Moving Across the Zoo-Field Border: Heini Hediger in Congo

MOVING ACROSS THE ZOO-FIELD BORDER:

HEINI HEDIGER IN CONGO

Raf De Bont

Abstract:

The twentieth century witnessed the rise of zoo biology. Such a discipline might seem anchored in a specific spatial setting (that of the zoological garden), but if historians want to understand its development they should not limit their view to the confines of the zoo grounds. After all, understanding animals and their behaviour at the zoo often involved thinking about them in other spaces as well. Notably, the 'artificial' state of animals in captivity invited reflection on their 'natural' condition in the wild. In order to study the changing relation between science performed at the zoo and in the field, this article conceptualizes a 'zoo-field border' – arguing that movements across this border are crucial to understand practices on both sides. In particular, the article analyses a field expedition to the national parks of the Belgian Congo set up in 1948 by Heini Hediger, the Swiss zoologist who is often credited as the pioneer of zoo biology. Hediger's expedition, I argue, involved conceptual, methodological and logistical border-crossing. The combination of these forms, then, ultimately enabled a rethinking of animals and their behaviours on both sides of the border.

Contributor biography

Raf De Bont holds the Chair of the History of Science and the Environment at Maastricht University, the Netherlands. His research focuses on the history of conservation, the life sciences and human-animal relations in the nineteenth and twentieth centuries. De Bont's recent publications include *Stations in the Field: A History of Place-Based Animal Research, 1870-1930* (The University of Chicago Press: 2015) and *Nature's Diplomats: Science, Internationalism and Preservation* (The University of Pittsburgh Press: 2021).

r.debont@maastrichtuniversity.nl

Department of History, Maastricht University, Grote Gracht 90-92, 6211 NW Maastricht, Netherlands

The archives of the Institute of the National Parks of Belgian Congo (INPBC) contain a small paper slip that reads 'decision 1643: Study mission in the colony'.[1] The decision in question, taken by the institute's direction committee in 1947, approves a four-month long research expedition through the national parks of the Belgian Congo and the Territory of Ruanda-Urundi. In itself, this approval was not so remarkable. After all, the INPBC prided itself that the parks under its administration served as 'living laboratories' for scientific research.[2] What was remarkable, however, was the name of the expedition leader: Heini Hediger. At the moment of the decision, Hediger was director of the zoological garden of Basel, Switzerland, and, as such, the first zoo professional to take up an expedition in the Congolese national parks. While Hediger had particularly published on animal behaviour *in captivity*, he clearly did not deem this sufficient as a knowledge base for running a zoo. 'The research of animals in their *natural environment'*, he wrote not long before leaving, 'is currently of the highest significance'.[3] This conviction would take him to the heart of Central Africa – 6000 kilometres away from his enclosures in Basel (as the crow flies) (see *figure 1*).

Of course, historians have drawn ample attention to the scientific practices developed by zookeepers. Zoos, they have rightly argued, constituted important sites for the lay and professional observation of undomesticated animals, venues for the popularization of scientific knowledge, and spaces for practical breeding experiments.[4] At the same time, historians portray zoological gardens as occupying a slightly idiosyncratic 'niche' and embodying 'their own distinctive spatial formations of scientific knowledge'.[5] Zoo science takes place in condensed urban spaces, organized with public exhibit and entertainment in mind, and, as such, appears as detached from scientific practices developed elsewhere. It is important to acknowledge, however, that the identity of the zoo as a centre of science developed in interaction with and in contradistinction to other spaces of knowledge production. Indeed, understanding animals and their behaviour in zoological gardens usually involved thinking about them in *other* spatial

contexts. In particular, the 'artificial' captive state of animals at the zoo has invited reflection among zoo professionals about their 'natural' state in the wild.[6] So far, however, historians of science have only addressed this interaction between the zoo and the field – as ideal types *and* as tangible physical spaces – to very a limited degree.[7]

Conceptually, scholars interested in the interactions between zoo and field science can draw on the expansive literature that appeared in the wake of 'the spatial turn'. In particular, they can exploit the insights of the historiography that has analysed the historical relations between lab and field biology.[8] The publications of Robert Kohler have been particularly influential in this respect. In his *Landscapes and Labscapes*, Kohler highlighted how 'the categories of field and laboratory were coinvented and are mutually (and changeably) defining'.[9] Furthermore, he conceptualized a 'lab-field border' and studied how productive movements across this boundary took shape. Notably, he showed how field biologists imported techniques of counting and experimentation from the lab and adapted them for studying landscapes and organisms in a field context. In line with Kohler's ideas, I propose we conceive of an equally permeable zoo-field border. In this article, I will argue that the lands on both sides of this border, too, mutually and changeably defined each other.

Of course, metaphors always hide as well as reveal. Notions like the 'zoo-field border' and 'coinvention' might create the image of an essential and unchangeable dichotomy. Such an image, however, would be wrong. Evidently, animal researchers never live in a binary world of zoos and field sites, but in a messy reality in which other scientific spaces (such as labs) and mundane infrastructures (such as state bureaucracies) are highly relevant as well. The coinvention of the zoo and the field, furthermore, was, of course, not a singular event, but a long-term process in which relations and interconnections continuously changed. This article does not have the ambition to grasp this entire process, but rather analyses one pivotal period,

the mid-twentieth century, by foregrounding the work of one particularly influential border-crosser, Heini Hediger.

Hediger indeed offers a high-profile case. After all, both historians and zoo practitioners celebrate him as the 'father of zoo biology', the discipline aiming to make the management of animals in captivity scientific. Crucial to Hediger's approach was his vision that the study of animal psychology should be central to zoo design and management. A practitioner as much as a theoretician, he tried to apply this vision during his directorships of, subsequently, the Tierpark Dählhölzli in Bern (1938-1943), the Basel Zoo (1944-1953) and the Zoo of Zurich (1954-1973). The interest for practically managing captivity was central to his zoo biology. While laboratory biologists also work with captive animals, captivity *itself* is hardly their focus. Laboratory research famously aims at a universal 'view from nowhere', not a view from the cage.[10] Zoo biology is different. As Mitchell G. Ash has indicated, it focuses 'reflexively on the institution in which its research […] [is] carried out' – and this in order to improve the conditions of animal captivity.[11] As such, its special relation with field biology (rather than with laboratory biology) is understandable. As the *opposite* of captivity, life in the wild could offer researchers such as Hediger a vantage point to understand the particularities of life at the zoo. It is in this context that the zoo-field border receives its particular significance.

Hediger's approach would resonate globally. He had earned himself a reputation not just in animal psychology, but also in its applications to zoo design and management – first in Europe, then in the US, and finally across the world. In 1965, when the second English edition of his renowned *Wild Animals in Captivity* came out, he had reached such prominence that the National Zoological Park in Washington distributed copies of the book among its keepers.[12] A few years later, the journal *Science* referred to Hediger as the discipline's 'bishop' and to his work as 'doctrinal' – while his global leadership status was also apparent from his consultancy

missions to (re)design zoos in places such as São Paolo, Simla (India), and Sydney.[13] Until today, handbooks in zoo biology prominently reference him as the discipline's founder.[14]

Given such renown, it should not be a surprise that Hediger's work received quite some scholarly attention already. He himself took part in the shaping of his popular legacy by publishing an autobiography a few years before his death.[15] In the 2000s, two more biographies came out, and, subsequently, the rise of human-animal studies and environmental humanities further fuelled the interest.[16] The spatial context that is central to all this scholarship, however, is that of the western urban zoo. So far, Hediger's ventures into 'the wild' and how these relate to his zoo work have received only scant historical attention.

My focus in this article will be on one particular field trip: Hediger's aforementioned mission to the national parks of Belgian Congo. This was not Hediger's first overseas expedition. In 1930, he had engaged in a mission to German New Guinea, and, in 1932, to the French Protectorate of Morocco. The Congo expedition, however, came closest to his own ideal of what such a mission should entail. While in New Guinea and Morocco, much of his time was essentially devoted to the collecting of specimens, the mission to Congo focused exclusively on the study of animal psychology. In his autobiography, he stressed that, as such, it was 'the first of its kind to be sent to Africa'.[17] Of all his trips, this was the one most crucial for Hediger's coinventing of zoo and field practice.

To understand this coinvention, I will explore movements across the zoo-field border at various levels. Above all, this article is interested in conceptual travel, studying the extent to which approaches and sensibilities developed at the zoo shaped understandings in the field, and vice versa. Secondly, such travel clearly had an important methodological side to it. In order to perform animal psychology 'in the wild', Hediger had to come up with new methods as well as legitimations for these methods. These partially pertained to his own movements as a field researcher, but also to the ways his movements interfered with those of the animals

under research. Finally, Hediger's border-crossing had a clear logistical dimension. After all, conceptual and methodological movement relied on the logistical intricacies of long-distance expeditionary travel. Moving back and forth between the zoo and the field is indeed substantially complicated when these sites are 6000 kilometres apart.

Subjective territories

Hediger, of course, would not enter the Congolese field as a blank slate. His observations of wild animals made use of a particular theoretical lens that he had been developing through the 1930s and the early 1940s – based on his experiences at the zoo and his reading of a broad range of zoological literature. The outlines of his theoretical framework are generally well known. In order to understand how they shaped his approach to fieldwork, however, it is important to revisit them here once more.

Probably most crucial to Hediger's understanding of animal behaviour is the notion of *Umwelt* as developed by the Baltic German biologist Jakob von Uexküll.[18] Following von Uexküll's line, Hediger claimed that animals did not just live in an objective environment, the *Umgebung*, but also in a 'subjective world', the *Umwelt*, in which their material surroundings received particular meanings.[19] Hediger, furthermore, indicated that if one wanted to understand the animal's subjective world one particularly had to analyse the functioning of its 'territory'.[20] Ornithologists had launched this notion of 'territory' in the late nineteenth century, and, by the 1920s, it had become a popular concept to discuss how male birds competed with each other over particular spaces.[21] Hediger, however, came with an influential rethinking of the concept, defining it as 'a system of biologically significant, more or less connected points rather than as a bounded space'.[22] He argued that these 'fixed points' fulfilled various functions (and, thus, had different meanings) in the animal's live. There were places that served as a 'home' or 'nest'; there were feeding places; there were places for urinating, defecating and

excretion; there were drinking places, food stores and demarcation points. These various places, then, were interconnected by tracks that the animal used regularly.[23]

By the early 1940s, Hediger synthesized all these ideas in a schematic image that purportedly applied across species and that would become an oft-reprinted classic in animal ethology (see *figure 2*).[24] While the scheme rendered the spatial dimension of an animal's territory tangible, Hediger was quick to add that it also involved a temporal component. After all, so he argued in his *Wildtiere in Gefangenschaft* (1942), 'movements within this geometrical system [of the territory] […] normally take place at definite times'.[25] Hediger was convinced that animals, appearing rather punctually on the same spot at the same moment of day, were locked in what he defined as a 'space and time pattern'. Their relation to their *Umwelt* was in other words a very conservative one.

Up to the late 1940s, Hediger's publications on animal territories and *Umwelten* hardly drew on personal observations in the field, but they did already entail some first (conceptual) crossings of the zoo-field border. After all, his vision on wild animal behaviour tied in with the ways in which he conceived (and legitimized) the zoo. The 'space and time pattern' of animals in the wild, Hediger would repeat almost endlessly, undermined the 'anthropocentric illusion' that they were 'free' in any meaningful sense of the word. Rather, their movements, driven by an 'inexorable compulsion' and using only a very limited part of the overall territory, testified of 'an extreme restriction'.[26] Such an interpretation, in which wild animals were not 'free' to begin with, offered an indirect defence against the claim that zoological gardens robbed animals of their freedom.[27] The fact, then, that Hediger felt the need to come with such a defence had everything to do with the rise of an increasingly vociferous animal rights movement. As early as 1931, Hediger published an article in the journal of the Swiss society for nature protection, to argue that in a modern zoo, the animal 'lacks nothing', and that zookeepers took care of its entire 'physical and psychological well-being'. The journal editors,

however, issued an addendum in which they reiterated their ethical concerns with keeping animals in captivity for human entertainment.[28] It was partially in response to such 'sentimental' voices that, over the following decades, Hediger would develop his zoo biology.[29]

Relativizing the 'freedom' of wild animals, Hediger made a principled point about the legitimacy of zoological gardens. At the same time, however, he was ready to admit that traditional zookeeping was problematic in various respects. In zoo enclosures, he argued, animals often lacked the space, and, more importantly, the 'functions' of their territories in the wild. Moreover, without 'natural' activities such as enemy avoidance and foraging, animals became passive – to the detriment of their health and muscularity. Finally, Hediger believed that the persistent close presence of humans was often harmful as well. As humankind represented the 'universal enemy' of undomesticated animals, the latter would naturally run off when the former came within what Hediger described as their 'flight distance'. Since this was impossible in captive conditions, many wild-caught animals in zoos were in a continued state of stress. Hediger, in short, diagnosed a whole range of 'biological and psychological zoo problems'. Through the late-1930s and the early-1940s, he, furthermore, tentatively formulated possible solutions. The enrichment of enclosures was to provide animals with all the functions of a normal territory; 'biological dressage' and human-organized forms of 'play' would increase their activity levels; taming through gradual habituation could reduce stress. For the rest of his career, Hediger tried to develop these ideas and turn them into practice.[30]

Empirically, Hediger's reform program partially utilized his personal observations, which, initially, mostly came from the 'artificial' context of the zoo. To understand animal territories he documented scent markings of various captive species as well as territorial clashes between rival males in bordering enclosures. Likewise, he made notes about the responses of wild-caught animals to humans coming within their flight distance.[31] Yet, all the while, Hediger was convinced that to understand the 'special condition' in the zoo, it was ultimately necessary

to consider the 'normal state' in the wild. In this respect, he compared zoo biologists to medical practitioners. The latter, after all, could not understand a 'pathological phenomenon' without studying the 'normal function of the human body.'[32]

Yet, information about the 'normal state' of animal behaviour proved hard to come by. In his articles from the 1930s and early 1940s, Hediger drew on a piecemeal and often anecdotal natural history scholarship, as well as on the incidental observations he had made on his collecting trips in Morocco and New Guinea. In an overview article of 1944, he lamented that some of the most basic questions regarding the daily lives of wild animals remained unanswered. Professional biologists, he believed, had overlooked them because they involved leaving the relative comfort of the laboratory behind, and engaging in difficult and time-intensive field studies.[33] Yet, if zoo biology was to professionalize, at least some of these difficult questions needed tackling. Consequently, the zoo-field border was to be crossed – not just conceptually, but physically too.

In this context, it should not be a surprise that when INPBC's director Victor Van Straelen contacted Hediger to set out on an expedition to Belgian Congo the latter jumped to the occasion. While a time-pressed zoo director might have found places that were more convenient for performing field research, the far-off destination actually contributed to the appeal. Hediger, indeed, believed the most urgent knowledge he needed concerned animals in the tropics. In *Kleine Tropen-Zoologie*, a monograph he prepared in the lead-up to his Congo mission, he indicated that tropical animals were rapidly vanishing, while even their most simple life habits remained unknown. His expedition, thus, could be considered a form of salvage zoology, set in a disappearing tropical world he described as 'so unimaginably rich and varied, and of a bewildering splendour and opulence'.[34] This kind of imaginary of a tropical and threatened 'environmental other' clearly resonated with the exoticism that pervaded western zoos. Sub-Saharan Africa, and its large charismatic mammals in particular, took up a prominent

position in this exoticist imaginary.[35] In his autobiography, Hediger later indicated that Rudolf Geigy, head of the Basel's zoo board of directors, only gave him permission for the Congo expedition because it would concern the typical African megafauna so well represented at the zoo.[36] Simultaneously, the same charismatic mammals increasingly also mobilized wealthy European tourists to visit African national parks.[37] As Hediger argued in his *Kleine Tropen-Zoologie*, it was 'precisely those creatures that Europeans […] wish to meet in the tropics'.[38] Indeed, Van Straelen's request to Hediger sprang from the fact that he wanted to understand the impact of increased tourist numbers on the charismatic wildlife in his national parks. An expedition focusing on the psychology of 'big game', thus, catered both to the ambition of a zoo biologist to become acquainted with his 'foster children under natural conditions' and the ambition of a national park administrator to understand the interaction between wildlife and tourists on his grounds.[39]

While Hediger's defence of fieldwork hinged on a distinction between the 'natural' and the 'artificial', he certainly did not think of these two as neatly separated categories. In fact, the trip to the Belgian Congo appealed to him exactly because it would offer him a whole gradient of sites between the wild and the tame, the field and the zoo, the natural and the artificial. Of the projected destinations of the mission, Garamba National Park arguably offered the most 'wild' place: an area of 500.000 hectares in the north of the country that was only established as a park in 1938 and that had not opened up to tourists yet. Among the other destinations, the Kagera National Park (est. in 1934, in the Territory of Ruanda-Urundi) saw some embryonic tourism, while the Albert National Park (est. in 1925) had become already fairly popular and experienced quite some traffic on the road infrastructure in its southern parts. Hediger presumed such differences would certainly leave their traces in animal behaviour. Other destinations, finally, included the Léopoldville Zoo, the Okapi Capture Station in Bilota

and the Elephant Domestication Station in Gangala-na-Bodio – offering various forms of animal captivity, transit and tameness (see *figure 3*).[40]

In Hediger's mind, crossing the zoo-field border was not a straightforward move from one homogeneous entity (the zoo) to another (the field). Rather, he conceptualized his expedition as a journey through a variation of mixed spaces that each offered different types of human-animal interactions. As we will see, his scientific results would clearly bear the mark of this particular reading of the landscape. First, however, we turn to the logistics of the expedition. These not only enabled Hediger to get into Congo in the first place, but also shaped the type of work he could actually carry out.

Established Infrastructures

For a European zoo director interested in African mammals, crossing the zoo-field border unavoidably involved time-consuming long-distance travel. In popular representations, expeditionary travel often appears as an individualist enterprise, carried out by heroic leaders who move freely and autonomously into uncharted territories.[41] Yet, it is clear that expeditions depended as much on logistical infrastructures and regulatory frameworks as they did on individual leadership. These infrastructures and frameworks enabled certain practices, but also complicated and constrained them in various respects. The latter was certainly the case for Hediger's mission to Belgian Congo. The practicalities and bureaucracies of travel proved very onerous, limiting the actual time available for research in the field. They, furthermore, left their traces in the ways Hediger ultimately conceived of his research.

The archives of the Hediger mission show the extent to which an expedition in late-imperial Africa was a bureaucratic affair. Apart from his passport, Hediger needed a visa, a 'certificate of good conduct' and an international vaccination record.[42] The expedition, furthermore, required an official ministerial approval, and, for the pharmaceuticals for the

expedition members, an import license.[43] To ease travel, the parastatal INPBC provided letters of recommendation for colonial officials.[44] A contract of eight pages between the INPBC and Hediger detailed mutual obligations, while a separate directorial decision made the expedition conditional on the fact that Hediger would be accompanied by a Belgian assistant. Jacques Verschuren, a young biologist halfway his studies, was hired in that capacity.[45] Because of national park regulations, Hediger's request to take his pistol on the trip was denied.[46] It might be clear that the bureaucracy not just confronted Hediger with time-consuming red tape, but also shaped the way he travelled and with whom.

Apart from governmental and parastatal agencies, the expedition mobilized a whole range of commercial enterprises to provide, ship, insure and repair the necessary equipment. Despite the fact that Hediger presented animal psychology as a low-tech discipline, his mission carried around material for a total weight of 750 kilogram.[47] The INPBC worked with specialized companies to arrange 'colonial tents', pharmaceuticals, and photographic and cinematographic equipment.[48] Notably the latter, which Hediger deemed crucial for his psychological field studies, came with logistical challenges. Reels needed supplementing throughout the mission, while the expedition members continuously sent back shot film for development – either by airplane (for colour film) or ship (for black and white). A tele-objective that proved malfunctioning during the mission needed to be sent back to Belgium twice. Communication on these matters proved cumbersome, particularly since one of the planes carrying airmail crashed on its way to Belgium. Throughout the four months, the expedition thus depended on a vulnerable lifeline along which letters, reports, film and equipment travelled back and forth between Brussels and Congo.[49]

The travel of Hediger and Verschuren themselves was organized by the multinational shipping company Agence Maritime Internationale. Flying from Brussels to Léopoldville (the capital of Belgian Congo), the expedition members travelled on a commercial wheel steamer

over the Congo River to Stanleyville, where a colonial Ford dealer provided a car.[50] After long deliberations, the INPBC eventually selected a pick-up over a station wagon. While local dealers admitted the former was more comfortable, the latter could carry more weight, and, important in their opinion, it separated the European expedition leaders from their indigenous servants.[51] It was a logistical choice that shaped the expedition in various ways – be it in some respects more strongly so than in others. As we will see, the social separation induced by the pick-up did not refrain Hediger from conversing with indigenous informants, whose knowledge he deemed particularly valuable. Yet, the choice to travel heavy proved to be a more determining factor. Together with the limited time at his disposal, the bureaucratic rules in the Belgian Congo, and the fact that film and photographic material needed continuous resupply, it made Hediger stuck to the colonial road system. This was decisive for the type of nature he encountered.

Apart from a six-day 'safari' – which mobilized 25 porters – the Hediger expedition stayed very close to human-made infrastructures, even when entering the national parks. This implied that the field, unlike what Hediger had envisioned in *Kleine Tropen-Zoologie*, could never serve as a fully 'natural' counterpoint for the 'artificial' settings of his own zoo. The field Hediger entered was ill suited as a place to study animals in the absence of humans. It did offer good prospects, however, to investigate the ways humans and animals interact. Roads, Hediger indicated, were not just infrastructures connecting research sites. He conceived them as interesting spaces of research in themselves.[52]

Within the expedition, there were certainly qualms about this approach. Verschuren, notably, complained to his INPBC superiors that the mission hardly entered '*in* the national parks' – implying this interior was only to be found away from the parks' road infrastructure. When Verschuren quizzed Hediger about this, the latter replied he 'only wanted to see what the tourists see'. Such a tourist gaze, which in various respects resembled the gaze of a zoo

visitor, indeed implied a particular conceptualization of how to approach 'the field'. It was a vision that clearly carried the marks of the administrative and logistic frameworks on which Hediger relied to cross the zoo-field border.[53]

Creating observations

Of course, Hediger needed to confront not just challenges of a logistical, but also of a methodological kind. The territorial behaviour, flight distances and trail use of African mammals hardly constituted established objects of inquiry. Hediger actively had to make these phenomena observable, and convince others that he did so in a way that was properly scientific.

In advance of leaving, the Swiss clearly fretted about how to make the psychology of animals into an object of accurate observation. While zoo enclosures were explicitly designed to offer optimal views of animals, the wild often brought *in*-visibility – because terrains were uneven or overgrown, and because many animals lived secretive, nocturnal or underground lives. Hediger therefore pressed Van Straelen to provide telephoto lenses in order to capture shy wildlife on film, and made sure to call for shovels and spades with the purpose of reaching the underground burrows of animals such as aardvarks.[54] While the national park's administrators easily met these requests, they denied some of Hediger's more radical ideas to make Congo's elusive animals observable. Since Van Straelen propagated a model of 'strict reserves' in which human intervention was limited to a bare minimum, he rejected Hediger's proposal to set up night-time observations through the use of flares.[55] Similarly, the administrators of the parks turned down a request to burn parts of the park's vegetation in order to enable long-distance vision – be it that they did allow for some 'clearings' in order to create 'observation areas' in exceptional cases.[56] As a zoo director, Hediger was clearly used to manipulative interventions of generating visibility. The parameters imposed on him in the national park, however, limited the options.

Hediger's challenge was not just to develop practices that enabled observation while staying within national park regulations, but to do so in a way that convinced professional scientists that these practices delivered accurate data. Associated with low-status work in the zoo and haphazardly recorded particulars from the field, animal psychology did not have a reputation for analytical rigour. In the report that Hediger would write on his Congo expedition, he indicated that both lay people and scientists believed the whole discipline only consisted 'of subjective impressions and more or less hazardous hypotheses'.[57] Both the observational practices he constructed and the ways he represented these practices were to counter that impression.

The field was important for Hediger, as – unlike the zoo – it gave access to 'natural' animal behaviour. Yet, when it came to scientific ideals such as control, precision and generalizability, many believed fieldwork to be epistemically suspect. In order to generate credibility for his animal psychology Hediger therefore had to engage in another form of (imaginary) border-crossing: he mimicked the higher-status practices of the lab. In his report he insisted that his animal psychology was 'not less precise than, for instance, histology.'[58] In order to further convince his readers (and in a move that mirrored journals for laboratory biology), Hediger started his report with a short overview of the instruments he had used. Some of these, such as binoculars and a notebook, probably did little to advance his work's epistemic prestige, but others proved more suited to the cause. The latter included 'gunter's chains', of which Hediger stressed they enabled him to measure the 'exact' flight distance of animals. Furthermore, he listed his photographic and film camera, arguing they could record animal behaviour in similar ways as microscopic slides documented histological development. Finally, then, he listed his car. The rapidity of cars, Hediger indicated, extended the scope of possible observations by 'speeding up the succession of visual impressions'. Here, he made the comparison with cinematographic film. By speeding up images, both films and cars made

phenomena visible that would otherwise remain hidden from sight. Indeed, Hediger suggested that getting a broad glimpse of animal behaviour in Central Africa required a high enough tempo on the side of the observer.[59] The image he thus evoked was one of technological manipulation and accurate measurement. While physically crossing the zoo-field border, he metaphorically travelled from the field to the (higher-status) lab.

Notably in Garamba National Park, Hediger integrated his car in a 'practice of place' that echoed laboratory ideals. The park's only road infrastructure consisted of an unpaved track of twenty-five kilometres length. Hediger, accompanied by the park's warden Marc Micha, drove the same strip under various conditions and at various moments of day for over a month – stopping each time he noticed something unusual. His goal, he wrote in a letter to Van Straelen, was to establish 'a monograph of the track'.[60] In his report, he later indicated that only through 'constant re-examination of the same spaces' one could gain credible insights into the animal use *of* those spaces.[61] Once again, it is not hard to see how his set-up reiterated the laboratory model of multiple trial experiments.

In the field, 'constant re-examination' was arguably even more indispensable than in the lab. Before setting off to Congo, Hediger had already indicated that animals in the wild could not be controlled and manipulated as they could in lab conditions.[62] The practice of observation, after all, was not to interfere with the natural behaviour of the animal. Only occasionally, Hediger would consciously break this rule by setting up a small-scale field experiment. One example included constructing a barrier on an oft-used trail to test animals' adherence to their fix trajectories. While buffaloes removed the barrier, hippos moved around it, quickly establishing a track that changed little to their erstwhile routines. Both responses only seemed to offer experimental confirmation of Hediger's idea that wild animals were highly conservative in the ways they moved through their territory.[63]

While consciously disturbing the animals in some ways, the barrier experiment avoided interference with their 'natural' behaviour in other respects. After all, Hediger did not analyse the animal's response to the barrier directly, but indirectly – by studying the tracks and marks they had left. He deemed such 'indirect observation', which he also used in other instances, of 'fundamental importance' for animal psychology. While modern biologists only had shown limited attention for animal traces, Hediger stressed they contained all kinds of information about life habits. Footprints, of course, gave insights into movement patterns, and traces such as excrements and marks provided good indications about the animal's use of its territory. Hediger argued that while the behaviour of animals is a fleeting phenomenon and often hard to observe, their traces are 'fixed' and constitute 'graphic registrations on the level of the territory'. What is more, the fixation was carried out by the animals *themselves* – generating an 'auto-inscription' that did not require any human intervention at all.[64] Through this argumentation, Hediger tried to free the study of animal tracks from traditional associations with amateurs and hunters, and present it as a highpoint of 'mechanical objectivity'.[65] While he was following animal trails in the interior of Africa, he made it sound as if he was studying inscriptions produced by an automated laboratory device.

Of course, Hediger's published report strategically framed his methodology as a procedure carefully conceptualized in advance. Letters in the archive, however, seem to indicate that it was at least partially born out of necessity. Denied the possibility to make animals visible through flares or bush burning, he had to make do. Particularly in Garamba national park, challenges were many. In an informal report, Verschuren highlighted that 'direct observations' had been largely impossible because of the relative rarity of game, its 'extreme shyness', the bushy vegetation that obstructed vision, and the fact that the hunts of the Elephant Domestication Station had chased away many animals. 'Indirect observation', he suggested, had been the only alternative.[66] While Hediger's own letters struck a more upbeat tone, they

equally testified of frustration with observational limitations. Reaching out to Van Straelen, he came with the suggestion to deploy airplanes to facilitate the observation of animal territories. He indicated that particularly his study of 'hippo trails' would be furthered if he could tap into the synoptic vision offered by aerial photography. Informed by local administrators that cartographic mapping of the parks would involve this technology anyway, Hediger argued he could make the INPCB a pioneer in 'the application of aerial photography to behavioural science'.[67] Van Straelen enthusiastically scribbled 'yes!' in the margins of the letter, but failed to speed up the process enough for the pictures to be of any use.[68] As a result, Hediger could only observe animal auto-inscriptions from his car.

Embedded Knowledge

Relatively soon, it became clear to Hediger that, even when using methods of 'indirect observation', much remained hidden from sight. Although the Congo expedition took several months, the distance covered (no less than 16.000 kilometres) and the elusiveness of many of the animals implied that his trip could be nothing more than an orientation mission. Apart from first-hand observation, Hediger therefore assembled 'local' knowledge about animal psychology – consulting both Europeans and indigenous populations who held long-term residence in the places he visited. This, of course, was not an uncommon practice. Much recent scholarship stresses how expedition leaders, often unfamiliar with the area they entered, relied heavily on both the knowledge and labour of 'local' populations – thus blurring the lines between 'who was leader and who was led'.[69] This dependence was particularly outspoken in the case of Hediger, since his questions regarding animal psychology clearly required a type of long-term observational practice that was particularly hard to achieve on a hasty mission. In his informal report, Verschuren admitted that because of the 'relative brevity' of the trip many questions could 'merely be posed'; solving them, after all, would involve 'many months of

uninterrupted observation'.[70] An alternative to doing the observations themselves, however, was to tap into the knowledge of the long-term residents they encountered.

Thanks to Van Straelen's network, Hediger gained direct access to various diplomats, veterinarians and military-trained park rangers. Furthermore, apart from consulting with European administrators, the mission relied heavily on indigenous knowledge and skill. Operating in a colonial context and benefiting from unequal power relations, Hediger could call upon large numbers of indigenous 'assistants' who remain mostly unnamed in his publications. Their exact contributions are not always clear, but the archival sources do provide a few hints. The films made by Verschuren, for instance – while mostly focusing on wildlife – show occasional glimpses of the indigenous men whom he and Hediger engaged with: an elephant tamer in Gangala-na-Bodio, an okapi carer in Bilota, a guide pointing out a hole dug by an aardvark in Garamba, a uniformed park guard closely following Verschuren while the latter tried to enter within an elephant's flight distance in the Albert National Park.[71] Indigenous help particularly proved crucial in tracking and occasionally catching animals. In Garamba, for instance, the mission mobilized up to 25 local Zande, who according to Hediger belonged to 'a secret society that already had eaten aardvark', to trace and dig up an individual of this otherwise invisible animal.[72] The operation – extensively documented on photo and film – enabled him to describe the burrow structure of a species that so far had remained largely unknown to Europeans (see *figure 4*).[73]

Zoos, of course, depended on indigenous skill for tracking, catching and transporting animals since time immemorial. Hediger's new focus on animal psychology, however, made him rely not only on the manual labour of indigenous people, but also on their *understandings* of the natural world. When, in 1958, Micha published a collection of Zande folk stories about animals, Hediger wrote an enthusiastic preface.[74] 'So-called primitive people', he indicated there, 'use picturesque ways to recount scientific facts, which, as a general rule, have a

biological basis'.[75] The statement echoed his experiences in the Congo from ten years earlier. Yet, while Hediger clearly drew on indigenous informants, the latter only exceptionally received a voice in his publications. One such exception was the 'son of Timwa', a leper who had exceptionally received permission to live in the Garamba National Park. The son in question appears only in passing in the official report of 1950, but the more anecdotal format of Hediger's autobiography (published in the post-colonial context of 1990) allowed for some more space. Here, Hediger credits the man as 'our indigenous expert' and as 'an extraordinarily gifted and knowledgeable park ranger'. He singled him out in particular as his informant about warthog defensive behaviours, as well as about the symbiotic relation between hippos and a fish locally known as 'Dorumbia' that cleaned the former's skin.[76] Hediger was so impressed with the latter finding that he followed up the issue with Zande porters, who referred to the fish as the 'oxpeckers of the water'. He extensively discussed the form of symbiosis in his mission report, and made it the subject of a separate article in the specialist journal *Säugetierkundlichen Mitteilungen.* In both cases, he omitted his informant's name.[77]

It is unclear whether Hediger interacted directly with Timwa's son. Overall, however, one can presume he made use of translators and go-betweens in order to get access to indigenous knowledge.[78] Mostly omitted from published results as well, one such intermediary between 'local' and 'western' knowledge nonetheless receives explicit mention in Hediger's autobiography. The man in question was Jean de Medina, the head of the Okapi Capture Station. Indicating that de Medina was the son of a Portuguese physician and an indigenous woman, Hediger stressed how he was familiar with both 'the technical possibilities of Europe and the specificities of the Congolese forest'.[79] This included useful indigenous knowledge on the whereabouts of okapis and the best ways of catching them. In order to minimize stress and bodily harm, de Medina resorted to traditional 'Pygmy' methods of camouflaged pits, which via 'runways' connected to 'settling down enclosures'.[80] Such practical knowledge might have

been technically outside the scope of Hediger's mission, but it could not but interest a zoo director. The contacts established during the expedition, furthermore, eventually proved instrumental in bringing an okapi – Switzerland's first – to Basel in 1949.[81]

Field/Zoo and Nature/Culture

Travel between the field and the zoo was not limited to the okapi that came from de Medina's Capture Station. The more important travel was of a conceptual kind. Hediger's field observations on animal *Umwelten* would indeed echo in his zoo science. In Congo, Hediger had been able to observe how some markers in the landscape received meanings in the subjective worlds of different species. Termite moulds, for instance, served as observatory platforms for baboons and birds, as feeding sites for aardvarks, and as 'rubbing places' for elephants, buffaloes and zebras. Such knowledge, Hediger indicated, was immediately applicable for making animals at home in the modern zoo. Returning from his trip, he almost immediately had a mock termite mould erected in the zebra enclosure. According to Hediger, the zebras started rubbing so enthusiastically that they overthrew the cement construction, with the result that he had to replace it with one in reinforced concrete (see *figure 5*).[82] Similarly, Hediger tried to bring other 'functions' of animal territories he had witnessed in Congo to his Basel zoo enclosures – such as branches for releasing secretions, or mud pools for wallowing.[83]

While reforming the zoo often consisted of small interventions in the existing architecture of enclosures, Hediger exceptionally could also design animal housing from scratch. This was notably the case for the African House that opened during his tenure at the Zurich Zoo in 1965. More than fifteen years after his expedition to Congo, it materialized some of his earlier observations from the field. In collaboration with the architect Rudolf Zürcher, Hediger conceived a rounded structure in reinforced concrete that broke with what he saw as 'anthropomorphic' rectangular designs. Housing hippos, among other animals, Hediger was

eager to apply his Congolese field knowledge to zoo architecture. The design involved a basin that the hippos could reach through a hollow steep path similar to the ones he had observed in Congo. Furthermore, Hediger recalled from his mission that hippos preferred to spend most of their day in the river at a depth of 1.2 meter. In the Africa House, he would make the basin recline to this depth in order to lure the animals closer to the viewing area. His idea to introduce the symbiotic 'Dorumbia' (now identified as *Labeo velifer*) proved too expensive. Yet, he was able to accommodate oxpeckers in the enclosure – in this way replicating at least part of the symbiotic relations hippos engaged in. The structure in concrete did not provide the illusion of wilderness, but Hediger insisted that it did replicate central aspects of the hippo *Umwelt* in Congo.[84]

More generally, Hediger imported his methods of indirect observation as tested in Congo to his zoo research, developing a particular interest for trails of animals within their enclosures. In the zoo, these trails often showed stereotypical repetitive movements, which Hediger explained as hypertrophied versions of natural activities due to the fact that enclosures condensed wild territories up to 10.000 times. Once again, he believed the problem could be overcome by further modifying the artificial situation. In this case, he recommended interventions such as dressage or enclosure enrichment.[85]

Hediger's Congolese fieldwork, thus, clearly shaped his initiatives at the zoo. Yet, also the reverse was true. As a zoo director, Hediger had always tried to understand animals in interaction with humans. This implied he came from a completely different angle than the Belgian park administrators whose ambition it was to enable animal studies in complete isolation *from* humans. While the latter conceived the national parks as 'natural laboratories' that offered remnants of primitive nature, Hediger read them as cultural landscapes. As such, he was not only sensitive to the presence and impact of roads and tourists, but also pointed out the traces of more traditional indigenous activities. In the Albert and Kagera National Parks,

for instance, he encountered intricate networks of pits and ditches, which he thought were the remains of large-scale indigenous hunting infrastructures. He believed such traces of human-animal interaction were well worth the attention of the animal psychologist. In fact, in a letter to Van Straelen, he singled them out alongside hippo trails as the one research object he wanted to develop further through aerial observation.[86] While such observation failed to materialize, Hediger did find other 'traditional' human-animal interactions he could observe without the use of airplanes. Just outside of the Albert National Park, he studied the village of Katanda, which seemed to exist 'in close harmony' with particular forms of wildlife. Hediger indicated that residents did not hunt species such as Nile geese, guinea fowl, waterbuck and even elephants in the immediate surroundings of the village, gradually making these animals semi-tame. He considered the resulting nature-cultural complex 'a testimonial of the interesting primitive relations between man and animal' and, as such, worthy of protection.[87] To Hediger, the situation in Katanda proved humans could shape the natural world not just for the worse, but also for the better.[88]

Hediger's comparison between the various national parks of the Belgian Congo further developed the point that animal behaviour was closely entangled with human activities. This was particularly clear in his study of flight distances. While such distances tended to be large in the Garamba National Park, they were shorter in the more heavily visited Kagera and Albert National Parks. Based on literature references, Hediger argued that they were even shorter in South Africa's Kruger National Park, and almost absent in the most popular national parks in the US. In all these places, humans were clearly present in the animals' *Umwelten,* but in different ways. While they were perceived as the 'universal enemy' in the Garamba National Park, they had come to be seen as suppliers of food in some of the American national parks. As such, Hediger tried to shift the perspective of the Belgian park administrators. The question

was no longer how to avoid humans interacting with animals, but how to organize this interaction.[89]

In line with this reasoning, Hediger indicated in his recommendations that the ideal of 'strict reserves' was no longer tenable. National parks were always 'slices' of nature that required human interventions by definition. Surplus animals within the park were to be killed to avoid overpopulation, and domestic animals at the parks' border needed to be vaccinated in order to contain zoonotic diseases. Hediger was also convinced that roads and jeeps were unavoidable if one wanted to contain poaching. A serving road system, however, did not necessarily provide a problem for animal behaviour.[90] In Garamba, Hediger had observed that the short existing road received a 'positive meaning' with most animals. Studying footprints and excrements, he found out that at least 32 different species used the dust track, making it 'a true artery of a gigantic menagerie'. Yet, heavy traffic, like encountered on the main road through the Albert National park, resulted in negative connotations. Consequently, animals shied away from such roads and only nervously crossed them – with 'fleeing diarrhoea' offering evidence of their distress. For Hediger this certainly did not imply that car tourism (so reluctantly allowed by the Belgian national parks administration) was to be avoided. He believed one only had to consider animal psychology when organizing it (see *figure 6*).[91]

In his recommendations for Van Straelen, Hediger argued that animals tended to interpret cars as just another animal species. He concluded this from recorded attacks of elephants and hippos that always aimed for the car's 'head', namely the radiator. The headlights, he speculated, were probably seen as 'eyes'. The trick, then, was to make animals perceive their fellow 'animal-automobiles' as inoffensive. In order to achieve this, every association with humans was to be avoided. Tourists, thus, should be forbidden to leave their cars at all costs. Furthermore, they ideally provided their vehicles with animal-like behaviours. Tourists were to follow a specific space and time pattern, only visiting particular places of the

park during particular moments of the day. At some 'fixed points' in the tourist's territory, infrastructures could be erected where they could leave the car hidden from the animal's sight. These fixed points would contain toilets (defecation!) and observation plateaus from which the tourists could watch the animals from a distance.[92] Interestingly, these recommendations inverted the zoo architecture Hediger had simultaneously been developing in Switzerland. In a zoo context, he opted, as Christina May has shown, for 'arena-like viewing areas for the public, and hygienic boxes for the animals'.[93] In the national park, the tourists were put in a box, shielded off from animal sight lines.

Hediger's vision for reorganizing national parks clearly co-developed with his ideas about zoos. For their human visitors, he indicated, both spaces had similar goals, namely to offer instruction and relaxation. For their animal inhabitants, however, they ideally were each other's opposites. At the zoo, human-animal interactions were maximized, gradually creating 'tameness' and allowing for 'intimacy'. The national park, however, had to maintain distance and preserve the 'primary significance' of humans as 'universal enemies'. In interaction with the tame animals of the zoo, human visitors could freely circulate. In the national parks, they could only leave their static observation platforms when hidden inside 'animal-automobiles'.

The visions Hediger developed for rethinking the national park proved less influential than his ideas for transforming the zoo. One Belgian zoologist did pick up Hediger's report in an attempt to push the INPBC officials to reform their policies of 'non-intervention', but his letter to that effect met little enthusiasm with the people in power. In the margins, Van Straelen simply wrote 'not my point of view'.[94] The biological ideas of Hediger struck a chord with fellow zoo directors, but they clearly fell flat among park administrators of Van Straelen's generation.

Conclusion

The zoo biology as conceived by Hediger offered something new. Unlike lab biology, which generated claims about life *beyond* the laboratory walls, zoo biology aimed at reflexively understanding the institution in which it was situated: the zoo. As such, the discipline focused on understanding captivity and its implications for animal lives. Such an understanding, Hediger believed, was only possible if one also undertook study in the place where this captivity was absent: the field.

Yet, while the conceptual dichotomy between zoo and field was crucial for Hediger, he also redefined what this dichotomy entailed. Against traditional ideas, he did not conceive animals in the field as 'free' nor did he believe their behaviour was unaffected by human intervention. He argued that *both* in the field and in the zoo, animals were prisoners of their space and time pattern. Furthermore, much like contemporary Anthropocene scholars, he indicated that 'nowadays all animal behaviour is directly or indirectly influenced by man' – even in Congolese national parks.[95] If Hediger still had a special interest in the field, then, it was because it offered behaviour that was presumably 'genuine', 'natural' and 'healthy', and thus provided him with a model to replicate in the zoo.[96] Having rejected the idea that zoo and field were fundamentally different in terms of animal freedom and human impact, Hediger also made such a replication actually conceivable. The same conceptual framework, furthermore, also eased travel in the other direction. It led him to break with the idea of an 'integral reserve' (with free animals shielded off from human presence), and to conceive the Congolese national parks as spots of carefully managed human-animal interactions. Mirroring the zoo, he argued these interactions should be shaped by distance rather than intimacy. As such, the field and the zoo were coinventions indeed.

The questions Hediger asked originated from the condensed and human-crowded environment of the urban zoo, which confronted him with problems of how to manage animals in their relation to space (the territory) and in their relation to humans (the flight distance). This

problematique shaped the questions of his expeditionary fieldwork. Yet, addressing zoo questions in the field (while preferably upholding to the accuracy of the lab) was methodologically and logistically challenging. And it proved hard to combine with a job as a zoo director. Because of his day-to-day occupations, Hediger could only find time for a planned 'control mission' to Congo in 1960 – twelve years after his first trip.[97]

Through his publications, Hediger's ideas resonated in fundamental and applied behavioural research in zoos in Switzerland and beyond. Hediger himself supervised seventeen doctoral students in Basel and Zurich on topics that ranged from turtle movements to the begging behaviour of zoo animals.[98] Most of this work, however, was zoo-based and lacked a field component. As border-crossing came with substantial complications and financial costs, it was only a conceivable option for researchers with access to exceptional funding. One such a researcher was the Frankfurt zoo director and television personality Bernhard Grzimek, who, inspired by Hediger, could set up several African expeditions that focused on animal territory use and flight reactions (with an eye to adapting his zoo paddocks in Germany).[99] In the mid-1960s, a few of Hediger's students engaged in similar enterprises. Fritz Walther secured money from the Thyssen Foundation to research the trail use and territorial behaviour of antelopes in the Serengeti, while Fred Kurt used a project of the Smithsonian Institution to travel to Ceylon for a behavioural study of wild and captive elephants.[100] Such opportunities, however, were few and far between. Despite its conceptual importance for zoo biology, fieldwork remained a highly exceptional practice for most mid-century zoo professionals.

Only around 2000, traffic across the zoo field-border intensified. This was mostly because large zoological gardens such as the Bronx, San Diego or London Zoo increasingly involved themselves with *in situ* conservation projects. Zoo professionals argued their expertise was particularly applicable to a field context characterized by increasingly small populations that required interventionist forms of management for their survival.[101] In a *Nature* article in

2013, conservation psychologist John Fraser stated that the situation called for "people who are limber enough to move between field and zoo."[102] In the twenty-first century context of the biodiversity crisis, such movement indeed took up new meaning and intensity. This should not detract from the fact, however, that limber border-crossers had been active for many decades already.

Acknowledgements

This article was written as part of the VICI project Moving Animals (VI.C.181.010), funded by the Netherlands Organization for Scientific Research (NWO). I would like to thank Jens Lachmund, Lisa Onaga and Geert Somsen for their comments on earlier versions of this text.

[1] 'Decision 1643', Missions scientifiques accordés. MSA Hediger. N.1, Fonds de l'Institut des Parcs Nationaux du Congo et du Ruanda-Urundi, HA.02.0009, Royal Museum for Central Africa (RMCA), Tervuren.

[2] Raf De Bont, "A World Laboratory: Framing the Albert National Park," *Environmental History* 22 (2017): 404–432.

[3] Heini Hediger, *Kleine Tropen-Zoologie* (Basel: Verlag für Recht und Gesellschaft, 1948), 1.

[4] See, e.g. Michael A. Osborne, *Nature, The Exotic, and the Science of French Colonialism* (Bloomington: Indiana University Press, 1994); Nigel Rothfels, *Savages and Beasts: The Birth of the Modern Zoo* (Baltimore and London: John Hopkins University Press, 2002); Lynn K Nyhart, *Modern Nature: The Rise of the Biological Perspective in Germany* (Chicago and London: University of Chicago Press, 2009), 79–124; Oliver Hochadel, "Watching Exotic Animals Next Door: 'Scientific' Observations at the Zoo (ca. 1870-1910)," *Science in Context* 24, no. 2 (2011): 183–214; Christian C. Young, "Zoos and Aquariums," in *A Companion to the History of American Science*, ed. Georgina M. Montgomery and Mark A. Largent (Oxford: Wiley Blackwell, 2016), 553–65; Mitchell G. Ash, "Zoological Gardens," in *Worlds of Natural History*, ed. Helen Anne Curry et al. (Cambridge: Cambridge University Press, 2018), 418–32; Violette Pouillard, *Histoire Des Zoos Par Les Animaux. Contrôle, Impérialisme, Conservation* (Cheyzérieu: Champvallon, 2019).

[5] David N Livingstone, *Putting Science in Its Place. Geographies of Scientific Knowledge* (Chicago: University of Chicago Press, 2003), 62.

[6] Apart from Hediger, twentieth century examples include: Lutz Heck, *Aus Der Wildnis in Den Zoo* (Berlin: Ullstein Verlag, 1930), 5; Hal Markowitz, *Behavioral Enrichment in the Zoo* (New York: Van Nostrand Reinhold Co, 1982), 14.

[7] Gregg Mitman, however, does touch upon the topic in his analysis of the history of the Jackson Hole Wildlife Park, and Richard Burkhardt refers to zoo-field interactions in his history of the discipline of ethology. Gregg Mitman, "When Nature Is the Zoo: Vision and Power in the Art and Science of Natural History," *Osiris* 11 (January 22, 1996): 117–43; Richard W. Burkhardt, *Patterns of Behavior: Konrad Lorenz, Niko Tinbergen and the Founding of Ethology* (Chicago & London: The University of Chicago Press, 2005).

[8] See, for instance: Robert E Kohler, *Landscapes and Labscapes: Exploring the Lab-Field Border in Biology* (University of Chicago Press, 2002); Raf De Bont, *Stations in the Field: A History of Place-Based Animal Research, 1870-1930* (Chicago & London: The University of Chicago Press, 2015); Jeremy Vetter, *Field Life: Science in the American West during the Railroad Era* (Pittsburgh: The University of Pittsburgh Press, 2016); Raf De Bont and Jens Lachmund, eds., *Spatializing the History of Ecology: Sites, Journeys, Mappings* (New York: Routledge, 2017).

[9] Kohler, *Landscapes and Labscapes: Exploring the Lab-Field Border in Biology*, 3.

[10] Steven Shapin, "Placing the View from Nowhere: Historical and Sociological Problems in the Location of Science," *Transactions of the Institute of British Geographers* 23, no. 1 (1998): 5–12.

[11] Ash, "Zoological Gardens," 427.

[12] Theodore H. Reed to Heini Hediger, 16 April 1965, Zoo Zürich AG, VII.559.1.2.6.5.7, Stadtarchiv Zürich (SZ).

[13] Peter Crowcroft, "Man and Animal in the Zoo. Zoo Biology. Heini Hediger. Translated from the German Edition (Zurich, 1963)," *Science* 168, no. 3932 (1970): 725–26; Heini Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt* (Zurich: Werd Verlag, 1990), 303–5, 343–45, 353–58.

[14] For instance: Paul A. Rees, *An Introduction to Zoo Biology and Management* (Chichester, UK: Wiley-Blackwell, 2011), 188.

[15] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*.

[16] Thomas A. Seobok, *The Swiss Pioneer in Nonverbal Communication Studies, Heini Hediger (1908-1992)* (Lega, 2001); Andreas Rübel, *Heini Hediger 1908-1992. Tierpsychologie - Tiergartenbiologie - Zoodirektor* (Zurich: Beer, 2009).Matthew Chrulew, "My Place, My Duty: Zoo Biology as Field Philosophy in the Work of

Heini Hediger," *Parallax* 24, no. 4 (October 2, 2018): 480–500; Matthew Chrulew, "Managing Love and Death at the Zoo: The Biopolitics of Endangered Species Preservation," *Australian Humanities Review* 50 (2011): 135–57; Matthew Chrulew, "Preventing and Giving Death at the Zoo: Heini Hediger's 'Death Due to Behaviour,'" in *Animal Death*, ed. Jay Johnston and Fiona Probyn-Rapsey (Sydney: Sydney University Press, 2013); Christina Katharina May, "Concrete Kingdoms: Heini Hediger's Territories at the Zurich Zoo," in *Animal Housing and Human-Animal Relations: Politics, Practices and Infrastructures*, ed. Kristian Bjorkdahl and Druglito Tone (Routledge, 2016), 132–50.

[17] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 186.

[18] Matthew Chrulew, "Reconstructing the Worlds of Wildlife: Uexküll, Hediger, and Beyond," *Biosemiotics* 13 (2020): 137–149. On Uexküll: Anne Harrington, *Re-Enchanted Science: Holism in Germa Culture from Wilhelm II to Hitler* (Princeton: Princeton University Press, 1997).

[19] Heini Hediger, "Zur Biologie Und Psychologie Der Flucht Bei Tieren," *Biologisches Zentralblatt* 54 (1934): 21–40; Heini Hediger, *Wildtiere in Gefangenschaft: Ein Grundriss Der Tiergartenbiologie* (Basel: Benno Schwabe, 1942).

[20] Hediger, *Wildtiere in Gefangenschaft: Ein Grundriss Der Tiergartenbiologie*; Heini Hediger, "Die Erforschung Des Tierlichen Alltages," *Forschungen Und Fortschritte* 20, no. 1/2/3 (1944): 10–12.

[21] Burkhardt, *Patterns of Behavior: Konrad Lorenz, Niko Tinbergen and the Founding of Ethology*, 97–98.

[22] Torsten Malmberg, *Human Territoriality: Survey of Behavioural Territories in Man with Preliminary Analysis and Discussion of Meaning*, ed. Mouton Publishers (The Hague, 1980), 28.

[23] Hediger, *Wildtiere in Gefangenschaft: Ein Grundriss Der Tiergartenbiologie*, 18–20.

[24] See: Hediger, *Wildtiere in Gefangenschaft: Ein Grundriss Der Tiergartenbiologie*, plate 5; David Eilam et al., "Rituals, Stereotypy and Compulsive Behavior in Animals and Humans," *Neuroscience and Biobehavioral Reviews* 30, no. 4 (January 1, 2006): 456–71.

[25] Hediger, *Wildtiere in Gefangenschaft: Ein Grundriss Der Tiergartenbiologie*, 22.

[26] Heini Hediger, "Bemerkungen Zum Raum-Zeit-System Der Tiere," *Schweizerische Zeitschrift Fur Psychologie Und Ihre Anwendungen* 4, no. 4 (1946): 242–43, 247–48.

[27] Hediger engaged with tropes that had a long history. Eighteenth-century naturalists, for instance, often contrasted 'unhappy prisoners' in the zoo with 'free' animals in the wild. See: Louise E. Robbins, *Elephant Slaves and Pampered Parrots: Exotic Animals in Eighteenth-Century Paris* (Baltimore and London: John Hopkins University Press, 2002).

[28] Heini Hediger, "Zoologische Gärten Und Naturschutz," *Schweizerische Blätter Für Naturschutz* 6, no. 6 (1931): 100 and 104–5.

[29] Heini Hediger, "Zur Biologie Und Psychologie Der Zahmheit," *Archiv Für Die Gesammte Psychologie* 93 (1935): 143.

[30] Hediger, "Zur Biologie Und Psychologie Der Zahmheit"; Hediger, "Zur Biologie Und Psychologie Der Flucht Bei Tieren"; Heini Hediger, "Biologische Und Psychologische Tiergartenprobleme," *Vierteljahrsschrift Der Naturforschenden Gesellschaft in Zürich* 89 (1944): 92-108.

[31] Heini Hediger, "Die Bedeutung von Miktion Und Defakation Bei Wildtieren," *Schweizerische Zeitschrift Fur Psychologie Und Ihre Anwendungen* 3 (1944): 170–82; Hediger, "Biologische Und Psychologische Tiergartenprobleme," 94; Heini Hediger, "Säugetier-Territorien Und Ihre Markierung," *Bijdragen Tot de Dierkunde* 28 (1949): 172-184.

[32] Hediger, "Biologische Und Psychologische Tiergartenprobleme," 92.

[33] Hediger, "Die Erforschung Des Tierlichen Alltages," 10.

[34] Hediger, *Kleine Tropen-Zoologie*, 1.

[35] Garry Marvin and Bob Mullan, *Zoo Culture: The Book about Watching People Watch Animals* (Urbana, Illinois: Illinois University Press, 1999), 73–75; David Arnold, *The Problem of Nature Environment, Culture and European Expansion*, 1996, 142.

[36] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 184.

[37] or the context of British East-Africa: Roderick P Neumann, "The Postwar Conservation Boom in British Colonial Africa," *Environmental History Environmental History* 7, no. 1 (2002): 22–47. For the Belgian Congo: Patricia Van Schuylenbergh, "De l'appropriation à La Conservation de La Faune Sauvage. Pratiques d'une Colonisation: Le Cas Du Congo Belge (1885–1960)" (Unpublished PhD Thesis, Université Catholique de Louvain, 2006), 666–74.

[38] Hediger, *Kleine Tropen-Zoologie*, 1.

[39] For the quote: Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 184.

[40] Heini Hediger, "The Capture of Okapis," *Zoo Life* 4, no. 2 (1949): 43–48; Heini Hediger, "La Capture Des Éléphants Au Parc National de La Garamba," *Bulletin de l'Institut Royal Colonial Belge* 21, no. 1 (1950): 218–26; Heini Hediger and Jacques Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge* (Brussels: RBINS, 1950).

[41] Dane Kennedy, "Introduction: Reinterpreting Exploration," in *Reinterpreting Exploration: The West in the World*, ed. Dane Kennedy (Oxford: Oxford University Press, 2014), 1–20.

[42] H. de Saeger to Van Straelen, 12 January 1948, De Saeger to Hediger, 10 February 1948 MSA Hediger. N.1, RMCA.

[43] De Saeger to Pierre Wigny, Minister of Colonies, 5 January 1948, De Saeger to Van Straelen, 14 January, 1948, MSA Hediger. N.1, RMCA.

[44] Van Straelen to Léon Pétillion, 1 March 1948, MSA Hediger. N.1, RMCA.

[45] 'Contrat'; 'Decision 1643', Van Straelen to Paul Débaissieux, 12 August 1947, MSA Hediger. N.1, RMCA.

[46] Hediger to Van Straelen, 6 November 1947; Van Straelen to Hediger, 12 November 1947, MSA Hediger. N.1, RMCA.

[47] Hediger to Van Straelen, 14 November 1947, MSA Hediger. N.1, RMCA ; Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 5.

[48] Director of the Wittock van Landeghem Company to Van Straelen, 27 October 1947; L. Marinus (Central Photo) to the INPBC, 22 November 1947, MSA Hediger. N.1, RMCA.

[49] Verschuren to Van Straelen, 21 May 1948; Verschuren to Van Straelen, 27 May 1948; Walter Robyns to Hediger, 3 June 1948; Van Straelen to Hediger, 6 March 1951, MSA Hediger. N.1-3, RMCA.

[50]Manager of the Agence Maritime Internationale to the INPBC, 4 December 1947 MSA Hediger. N.1, RMCA.; Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 187.

[51] Hediger to Van Straelen, 23 September 1947; Manager of Compagnie Générale d'Automobile et d'Aviation de Congo Belge to Jean-Paul Harroy, 7 November 1947; Harroy to Van Straelen, 15 November 1947, MSA Hediger. N.1, RMCA.

[52] Verschuren, 'Rapport succinct de la mission', MSA Hediger. N.2, RMCA.

[53] Verschuren, 'Demande officielle', MSA Hediger. N.2, RMCA.

[54] Hediger to Van Straelen, 6 November 1947; Verschuren to De Saeger, 30 November 1947, MSA Hediger. N.1, RMCA.

[55] Verschuren to De Saeger, 30 November 1947, MSA Hediger. N.1, RMCA.

[56] Van Straelen to Harroy, 20 January 1848, MSA Hediger. N.1, RMCA.

[57] Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 5.

[58] Hediger and Verschuren, 4–5. It was a comparison to which he would return in later work, where he stressed fieldworkers performed their research with 'the objectivity of white-coated laboratory biologists'. See: Hediger, *The Psychology and Behaviour of Animals in Zoos and Circuses* (New York: Dover Publications, 1968), 16.

[59] Hediger and Verschuren, 5–8.

[60] Hediger to Van Straelen, 22 May 1948, MSA Hediger. N.1, RMCA.

[61] Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 6.

[62] Hediger, "Die Erforschung Des Tierlichen Alltages."

[63] Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 94–95.

[64] Hediger and Verschuren, 86–89.

[65] Lorraine Daston and Peter Galison, *Objectivity* (Princeton: Zone Books, 2007).

[66] Verschuren, 'Rapport succinct de la mission' MSA Hediger. N.2, RMCA.

[67] Hediger to Van Straelen, 26 June 1948, MSA Hediger. N.1, RMCA.

[68] The oldest aerial pictures in the collection of the INPBC appear to be the ones taken as part of the mission of the geologist Jean de Heinzelin de Braucourt in 1950, Archives of the Royal Belgian Institute for Natural Sciences [RBINS].

[69] Felix Driver, "Intermediaries and the Archives of Exploration," in *Indigenous Intermediaries: New Perspectives on Exploration Archives*, ed. Shino Konishi, Maria Nugent, and Tiffany Shellam (Acton: ANU Press, 2015), 15.

[70] Verschuren, 'Rapport succinct de la mission', MSA Hediger. N.2, RMCA.

[71] Verschuren, 'Station de domestication des éléphants' (6 minutes) ; 'Parc National de la Garamba' (5 minutes) ; 'Parc National Albert' (6 minutes), 1948, Royal Belgian Film Archive, CINEMATEK.

[72] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 202–4.

[73] Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 61–76.

[74] Hediger had incited Micha to write the book and used his contacts to find a publisher. Micha to Hediger, 25 July 1958, Zoo Zürich AG, VII.559.1.2.6.2.4, SZ.

[75] Marc Micha, *Les Lois de La Brousse: Contes Naturalistes* (Neuchatel: Delachaux & Niestlé, 1958), 8.

[76] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 198 and 202.

[77] Heini Hediger, "Ein Symbioseartiges Verhältnis Zwischen Flusspferd Und Fish," *Säugetierkundlichen Mitteilungen* 1 (1953): 75–76; Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 106–10.

[78] More generally on the role of such go-betweens in the development of western science: Kapil Raj, "Go-Betweens, Travelers and Cultural Translators," in *A Companion to the History of Science*, ed. Bernard Lightman (Chichester, UK: Wiley Blackwell, 2016), 39–57.

[79] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 193.

[80] Heini Hediger, "The Capture of Okapis," *Zoo Life* 4, no. 2 (1949): 43. On the wider context of animal catching in the Belgian Congo: Violette Pouillard, "Conservation et captures animales au Congo Belge (1908-1960). Vers une histoire de la matérialité des politiques de gestion de la faune," *Revue Historique* 679 (2016): 577–604.

[81] Hediger to Van Straelen, 21 June 1949, MSA Hediger. N.2, RMCA.

[82] Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 31–38.

[83] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 198.

[84] C. R. Schmidt, "The Africa House at Zurich Zoo," *International Zoo Yearbook* 7, no. 1 (January 1, 1967): 62–66; Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 320–24; May, "Concrete Kingdoms: Heini Hediger's Territories at the Zurich Zoo," 139–43.

[85] Heini Hediger, "Tierstrassen Im Zoo," in *Die Strassen Der Tiere*, ed. Heini Hediger (Wiesbaden: Springer, 1967), 4–5.

[86] Hediger to Van Straelen, 26 June 1948, MSA Hediger. N.1, RMCA ; Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 139–40.

[87] Hediger and Verschuren, 142–43.

[88] Hediger and Verschuren, 175.

[89] Hediger and Verschuren, 133 and 162.

[90] Heini Hediger, "Tierpsychologische Studien in Afrikanischen Wildreservaten," in *Lebendiges Wissen*, ed. H. Friedrich (Dieterich'sche Verlagsbuchhandlung, 1953), 183.

[91] Hediger and Verschuren, *Observations Sur La Psychologie Animale Dans Des Parcs Nationaux Du Congo Belge*, 155.

[92] Hediger and Verschuren, 185–87.

[93] May, "Concrete Kingdoms: Heini Hediger's Territories at the Zurich Zoo," 137.

[94] R[ené] V[erheyen] to Van Straelen, 23 April 1951, MSA Hediger. N.3, RMCA.

[95] Hediger, *The Psychology and Behaviour of Animals in Zoos and Circuses*, 14.

[96] Hediger, *The Psychology and Behaviour of Animals in Zoos and Circuses*, 12.

[97] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 307-317.

[98] Hediger, *Ein Leben Mit Tieren Im Zoo Und in Aller Welt*, 386–88.

[99] Thomas Lekan, *Our Gigantic Zoo. A German Quest to Save the Serengeti* (Oxford & New York: Oxford University Press, 2020), 24, 41–42, 71.

[100] Walther to Hediger, 23 December 1964 and 29 January 1965 Zürich AG, VII.559.1.2.6.2.16, SZ; Kurt to Hediger, 8 July 1968, Zoo Zürich AG, VII.559.1.2.6.5.9, SZ; Fritz Walther, "Tierstrassen in Afrika," in *Die Strassen Der Tiere*, ed. Heini Hediger (Wiesbaden: Springer, 1967), 19–25; Fred Kurt, "Elephant Survey in Ceylon," *Oryx* 9, no. 5 (1968): 364–65.

[101] See, for instance: Laura Zimmermann, "The Role of Zoos in Contributing to *In Situ* Conservation," in *Wild Animals in Captivity: Principles and Techniques for Zoo Management*, ed. Devra D. Kleiman, Katherina V. Tompson and Charlotte K. Boer (Chicago and London: The University of Chicago Press, 2000), 281-287; Laura Penn, Markus Gusset and Gerald Dick, *77 Years: The History and Evolution of the World Association of Zoos and Aquariums, 1935-2012* (Gland: WAZA, 2012), 80-93 and 106-108; Irus Braverman, *Zooland: The Institution of Captivity* (Stanford: Stanford University Press, 2013), 167-172.

[102] Amanda Mascarelli, "Ecology: Nature in Captivity," *Science* 498 (2013): 263.