Introduction

"Never be surprised by the crumbling of an idol or the disclosure of a skeleton."

Lord Acton, *Inaugural Lecture on the Study of History*.[1]

If you are fortunate enough to have the opportunity to walk through the splendid collections of the natural history museum in Leiden, you immediately notice the collector's names written on old labels in careful—almost loving—handwriting: Reinwardt, Kuhl & Van Hasselt, Temminck, Büttikofer, S. Müller… Truth be told, we know surprisingly little about these men. Take Coenraad Jacob Temminck. He owned a magnificent bird collection and was the author of a series of often-cited monographs on birds and mammals. Also, Temminck promoted the foundation of the Leiden museum and became its first director in 1820. One might expect that his peers and biographers had definite views of Temminck, both as a naturalist and a museum director, giving us an idea of the stature and character of the man. And yet, they have left us with only a few portrayals of his work and significance, which are not only superficial, but also downright contradictory. Some found Temminck one of the most outstanding ornithologists of the day, while others depicted him as an educated aficionado. Some stated that he played a key role in standardizing the methods of zoological nomenclature and classification, but a few accused him of being mostly occupied with stealing the work of others. I have discovered that they were all right.

Obviously, Temminck could not be all of the above at the same time. But with time he specialized and evolved as he occupied a leading position in a national museum until, in the end, zoological classification was developing faster than he could—or was willing to—digest. It is precisely because of this link between Temminck's reputation and the developments in systematics that a more careful and in-depth study of his life and work helps us understand the transformation of the field during the early nineteenth century. This transformation has received almost as little attention as has Temminck himself. In particular, the emergence and evolution of the field of zoological

[1] John Emerich Edward Acton, *Lectures in Modern History* (London: MacMIllan and Co., Limited, 1906), 24.

classification and its significance for the natural sciences has not been adequately treated. The literature about its practices, philosophies, debates and cultural influences during this period is scant and fragmented. By integrating Temminck's scientific biography with an account of the development of zoological classification we kill two birds with one stone: this book provides a more accurate portrait of a key Dutch historical figure while at the same time unearthing the main outlines of the history of systematics between 1800 and 1850.

Portraits of Coenraad Jacob Temminck

Placing the biographies of Temminck and the reviews of his works side by side leaves one disappointingly confused. How disparate the judgements on Temminck are can be seen from the following examples.[2]

Temminck's first monographs were received with enthusiasm. On this, everyone agreed. The books appeared during the first decade of the nineteenth century and treated his favorite birds: the pigeons and the gallinaceous birds. The British naturalist William John Swainson found Temminck's work "clear and masterly" and thought it "should be taken as a pattern for all such dissertations."[3] Temminck's avifauna of Europe (the *Manuel d'Ornithologie*) cemented his reputation, and his system of classification was quickly adopted by naturalists. Swainson even equalled Temminck to Linnaeus, "next to whom, as an ornithologist, he assuredly ranks."[4] This is arguably the best compliment a naturalist could ever hope for. Both reviews were written in the mid-1830s. But thirty years later, the Keeper of Zoology at the British Museum in London John Edward Gray had quite a different view:

[2] For Temminck's biographies, see Willem Hendrik de Beaufort, "Coenraad Jacob Temminck, uit zijne brieven geschetst," *Ardea* 9, no. 2 (1920); Lipke Bijdeley Holthuis, "The Three Dutch Authors of von Siebold's Fauna Japonica, with some Notes on the Artists," in *Ph.F. von Siebold and Natural History of Japan. Crustacea*, ed. Takai Yamaguchi (Tokyo: The Carcinological Society of Japan, 1993), 689-731; Lipke Bijdeley Holthuis, *Rijksmuseum van Natuurlijke Historie 1820–1958* (Leiden: Nationaal Natuurhistorisch Museum, 1995), 18-25; Alberta Maria van Lynden-de Bruïne, *In vogelvlucht door Europa: de reisjournalen van Dionysia Catharina Temminck-Cau, 1807–1824* (Zutphen: Walburg, 2001), 11-21; Alexis J. P. Raat, "Coenraad Jacob Temminck (1778–1858). Een biografische schets," *De Negentiende Eeuw* 2, no. 2 (1978); Samuel Constantinus Snellen van Vollenhoven, "Coenraad Jacob Temminck," *Algemeene Konst- en Letterbode* 9 (1858); Erwin Stresemann, *Ornithology from Aristotle to the Present*, trans. Hans J. Epstein and Cathleen Epstein (Cambridge, MA: Harvard University Press, 1975), 111-25; Joannes Andreas Susanna, "Levensschets van Coenraad Jacob Temminck," *Jaarboek van de Maatschappij der Nederlandse Letterkunde* (1858); Willem Vrolik, "Levensbericht van Coenraad Jacob Temminck," *Jaarboek van de Maatschappij der Nederlandse Letterkunde* (1857).

[3] William Swainson, *On the Natural History and Classification of Birds*, 2 vols., The Cabinet Cyclopædia. Natural History (London: John Taylor, 1836–1837), 205.

[4] William Swainson, *A Treatise on the Geography and Classification of Animals*, The Cabinet Cyclopædia. Natural History (London: Longman, Rees, Orme, Brown, Green & Longman, Taylor, 1835), 185.

> M. Temminck was an eminent ornithologist, and has studied some groups of Mammalia, perhaps not with so much success. He was an amiable naturalist, but has carried his political anglophobia into his zoological studies. [...] It is to be observed that he never had a regular scientific training, never attempted to form scientific specific characters, and is rather to be regarded as a patron and amateur than as a scientific zoologist.[5]

Even if Temminck's classification system was outdated by the time John Gray wrote this, what had happened to tarnish Temminck's reputation in this way? Linnaeus' system had long been outdated too, but his name was still revered by naturalists. Clearly, what made somebody eminent, how to measure success and even the importance of scientific training had changed since the beginning of the century. But how much so and why? And what about Temminck's political anglophobia?

In the Netherlands, we find that Temminck was also both praised and criticized. His peers seemingly could not agree on Temminck's competence nor could his later biographers, although here the balance is tipped in Temminck's favor. One biographer, the cartographer and architect Pieter Harmen Witkamp, argued that Temminck's works were appreciated because of the "very accurate descriptions, accurate synonymy and the many descriptions of the way of life and habits of birds, which surpassed everything that had been written previously."[6] Willem Vrolik—the celebrated Dutch anatomist and pathologist—affirmed that Temminck had become a "systematist zoologist of the highest level."[7] Vrolik did not specify why or how Temminck achieved such scientific eminence. On the other hand, Temminck's successor Hermann Schlegel portrayed him as a greedy, selfish man, who locked away specimens to prevent his colleagues from working on them, and who would not hesitate to publish another's discoveries as his own.[8] This was his personal perception of Temminck after thirty-three years of collaboration.

About a century later, Erwin Stresemann devoted a whole chapter to Temminck in his influential *Die Entwicklung der Ornithologie* and concluded that, in the end, Temminck "remained what he had been in 1820 […]—a well-informed zoological amateur."[9] The chapter is mostly a chronological biography, full of details about Temminck's social network: his correspondents, his visits to fellow naturalists during his extensive travels

[5] John Edward Gray, "A Revision of the Genera and Species of Viverrine animals (Viverridae) founded on the Collection in the British Museum," *Proceedings of the Zoological Society of London* (1864): 505.

[6] Pieter H. Witkamp, "Vier-en-twintig voorgangers," *Jaarboekje Natura Artis Magistra* (1869): 199.

[7] Vrolik, "Levensbericht van Coenraad Jacob Temminck," 66.

[8] Gustav Schlegel, "Levensschets van Hermann Schlegel," *Jaarboek Koninklijke Akademie Wetenschappen* (1884).

[9] Stresemann, *Ornithology from Aristotle to the Present*, 147.

through Europe and his role as director of the Leiden museum. The information is extracted from letters and from Hermann Schlegel's autobiography—as is almost the entire chapter on Schlegel. Stresemann's book offers no insights into Temminck's systematic work, except a severe judgement on Temminck's treatment of the material sent to Leiden from the Dutch colonies: "Temminck did not have that sort of intellect."[10] There is no mention of Temminck in other chapters of the book (for instance, in chapter 10, *The Effect of Natural Philosophy*), which might have helped in understanding what kind of naturalist Temminck was. In addition to the *Entwicklung der Ornithologie*, Stresemann also published the correspondence between Temminck and some of his colleagues, his associate the Baron Meiffrein Laugier de la Chartrouse (together they published the *Nouveau Recueil de Planches Coloriées* between 1820 and 1839), or Temminck's exchanges with Karl Illiger and his successor Hinrich Lichtenstein (both directors of the Zoological Museum in Berlin).[11] There is, however, no reflection upon the contents of the letters. Nonetheless, the information provided by Stresemann has been useful firstly—and obviously—for making these primary sources easily accessible and secondly, to better define the social environment in which Temminck worked and communicated.

In the 1990s Lipke Bijdeley Holthuis, curator and "the institutional memory" of the Leiden museum, sought to demonstrate that Schlegel's claims were biased.[12] He argued that antipathy and resentment towards Temminck had distorted Schlegel's interpretation.[13] Holthuis' views of Temminck are very different from Stresemann's: "Temminck's significance for science, especially for ornithology and mammalogy, is considerable. He published many fundamental works and he continued to do so until he reached an advanced age."[14] Disappointingly, neither Stresemann nor Holthuis cover the subjects treated in Temminck's publications, his ideas and propositions, his methods of classification, nor how his work was received by his peers. Holthuis' account is mostly a chronological account of the Leiden museum and therefore limited to Temminck's role as director, without an exploration of his systematic work. The main shortcoming of Holthuis' book about the Leiden museum is, in my view, the absence of

[10] Stresemann, *Ornithology from Aristotle to the Present*, 147.
[11] Erwin Stresemann, "Aus C. J. Temmincks Briefen an H. Lichtenstein," *Ardea* 39, no. 4 (1951); "Histoire des origines des 'Planches Coloriées' de Temminck et Laugier," *L'oiseau et la revue Française d'ornithologie* 21 (1951); "Ornithologen-Briefe aus den Jahren 1816 bis 1820 gewechselt zwischen J. F. Naumann und C. J. Temminck," *Centaurus* 2 (1952); "Aus dem Briefwechsel von C. J. Temminck mit dem Grafen von Hoffmannsegg und C. Illiger 1810-1814," *Ardea* 44, no. 4 (1956).
[12] Charles H. J. M. Fransen and Martien J. P. van Oijen, "L. B. Holthuis, 'The institutional Memory' of the Leiden Museum – Obituary," *Contributions to Zoology* 77, no. 3 (2008).
[13] Holthuis, "Dutch Authors of von Siebold's Fauna Japonica."
[14] Holthuis, *Rijksmuseum*, 24.

references to the history and status of systematics, which was, after all, the core business of the museum. The question therefore remains, how did Stresemann and Holthuis arrive at their conclusions concerning Temminck's role in the history of systematics? This point clearly needs further elaboration.

It was not until 1982 that Temminck was treated in a history of ornithology that also considered the social and intellectual aspects of the practice of classification: Paul Lawrence Farber's *The Emergence of Ornithology as a Scientific Discipline: 1760–1850*. Before 1982, Farber had already explored some factors that influenced the development of ornithology and zoological classification, including taxidermy, the development of collections and the different type concepts.[15] Then, in his history of ornithology he integrated technical, material and cultural aspects in the discussion of the conceptual issues that preoccupied naturalists during those ninety years, revealing the complexity of the history of bird classification. Concerning Temminck, he wrote: "In his writings, we find evidence not only of one of a number of approaches to systematics, but another feature of this group of naturalists who dominated ornithology in the first decades of the nineteenth century: an increased specialization and rigor."[16] His claim is mostly based on Temminck's efforts to standardize nomenclature and his dislike of iconographic, narrative works. Indeed, Temminck focused almost exclusively on bird classification, favoring monographs over encyclopedic work, either on particular groups of birds (pigeons and fowl) or about a specific geographic region (Europe). Farber concludes: "Temminck is one of the key figures in the transition of the study of birds from a sub-branch of natural history to a scientific discipline."[17] Still, there are questions that remain unanswered: how exactly can we appreciate this increased rigor in zoological classifications? How many approaches to systematics were there? What was Temminck's own approach—and why?

In short, the existing literature on Temminck does not situate him in the context of nineteenth-century natural history. In order to rectify this, it is necessary to turn our attention to the history of zoological classification.

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[15] Paul Lawrence Farber, "The Type-concept in Zoology during the First Half of the Nineteenth Century," *Journal of the History of Biology* 9, no. 1 (1976); "The Development of Taxidermy and the History of Ornithology," *Isis* 66, no. 244 (1977); "The Development of Ornithological Collections in the late Eighteenth and early Nineteenth Centuries and their Relationship to the Emergence of Ornithology as a Scientific Discipline," *Journal of the Society for the Bibliography of Natural History* 9, no. 4 (1980); *The Emergence of Ornithology as a Scientific Discipline: 1760–1850* (Dordrecht: D. Reidel, 1982).

[16] Farber, *Emergence of Ornithology*, 85.

[17] Farber, *Emergence of Ornithology*, 90.

A brief review of historiography

A quick review of the existing literature on Dutch natural history reveals that the entire history of biological systematics in the Netherlands is awaiting close examination. For the late eighteenth and early nineteenth century period, the few available accounts have focused either on the institutional history of museums and collections or on the biographies of key figures. The history of the Dutch national museum of natural history in Leiden has been chronicled by Lipke Holthuis but also by the Dutch zoologist Agatha Gijzen. In 1938 Gijzen wrote her doctoral thesis on the history of the museum from its foundation up to the beginning of World War I, after years of ploughing through the chaotic museum archives. As a result, the archives were finally ordered, and her book, entitled 's *Rijks Museum van Natuurlijke Historie 1820-1915*, provides a wealth of information on the collections, their origins, the policies of the museum, and its first three directors and its staff.[18] It quickly became an essential guide for the museum curators—and it still is. But as much as that of Holthuis, her book is a chronological reconstruction of the main developments at the museum between 1820 and 1915, her main focus being on the growth of the collections. As this was also one of Temminck's primary concerns, Gijzen's disclosure and summary of archival material has been extremely useful. Her portrait of Temminck, however, is limited to his directorate, mainly to his decisions concerning the collection, acquisition and exchange of specimens. This, and the fact that it is written in Dutch, may explain why it has been little quoted by historians of science outside the Netherlands despite the many interesting details it reveals.

After Gijzen, the history of the national museum of natural history in Leiden, as well as that of the Dutch national herbarium, has been recorded on several occasions. The best known narrative is that of Lipke Holthuis already mentioned, but it is certainly not the only one. Additionally, a handful of institutional accounts are available, as well as biographies of a few collectors and naturalists, but unfortunately, the total harvest remains disappointing.[19] Complementary information about Dutch natural history can

[18] Agatha Gijzen, " 's Rijks museum van natuurlijke historie, 1820–1915" (PhD dissertation, Leiden University, 1938).

[19] For instance, Stresemann devoted a chapter in his book *Ornithology* to the vicissitudes of the *Natuurkundige Commissie* (the Natural Science Committee for the Dutch East-Indies), created to explore the natural richness of the Indonesian archipelago. See also Marinus Boeseman, "Collectors and Fish Collections of the Rijksmuseum van Natuurlijke Historie in Leiden, the Netherlands (1820–1980)," in *Collection Building in Ichthyology and Herpetology*, ed. Theodore W. Pietsch and William D. Anderson Jr. (Lawrence, Kansas: American Society of Ichthyologists and Herpethologists, 1997); Rolf P. Dreier, "Voor Museum en Vaderland. De oprichtingsjaren van 's Rijksmuseum van Natuurlijke Historie in Leiden (1815–1830)" (Master's thesis, Leiden University, 2003); Charles H. J. M. Fransen, Lipke Bijdeley Holthuis, and J. P. H. M. Adema, "Type-catalogue of the Decapod Crustacea in the Collections of the Nationaal

be gathered from a small number of essays dealing with scientific research in the Indonesian archipelago; the oldest dates back to 1879, and it is still useful today for the amount of archival material it includes.[20] Nevertheless, all these works (the institutional accounts, the biographies and the histories of Dutch science in Indonesia) are curiously silent on Dutch systematics. None of them explore what was involved in systematics during this period: its practices, theories and cultural, political and international influences. Similarly, the relation between the rich botanical and zoological collections in Leiden and the activities of the naturalists working with them is still largely unexamined. This is remarkable because the naturalists referred to in these histories were, in fact, mostly concerned with collecting and classifying specimens, especially at 's Rijks Museum van Natuurlijke Historie in Leiden.[21] And yet, the process and theory of classifying plants and animals has been left out of such studies. Consequently, it is not surprising that references to Dutch nineteenth-century natural history are practically absent from the existing literature on the subject.

Natuurhistorisch Museum, with Appendices of pre-1900 Collectors and Material," *Zoologische Verhandelingen* 311 (1997); Lars W. van den Hoek Ostende, René W. R. J. Dekker, and Guido O. Keijl, "Type-specimens of Birds in the National Museum of Natural History, Leiden. Part 1. Non-Passerines," *NNM Technical Bulletin* 1 (1997); Holthuis, "Dutch Authors of von Siebold's Fauna Japonica"; Charles John Joseph Klaver, *Inseparable Friends in Life and Death: the Life and Work of Heinrich Kuhl (1797–1821) and Johan Conrad van Hasselt (1797–1823), Students of prof. Theodorus van Swinderen* (Groningen: Barkhuis, 2007); W. F. J. Mörzer Bruyns, red., *Met de Triton en Iris naar de zuidwestkust van Nieuw Guinea in 1828: de reisverhalen van Justin Modera en Arnoldus Johannes van Delden*. Werken van de Linschoten-Vereeniging; CXVII (Zutphen: Walburg Pers, 2018); G. A. Six, "Overzicht der diensten door het Rijks-museum van natuurlijke geschiedenis te Leiden aan de dierkunde bewezen," *Album der natuur* 26, no. 1 (1877); Robert P. W. Visser, "Het Rijksmuseum van Natuurlijke Historie in de 19de eeuw," in *Het verdwenen museum. Natuurhistorische verzamelingen, 1750–1850*, ed. Bert C. Sliggers and Marijke H. Besselink, (Haarlem: Teylers Museum, 2002); Takai Yamaguchi, ed. *Von Siebold and Natural History of Japan: Studies on the Unpublished Specimens of Japanese Animals Collected by Von Siebold and Still Preserved in the Museums of the Netherlands* (Kumamoto: Kumamoto University, 1987).

[20] See, for example, Peter Boomgaard, "The Making and Unmaking of Tropical Science: Dutch Research on Indonesia, 1600-2000," *Bijdragen tot de Taal-, Land- en Volkenkunde* 162, no. 2/3 (2006); Andrew Goss, *The Floracrats. State-sponsored Science and the Failure of the Enlightenment in Indonesia* (Madison, Wisconsin: University of Wisconsin Press, 2011); Pieter Honig and Frans Verdoorn, eds., *Science and Scientists in the Netherlands Indies* (New York: Board for The Netherlands Indies, Surinam and Curasao, 1945); Marius Jacob Sirks, "Indisch natuuronderzoek" (PhD dissertation, Utrecht University, 1915); Huibert Johannes Veth, "Overzicht van hetgeen, in het bijzonder door Nederland, gedaan is voor de kennis der fauna van Nederlandsch Indië" (PhD dissertation, Leiden University, 1879); Andreas Weber, "Hybrid Ambitions: Science, Governance, and Empire in the Career of Caspar C. G. Reinwardt (1773–1854)" (PhD dissertation, Leiden University, 2012).

[21] In this book I will refer to the Leiden museum as 's Rijks Museum van Natuurlijke Historie. This is the name used between its foundation in 1820 and 1931, when it was changed to Rijksmuseum van Natuurlijke Historie. In 1989, it was rechristened the Nationaal Natuurhistorisch Museum, and in 1998 it became the Nationaal Natuurhistorisch Museum Naturalis. In 2010, the museum merged with the Zoological Museum Amsterdam (ZMA) of the University of Amsterdam, and the Dutch National Herbaria of the universities of Leiden, Amsterdam and Wageningen, to form the Nederlands Centrum voor Biodiversiteit. In 2012, the institute's name became Naturalis Biodiversity Center.

From Ernst Mayr's classical *The Growth of Biological Thought* (1982), in which he devotes three chapters to classification, to Peter Bowler and John Pickstone's *The Modern Biological and Earth Sciences* (2006), Dutch natural history is occasionally mentioned when the country's collections are discussed—and virtually nowhere else.[22] Similarly, the essays compiled in *Cultures of Natural History,* edited by Nicholas Jardine, James Secord and Emma Spary (1996), which explore the cultural, institutional and political context of natural history and its practices, do not include Dutch natural history.[23] If one were to judge from references to the Netherlands in works dealing specifically with classification—which have proliferated during the last thirty years or so—one might conclude that the contributions from that country were negligible. Of course, there is nothing to support this and as the traditional aphorism proclaims, absence of evidence is not evidence of absence. The need for a historiography of Dutch systematics becomes more pressing because, without it, Dutch natural history is doomed to be routinely excluded from the history of natural history.

From the growing corpus of literature on natural history and biological classification, I wish to highlight two books that have succeeded in capturing and explaining to a great extent the complexity of systematics during the nineteenth century. I have therefore used them—often and gratefully—as a springboard for my own research. These are the re-evaluation of Antoine-Laurent Jussieu's contribution to botany in *The Development of Biological Systematics* (1994) by Peter F. Stevens, and Jim Endersby's depiction of the botanist Joseph Dalton Hooker in his *Imperial Nature* (2008).[24] Stevens deals with many of the theoretical questions I have been mulling over, like the rise and status of systematics or the relation between classification and natural philosophy. Endersby links the material practices of classification to broader issues like philosophy, empire and professionalization. Both works focus primarily on botany, and they are insightful and essential as a starting point for anyone keen to explore the history of zoological classification, an area where a great deal of work remains to be done.

Our understanding of the emergence of zoological systematics remains inadequate because the existing literature is mostly episodic. Some authors have focused on the

[22] Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Mass: The Belknap Press of Harvard University Press, 1982); Peter J. Bowler and John V. Pickstone, eds., *The Modern Biological and Earth Sciences*, Vol. 6. The Cambridge History of Science (Cambridge: Cambridge University Press, 2009).

[23] Nicholas Jardine, James A. Secord, and Emma C. Spary, eds., *Cultures of Natural History* (Cambridge University Press, 1996).

[24] Jim Endersby, *Imperial Nature. Joseph Hooker and the Practices of Victorian Science* (Chicago: University of Chicago Press, 2008); Peter Francis Stevens, *The Development of Biological Systematics: Antoine-Laurent de Jussieu, Nature, and the Natural System* (Columbia University Press, 1994).

history of the classification of certain groups of animals.[25] Other historians have explored aspects related to the practice of classification, such as the field work and collecting practices, the history of zoological nomenclature, local or national histories, or the contributions of eminent naturalists.[26] The conceptual history of systematics is also fragmentary. Mostly, historians have focused on specific concepts: the role of essentialism in classification, the concept of species or the type-concept, for instance.[27] But the philosophical premises of classification and what was represented by classifications—and the species, genera and families—, what in the natural world these classifications actually stood for in pre-Darwinian natural history, and why, is all poorly understood. The most complete works are still those of Henri Daudin from 1926.[28] Without denying the interest and value of these studies, I still feel the need for a more detailed history of the foundations and aims of zoological classification, an account in

[25] A few examples are Arthur J. Cain, "The Development of Systematic Ideas of Variation Illustrated by Malacology," in *History in the Service of Systematics*, ed. A. Wheeler and J. H. Price (Society for the Bibliography of Natural History, Special Publication, 1981); Carl H. Lindroth, "Systematics Specializes Between Fabricius and Darwin: 1800-1859," in *History of Entomology*, ed. Ray F. Smith, Thomas E. Mittler, and Carrol N. Smith (California: Annual Reviews Inc. and the Entomological Society of America, 1973); Mary P. Winsor, "The Development of Linnaean Insect Classification," *Taxon* (1976).

[26] See, for example, Toby A. Appel, *The Cuvier-Geoffroy Debate: French Biology in the Decades before Darwin* (Oxford University Press, 1987); Jim Endersby, "Classifying Sciences: Systematics and Status in mid-Victorian Natural History," in *The Organisation of Knowledge in Victorian Britain*, ed. Martin Daunton (British Academy/Oxford University Press, 2005); Paul Lawrence Farber, *Finding Order in Nature: the Naturalist Tradition from Linnaeus to E. O. Wilson* (Baltimore Md.: Johns Hopkins University Press, 2000); Susannah Gibson, "The Careering Naturalists: Creating Career Paths in Natural History, 1790–1830," *Archives of Natural History* 44.2 (2017): 195–214; Robert E. Kohler, *All Creatures: Naturalists, Collectors, and Biodiversity, 1850-1950* (Princeton, Oxford: Princeton University Press, 2013); Gordon McOuat, "Species, Rules and Meaning: The Politics of Language and the Ends of Definitions in 19th Century Natural History," *Studies in History and Philosophy of Science Part A* 27, no. 4 (1996); Richard V. Melville, *Towards Stability in the Names of Animals: a History of the International Commission on Zoological Nomenclature, 1895-1995* (London: International Trust for Zoological Nomenclature, 1995); L. C. Rookmaaker, "The Early Endeavours by Hugh Edwin Strickland to Establish a Code for Zoological Nomenclature in 1842-1843," *Bulletin of Zoological Nomenclature* 68, no. 1 (2011); Martin J. S. Rudwick, *Georges Cuvier, Fossil Bones, and Geological Catastrophes: New Translations & Interpretations of the Primary Texts* (Chicago: University of Chicago Press, 1997); Mary P. Winsor, *Starfish, Jellyfish, and the Order of Life: Issues in Nineteenth Century Science* (New Haven: Yale University Press, 1976).

[27] Of special interest are David L. Hull, "The effect of Essentialism on Taxonomy. Two Thousand Years of Stasis (I)," *The British Journal for the Philosophy of Science* 15, no. 60 (1965); David L. Hull, "The effect of Essentialism on Taxonomy. Two Thousand Years of Stasis (II)," *The British Journal for the Philosophy of Science* 16, no. 61 (1965); Robert J. O'Hara, "Representations of the Natural System in the Nineteenth Century," *Biology and Philosophy* 6, no. 2 (1991); Farber, "Type-concept in Zoology."; Mary P. Winsor, "The Creation of the Essentialism Story," *History and Philosophy of the Life Sciences* 28 (2006); Joeri Witteveen, "Naming and Contingency: the Type Method of Biological Taxonomy," *Biology and Philosophy* 30, no. 4 (2015).

[28] Henri Daudin, *Cuvier et Lamarck: les classes zoologiques et l'idée de série animale (1790–1830)*, 2 vols., Études d'histoire des Sciences Naturelles 2 (Paris: F. Alcan, 1926); Henri Daudin, *De Linné à Jussieu; méthodes de la classification et idée de série en botanique et en zoologie (1740–1790)*, Études d'histoire des Sciences Naturelles 1 (Paris: F. Alcan, 1926).

which concepts are explored in relation to natural philosophy and embedded in the pertinent social and cultural contexts. If we want to understand how and why systematics developed, and why its status within natural history has been a matter of discussion for almost two hundred years, we need both a deeper conceptual history and a social history of zoological systematics.

Goals and scope

I started this book hoping that a comprehensive scientific biography of Coenraad Jacob Temminck would provide a starting point for a discussion of the practices in Dutch zoological classification during his time. However, in the process of studying and analyzing Temminck's career, I have been forced to reconsider three much wider themes that were central to nineteenth-century natural history: the development of systematics as a discipline, the rise of a meritocracy in natural history and the status of systematics within natural history and natural philosophy. As a result, what started as an effort to understand the contradictions in the reviews of Temminck's work, has led me to open a Pandora's box and re-examine a series of questions that, until now, have been explored only partially. Even the question of what was actually involved in *natural history* during Temminck's time is unclear. The term was then, as it is now, generally used but seldom defined.

The very first question that needs addressing is: how did systematics develop in Temminck's lifetime? Did biological classification become a discipline within natural history? If so, what was Temminck's role—if any—in the process? In order to clarify this, I first had to identify the major issues that preoccupied naturalists concerned with classification: the search for a natural classification system, the standardization of rules, methods and definitions and, finally, their fundamental ideas about nature. What role did their idea of continuity, their understanding of the geographical distribution of animals and their concepts of species, genus, and type, play in their classifications? A particularly interesting question is whether naturalists, in their efforts to standardize systematics, were conscious of any process of discipline formation. For the analysis of this point, I have followed mainly—but not exclusively—many of Farber's and Stevens' leads and I have picked up Gordon McOuat's discussions of the concept of species, nomenclature and the authority to set rules.[29] Also, it was necessary to identify Temminck's role. In order to situate Temminck in the international scene I turned to the primary literature and archival sources.

[29] Gordon McOuat, "Cataloguing Power: Delineating 'Competent Naturalists' and the Meaning of Species in the British Museum," *The British Journal for the History of Science* 34, no. 1 (2001).

Two issues become almost immediately evident when delving into the primary literature. First, and rather discouragingly, most naturalists were silent about the philosophical foundation of their classifications. Temminck, for one, was very reticent when it came to explaining the theories supporting his systems of classification. Definitions of crucial concepts such as the species, genus or type are scattered through his books. His references to what constituted a *natural* system are equally difficult to follow as he never wrote a well-articulated chapter or section explaining his classifications. This fact alone deserves scrutiny. The second interesting fact that is evident from the primary literature is that these rather enigmatic naturalists were forced to clarify their views when in disagreement with each other. They did so mostly in written form in the introductory sections of their books and in the many journals that were coming into existence in the 1820s and 1830s. In particular, British journals offered an effective stage for the debates. For instance, the *Annals and Magazine of Natural History* and the *Transactions of the Linnean Society* included numerous articles and letters to the editor by naturalists refuting each other's views, more often than not in a rather belligerent tone. Apparently, the issues at stake were very dear to the naturalist's heart, including Temminck's. Whenever he found himself being challenged, Temminck was forced to articulate his arguments, to define concepts and to explain his methods. It is therefore in these debates between peers that we will find a wealth of interesting material to unravel the foundations of early nineteenth century systematics. The discussions with his peers allowed me to reconstruct Temminck's theoretical framework and answer some related questions: how did he understand the position of his area of expertise, zoological classification, within natural history? Did he propose original theories and methods, or did he build upon the work of others? The debates are useful for unravelling the conceptual issues that were being discussed among naturalists. In addition, the contemptuous tone of some of these debates hint at a change in leadership. Who was leading these debates and how was the scientific pecking order established? In other words, what qualified a naturalist as an authority? The question is embedded in a complex web of cultural, political and conceptual factors, that changed rapidly and locally.

The debates also help answer—at least, partly—some additional questions: What was the status of systematics in the Netherlands and in neighboring countries? Were there national traditions in classification, or were different approaches the result of each naturalist's personal preferences? The questions of who practiced systematics and where it was being carried out led me to explore the geography of systematics and the platforms used by naturalists to communicate and share their knowledge. Here, the

essays on ornithology by Farber and Endersby's exploration of the material practices of Victorian botany have been valuable points of departure.

Necessarily, because of the complexity of these questions and the lack of local historiography, I have had to discuss some of these points briefly, while I have treated others more in depth. In particular, I have given much attention to issues related to Temminck's classifications and to his role as founder and director of the Leiden museum, a role intimately linked to his international stature as a naturalist. Other intriguing questions await further research. There is much to explore concerning the link between the political, economic and technical transformations in most of the European countries during this period and the transformation of the natural sciences, for example. The exploration of the colonies, the processes of professionalization and specialization, the rise of national museums, the expansion of transportation, or the effect of technological advances are just a few aspects that need to be examined more closely.

Concerning the selection of works and naturalists here considered, I must admit that Temminck's activities and network have forced me to include certain authors while ignoring others who might perhaps seem more relevant. This may make the choices seem random or not representative enough, but fortunately, there is abundant literature on figures like Georges Cuvier, Lorenz Oken, Richard Owen or Alexander von Humboldt to compensate for these gaps. This book is primarily centered around Temminck and the debates he was involved in, which means that naturalists with whom he disagreed play a more prominent role, people like Louis P. Vieillot, Hugh Strickland, Nicholas A. Vigors, Frédéric Cuvier or William Swainson. I also explore how other naturalists reacted to Temminck's classifications, and why. By placing these men's ideas alongside Temminck's, I seek to provide a more meaningful portrait of Temminck. My goal is not to give a comprehensive history of zoological classification, nor to reconstruct the institutional history of 's Rijks Museum van Natuurlijke Historie, but to sketch Dutch systematics during the first half of the nineteenth century using Temminck's debates as a touchstone.

In short, this book is a further step along the trail blazed by authors like Paul Farber, Peter Stevens and Jim Endersby—to name but three—to contribute to the necessary background to understand the history of nineteenth-century systematics. Also, I hope this will be the starting point of a wider and ever-growing historiography of Dutch natural history.

A word of caution: on definitions

In the previous passages I have referred to *systematics*, *classification*, *discipline*, *naturalist* and *natural history*. However, these are not clearly defined terms—far from it—and their meaning has changed over time and from author to author. It is important, therefore, that I provide an explanation for my choice of words and their intended meaning in this book.

There is today a great deal of ambiguity surrounding the terms *taxonomy* and *systematics,* with various definitions available in the specialized literature. For example, Randall Schuch regards both terms as synonyms, while for Michael Simpson systematics encompasses taxonomy (the description, identification, naming and arrangement of organisms) and has as its primary goal the reconstruction of the evolutionary history of organisms.[30] Often, taxonomy is defined as the theory of classification and nomenclature, while systematics includes the arrangement of groups in an orderly, systematic fashion, based on the relationships between groups (today, based on evolutionary kinship).[31] I have avoided using the term *taxonomy* and have preferred *systematics* instead. The reason for this is simply that *taxonomy* was not a commonly used term in Temminck's time. *Taxonomie* was coined by Agustine P. de Candolle in 1813 in his *Théorie élémentaire de la botanique*, as a new term for *la Théorie des classifications*.[32] The term was sometimes used in textbooks. For example, the Dutch zoologist Jan van der Hoeven used *Taxonomia* in his handbook of zoology written mostly for students.[33] In general, the term *taxonomy* is virtually absent from the literature on zoological classification up to 1850.

In general, naturalists used the terms *système*, *arrangement*, *méthode* and *classification*, which were also ambiguous. Many zoologists used them as Georges Cuvier had defined them in 1816. He made the distinction between a system and a method: "système" applied to artificial classifications (convenient catalogues that did not necessarily reflect the true relations between organisms) while the "méthode" indicated a natural classification, made by careful comparison of the organisms following the principle of

[30] Randall T. Schuh and Andrew V. Z. Brower, *Biological Systematics*, 1 ed. (Ithaca, NY: Cornell University Press, 2009), 15; Michael G. Simpson, *Plant Systematics*, 2 ed. (Elsevier Science, 2010), 9-12.

[31] Alessandro Minelli and Giancarlo Contrafatto, eds., *Biological Science Fundamentals and Systematics*, vol. 2 (EOLSS Publications, 2009), 163; Mary P. Winsor, *Reading the Shape of Nature: Comparative Zoology at the Agassiz Museum*, Science and Its Conceptual Foundations (Chicago: The University of Chicago Press, 1991), xii.

[32] Augustin Pyramus de Candolle, "Introduction," in *Théorie élémentaire de la botanique; ou, Exposition des principes de la classification naturelle et de l'art de décrire et d'étudier les végétaux* (Paris: Déterville, 1813), 19.

[33] Jan van der Hoeven, "Inleiding," in *Handboek der dierkunde, of grondbeginsels der natuurlyke geschiedenis van het dierenrijk*, vol. 1, (Delft: J. Allart, 1828), 28.

the subordination of characters.[34] The "méthode" thus resulted in seemingly natural classifications that reflected the true order of nature, and it was constructed not by division, but by synthesis.[35] Although nearly all naturalists were well aware of this distinction between natural and artificial classifications, the use of Cuvier's nomenclature was not universally adopted, and some authors even inverted it, resulting in misunderstandings and confusion.[36] Temminck was one of them. He used phrases like "système général d'ornithologie," "système de la nature" and "partie systématique de l'étude de la nature" for nearly all zoological classifications. As we will see, Temminck believed that the existing classifications were all artificial, and that only by prolonged and careful study following Cuvier's precepts would these classifications become natural. I will return to this point in chapter five. However, he referred to single-character classifications and to the Linnaean arrangement of birds as the "méthodes artificielles" or "classification méthodique," and to Linnaeus' followers, as "méthodistes."[37] On the other hand, Temminck used the term *système* to denote any classification, natural or artificial—the equivalent of *system* in everyday language, not in Cuvier's sense. In short, we can never be sure of the meaning of these terms if they are taken out of their original context.

In view of these ambiguities, which are a reflection of the conceptual confusion of the time, I have adopted the terms *systematics*, *system* and *classifications*, and I will indicate whether or not the classification was thought to be natural or artificial. Also, by using *systematics* and not *taxonomy* I want to avoid giving the impression that nineteenth century naturalists were not preoccupied with understanding the relationships between the groups of organisms they were describing, naming and ranking. On the contrary: it was their main concern. Similarly, I will use the terms *naturalist*, *zoologist*, *botanist* and sometimes, *systematist*, but generally not *scientist* or science. However, I translate the Dutch word *wetenschap* (which means both *knowledge* and *science*) as *science*, which seems more appropriate simply because *knowledge* is such an extremely broad concept.

Throughout the book, I also use the terms *discipline* and *field*, but I do so in a different sense than Farber's use of *discipline*.[38] Farber summarizes the activities of eighteenth

[34] Georges Cuvier, *Tableau élémentaire de l'histoire naturelle des animaux* (Paris: Baudouin, 1798), 19-21.
[35] See also Mayr, *The Growth of Biological Thought*, 190-93; Stevens, *Development of Biological Systematics*, 10-11.
[36] For example, William Sharp Macleay, "Preface," in *Horae Entomologicae or, Essays on the Annulose Animals*, vol. 1 (London: S. Bagster, 1819), viii-ix; Stevens, *Development of Biological Systematics*, 13.
[37] See, for example, Coenraad Jacob Temminck, "Introduction de la seconde édition," in *Manuel d'ornithologie, ou Tableau systématique des oiseaux qui se trouvent en Europe; précédé d'une analyse du système général d'ornithologie, et suivi d'une table alphabétique des espèces*, 2 ed., vol. 1 (Paris: H. Cousin, Edmond d'Ocagne, 1820), vii.
[38] Farber, *Emergence of Ornithology*.

century natural history as comprising four "different research traditions": nomenclature and systematics, the description of the life histories of individual species *à la* Buffon, comparative anatomy and physiology. While the last two evolved into separate disciplines, life histories and systematics "ramified into the specialized discipline of ornithology." Farber writes: "Morphologists and physiologists sought general laws regulating form and function, whereas ornithologists sought to classify and describe a particular group of animals."[39] In this way, Farber equates nineteenth century ornithology to "bird systematics" and considered it a scientific discipline. However, even when systematics dominated the practice of ornithology at that time, it was also the central task of entomology, mammalogy or carcinology, for instance. Naturalists were dealing with issues common to all of them: the chaotic nomenclature, and the search for a natural classification system and for standard methods. Even considering that the main occupation of ornithologists during the period covered by this book—and Farber's—was, indeed, systematics, books on birds also included detailed life histories, behavior, breeding information and other matters generally more appealing to the general public. All of this also falls under the umbrella of ornithology: it was a field including, but not exclusively occupied with, systematics. I will therefore treat ornithology as a field and systematics as a discipline. Here I define a discipline as a branch of science having its own set of goals, methods and techniques, a specific new language adequately describing the subject matter with unique terms and having a social structure: a community of practitioners, organizations like clubs and societies, platforms for publication like specialized journals and a place in the academic curricula. Taking this definition as a starting point, what was the situation of systematics towards 1850? Can we speak of a scientific discipline, even if it is still in the early stages of development? If so, did it evolve at different rates in different countries and for different domains?

Finally, the phrase *natural history* defies definition. Even during the relatively short period of fifty years covered by this book, *natural history* had an array of meanings, and it still has. Although I tackle the problem of its meaning in Temminck's time in chapter seven in a discussion of what fields and disciplines it included, I hope I will be forgiven for using, throughout this book, the term *natural history* in its broadest and most intuitive sense, in which it includes all branches of botany, zoology and geology.

[39] Farber, *Emergence of Ornithology*, 125.

Summary of chapters

This book consists of seven chapters in three parts, plus this introduction and some final remarks in the conclusions. In the first part we follow Temminck's life and career, starting from his parental home in Amsterdam until his last years as director of 's Rijks Museum van Natuurlijke Historie in Leiden. The second part of the book is about Temminck's writings and thought, in order to distill his theoretical framework and the concepts that were the foundation of his classifications, while in the third and final part I take a broader perspective as I examine the emergence of systematics within the tradition of natural history, while keeping the figure of Temminck as a touchstone for this discussion.

Part One starts at the beginning of Temminck's life. I have paid attention to Temminck's childhood and early years in chapter one because his love of birds was ignited at home, where he was surrounded by stuffed birds, aviaries and the fabulous stories of François Levaillant struggling up the Orange River in South Africa and chasing parrots in South America. In addition, the inheritance of his father's collection of natural history objects spurred Temminck towards zoological classification through the practice of ordering and cataloguing, which depended directly on his capacity to identify species. Then, collection catalogues became complements of existing—but in Temminck's view unsatisfactory—classifications, and later on, they turned into monographs that launched Temminck into the international arena of natural history. Temminck's path as a naturalist is described in chapters two and three. His career took off because of his well-received monographs and was advanced further thanks to his patrician background. He held a series of posts that, in the end, served him as stepping stones towards the highly regarded and coveted directorship of the brand new Rijks Museum van Natuurlijke Historie. The most important of these posts was that of director *ad interim* of the national cabinet of natural history, one of Louis Napoleon's pet projects. After five years in this post, Temminck had built up a reputation as a museum curator and an ornithologist. Along the way, though, he also made some enemies, such as the influential Martinus van Marum, the secretary of the Dutch Society for Sciences in Haarlem and director of Teylers museum. Chapter three deals with the establishment of 's Rijks Museum, his years as director and his efforts to put the museum on the international stage. The emergence of systematics was a major factor in all these events, one largely overlooked by historians. I also explore the tremendous effect that the political and economic changes in the Netherlands between 1820 and 1850 had on the museum finances and its scientific output, and consequently, on Temminck's status, as he was expected to produce more than he possibly could.

Part Two comprises the conceptual analysis of Temminck's zoological classification and his views of nature. In chapter four I discuss Temminck's understanding of the concepts of type, genus and species as they become clear from his law about the geographical distribution of mammals and birds. This analysis of his ideas on animal distribution also reveals his belief in the fixity of species and multiple creations. Cuvier's influence on Temminck becomes evident in this chapter. In chapter five I follow the arguments between Temminck and his fellow ornithologists, Louis Pierre Vieillot and Nicholas Vigors. The discussions revolved around the definition and delimitation of genera and species, the rules of zoological nomenclature and their different approaches to arrive at a natural system of classification. If anything, this chapter shows a rather chaotic state of affairs and a lack of understanding among naturalists, but also their increasing awareness of this fact, which led them to concentrate on standardizing practices and methods in zoological classification.

In Part Three, I place Temminck's career and his theories about the natural world within the wider context of nineteenth-century natural history. Chapter six includes a discussion of the democratization of natural history and the emergence of a scientific meritocracy with Britain in the lead, which had a great impact on Temminck's authoritative status. Furthermore, I sketch where and how the practices of classification took place. After looking at the arguments advanced by naturalists working in the field, in museums and in universities, I suggest that each type of location was occupied by a different discipline, which brought about conflicts and misunderstandings when naturalists themselves were not aware of this niche formation. Additionally, I discuss briefly how Temminck communicated and what platforms he used to publish his work, the multi-volume works he preferred rapidly becoming outdated. As a consequence, Temminck became increasingly isolated. Chapter seven starts with an inquiry on what *natural history* actually meant, before discussing the issue of the status of systematics within natural history, especially when contrasted with the highly regarded and relatively new discipline of comparative anatomy. I conclude that the inclusion or exclusion of philosophical arguments in systematics greatly affected its status, and that most naturalists were well aware of this. However, around 1850, since systematists had still failed to unveil the true order of nature and as half the world was still being explored, most of them opted for carrying on with descriptive natural history. They rejected natural philosophy while expecting that classifications alone would eventually provide the necessary explanations by the time their classification systems were completed. This rather passive attitude further diminished the status of systematics. Temminck's authority had practically vanished by the middle of the century.

The final section assembles the conclusions that can be drawn from these seven chapters, focusing on the question of the emergence of systematics as a discipline. All in all, this book presents an analysis of Temminck's role and significance and fills a gap in the historiography of Dutch natural history. In addition, it provides a study of the different approaches to zoological classification and, however incomplete, it enables us to re-examine the foundations and aims of systematics during the first half of the nineteenth century.