Deterritorializing the Future

Heritage in, of and after the Anthropocene

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Chapter 4

Folding Time: Practices of Preservation, Temporality and Care in Making Bird Specimens

Adrian Van Allen

Introduction

Through crafting specimens and corresponding categories of life, natural history museums have been apparatuses for articulating knowledges, power and natures into an ordered whole, practices that have extended through to contemporary natural history museums and their genetic collecting programmes. This chapter considers the material and semiotic practices of making futures through making bird specimens, drawing on ethnographic and archival research at two national museums of natural history: the Smithsonian National Museum of Natural History (NMNH) in Washington D.C., USA and the Museum National d'Histoire Naturelle (MNHN) in Paris, France.[1] Examining the ways that animal bodies are made and remade at these two sites I explore how they are configured into specific representations of types of time – as windows into ecological pasts, markers of deep evolutionary time or as instruments for future biodiversity conservation policies. Following scientists and their specimens into the workrooms, laboratories and biorepositories of these museums, I learned to stuff bird skins, take tissue samples, extract DNA and assemble genomic data. I suggest that the practices of integrating new technologies into historical techniques is a form of 'folding time'. That is, new modes of making do not merely replace old ones, but instead encapsulate and transform them, folding them into the details of practice. In doing so scientists incorporate not only new materials into specimen preparation methods, they also incorporate new perceptions of preservation, endangerment and care – all oriented towards charting the unified genomic biodiversity of life and preserving it for uncertain futures.

In this comparative study, I examine the origins and implications of preparing bird specimens for natural history collections in the shifting domain of a genomic age. Through making bird specimens and preserving pieces of them in specific ways, museum scientists construct specific types of time that re-inscribe their disciplinary and institutional histories on the one hand, while also constructing imagined future uses for the increasingly abstracted animal-objects they create on the other. This brings to the fore questions of how specific types of time and different temporalities are created, modified, maintained and reproduced in the museum, requiring particular kinds of labour.

Attending to the materials themselves – from feathers and cotton thread, to tissue samples and DNA extracts – highlights the vital role of the materials themselves in the current project of 'archiving' life through biobanking tissue samples and genomic data[2] – projects that frame an understanding of our current ecological crises (Rose and van Dooren 2011; Waterton, Ellis and Wynne 2013) shaping potential futures preserved and understood through frozen materials such as ice cores, seed banks and blood samples (Antonello and Carey 2017; Harrison 2017; Radin and Kowal 2017; Breithoff and Harrison 2020). I suggest that one method for accessing these processes of making time and constructing types of care is through examining the histories, materials and techniques that constitute them, analyzing the negotiations between these different aspects as time is 'folded' together in changing practices on the lab bench.

Both museum research sites – the Smithsonian NMNH and Paris MNHN – have distinct histories that shape their contemporary research agendas, collecting expeditions and specimen preparation practices. Following scientists and their specimens through these two museums, I ask: How are specimen collections made in response to projected futures of extinction, based in the details of material practices? How are these practices then transformed as biotechnology moves into the museum and redefines what is preserved, by what methods and for what intended purposes? Finally, how are specimens used to perform types of time as they move across boundaries, from field to freezer, from lab to collection, from database to scientific publics?

To answer these questions, I focus on two sets of objects used in bird specimen preparation, as a method to unfold the narratives of temporality,

preservation and care at work in the contemporary natural history museum. First, I take up the ideas of *preservation* and *care* through the set of tools used in bird specimen preparation, from scalpels and thread to handwritten specimen catalogues. I compare my own experience in the Paris MNHN workrooms stuffing birds with the centuries of bird preservation history at the same institution, within histories that stretch back to the origins of ornithology and to specimen preparation manuals from the sixteenth century. Next, I explore the concept of *temporality* through a survey of the kits each specimen preparator at the Smithsonian NMNH has assembled. Each container holds many of the same items for cutting, cleaning and sewing bird skins, bones and feathers, but also new additions such as cryovials and superglue. Through a close attention to these new materials I examine how types of time – narratives of reconstructed pasts and imagined futures – are shaped by individual makers through the materials themselves. These include birds' skins but also biobanked tissue samples that function not only as indexes to the bird collections, but also as an index of the current crisis to preserve biodiversity in the face of mass extinctions. This ethnographic study examines how scientists work to integrate emerging technological structures, such as genomic collections and globally dispersed data, while also maintaining continuity with disciplinary pasts.

Through learning to use these sets of tools to skin and stuff bird skins, take tissue samples and log specimen data I examine the material practices used by scientists to craft specimens, reify histories and construct futures. Using specimen preservation techniques that have changed little over centuries, I explore how scientists are working to integrate new biotechnologies into existing practices. Within the context of these longer histories of specimen preparation, I argue that as birds are taken apart and reassembled in the museum, they articulate different purposes with different pieces. Further, I suggest that the capacities or limitations of the materials themselves are a vital component of these future-making practices – what materials are used to construct specimens' shapes not only the form of the stuffed bird, but its perceived potential and imagined future utility. The body of the preserved bird is then assembled not only from biological materials such as feathers and bones, cotton and thread – but also from the invested interests of the makers and their visions of caring for the future that they fold into the making of their specimens.

Practices, care and preservation, or how to fold time in the museum

Linear, accelerating time has been a marker of conventional Western views of temporality, which in turn has shaped both cultural and natural heritage conservation efforts (Fabian 1983; Harrison 2015; Radin and Kowal 2017). In this research I suggest that the different dispositions towards time that each specimen preparator brings to the worktable shapes the specimens they are creating. They describe the specimens they prepare as needing to persist through "long and uncertain futures" (Van Allen 2017: 534). Intent on making something that will last for centuries, the move towards freezing tissue samples of birds to preserve them echoes previous salvational efforts, such as Joanna Radin's (2013) work on the 'latent futures' conserved in human blood samples taken from Indigenous populations. Frozen in time, the collections of frozen tissues carefully created and preserved in museum biorepositories do much work. These include orienting ideas about what constitutes proper methods of preservation for specimens – that is, what should be kept and for what (imagined) future uses – as well as what these specimens stand for in both taxonomic communities and for larger publics.

The current epoch of the Anthropocene serves as a frame in which human beings have become a primary force in shaping ecological worlds on a geologic time scale, stakeholders in what Deborah Bird Rose has called the 'ethical time' of human decisions shaping the fate of multispecies ecosystems (Rose 2012). This shift in time, bringing humans into contact with immeasurably long expanses of geologic 'deep time' (Ginn et al. 2018) on the one hand has also made immanent futures of cataclysm and loss starkly visible (Tsing et al. 2017). This framework of both deep time and immanent loss has shaped practices of care for those in peril, from endangered species, to ecologies, to optimistic futures. If we take the various discourses on the Anthropocene and its iteration of -cenes (e.g. Crutzen and Stoermer 2000; Haraway 2016; Harrison 2015; Lorimer 2015; Neimanis, Åsberg and Hedrén 2015; Smithsonian Institution, Living in the Anthropocene Consortia 2015; Tsing et al. 2017) to all, in some way, centre on the subject of marking time, then I suggest that museum specimens – and specifically museum collections documenting historical sequences – can be conceived as a form of 'core

sample' through these narratives of (albeit, linear modernist) time. They do so as biological samples collected over time, as was their intended purpose for the scientists who originally collected them, yet importantly they are also a chronology of the *techniques* used for 'archiving' life. Further, they function as an archive of the orienting concepts of preservation and care bundled within those techniques.

The importance of materials and an attention to techniques has long been a part of Science and Technology Studies (cf. Law 2010; Latour 1988) as well as anthropology, particularly in the following of the *chaîne opératoire* (or 'operational chain') of how materials and ideas are wound together into processes (cf. Dobres 1999; Lemonnier 1986). However, I suggest that while it is important to attend to what people say versus what they do with materials, it is equally important to go further and examine what the materials themselves can communicate when engaged firsthand (Mol 2003).

For the scope of this chapter I focus on the practices used for producing bird-objects in the museum, unravelling their multiple biographical trajectories and their roles in producing multiple kinds of knowledge (Knorr-Cetina 1999; Rheinberger 1997). Moving into the behind-the-scenes museum workspaces where matter and meaning were woven together in the daily routines and techniques, I explored the intimate and fluid connections between the minutiae of biological organisms, their tissue samples, their data, their DNA and the embedded visions for shared human and non-human futures. I observed the ways in which the taxonomic community in the museum, inheritor of several centuries of specimen collecting bound up with centuries of colonialism, now finds itself caught up in the changing landscapes of several wider intersecting domains. These include the genomic life sciences, biodiversity policy and the increasingly fraught activity of collecting and transporting specimens (now categorized as 'national biowealth' after the ratification in 1992 of the Convention on Biological Diversity and Nagoya Protocol in 2014) across international borders.

Over the course of several years (since 2014 at the Smithsonian and 2017 at the MNHN in Paris) I interviewed and worked alongside curators, conservationists, collections technicians and visiting researchers. We carefully skinned and stuffed birds, took tissue samples, extracted

DNA, sorted genomic data and carried taxidermy through narrow corridors. This provided me with 'a view from below' (Harding 2008), that is, access to the wealth of mundane details and occasional moments of epiphany that constitute the ongoing labour of museum work.

While an attention has long been put on practices – what people do, and how they speak about those actions – I advocate for a more articulated and embodied engagement with precisely how 'matter comes to matter' (Barad 2003) not just by observing it, but by transforming it with one's own efforts. Doing so hopefully transforms one's understanding of how the various and shifting worlds we inhabit are continually made and remade. The materials themselves can be a subject as they offer up their own narratives, with the qualities of materials either bending to the task at hand or fighting every step of the process. Materials have much to tell, not only about their life histories, their capacities, their limitations, but also about one's own physical and psychological engagement with the research site. As fingers slide over blood, bone and feathered skin, triggering a tinge of nausea or feeling the ache in your wrist from pipetting extracted DNA – these actions have the potential to shift one's understanding of the maker, the animal-turned-object, and their co-constituted process of coming into being.

Previously I have argued that scientific objects such as genomic tissue collections and museum specimens were far from neutrally composed (Van Allen 2017, 2018, 2019a, 2019b). This builds on scholarship that suggests the complexities of the biographies of scientific objects could contribute to the value they accumulate (Bowker 2000; Ellis 2008; Sunder Rajan and Leonelli 2013), taking on and performing multiple layers of meaning and value as they travel in and between different sites, communities of practice and epistemic expectations. This transformation of practices, integrating new materials and techniques and transforming others, is what I call 'folding time' as histories fold into the present, as imagined futures shape the human and non-human subjects of the natural history museum.

Orienting museum collections towards the future

By the end of the twentieth century, taxonomy, like most areas of the life sciences, was being reframed by state-of-the-art genomic approaches,

increasingly relying on DNA and molecular techniques and powerful computer technologies to 'split' or 'lump' the natural world. Taxonomists themselves were classified as either 'splitters' or 'lumpers' depending on their propensity to either divide species into an increasing number of sub-species or mass them together into one species 'lump'. These methods of analysis built on the 1990s 'genome revolution', reifying an underlying assumption that molecular genetic sequences were the code of life, deterministic of all that was imagined to follow (Fujimura 2003; Parry 2004; Waterton 2010; on museum genomics see: Murray et al. 2011; Nachman 2013). This genomic reframing enabled an acceleration of taxonomic practice and allowed the discipline to expand its scale and speed of knowledge production, to collect, categorize and build a map of all life on Earth. As one curator put it, "We have to know what there is before we know what we have to save" (Van Allen 2016: 237).

With the influx of biotechnology into museum practices, museum collections are currently being reframed as a resource now available for big data science. Natural history collections have been accumulating for hundreds of years, with the amount of "untapped biodiversity resources" (Kress 2014: 1310) compressed into museum collections, botanical gardens and university collections estimated to be as high as three billion specimens (Bi et al. 2013; Hykin, Bi and McGuire 2015) – which "suggest the magnitude of this storehouse of information about the natural world" (Kress 2014: 1310). However, I would argue that this 'storehouse of information' has been configured in a specific way, based on the specific cultural histories that formed it, which in turn have shaped the kinds of information it can then offer up. Or, more precisely, that it can be *conceived* of offering up. "Our predecessors in [the Division of] Birds collected these specimens, they had a very specific idea of what they were going to be used for," a curator in the Smithsonian NMNH Division of Birds told me, "Now we use them for things they never could have imagined."[3] When I ask her what future uses she can imagine the collection being put to, she turns over the bird skin she's holding in her hands before replying, "We can't know, of course, what direction technology will go. But we can prepare things in different ways – like pickling the specimen [preserving in alcohol] so the entire organism stays intact, making sure we don't lose anything, or at least we will lose less… For the

future, we just have to be very detailed in the data, make sure we keep it all connected, record everything… You never know what might end up being relevant."[4]

Much of the current scientific understanding of several recently extinct species – such as the Tasmanian tiger or Thylacine (*Thylacinus cynocephalus*), the Caribbean monk seal (*Neomonachus tropicalis*) and the passenger pigeon (*Ectopistes migratorius*), to name but a few – have directly resulted from genomic information extracted from museum collections (Miller et al. 2008; Schipper et al. 2008). This includes not only genomics but other kinds of extractions and abstractions of biomaterials: "combining DNA-, amino acid- and isotope-based analyses of a few grams of bone from a historical specimen of an endangered Pacific seabird, the Hawaiian petrel, has illuminated aspects of the bird's diet, past population demographics, food chain dynamics and the deleterious impacts of industrial fishing on this oceanic predator" (Rocha et al. 2014: 814). From this perspective, museums are being recast as unparalleled – and largely untapped – resources for creating genetic collections of extinct species, part of large-scale genomic studies of animals and plants.

Potential future needs, as imagined by curators and preparators, compel museums to continue collecting and preserving for as-yet-unknown uses. As the "common language of the biological sciences" (Kress 2014: 1310), collections not only speak for the past, but must be maintained and added to with new specimens to speak for the future as well. Although most museum specimens were not originally collected for the purposes for which they are now used, new technologies will "continue to reveal new information previously unanticipated in scientific specimens" (Hykin, Bi and McGuire 2015: e0141579). According to many at the Smithsonian (Rocha et al. 2014; Sholts, Bell and Rick 2016) and beyond (Droege et al. 2013; GGBN 2015) the collections need to be added to – 'extended' with genomic samples that are tied to the bird body they came from – to maintain their value and 'keep in time' with the time series already marked out by the existing collections. For instance, DNA extracted from the toe pad of a bird skin collected a century ago can now be sequenced and compared with one collected last year, or one living in a zoo (Grealy et al. 2017).

As scholarship in both the biological sciences (Pyke and Ehrlich 2010; Suarez and Tsutsui 2004; Winker 2004), history of science (Daston 2004; Strasser 2010) and in science studies (Fujimura 1996; Kohlstedt 2005) have shown, many scientists continue to use collections to discover, describe and document plants and animals with traditional methods – such as the stuffed bird skins I learned to produce. However, the application of new technologies to study specimens is expanding, becoming integrated into the traditional practices, or in some cases disrupting them. In the following section I take up the idea of preserving specimens as a method of care for both endangered species and as a way to care for uncertain futures. I do so through a set of tools used to make bird specimens, comparing my own experience making birds in the context of techniques, tools and histories that stretch back to the origins of ornithology.

Making birds, preserving histories, constructing futures

Paris, February 2018. Sitting at a large communal table, with tools and materials piled in the centre (cotton, sawdust, scissors, scalpels, tissue tubes) I skinned and stuffed birds with a group during weekly sessions at the Muséum National d'Historie Naturelle (MNHN).[5] We sat next to a freezer where the tissue samples we cut from the birds were stored. Liver samples were being kept from the falcons for a study on heavy metal contaminants, feathers were pulled from others for a plumage study and a combination of liver-heart-muscle were carefully snipped and stuffed into 2ml cryovials for as yet unknown future uses, an expansion of the collection of stuffed skins and taxidermy mounts into the realm of the molecular (Figure 4.1).

The process of crafting a bird study skin broke down into a series of processes of measuring, skinning, sampling, washing, drying, stuffing, sewing and pinning out to dry. The third of these – sampling – was the most recent addition to the workflow, while most of the process remained little changed from the procedures set out in historic manuals centuries earlier (Belon 1555; see also: Farber 1977). As I stepped through these processes, I felt a certain kind of vertigo as my hands went numb in the thawing bird blood – a visceral reminder of the formerly living thing I

was slowly dismembering. Past and future both seemed very present: as my hands pinned out feathers which looked like a vignette out of one of the historic specimen preparation manuals, I experienced a link to the past and a continuity with histories of collecting (Kalshoven 2018). Various futures also seemed immanent through the potential uses for the tissue samples I was taking, coupled with the idea that I was making something that would be kept in perpetuity, tended to for unknown decades or centuries.

As I prepared a different bird each week – weighing and measuring, pulling the feathered skin off of the body, washing and drying it with a hairdryer, stuffing it with cotton, sewing it closed, pinning it to dry – I

Figure 4.1 — Preparing study skins, Paris MNHN Department of Birds, 2018. (Photograph by Adrian Van Allen).

recognized the same techniques as described in the sixteenth- to nineteenth-century French taxidermy manuals I had been reading in the museum's archives. Printing out pages from these manuals, I brought them to a weekly session and asked the bird preparators about their sense of time, history, heritage and tradition. "I did not realize how little things had changed," one said as she pulled a page towards her, showing a taxidermist's tools from an 1853 manual. "These look so familiar, just like I use now,"[6] she said as she sorted through the tools on the table in front of her – a pair of scissors, a scalpel, tweezers, linen thread and wads of cotton – aligning them with the image from the antique taxidermy manual (Figures 4.2–3) (Brown 1853: 71).

As we compare the tools in front of us to the image from the book, she describes how she still uses each of these tools in her process of making bird specimens, and why she spends so much time on the details. She explains there are many moments in the process of specimen preparation when one can "go quickly and the bird skin is stuffed and pinned to dry, very fast," she said, but when going fast "there are consequences."[7] These

Figure 4.2 — Preparators' tools, circa 2018. (Photograph by Adrian Van Allen).

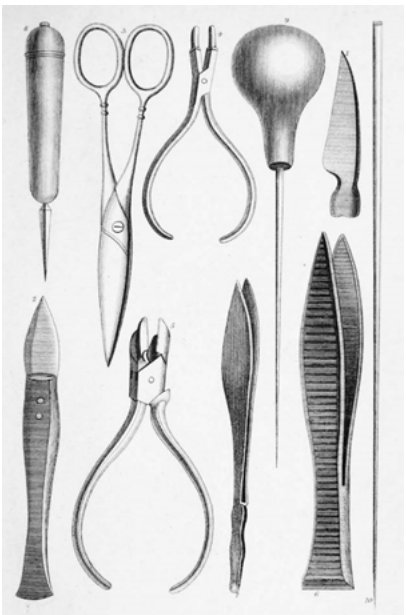

Figure 4.3 — Preparators' tools, circa 1853. (Brown 1853: 27).

consequences are not only for the longevity of the individual specimen, but also have the potential for pest problems that can destroy entire collections.

To 'make specimens last as long as possible' and not provide a food source for insects involves a series of time-consuming tasks. These include using a needle to clean marrow from leg and wing bones, puncturing toe pads with a small needle to drain the fat, cutting the delicate skull open with scissors, slicing out the brain with a scalpel and using bits of cotton to carefully clean out any remaining brain matter. "The insects they love to eat fat, and the brain – it is all fat – so it must go."[8] The tools used for each of these processes have persisted through time, as they align with the continuing intent to make specimens that will last for a century or more. Taking the tissue sample for the frozen tissue collections also uses the same tools: a scalpel to cut off a section of muscle and tweezers to slide it into a small plastic tube – the intent is still to make a (tissue) specimen that will last indefinitely. While these tools are used to preserve specimens for unknown futures, they also preserve parts of the past.

Continuity with the past then stretched into the future. I kept this sense of long histories and longer futures in mind as I learned to skin, measure, sample, wash, dry, stuff, sew and pin my bird study skin. Sewing up the bird, I thought about the other kinds of 'conservation' done in the museum with needle and thread, and what versions of time they create or recreate. How is sewing up a bird skin like conserving other sewn objects in collections?

As I sew the bird skin closed, I think about a conservationist at the Victoria and Albert Museum in London who analyzed her process of repairing a seventeenth-century Spanish Mantuan gown – the tailored bodice modified over generations to fit the bodies of new owners and new styles. She questioned which version of stitches was the 'authentic' one, arguing that each series of actions she took in 'conserving' the object was also an ethical choice and construction of a specific 'truth' made in relation to that object (Malkogeorgou 2011: 442). She sees each stitch she saved or removed as an ethical choice about how to preserve different "life histories" (2011: 443) of the garment and its wearers.

I would argue this can be carried over to the bird skins and tissue samples on the lab bench, where each decision about producing a

specimen – be it morphological or molecular – can be thought of as the same process of ethical choices made in relation to constructing 'authentic' life histories for these animal-objects. The choices made determine (and are determined by) contemporary concepts of value and use – what is removed, what is saved and how what remains is classified. The museum scientists also reflect on the changing values of specimens, as mentioned earlier, where they contemplate that their scientific predecessors could never have imagined what use they would be making of specimens collected a hundred years ago, such as sampling the study skin of an extinct species for DNA.

Continuities with past practices

Paris, October 2018. Re-inscribing continuity with past practices, as well as constructing predictive futures for objects, is part of the daily work of museum staff. At the MNHN large paper books are still used to catalogue their specimens, marking down DNA samples in the same margins that once noted seizures from the Versailles Menagerie during the French Revolution. In recent years this data has also been duplicated on databases, but the entries are still meticulously entered on paper in black ink (Figure 4.4). The nineteenth-century catalogues record the same data as

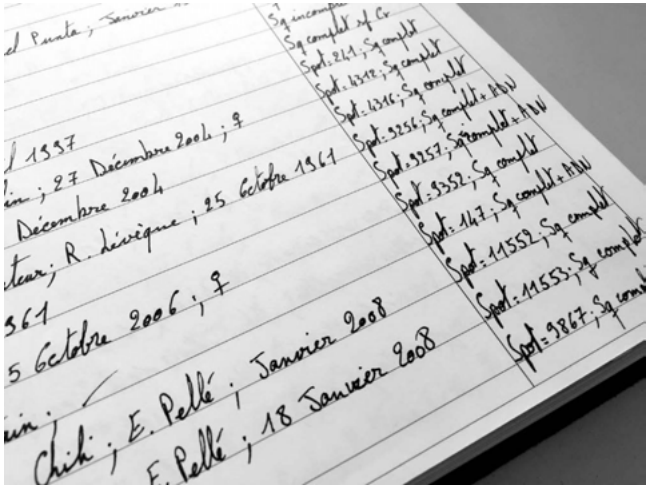

Figure 4.4 — Paper catalog books at the MNHN Department of Birds, 2018. The notes for DNA ('ADN' in French) are visible in the margin. (Photograph by Adrian Van Allen).

2018 entries: name and date collected, locality, but the type of preparations from the specimen now include not just a skin, a skeleton, but also a DNA sample, carefully penned into the narrow margin. Different curators' lifetimes are spanned across these pages, the collections they created marked in their own handwritten script.

"It gives me a sense of tradition, part of the history of this place," as one curator described his use of the catalogues, "and it will always be there… just in case something happens to the database."[9] Like the taxidermy manuals from the sixteenth century with illustrations of tools identical to those on the workbench in 2018, these paper catalogues offer a view into a continuity with past practices – a record of how museum staff find ways to weave new types of data into existing infrastructures even as those objects shift status within the museum.

Tracing the continuities and changes for preserving birds in the taxidermy manuals and the specimen catalogues traces the shifting value of a bird carcass. Once used to map the diversity of living things, preserved birds have now become sites for care in the face of mass extinction. The museum practices of collecting and cataloguing individuals of a species, I suggest, are conceived as a form of caring for the species as a whole. For example, one scientist articulated the act of collecting and sampling an individual bird for the heavy metals in its liver tissue as useful for shaping environmental policies, which in turn could potentially help preserve the species (Berny et al. 2015). Museum collections have also been used to compare historical and contemporary biodiversity surveys, with the collections mined for past ecological changes and the ensuing impacts on endangered species, and the data then used to inform policy decisions on conservation strategies (Hanner, Corthals and DeSalle 2009). In doing so, scientists articulate their specimen collecting and preserving as salvational tools, that is, the collected dead in museum collections are being used to preserve their living kin in the wild.

Preserving birds and shaping ornithology

Pierre Belon's *L'histoire de la nature des oyseaux*, published in Paris in 1555, is one of the earliest known examples of preservation techniques for making bird skins into objects for scientific study, and includes

examples of exotic birds such as parrots collected during French expeditions (Belon 1555; Schulze-Hagen et al. 2003) – birds that still cluster on the shelves of the collections (Figures 4.5–6). Most of the bird specimens prepared for early cabinets of curiosity were of articulated bird skeletons, eggs, feathers or dried wings – parts of birds that were less prone to sunlight, humidity and insects (Farber 1982; Pomian 1990). As techniques for preserving the delicate materials of skin and feathers were developed, whole bird skins were preserved in more life-like poses, wings spread as if in flight or perched on wooden stands. Walking past the taxidermy workrooms at the MNHN in 2018, I glimpsed a scene that could have been from 1718 or 1918 – workbenches filled with bones and pliers, paintbrushes and glue, feathers and glass eyes. 'Nature' in the process of being crafted, in intricate detail.

The history of taxidermy – which comes from the Greek words *taxis* ('arrangement') and *derma* ('skin') – used complex techniques to preserve a life-like appearance of animals, evolving slowly over centuries of experiments with mummification, drying and chemical preservatives (Péquignot 2002; Wonders 1993). Yet the process in the European tradition for preserving a bird skin has remained essentially unchanged for the past 400 years. The instructions for making a bird skin I read in Belon (1555) or Buffon (1800) were almost identical to those I learned at the workbench in the MNHN in 2018, from using the same materials (salt, sawdust, cotton) to the tools (knife, tweezers, needle and thread).

In brief, the process involves: (1) opening the bird body and removing the flesh, fat and viscera, including the eyes and brain – anything that would attract mould or insects, (2) rubbing the insides with salt or another preservative, historically ashes or pepper were used to deter insects before the invention of arsenic soap in the eighteenth century, but this toxic substance is no longer used in current practice, (3) stuffing the bird skin with cotton, straw or wood wool (shredded wood fibres) wrapped around an armature of wire, wood or plaster, (4) sewing it closed and arranging the body and feathers into the desired shape, and (5) setting it to dry, sometimes pinned in position or bound with thread to hold the feathers in place during the drying process.

However, these life-like poses slowly gave way to a different form, what is called a study skin or round skin (Figure 4.7). In this form, the

Figure 4.5 — Green parrots in Pierre Belon, *L'histoire de la nature des oyseaux* (1555: 298–99).

Figure 4.6 — Taxidermy mounts of green parrots (MNHN Zoothèque, 2018). (Photograph by Adrian Van Allen).

bird is laid flat on its back, wings tucked underneath, legs crossed and instead of glass eyes the sockets are filled with balls of cotton, and most importantly a label is tied around the bird's foot noting among other pieces of data its species name, location and date where it was collected and who collected it. The process of transforming a bird into a specimen is bound to this label, as a preserved bird skin without data becomes, in the words of one museum staff member, "very expensive compost"[10] – without it the bird isn't viable for scientific purposes.

The bird skins I stuffed at the MNHN were within this long tradition of making bird bodies into tools, a process of standardizing the imperfect animal body into a symmetrical, regulated object – one that could reveal relevant data, or as one ornithologist said, "to see variation looking down a drawer."[11] In other words, the form of a study skin as tool for scientific study allowed unusual characteristics to stand out when looking across a row of similarly stuffed birds. These details are important, as the material properties of making specimens is the foundation for understanding how

Figure 4.7 — Blue and yellow macaw specimens made from birds who once inhabited the Menagerie at the Jardin des Plantes, Paris (MNHN Department of Birds, 2018). (Photograph by Adrian Van Allen).

they were crafted to persist through time and produce specific kinds of knowledge.

Preserving feathers and skin, which by their nature are prone to degradation in humidity, sunlight and being eaten by insects, offers a considerable challenge. The same concerns for collections and their susceptibility to damage were voiced in the workrooms of the Paris MNHN during my fieldwork in 2017–2018 as well as in notes in some of the earliest taxidermy manuals from previous centuries (Belon 1555; Buffon 1800; Dufresne 1803; Turgot 1758). Crafting a bird body to persist through time presents a challenge, and it seems, always has. Yet the emergence of ornithology as a discipline is bound to the material production of these specimens – in their embodiment as representations of theoretical views of nature and forms of life. And they continue to be vital to the re-imagining of the natural world, as they are transformed from exotic curiosities to scientific tools, from objects marking the historical development of ornithology to resources for biotechnological mining.

Turning now to the Smithsonian National Museum of Natural History (NMNH) and a survey of the specimen prep kits assembled by technicians, I examine how types of time – narratives of reconstructed pasts and imagined futures – are shaped by individual makers through the materials themselves, thinking through the narratives the materials can tell and the stories to which they bear witness.

Histories of collecting and folding time: A bird skin as a time capsule

Washington DC, June 2015. I am in the Division of Birds at the Smithsonian National Museum of Natural History (NMNH). Long corridors lined with white metal cases stretch out into a labyrinth, stacked to the ceiling and filled with bird skins, nests, eggs and wings neatly arranged in rows. More than 640,000 bird specimens are housed here – the third largest bird collection in the world (Smithsonian NMNH, Division of Birds 2016).

In the Vertebrate Zoology Preparation Lab, I sit with a group of specimen preparators at a long table, surrounded by half-frozen birds taken from the freezer, our tool kits and in the centre of the table a communal bag of cryotubes and biorepository labels with individual barcodes.

Preparing a traditional bird study skin, according to several curators in the Smithsonian's Division of Birds, is like "keeping the wrapping paper and throwing away the gift."[12] That is, the most valuable 'body' of information is the actual bird's body, which is removed from the skin and discarded (Figure 4.8). The hollowed-out skin is then stuffed with cotton wool and sewn shut, the spine replaced with a wooden dowel. Some bones remain, such as the skull, some partial wing and leg bones. However, what is considered most valuable at this particular moment – taking samples of their heart, liver and muscle tissue to mark their existence in a specific point in time – were traditionally discarded. In current practices, tissue samples are taken and carefully preserved after which the majority of the body is disposed of as biological waste. However various curators, collection managers and technicians in Vertebrate Zoology are going, as one curator called it, "the way of the fishes."[13] The Division of Fish and Reptiles have traditionally 'pickled' their specimens, that is, 'fixed' them in formalin and then preserved them in sealed jars of either 70% or 90% ethanol. This has the advantage of preserving the entire organism, including its digestive tract and the organism's last meal. The preserved specimen then becomes a tiny microcosm of its environment, a moment stopped in time that preserves epigenetic (microorganisms both in and on the bird) as well as genetic data for future research.

"Time capsules, that's what collections are," one curator told me. "A window back in time, if you know how to get what you need out of them. And, of course, if you can get the permission to get it out in the first place."[14] The pickled specimen can be X-rayed, CT scanned or genetically sampled later – though the DNA may be fragmented by the formalin and requires special techniques to stitch the sequences back together and produce 'meaningful data'.[15] While these practices in different zoological disciplines have long histories, which have shaped their ways of making and ways of knowing, they each concentrate global biodiversity into a museum setting where the meaning and value of each specimen is negotiated.

In the prep lab, we pulled out piles of cigar boxes and Tupperware from the cabinets – individual kits of tools used for specimen preparation. Some were passed down, I was told, as people retired, but most people arrived with their own kit that they had assembled over time

Figure 4.8 — Making a meadowlark (Vertebrate Zoology Prep Lab, Smithsonian NMNH, January 2015). (Photographs by Adrian Van Allen).

from learning to prep their first bird skins. Instead of a box of communal tools pulled out for weekly sessions at the Paris MNHN, here at the Smithsonian everyone had their own kit, stocked with their own sets of selected tools and materials, shaped to their own habits and views of what was needed to prepare bird skins (Figure 4.9).

Opening up an old cigar box, the owner and I unpack the collection of tools inside and lay them out (Figure 4.10). They include traditional tools such as an array of scissors, scalpels and tweezers, linen thread and sewing needles, an awl and paper tags ready to be tied around a bird's leg to label it with an identifying collection number. However, we pull out

Figure 4.9 — Specimen preparation kits. (Photographs by Adrian Van Allen).

Figure 4.10 — Items in the specimen preparation kit: [1] cigar box; [2] cotton wool; [3] superglue, bottle with precision applicator tip; [4] brush for removing corncob 'dust' from feathers; [5] tissue tube; [6] Sharpie for marking tissue tube with collection number; [7] measuring tape; [8] cotton thread; [9] sewing needles; [10] scalpel blades; [11] identification tags, pre-strung with thread; [12] pointed scissors, medium; [13] pointed scissors, small; [14] round-tip scissors, two pairs; [15] plastic ruler, marked in mm; [16] scalpel; [17] tweezers (one featherweight), four pairs; [18] angled tweezers; [19] wooden dowels and bamboo skewers, to use in wings and as 'backbones' in smaller birds. (Vertebrate Zoology Prep Lab, Smithsonian NMNH, January 2015).

new additions as well: the cryotubes for tissue samples and the superglue. I ask about the superglue, and I'm told it is used to glue beaks shut. The muscles holding the beak together are removed during the cleaning process, leaving the loose upper and lower beaks prone to damage. "Not

everyone uses it [the superglue]," the preparator tells me. "Some think it might add chemicals that could interfere with future genetic sampling… So some [preparators] use the old way and tie the beak closed with thread, but it takes more time… and I have a freezer full of birds to prep[are]."[16]

This collapsing of time – patina of old against new, juxtaposed but also in parallel use, different parts of a process changing ever-so-slowly – was a recurring theme in the preparation lab, and indeed across many spaces of the Smithsonian. At times, it became disorienting, this play of time stretching and folding back on itself. It was also in these moments of contrast – of twenty-first century superglue and tissue tubes alongside nineteenth-century cotton and wooden dowels – that caught my attention, signalling a shift in practices. However, these new practices were quickly becoming 'natural' to the museum staff. "I don't even notice anymore," one preparator told me. "Making study skins just looks normal to me now… Taking [tissue] samples will probably be that way too," he pauses, "eventually."[17]

It is useful here to think briefly about the material aspects of things in play, or in other words, how they are constantly generative of new circumstances and resulting consequences – such as collecting tissue samples, creating new data types to render the proliferating parts and pieces meaningful. Thinking through this 'liveliness', or at least the potential for liveliness as I held the internal organs of a bird in my hand, I extend this into the liveliness of material things-in-process. The heart of the matter, in this case, might be an actual heart. Or a very small section of a heart, accompanied by slices of muscle tissue and liver, carefully pushed into the bottom of a small plastic vial so they didn't squeeze out when the cap was screwed on as life was, once again, at risk of spilling over its frame.

In re-conceptualizing the boundaries between humans, things and technologies in the making and remaking of bird specimens, I want to critically engage the implicit control enacted over animate and inanimate life – what Clarke and Fujimura call a new "philosophy of becoming" (1992: 30). This opens up an understanding of social theory by emphasizing not only the play of words, but the interplay of the (bio)materials through which knowledge is produced and negotiated. The generative potential of a tissue sample, then, is balanced uneasily at the border of

animate and inanimate. It was, on the one hand, just little bits of meat (Figure 4.11). On the other hand, these little bloody fragments held the potential for multiple technological and temporal 'unfoldings' into the future – the extracted DNA assessed and amplified, mapped and assembled, and then circulated to databases the world over, a form of 'proxy' for the individual animal, the species as a whole, or even as an indicator for the health of an ecosystem. Through skill and careful technique, new materials and new technologies become 'natural': just as making study skins becomes something that "just looks normal," as the preparator said, so too will making the tissue tubes become a standard and unremarkable object in the museum. Yet the ideas around what iteration of life is being preserved in the making of these objects – that is, the representation of a species made through the body of a bird, through a genome-quality tissue sample, or through the genomic data itself – is inextricably bound up with the making of those objects, freighted along with the feathers, tissue or data as they are hand-crafted.

Figure 4.11 — A tray of frozen bird tissues. (MNHN Department of Birds, 2018). (Photograph by Adrian Van Allen).

Conclusion

Bird preservation in museums takes on multiple forms. Once, taxidermy mounts made from hollowed-out feathered skins were used to represent their species, yet now the bodies of birds are taken apart and put back together into a wide array of forms both morphological and molecular. These can include many recognizable and abstracted bird-derived objects: a stuffed bird skin, parasites combed from feathers, heavy metals extracted from liver, pollen carved from beaks, isotope samples from bone marrow, frozen tissue samples, DNA extracts, genetic and genomic data from DNA barcodes to whole assembled genome sequences, to the layered labels tied to a specimen's foot or stuck on a cryotube, collection data handwritten in log books to entries in public databases. This array of bird-derived parts and pieces form a networked tangle at varying stages of transformation from the morphological to the molecular, from the analogue of a handmade object with the hand of the maker visible, to the digital world of databases and protein sequences that are equally handmade, but where the handwork is obscured.

The 'rediscovery' of natural history collections by conservation biologists as sites for gaining new types of data – data types that were unthinkable when the collections were originally made 150, or even 50, years ago – has rapidly shifted the value of these animal-objects in the face of new demands by new audiences, in ways and directions beyond the valuations given by museum biologists. Valued now as sources of potential insight into historic climate change, population bottlenecks and extinction events, these natural history collections become 'windows into the past' that will ostensibly provide for our own species' future needs, according to the many scientists I interviewed and worked alongside at both museums. The collections are not just a way of marking time in the 'Anthropocene', of measuring human impact and configuring pieces to fill gaps that humans have made in the fabric of biodiversity. Natural history collections are also cultural artefacts of our species' multiple and ongoing redefinitions of what constitutes the 'natural world' – as defined in the Global North. As such they serve as a conduit for voicing what place in that iteration of 'nature' human beings could, or should, occupy.

A deeply motivating factor for conservation of biodiversity stems from the destruction of 'natural' habitats (Lowe 2006; Lowe and Münster

2016; Tsing 2015a). Though a deeper analysis of the 'naturalness' of many of these environments is clearly warranted, it is perhaps also productive to examine this move as articulating a perspective of the 'natural' world as merely a resource – one that has flowed from the Global South into the collections and laboratories of the Global North. Within the context of 'salvage' operations to biobank biodiversity before it disappears, it is also important to attend to the materials through which these claims are made and negotiated. As a curator at Paris MNHN articulated this concern, "We must get as much as we can from each specimen, because we do not know when we might be able to collect another."[18]

I follow the argument made by Donna Haraway (2015) that issues of naming the era of the Anthropocene have to do with "scale, rate/speed, synchronicity and complexity" (2015: 159) more than the simple acknowledgment that human beings have radically reshaped the natural world over differently defined epochs of time. The recurring question in considering such systemic phenomena must be an attention to "when *changes in degree become changes in kind*, and what are the effects of bioculturally, biotechnically, biopolitically, historically situated people (not Man) relative to, and combined with, the effects of other species assemblages and other biotic/abiotic forces?" (2015: 159 emphasis mine). In Haraway's interwoven multispecies world no one species acts alone; instead "assemblages of organic species and of abiotic actors make history… the evolutionary kind and the other kinds" (2015: 159). This brings to the forefront not simply ecological devastation brought about by human forces – a dominating version of the Anthropocene cast as the 'Age of Humans' – but instead shifts the focus down to specific assemblages of historically situated and materially grounded *people*, *places* and *things* and the effects of their interactions. This resonates with my own focus here on the details of practice, material interactions and the types of time involved in making specimens at the Smithsonian NMNH and Paris MNHN.

In 'Feral Biologies' (2015b), Anna Tsing suggests that the inflection point between the Holocene and the Anthropocene might be the wiping out of most of the spaces for refuge (what she calls 'refugia') where diverse "species assemblages" (ibid) can be reconstituted after major cataclysmic events such as massive loss of habitat, epidemics or an influx of invasive species that shift local ecologies. From one perspective the

natural history museum projects under consideration here to collect and preserve 'all species of life' can be seen as a replica of a 'refugia', a constructed site of refuge from which to reconstitute the 'natural' world after a potential cataclysmic event in the future.

Within changing concepts of time such as the Anthropocene, humans have been re-situated into a larger temporal framework of 'deep time' (Ginn et al. 2018) and are now conceived as a geologic force, with our species' impact on environments archived through biosocial (or perhaps 'cryosocial', see: Hoeyer 2017; Kowal and Radin 2015; Radin and Kowal 2017) objects frozen in time such as ice cores (Antonello and Carey 2017), seed banks (Harrison 2017; Parry 2004), human (Radin 2017) and non-human genetic biobanks (Breithoff and Harrison 2020; Van Allen 2018, 2019b). New moral and ethical imperatives have emerged in response to these conceptions of time, shaping concepts of care in times of crisis such as natural history museum projects to 'preserve and understand the genomic biodiversity of life on Earth' (GGI 2019) in the face of increasing extinction rates.

The condition of possibility for such projects is the introduction of biotechnology into traditional museum collecting methods, where genomics becomes a salvational tool for making an archive of 'life' for the future. However, as the material world of Anthropocenic '*nature*' becomes a site of contesting interests and values, it is also the material *culture* of nature that is called into question as embodied in the practices for collecting and preserving natural history specimens. As Joanna Radin's (2013) account of frozen blood and tissue samples demonstrates, the value of genetic collections were archived as a form of latent values, to be thawed and used at some future moment in time.

Through analyzing two sets of objects – historic specimen preparation tools and inventories of contemporary prep kits – I have examined a different kind of 'time series', one that suggests that specimen preparation practices are archives of the past, not just in the body of the bird itself but of the techniques, materials and epistemic frameworks used to create the specimen. Ways of knowing the world are archived in the materials, as well as in the ways they are used. These are layered into the specimen and its network of abstracted parts and pieces through the process of transformation from a living thing into a museum specimen. As

specimen preparators skin, sew, cut and freeze pieces of birds, they create specimens shaped by their labour as much as they are shaped by their ideas of care for uncertain environmental futures. It is within these practices that time is folded, as disciplinary histories are woven together with visions for various futures in the transformed bodies of birds. As specimens, these birds' bodies are being intricately crafted to offer up future potential, be it data to expand scientific knowledge, to protect species or to repair ecologies.

Notes

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2. Genetic collecting projects in museums range from small collections made by curators for their own phylogenomic research, to institutional or global collecting programmes. These include projects such as the Global Genome Initiative at the Smithsonian (GGI 2019; see also Van Allen 2016, 2017), the Barcode of Life project to capture DNA snippets to identify all species (BOL 2016; see Ellis, Waterton and Wynne 2009; Waterton 2010; Waterton, Ellis and Wynne 2013), global public databases such as GenBank (GenBank 2018), as well as many family-specific projects such as the All Birds Barcoding Initiative (ABBI 2018) and the Bird 10,000 Genome Project (B10K Database 2018), set on drafting genomes of all existent bird species by 2020.

3. From interview notes with a curator, Smithsonian NMNH, February 5, 2015.

4. From interview notes with a curator, Smithsonian NMNH, February 5, 2015.

5. Interviews were conducted by author in a mix of French and English, interspersed with Latin names for birds. All translations are my own.

6. From interview notes with a specimen preparator, Paris MNHN, February 21, 2018.

7. From interview notes with a specimen preparator, Paris MNHN, February 21, 2018.

8. From interview notes with a specimen preparator, Paris MNHN, March 7, 2018.

9. From interview notes with a curator, Paris MNHN, November 18, 2017.

10. From interview notes with a collection manager, Smithsonian NMNH, June 20, 2015.

11. From interview notes with a curator, Smithsonian NMNH, April 10, 2015.

12. From interview notes with a curator, Smithsonian NMNH, April 10, 2015.

13. From interview notes with a genetics project manager, Smithsonian NMNH, July 10, 2015.

14. From interview notes with a collection manager, Smithsonian NMNH, February 1, 2016.

15. From interview notes with an ancient DNA specialist, Smithsonian NMNH, August 2016.

16. From interview notes with a specimen preparator, Smithsonian NMNH, February 2, 2015.

17. From interview notes with a specimen preparator, Smithsonian NMNH, January 12, 2016.

18. From interview notes with a curator, Paris MNHN, November 18, 2017.

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