the research primarily concerns, says Haraway. To

learn more about the children in the ECA project, Linnea thus needed to "become with" the children and their experiences. Depending on how the research apparatus[18] was set up, the different worlds of the children could potentially become available. Accordingly, the research apparatus could, following Haraway,[19] be described as both world*ly* and world*ing*. That is, the research apparatus should be simultaneously *of* the world and productive of the worlds and realities of the children.

In the ECA project, this would mean to "become with" an enactment of various worlds of children as they explored the EEG testing with the researcher. To think more creatively about how this could be done, Linnea turned her attention to explorative and emergent research with young children.[20] These inquiries are often pursued within the realm of new materialist and posthumanist artistic research practices. A number of early childhood education researchers have explored children's *world*ings with inspiration from Haraway. For instance, Australian childhood researcher Miriam Giugni, also known as Red Ruby Scarlet, has worked with the theories of Haraway to reimagine her own early childhood teacher activism.[21] Important for Linnea's explorations with children was how Giugni describes her work with the *ordinary* practices of the everyday lives of the children in her study as *extraordinary*. To be able to engage with those extraordinary practices, she argues that we need to "think and do beyond what we consider knowable and comfortable" and keep "looking for and creating leakages; colouring outside the lines."[22]

The work of Anna Palmer, an ECA team member, was another source of inspiration for the exploratory work with the children described in this chapter. Drawing on a posthumanist understanding of ethics, Palmer has investigated what happens when preschool children's interests and questions expand to the greater world outside of preschool. She discusses how to engage with the ethical dilemmas and uncomfortable questions that emerge when a project on the world's tallest building suddenly became an investigation and discussion of the World Trade Center and 9/11.[23]

Other important methodological inspiration was picked up from the inquiry performed by the preschool researcher Christine Eriksson and artistic researcher Monica Sand. They take as their starting point discussions on how to give children a voice in childhood and early childhood education research. Using artistic methods, they displace, or re-place, the metaphor of voice, as in placing a voice in a new setting. They invited a group of children one-and-a-half to three years of age to encounter materiality and embodied experiences while exploring their voices during

explorative play in a long walking tunnel beneath central Stockholm: the Brunkeberg Tunnel.

These studies, among others, together with Haraway's thinking about *becoming with*, opened up methodological pathways by which to take children's questions and experiences during the ECA project seriously. Linnea thus aspired for herself and the children to become worldly with the caps in ways that the children had playfully introduced. In what follows, we will unfold what happened in this emergent process and how aspects of the brainwave recordings, which might seem unfamiliar or even scary, would eventually, and as a result of the collaborative explorations, enable *an intervening in the intervention study from within*.

Woolen Hats and EEG Caps

A winter day, when Linnea was just about to leave the preschool, two five-years-olds, Li[24] and Naima, were standing by the window, wearing their woolen hats inside. It was in the middle of the Swedish winter, but it was still an unusual sight. It was actually very warm inside, and the children shouldn't have been wearing their winter clothes inside. When Linnea asked the girls about their hats, they explained that they had put them on because it was cold inside. However, one of their teachers told Linnea in a giggly tone that the girls had been pretending all day that their woolen hats were the "bathing hats" they wore during the EEG testing. In this short event, the children can be understood to incorporate one of the scientific practices of the ECA project in their everyday play activities. For Linnea, this appeared to be exactly the social cue that she had been looking for. It constituted an entry into the worlds of the children and how they, in their everyday lives, engaged with experiences from or understandings about what was going on in the ECA project.

For us, as educational researchers, the measuring of brainwaves was the least familiar practice of all the different tests and methodologies that were used as part of the overarching RCT in the ECA project. The EEG caps were connected not only to electric cords and computers but also to the critique of the testing of young children and the discourses of the objectifying nature of this research practice. However, the children seemed very interested in what we together eventually started calling "the hats." The hats, and the very material practices connected to them, seemed to be a way of engaging with the children's questions and a way of taking their experiences of the research project seriously. Returning to Haraway[25]

again: "To respond was to respect; the practice of 'becoming with' rewove the fibers of the scientist's being," and we thus needed to engage with the children's engagements.

The Making – and Maybe Faking – of the Hats

From the encounter in the hallway described earlier, Linnea already knew that Li and Naima were particularly interested in the EEG caps. Together with the teachers at the preschool, a group was formed consisting of Linnea, Li and Naima, and four other children who had expressed interest in the caps: Adam, Caesar, Ethel, and Victor. When the collaboration started, Linnea did not know who had been part of the EEG testing and consequently had worn the EEG cap. This was a deliberate decision, as the uncertainty about who had "really" been wearing the caps and performed the testing made Linnea unbiased in relation to the children's previous experiences, though the children themselves probably knew who had done the testing and who had not. Not knowing could help Linnea open up possibilities for all children to, at some point, become experts on some part of the EEG activity.

As events passed, some children became experts on the caps, others on the sound from the stories, and yet others on the accessories connected to the caps. Expert, or connoisseur, a concept used by Isabelle Stengers,[26] is to be understood as a knower of the situated and specific aspects of a particular event or context. Stengers says that it crucial to engage with and collaborate with connoisseurs when performing research on a particular phenomenon and/or relation. Connoisseurs are simultaneously critical partners who question the methods and the results and experts on their own local practices.

In line with Stengers' thinking and how early childhood education researcher Teresa Elkin Postila has theorized children as connoisseurs,[27] Linnea thus needed to trust the children as local experts who could enable new understandings of the caps, as well as the children's experiences, ideas, or fantasies about them. Understanding the children as connoisseurs helped the adult researcher relinquish control and hand themselves over to the unfolding of the process. This is a methodological approach that requires that the researcher remain attentive to what is happening in the moment of the here and now. In terms of power relations, this also became a way of challenging binary relations between the adult researcher, the children, and the shared topic of inquiry or matter of concern. Moreover,

this meant that the questions or problems the children and Linnea raised in relation to the caps were not the same, and sometimes not even mutually understandable to the different collaborators.[28] Nonetheless, all questions were recognized as being important for learning more about the children's experiences of the ECA project. Not until after the last encounter with the children did Linnea discover that only two of the participating children had been part of the actual EEG recordings. The rest had not, nor, of course, had Linnea herself.

Together, the group of children and Linnea agreed that one way to investigate the caps would be for the children to create their own. During a six weeks period of collaboration, Linnea visited the preschool at least once a week. How this collaboration played out and what could be learned about the ECA project from this will be outlined in what follows.

Starting with the Comfortable

A first step in investigating how the preschool-made EEG caps might be constructed was to imagine what they might look like and what they might be made of. Linnea tasked herself with obtaining some materials that would be useful for the collaborative work with the children. For the first time, she needed to *really carefully* think about the caps. As Linnea had entered the ECA project during a later phase, she had actually never encountered a real cap herself, unlike the other team members, who had all gone to the University of Oregon to visit a brain lab (Chap. 10). Linnea had never touched the fabric or electrodes or felt a cap on her head. She had never smelled one or felt the gel that would be applied by syringe. Linnea relied on photos from the Internet and the video shown to the children, but most of all on what the children described. She knew from the photos and videos that the original cap consisted of a stretch fabric and that it had a number of round electrodes attached to it. Linnea consulted a retailer of EEG caps[29] that she found online and learned that the fabric was breathable and that the electrode cups were made out of soft silicone. Moreover, the cap needed to be easy to put on, it should be easy to clean, it should dry quickly, and it had to be soft on the skin with a comfortable fit. But most importantly, it had to provide optimal signal quality.

From what was learned from the retailers webpage, it was apparent that a lot of effort and money had been devoted to making the caps both efficient and pleasant to wear. From her conversations with the children,

Linnea knew that the caps were sometimes tight and itchy, so trying to find a suitable fabric that would be easy for the group to work with, comfortable to wear, and not too expensive became the starting point. She went to a pharmacy and found a gauze bandage that seemed soft to the skin and breathable and stretchy enough that the caps stay on the head. In a memory note from the first collaboration with the children she wrote:

> I pick up the package that stores the bandage to show everyone. I tear it open and put the long bandage tube over my head. Caesar suggests that the bandage needs to be shorter to look more like a cap. I ask him if he wants to try it and when I place the bandage-cap on his head, I realize that it is very tight. I ask him if it hurts, and even if he says no, he still wants to remove it. But Adam is very eager and suggests that we need to have rubber bands to "close" the tube after we have cut it, to fit the shape of our heads. We go round the table, and I help Naima, Ethel, Victor, and Li put on bandages. The children cut each other's bandage to the right length, and suddenly everyone is wearing a cap, even Caesar. The piece of bandage left is just enough for me to have my own.

Linnea had discussed the setup of the collaboration with the children with other members of the ECA project, trying to be inventive in choosing what materials to work with. Still, something interesting became evident in connection with the gauze bandage. In this first attempt to "become with the cap," it was apparent how the materials chosen were connected to both discourses and the materialities of the original cap. Even if the portable lab at the preschool hardly resembled the experimental design of a medical research lab and the researchers performing the testing worked really hard to make the setting and the syringes less like a hospital, Linnea went to a pharmacy to find creative materials. Due to the fibers of the gauze bandage, the caps – again – became connected to medical discourses and practices. In the meeting with electrodes and cords this, however, would change.

Becoming with the Caps

Of course, the cap explorers needed cords and electrodes to make the caps work. Together, Linnea and the children looked for things in the everyday preschool environment to use. They realized that pipe cleaners or yarn would work as cords and that round sequins would be perfect as

electrodes. In a large container of sequins, they soon learned, however, that the only sequins that were large enough to resemble electrodes were not at all round. Instead, the children would choose sequins in the shape of purple elephants, green leaves, blue and pink snowflakes, yellow stars, silver butterflies, and red hearts. The electrodes that were set on the children's caps didn't look very much like those in the photos or the video, and they were much different from the online descriptions of the soft silicone caps with the optimal signal quality. Linnea's memory note from the preschool continues:

> Adam takes blue and green sequins and places the ones with similar shapes in vertical rows on the cap. Victor follows his example, while Ethel and Naima mix different shapes and different colors in asymmetrical patterns. The glue gun is passed over the table, hot. I try to keep an eye on Li and Naima who want to use the glue gun by themselves, while I try to help everyone else as much as I can. And as I try to work on my own cap. I can't help thinking, "Oh God, why aren't I a trained preschool teacher?!" As I'm not, Isme [a childminder] enters the room to help us. The electrodes shaped as elephants become the most popular ones, as Isme tells us that elephants often symbolize fortune and happiness. Adam glues rows of purple elephants to his cap, while Caesar places them haphazardly. We turn the caps over and over, to put electrodes on all sides. Ethel wants them on the front of the cap only. When we finish, I see that my cap has less than ten electrodes. All are shaped like snowflakes, the ones I found closest to a round shape.

In between the weekly meetings, the caps were placed on large soda bottles to let the glue dry and the sequins stay in place. Thus, what became the most important aspect of the work in the small group were the details: the fit of the caps customized by rubber bands, the placing of electrodes, the fortune elephants, and the colors and shapes of the sequins. The colorful sequins and the fortune elephants glued to the gauze bandage inevitably challenged the medical discourse of the gauze bandage. It thus seemed as the becoming with – in and through the details – rewove not only "the fibers of the scientist's being," as Haraway[30] suggests, but also the fibers of the caps.

The children carefully examined each decision in the making of the caps. They wondered, for example, what would happen to the caps if this and not that sequin was used. Would this affect the reliability of the hat during the recordings? What would happen if the glue slipped through the surface of the gauze bandage, gluing the front to the back, making them

impossible to fit on the head? How would the pipe cleaners or the yarn best be fixed to ensure a smooth transfer of signals to the computer – a question of great interest also to the retailer? What would happen if there weren't enough elephant sequins for everyone to experience fortune and happiness when doing the testing and the brainwave recordings?

All of these details made it possible to stay within the relations with the caps that the children had already formed during the pretest period, whether or not they had in fact been tested. These relations were created in multiple ways and differently depending on the individual child. Some children had been part of the testing and formed their relation in the situation of being tested. Other children had read the information booklet about the EEG or seen the video. All of the children had participated in the conversations with the researchers and the other children at the preschool. The questions posed by the children about the caps became a way of engaging with how the children experienced the brainwave recordings and the EEG caps themselves, whether they had been tested or not. These questions enabled more and other ways to stay within the children's experiences of the EEG caps and the brainwave recordings versus the interviews. This can be described as a "becoming with" the hats and the EEG recordings through a remaking, or even a faking, of the hats (Fig. 8.2).

The children's caps, filled with fortune and happiness thanks to the elephants, and playful and colorful cords show that even such a powerful materiality as an EEG cap is interconnected with the children wearing them and how they imagined what it meant to wear a cap. These caps are also connected to all the worries about what might happen to the agency of the children wearing them that adults project on them. This way of exploring and, thus, relating to the EEG caps and the children's experiences of wearing them can enable a problematization of a line of thinking that understands EEG testing, including the wearing of caps, as an objectifying practice. Engaging with the details provided by the children as connoisseurs of their own experience and preschool world made it possible to stay within a responsive relationship with the children. Following Haraway,[31] this responsive relationship is thus a way to respect the practices of the children, which necessarily also affect the practices of the researcher and the inquiry together with the children.

However, it is important to emphasize that that you cannot simply transfer the children's questions and discussions on the constructed hats to the original EEG caps. Even if a lot of effort was put into making the hats look like EEG caps, the children's explorations were directed to more

Fig. 8.2 Children wearing the EEG caps they made at their preschool

and other questions than just those that concern their experiences of the research project, for example, the enjoyment of the glimmering sequins or questions of what might bring luck during testing. Just as the children were diverted from our sought-after answers during the interviews, they were diverted from what one might have expected of them during the construction and play with the hats. Still, this way of collaborating with the children allowed for another form of engagement with the worldly, and often ethically saturated, problems and dilemmas that children are often interested in, something elegantly described by Palmer, who says, "Allowing children to be curious and involved in many different issues, and thereby challenging the understanding of childhood could result in a more inclusive and 'worldly' preschool practice, where no questions are seen as difficult or impossible."[32]

In the explorations of the EEG caps, the children pondered the question of brainwave recordings that had been difficult for some of the educational researchers to tackle at the beginning of the ECA project. The children also expressed how much they cared for one another as they shared elephants, and thus happiness and good fortune, with one another. But they also showed how much they actually cared for the ECA project in their attempts to create cords with high-quality signals and in the creation of headphones, as will be discussed in the following section.

The Need for Headphones

As described in the previous section, the children listened to two stories during the brainwave recordings. For the caps to be useful, they needed some sort of audio technology. Already at the first meeting, Li suggested to Linnea that they needed to construct headphones to be able to hear the stories. However, at this point, the gauze bandage and the activity of constructing the caps themselves occupied everyone's attention. Several weeks later, Naima picked up on the subject of making headphones. The exploration now took off in a new direction. The last three weeks of the collaborations were dedicated to the construction of accessories for the caps. Milk bottle corks and pipe cleaners were turned into headphones.

The children had different ways of engaging with this new aspect of EEG testing. Ethel made a headband with small cat ears by twisting pink and green pipe cleaners. Naima glued a standing purple elephant to the pipe cleaners on top of her headphones. Victor colored two milk bottle corks in red, white, and black to make them look like Pokémon balls. And Caesar glued a seashell-shaped sequin to each cork. To make the headphones stick to the head, rubber bands were attached to the pipe cleaners to put under the chin. Another of Linnea's notes reads as follows:

> The children move their bodies to the imaginary music in their headphones, and when I ask Caesar about his headphones, he cannot hear me. "What?!" I ask him again. "What?!" and when he laughs, I realize that he had tricked me into believing that the sound from his headphones was too loud for him to hear me.

Performing EEG testing at a Swedish preschool in a portable *in situ* lab could certainly be described as an extraordinary practice. However, the children's engagements with the EEG testing by constructing

headphones, Pokémon milk bottle corks, and cat ears and playing imaginary music show how the extraordinary can turn into something fairly ordinary and everyday as in a preschool setting. This is almost a reversal of Giugni's description of how ordinary practices of the everyday are most often extraordinary.[33] Or maybe it is an example of how extraordinary research methodologies turn into new and yet unknown extraordinarinesses when both researchers and children enact their different ways of *world*ing in preschool. Inspired by how Eriksson and Sand re-place children's voices in a tunnel,[34] it can also be claimed that the exploratory constructions of the caps and the headphones re-place preschool practices into unfamiliar spaces like portable labs for EEG testing. The latter is particularly apparent in the following and last example.

As the collaborative explorations with the six children drew to an end, Linnea asked them if they were willing to set up an exhibition featuring their hats and headphones. In this way, those children who had not participated in the collaborative explorations would be included in the discussions about the EEG testing, the caps, and the headphones. The six children displayed their constructions to the other children, the teachers, and the two researchers who had carried out the EEG testing with the children. The hour-long video recording from that day shows five anxious children (unfortunately, Ethel was sick) and a nervously smiling researcher, Linnea, entering the largest room of the preschool wearing their hats. The audience claps enthusiastically. The atmosphere is bubbly, as the children in the audience ask questions to the hat makers and the children describe the hats and all their features. The teachers and EEG researchers also ask questions and answer questions posed to them. The children want to know: How many electrodes do the caps really have? Do all electrodes have a cord connected to them? What about the headphones?

Of course, the headphones and their volume-control buttons attract a lot of attention. Especially when a sudden silence descends upon the room and Caesar explains that it was because he had muted the volume of everyone in the room. In an unexpected way, this short moment of silence became the crescendo of the explorations. However, it also creates some confusion, as the EEG researchers explain that there were no headphones in the *in situ* lab. There were actually loudspeakers on either side of the children as they did the test. Had Linnea been tricked or fooled? Or was this exactly what was meant by becoming worldly with the children's experiences and imaginaries? Obviously, this was a way for the children to intervene with the testing they had, or hadn't, been a part of – from within!

Wearing and Daring the Hat and Grappling with the (Extra)ordinary

The aim of this chapter was to contribute to new ways of understanding the entanglement between *how* children's experiences are researched in a specific way and what kind of knowledge might thereby be produced. Working with children as connoisseurs in an emergent kind of knowledge production became a way to create new realities by means of play and other engagements, that is, onto-epistemology. The matter of interest to the children and the researcher was the children's understanding and experiences of the brainwave recordings, that is, a kind of testing that most educational researchers would not merely refrain from but be openly hostile to.

The making of the caps became a way of problematizing understandings of the possibility of "capturing" the experiences of children while trying, for instance, to find the right interview questions to ask. Instead, the children steered Linnea toward their interest in the caps, and the collaboration and explorative methodologies helped her to not refrain from the controversial brainwave recordings. Rather, Linnea was forced to *become with* the children's different understandings or experiences of the EEG testing, whether they had actually taken part in them or not. Engaging with, rather than avoiding, the brainwave recordings and the children's interest in the caps can be characterized as both *wearing and daring the EEG hat* in preschool research.

What seemed to unite the six children involved in what became a collaborative exploratory construction of EEG hats and accessories was how their individual and different interests were closely tied to each of their worldly (extra)ordinary engagements, like glimmering elephant sequins, Pokémon balls, cats, or headphones. The researcher and children collaboratively produced a joint experience, which would also be shared with the rest of the children at that unit. Thus, from an ethical perspective, the most important aspect seemed to be about finding methodologies that could encompass all the different important relations that the children had, and formed, during the explorations with the hats, for instance, the importance of symbolic representations that some of the sequins

constituted, especially the elephant that brought the child luck in the imagined EEG testing. Constructing and playing with the EEG caps, the children were in an ongoing process of *world*ling with the hats and, consequently, with the practices being applied in the ECA project. Linnea's task of learning about the children's experiences entailed her allowing herself to become with the children's *world*ings.

In conclusion, the difficulties of producing knowledge that can answer your research questions while using conventional methodologies, such as child interviews, do not mean that we should abandon these kinds of methodologies. Our point is rather that the explorative collaboration with the children described in this chapter demonstrates that we need *more* and *multiple* research methodologies, not fewer, which is what some people have argued for.[35]

NOTES

1. Abbreviation for electroencephalogram.
2. Onto-epistemology, as a simultaneous production of knowing and enacting of reality, as proposed by Karen Barad (2007). Compare Lenz Taguchi and Elkin Postila (2024).
3. Haraway (2008).
4. See, for example, Einarsdóttir (2007), Roos and Rutanen (2014), and Christensen and James (2017).
5. Frankenberg et al. (2019).
6. Roos and Rutanen (2014).
7. See Chaps. 5, 6, 7, and 9.
8. In Swedish preschools teachers with a higher education degree of 3 1/2 years, usually work together with high-school-educated educators in teams of three. At best there is one teacher per team who is the responsible person for pedagogical documentations, planning, and development. If there are more than one teacher, the responsibility is shared equally.
9. Lena Aronsson, who also later on wrote on the data within the framework of the second research project led by Bodén, concludes in her article that children's participation and discussions on ethics connected to this also need to include the possible benefits for the children of participating in the research. This can include, for example, learning more about research, being involved in something new and exciting, and creating an interest in scientific knowledge. See Aronsson (2022).
10. See Signe Tonér's PhD dissertation (2021) and Petter Kallioinen's PhD dissertation (2024), which includes a rigorous description of these tests and the results in terms of executive functioning.

11. Luck (2014).
12. Gerholm et al. (2018, 2019); Tonér (2021).
13. Hanley et al. (2016); see also Lather (2004) and Biesta (2007).
14. Lenz Taguchi et al. (2020) describe the overall development in Swedish ECER and its influence on ECE. Aronsson and Lenz Taguchi (2018) show this development concerning children's language development and literacy practices.
15. Haraway (2008), p. 23.
16. Haraway (2008), pp. 23–24.
17. Haraway (2008), p. 24.
18. Here, we refer to the way Barad (2007) uses the concept of research apparatus.
19. Haraway (2008).
20. At present, there are several accounts of emergent methods and storytelling practices in inquiries with young children. These studies are often inspired by Haraway. See, for example, Blaise et al. (2016), Elkin Postila (2019, 2023), Kind (2020), Lenz Taguchi and Elkin Postila (2024), Murphy (2020), Nxumalo (2018), and Taylor et al. (2012).
21. Giugni (2011).
22. Giugni (2011), p. 26.
23. Palmer (2016).
24. All names, apart from Linnea's, are pseudonyms. The data were collected with approval from the Regional Ethical Review Board (Stockholm EPN: 2015/1664-31/5). An addition to the original application for ethical vetting that clarified that the data material could be analyzed in relation to children's experiences was approved in 2018 (Stockholm EPN: 2018/171-32).
25. Haraway (2008), p. 23.
26. Stengers (2018).
27. Elkin Postila (2019, 2023).
28. See also Aronsson (2019).
29. Biomedical (2017).
30. Haraway (2008), p. 23.
31. Haraway (2008), p. 23.
32. Palmer (2016) p. 295.
33. Giugni (2011).
34. Compare with Eriksson and Sand (2017) and the re-placing of preschool practices.
35. Lenz Taguchi et al. (2020).

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The Researchers and a Displaced Postdevelopmentalism

Gendered-Trouble in the Interdisciplinary Bakery

This chapter takes as its starting point the metaphor provided by social science scholars Felicity Callard and Des Fitzgerald ([2015](#)) of an interdisciplinary layer cake.[1] The aim is to discuss our experiences as researchers collaborating in the inter- and transdisciplinary research project Enhancing Children's Attention (ECA) project that constitutes either the main protagonist or backdrop for multiple encounters in this book.[2] We will theorize what happens in what we call the *interdisciplinary bakery* as a figuration[3] of the complexities of collaborations, where scientific knowledge and experience-based knowing intersect. These are forms of knowledge and knowing at multiple and different scales:[4] scientific knowledge, embodied knowing, personal accounts, media discussions, and the historicity of academic conflict and friction. One aspect in this complexity is the gendered nature of knowledge and knowledge production, proposed by feminist science theorists and scholars.[5] We will theorize on how this particular way of understanding the collaboration affects interdisciplinary collaboration in the specific situatedness in the field of Swedish early childhood education of the ECA project.

As shown already in the book's introduction, Felicity Callard and Des Fitzgerald conclude their account of experiencing interdisciplinarity between sociology, geography, and the neurosciences on a somewhat discouraging note.[6] Their message is basically that social science scholars need to *give in* to the existing norm of governing epistemic power. They

even recommend that interpretivist social science scholars who have a desire to get entangled with the neurosciences more or less subjugate themselves to neuroscientific interests in the collaboration for it to work.[7] As we compare our own experiences to theirs, our conclusion is rather that the educational sciences need to *step up* and take a legitimate and stronger position in the collaboration (see Chap. 4 and conclusion). In such a position, educational researchers need to articulate clearly what their methodological, theoretical, and sociocultural strengths are in the collaboration with researchers from other disciplines. Moreover, the chances for a more fruitful interdisciplinary collaboration are better when the inquiry is done together with a third party in their lived and ongoing practices. In our case, the third party was constituted by children, parents, teachers, and educators[8] in preschool settings. This contrasts with the collaborative experiences of Callard and Fitzgerald, which took place exclusively inside a university setting.

As a contrast to laboratory research, an interdisciplinary research team in lived social practices needs to "team up" in order to negotiate with teachers, educators, and stakeholders around the conditions of possibilities for research. The space where the inquiry is to take place is one where researchers are guests. Researchers and their practices can be understood as more or less welcome intruders. The task is to negotiate, first, the often very different goals and aims stakeholders and researchers might have in carrying out their inquiries in the first place, even if it's a shared overarching problem of concern. Moreover, *in situ* lived educational practices and environments do not merely consist of people. They also consist of material and complex organizational conditions, entangled with issues of finance, policies, and local politics, but also academic traditions. All these aspects affect teachers, educators, and children in a project like the ECA project in more ways than is acknowledged in the methodology literature. Hence, what goes on in the municipality and educational practices gives rise to frictions that will not appear in interdisciplinary research that is conducted within the confines of a university.

In relation to what has just been said, team members in projects such as the ECA project need to continuously keep their eyes on the shared matter of concern that they have negotiated with teachers, educators, and stakeholders.[9] The researchers need to acknowledge that there are multiple desires, aims, and problems of concern, not only among teachers, educators, and other stakeholders but also within the researcher team itself. In the ECA project, the shared matter of concern was the evaluation of a

commonly used and upgraded version of an investigative group-learning pedagogy with respect to its effects on children's learning and language development.[10] Frictions and conflicts were, however, unavoidable as part of the collaborations among the interdisciplinary team members in ways that sometimes corresponds to the experience reported by Callard and Fitzgerald. Due to ethical considerations, we will discuss this on a more abstract level, in terms of encounters, conflicts, and frictions between epistemologies and methodologies in the interdisciplinary bakery as a figuration.

We understand the concept of figuration in line with Donna Haraway's definition as something that is constructed by a researcher so as to make sense of a complex phenomenon of some kind. Haraway describes figurations as "material-semiotic nodes or knots in which diverse bodies and meanings coshape one another."[11] In this context, the figuration of the interdisciplinary bakery invites an imaginative and performative construction that ties together an assemblage of multiple intra-acting realities, knowledges, ideas, matter, and practices of different kinds. These are produced at, and relate transversally to one another across, different scales, that is, in face-to-face interactions between researchers, at research seminars, and at municipality assemblies, for example, and with reference both to individual bodies and taken-for-granted and disputed academic notions about science. This means that the figuration of the bakery should be understood not as a representation or illustration but as a form of storytelling that entwines bodies and technologies, facts, situated experiences, and fictions.[12] Figurations are, according to Haraway, "where the biological and literary, or artistic, come together with all of the force of lived reality."[13] This has the potential of producing new imaginaries and new possible ways of thinking both pasts and futures for interdisciplinary collaborations concerning young children.

The interdisciplinary bakery figuration, together with the concept of scale, will help us place the discussion to the extent possible on a meta-level. However, it is impossible to shy away from the ways in which epistemologies and methodologies are embodied practices and experiences. Our aim is, however, to understand embodied individual experiences as primarily going on at different abstract discursive scales in different spaces. One such scale is constituted by the still ongoing academic undercurrent of the science war, also discussed in Chaps. 2 and 4. Furthermore, we wish to remind the reader about what Annemarie Mol[14] has presented as a negotiated and reciprocal divide between diverting research problems,

concerning either the social or the natural worlds, which took place in the 1950s (Chap. 2). The frictions between academic cultures thus have a long history. They play out differently in different local academic and national contexts, as previously discussed in Chaps. 2 and 3. Hence, in a heated face-to-face discussion between researchers, this discussion might be entangled with many previous historical events that can be traced back, not merely to the 1950s, but even back over 150 years.[15] Or it can at least be traced, in the Swedish context, to the described divorce between the disciplines of psychology and pedagogy (Chap. 3).

How, more specifically, will the concept of scale be applied in this chapter? The social geographer Nigel Smith defines scale as an "active progenitor of social processes … that both *contains* social activity, as it provides an already partitioned geography within which social activity *takes place*."[16] He states that scale is not socially and culturally hierarchical but should rather be understood as *nested* in a social and political connectedness across scales. Here, a key feature of scale is "jumping scales," i.e., establishing such connections across apparently separate scales of, for instance, individual *bodies, homes, communities, urban spaces, regions, nations,* and *the global*.[17] Feminist anthropologist Carla Freeman[18] points in a similar fashion to the embeddedness of the local in the global and the multiple relations at and across different scales. This is also a key feature of scale according to anthropologist Anna L. Tsing.[19] Moreover, Haraway[20] talks about the ways phenomena in the world are made flesh in natureculture interactions at and across different scales. Finally, Karen Barad articulates this in terms of an enfolding of different scales that involves space-time-mattering entanglements. This is because what goes on at each of these scales – i.e. individual bodies, homes, communities, regions, nations, the global, across historical events – "are intra-actively produced through one another."[21]

Thus, when activating a reflection about scale in interdisciplinary collaborations, it becomes possible to identify how the play of epistemologies can take place simultaneously within an individual researcher's embodied subjectivity, and in a wider context of academia and in society at large. On the level of the individual, epistemological belongings can thus also be multiple, consisting of intersecting, "ontologically conflicting," epistemologies, acquired either by training or as a result of sheer interest or in relations with other researchers. But epistemologies are only "ontologically conflicting" if we believe that there is only *one* best way of describing our (and other species') being in the world – ontology.

In relation to the foregoing discussion, the two of us do not believe that any kind of scientific activity should strive to figure out the *one and only* best way of understanding being in and knowing the world. Rather, scientific activities can be enhanced if they engage in and operate from an idea about multiple ontologies in relation; ontologies are not to be understood as necessarily conflicting in the first place. They are merely different from one another.[22] However, the structural academic system of disciplines, faculties, and publication does not sufficiently encourage such multiple disciplinary, epistemological, and ontological belongings.[23] Among the ECA team of researchers, several members had multiple belongings, which might indeed have been an important factor to the (relative) success of our collaborations.

The overarching questions that guide the present chapter are the following: How might we understand the figurations of the interdisciplinary layer cake and the interdisciplinary bakery? What *counts* as knowledge and what *kinds* of knowledge can be produced in the interdisciplinary bakery in studies of this kind? How can this bakery be theorized in terms of a shared space of power production and encounters and learning across knowledge and experience-based knowing from and with different epistemologies and, thus, at different scales? How is it possible to understand the gendering of different disciplinary knowings and practices of interdisciplinary research? And what might we learn from this?

Introducing the Layer Cake Metaphor and the Space of the Bakery

To get into the mood of what is produced in the interdisciplinary bakery, we encourage you to simply enter the word "*layer cake*" in your browser or search engine. Click on images and all kinds of mouth-watering (assuming you like cake!) creations will appear on your screen. Most of the cakes will have multicolored or multiflavor layers, often neatly separated by a layer of frosting. These cakes are baked in a process involving multiple separate pans, which are put separately in the oven to bake, and then put together to make a layer cake.

In terms of the imagined knowledge output from the interdisciplinary bakery figuration, interdisciplinary multipan layer cakes can imply that results are generally written up in separate disciplinary journals, as specific kinds of knowledge specialized in by each journal. This is true, whether the collaborations between researchers have been reciprocal or simply a

collaboration "on record/paper." Most commonly, interdisciplinary projects across the natural and social sciences are, in fact, constituted by very little actual collaboration in knowledge production. The latter is what Callard and Fitzgerald experienced.[24] However, as social scientists, the two of them learned a lot about neuroscience methodologies, but they did not seem to have exerted an equal influence or effect on what was going on in these methodologies in a bidirectional manner.

Discussions about the difficulties of mutual and reciprocal collaborations are hardly new. Interdisciplinary studies scholar Julie Thompson Klein,[25] who has written extensively on interdisciplinary collaborations, explains that a lot of research conducted within a framework of interdisciplinarity can best be described as multi- or pluridisciplinary. Rather than jointly exploring a shared topic and possible methodologies to do this, collaborations across disciplines often boil down to an "adding approach." This simply means that different topics, or perspectives on the same topic, are added to one another. The various disciplines included will thus not be affected by the collaboration, at least not to any significant degree. According to Klein, this can best be described as a "borrowing" of methods and theories or a way of solving specific problems together, but without trying to achieve a shared base for a collaborative knowledge production.

Callard and Fitzgerald, who were first to explicitly refer to the layer cake as a telling metaphor for what is said above, describe this work in terms of doing research "*alongside*" one another.[26] They make the following observations based on their experiences as social scientists in a project with neuroscientific researchers:[27]

> If you are going to live in such spaces, better to learn to live in them as they are, and give up on an agentic fantasy in which you will be able substantively to transform imbalances, inequalities, and existing norms governing epistemic (and other kinds of) potency. Second, as two social scientists caught in this space, we have learnt neither to lament, nor to spend energy resisting, this state of affairs: what we have learnt, instead, is sometimes to subjugate (or at least accept the subjugation of) our work and our interests to the neuroscientific interests in which we seek to entangle them. To the extent that we, in order for our research interests to move forward, need 'the neuroscientist', and they can get on perfectly well without us (in our estimation, anyway), we remain intensely aware that we need to narrate our own research interests in ways that make sense to our collaborators, without much expectation that they will do likewise. If we often know more about cognitive neuroscience than any of our collaborators do about geography, sociol-

ogy, the history of science, and so on – this is not because we find ourselves diligent, but because we find ourselves weak.

This quote talks about a "fantasy" of transformations of epistemic "imbalances, inequalities, and existing norms." There is thus no surprise that Callard and Fitzgerald do not perceive the layer cake as being the result of a joint knowledge production. Rather, following the norm of "the layer cake model,"[28] interdisciplinarity simply means that "each disciplinary layer has dominion over a particular kind of expertise, particular methods, and particular objects of knowledge"[29] and putting this expertise to work while working merely "alongside"[30] one another.

However, we will argue that a sense of dominion over one's disciplinary expertise is both necessary and of great importance for any constructive interdisciplinary collaboration, whether it turns out to be a reciprocal learning experience or not. Rather, what we want to discuss is the *extent to* and the fashion *of* what is meant with collaborating "alongside" one another or, expressed slightly differently, to what extent everyone is doing their own thing without *at all* being open to the influence of others and without engaging in any kind of learning as a result of the collaboration. In our experience, even the slightest space of sharing socially, but preferably professionally, will make a difference. It eventually boils down to whether or not team members are, or in time become, ready and able to open themselves up to learning from what emerges in interdisciplinary encounters. Because such encounters do carry the potential for mutual learning and for becoming different in oneself as researcher *if* you let yourself go there. In this chapter and the next, we will show when that would actually happen during the ECA project, despite the many ongoing frictions between epistemologies.

Their discouraging conclusions notwithstanding, Callard and Fitzgerald[31] have nevertheless made us aware of what they refer to as the *shared space* of relations. This space is what, for us, constitutes the figuration of the interdisciplinary bakery. This is a space for analyzing the phenomenon of interdisciplinarity, but also for imagining new possibilities. In this space, it is important to address the problem of the prefix *inter-* as implying "both spatial and temporal 'betweens.'"[32] Callard and Fitzgerald conclude that the prefix *inter-* forces us to imply and take for granted a preexisting separation *between* one thing and another (cf. Chap. 1).

The Figuration of the Bakery as a Shared Space of the Multiple

Let us imagine the figuration of the interdisciplinary bakery, where researchers with very different ways of doing research must design a joint research project in societal practices with those interested in the matter. This bakery is an imaginary space, situated simultaneously in different departments of a university but, in terms of place, primarily played out directly in lived everyday practices of preschool education, as in the case of the ECA project. Given the problems between different kinds of disciplinary power productions discussed earlier and in previous chapters, it is easily imagined that what goes on in the bakery can be related to the bad relationship (ending in divorce) between developmentalism (psychology) and postdevelopmentalism (pedagogy) (Chap. 3). As these two divorced parties meet to do a multifaceted, joint research project, this will require that everyone both *stay* and *make* with the trouble (cf. introduction and conclusion).[33]

The affirmative idea about staying and making with the trouble refers to the creative and inventive production of something unexpected and new. That is, a new, more friendly and reciprocal relation. This is a relation based on the courage to make visible the ongoing power productions and actively putting to use the power invested in differences, historicities, affect, and material realities. In the ECA project, this entailed being creative in ways of combining and relating different disciplinary methodologies or forms of knowledge and knowing to one another, as has been illustrated in the chapters featuring the children's experiences of the project (Chaps. 7 and 8). This can also be referred to how different forms of research and researcher ethics were negotiated to generate unforeseen and new ethical practices, as has been introduced in Chap. 5 and will be taken up here in a section of its own. Chapter 6 also radically problematized taken-for-granted ways of understanding ethics in inquiries that concern small children.

The figuration of the interdisciplinary bakery teases our imagination to think with scales. That is, the arrangement, ranking, and weighing of ingredients as research practices, and the scale and weight of different disciplinary fields of knowledge at the scale of the department, university, ranked journals, and so forth. On the face-to-face scale of the bakery, a pound cake, as a base for layer cake batter, *can* be made without either butter or a liquid such as milk or water. It cannot, however, be baked

without eggs or the vegan alternative Aquafaba or chia seeds. There is a need for an emulsifier of ingredients that would otherwise not mix. We'll also need some baking soda as the expanding leavening agent. These ingredients will be discussed in terms of practices involved in the ECA project, with a focus on what different ingredients do, and possibly the weight of importance they might have. It isn't just about the chemistry; it also matters how ingredients are socioculturally handled and mixed together. All of these natureculture coconstitutive relations will determine the quality of the cake.[34]

In the construction of the layer cake, the different disciplines are imagined in terms of differently colored layers, placed one on top of another. This produced differently designed layer cakes during different phases of the research project: from planning to execution, and the subsequent collaborations and in-service training upon completion of the formal research. In the case of the ECA project, this was a matter of placing *either* pedagogical practices (pedagogy) *or* cognitive neuroscience as the foundational bottom layer, depending on the focus of the process. The logic worked according to a bottom-up principle of scale, that is, valuing what would be the most important discipline during that specific period of the process and, thus, placed at the bottom of the cake as the foundational layer. During another period, the foundational layer would be a discipline of different color, ascribed the highest weight and value. The rest of the disciplines would follow hierarchically moving up, with the least important on top. In this way of baking several interdisciplinary layer cakes, constructed differently, you need to use multiple pans for the different colored layers and pick the order of the disciplines according to which phase the project is currently in. We will later suggest baking, instead, a one-pan layer cake, where the different forms of knowing are poured into the same pan. In the conclusion of this book, we will, however, suggest abandoning the figuration of the layer cake altogether in favor of another figuration.

As anyone who has baked a layer cake knows, there is no layer cake if layers are missing. For instance, for a randomized controlled trial (RCT) methodology, there *is* no measuring of effects if there is no intervention whose outcomes are to be measured. Moreover, there simply *is* no study if there are not enough children (families) who have given their consent to participate. These interdependencies at different scales matter in the material enactment of constructing this kind of inquiry. The research cannot be done without the children or without the educational researchers constructing the interventions negotiated with teachers and educators.

Furthermore, there simply is no effect or results to analyze from an RCT without rigorous and ethical well-performed testing that the children are comfortable with and happy to undertake.[35] Since children in Swedish preschools are not used to being tested, it is important to inform them completely about what they are participating in to get their consent. However, the preschool children in the ECA project showed a surprisingly keen interest in participating "*to help the researchers do their research.*"[36] They also often evinced a desire to have face-to-face interactions with an affirmative adult and/or engage in completely novel forms of play and exercises. Consequently, and to the surprise of at least the educational researchers, the children basically lined up to be tested in the allocated time slots for testing at each preschool (Chaps. 5, 6, 7, and 8).

Nevertheless, the scale and weight of what counts as knowledge among the scholars during the implementation of an educational neuroscience project constitute a messy process of power relations in the encounters of various epistemologies, teachers, educators, stakeholders, children, material conditions, preschool policies, and different forms of values operating in educational settings. In an entanglement of spacetime-mattering, in Barad's[37] way of theorizing, what counts as knowledge at the local scale of the ECA interdisciplinary bakery will nevertheless and inescapably always already be enfolded with what counts as knowledge in mainstream scientific theory on the scale of global Western academia and its specific history. That is, experimental forms of evidence-based research, such as RCTs, will, in a taken-for-granted manner, be given a higher value than different forms of qualitative forms of inquiry, even in Sweden (Chaps. 2 and 3).

We do, however, need to repeat that in this particular field of early childhood education, situated in Sweden at this sociohistorical time, performing an RCT is, in fact, not given the same weight as it would be given in the United States, UK, and most EU countries. To recall what was discussed in Chaps. 3 and 7, the scale of the "gold standard" for evidence-based research that is valid for RCT research in educational settings in the United States, UK, or EU has been problematized or even seen by some as an ethically inappropriate method for research in the Swedish context of early education research due to the mandatory testing of the children involved.

What Counts as Knowledge in the ECA Interdisciplinary Bakery?

What counts as knowledge is a question of academic discussion that comes up in daily encounters between scholars from different epistemological backgrounds in an interdisciplinary project. In the ECA project, five disciplines collaborated: early childhood education, pedagogy, linguistics, developmental psychology, and cognitive neurosciences. For the epistemological encounters of the ECA project, three of the involved disciplines brought knowledge and experience from experimental methodologies, crucial for doing a RCT. Linguistic scholars use neuroimaging techniques in linguistic-lab environments at the university, as well as statistical data analysis, in alignment with a naturalistic ontology. Developmental and cognitive psychology brought similar knowledge and experiences to the project. Scholars from early childhood education and pedagogy brought experiences of designs for learning, critical pedagogy, educational philosophy, poststructuralism, science technology studies (STS), new materialism, and posthumanist emergent forms of methodologies, that is, epistemologies underpinned by what we previously collected under the ontological umbrella of idealism (Chaps. 2, 3, and 4). Methodologically, some of these latter epistemologies entail a critical stance toward naturalist and experimental forms of inquiry that aspire to produce knowledge that can be generalized and behavior that can be predicted. In contrast to this, critical and post-perspectives engage in locally situated, praxis-oriented, collaborative, and participative forms of qualitative studies. These might use standard forms of participative observations, individual and focus-group interviews, and *in situ* emergent forms of collaboration performed directly with children.[38]

Standing firmly on the shoulders of a long line of feminist philosophers and science theorists, we necessarily need to point to the obvious *gendered* character of the unfortunate constructed territorial void between the aforementioned various forms of ontologies and epistemologies.[39] In terms of scale, value, and weight of what counts as knowledge in academia at large, the ECA project featured collaborations between, *on the one hand,* disciplines of a taken-for-granted higher value in the academy – developmental, cognitive, and neurosciences as well as neuroscientific linguistic research – and, *on the other hand,* disciplines that are basically thought to belong at the bottom of the value scale in academia – early childhood education and pedagogy. In relation to the figuration of the gendered

interdisciplinary bakery, the former can also be perceived as representing the higher-status and masculinely coded scientific chemistry laboratory, while the latter represent the lower-status, private sphere of the femininely coded kitchen. Here, the bakery can be constructed as an ambiguous space in terms of gendered status. Such ambiguousness makes this inter-disciplinary bakery an interesting space.

Moreover, in terms of gender, the space where the research was to take place – municipal preschools – can definitely be understood as femininely coded spaces in Sweden, as in most other countries. With child care and education being almost exclusively performed by women in Sweden, only three percent of staff identify as male. This is true despite the fact that Swedish preschool is formally considered to be the first phase of the edu-cation system, with a total enrollment of almost 90% of all children aged one to five years. At the beginning of the ECA project, the femininely coded space of preschool favored and rendered powerful the well-known educational researchers, who had been involved in praxis-oriented research and in-service training for many years. Moreover, many preschool teachers and practitioners in preschools share an aversion to testing, which is strongly felt in the collective of Swedish educational researchers (Chap. 3). This created a specific bond that would be simultaneously used and chal-lenged during the implementation of the RCT research.

CONSTRUCTING THE INTERDISCIPLINARY LAYER CAKE IN DIFFERENT VERSIONS

In this section, we will present the making and baking of three versions of an interdisciplinary layer cake. In this discussion we will show what argu-ments could be made regarding which disciplinary layer, during specific phases of the project, should constitute the most important and founda-tional bottom layer, which would constitute the middle and following, slightly less important, layers, and then the "least" important top layer. Furthermore, there might also be a decoration on top of the cake, "for show." In other words, the question in focus was knowing what was more or less/least valued in different phases of the project, for whom and on what grounds. Moreover, another discussion could be described as the nature of the separations between the layers.

The figuration of collaboratively preparing and making an interdisci-plinary layer cake entailed a complex power wrangling in the interactions

among epistemologies. This process was especially intense during the first year and a half of preparations as the focus of attention necessarily shifted between different parts of the research design. If the overarching RCT framework initially needed to dominate the design process, how would other forms of methodologies "fit into" the design? There were, especially initially, obvious and unquestionable reasons as to why some forms of knowledge and methodologies should be considered of higher value than other forms of knowing and, thus, be given the foundational position at the bottom of the layer cake. First, the grant received from the Swedish Research Council was based on an application for a RCT in response to a specific call. This call for funding was specially articulated to address educational interdisciplinary research with neuroimaging techniques, which corresponded to the electroencephalogram (EEG) measures as a part of the before and after measures in our study. Hence, all the other desired epistemological accommodations for this project depended on the capability of the RCT apparatus to function according to the best, gold standard research practice. In light of this, it was even possible to argue that the other forms of epistemological data production were merely supplementary and less important despite being part of the interdisciplinary plan.

From another point of view, what should be considered foundational, when doing *in situ*, applied educational research, are inevitably the educational practices and the children and preschools where the study takes place. These are the practices and children for which the research is being done in the first place (cf. Chap. 2). In this latter version of the story, the early childhood educational practices are considered foundational, based on knowledge from pedagogy and early childhood education research. In this version, the RCT merely constitutes the evaluation apparatus in service of those practices.

In drawing up the initial design and application, the PI (Lenz Taguchi) and the co-leader (Nilsson Gerholm) can be said to hold both of the previously sketched views simultaneously, and without friction. At the time of writing up the application, reciprocal relations between what we might call "team naturalism" and "team idealism" were tainted by an interdependent and flattened relation between all elements of the research. And yet, when matters came to matter and you're looking out for the color of your own team, these initial flattened relational interdependencies can, and maybe must – momentarily – be layered hierarchically so as to give certain disciplinary practices more or less weight and space to be planned and enacted.

When baking the first version of the interdisciplinary layer cake and taking as the starting point the application for the grant, the RCT apparatus, with pre- and posttesting, was laid as the foundational bottom layer on which everything else depended. The top layer would be constituted by some of the additional epistemologies of researching the children's, teacher's, and educators' experiences of the research. The top rose, as the decoration of the cake, would be the posthumanism-inspired emerging explorations with children reported in Chap. 7. In other words, this methodology can be seen as a pretty decoration, but not necessary to construct the RCT as the main methodology. For the RCT, the necessary leavening agent in the baking process – baking soda – would definitely be the testing. That is, what would be considered somewhat of a problematic ingredient (despite its necessity) by the educational "team idealism" (Fig. 9.1).

The second version of the cake was baked during the phase in which all the stakeholders and participants in the ECA project were informed: children, parents, teachers, educators, heads of schools, other municipality stakeholders. The educational researchers, from "team idealism," then insisted that the cake be constructed with the help of the children, with educators as the heavy bottom layer, followed by the pedagogical
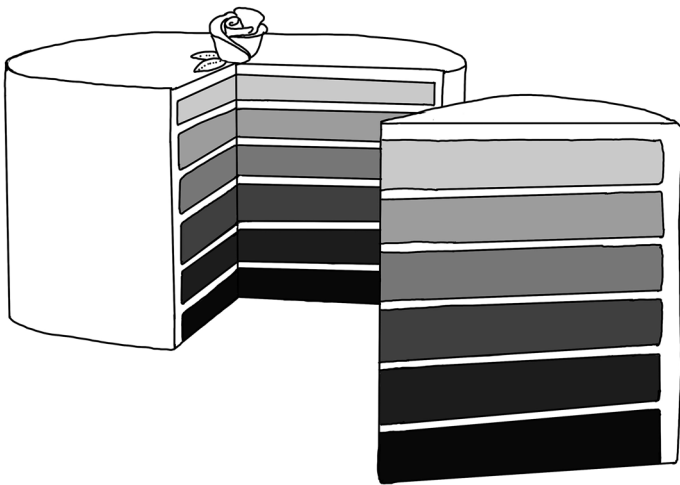
Fig. 9.1 The interdisciplinary layer cake with the RCT apparatus as foundational layer

interventions, that is, the children, teachers, and educators, without whom the research could not be performed in the first place.

Let us play around a bit with some of the cake ingredients. In this second version of the interdisciplinary layer cake, interventions meant that enhancing the children's attention, language, and socioemotional development constituted the problem of a shared societal concern, with the same chemical function as that of the releasing and expanding leavening agent, i.e., the baking powder. They are simply essential for baking any kind of interdisciplinary pound or sponge cake. The interventions, in this version, need the teachers, educators, and children in their situated preschool environment just as the cake needs flour, sugar, and occasional butter and/or milk or water. This is what will make the mix "rise to the task" of doing the research project together (Fig. 9.2).

In the second version of this layer cake, the EEG/event-related potential (ERP) scans (Chaps. 5 and 8) and the psychological and linguistic test battery (Chaps. 5 and 7) constitute the upper layers as tools of evaluation. However, this did not necessarily mean that knowledge from these disciplines was considered to have less weight and importance. In contrast, the methodologies used by "team naturalism" were considered to uphold
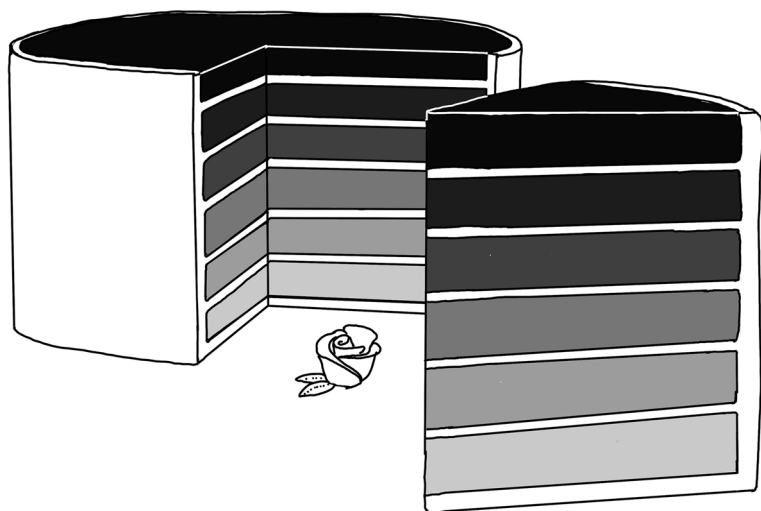
Fig. 9.2 Interdisciplinary layer cake with children, families, educators, and teachers as foundational layer

great legitimizing weight on the scale of national and international academy. Nevertheless, the EEG/ERP scans were actually sometimes teasingly described as the pretty rose on top when this version of the cake was constructed. It could even at times be thought to be the mere décor to "sell" the project to funders and generate "buzz." This undoubtedly corresponded to the fact that the neuroimaging part of the testing had most probably been defining in acquiring this large research grant. Hence, its status corresponds simultaneously to two scales throughout the project: the most and least important at once. In one sense, all of the involved forms of knowledge production might be understood in this paradoxical way. This fact, more than anything, can open up a space for humility and connection, rather than friction and conflict.

But hey! *What about the eggs*, you might ask? There has been no mention of the eggs so far! The story about the essential eggs, described as the emulsifiers of the cake batter, is of specific importance to the ECA project, where the eggs would take the form of bringing together the researcher and research ethics, that is, what we would call a *relational ethics*.[40] It would help bind all of the various agents in the baking process together into a relatively smooth batter. This story will soon be told, but first, and drawing from the earlier discussion on how knowing can also be understood as gendered, let us tell yet another version of the process of collaborations in the ECA project with a focus on the gendered interdisciplinary bakery this time.

A Gendered Interdisciplinary Bakery

The members of the research team coming from the educational sciences – "team idealism" – had an already established, strong relation to the preschool practices in the municipality where the research was performed (Chap. 5). They had constructed the network with teachers and educators from which the research application grew to materialize as a research grant. They constructed and performed the interventions and did most of the video ethnographies, focus-group talks, and the explorative work with children, the latter with the aim of knowing more about the children's experiences of the research. In contrast, the main task of "team naturalism" was to perform the pre- and posttesting, conducting surveys, and making the video recordings that would establish the fidelity of the implemented interventions. Hence, in terms of gendered tasks, "team idealism" can be understood as doing the major bulk of the relational, motivational, and care work in relation to both children and staff. This can be perceived

as doing the necessary but invisible and feminized "housework" in the research bakery. Taking the gendered version of the story to its limits, this work can be understood as "sweeping the floors," doing all the necessary preparatory work to motivate teachers, educators and stakeholders about the children being tested or, at worst, as constituting the necessary backdrop and/or space/stage in/on which the research was to take place.

With the aforementioned gendered imagery in mind, when the testing assistants and researchers from "team naturalism" arrived to set up an *in situ* test lab room at each preschool unit, the children were always extra excited. Hence, the pre- and posttesting were embedded in an aura of ceremonial solemn formality associated with practices of high status and value. These practices were set up in ways that would be as neutral and objective as possible, although taking place at each preschool unit rather than at the university lab. These were occasions when the children, having given their *in situ* ethical consent to participate in the testing, were to offer their valuable data to the research project for this data to determine the (statistical) effects of the pedagogical interventions. Moreover, this constituted a contrast to the four-days-a-week performances of the two interventions at the units randomized to implement them, which, ideally, should be thought of as an everyday practice. As such, these pedagogical interventions were much more complex, shifting, and sometimes downright messy. Hence, the different practices going on in the interdisciplinary bakery can, if you will, easily be read in terms of, on the one hand, more masculinely and rationally coded activities and, on the other hand, more femininely coded practices, respectively.

The foregoing gendered version of the story of the ECA project can be read as the educational researchers subjugating themselves in relation to the evidence-based practices of the RCT. This is a story not unlike that provided by Callard and Fitzgerald, quoted at length earlier. However, in the previous section, another version was outlined where the epistemologies and methodologies of "team naturalism" necessarily must submit to the strong positioning of educational discourses and actors as foundational, for any kind of intervention study to materialize. In that section, we also showed how reciprocal learning was actually accomplished around the issue of ethics. In this way, shifts in – more or less – subjugating positionings took place in various directions between epistemologies and disciplines during the ECA project. This was often experienced as uncomfortable, as the situation might require learning something important new about, or from, the others' disciplinary knowledge practice or experience-based

knowing. As Callard and Fitzgerald conclude, there are various forms of subjugation in the territory of interdisciplinarity.[41] Moreover, learning about our own prejudices and "ontological, epistemological, and political blockage" sometimes hurts.[42]

WHAT ABOUT THE EGGS? ETHICS AS AN EMULSIFYING AGENT

In the ECA project, the relational ethics that was in place functioned as the emulsifying agent. It was this relational ethics represented by the eggs that made it possible for substances as various forms of disciplinary knowing that would not otherwise mix to merge and come together. Activating ethics as the emulsifier between seemingly nonmixable notions about ethics demanded a lot of mutual effort and patience. Encounters between epistemologies circulated around taken-for-granted ideas about others' ways of doing ethics (cf. Chap. 6).

At the center of attention was, of course, the pre- and posttesting of children. There was undoubtedly a taken-for-granted mistrust from "team idealism" in relation to how the researchers and assistants from linguistics would be able to acquire *in situ* consent from children to participate in the testing sessions. Would they be able to allow the children to leave the test setting if they did not want to finish, for instance, if a child became uncomfortable or too tired to do the testing to the end? However, "team naturalism" was able to show that the experienced linguists and speech therapists acting as assistant researchers were more than up to the task. Moreover, as indicated earlier, if a child is not comfortably collaborating in a given test situation, the test results will not be reliable anyway. This cynical, if you will, reason for upholding a strict ethics protocol, reading the signals of children's ability to perform a given task and feeling enjoyment while doing so, is nevertheless a very convincing argument for an adequate ethics protocol being put in place (Chaps. 6 and 8).[43]

The linguists on the team clarified their ethics protocol. They described the manner of encountering the children and acquiring their consent verbally, as well as how they confirmed consent via body language while in the test situation. Correspondingly, the education researchers articulated an ethics protocol on how to act during the interventions as instructors and while doing the video ethnography. Here, an *in situ* verbal and/or embodied consent of participation was required before filming and taking

photographs. All research staff wore blue T-shirts, which made them easily identifiable to the children.

This important experience from the ECA project, of being able to make a relational ethics work as an emulsifying agent of reciprocal learning and trust in collaborations, points to important possibilities for future interdisciplinary collaborations. In our view, ethics can work in this unifying way, regardless of whether the collaborations stick to a traditional layer cake design, applying a thick protective layer of frosting between layers of disciplines or one spread that holds the layers together. Or maybe, if managing to learn more from one another, pursuing the task of baking a one-pan layer cake.

Reciprocity and Mutual Learning in Multipan or Single-Pan Layer Cakes?

One central conclusion of this chapter is that what is at stake in all kinds of inter- and transdisciplinary inquiries is how various methodologies and practices can be understood to deal with values and power-producing status attached to knowledge at different scales. Scale intertwines with the embodiedness of individuals in face-to-face interactions in private and other spaces, with the local spaces of community, university, preschool, and school, which are also connected to the regional, national, and global realms in different ways. This makes it important to know more about one's own differences with others in encounters and the historicity and situatedness of specific forms of knowledge production in academia.

We believe that collaborations of reciprocal learning can be achieved in an atmosphere of mutual respect and in a spirit of knowledge sharing about scientific theory and history while understanding reality as *multiple*. Any phenomenon can be known in different ways, by means of various knowledge practices. Hence, any phenomenon can be narrated in multiple forms of storytelling or as stories told in different versions of the phenomenon. Each story or version is equally important and true to the phenomenon, but each in its own different way, as Mol concludes.[44]

Some unanswered questions remain: Is the ultimate message that we should aspire to bake a one-pan interdisciplinary layer cake? That is, should we pour the different knowledge practices (epistemologies and methodologies) into the same pan so as to allow them to do their own thing but also become connected with others and absorb some of the flavor
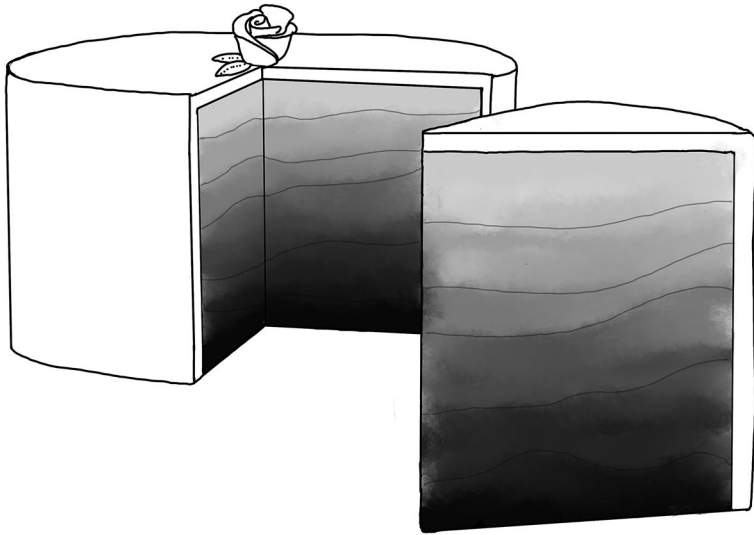
Fig. 9.3 A one-pan layer cake of collaborative and reciprocal interdisciplinary learning

(learning) from those others? Does this constitute an integration of two or more disciplinary epistemologies and, thus a construction of a transdiscipline of sorts? Is this what happened in the ECA project (Fig. 9.3)?

In conclusion, we do not wish to claim that what was enacted in the ECA project should be called transdisciplinary educational neuroscience research, especially in light of the foregoing discussion on the experience of epistemological encounters, which meant baking a number of different kinds of interdisciplinary layer cakes at different points in the research when specific practices were implemented. Rather, we baked multiple cakes and each of these cakes looked different due to the order of disciplinary/epistemological layers in the construction and what was placed on top. However, as we achieved more of a reciprocal and respectful exchange and learning when constructing the shared relational research ethics, we did actually manage to bake a version of what can be understood as a one-pan layer cake featuring relational ethics, which required many emulsifying eggs (or Aquafaba or chia seeds).

Notes

1. Callard and Fitzgerald (2015), p. 157; Fitzgerald and Callard (2015).
2. Parts of this chapter were presented in a keynote address in July 2017 at Manchester Metropolitan University in the UK during the biannual MMU Summer School, initiated and led by Professor Maggie MacLure. In this joint keynote address, Lenz Taguchi and the - at the time – PhD student Lena Aronsson presented the ECA project and Aronsson's PhD project as one example of qualitative research in education engaging neuroscientific knowing as focus-group interventions with preschool teachers (Aronsson, 2019; Aronsson & Lenz Taguchi, 2018). For this chapter, the major parts of this unpublished keynote address, which were written solely by Lenz Taguchi, have been revised.
3. Haraway's (2004) concept of figuration refers to tying together a complexity of components in an assemblage.
4. Smith ([1984]/2008, 1992); Tsing (2015).
5. For example, Fox Keller and Longino (1996); Kumashiro (2000); Stengers and Despret (2014).
6. Callard and Fitzgerald (2015).
7. Callard and Fitzgerald (2015), p. 99.
8. In Swedish preschools teachers with a higher education degree of 3 1/2 years, usually work together with high school educated educators in teams of three. At best there is one teacher per team who is the responsible person for pedagogical documentations, planning, and development. If there are more than one teacher, the responsibility is shared equally.
9. Frankenberg et al. (2019); Aronsson and Lenz Taguchi (2017).
10. Gerholm et al. (2019).
11. Haraway (2008), p. 4.
12. Compare Gunnarsson (2015); Lenz Taguchi (2017).
13. Haraway (2008), p. 4.
14. Mol (2002), pp. 9–21.
15. Daston (2019).
16. Smith (1992), p. 66.
17. Smith (1992), p. 66.
18. Freeman (2001).
19. Tsing (2015).
20. Haraway (2004).
21. Barad (2007), p. 245.
22. Compare Lenz Taguchi (2017) and Lenz Taguchi and Elkin Postila (2024).
23. For example, Stengers and Despret (2014).
24. Callard and Fitzgerald (2015).
25. Klein (1990).

26. Callard and Fitzgerald (2015), p. 84.
27. Callard and Fitzgerald (2015), p. 105.
28. Callard and Fitzgerald (2015), p. 84.
29. Callard and Fitzgerald (2015), p. 83.
30. Callard and Fitzgerald (2015), p. 84.
31. Callard and Fitzgerald (2015), p. 81.
32. Callard and Fitzgerald (2015), p. 85.
33. Haraway (2008) and Renold and Ivinson (2022).
34. For more on natureculture coconstitution, see Chaps. 2 and 3.
35. See Frankenberg et al. (2019).
36. Frankenberg et al. (2019), p. 189.
37. Barad (2007).
38. For an overview see Lenz Taguchi and Eriksson (2021); see also Chaps. 6 and 7.
39. For example, Cooke (2022).
40. See Frankenberg et al. (2019).
41. Callard and Fitzgerald (2015), p. 99.
42. Callard and Fitzgerald (2015), s. 113.
43. See Frankenberg et al. (2019).
44. Mol (2021).

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The Problem of Words and Language in Interdisciplinary Collaborations

The aim of this chapter is to discuss the problem of words and language in and across different disciplinary lexica and show how they can become an obstacle or a meeting point for mutual encounters of learning in interdisciplinary collaborations. Historian Carol Gluck and anthropologist Anna L. Tsing write in their book *Words in Motion: Toward a Global Lexicon* about how the choice of words, metaphors, and stories we tell with words and concepts shape our worlds. Tsing[1] writes:

> Words stabilize our understanding. They allow us to insert ourselves into discourses, institutions, and social relations.

With Gluck[2] adding,

> As words change, the world changes. This ancient conceit turns on the power of words to make worlds, but the world, we know, also has the power to change *words*.

Gluck points out how the materiality of the world itself equally shapes our spoken and written words, metaphors, and stories in both scientific and cultural practices. Hence, both Gluck and Tsing engage in the coconstitution of discourse and matter, that is, of discursive materializations and how materiality becomes productive of linguistic articulations.[3]

Articulations in the forms of words, concepts, and disciplinary lexica aid humans in making meaning, structuring, and organizing the world around us, as words to thereby live *with*, *through*, and *by*. Tsing and Gluck are inspired by the science theorist and physicist Thomas Kuhn. His 1962 book *The Structure of Scientific Revolutions* became one of the greatest bestsellers in the history of science. Kuhn writes that a revolution of new knowledge in the discipline of physics is constituted by changes in the lexicon that physicists use. His colleague, the science theorist Evelyn Fox Keller, has also written extensively on Kuhn. The nouns used in physics "carve up the world into taxonomic categories," as Fox Keller writes.[4] There can be no ambiguity about what is linguistically meant by such categories, although quantum physics, as one important trajectory of physics, nevertheless relies on the mathematics of uncertainty.

Fox Keller writes about the transformation that might occur when multiple meanings of a concept –what is referred to as polysemy – become a source of serious disagreement or rupture.[5] When multiple meanings create splits in the meaning making within a discipline, this usually leads to a situation where either one meaning displaces the other to the margins to be silenced *or* the community of researchers divides into two. Interestingly, scholars in biology don't seem to mind a fair amount of polysemy in biological debates as long as it doesn't severely affect what is pursued empirically. This general uninterest, says Fox Keller, in language and the construction of a shared lexicon among biologist scholars contributes to the present confusion in the public discourse around genes, genomes, and the relation between nature and nurture. In academia, this becomes a problem for those in other disciplines, who sometimes continue to discuss nature and nurture as distinctly separate. Hence, Fox Keller's mission as a science theorist has been to try to affect the generic discourse in such a way that it becomes more in sync with the empirical findings in evolutionary biology and biology at large, which is the story of naturenurture and gene–environment coconstitution (Chaps. 2 and 3). This is because, as anthropologist Marilyn Strathern has stated: "It *matters* what stories we tell to tell other stories with."[6] It matters for what we think and do in our daily lives and how we build our societies.

So what about the different lexica that revolve around children, in the educational and social sciences and the humanities? The qualitative methodologies most often used here rely on language and interpretations of what is observed or said, which is then articulated in written words. Moreover, these are disciplines that are almost entirely inter- and multidisciplinary and that internally often encompass multiple theories and methodologies to conduct various forms of inquiry. Given these multiple

epistemologies at work, one might conclude that this self-evidently comes with an openness to multiple meanings (polysemy). However, the norm seems to be internal conflicts around what theories and methodologies do the better job regardless of the research problem. The frictions among scholars within a discipline or across disciplines is even greater around disputes on whether to use methodologies belonging to naturalistic or idealistic epistemologies. As discussed in previous chapters, this led to a decisive divide between disciplines doing empirical inquiries (natural sciences, psychology, and economics) and disciplines doing primarily interpretive inquiries (humanities and social sciences) in the mid-twentieth century.[7] This main divide can be roughly traced to the 1950s divide between medicine and sociology discussed in Chap. 2.[8] It is also reflected in the subsequent divorce between the previously interdependent disciplines of psychology and pedagogy in the Swedish context, although both disciplines to this day still belong to the social science faculty (Chap. 3).

In the field concerned with inquiry *on*, *to*, *for*, *with*, or *by* young children, the divide between pedagogy and psychology has caused a split in how nouns such as *subject*, *individual*, *self*, *consciousness*, *mind*, *normal*, *deviation*, *power*, and *position*, for example, are defined. As a result, at least two different lexica with distinct epistemological underpinnings have been constructed. The meanings of these concepts affect scientific research practices, which sometimes spill over into everyday generic conversations in nonacademic settings, such as preschools, schools, and the media. Evidently, in interdisciplinary collaborations that entail both naturalistic and idealistic epistemologies, this will matter for how scholarly collaborations and relations are played out, at least it did a great deal for the interdisciplinary relations in the Enhancing Children's Attention (ECA) project.

In the next section, we intend to deepen the discussion on the problem of language and concepts in academia. The section that follows describes some aspects of the context of the ECA project as the main protagonist in this chapter, focusing on some of the learning processes during the planning of the overarching methodology: the randomized controlled trial (RCT). We describe the joint study trip to the Brain Development Lab at the University of Oregon during the fall of 2015. Moving into some more theoretical and conceptual trouble, the subsequent section focuses on the construction of the main pedagogical intervention (investigative socio-emotional group learning). The discussion revolves around the lack of experience among the qualitative researchers in constructing a reliable program theory and theory of change (ToC)[9] to be evaluated as part of the RCT research (see also Chap. 5). The chapter ends with some reflections on the topic of the problem of language.

The Problem of Language
in Interdisciplinary Relations

The lexicon of a particular research discipline becomes internalized over many years of use in higher education. If a concept in the discipline also has everyday, generic, or other disciplinary meanings, these will quickly fade out, as the "proper" professional toolbox becomes increasingly internalized and embodied. In line with Gluck's and Tsing's earlier quotes, cognitive linguist George Lakoff has said that the words and metaphors we use are not merely linguistic tools; they become universal, and structure our minds and the way we self-evidently think about the world.[10]

This corporealized automatization of a professional lexicon is generally considered a desirable goal of education. You become a professional when you know how to respond without thinking to words of specific kinds in your area of expertise. This applies whether you are a pilot, nurse, surgeon, or professional researcher. In the context of academia, you are, however, simultaneously expected to think critically and outside the box to push the limits of your own thinking and discipline. An automatization of language use might, then, constitute an obstacle. At worst, automatization as a habitual use of concepts might counteract the possibilities attached to meta-reflection, contrafactual thinking, and innovation. Either way, when scholars in an interdisciplinary collaboration express themselves as if a concept had merely one self-evident meaning, this disrupts the communication with scholars from other disciplines. In a context of interdisciplinary scholars conducting their inquiry in various ways that concern young children, this is especially true of concepts shared by developmental psychologists and critical scholars of education, such as *individual*, *individualization*, *socio-emotional self-regulation*, and *self-control*.

American biologist Lynn Margulis, who was most famous for her evolutionary theory of symbiosis,[11] writes on the problem of the situatedness of ideas and thought in academia.[12]

> Even if we lack a proper name for and knowledge of the history of any specific philosophy or thought style, all of us are embedded in our own safe "reality." Our outlooks shape what we see and how we know. Any idea we conceive as fact or thought is integrated into an entire style of thought, of which we are usually unaware.

Considering what we referred to earlier as the important formative years of undergraduate and further academic studies, we wish to share the continuation of the quote by Margulis[13]:

> Call the cultural constraints "trained incapacities," "thought collectives," "social constructions of reality." Call the dominating inhibitions that determine our point of view whatever you wish. They affect all of us, including scientists. All are saddled with heavy linguistic, national, regional, and generational impediments to perception. Like those of everyone else, the scientist's hidden assumptions affect his or her behavior, unwittingly, directing thought.

The way we see it, what Margulis refers to as the "proper name for and knowledge of the history of any specific philosophy or thought of style" in the first part of the quote is best understood in terms of how we articulate our methodologies for conducting research and analysis, that is, taking into account what our research practices are meant to produce and the conditions of how they achieve this production. This corresponds to what Kuhn called *methodological relativism*,[14] which is always a matter of fact for any kind of knowledge production. One kind of knowing necessarily cannot encompass all other ontologically given realities of a phenomenon. It can only reflect the particular knowledge that has been produced under specific circumstances of a study based on a chosen theory of knowledge (epistemology). Unseen to us or not, "the scientist's hidden assumptions affect his or her behavior, unwittingly, directing thought," as Margulis concludes in the preceding quote.

You might think that discussing and making visible these hidden assumptions and the ambiguousness of words, language, and metaphor in research should be the hottest possible topic of academic discussions. One could only wish this was the case! On the contrary, what is of much greater interest to scholars is their reward for producing what their own field recognizes as valid knowledge and, of course, what is expected and rewarded by specific journals, where publication can advance one's career.

If the cynicism revealed by the preceding comment were true, Darwinian competition and the survival of the fittest – *which is seriously contested in contemporary biological evolutionary theory* – might not be a farfetched

theory of the evolution of knowledge and career making in academia. However, researchers and scholars in collaboration and "partner[s] of symbiosis, fellow symbionts [that] abide in the same place at the same time" is an equally valid description of what is actually *also* going on in academia, according to Margulis.[15] So perhaps an outdated Darwinian and a more up-to-date Margulisian description of the ontology of researcher collectives in action are in fact simultaneously valid as descriptions of what goes on in academia? The interdisciplinary bakery that we described in the previous chapter came to constitute a space of what we would later identify in terms of achieving the first step toward an ontological relationality of the Margulisian kind in the baking of the one-pan layer cake (Chap. 9).[16] In this space, different forms of knowledge and knowing in encounters produced frictions between scholars in their respective situated sociohistorical and material realities. In these frictions, however, new forms of experiences, knowing, and doing inquiry did indeed evolve.

Placing ourselves, once again, in the ECA project's interdisciplinary bakery, and focusing specifically on words and language in this chapter, we return to the need to bake different layer cakes during different phases of the project. We will also reactivate thinking in terms of scale. In the previous chapter, we discussed how some forms of knowledge tend to be viewed globally as producing general, universal, and normative forms of knowing that can predict educational outcomes, preferably based on "gold standard" methodologies such as RCTs. Simultaneously, other forms of knowing might dominate on the local scale of the nation, university, or department (Chaps. 4 and 5). This complicates the power balance of interdisciplinary research in Sweden, perhaps more than it does in other national contexts. This is because the postdevelomentalist, critical, and constructivist forms of knowing have a lot of leverage in the Swedish academy when it comes to research involving children.[17] Interestingly, this does not immediately make epistemological relations more equal, as one might think; it merely generates other kinds of friction.[18]

Before we continue, we wish to mention another important angle of the power relations between different disciplines. It is well known that scholars in the "lesser" valued humanities and social sciences struggle with an underdog positioning in relations with their colleagues relying on naturalistic methodologies.[19] What is less known is that the generally higher valued research cultures of naturalistic and realist epistemologies have become equally offended when frictions arise between the *Two Cultures*, to quote the title of C.P. Snow's 1959 book.[20] They have asserted that

they are equally subjugated to the knowledge claims of what they call the academic left and/or constructivist and postmodernist theories and methodologies. Proponents of this view are critical of how the alleged academic left aims to produce theories and methodologies that are alternatives to those of the natural sciences.[21] But why are natural scientists so offended by the production of alternative social science theories and methods, you might ask? Why the need, for instance, to disparage alternative and sometimes critical accounts of the natural sciences[22] and entire bodies of work by certain philosophers,[23] alleging that they are not knowledge productions at all? There are, of course, several reasons for this. Two possible answers are offered by biologist Edward O. Wilson and science theorist Isabelle Stengers.

Wilson suggests that it has to do with a historically based desire among scholars in the natural sciences, such as biologist Paul Gross and mathematician Norman Lewitt, to formulate a comprehensive meta-theory of everything: *the one*.[24] This quest is simply disrupted by claims about the need for critical and other forms of inquiry that do not fit into their vision and mission. Stengers' answer is a bit more complex. She refers to how naturalistic scholars used to treat critical scholars with "amused scorn," until they learnt that ANT scholars, such as Bruno Latour,[25] could argue that science is "*nothing but* a practice like any others."[26]

So what is the problem? Talking about the natural sciences as hierarchically equal to any other practice, as in "*nothing but…*," is what caused anger to replace irony, writes Stengers. Alternative ontologies, such as ANT and critical epistemologies, were therefore downgraded to be understood as irrational outbreaks of arbitrariness, relativism, and equating scientific truth to common sense. In the present discussions, these ANT and critical theories are even sometimes connected to political fake news and alternative facts. The terrible genie has been let out of the bottle, as Stengers concludes.[27] The suggestion of understanding science basically as a social practice of agreements and facts as results of relations of force seems to have made it seem even more important to natural science scholars to enlarge the rift between their disciplines and what is simply referred to as unscientific commonsense thinking, according to Stengers.

As a consequence of the preceding points, it is not too farfetched to argue that the persistent naturalistic standard epistemological form of knowledge production constitutes a unwavering backdrop in academia at large, even in Sweden. A naturalistic standard epistemology can be seen as a stable, unfailing truth generator used to fence off occasional emerging,

local, and critical forms of inquiry and alternative methodologies. Expressed in other words, despite occasional shifts in epistemic dominations or local positionings in the humanities and social and educational sciences, an underlying awareness of what *really* counts as scientific knowledge is nevertheless always present. Thus, a hierarchy of epistemologies and ontologies persists and is reflected in potentially all interactions among academic scholars.

The preceding discussion suggests that there will undoubtedly exist tension especially among scholars who engage in interdisciplinary collaborations. There will be scale values in relation to different forms of knowledge practices, which relentlessly cut into the embodied minds and emotional experiences of individual researchers' bodies; regardless of their preferred epistemological lexicon. Encounters with others' epistemic uses of words, concepts, and ways of expressing themselves will sometimes affect individual researchers in ways that might make it difficult to keep the professional and personal separate.

Encountering the Context of US Preschools and Neuroscience Testing

In this section, we will describe the encounters between Swedish educational researchers and research methodologies and preschool settings in the US state of Oregon. We provide more details on some of what took place during the visit to the Brain Development Lab at the University of Oregon, where we went to learn how to do brainwave recordings (EEG/ ERP) as an important part of the ECA project (Chaps. 5 and 8).[28] In relation to the previous chapter about the interdisciplinary bakery, the visit to Oregon was crucial for the baking of the first version of the layer cake. The educational researchers were familiar with neither the RCT methodology and brainwave recordings nor the US preschool context. As educational researchers, we *un*learned and *re*learned amid the frictions between our own biases and conceptual understandings as we encountered the experience and expertise of brainwave techniques and Head Start preschool practices and their teachers and educators.

In line with the most common ways of constructing interdisciplinary educational neuroscience research, the Oregon team consisted of cognitive psychologists working directly with specially trained preschool teachers, as opposed to educational researchers.[29] Meeting the whole team and participating in the in-service training with a larger group of Head Start

teachers made visible a seemingly taken-for-granted, top-down relation of applying and translating cognitive psychology directly to teachers in specific practices. This was in accordance with how educational neuroscientific research is described in the mainstream neuroeducational research literature[30] (Chap. 4). The researchers gave very inspiring lectures about the plasticity of the brain. This was successfully tied to specific pedagogical practices with children during preschool hours and – in addition –suggestions to parents on what to do as follow-up exercises with their children at home. On what could definitely be seen as a bidirectional bridge between science and practice, the experiences of teachers from working with prescribed practices were also actively considered in (re-)shaping the research practices.[31]

The Swedish education researchers were impressed by the ways in which the researchers took advice from teachers. The Oregon teachers were willing to simultaneously take up, adapt to, and outspokenly problematize the scientific input provided by the Oregon researchers. The aim here, as the aim of the Swedish ECA project, was never to implement and adopt practices just for the research but to change practices in a long-term perspective.[32] Nevertheless, the unquestioned top-down, science-practice relation of applying science to practices constituted a friction in the minds of the Swedish educational researchers. This is due to the taken-for-granted pattern of decentralized governing of preschools in the Swedish context, giving the teachers and educators a great deal of agency and power over their own practices. An aspect of this agency is also that university educated teachers work with high school educated educators in teams which are basically non-hierarchial, sharing all tasks throughout the day including teaching-practices, although the teachers have some formal responsibilities in relation to the National curriculum.[33]

The educational team members on the Swedish team took home useful experiences in relation to the planning of the interventions for the ECA project. This entailed suggesting detailed tools and instructions for, in particular, the main group-based pedagogical intervention (SEMLA, see Chap. 5). Such tools, we learned, needed to be clearly motivated by prior research findings as part of a program theory and ToC,[34] before and during negotiations with teachers and educators around how to do the intervention. These tools and instructions should correspond to the active mechanisms of learning anticipated to be enhanced by the pedagogical interventions and evaluated (measured) in the pre- and posttesting (Chap. 5).

The details in this chain of correspondences between teacher–child practices, a ToC, and evaluation methodologies proved extremely meaningful for the educational researchers to envision and articulate. This was especially true for establishing the criteria for evaluating the fidelity of the implementation of the main intervention based on ToC by varying degrees of application of the key pedagogical strategies. What was articulated based on the ToC materialized as a (hands-on) instructive handbook for the SEMLA intervention. It pointed out the relations between teachers' strategies of scaffolding and how it was thought to affect children's curiosity, attention, and learning in different ways. What was needed in order to perform an RCT in terms of good-quality experimental science could, in fact, *also* be used as tools for in-service training, further discussion, and revisions with educators and teachers. In this way, educational researchers were able to connect and entangle knowledge from educational practices and pedagogical investigations with knowledge from the cognitive and developmental sciences for the SEMLA intervention.

Conceptual Frictions in the ECA Project

We wish to start this section by briefly mentioning some of the overall (feminist) irritation regarding a few concepts that are central to RCT design. Then we will turn to an example featuring some central concepts that caused frictions in the interdisciplinary relations.

Feminist science scholars have always had a problematic and double-edged relationship with the natural sciences, as described in Chap. 2. What was called the first wave of academic feminist critiques of science and academia constituted a critique of the illusion of the "view from nowhere" underpinning the idea of objectivism.[35] It was also a critique of the often masculinist and/or sexist metaphors of scientific lexica, as we will exemplify below. However, as science theorist Donna Haraway, philosopher Helen Longino, and others conclude, feminists cannot afford to give up on the real material world, scientific facts, and knowledge about the body to make true statements about the reality of women's situated lives, their oppression, and their inferior social status.[36] The political scientist Susan Hekman[37] sums this up by stating: "Without the ability to make true statements about women's lives, feminism, like science, makes little sense."

And yet, it can be downright irritating to hear metaphors used in talk about empirical research that draw on imagined warfare of battling viruses, sickness, and invading enemies, or enemies in conquest to be eliminated.

We need to recall here the historical circumstances that produced such lexica. These are indeed still valid, as issues of security and health still constitute humanity's most decisive threat, although no due to self-inflicted conflicts, capitalist races to fortune, and global warming. All the same, when we talk or write about setting up a RCT, we use concepts such as *intervention*, *test battery*, *trial*, and *treatment.* For the researchers on our team who were trained in psychology and linguistics methodologies, these concepts are merely conceptual tools, unproblematic and taken for granted. But for educational researchers trained in the Swedish academy of pedagogy or early childhood education, these concepts are simply not part of the professional vocabulary. And if they are, they are known from a context of critique of naturalistic and realist epistemologies, that is, what *not* to do (cf. Chaps. 6 and 8).

Either way, these words risk triggering negative emotional responses in scholars who do not take them for granted as part of their research practices. They might activate a mental imagery of invasion, intrusion, forced interference, attack, being treated (or not), ordeal, hardship, trouble, worry, and distress, but also legal prosecution, being on trial as a suspect or judged, and so forth. Hence, what one might think of as an everyday "innocent" professional vocabulary that is used when planning and enacting research apparatus caused emotional discomfort for some researchers participating in the ECA project. For other team members, it could instead be perceived as a demonstration of scorn when the same vocabulary was used in ironic jokes. Regardless, the emotions evoked around this vocabulary risked undermining the possibilities of reciprocal collaboration. The notions and emotions evoked thus needed to be put on the table and made visible.

Correspondingly, the meanings of concepts such as *individual*, *individualization*, *self-regulation*, *self-control*, *socioemotional*, and *mentalization* evoked very divergent meanings depending on scholarly training and background. The first heated discussions around these concepts occurred during casual conversations among team members during the Oregon visit with the seven core team members while walking to or from lunch or dinner at some restaurant. This is when we, in an embodied sense, first recognized how important the theoretical undercurrents in our respective conceptual lexica actually were. It confirmed what Fox Keller, Gluck, Tsing, Lakoff, and Margulis all attested to in their respective quotes earlier in this chapter. In short, this is when developmentalist and postdevelopmentalist lexica confronted one another. Today, neither of us recalls how

these discussions went. However, and actually in line with what cognitive neuroscience has shown about learning and place, some of us remember the exact geographic places where discussions started to become more emotionally charged, as we walked along a riverbank or sat in a restaurant over a meal.

Let us narrate an example of what these heated discussions revolved around. We start in the entanglement of generic and academic discourse of a concept that all of us use every day. Consider how we in a private and generic fashion talk about an *individual*, the *self*, or the simple noun *I*? We unquestionably talk about experiencing ourselves as individual selves, separated from other individual selves, despite our interdependencies. We experience an "inner self," not seldom lonely or misunderstood by other people in the "rest of the world" of other selves. When we are not feeling like "ourselves," we say that we do not feel "whole," or "together." Instead, we feel "incoherent," "unstable," "out of our element," "scattered," "in pieces," "dispersed," and in need of "pulling ourselves together" to "become ourselves" again – to become "whole."

Extending from this generic lexicon, cognitive and developmental psychology have constructed a scientific lexicon around the individual self. This lexicon points to mechanisms referred to as practicing strategies of *self-regulation* and *self-management*.[38] These are about making oneself aware of the mechanisms by which one can gain control of oneself, corresponding to the everyday expression of "pulling oneself together." In a discussion on what pedagogical strategies might enhance children's attention, these concepts were immediately mentioned. In the Oregon Head Start preschools, children were encouraged to learn how to calm themselves, to take a deep breath, perhaps express their disappointment or feelings of hurt, and then be guided to think of an alternative way of grappling with the situation.[39]

The simple behavioral strategies described earlier are about exercising one's executive functions, developing mainly in the frontal lobe of the embodied brain.[40] Executive functions develop at an extremely high speed during a child's earliest years. A toddler is more or less automatically compelled to practice, learn, and embody such strategies in the context of other social beings.[41] Self-regulatory practices and attempts to understand how others feel and experience the world, what is sometimes referred to as *theory of mind*, are understood as desirable practices. *Mentalization* is a concept central to the skills involved when learning to understand both one's own and others' mental states, that is, to comprehend one's

intentions and the intentions and emotions of others. The development of mentalization is said to depend upon a child's secure attachment to at least one significant adult during the first years of life.[42]

These skills that can be practiced and learned in preschool, and elsewhere, are grouped together in terms of *social emotional learning*.[43] This concept is, however, often defined as the self-monitoring and self-regulation of thought and action by inhibiting the expression of inappropriate emotional responses in a specific social context, but it also refers to the ability to empathize with others and to metacognitively predict consequences, plan ahead, and be patient.[44] From a developmental scientific point of view, becoming an individual self thus entails learning to become aware of one's own feelings and thoughts and how these connect to actions (metacognitive thinking) and how others might feel or think (theory of mind and mentalization). The extent to which children and youth have been allowed to practice these abilities has been said to predict future outcomes of further education and adult life.[45]

And yet, why did this kind of talk about explicit teaching practices of socioemotional learning make the educational team members shrug in aversion? Why is this developmental psychological lexicon literally frowned upon in a majority of academic contexts of pedagogy and early childhood education in Sweden? The same could be said of some international critical research communities referred to in Chaps. 2 and 3 as well. This is because this is considered a way of talking in accordance with a developmentalist lexicon (Chaps. 2 and 3). This means that these words come with, and are thereby thought to materialize, what is critically understood as subjugating power-producing practices in early childhood, whether in the home or in preschool or other social institutions.[46] Critical psychologist Nikolas Rose urged academics, teachers, educators, and other stakeholders to critically scrutinize what he called the "psycho-pedagogy discourse" in his 1989 book *Governing the Soul: The Shaping of the Private Self*.[47]

Let us now circle back to what was laid out in Chap. 2. The construction of an "I," in critical theory and critical psychology, is understood as a cultural construct that risks fostering a damaging individualism as an effect of the "psycho-pedagogy discourse," starting with preschool. In accordance with such thinking, the Swedish social science and educational academic discourse has, since the 1990s, been preoccupied with a strong interest in theories and philosophers critiquing a modernist and humanist idea of the individual self and the practices of individual freedom and choice.

Within the realm of the previously described critique, *Cartesianism* thinking[48] is thought of as laying the foundation for Enlightenment humanist ideas, such as that of the eighteenth-century philosopher Immanuel Kant's idea of *sapere aude*, that is, having the courage to use your own reason, to think for oneself, individual choice, and freedom. Rose has written several texts about how this freedom that comes with modernity, which emerged during the European Enlightenment, constitutes an illusion that we are willing to subjugate ourselves to via self-regulatory and self-management practices. Individuals are thus ultimately governing themselves by their own desires for freedom, happiness, and individual fulfillment.[49] We wish to quote some of Rose's words about self-regulation, for readers unfamiliar with this critique, to shed light on some of the fears conveyed in terms of a subjugating power production connected to a concept such as self-regulation. Rose writes about how life itself has become a skilled performance by learning self-regulatory practices from psychologists who are the experts in this area. He says:[50]

> These progressive principles [of self-regulation] are doubled-edged. They institute, as the other side of their promise of autonomy and success, a constant self doubt, a constant scrutiny and evaluation of how one performs … The self becomes the target of a reflexive objectifying gaze, committed not only to its own technical perfection but also the belief that "success" and "failure" should be construed in the vocabulary of happiness, wealth, style and fulfilment and interpreted as consequent upon the self-managing capacities of the self.

Developmental psychology, according to critical theory, is thus thought of as enforcing a developmentalist idea about a generalizable development. As a consequence, this calls for critical *post*developmentalist inquiries of how subjects are formed and molded from within the social fabric of self-regulating norms, in specific sociohistorical contexts.[51] The aim of a critical postdevelopmentalist approach thus means critically engaging with ideas having to do with the emergence of scientific, generalizable knowing about children's development and ideas about an independent and coherent human subject, that is, critically examining the performative and materializing words in the lexicon of Enlightenment humanism.[52]

In what was exemplified in the preceding discussion, the frictions between two very different views of children, children's development, and what is supposed to be going on in research and education can be clearly sensed. These differences would also surface in discussions among team

members in the interdisciplinary bakery of the ECA project, especially during the period when the overarching RCT was being planned and designed. What we learned, both as an interdisciplinary team and as individual team members, was that we needed to first acknowledge the mere presence of these different epistemological meanings in conversations. Second, we needed to recognize that a colleague might not understand the meaning you yourself would make of a concept and therefore did not deliberately use it to produce power. Third, we learned not only why it was necessary to understand why others use a different kind of lexicon but we also that we need to deconstruct our own lexicon. Fourth, we learned to try to separate out the context in which a particular concept was meant to do its job in the best possible way. Lastly, we needed to try to separate the person using the words in a specific context from the negative emotional bias we might have in relation to the concept (see also conclusions).

STAYING AND MAKING WITH THE THEORETICAL AND CONCEPTUAL TROUBLE

In this last section, we wish to discuss some of the internal theoretical battles and learning processes among the educational researchers. These battles with our own and others' lexica would lead to an understanding of the need for a multiepistemology approach to children's learning and, subsequently, to doing interdisciplinary research. We wish to tell a short version of the story of how two of the educational researchers[53] constructed the main intervention based on multiple theories and multiple conceptual frameworks. To set out the context of the onset of the process, let us offer a brief description of how a "typical" Swedish early childhood educational researcher's mind operates conceptually.

Typically, educational researchers in Sweden are dedicated to various sociocultural and post-theories and working within a critical postdevelopmentalist framework, as described in the previous section and Chap. 3. The focus is mainly on theorizing about aspects of teachers' and educators' approach to children, that is, the ways of addressing and approaching the child as part of the discourse on children or the view or image of the child. This image is connected to the image of knowledge and how a child learns within – preferably – the realm of a playful and explorative learning environment. The focus in studies of a wider postdevelopmentalist framework is most often on material ways of organizing and enacting practices,

as preconditions for children's development and learning.[54] These studies might also focus more specifically on children's interactions with and explorations of matter and more-than-human agents as intra-actions for learning.[55]

This, in Sweden, dominant early childhood education research approach constitutes a child perspective that focuses on the material, environmental, and immaterial (ideas, notions, approaches of adults) conditions for children's development and construction of learning and subjectivity.[56] The focus is thus not on inquiring into individual children's developmental skills or specific objects of learning. Sometimes case-study examples of a group of children's learning are given with examples of individual children's statements to exemplify what the group has done, learned, or experienced. In the national context and scale, this is in line with what the curriculum describes in relation to what kind of evaluations are recommended in preschool. Hence, early childhood education research is performed along the same lines of thinking as those used to support teachers' and educators' thinking about how they might organize their practices based on qualitative scientific studies and proven/documented professional experience.

It goes without saying that this diverges from studies in the developmental sciences. Such studies are rather designed precisely to target the embodied *mechanisms* of development and learning. This entails a focus on the involved materialities in interactions with children's bodies, and the embodied brain, sometimes on the level of the scale of neurons firing in specific areas of the brain as a result of learning interactions. With the addition of the cognitive neurosciences, the focus is thus on the material transformations that might take place as an effect of interactions in learning environments under specific conditions as some mechanisms are targeted in the research.[57] Or, put differently, the developmental sciences focus on how individual children respond (are affected) as individuals to a specific intervention, given the material-discursive environmental circumstances within and outside of each individual. From this, the mean response on the group level of children in a certain age group, or other chosen variable, can at best be calculated and perhaps generalized to a similar population of children in similar circumstances.[58]

For the ECA project, all individual pre- and posttesting results were analyzed on the group level. However, for the main group-based collaborative learning intervention, the aim of the pedagogical strategies was to target and affect each individual child while working with smaller groups

of children. This shift of focusing simultaneously on the group and the individual, rather than just the group by itself, hoping that individuals will learn as a consequence, was shared by all members of the research team and the teachers and educators. Hence, the ToC that underpinned the intervention and was transformed to hands-on instructions of how to plan and interact in the learning sessions with groups of children also entailed goals of enhancing individual children's development of attention, language, mathematics, and socioemotional behavior (though tested and measured only on the group level). Documentation of individual children's discoveries and socioemotional and language development during the explorative learning sessions was also produced by the teachers and educators themselves, with support from the researchers.

To be able to establish a ToC in accordance with the aforementioned goals, we asked ourselves how we might combine and put in relation and friction theories that deal as much with the embodied *inside* as a consequence of the natureculture interactions (using naturalistic epistemologies), as the theories that deal more explicitly with the natureculture *between* the child and its social and material environment (using what we refer to here as idealist and posthumanist epistemologies).

What was revealed and learned during this work was that some of the, in Sweden, dominant postdevelopmental research approaches, such as an agential realist approach influencing practices, already entailed an incitement of looking more closely into the embodied mechanisms of learning in terms of individual children. During the last decade, the Swedish early childhood education research field had epistemologically moved – at least in part – from focusing entirely on what is *between* in terms of the social (predominantly sociocultural and poststructural) to becoming more interested in material-discursive intra-activity, influenced by Karan Barad's agential realism and Deleuzian philosophy.[59] This meant that there was already, in theory, a potential possibility and openness to epistemologically moving from the sociocultural and discursive constructions of bodies in the preschool classroom to an onto-epistemological agential realism of the processes taking place,[60] that is, an *inside-out-and-outside-in* kind of process: a natureculture coconstitutive process. Hence, the vocabulary had been altered in early childhood education in a manner that also overlapped with what was going on in the developmental science approaches.[61] However, as revealed by the discussed critique, these epistemological insights were still merely used to conduct inquiry into the *between* of children's bodies and matter, not involving the matter of the child's body on

the biological, molecular, and cellular scales.[62] Or, to put it differently, the child's skin nevertheless remains a border that cannot be crossed due to a remaining fear and aversion (cf. Chap. 2).

How, then, is it possible to seriously include knowledge from the biological, developmental, and cognitive neurosciences in an onto-epistemological kind of inquiry, that is, in an inquiry that shows the mutual implications and coconstituting effects of natureculture intra-actions in preschool? This is where we suggest following in the footsteps of what feminist science has always and repeatedly claimed and using multiple theories and methodologies, in relation, friction, and combination, that is, not to integrate them, at the risk of constructing yet another grand theory – *the one – and* at the risk of losing what each methodology is doing well already in its own limited way. Thus, walking in the footsteps of feminist science scholars such as Haraway, Fox Keller, Margulis, Tsing, and others, we desire to construct either a "cartography" or a temporary playful and explorative "piling" or "stacking" of multiple theories that might produce something important together in their inevitably frictions, as part of what we in this book will discuss further in terms of ontological and epistemological relationality (see more in conclusion).[63]

Concluding Reflections

For some of the educational researchers in the ECA project, Audre Lorde's[64] words kept ringing in our heads, especially during the first phases of the project: "*The master's tools will never dismantle the master's house.*" In the encounters with some of the conceptual and, thus, theoretical and methodological mismatches in the conversations we had, some of us felt discouraged in the same ways that Haraway[65] and other academic feminists have identified. Hence, interdisciplinarity was materialized, some nights, as sweaty anxiety and waking up with fear of, for instance, how to best justify the testing to preschool staff, families, and colleagues. And why introduce tests *at all* as we as dedicated feminist poststructuralists had actively been involved with *resisting* during a major period of our careers? That resistance has actually paid off, according to the logic of critical theory, in the field of early childhood education, as discussed earlier. (But it also came with a cost; see introduction and Chap. 5.)

As the work progressed and we as educational scholars learned more and more about other epistemologies and why the overarching RCT methodology needed to be applied in this specific way, something changed.

In this work, we learned more about our *own* "ontological, epistemological, and political blockages" inherent in our own disciplinary research practices, as cited earlier from Callard and Fitzgerald.[66] Slowly we came to appreciate what was possible to know about children's learning and development from, and together with, other forms of knowledge. *We experienced the gains of the multiple.* As researchers we became more, rather than less, differentiated in this process.[67] However, this applies not just to social science and educational researchers but to all scholars in the academy.

Notes

1. Gluck and Tsing (2009), p. 11.
2. Gluck and Tsing (2009), p. 3.
3. Karen Barad (2007) theorized on this in terms of material-discursive intra-action.
4. Fox Keller (2002), p. 528.
5. Fox Keller (2002), p. 528.
6. Haraway (2016), p. 12. The quote by Haraway with reference to Marilyn Strathern (1990).
7. Compare Stengers (2023) and Mol (2002).
8. See Mol (2002).
9. Hoffmann et al. (2014).
10. O'Gieblyn (2022), p. 23.
11. Symbiosis is the process of mutual communication and adaption between species, which challenged the dominant Darwinian idea of competition and survival of the fittest. See Margulis (1998).
12. Margulis (1998), p. 3.
13. Margulis (1998), p. 3.
14. Kuhn (2022).
15. Margulis (1998), p.
16. e.g. Lenz Taguchi and Elkin Postila (2024).
17. Pontoppidan et al. (2018).
18. When we use the concepts of scale and friction in this chapter, we rely on Tsing's (2004) and (2015) accounts of these concepts in her books.
19. Compare Chap. 9 and Callard and Fitzgerald (2015), who describe this relation in a nuanced way.
20. Snow (1959).
21. Gross and Levitt (1997).
22. See for instance the alternative accounts of the scientific laboratory by Bruno Latour and Steve Woolgar (1986), and what emerged as an alternative relational ontology of understanding the production of knowledge

known as Actor Network Theory. Which also had an important impact on Social Science Studies, and Science Technology Studies, etc.

23. The French philosopher Jacques Derrida stands out as a philosopher that has been targeted in this fashion, and accused of being not only incomprehensible but dangerous.
24. Wilson et al. (1998).
25. Latour et al. (1986).
26. Stengers (2023), p. 13–14.
27. Stengers (2023).
28. The Brain Developing Lab at the University of Oregon was founded by the late Professor Helen Neville, had been doing cutting edge research on small children's auditive/auditory selective attention and inhibition ability (EEG/ERP) for many years in close collaborations with children, families, teachers and educators in Head Start preschools.
29. e.g. O'Neil et al. (2019).
30. e.g. Howard-Jones (2014); Della Sala and Anderson (2012).
31. e.g. O'Neil et al. (2019).
32. Although the research with the Brain Lab was performed as an RCT, the mindset of the involved teachers, educators, and researchers were, to our Swedish understanding, more in line with what we would later identify as doing a collaborative Theory of Impact study (see Fisher et al., 2020).
33. e.g. Aronsson and Lenz Taguchi (2018).
34. Hoffmann et al. (2014).
35. e.g. Haraway (2004); Harding (1990); Hekman (2010).
36. e.g. Haraway (2004); Longino (1990).
37. Hekman (2010), p. 66.
38. Goswami (2019).
39. e.g. Neville et al. (2013); Stevens et al. (2009).
40. e.g. Goswami (2019).
41. e.g. Goswami (2019).
42. e.g. Cozolino (2014).
43. Durlak et al. (2011).
44. Durlak et al. (2011); Goswami (2019); Siegel et al. (2021).
45. Moffitt et al. (2011).
46. E.g. Burman (2016).
47. Rose (1989), p. 238.
48. Cartesianisms has been constructed as a philosophical thinking building on the seventeenth century mathematician and philosopher René Descartes. See also St. Pierre (2000).
49. Rose (1989).
50. Rose (1989). p. 239.
51. e.g. Edwards et al. (2009).

52. St. Pierre (2000).
53. Hillevi Lenz Taguchi and Anna Palmer.
54. e.g. Pacini-Ketchabaw (2011).
55. e.g. Lenz Taguchi (2009).
56. Pramling Samuelsson and Sheridan (2009).
57. Lerner et al. (2015).
58. Cartwright (2009).
59. Lenz Taguchi (2009); Youdell and Lindley (2018).
60. Compare Hekman (2010).
61. Youdell et al. (2020).
62. Lenz Taguchi and Eriksson (2021); Bodén and Joelsson (2023).
63. Lenz Taguchi and Elkin Postila (2024).
64. Lorde ([1984] 2007), p. 110.
65. Haraway (2004).
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Conclusion and a Possible Displaced Postdevelopmentalism

Our primary and overarching aim with this book was to make the case for researchers to conduct relevant forms of inquiry for the benefit of children, whether the research is done *on*, *to*, *with*, and/or, *by* children. The position taken here with respect to research involving children applies to many different disciplines using multiple methodologies and forms of knowing and without loosing sight of the fact that those disciplines produce their own knowledge using their own methodologies. With this as our starting point, this concluding chapter will grapple with the question of whether or not a natureculture coconstitutive approach to what can be understood as post-developmentalism is possible and, if so, will present some preliminary thoughts on how. The question is directed at the field of child development, childhood, and early childhood education studies, and we especially address the critical, posthumanist, and new materialist trajectories within this field. These trajectories frequently use or affirm the currently dominant understanding of postdevelopmentalism as a critique of developmentalism (Chaps. 2 and 3). This most likely means that these trajectories have not (yet) seriously considered whether or how knowledge from the developmental sciences might be of importance for the phenomena of their own inquiry. Therefore, an important question is what a displaced approach to postdevelopmentalism might entail, both in academic inquiries and in terms of early childhood education practice in preschools while constructively considering and putting into an encounter multiple forms of

knowledge from various research disciplines and other forms of knowing, from art, poetry, and for example voices from first-person experiences.

The first section of this conclusion starts with a discussion on how the understanding of postdevelopmentalism in the dominant critical trajectory in the field can be displaced (Chap. 3). The next section then considers what such a displacement might entail. It starts out reminding the reader that the developmental sciences (in the biological, cognitive, and neurosciences) are already engaged in what can be understood as natureculture coconstitutive postdevelopmentalism in their various disciplines (Chaps. 2 and 3). We then argue for the possibility of thinking about both reality and knowledge as multiple. We further introduce Isabelle Stengers' account of a slow science and Anna L. Tsing's patchy epistemic piling practices and show how these might connect to the Enhancing Children's Attention (ECA) project.

In the last section, we discuss what happened after the ECA project ended. We mention the various new interdisciplinary research projects that were made possible as a consequence of this project and, more specifically, discuss one collaboration with educators that developed around the main pedagogical group intervention (SEMLA) (Chaps. 5 and 10). All of these projects are collaborative inter- and transdisciplinary projects on matters of concern shared by teachers and educators and stakeholders and of relevance *for* children. We bring the book to its conclusion by sharing our reflections on the lessons learned from our experiences in the ECA project.

Displacing the Concept of Postdevelopmentalism

Previous chapters of this book presented the concept of postdevelopmentalism as a critique of developmentalism.[1] Postdevelopmentalism can be characterized as having emerged from a place of fear (Chap. 3). This fear sprang from an aversion among Swedish educational academics, teachers, and educators to the developmentalist normalization and subjugation of practices in child care and preschool that might follow. So, how can this dominant meaning making of postdevelopmentalism be displaced? How can postdevelopmentalism be reconceptualized in such a way as to consider the importance of knowledge produced in the cognitive and developmental sciences, but without losing its critical approach?

If we aspire to displace and reconceptualize the concept of postdevelopmentalism, let us consider what the prefix *post-* in *postdevelopmentalism* might help us do. *Post-* means *after*. For most critical posthumanists, *post-* refers to

something that descends and emerges from something else. As a prefix, *post*-causes the word to self-differentiate from what it means. The meaning then becomes *dis*placed rather than *re*placed. In other words, postdevelopmentalism as a concept needs *not* to be understood as being in a negative relation to developmentalism or as being an *anti*-developmentalism.

As we saw in Chap. 2, feminist science theorists, such as Karen Barad, Evelyn Fox Keller, Donna Haraway, Helen Longino, Lynn Margulis, Marilyn Strathern, Isabelle Stengers, and others, understand that what comes *after* includes and depends on what came before. This is key to both Barad's agential realism, to a processual thinking of development, and to process philosophy (Chap. 3). Postdevelopmentalism, in its critical meaning, need not be about a disownment but rather seen as being dependent on developmentalism for its displaced meanings. Before we get to our discussion of how such a displaced postdevelopmentalism might be understood, let us turn to Barad and the way she as a physicist has come to terms with the consequence of knowledge production inside the discipline in which she was trained.

In her book *Meeting the Universe Halfway*, Barad[2] poses an imperative question to herself as a physicist. She asks how there might be a way for her, following the construction of the atomic bomb and its detonations at Hiroshima and Nagasaki, to continue doing physics responsibly and differently. She answers her question by applying the insights from physics itself to undermine its entanglement with destructive, sexist, racist, and colonizing practices.[3] Drawing on Barad, in the field of child development, childhood, and early childhood education, with its dark historicity that connects biology and behaviorism to racist and colonizing practices (Chap. 3), *and* with an interest in including knowledge from the developmental sciences, we need to ask ourselves: How would one include knowledge from the developmental sciences responsibly, sensibly, and constructively in this field?[4]

Toward a Processual and Coconstitutive Postdevelopmentalism

With a focus on the critical, posthumanist, and new materialist trajectories of research in the field of child development, childhood, and early childhood education, we argue that we need an approach to postdevelopmentalism that isn't merely critical of developmentalism but inclusive and open to multiple forms of knowledge. What we suggest is a postdevelopmentalism

that doesn't put nature and nurture, or nature and culture – *and, thus, not naturalistic epistemologies and idealist epistemologies* – in opposition to one another. Instead, we argue for a displaced form of postdevelopmentalism that entails a processual thinking in terms of natureculture (and, thus, naturenurture) coconstitution when it comes to inquiries concerning child development, childhood, and early childhood education.

A processual natureculture coconstitutive thinking has been developed in a number of disciplines, as we showed in the introduction and Chaps. 2 and 3. This has happened within biology, the cognitive and neurosciences, and in evolutionary and developmental psychology, in more or less parallel trajectories during the last 50 years or more.[5] This happened during the same period as various critical forms of inquiry evolved in the humanities and social and educational sciences.[6] Postdevelopmentalism developed while taking a stance against naturalistic forms of knowledge production that concern children's development and learning or, more specifically, against what the practices that knowledge from these disciplines might do to children. Moreover, during that same period, new forms of understanding knowledge production per se were developed in science and technology studies and actor network theory, for example, which theorized about assemblages, network relations, and natureculture coconstitution of phenomena in both the "natural" and "social" worlds.[7]

Thus, if we take natureculture coconstitution seriously, we also need to take seriously different forms of scientific knowledge and other forms of experienced-based knowing, as they together, in relations of friction or overlapping corroboration, produce phenomena such as child development, childhood, and early education practices in sociohistorical, material, and situated contexts.[8] That is why epistemological and ontological relationality constitutes our underlying onto-epistemological positioning for this processual natureculture coconstitutive approach to postdevelopmentalism.[9] Let us elaborate on what we mean by an epistemological and ontological relationality.

In line with what was just said, ontological relationality entails that what we call "the" reality of a child, childhood, or early education is, in fact, rather constituted by an assemblage of *multiple realities* enacted as various locally situated practices. These enacted practices might overlap, interact, divert, or be in a state of friction, but they nevertheless together produce the phenomenon of the child, childhood, or early childhood education *differently,* in different sociomaterial and historical contexts. What we are talking about is, as John Law expresses it "*different* realities being

done in different practices … [this approach] treats reals as *effects of contingent and heterogenous enactments, performances or sets of relations.*"[10]

Indebted to feminist technoscience and actor network scholars before him,[11] Law concludes that in terms of ontology, "the real" of human or other than human species and matter is constituted by plural realities that are enacted in the situatedness of "different and power-saturated practices" rather than being that "one world."[12] That is, *the one*, as what human beings desperately seem to desire most but that which Haraway[13] has since long acknowledged causes so much trouble. This is because to be defined, *the one* inevitably produces ideas of what it is *not*, that is, the contrasting other – a difference from – and the construction of binaries. "One is too few, but two are too many," as our companion words for this book by Haraway summarizes.[14] The idea of the one dismisses thinking in terms of processual emergences of multiple reals that coconstitute human and nonhuman actors (see introduction and Chaps. 2 and 3).[15]

As a consequence of the foregoing considerations, multiple forms of knowledge practices can be put into productive relations without scholars having to enact a naturalistic form of study by themselves. Examples of how this can be done are provided by Annemarie Mol[16] in her various studies of tracing a phenomenon, by Stengers and her *slow science* approach, and by Tsing and colleagues in their recently published *Field Guide to the Patchy Anthropocene: The New Nature*. These inquiries present practices of what Tsing has called a *patchy epistemics* and *piling*, as a methodology that constitutes a *making with differences* in the inquiry of a phenomenon.[17] In what follows, we will say something about how a slow science approach to inquiry and a patchy epistemic piling practice can be connected to the ECA project.

Stengers' Slow Science and the ECA Project

What might a slow science, in this field of inquiry that concerns young children, entail? Stengers and Vinciane Despret[18] write in their book *Women who Make a Fuss* that making a fuss while doing a slow science kind of inquiry is in no way a heroic mission. It is all about the messy work of creating locally situated emergent methodologies for the benefit of, in our case, children. That is, methodologies that are based on the engaging trusting relations with the local actors and connoisseurs, who are always site-specific and different.[19] Stengers[20] describes the methodology of a

slow science by contrasting it to what she describes as a fast and specialized kind of "sleep-waking" scientific practice:

> Slow science is about the quality of research, that is, its considered relevance for today's issues. Researchers are meant to situate themselves in their cities, communities, and neighborhoods and to be(come) available to discuss, examine, and reflect upon science, technology, and "progress." Such scientists would be able and willing to connect with the "matters of concern" of those about them, instead of seeing everything as "matters of fact" requiring no review, examination, or negotiation. /.../ [Contrary to this] are [s]cientists who are in a hurry to publish, to get bigger grants, and to "move on." They will not have the time or the imagination needed to inform, discuss, and attend to others [i.e., fast science].

The quality of research that Stengers describes in the preceding quote therefore starts with the researchers situating themselves in their communities and neighborhoods to become available to those questions and problems that concern people and nonhuman agents in those environments. This is, in fact, what we as educational researchers were trying to do when we started the network in the municipality, where we subsequently performed the ECA project together with children, parents, and teachers a few years later (see Introduction and Chap. 5).

Teachers and educators with a high school degree work in teams together led by teacher. In this particular municipality several teams of teachers and educators in different preschools worried about children's development, especially those working in areas enrolling many children with lower socioeconomic status and multiple home languages. They took an interest in children's language development as they observed that individual children did not always get the support, attention, and scaffolded learning that they needed to learn either Swedish or their spoken home languages. Based on their concerns, the teachers and their superior heads of schools contacted researchers[21] they knew from lectures and books. A network was set up to investigate the questions the educators and researchers both were most eager to know more about: children's development and learning from a developmental[22] and neuroscientific perspective with a focus on language development. Only later did the educational researchers ask the teachers and educators if they were interested in participating in a larger research project that could address some of their concerns.

Tsing's Patchy Epistemics, Piling, and the ECA Project

Tsing proposes a patchy epistemics[23] in one of her chapters in the *Field Guide*. Patchiness is a concept that stands for the multiple, as in multiple realities of a phenomenon and the multiple forms of knowledge practices that are needed to conduct an inquiry into phenomena of any kind in our present time. Patchy epistemics has helped us, in the writing of this book, to challenge how we previously discussed the interdisciplinary collaborations in Chaps. 9 and 10. More specifically, the practice of piling, as a part of patchy epistemics, challenges the metaphor of the interdisciplinary layer cake, discussed in chapter nine. And yet, there is at least one important similarity between the two, apart from the differences we will point out in this section.

An inquiry, says Tsing, means a continuous patch-making process, which she sometimes refers to as a mapping of the multiple realities of a phenomenon. Mapping is about a curious identifying of multiple forms of knowledge and other representational knowledge practices (e.g., policy documents, statistical data, economics' data, art, personal experiences), as grounded material relations across different scales.[24] "Patches can be identified at many scales," as they form together an ecology of knowledge practices or systems, writes Tsing.[25] In place-based thinking, that is, when thinking simultaneously *in* and *from* the situatedness of place, the inquirer must embrace a variety of descriptive and representational modes – knowledge practices – and cultivate the connections across their differences. It is in the epistemic frictions and/or relations that will emerge between patches of knowing that new forms of knowledge can be produced.[26]

Thinking in terms of Tsing's patchiness is a thinking with and across patches of knowledge, and sometime also with or across experience-based cultural and personal experiences of knowing. Moreover, it is about a practice of *piling*, that is, curiously piling different forms of knowledge practices on top of one another, often in an experimental and almost random fashion so as to explore the relations and frictions that might then be produced. Piling, Tsing claims, becomes in this way a knowledge-building practice that does not take into account any *a priori* hierarchical order or foundational claims between different forms of knowledge. Tsing[27] puts it as follows:

> To practice patchy epistemics is to value the empirical and analytic traction that disciplinary specializations enable, without insisting on the imposition of hierarchies of value and truth from afar.

Such an inter- or transdisciplinary piling as a methodology of inquiry can allow for unforeseen connections and important cautionary lessons that need to be learned about a phenomenon; it shows the multiplicity of that phenomenon. Such an inquiry can present what Tsing calls *place-based evidence* with a situated form of validity.[28] Importantly, Tsing[29] places considerable emphasis on the idea that a researcher must continuously reflect upon the following question:

> What diverse processes, stakes, and concerns might become evident when different knowledge systems are brought together *on their own terms*, within and across patches?

Let us relate the practice of patchy epistemic piling to the knowledge practices in the ECA project. First, the ECA project itself constituted an inter- and transdisciplinary project while putting to work multiple and very different knowledge practices and, thus, research methodologies, causing frictions and new learning (Chaps. 5 and 9). Second, piling can also be related to the construction of the main pedagogical group-based, socioemotional, and material learning intervention (SEMLA). As a pedagogical method, it was, on the one hand, based on knowledge from multiple knowledge practices at different scales (i.e., different disciplinary knowledge) (cf. Chap. 10). On the other hand, it was open-ended in the sense that whatever new kinds of knowledge or experience-based knowing we as researchers would encounter, we would consider whether or not this knowing might also be productive for some children as a part of the local SEMLA practice (Chaps. 5 and 10).

This attitude of multiple theories and pedagogical methodologies working together in SEMLA and, in a specific sense, put into different kinds of patchy piles to fit the situatedness and to suit the particular group of children greatly engaged teachers and educators in the ECA project. They have found that seeking the one best method is not just impossible but also problematic in relation to unnecessary power productions among educators themselves. The idea of multiple knowledge practices means that some forms of knowing can be put together in different piles or ways to better stimulate and scaffold specific children, whereas another patchy pile of theory and methodology might better benefit others, which means treating each of the theories and pedagogical methodologies as partial and equal knowledge practices while being piled in different ways to suit the local context or individual children.[30]

The practice of piling can also, and perhaps more obviously, be related to the baking of the layer cake as a metaphor for the interdisciplinary relations among different forms of knowing and knowledge practice, as described in Chap. 9. Constructing a layer cake doesn't, at first glance, seem to differ that much from piling. However, the layer cake and patchy epistemic piling are, in fact, different in decisive ways.

The layer cake must be constructed in an interdisciplinary bakery, using either multiple or single-layer cake pans, pans that will inevitably force and restrict the piling of disciplinary layers according to some kind of hierarchical order, determined by what is more important in the given phase of the research (Chap. 9). Moreover, the results and knowledge gained from an interdisciplinary project are mainly reported separately due to specific interests of different disciplines and journals. This leaves teachers, educators, heads of schools, and policymakers having to pick and choose from the results of scientific studies to best guide their policies or daily practices. Or worse, it leaves them with the difficulties of translating and analyzing how different studies might construct some kind of unifying scientifically based "truth" to build one's practice on, that is, basically letting them *re*construct an inclusive cake by themselves.

Tsing's patchy epistemic piling can help us trouble and doubting the layer cake metaphor as the most productive way of understanding what was going on in our collaborations. Tsings theorizing means thinking about reality as patchy and multiple, something far different from an idea of constructing a unifying layer cake. Piling means that differences and frictions between various knowledge practices must be maintained, but perhaps reorganized – *un- and re-piled over and over* – and, critically, be put in a relation to the local place and context. Furthermore, and unlike layer cakes, piles are always unstable. In fact, piles are *necessarily* unstable, which enables an un- and re-piling, and to undermine the risk of creating a sort of piling that constructs a unifying knowledge practice as "*the one fits all.* Tsing writes:[31]

> [Piles have] no load-bearing capacity, and piling something too high will eventually lead to collapse … It is a careful but loose sorting.

A curious and experimental epistemic piling practice can, we argue, enable a more processual and coconstitutive postdevelopmentalism. However, what is important to bring to an epistemic piling from what we learned in the interdisciplinary bakery are two intertwined things. The first is what Tsing emphasizes in terms of acknowledging different knowledge

systems *on their own terms* when bringing them into a relation (see foregoing quote), which means respecting the expertise of different epistemological knowledge practices based on their respective possibilities and limitations. This was evident in the ECA project (Chaps. 9 and 10). The second thing we learned was the importance of transparency vis-à-vis the participating children, teachers, and educators, supported by a strong ethics protocol while baking a one-pan layer cake with lots of emulsifying eggs in the baking process. We saw that the ethics protocol empowered children to become active agents of choice and participation (Chaps. 5, 6, 8, and 9).

And yet, unlike piling, un-piling, and re-piling and shuffling patches together in different combinations, baking layer cakes will always be accompanied by problematic restrictions and limitations due to the pan itself. Worst of all, baking layer cakes – whether with multiple pans or just one – will always come with the desire to bake that the *one* perfect cake! That is, desiring the one best theory, the one best method, the one best explanation or description. This is why the idea of the multiple, and multiple ontologies and epistemologies are so important for us and how we think about a possible displace postdevelopmentalism.

AFTER THE ENHANCING CHILDREN'S ATTENTION PROJECT

What happened after the ECA project had ended? This is not a story about how the randomized controlled trial, with null results, was published and received, which attracted zero attention, as expected.[32] Several new inter- and transdisciplinary kinds of research projects were initiated after the ECA project by former team members, exploring different kinds of phenomena. Some of the research from Bodén's study, which provided more analyses about the children's experiences of the ECA project, was presented in Chaps. 6, 7, and 8.[33] Sofia Frankenberg and colleagues analyzed already collected data from the project to generate a theory and evaluation tool for scaffolding children's learning of everyday tasks and exploratory and playful learning situations.[34] Frankenberg also secured funding for a large interdisciplinary project to investigate central practices of care and hygiene in preschools; this project's research has not yet been published. Susanne Kjällander and Sofia Frankenberg's collaborative project with cognitive neuroscientists explored digital learning as a complement to teaching practices, as well as an evaluation tool for math teachers.[35] Moreover, two PhD projects were inspired by the ECA project, one by Signe Tonér[36] in linguistics and neuroscience and one by John Kaneko in early childhood education and cognitive psychology.[37]

We now turn the focus to a project that developed from an in-service training collaboration in a different municipality than the one where the ECA project took place but that would not have been possible without it. Although the ECA project did not point to the effects of the group-learning SEMLA intervention on the group level, teachers, educators, and families at a couple of preschool units saw how the SEMLA intervention significantly motivated the children into becoming more linguistically competent, concentrated, curious, and collaborative social beings. Although this was anecdotal evidence, the SEMLA practices were shared with all educators who wanted to learn them as part of our ethical commitments to the educators and stakeholders (Chap. 5). A number of SEMLA workshops were thus conducted over a one-year time span. Moreover, SEMLA practices started traveling from one municipality to another, following the experiences of the teachers and educators, as they sometimes also changed workplaces in the Stockholm area. This would lead to a new combined collaborative in-service development and research project led by one of the two educational researchers who had developed SEMLA, Anna Palmer.[38]

In the next few paragraphs, we'd like to discuss some aspects of the work that Palmer,[39] with support from one of us (Lenz Taguchi), has done together with teachers, educators, families, and children in a municipality that can be described as strategically disadvantaged and facing a number of social problems. Preschool-aged children here do not attend preschool to the same extent or on a regular basis compared to children in other municipalities in the wider Stockholm area. The children's language and other development vary significantly from what in developmentalist terms would be considered "normal development" in relation to mean values of development. Some of the teachers and educators working with the educational scholars during the ECA project changed jobs to work in this municipality. They invited Palmer to help do in-service training. They were eager to develop the group-based SEMLA pedagogy, focusing on scaffolding of individual children's socioemotional development and learning as part of the group-learning process.

Inspired by the ECA project, the strategic teachers who are responsible for pedagogic development and Palmer, together with heads of schools and superior leaders in the municipality, decided what the goals of the collaboration should be, including potential aims for research. When engaging multiple aims in the same practice of inquiry, it is crucial that everyone involved be made aware of these different aims and goals.[40] These need to

be validated – equally – and identified as belonging to and operating at one scale, but simultaneously connected and making a difference at other scales.[41] The researchers are responsible for equally honoring these goals and making visible how they are interconnected. In terms of a slow science inquiry, the knowledge practices must be based on collaborative initiatives of experimentation with feedback loops and performed under the direction of a strong ethics protocol.

Stengers,[42] when discussing slow science, argues that researchers need to step up to be inclusive of public or professional connoisseurs in a specific context, on which they are dependent for doing their research. In the case of our example, this referred not merely to teachers, educators and other staff at the preschool but also the children themselves and their families. What Stengers calls a "cultivated science"[43] should thus be active in the support of such connoisseurs, understanding children, teachers, and educators as locally and situated intelligence specialists. In this role, they can simultaneously support the researchers, as they can challenge them to think differently about a given phenomenon or task.[44] A reciprocal and cultivated relationship also includes preventing the researchers from skipping over, or disguising, some of the inevitable weak points of the research. Stengers[45] concludes here discussion of this as follows:

> [Connoisseurs are] agents of resistance against a scientific knowledge that pretends it has general authority; they partake in the production of what Haraway calls 'situated knowledges.'

In the in-service collaboration with Palmer, the SEMLA pedagogy was constructed as a processual and open-ended practice, which necessarily must also conform and adjust to the children and the situated practices where it was performed and which also includes interactions with parents. As we outlined earlier, SEMLA's baseline is constructed by multiple interdisciplinary theories and pedagogical practices, with the idea being to combine group-based investigative learning with individual scaffolding and support of individual children's development and learning in their differences.[46] In the workshops, Palmer worked with two strategic teachers to set up an educational center based on the idea of embodied processual natureculture coconstitutive postdevelopmentalist learning. The workshops with the teachers and educators were designed in such a way that the educators themselves would become engaged in an embodied play and learning event.[47] These took place in the same preschool environment where the children were expected to play and learn. Here, the teachers

and educators were invited to try out materials and tasks that the children would be asked to explore or investigate, as when four- to six-year-olds were asked to imagine building a house below the surface of some body of water, or when one- to two-year-olds were invited to investigate light and shade as they tried out gestures and words to explore their experiences in colorful and exciting new environments.

In these kinds of learning endeavors, teachers' and educators' work experiences, as well as their personal and embodied experiences of fantasizing, exploring, constructing, and experiencing investigative play, became activated. What took place was documented and reflected upon in groups with supervisors and researchers. These embodied reflections and experiences were subsequently put in a relation to, for example, scientific knowledge from various cognitive and neuroscience studies, but also new materialist and posthumanist art-based research or works of art, for example.[48] What was crucial to the teachers' and educators' learning experiences was observing their own bodies in relation to, for example, words, concepts, and matter. They were asked to imagine how young children encountered and learned *in* and as being *of* the world around them.

In the next phase, the teachers and educators brought a smaller group of children to the education center to practice interacting with the children during an eight- to ten-week period in weekly workshop sessions. The teachers and educators were guided by a number of negotiated goals for what the children were to experience, learn, achieve, and so forth, be that words, concepts, or skills of construction, or early math, for example. These sessions were also documented so they could be further reflected upon in relation to, say, scientific research and curriculum goals, together with the researchers and strategic teachers who led this in-service-training.

This iterative and circular process has much in common with Stengers' description of slow science, as it is enacted with children, teachers, and educators as professional connoisseurs together with researchers. It also has much in common with Tsing's patchy epistemics and the practice of piling different forms of knowing and learning in the relation and frictions that emerge. So far, this way of working has had empowering effects on teachers, educators, families, and children. The network of involved preschools is presently growing rapidly.

However, we would also like to propose for a slow science approach to take notice of what is presently growing in the developmental sciences in terms of collaborative intervention research. A slow science process, built on shared concerns and aims, can be developed in an organized way as to be influenced by what has been called a *theory of impact*. This is a collaborative

methodology generated as part of what in known as a *continuous quality approach to the evaluation* of early childhood education and care provision.[49] It has been constructed as a way to work more closely with teachers and educators with the aim of obtaining continuous feedback, over long periods of time, on what teachers and educators say works for individual children and groups of children. The focus is on a shared interest in some mechanisms of learning in play and learning activities. In this way, a local and contextualized theory of impact can be articulated over a longer time span.

Moreover, the developmental sciences have seen a decisive shift from studies that seek results on the level of group averages. Instead, the interest has shifted toward variability and individual variations in development and learning due to cultural and contextual environments. This shift corresponds much better to and partly overlaps with the concerns of social science and educational researchers. Thus, a processual collaborative study as slow science might be done under the influence of a processual theory of impact methodology in the developmental sciences – and the other way around.

However, in line with the conclusions presented in Chap. 4, we argue that educational researchers need to step up to the challenge of playing a leading role in collaborative inter- and transdisciplinary projects. Educational scholars, with knowledge about the sociocultural and historical developments of institutions of care and education, and with know-how on the face-to-face scale of relations, power productions, research ethics, and critical inquiry, can act as coordinating networkers and initiate and maintain reciprocal translational practices between different scholars from various knowledge practices. That is, if they can step up to the challenge of acknowledging *multiple* forms of knowledge and knowing at different scales and with respect for their equal value. This can be done in a processual fashion, working also out of a theory of impact while engaging in explorative practices of *natureculture coconstituting epistemic piling*, so as to learn in the encounters and frictions of different forms of knowledge and knowing.

And in the End…

And in the end, the love you take is equal to the love you make.

We begin this last section with lyrics by John Lennon and Paul McCartney.[50] These lyrics are from the song "The End" from the Beatles' album *Abbey Road* and bears the message of a desired affirmative reciprocity and bidirectionality that might be found in love, friendship, and/or

high-quality collaborations. In our case, this reciprocity concerns engaging multiple knowledge practices in relations and/or multiple scholars from different academic disciplines to work with children and other related stakeholders in various forms of collaborations. This book has set out to further explore such collaborations based on a concern over disciplinary and methodological frictions and difficulties that persist in academia, but with an important hope for future possible collaborative engagements. Here, we return once again to the interdisciplinary bakery of the ECA project, described in Chaps. 9 and 10, and its extended assemblage of distributed relations among other scholars who work with children and stakeholders: both on the scale of face-to-face relations and the scale that constitutes the municipality, the city, and Swedish preschooling system.

So what did we learn from the ECA project? When considering relations between agents at different scales sketched previously, it seems that relations between teachers and educators in schools or preschools and scholars are less problematic than relations among academic colleagues trained in different disciplines and methodologies. Let us reflect on why it seems more difficult for, say, child development, cognitive, and neuroscience scholars to interact and collaborate with educational scholars in pedagogy and early childhood education than directly with preschool teachers and educators. One answer might be that educational scholars in one sense constitute a kind of situated connoisseurship that is *too* critically aware, *too* informed, and, thus, *too* close to home in the academia to which they both belong. On the other hand, the events taking place in the interdisciplinary bakery as described in Chaps. 9 and 10 and here in the preceding discussion constitute exactly that challenge and demanding environment for the kind of slow science that Stengers is arguing for when she calls for local connoisseurs in scientific research. However, as we have also shown, when one is engaged in multiple methodologies, the tasks of *un*learning and *re*learning – or, as Tsing calls it, un- and re-piling – sometimes falls to a larger extent on those scholars who are not trained in naturalistic methodologies. Accordingly, Callard and Fitzgerald, who as social scientists chose to engage in interdisciplinary collaborations with scholars from the neurosciences, claim to have made more of an effort than their collaborators to learn about unfamiliar epistemologies in their collaboration. As cited in this book's introduction, Callard and Fitzgerald assert that this is "not because we find ourselves diligent, but because we find ourselves weak."[51] In line with Callard and Fitzgerald's argumentation, we have also suggested that this has to do with a strong societal, as well as

academic, undercurrent that favors the methodologies of an ontology based in naturalism and classical realism.

In relation to the foregoing discussion, Stengers, as a former chemist and philosopher of science, points to the importance of the fact that scholars devoted to naturalistic epistemologies need to *re*learn the history of science and a broader scientific philosophy, which they often seem to forget or shy away from. Stengers contends that they need to learn about epistemologies and methodologies also in the humanities and social sciences. She refers to her experiences as a university teacher and how students of the "hard sciences" become less and less motivated by their initial curiosity and more and more motivated by "well-posed problems" and "right solutions" implicit in their scientific discipline.[52] This is most certainly also true of scholars in the humanities and social and educational sciences, who often avoid learning about how and why knowledge is produced the way it is in naturalistic epistemologies.

We ultimately learned a lot during the ECA project, as scholars from five different disciplines working collaboratively: pedagogy, early childhood education, linguistics, developmental psychology, and cognitive neuroscience. In terms of the different disciplinary lexica each of us brought to the conversation, we learned to acknowledge the sheer array of different meanings of concepts and words in different scientific lexica, as described in Chap. 10. We also learned that it was necessary, not only to understand *why* colleagues from another discipline use a different kind of scientific lexicon tied to a specific epistemology, but to also be ready to deconstruct and relearn our own lexicon. We moved from a mere awareness of multiple meanings of words to a context of *pluriverse*,[53] that is, to recognize the existence of *multiple* meanings, epistemologies, and ontologies at work in situated forms of relationality (cf. Chaps. 3 and 10). As Callard and Fitzgerald[54] suggest, this means making together a shared space, where our differences could "rub off" on one another.

Moreover, we learned to separate out the context in which a particular concept was meant to do its job in the best possible way in relation to a specific aim; in addition, we became proficient at simultaneously allowing for new ways to understand particular concepts or phenomena in the frictions of differences. This relates to what Stengers, again, has said about the relationship between researchers and public or professional connoisseurs. This is something that also applies to academic colleagues, irrespective of what discipline, epistemology, or ontology we position ourselves in. That is, that we need to open ourselves up to encounters with those who

ask different questions so as to immerse ourselves in a process of self-differentiation. On this score, Stengers[55] writes as follows:

> … Being capable of situating oneself – situating what one knows, and actively linking it to questions that one brings in and to ways of working that respond to it – implies being indebted to the existence of others who ask different questions, importing them into the situation differently, relating to the situation in a way that resists appropriation in the name of any kind of abstract ideal.

To conclude: Five years have passed since the ECA project officially ended. Nevertheless, emotions of being subjugated to power relations remain as undercurrents in academic life, in different ways for different scholars, depending on what discipline one works within. We think this has to do with the question of whose knowledge is considered more valid and, thus, powerful in different disciplines, but also in the world of academia at large and among policymakers.[56] The case study of Sweden presented in this book in the field where developmentalism and postdevelopmentalism encounter one another has also pointed to the possibility that idealist epistemologies can sometimes more profoundly influence scholars in this particular field that concerns itself with young children. This can cause scholars from fields that work in traditions based on naturalistic epistemologies to have to argue for why the field also might require knowledge from the developmental sciences (cf. Chap. 4). In line with this, we have spent considerable effort arguing for the importance of why scholars in the humanities and social and educational sciences should consider how knowledge produced in the developmental sciences might actually be important for and even similar to their own interests. Although, this is indeed true for what might be considered the outlier context of Sweden, it might also be true for other local spaces.

Moreover and lastly, we have also argued that scholars from the humanities and social and educational sciences should take up a much more engaged and active position of networker; stepping up to the task of negotiator and initiator of collaborative translations between different disciplinary knowledges, while doing justice to each of the different scientific lexica on their own terms. This, we believe, can contribute to conducting relevant forms of inquiry that bring together multiple forms of knowledge and knowing, around negotiated shared phenomena of concern for

children's development, learning, and lives, that is, inquiry and work of relevance *for* children, whether it is done *on*, *to*, *with*, and/or *by* children.

Notes

1. Developmentalism and postdevelopmentalism are also concepts in economics (Chap. 3).
2. Barad (2007).
3. Barad (2007).
4. Lenz Taguchi et al. (2020)
5. For example, Cantor et al. (2019); Lerner et al. (2019); Overton (2014); Osher et al. (2020).
6. For example, Burman ([1994] 2016); Cannella (2005); Davies and Harré (1990); Walkerdine (1998).
7. For example, Haraway (1988, 2016a, 2016b); Latour and Woolgar ([1979]/2013).
8. Mol (1999, 2002, 2021); Tsing (2015); Tsing et al. (2024).
9. Lenz Taguchi and Elkin Postila (2024).
10. Law (2015), p. 127 (italics in original).
11. That is, Donna Haraway and Bruno Latour, just to state the two most obvious.
12. Law's (2015) article is titled "What is wrong with a one-world world?"
13. Haraway (2016b), where the Cyborg Manifesto from 1985 is also published.
14. Haraway (2016a, 2016b).
15. Barron et al. (2023); Ginsburg and Jablonka (2021); Jablonka and Ginsburg (2022); Jablonka and Lamb (2007).
16. Mol (2002, 2021).
17. Tsing (2015); Tsing et al. (2024).
18. Stengers and Despret (2015).
19. Compare Elkin Postila (2019, 2022, 2023); Lenz Taguchi and Elkin Postila (2024).
20. Stengers (2016), p. 54.
21. Lena Aronsson, Hillevi Lenz Taguchi, Susanne Kjällander, and Anna Palmer, all from Child and Youth Studies, Stockholm University, led the network together with principals of a number of preschools.
22. For example, Bjorklund (2020); Mascolo and Bidell (2020); Overton (2014).
23. Tsing et al. (2024), p. 193.
24. Tsing et al. (2024), pp. 47–48.
25. Tsing et al. (2024), p. 35.
26. Tsing et al. (2024), p. 197.

27. Tsing et al. (2024), p. 197.
28. This has been pointed out by many feminist scholars for decades already. See Harding (1995) and Lather (1993).
29. Tsing et al. (2024), p. 197.
30. Tsing calls this *juxtapositioning*. See Tsing et al. (2024), p. 198.
31. Tsing et al. (2024), p. 198.
32. Gerholm et al. (2019).
33. Bodén (2021, 2024).
34. Frankenberg (2023).
35. Gulz et al. (2020); Kjällander (2021); Kjällander and Blair (2021).
36. Tonér (2021, 2022); Tonér et al. (2021); Tonér and Nilsson Gerholm (2021).
37. Kaneko (2022); Kaneko and Frankenberg (2022).
38. SEMLA was developed by Hillevi Lenz Taguchi and Anna Palmer together. See Lenz Taguchi and Palmer (2017) and Palmer et al. (2023).
39. Palmer was granted funding for a combined in-service and research project in this municipality in 2023, which underwent an ethical evaluation-approval process by the National Ethics Committee.
40. Aronsson (2020).
41. Compare Freeman (2001); Tsing (2015).
42. Stengers (2018).
43. Stengers (2018), p. 8.
44. Stengers (2018), p. 8.
45. Stengers (2018), p. 9.
46. Lenz Taguchi and Palmer (2017).
47. Palmer et al. (2023).
48. Palmer (2022).
49. Fisher et al. (2020).
50. Lennon and McCartney. "The End" from *Abbey Road*, 1969.
51. Callard and Fitzgerald (2015), p. 105.
52. Stengers (2018), p. 11.
53. Escobar (2020).
54. Callard and Fitzgerald (2015).
55. Stengers (2018), p. 45.
56. Youdell et al. (2018).

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