What was developed during several small steps that were not solely performed in a linear, consecutive order, but rather in a messy, multi-layered, entangled environment, cannot be retraced from the resulting graphs. In hindsight, the final images representing the outcome of the research in the coming papers appear to be one large step, produced directly from bird to paper; the life cycle of the data construction has been replaced by a brief explanation in the methodology section.

6.2. Relocating Birds and Biologists

Not only are the birds relocated from field to office during the filtering processes, but the biologists' working environment also changes. While the fieldwork is highly specific and dependent on a specific location – the boreal forests of Arvidsjaur – and cannot easily be replaced by a different location, the offices are less dependent on a particular geographical location. Instead, they depend on the biologists who analyse the data and thus have authority over them. During our collaboration, Michael and his team changed offices several times, depending on Michael's position and the relevant funding bodies.

When my fieldwork started, Michael's team had their offices in the Anthropological Institute of the University of Zurich. After the project's funding period had expired, Michael's office, along with his archives, was moved into his private basement. With the imposition of several COVID-19 lockdowns, the team's working environment moved into the digital space, with the biologists working remotely from their homes, which is where I would meet them. Since then, Michael has assumed a new position at the University of Konstanz. He, his research project, and, most importantly, the digital data (on hard drives and in archives) have thus,

once again, moved offices and become embedded in a new working environment. Along with this, the size of the team and their respective roles also changed.

What remained the same throughout was the field in Sweden, except for the birds that have inevitably aged. Some (with or without IDs) may have died, and new nestlings may have been born and equipped with IDs. Some groups may have grown, some may have diminished, and others, as in the deforested territories, may have disappeared altogether. In this way, the territories may have changed slightly over the years, but all these events will have occurred in the boreal forests of Arvidsjaur. However, this sense of location experiences one last shift when the results are published as the final step of the research; the scientific results about the birds become entirely detached from a location once they circulate in scientific journals around the world, although they usually remain within a small group of scientific peers.

When studying the entire dataset, it becomes clear that the data are mainly produced in two environments: first, in the field and, second, in the office. While the first moves in a rather analogue and concrete space, the latter migrates almost entirely into the abstract digital space. Both fieldwork and office work are essential to the scientific study of the birds' behaviour and complement one another. These work environments are shaped by different practices, material, infrastructure, ways of thinking and knowing, skills, and sensory experiences. In the field, thinking is mainly shaped by data collection as thinking in practice; in the offices, thinking takes on a more analytical form, where data are interpreted, algorithms are written, hypotheses are confirmed/rejected, and new hypotheses defined. The biologists sit behind their computers, analyse data, program algorithms, exchange information with one another (on red sofas), and discuss the data and outcomes (behind adjustable desks). Once

they have *confirmed* their hypothesis, they start writing and developing research papers, which they submit to scientific journals for publication.

The work in the field is shaped by pragmatism, prototyping, ingenuity, and creativity: from preparing the equipment for fieldwork to fixing the house and preparing food. However, the *doing* part, the fieldwork – observing the birds, and the tools and skills required for this, as well as the moments of despair on cold days when no birds appear – has disappeared from the results. Instead, this environment has now been replaced by human infrastructure provided by the institution, where facility managers take care of the equipment, technical staff fix the computers, and the biologists have lunch, and perhaps even dinner, in the canteen (where a great deal of thinking may also take place). It appears that once the biologists have proven their skills of surviving by themselves in the field, they can invest all their energy in their analytical process and output when they return to their offices, as the institution ensures that no other tasks distract them from their work, as long as they have sufficient funding and generate scientific output.

One additional aspect accompanies this process of relocation: during data collection, as I have described in Parts 1 and 2, the biologists immerse themselves in the field, not only regarding their research objective but also with regard to their entire bodies and sensorial attention. They experience the weather conditions, strenuous fieldwork, and the physical exertion of moving through the snow in the field. They also experience a *sensory alignment* (described in Chapter 5: 5.3) where they, to a certain extent, need to identify with the birds, imitate their calls, catch them, handle them – literally – and follow their ways of thinking when searching for their nests in summer. Thus, they engage with the birds on a multisensorial level, combining the auditory, visual, and haptic, as well as the 'in-between' of these senses.

Once fieldwork has been completed, these aspects are no longer relevant. The sensory engagement is now reduced to visual observations and sense-making on screens and in field notebooks, thus affirming my initial interest in visualisation. In hindsight, this initial interest is no surprise because it reflects what is publicly visible of scientific work. When the biologists analyse field videos in their offices, they no longer listen to the bird sounds as they would during fieldwork. They only (visually) observe the interactions of the birds and listen to the words of the biologist speaking on the video, who is interpreting the calls they hear during the observation or pointing out aspects that may not be visible on the video.

Therefore, the biologists' sensory attention is reduced to the visual during office work and thereafter. However, during fieldwork, the biologists are engaged with all their senses. They *observe* with their entire bodies. During these practices, they collect embodied and implicit knowledge that is (epistemologically) lost once their bodies are reduced to sitting in their office chairs and staring at computer screens. However, this knowledge remains inscribed on their individual bodies and becomes activated once they are exposed to the field again. To others, such as myself, this knowledge becomes perceptible when observing the different practices of sensory and bodily engagement in the field, as well as the different levels of experience and virtuosity with fieldwork. In this sense, the sensory and bodily engagement of the biologists during research only serves as a means to an end. Its capacity as a means for data collection is thus discredited and possibly also underestimated.

The contrast between fieldwork and office work is striking. Even though the fieldwork is crucial and forms the basis for the office work, until I started my research, the practices of the field were a mystery to me. I could imagine the processing of data on computers, but I had no concept of

how the research team would obtain their data in the first place, how they would collect and store data, and how this would form the basis for a research paper.

Enriching vs Poorifying Data

Returning to my initial question, the gap between the research subject in the field and the object in the paper was one I could not bridge without conducting ethnographic research through my case study. This gap was not caused by a lack of information but rather by a lack of access. After the filtering process that transforms the birds into data, the life cycle of these data is eliminated. The practices, materials, and working conditions of scientific research are rarely publicly presented, as I have aimed to do.

This method of handling data is entirely different from practices in anthropology. Here, reflective and field diaries also involve the emotional and mental aspects of the biologists themselves; one can read about their fascination for their research and the activities that accompany data collection. An interview is relevant not only for the spoken aspects that can be turned into data but also for the unspoken, and the atmosphere and setting that embeds the interview situation within the social context encountered in the field. It appears to be the ethnographer's intention to reveal the relationships, entanglements, sensory engagement, and messiness of the field situation rather than to clean it up and present sterile data. As an ethnographer, I paid particular attention to what is filtered out in scientific research, as this is where I can observe the specificity of certain practices, such as sense-making, and often where the conditions of knowledge production become visible.

The scientific validity and acceptance of the data seem to be established by a sensory and atmospheric *surplus* that reveals the conditions of research and provides information

about the research partners – the environments – and thus has the capacity to reveal social conditions. Conversely, what I filter *in* as part of a thick description in biology is filtered *out* for scientific validity. While Michael works in his office, purifying his empirical data and formulating his findings, I am sitting in my office, attempting to enrich my text with sensory descriptions of the field situations in which I found myself, along with Michael, in the spring of 2015 and 2020. I am not doing this as an author of a novel, but to allow my audience to engage with what I encountered during my fieldwork as precisely as possible, while being aware of my partial perspective, the only perspective I can have. With this, I attempt to add one piece to the puzzle of scientific work that usually remains a mystery to people outside the scientific community.

6.3. Thick Description by Means of Visualisation

I introduced the metaphor of filters to offer a new perspective on what Latour and Woolgar called 'cascades of inscription'.[29] The metaphor was used to understand the practices of knowledge generation in my case study differently. The concept of filtering is useful to attend to the practices, thus analysing the processes of data collection rather than independently analysing the results. However, this metaphor also has limitations and disadvantages. The concept of filtering is often closely related to refinement, purification, and essence, thus affirming the notion of improving and optimising the data. As I have attempted to argue, this process of filtering – and the *purified* results – while inevitable for knowledge production in evolutionary biology, is, from an STS perspective, closely related to a *poor*ification of data: the loss of complexity. One could also call it

29
Latour and Woolgar, *Laboratory Life*, 21.