

‘Natural History Values and Meanings in Nineteenth-Century Chile’  
Manuscript ID RSNR-2017-0051  
Patience A. Schell\*  
Spanish and Latin American Studies  
School of Language, Literature, Music and Visual Culture  
Taylor Building  
University of Aberdeen  
AB24 3UB  
p.schell@abdn.ac.uk

In 1900, Chilean naval doctor Federico Delfín reflected on the benefits that fishing for science offered its practitioners, arguing that fishing developed the collector’s character. Delfín mused, ‘In this struggle one learns to dominate the self ... in this school, great character can be formed’.<sup>1</sup> Delfín was not alone in his contention that collecting, amongst other practices of natural history, was beneficial to an individual. Others went further, arguing that scientific work and study, including natural history, offered social benefit, too. In this article, I examine the ways naturalists and their supporters in Chile argued, throughout much of the nineteenth century, that natural history was good for individuals and society because it developed and tempered the character of its practitioners. Examining this discourse of beneficial science is important for three reasons: first, the discourse of value-laded sciences offered this field a powerful justification for its development, especially in the face of criticism; second, because naturalists believed in this discourse, it helps explain what their work meant to them and, finally, these values highlight the disjuncture between discourses about natural history and their links to military conquests, as well as the ways in which natural history was an exclusionary practice. I begin this article by discussing examples of the values attributed to natural history in other places, before providing contextual information on nineteenth-century Chile. Next, I address the values of naturalists and the value of natural history, broadly divided between fieldwork, and its

representations, and indoor work. The final section addresses how this community of naturalists, and their supporters, understood natural history's value in a life, studying one of Chile's most prominent naturalists.

### Introductory Context

Scholarship on science and natural environments in other places has recognised that it was a value-laden practice. For example, Robert Kohler argues that, in the nineteenth- and early twentieth-century United States, the natural world became a 'physical and moral landscape of improving outdoor recreation for fagged-out professionals and office workers', helping justify the development of survey science and fieldwork.<sup>2</sup> Similar arguments were made in nineteenth-century Britain; Anne Secord has shown that the enjoyment which promoters of science claimed for their disciplines helped expand the scientific community.<sup>3</sup> She concludes, echoing Stefan Collini, 'Science appeared to encapsulate moral values in its very practice: one of its advantages, through the self-discipline it involved, was ultimately its value for developing character'.<sup>4</sup> In another example, in the first volume of *Cosmos* (1849), the famed Prussian naturalist, Alexander von Humboldt (1769-1859), argued that being in nature benefitted individuals: 'Mere communion with nature, mere contact with the free air, exercise a soothing yet strengthening influence on the wearied spirit, calm the storm of passion, and soften the heart when shaken by sorrow to its inmost depths'.<sup>5</sup>

A discourse of natural history as personally renewing, character-building and socially transformative also flourished in nineteenth-century Chile. Chile won its independence from Spain in 1818 and, by the 1830s, had a limited constitutional democracy. Over the course of the nineteenth century, Chile also became a regional power, engaging in successful campaigns of

territorial expansion. War against Bolivia and Peru (1879-1884) and a military campaign, from the 1860s, against the independent Mapuche people living in the southern region between the Bío Bío and Toltén rivers, increased Chile's territory. Compared to its neighbours, nineteenth-century Chile was relatively stable and socially homogenous, which facilitated the institutional and economic development in which the sciences could prosper. Improved literacy rates due to expanded educational opportunities stemmed from a politically liberal perspective, which sought to distance Chile from its colonial past and stood in opposition to conservatives, for whom the colonial past offered the nation's foundations. For these political liberals, Chile could not be 'civilised' without increased literacy, as oral culture reflected 'barbarism'. For liberals, as well, education was a means to civilise individuals, temper and moderate customs and ensure national order.<sup>6</sup> Alongside increased educational opportunities, recently-founded newspapers and magazines disseminated debates and new ideas, including scientific ones, while the government supported scientific expeditions and institutions.<sup>7</sup> For the rulers of this new country, scientific exploration, sometimes directly linked to military expeditions, offered valuable information on Chile's territory, population and resources.

While this work built on eighteenth-century foundations, including the Spanish charting expedition of Alejandro Malaspina (1789-1794) and Jesuit Juan Ignacio Molina's 1782 natural history of Chile,<sup>8</sup> compared to other parts of Spanish America, Chile in the independence period was little known scientifically.<sup>9</sup> The situation gradually changed thanks to collaboration amongst Chileans and foreigners, with government support. It was through this type of collaboration that the *Museo Nacional* (National Museum) was founded in 1838 and its library, and the national library, both increased their collections of scientific books. Study of science was also introduced at secondary schools and at the *Universidad de Chile* (University of Chile),

founded in 1842.<sup>10</sup> This expansion of scientific activity and education took place despite conservative opposition, and concern amongst some Catholics about an increasingly secular civil society. While Chile was officially Catholic, and did not permit the practice of any other religion or denomination of Christianity,<sup>11</sup> the arrival of non-Catholic immigrants, as well as liberal and freethinking political currents, challenged the Catholic religious monopoly and the public place of religion. Legal changes, such as the 1865 law allowing practice of other faiths and the founding of non-Catholic religious schools, and the 1871 cemeteries decree, which secularised cemeteries, indicate the growing separation of Church and State. Yet supporters of the sciences still had to make their case to a public which, while becoming more secular, nonetheless doubted that the sciences were useful or nationally beneficial, even if they were interesting.<sup>12</sup>

Despite the scepticism of a nineteenth-century public about the usefulness of science, in the historiography of the development of the sciences in Chile, its utility, both for its practitioners and supporters, and as understood by historians been an important focus. Luis Mizón argues that the natural history work of French naturalist Claudio Gay, discussed in greater detail below, contributed to the construction of Chilean identity.<sup>13</sup> Rafael Sagredo Baeza concludes that Gay's work, and particularly his *Atlas de la historia física y política de Chile* (*Atlas of the Physical and Political History of Chile*), with its maps and plates depicting archaeological remains, social customs and botanical illustrations, all helped consolidate an 'idea of Chile'.<sup>14</sup> Juan David Murillo Sandoval contends that displays of Chilean nature, at Santiago's 1875 International Exhibition, were part of Chile's self-representation as a bountiful land of virtually untouched, productive nature. The ordered, organised, labelled specimens on display reinforced the idea of *Chilean* natural resources rich for exploitation.<sup>15</sup> For Zenobio Saldivia Maldonado the work of three prominent naturalists, Claudio Gay, Ignacio Domeyko and Rodolfo

Philippi, all discussed below, was in part characterised by their focus on the immediate utility of scientific knowledge.<sup>16</sup> These different approaches point to the rhetorical and real usefulness of science socially and economically. Yet while naturalists made arguments about use, they and their supporters consistently made other arguments about why the sciences mattered. Saldivia Maldonado briefly examines this other discourse when he discusses how prominent naturalists of Chile depicted themselves as romantic figures; nonetheless he believes that the utilitarian argument was widespread by the end of the 1860s.<sup>17</sup> But these alternative arguments, about the values and character traits the sciences developed, did not disappear in this later period, and remain evident in texts where naturalists and their supporters explained why they did what they did. Thus, to understand the work of naturalists in this period, and the development of the natural sciences, especially natural history, in nineteenth-century Chile, we must examine what its practitioners said about the value of being a naturalist. In textbooks, journals, private letters, poems and biographies, amongst other sources, the argument that scientific work benefitted individual character and society at large consistently appears. These arguments are the topic of this article.

### The Meanings and Values of Fieldwork: Experience and Narrative

Stunning sunrises, volcanic eruptions and calving glaciers were all part of the travelling naturalist's life, living a pared-down daily existence. Removing the trials and tribulations of 'civilisation' fostered what William Cronon calls 'the regeneration and renewal that came from sleeping under the stars, participating in blood sports, and living off the land'.<sup>18</sup> An explorer who experienced this pared-down existence was Enrique Ibar Sierra (1858-1878), a young naturalist attached to a Chilean naval charting expedition in the area around the Strait of

Magellan. This naval expedition responded to Chilean state, as well as private, concerns that the area, in which the border between Argentine and Chilean territory remained imprecise, was largely unsettled by colonizers, ‘underpopulated’ and little exploited for its economic resources.<sup>19</sup> Nonetheless, Ibar Sierra’s journal largely ignores these national and commercial concerns, and focuses more on pleasure in the trip and wonder at the experience. He recorded in his journal, while near the Strait of Magellan, in 1877, that, ‘The spectacle of the sky in Skyring [a large sound] is magnificent. It does not have the sweet monotony of Chile’s sky, but offers, instead, endless variety which one admires without tiring. Daily, we watched the capricious succession of sun and clouds, of calm and tempests, repeated to such an imposing degree that our admiration was awakened’.<sup>20</sup>

The writings of the French naturalist, Claudio Gay (1800-1873), who explored Chile under government contract throughout the 1830s, offer examples of this wonder and admiration prompted by landscapes. In 1832, when Gay climbed a summit on one of the storm-beaten Juan Fernández Islands, about 600 kilometres from the mainland, with a military expedition,<sup>21</sup> he commented

I will not paint all the sensations of pleasure and horror that I felt when I arrived at the peak ... While I considered ... that narrow and difficult path ... in which the least mis-step would have been enough to ensure my disastrous and certain death, I could not tire of admiring the landscape ... . It was a truly magical picture, garnished by a horizon of the loveliest blue that offered to the amazed imagination the image of brute nature confused with the ruins of an ancient city that the centuries had covered in dust and soot. ... My

soul aggrandised because of the dangers over which I had just triumphed and I believed myself superior over all by finding myself at a higher altitude.<sup>22</sup>

Gay's description comes straight out of the sublime handbook, vividly depicting the emotions of wonder, fear and amazement prompted by the scenery.

The concept of the sublime seemed particularly suited to the scale of continental American landscapes; as Elizabeth McKinsey argues about Niagara Falls, the complex intermingling of terror and wonder that the falls evoked in spectators even appeared to pre-date the 'sublime' as a concept.<sup>23</sup> McKinsey further argues that, in the early nineteenth-century United States, sublime scenery was perceived to foment virtue and morals. Staring into the chasm was necessary to experience an expansion of self.<sup>24</sup> Ibar Sierra and Gay's responses to the landscape also come out of the tradition of Romanticism. Venezuelan Andrés Bello (1781-1865), the *Universidad de Chile*'s first rector, who promoted and disseminated the sciences in Chile, also encouraged Spanish American poets to adapt Romanticism to their realities. Chilean Romanticism developed through the literary 'Generation of [18]42', when Chileans, exiles and immigrants, like Bello, engaged with European Romantic literature to create a national literature, distanced from the colonial past. Approaching the sciences from this point of view, Polish exile naturalist Ignacio Domeyko (1802-1889) believed that study of Chile's natural environment was a way for the new country to find its own 'reality', instead of copying European models. Saldivia Maldonado also suggests that ideas of Romanticism may have been discussed in social spaces, like Santiago's salons, frequented by naturalists like Gay, Domeyko and Prussian naturalist Rodolfo Philippi, discussed at greater length later.<sup>25</sup>

Accounts of exploration not only showed how landscapes prompted awe and wonder, but also offered examples of individual character and fortitude. As Michael Robinson has argued about depictions of the race to the North Pole, these narratives functioned as ‘moral tales in which explorers, through their toil and suffering, revealed the highest qualities of personal character’.<sup>26</sup> For Robert Kohler, in narratives of heroic exploration, ‘narrators’ personal virtue and direct experience ... lend authenticity to knowledge claims’.<sup>27</sup>

In the 1841 prospectus Claudio Gay published for his planned natural history of Chile (which eventually reached 30 volumes), he depicted himself as a dedicated, virtuous hero-explorer. Here he described Chile as one of the world’s ‘least known’ countries and recounted that he imagined writing a work which brought information about Chile’s natural resources and society to global attention. He described how,

Persuaded of the importance for all the natural sciences a special work about this beautiful part of America would be, I decided to undertake it ... The difficulties with which I would have to struggle were not hidden from me, nor the infinite tasks to which I would see myself committed; but with the strength of zeal and activity, with the inveterate habit of the occupations of the natural history cabinet, and with a very strong constitution, I undertook this enterprise, with the hopeful belief that my avocation for this type of work, that is a subsuming passion for me, would sustain me in the midst of the laborious and tiring investigations.<sup>28</sup>

Thus, Gay argued that his personal traits would ensure his project’s success.

Nonetheless, not all naturalists depicted themselves as heroes of their own adventure story. Enrique Ibar Sierra, the young Chilean naturalist mentioned above, also mocked himself. His account includes instances of his own foolishness, for example, when he did not listen to his guides' warnings and ended up dumped in a swift and deep stream by his horse, and moments when these guides laughed at him, for instance because he could not eat a full rhea egg.<sup>29</sup> Ibar Sierra's journal offers two interesting points for reflection: he died before he could revise it for publication, so we cannot know what form it might have taken under his editorship. Additionally, he was young, about 19. Maybe the heroic explorer narrative was harder to successfully depict for a young man on his first big trip. But these mishaps also contributed to rueful reflections and, perhaps, tempering his character. Ibar Sierra returned a better naturalist having proved himself.

Depictions of awe at landscapes and tireless zeal were repeated in texts about these naturalists, too. An 1867 biography of mineralogist Ignacio Domeyko, who became third rector of the university (1867-1883), depicted him as a heroic and tireless naturalist. In 1845, Domeyko planned to summit the Antuco Volcano, in the Mapuche indigenous region, which the Chilean state nonetheless claimed in the 1833 constitution.<sup>30</sup> Domeyko's biographer, liberal historian Miguel Luis Amunátegui (1828-1888), explained that both human and natural dangers were certain: 'To get to the volcano, there is only one rough road, far from the population centres, that crosses true desolation, in which various indigenous, nomadic and independent tribes wander'. But Domeyko 'took the firm decision to put up with the hardships [and] scorn the dangers, to accomplish his goal. Pliny's race has not been extinguished from the earth'. In this account, which drew heavily on Domeyko's own report in the 1848 *Annales de Mines*, Amunátegui even depicted finding a guide as a feat of heroism.<sup>31</sup> Domeyko's bravery was contrasted to the alleged

cowardice of one of his guides, Besera. Besera had been ‘poor and unknown’, when he guided the German explorer Eduard Friedrich Poeppig (1798-1868) in the same area, but had since gained status and earnings as an intermediary with local indigenous people. In his eighties and physically strong, Besera was ‘incredibly brave’ with people, but ‘incredibly fearful’ of this volcano. As they approached the start of the ascent, Besera, nonetheless, helped them avoid conflicts with the indigenous people they encountered. But they also received warnings that the volcano had not been so active in years.

Approaching the volcano, in Amunátegui’s account, Besera started to feign excuses to get out of his role, ‘complaining about pains in his feet and chest’ and offering a young shepherd as an alternative guide. Eventually, Besera stayed behind caring for the expedition’s mules and horses as the rest of the party began the ascent.<sup>32</sup> Faced with a volcano spitting ash and smoke, the shepherd also refused to go further.<sup>33</sup> Domeyko, an unnamed guide who had been with him the longest on this trip and his student, Miguel Munizaga, managed to get about 100 metres from the volcano’s crater but could go no further. Domeyko and Munizaga (the other guide is not mentioned) then tried another route, but that also failed. As Amunátegui concluded, ‘They had had the honour to climb to the summit ... but not to contemplate the boiling lava at the bottom of the crater. At least it had not been for lack of will or daring to scorn fatigue and danger’. Rather, the volcano itself had blocked them by destroying the route Poeppig had used.<sup>34</sup> This account offered lessons to readers about the discipline scientific exploration fostered, making the naturalist a model of daring and resourceful masculinity, whose attitude turned a failure into a sort of triumph.<sup>35</sup>

Amunátegui’s biography, from which this incident was taken, was published in 1867, the year Domeyko became university rector. Domeyko’s appointment, however, had been

controversial; some critics suggested that he was not qualified, while others were concerned that his conservative Catholicism would become an issue, in the context of debates about the role of the Catholic Church in public life. Amid this controversy, Amunátegui wrote the biography to defend Domeyko, with whom he had lived and worked. For Amunátegui, the heroic explorer Domeyko was, at the same time, an almost ascetic figure. He ‘has neither riches nor power; he does not dispense favours or political influence. The only [thing] he can give is, to his students, science; to his friends, the affection of a noble heart’.<sup>36</sup> Thus, to defend Domeyko, Amunátegui used the characteristics of an ideal naturalist.



Figure 1  
'Vista al Volcán de Antuco al momento de una erupción de gas (1 marzo 1839)'

Claudio Gay, *Atlas de la historia física y política de Chile* (Imprenta de E. Thunot, Paris, 1854)  
From the collection of the Biblioteca Nacional de Chile, available on 'Memoria Chilena'  
<http://www.memoriachilena.cl/602/w3-article-98586.html>

An image from Claudio Gay's travels, which depicts his party descending from the summit of the Antuco Volcano while it was erupting, also narrates the hero naturalist confronting the volcano (see Figure 1).<sup>37</sup> Despite the hot gas and rocks shooting towards the sky, Claudio Gay, in the centre of the image, calmly walks away, staff making solid contact with the ground, perhaps displaying the attitude of superiority already described. Everyone else flees the scene in terror. In this plate, the heroic naturalist alone offered his readers a model of masculine self-control, courage and dedication. Gay's depiction of unreliable porters and guides, those serving him, echoes the restrictions on suffrage in the 1833 Chilean constitution, which stipulated that the status of 'active citizen with the right of suffrage' for eligible men could be 'suspended' for those men employed as 'domestic servant[s]'.<sup>38</sup> Much of the work that expedition guides, porters and muleteers did, the carrying, cleaning, cooking and organising, has direct parallels to domestic servants' work. How could these men, who did this type of work, be heroes of national exploration? Moreover, a scene like this one could only have one hero, one leader. As Besera offered a foil for Domekyo's heroism, here Gay's party played the same role.

In this plate, Gay is not only at the centre of the volcano, but he is also at the centre of the landscape, with its high mountains all around. Catalina Valdés has argued that, in this period, the Andes took on a new cultural meaning. The mountain range functioned as a Romantic landscape and an 'allegory' of newly-independent Chile, a scene setter and, to a certain extent, a monument, but not a landscape to be depicted for its own sake. Thus for about the first two thirds of the nineteenth century, it was naturalists who sought to study and depict this national

monument as a landscape.<sup>39</sup> Moreover, if we take the Andes as a national monument, then Gay put himself, and by extension the role of the heroic naturalist, at the centre of the nation.

The territory of that Andean nation was increasing in the nineteenth century and the trope of ‘heroic’ fieldwork was often tied up in expansionist, imperial and military goals. Domeyko and Gay’s travels in Mapuche territory (called ‘Araucanía’ at the time by Chileans) disseminated detailed information about this area, sandwiched by Chilean territory both north and south, and its economic resources. The preface to Domeyko’s 1846 *Araucanía i sus habitantes (Araucanía and its Inhabitants)*, based on his 1845 travels, however, acknowledged the reality that indigenous ‘tribes’ lived ‘independently’ in an area in ‘the middle of the national territory’.<sup>40</sup> Domeyko described these lands as not having anything ‘that distinguished them particularly from the [Chilean] provinces immediately bordering them ... [it was] the same natural environment, the same configuration of land, the same forested mountains and mountain ranges, the same ocean’.<sup>41</sup> The natural environment gave no excuse for the territorial division, in Domeyko’s description. He also recommended strategies for the *reducción* (containment, settlement) of the indigenous population, using ‘morality’ and religion, while indigenous lands, in his opinion, offered opportunities for settlers.<sup>42</sup>

In this instance, exploration narratives helped create the context for conquest, but natural history also benefited directly from the 1879-1884 War of the Pacific, as Chile’s Museo Nacional received materials looted from Lima’s institutions, while seizure of new territories in the north offered opportunities for expanding the collection.<sup>43</sup> The museum’s director, Rodolfo Philippi was, in fact, disappointed that, despite having contacts on the battle front and in occupied territories, little material arrived. He also complained that pillaged material from Peru’s national library, seized during the Chilean occupation of Lima, was not up to scratch.<sup>44</sup>

As these examples reinforce, natural history practice, in both wartime and peacetime, cemented the power relations and hierarchies in which local knowledge was appropriated without credit, knowledge creation and attribution were limited to the ‘scientific’ practitioner and racial, class and gender hierarchies were confirmed. The values of natural history, and the values attributed to the ‘naturalist’, also supported this exclusionary understanding of scientific work, as the disregard for ‘dependent’ porters and guides indicates. These values may also have allowed the recognised naturalists in and out of these ‘unexplored’ places with reputations enhanced.

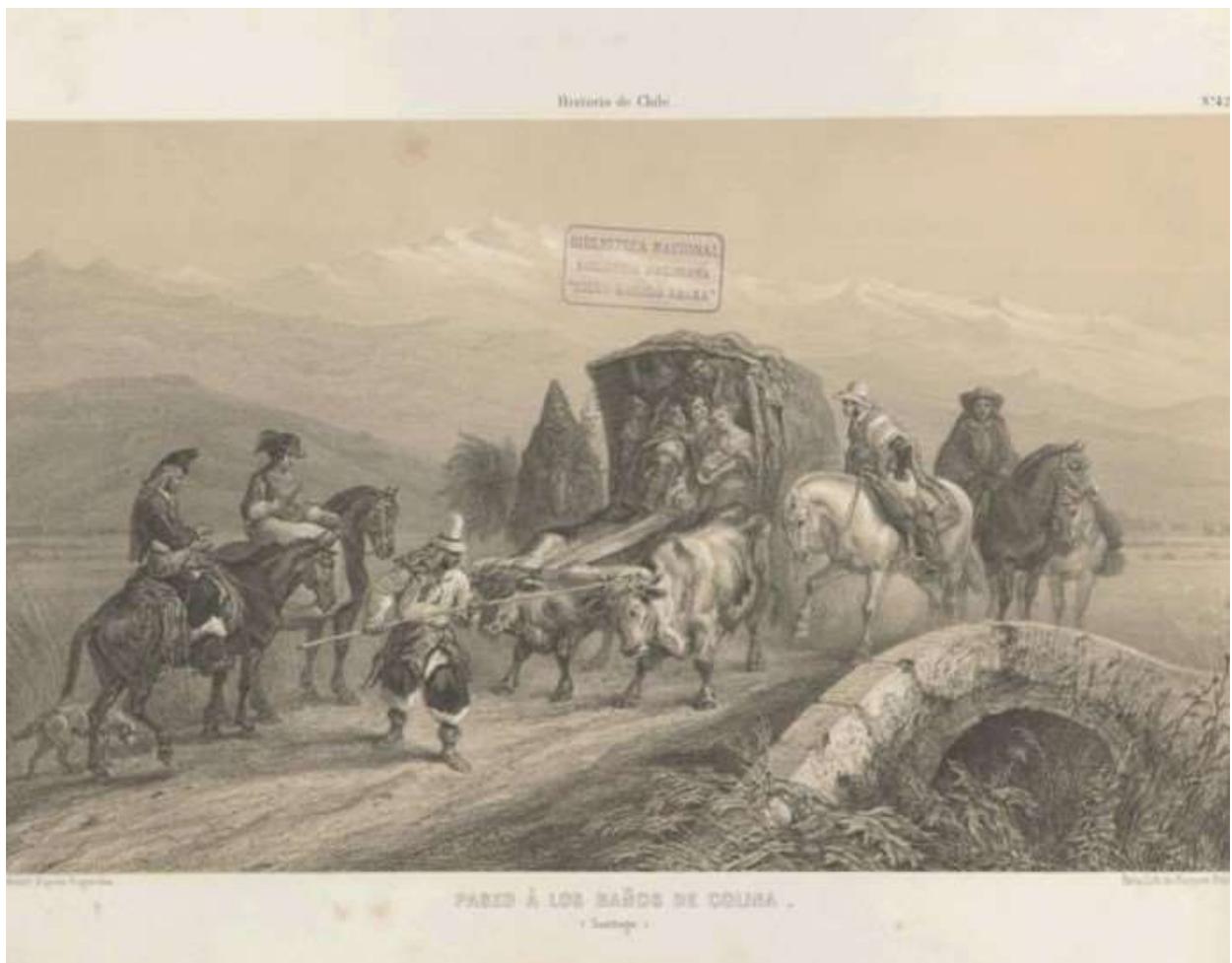
Enacting these values inoculated against any contamination from the wilds, giving the naturalist an armor of scientific civilisation which justified his activities. The values rhetorically proved that the activities in which the naturalists participated, and that they themselves, were good men whose work improved society, even if that work benefitted from, and sometimes depended upon, looting, theft and warfare.

#### Natural History Values through Hobby Fieldwork and Textbooks

As the century aged, and conquest brought new areas under Chilean state control, naturalists and their supporters promoted fieldwork and collecting not just as the heroic exploits for the few, but as a project to which many young men could contribute, for themselves and the improvement of important civic institutions, museums. A comment on gender is needed before we continue. My research-to-date has only uncovered one definite example of a woman doing field work in Chile: Claudio Gay’s wife Hermance was one of his field collaborators. There were at least a few women collectors, who donated items to the Museo Nacional. It is not clear how they acquired these objects, but at the moment it appears as if field collecting was a pursuit for educated men in nineteenth-century Chile. The values that this chapter discusses may help

explain that (apparent so far) exclusion of women from many natural history practices, as these values were tied to male endeavour. Moreover, in the nineteenth century, women were excluded from the formal political sphere, like the male servants discussed above. Nonetheless, as women could study at the Universidad de Chile, from 1877, and Eloísa Díaz become the first women to complete a medical degree in Chile (1886), her experience may offer some insight into women's botanical practice, at least.<sup>45</sup>

Naturalists in Chile thus encouraged more men to get involved in a popularisation of the practice which was, using Kohler's term, 'virtuous' recreation.<sup>46</sup> Chileans, already had a habit of outdoor leisure activity, for example visiting the hot springs of San Fernando and Colina in the hills around Santiago and promenading along the capital's tree-lined 'Paseo de la Cañada'. (See Figures 2 and 3.)<sup>47</sup> Luz María Méndez Beltrán argues that the history of leisure in the Pacific port city of Valparaíso particularly shows this cultural norm because the surrounding hills limited the city's spread, while the sparse vegetation fed residents' pleasure in gardens. Moreover, the city's French and English immigrant populations imported leisure traditions like walks, rides and foxhunting. In 1822, the British travel writer Maria Graham recounted, 'As there are no places of public amusement for gentlefolks at Valparaiso, the English, when they make a holiday, go in parties to the neighbouring hills or valleys, and under the name of a picnic, contrive to ride, eat and drink, and even to dance away most gaily'. Valparaíso's non-English residents also ventured beyond the port city, to the hills or beach. By the 1860s, some local recreation areas had become tourist sites, too, as beach holidays became fashionable amongst Chile's middle class.<sup>48</sup>



‘Paseo a los baños de Colina, (Santiago)’

Claudio Gay, *Atlas de la historia física y política de Chile* (Imprenta de E. Thunot, Paris, 1854)

From the collection of the Biblioteca Nacional de Chile, available on ‘Memoria Chilena’

<http://www.memoriachilena.cl/602/w3-article-99628.html>



Figure 3

‘Paseo de la Cañada (Santiago)’

Claudio Gay, *Atlas de la historia física y política de Chile* (Imprenta de E. Thunot, Paris, 1854)

From the collection of the Biblioteca Nacional de Chile, available on ‘Memoria Chilena’

<http://www.memoriachilena.cl/602/w3-article-99704.html>

Specimen collecting gave another intellectual and social purpose to time spent outdoors.

Carlos Porter (1867-1942), the director of the *Museo de Historia Natural de Valparaíso*

(Valparaíso Natural History Museum, founded in 1878), writing around the turn of the century,

believed that it was his responsibility to encourage hobby collecting, because natural history was

‘full of attractions’.<sup>49</sup> To this end, he published collecting instructions in newspapers, as well as

stand-alone pamphlets, based on ‘*The Admiralty Manual of Scientific Inquiry*’, which must have

been *The Manual of Scientific Inquiry: Prepared for the Use of Her Majesty's Navy and Adapted for Travellers in General* (first edition 1849), edited by John Herschel, and the *Guide du naturaliste préparateur et du voyageur scientifique*, by Guillaume Capus (second edition, 1883).<sup>50</sup> He used the *Instrucciones para coleccionar objetos de Historia Natural (Instructions to Collect Natural History Objects)*, a Chilean publication, as a reference for his instructions, as well as distributing it to those who were in a position to develop his museum's collection ('because of their situation and education'). This description suggests a continued expectation that naturalists, even amateurs, would have social status and some formal education.<sup>51</sup> In the second edition of another one of his pamphlets, in 1903, Porter noted that he had received many requests from secondary schools in Chile and other institutions to reissue it. He also noted that the first edition had been written for the use of young sailors.<sup>52</sup> Sailors, then, seemed to have the 'situation and education' he expected of suppliers.

To supplement the limited number of pamphlets, Porter commissioned collecting instructions, from Chilean and foreign colleagues, to appeal to younger readers, which he published in the *Revista Chilena de Historia Natural (Chilean Journal of Natural History)*, which he founded in 1897.<sup>53</sup> His expectation that the *Revista Chilena de Historia Natural*, articles in which included 'Notes on Some Ancient Chilean Skulls and Other Remains' and descriptions of fish collected during the *Challenger* expedition, would have a broad readership is suggestive of how serious he believed Chile's amateur natural history community was.<sup>54</sup>

These articles promoted collecting as valuable for society and the individual both. William Bartlett-Calvert, (b. 1856) future author of *Monografía de los elatéridos de Chile (Monograph of Chile's Elateridae)*, offered guidance on finding butterfly larvae to cultivate. This activity required intelligence and alertness while in the field:

The butterfly collector who aspires to success should read the book of nature very carefully while he is on an excursion. If he does not have the intelligence to note and gain benefit from each fact that falls under his observations, neither he nor science will gain benefit from his collecting. He must always know the *reason for which* he makes a capture or he will never be a prosperous hunter.<sup>55</sup>

This argument parallels Kohler's contention that, in the United States, hunting, with natural history as the goal, elevated the activity, giving it an intellectual status and justification.<sup>56</sup>

Bartlett-Calvert further noted that, 'I hope that the goal of my readers will be, not only to have a good collection, but at the same time to educate themselves'.<sup>57</sup> An uneducated hunter could improve neither the individual nor the wider society.

In another example from the series, Federico Delfín (1851-1904), offered instructions about collecting, preserving and shipping fish specimens; fish collecting, in his opinion, was a pastime that 'gave the most benefit to the body and our intellectual faculties'.<sup>58</sup> Jorge Muñoz Sougarret and Francisco Ther Ríos describe Delfín, not only a naval doctor, but also a research associate of the Valparaíso museum and the author of the 'Catálogo de los peces de Chile' ('Catalogue of Chilean Fish'), as someone who brought together European scientific training and knowledge of Chile's coast.<sup>59</sup>

In these public instructions, in 1900, Delfín gushed that fishing

takes advantage of our senses through its multiple and varied demands. To my mind, there is no entertainment or activity that requires more vivid imagination, more activity in all

senses at the same time, [it is an activity that unites] a spiritual tranquillity that allows you to bring your senses into harmony. For this reason, there are moments [while fishing] in which one is almost drowned in emotion.<sup>60</sup>

The loftiness of Delfín's descriptions of scientific fishing, that is the process of turning living animals into cultural artifacts,<sup>61</sup> is more striking when juxtaposed with documents about the intrinsic violence in a naturalist's daily practice. In a private letter, Delfín described how an unspecified sea bird, which he shipped to the museum in Santiago, had been 'drowned' or 'strangled'.<sup>62</sup> But this practice, which united amateur and professional naturalists, was not open to all those who caught fish. In what Muñoz Sougarret and Ther Ríos consider an unguarded moment, in his presentation at the seventh Chilean scientific congress (1903), Delfín condemned Chile's fishermen. Irrespective of their experience, Delfín believed that their knowledge of good fishing areas was 'empirical' or even 'imaginary'. They were technicians, lacking the 'spirit of observation' of those who 'intently studied natural laws'.<sup>63</sup> The interests of the fishermen and the naturalist were so divergent that Delfín advised his audience to look for specimens amongst rejected catch.<sup>64</sup> Delfín's derision about the skills of Chile's livelihood fisherfolk further suggests that the argument about the values of the natural sciences were, in part, a means to exclude men and women with certain types of skills and knowledge from the scientific community. His reflections also demonstrate again that the same activity had different cultural meanings, depending on who undertook it and, as Bartlett-Calvert argues, why.

A poem inspired by museum work further demonstrates how context and practitioner gave scientific practice part of its meaning and value. Eduardo de la Barra, founder of the Valparaíso natural history museum, was moved to poetry by the taxidermist's craft. 'In the Museum's

Workshop', which appears to have been unpublished and date from 1890, describes how a taxidermist used 'all his art' in order to 'instill life' in a dead mountain lion on the dissecting table. This romantic poem, using lines of eleven and seven syllables, without apparent pattern, depicts taxidermy as a transformational activity. Watching the taxidermist at work, the narrator muses that the 'skin without a soul' had come from an animal that had 'bravely fallen', an animal which had 'one day powerfully reigned over the luxuriant, Valdivian jungle [in the southern part of Chile]' and eaten two 'little children'. In this poem, the mountain lion, killed in a region which had been a frontier with Mapuche territory, could even be an 'other', a noble savage whose end, in providing information about life, justifies a violent death. Noble while alive and free, in its death the lion became something still greater.

While telling the story of this particular mountain lion, the poem emphasised the visceral experience of working with viscera:

Without pity the flying knife passes  
Slicing the nerves and the veins,  
And trembling clots of  
Blood like molasses, dark, thick  
Detaches at intervals  
Giving the flies a grand celebration.

Yet it was precisely amid this gore that natural history's true power became evident.

A hand took out from the entrails

A thing of flesh

Which enclosed the great secret of life!<sup>65</sup>

Thus, moments of connection with life's great mysteries, and natural history's values, emerged from the violence required to turn a living animal, or, at this stage, a decomposing body, into a specimen.

Textbooks were another genre that spread the values and benefits of the natural sciences to the younger generation. In 1863, Adolfo Murillo (1840-1899) published *Apuntes para la introducción al estudio de la Historia Natural (Introductory Notes for the Study of Natural History)*, written as part of his medical studies at the Universidad de Chile. He wrote the text to 'initiate Chile's young lovers of study in the beauties that the natural sciences offer us, to awaken interest in their study'.<sup>66</sup> In this text, Murillo quoted Georges-Louis Leclerc, Comte de Buffon (1707-1788), who argued that natural history 'offers to the curiosity of the human spirit a vast spectacle, the whole of which is so great that the details appear inexhaustible'.<sup>67</sup> Using Chile's landscape, Murillo imagined the benefits of natural history for the reader.

Put an individual on a rock of our Andes range, or on a high hill, in order to contemplate this magnificent panorama, this enameled picture of green and beauties that extends in front of his view, and he will be seen to wander across a field of lovely potential, of sweet thoughts, of pleasing ideas, he will be seen devoting himself to abstract and poetic contemplations, the idea of paradise and the lost golden age will be brought to his

imagination ... he will be seen to be astonished to consider himself as a grain of sand, amongst the millions of worlds that form the entire universe.<sup>68</sup>

The examiner's report on this extensive piece of coursework, included in the publication, noted that it would be 'very useful for awakening interest in the study of Natural History [which is] so little known in Chile'.<sup>69</sup>

That examiner was Rodulfo Philippi (1808-1904), professor of botany at the university, as well as the national museum's director, and another textbook author. In the introduction to his *Elementos de Historia Natural (Elements of Natural History)*, Philippi noted that 'in 1864, it is superfluous to say something about the benefits and need to study Natural History', but went on to quote Georges Cuvier (1769-1832), from 1798, arguing that natural history could 'improve individual customs and happiness. Those who occupy themselves tranquilly in studying nature should have few temptations to engage in the stormy sea of ambition; they would only succumb with difficulty to brutal or cruel passions'.<sup>70</sup>

Despite Philippi's declaration about the social benefits of natural history, his textbook also stood at the heart of a controversy about Charles Darwin's theory of evolution by natural selection. In a manuscript of the textbook, Philippi had ignored the debate but, at the request of the liberal historian and educator Diego Barros Arana (1830-1907), with whom he was collaborating in introducing natural history study at secondary level, Philippi added a non-committal summary of the arguments. Moreover, as Bernardo Márquez Bretón notes, in the geology section, Philippi offered the suggestion that small changes over time created species. As a result, Protestant Philippi was condemned in the conservative, Catholic press, which accused him of promoting human descent from primates.<sup>71</sup> But there were other concerns, as well,

because, despite the staunch Catholicism of a prominent naturalist like university rector Domekyo, some feared that the natural sciences challenged a Catholic world view. In 1869, an article in the *Revista Católica* (*Catholic Magazine*, founded in 1843 by the Archbishopric of Santiago) argued that natural sciences had to be stopped; ‘putting a dam to a current like this [is vital because], with time [it] could be fatal to us’. Critics feared that ‘modern civilisation’, with its experimental study of the natural world, would split people from God, separate church and state and take science away from divine truth.<sup>72</sup> Even if the study of sciences did not threaten civilisation, there were heads of secondary schools, and parents, who still argued that natural sciences offered students no practical knowledge and had no application. Despite these concerns, and thanks in part to lobbying by Barros Arana, in 1867 the government declared study of natural and physical sciences a requirement for those seeking university admission.<sup>73</sup> This type of criticism of science may also help explain the emphasis on values which its practitioners and promoters made.

### Institutions and the Values of Natural History

As we have started to examine science education, let us turn to the institutions that fostered the natural sciences and contributed to educating students and the wider public. For its supporters, the *Museo Nacional*, run by Prussian exile Rodolfo Philippi from 1853 until 1897, represented the values, for society, of natural history.<sup>74</sup> In a speech celebrating Philippi’s ninetieth birthday, the dean of the Universidad de Chile’s Arts and Humanities faculty described the museum (see Figure 4) as Philippi’s ‘monument’, which was ‘more solid than bronze’. Within the museum walls ‘the valuable collections that he has brought together form other pages in a giant book that, through the figure of a mummy, a bird, a shrub, a stone, discover the

mysteries of life and confirm the truths of science'.<sup>75</sup> Thus, the museum, an 'ideal place' as Dorinda Outram argues about the Muséum d'Histoire Naturelle in Paris, offered a route to the big laws guiding nature which science sought to discover.



Figure 4

The Museo Nacional, c. 1890

Biblioteca Nacional de Chile, Sala Medina; A09-0086

From the collection of the Biblioteca Nacional de Chile, available on 'Memoria Chilena'  
<http://www.memoriachilena.cl/602/w3-article-67604.html>

This quest for the big answers, undertaken as work inside the museum, was often lonely and fraught, because each answer led to another question. One of the museum's employees was

Filiberto Germain (1827-1913), a French arrival who had worked at the Museo Nacional in the mid-nineteenth century, leaving after a spectacular falling-out with Philippi, but returning in old age to reconcile. He ended his career at the National Museum curating the entomology section.<sup>76</sup> In an 1894 letter to Philippi, discussing the difficulties he sometimes had understanding his observations, Germain turned to poetry.

In this immense labyrinth  
Where we only walk in hesitation,  
The light is too often extinguished  
And the thread breaks at every turn.  
Through a door that we open  
We see ten more than need opening  
And every rule we discover  
Unravels another to be discovered.

...

And, as on a rough sea  
Without steering, crippled  
By a stormy day  
A ship runs adrift  
So, on this uncharted ocean  
Where the spirit is carried away.

We have but Doubt as a compass,  
And as a port, Eternity.

Using dramatic imagery, this poem depicts Germain as helpless and humble when faced with the seemingly infinite questions of scientific work. Yet he is also a hero bravely facing these questions, as he drifts exposed to the wild elements of the sea, which nonetheless offer sublime exhilaration and potential for discovery. He then added, 'Isn't this true! Our work is never finished. You will have noticed the same with crabs'.<sup>77</sup> (Perhaps Philippi had a crab-related intellectual conundrum which he had discussed with Germain.) Sharing this burden with museum colleagues helped reaffirm the value in their work and created the ties of community which bound them together, reducing their isolation.<sup>78</sup>

I have yet to come across other poems written by naturalists working in Chile, but Philippi himself, in about 1880, wrote a lyrical explanation for why he did what he did. He began, 'There is nothing more sublime, more religious, than the study of nature. Through this work, one knows the master, and in the marvels of the world, the creator is revealed'. He went on to contrast the feeling of pride at having the 'reason and intelligence' to know so much, balanced by an awareness of one's 'smallness' when facing the world, which taught humility. He concluded, 'The study of nature, the contemplation of its many products will always be a never-ending source of purest enjoyment, that will never leave remorse, and will never awaken petty passions'.<sup>79</sup> This description of studying nature distancing one from petty concerns echoes Cuvier's argument, which Philippi himself quoted in his natural history textbook, discussed previously.

Claudio Gay, founder of the Museo Nacional, also emphasized scientific work as soul satisfying, in his personal letters to his friend and politician Manuel Montt (1809-1880). Settled in Paris, Gay was overseeing his monumental *Historia física y política de Chile*, which included volumes on natural history, history and politics. Yet, he was regularly frustrated by a long-running conflict with Chile's consul to France, Francisco Javier Rosales; Rosales looked down on Gay because of his 'simple taste', 'modest appearance', inability to tie 'a tie' and lack of interest in luxuries. In an 1845 letter, Gay grumbled 'I believe myself as happy, because the work of the spirit always gives more tranquility and more happiness to the heart and soul'.<sup>80</sup>

This depiction of scientific work as outside everyday pettiness and uplifting to the soul continued to influence how naturalists and their supporters depicted their work over the nineteenth century. In his 1897 speech as president of the *Sociedad Científica de Chile* (Chilean Scientific Society), textbook author Adolfo Murillo, now one of the country's leading doctors and a dean on the university's medical faculty, argued that science was 'disinterested', full of the 'innocent pleasure of novelties' and treated with 'platonic love' by its 'admirers'.<sup>81</sup> Murillo also described science as 'lifting hearts, [and] dignifying spirits'.<sup>82</sup>

The 'innocence' of the activity certainly does not stand up to scrutiny, not least for the ways in which science was linked to territorial expansion discussed above, nor does the rhetoric of 'disinterestedness' itself fully withstand scrutiny. While these men were doing what they loved, they also needed to earn a living. Chile offered scientifically-trained migrants opportunities to improve their financial status. Sol Serrano has shown how figures like Domeyko and Philippi arrived in Chile in relatively precarious financial circumstances, becoming financially stable through their intellectual work. Domeyko even earned enough money to donate part of his university salary to support two student grants (thus showing some

‘disinterested’ love of science).<sup>83</sup> Stefanie Gänger has examined the collecting and commercial activities of German-speaking settlers in the area around Valdivia and Lake Llanquihue; Hermann Krause, a teacher at a German school in Corral, for example, created botanical collections both to donate to the Museo Nacional and to sell, augmenting his meagre teacher’s salary.<sup>84</sup> While a certain amount of money was necessary, the naturalists also had ‘interests’ beyond money and love. One of the reasons that the (romantic-inspired) poet, Germain, lost his position at the Museo Nacional in his youth was that Philippi suspected he was using museum-sponsored trips to make collections for influential people. Four decades later, Philippi had to ask the British Museum to return Museo Nacional specimens which another employee had donated, in his own name.<sup>85</sup> For men seeking to develop their reputations and build networks, the museum offered tempting (petty?) opportunities.

The classrooms of the university and at the *Instituto Nacional* (National Institute, the most prestigious secondary school in Chile) also promoted science, and its values, to generations of students. Amongst these teachers was the volcano climber, Domeyko, who taught at the Instituto Nacional. In 1847, he told his physics students that the study of natural sciences ‘elevated [man’s] moral dignity’. For him the life of the ‘great wiseman’, Humboldt, offered evidence of the ‘happy intellectual influence that cultivating natural sciences exercises on man’. Humboldt’s evocation, in *Cosmos*, of the stars flying like ‘whirlwinds of dust’ and of worlds ‘sprout[ing]’ in space, showed that, despite being ‘an old man who has spent more than half a century on his studies, [he is] infinitely younger than we are, because true youth is enthusiasm, youth of feeling and of the imagination’.<sup>86</sup> Domeyko concluded his lecture telling his students that ‘cultivating science and the arts puts man in possession of a power and force infinitely superior to his natural force or power’.<sup>87</sup>

Another naturalist in the classroom was Rodolfo Philippi. In 1853, Philippi was appointed professor of botany at the university; botany then was part of medical studies, a new field in Chile. Medicine still had an uncertain social status in a society in which law had traditionally been the high-status occupation. Study of medicine required dealing with putrid bodies and body parts, in close rooms, which some students found distasteful. Yet as María Soledad Zárte argues, despite these questions about status, medical students still understood their studies as part of a scientific practice that, in its broader conception, was ‘a legitimate and exclusive’ male arena.<sup>88</sup>

In addition to teaching botany, Philippi also made a significant contribution to the study of the natural sciences at secondary schools through his writing and teaching. When Philippi’s colleague and future friend historian Diego Barros Arana was given the task of standardizing the secondary school curricula throughout the country, he included study of natural history as a subject. For Barros Arana, science offered new ways of understanding the human past and present.<sup>89</sup> Barros Arana also needed a natural history teacher at the all-male Instituto Nacional and, although Philippi was the best person for the job, Barros Arana worried that busy, 57-year old Philippi would think this poorly-paid work beneath him. He also doubted very much that a university professor would want to take on 14-16-year-old boys. Barros Arana asked Philippi in person; to his surprise, the professor said yes. To Philippi, it was a chance to spread his love of science: as a ‘disinterested’ naturalist, he did not even ask what he was to be paid. His first class took place on 2 April 1866.<sup>90</sup>

Philippi was a hit with his students, earning their respect (and attention) through his reputation as a scientist and his ‘gentle’ character.<sup>91</sup> For the classroom, he brought together a collection of various specimens and natural history wall charts (*láminas murales*) and, when

these proved inadequate or insufficient, he quickly sketched animals and plants, or their parts, for his students. Every few weeks the class would visit the Museo Nacional to use the collection there.<sup>92</sup> Not satisfied with classroom methods or museum visits, Philippi took these young men on fieldtrips, where he taught them to collect and classify botanical materials.<sup>93</sup> According to Barros Arana, the classes were a success. Many students created their own collections of insects or shells, and formed their own herbaria.<sup>94</sup>

Fostering interest in natural history was, in part, an investment in the discipline's future. Philippi's secretary in his last years, Bernardo Gotschlich, described Philippi as a very 'amiable' teacher, 'who earned respect through his affection [*cariño*]; he had the secret of the true pedagogue and thought that these boys, who he managed and educated now, would later be men, and some with a great deal of influence'.<sup>95</sup> Philippi was also a teacher who 'inspired' students in 'the love of study' and who was 'remembered with affection'.<sup>96</sup> Because of his knowledge, the 'amenable [atmosphere of his] classes' and his 'gentle character', Philippi had also 'awoken, as much as possible, in the youth of our schools the taste for this type of knowledge'.<sup>97</sup> Two of his former Instituto Nacional students remembered Philippi as 'the man, the teacher and the friend that communicated to them the love of science that was his soul'.<sup>98</sup> But there were other reasons that these young men wanted to study the sciences, too. In the second half of the nineteenth century, students associated study of the sciences with a challenge to conservative views, to the role of the Catholic Church and as a way marker of national progress.<sup>99</sup> Thus, study of the sciences was a means to assert a modern, progressive attitude.

### Natural History in a Life

Considering Philippi's longevity and influence, it is not surprising that colleagues, friends and former students depicted his life as a model of a scientific life. Speeches given at Philippi's ninetieth birthday party were published as a fat commemorative pamphlet. Former students, who 'felt vibrate in our heads the eagerness to study the great stage of nature',<sup>100</sup> had come together, in this celebration, to tell Rodolfo Philippi that his work had not been 'fruitless' and that he would not 'leave ingratitude behind his footsteps'.<sup>101</sup> Through his teaching, Philippi had inspired in Chilean young men the 'love for mother nature that contains so many enchantments, that hides so many mysteries and holds so many lessons'.<sup>102</sup> One of the speeches described Philippi facing the 'legions' of his former students. Thus, 'happier than the chosen patriarchs of the Old Testament, you have been allowed to perceive how your sons begin to be as numerous as the stars of the sky and how they begin to emit the luminous irradiations of thought'.<sup>103</sup>

In another speech from that evening, the dean of the Arts and Humanities Faculty commented that Philippi was 'unusual' in that not only was he able to accomplish his scientific goals but he was able to see that 'his work was fertile, that it leaves sons and students capable of continuing his labours, and that [he has], in reward for disinterested service, the gratitude of an entire people'.<sup>104</sup> Thus, Philippi's intellectual virility was affirmed in speeches which turned his former students into a pseudo-family, ensuring the continuation of this 'masculine scientific' culture.<sup>105</sup> We also see that the emphasis on disinterestedness continued to be integral to understandings of natural history.

In his posthumous 1904 biography of Philippi, Diego Barros Arana argued that, while Philippi's life was not filled with gossip, 'it can offer useful lessons that it is good to collect and preserve'. Barros Arana noted that, while this biography would not be of interest to all readers, what he sought to depict was 'this life of probity and work, [and] the fruits that it produced'.<sup>106</sup>

The idea of that an exemplary life had instructive potential, by offering models of morals and values, had already been promoted in Chilean schools, for decades, with the use of textbooks like José Bernardo Suárez's *Biografías de hombres notables (Biographies of Notable Men)* and François Mignet's *La vida de Franklin (The Life of [Benjamin] Franklin)*. Barros Arana depicted Philippi, a model naturalist, as 'a man noted for his honorability all his life, for a rare modesty, and for the most extraordinary generosity of character, that did not exclude in any way the integrity and independence with which he always guarded his dignity and convictions'.<sup>107</sup> Barros Arana also addressed, in his discussion of the battles about the teaching of natural and physical sciences at secondary level, what benefit this teaching had brought Chile. Like Philippi himself had argued in his 1864 textbook, Barros Arana agreed that it was no longer necessary to discuss how these subjects develop 'intelligence and the human spirit', because it was a commonplace. Nonetheless, he noted that Thomas Huxley did a good job of making that case in *On the Educational Value of the Natural History Sciences (1854)*.<sup>108</sup>

These public celebrations of a life raise the question of what disjuncture there may have been between public and private selves, or public and daily working selves. We must also beware of the way in which these narratives order a messy life, littered with decisions that were not always so purposeful. Stefanie Gänger points out that narratives about heroic German-speaking 'explorers', popular as a trope amongst German-speaking settler communities in Chile, may have helped these settler naturalists make sense out of life's happenstance.<sup>109</sup> Certainly, for Philippi, there was often sadness behind the traits, such as modesty and living a quiet life, that were publicly praised. Philippi was a political exile, who never returned to his home country. While he married for love, he and his wife, Line, mourned the deaths of most of their children: they had ten children, only four of whom reached adulthood and only two of whom survived

Philippi.<sup>110</sup> Line herself died in 1867. Shortly after Rodolfo Philippi arrived in Chile, his younger brother, who had settled in Chile before him, was murdered.<sup>111</sup>

Some of this perspective is evident in a letter Philippi wrote in his early years in Chile. Philippi, who had initially migrated alone, wrote to a dear friend that ‘I want to remain brave even when in silence some tears fall’.<sup>112</sup> In another letter to a friend, written shortly after his wife’s death, he described living with resignation and without expectations, as a ‘hermit’.<sup>113</sup> In the memoir written for his family, unpublished in his lifetime, Philippi noted that, even at 89, he was frequently moved to tears.<sup>114</sup> Thus, the public interpretation of Philippi’s character elided over other explanations for these traits, instead celebrating them as proof that he fit into the model of an ideal naturalist. Moreover, as much as descriptions focus on Philippi’s ‘gentle’ character, the archival record indicates someone who quarrelled with colleagues and underlings in defence of his museum, natural history and his family’s reputation.<sup>115</sup>

### Concluding Thoughts

Philippi’s death marked the end of an era of natural history exploration and the development of scientific institutions in Chile. Philippi was the last of the naturalists connected to those early years of the republic and an era of ‘heroic’ exploration. Moreover, by the early years of the twentieth century, an expansion of state bureaucracy brought scientists, and their knowledge, more firmly into the realm of the state, offering them new recognition as technocrats, rather than hero-explorers.<sup>116</sup>

Philippi’s life and work, held up as a model for naturalists and wider society, remains just one example of the varied ways in which scientific work was depicted, by practitioners and supporters, as good for individuals and society. This rhetoric and its associated values, as

imperfectly as they were practiced in day-to-day work, were even more important in the context of a diverse group, of Chileans and immigrants, of teachers and students, of paid and amateur naturalists. These values helped unite a community, in Chile, and may have helped both immigrants and Chileans share a sensibility with colleagues in other parts of the world. Depicting the sciences as beneficial to wider society was also useful in a context in which, despite the expansion of scientific education and institutions, voices both skeptical and openly hostile to scientific work raised objections. Thus, an argument about the moral benefits of natural sciences stood in contrast to fears that scientific ideas were unhitching human beings from their place in the natural world and divine order. But for proponents this work was good for bodies and society, as well as souls. Fieldwork offered naturalists healthy recreation that exercised intelligence and contributed to the collective building of knowledge for the disinterested benefit of science. Through natural history institutions, such as the museums in Santiago and Valparaíso, through classes at the university and secondary schools and through a range of publications and private moments, these values were further reinforced and circulated.

Thus, dissemination of the sciences was value-laden, training generations of young men that scientific work required and fostered simplicity, self-control and dedication. The fact that this discourse continued to flourish over a period of approximately 70 years suggests that, for all the success of these institutions and growth of educational opportunities, science may have remained on the defensive and had to continue to justify its place in Chilean society. It also suggests that this discourse about the moral benefits of scientific work was a way of arguing for science as 'useful'. These shared values allowed the community to assert their status, despite their activities and associations. Yet it is important not to overlook, or analyse away, the fact that these discourses also endured because those promoting them believed that scientific work

had enriched their lives and society more widely. For all these reasons, when we seek to understand the spread and reach of the sciences in Chile, the values tied up with the practices are one key to unlocking that history's secrets.

---

\* I would like to thank Ralph O'Connor and Emily Wakild, as well as Ben Marsden and the anonymous reviewers for their insightful comments on earlier versions of this article. I am also grateful to Jesse Barker, for his help with the analysis of De la Barra's poem, and Nadia Kiwan and Clémence O'Connor, who helped with the translation and analysis of Germain's poem. Drafts of this paper were presented at Queen's University Belfast, the Latin American Centre of Oxford University and the Institute of Historical Research, University of London. Those audiences have all shaped this article with their comments and questions. My thanks to them, as well. Finally, I am grateful to the Biblioteca Nacional de Chile and 'Memoria Chilena' for permission to reproduce the images that appear in this article.

<sup>1</sup> Federico T. Delfin, 'Algunas observaciones sobre la colecta, conservación i remisión de peces para los museos', *Revista chilena de historia natural* **IV**, 148-152 (1900), at p. 148.

<sup>2</sup> Robert E. Kohler, *All Creatures: Naturalists, Collectors, and Biodiversity, 1850-1950* (Princeton University Press, 2006), p. 90.

<sup>3</sup> Anne Secord, 'Botany on a Plate: Pleasure and the Power of Pictures in Promoting Early Nineteenth-Century Scientific Knowledge', *Isis* **92**, 28-57 (2002), at pp. 29-30. For further examples see James A. Secord, *Visions of Science: Books and Readers at the Dawn of the Victorian Age* (Oxford University Press, 2014), p. 246.

<sup>4</sup> Anne Secord, "'Be what you would seem to be": Samuel Smiles, Thomas Edward, and the Making of a Working-Class Scientific Hero', *Science in Context* **16**, 147-173 (2003), at p. 170. See also Diarmid A. Finnegan, *Natural History Societies and Civic Culture in Victorian Scotland* (Pickering & Chatto, London, 2009), pp. 1, 21.

<sup>5</sup> Alexander von Humboldt, *Cosmos: A Sketch of a Physical Description of the Universe*, vol. 1, tr. E.C. Otté (Bohn, London, 1849), p. 25. Although Humboldt never visited Chile, he was involved in networks of those who had and would. He visited Juan Ignacio Molina when in Bolonia, and he was a mentor to Rodolfo Philippi, while the young man lived in Berlin, bringing Philippi's *Enumeratio Molluscorum Sicilio* to the attention of Prussia's Frederick William III, who awarded it a medal. Fabián M. Jaksic, Pablo Camus and Sergio A. Castro, *Ecología y ciencias naturales: Historia del conocimiento del patrimonio biológico de Chile* (Dirección de Bibliotecas, Archivos y Museos, Santiago, 2012), pp. 49, 76; Patience A. Schell, *The Sociable Sciences: Darwin and his Contemporaries in Chile* (Palgrave Macmillan, New York, 2013), pp. 119-121. See also Diego Barros Arana, *El Doctor Don Rodolfo Amando Philippi: Su vida i sus obras* (Imprenta Cervantes, Santiago, 1904), pp. 30-33.

<sup>6</sup> Sol Serrano and Iván Jaksic, 'El poder de las palabras: La iglesia y el estado liberal ante la difusión de la escritura en el Chile siglo XIX', *Historia* **33** (2000), available via

[https://scielo.conicyt.cl/scielo.php?script=sci\\_arttext&pid=S0717-7194200003300010](https://scielo.conicyt.cl/scielo.php?script=sci_arttext&pid=S0717-7194200003300010). On Chilean liberalism see also Iván Jaksic and Sol Serrano, 'El gobierno y las libertades. La ruta del liberalism chileno en el siglo XIX', in *Liberalismo y poder: Latinoamérica en el siglo XIX* (ed. Iván Jaksic and Eduardo Posada Carbo), 177-206 (Fondo de Cultura Económica, Santiago, 2011). All translations by the author.

<sup>7</sup> Zenobio Saldivia Maldonado, *La vision de la naturaleza en tres científicos del siglo xix en Chile: Gay, Domeyko y Philippi* (Universidad de Santiago de Chile, 2003), pp. 80-84.

<sup>8</sup> Tarsicio Antezana and Nibaldo Bahamonde, 'History of Marine Science in Chile', in *Oceanographic History: The Pacific and Beyond* (ed. Keith R. Benson and Philip F. Rehbock), 155-166 (University of Washington Press, Seattle and London, 2002), at pp. 155-156. See also Rafael Sagredo Baeza and José Ignacio González Leiva, *La expedición Malaspina en la frontera austral del imperio español* (Editorial Universitaria, Santiago, 2004).

<sup>9</sup> See, for example, Rafael Sagredo Baeza, 'El Atlas de Claude Gay y la representación de Chile', *Cahiers de Amérique latines* **43**, 123-142 (2003), at p. 125. A notable exception is the Malaspina expedition (1789-1794). See Sagredo Baeza and González Leiva *op. cit.* (note 8).

<sup>10</sup> Jaksic, Camus and Castro, *op. cit.* (note 5), pp. 80-81. On book purchases, see Saldivia Maldonado, *op. cit.* (note 7), pp. 46-47.

- <sup>11</sup> See ‘Constitución de la República de Chile jurada y promulgada el 25 de mayo de 1833’, Article 5, available via ‘Memoria Chilena’, <http://www.memoriachilena.cl/602/w3-article-7947.html>.
- <sup>12</sup> Bernardo Márquez Bretón, *Orígenes del darwinismo en Chile* (Editorial Andrés Bello, Santiago, 1982), p. 30 and Sol Serrano, *Universidad y nación: Chile en el siglo xix* (Editorial Universitaria, Santiago, 1994), pp. 89-95. See also Serrano and Jaksic *op. cit.* (note 6); Sol Serrano, *¿Qué hacer con Dios en la República? Política y Secularización en Chile (1845-1885)* (Fondo de Cultura Económica, México, D.F. and Santiago, 2008) and ‘Memoria Chilena’ ‘Ley interpretativa de libertad de cultos (1865)’ <http://www.memoriachilena.cl/602/w3-article-94949.html> and ‘lucha religiosa’ <http://www.memoriachilena.cl/602/w3-article-96979.html>.
- <sup>13</sup> Luis Mizón, *Claudio Gay y la formación de la identidad cultural chilena* (Editorial Universitaria, Santiago, 2001), pp. 65-72.
- <sup>14</sup> Sagredo Baeza, *op. cit.* (note 9), at p. 132. See also Rafael Sagredo Baeza, ‘Geografía y nación. Claude Gay y la primera representación cartográfica de Chile’, *Estudios Geográficos*, **LXX**, 231-267 (2009), at pp. 243, 245.
- <sup>15</sup> Juan David Murillo Sandoval, ‘De lo natural y lo nacional. Representaciones de la naturaleza explotable en la Exposición Internacional de Chile de 1875’, *Historia*, **48**, 245-276 (2015).
- <sup>16</sup> Saldivia Maldonado, *op. cit.* (note 7), pp. 56-60, 139-144. I use the Chilean version of the first names of these immigrants, names under which they lived in Chile and which the historiography generally uses.
- <sup>17</sup> Saldivia Maldonado, *op. cit.* (note 7), pp. 124-133, 147, 160.
- <sup>18</sup> William Cronon, ‘The Trouble with Wilderness: Or, Getting Back to the Wrong Nature’, *Environmental History* **1**, 7-28 (1996), at p. 14.
- <sup>19</sup> Schell, *op. cit.* (note 5), p. 189. See also Mizón, *op. cit.* (note 13), p. 87.
- <sup>20</sup> Enrique Ibar Sierra, *Estudios sobre las aguas de Skyring i la parte austral de Patagonia por el comandante i oficiales de la corbeta <<Magallanes>>* (Imprenta Nacional, Santiago, 1879), p. 17.
- <sup>21</sup> Schell, *op. cit.* (note 5), p. 49. On Claudio Gay and his role in Chilean nation-building see Rafael Sagredo Baeza, ‘Del Chile imperial al Chile nacional. América meridional analizada por los naturalistas’, in *Ampliando miradas. Chile y su historia en tiempo global* (ed. Fernando Purcell and Alfredo Riquelme), 43-72 (RIL Editores e Instituto de Historia PUC, Santiago, 2009), pp. 55-72. On his expeditions and collections see Carlos Sanhueza, ‘El Gabinete de Historia Natural de Santiago de Chile (1823-1853) in *Museos al detalle: Colecciones, antigüedades e historia natural, 1790-1870* (ed. Miruna Achim and Irina Podgorny), 201-218 (Prohistoria Ediciones, Rosario, 2013), pp. 205-217.
- <sup>22</sup> Claudio Gay, ‘Viaje científico. Valparaíso febrero 23 de 1832’, *El Araucano*, 3 March 1832.
- <sup>23</sup> Elizabeth McKinsey, *Niagara Falls: Icon of the American Sublime* (Cambridge University Press, 1985), p. 31. On Darwin and the sublime in Chile see also Paul White, ‘Darwin, Concepción, and the Geological Sublime’, *Science in Context* **25**, 49-71 (2012).
- <sup>24</sup> McKinsey, *op. cit.* (note 23), pp. 116, 124.
- <sup>25</sup> Miguel Luis Amunátegui, *Ignacio Domeyko* (Ediciones de la Universidad de Chile, Santiago, 1952), p. 42; Saldivia Maldonado, *op. cit.* (note 7), pp. 97-99.
- <sup>26</sup> Michael Robinson, ‘Manliness and Exploration: The Discovery of the North Pole’, *Osiris* **30**, 89-109 (2015), at p. 92.
- <sup>27</sup> Kohler, *op. cit.* (note 2), p. 136.
- <sup>28</sup> Claudio Gay, ‘Viaje Científico; Prospecto’, *El Araucano*, **544**, 29 Jan. 1841.
- <sup>29</sup> Schell, *op. cit.* (note 5), pp. 192-193.
- <sup>30</sup> Mizón, *op. cit.* (note 13), p. 79. See also ‘Constitución de la República de Chile’, Article 1, *op. cit.* (note 11).
- <sup>31</sup> Amunátegui, *op. cit.* (note 25), p. 74. On British discourses of mountaineering and masculinity see Michael S. Reidy, ‘Mountaineering, Masculinity, and the Male Body in Mid-Victorian Britain’, *Osiris* **30**, 158-181 (2015). On Domeyko’s Andean geological study see Rafael Sagredo Baeza, ‘De <<sublime espectáculo>> a <<cordilleras paralelas>>. Darwin, Fitz Roy, Domeyko, Steffen y Holdich en Los Andes’, in <<Yammershuner>> *Darwin y la darwinización en Europa y América Latina*, (ed. Miguel Ángel Puig-Samper, Francisco Orrego, Rosaura Ruiz and J. Alfredo Uribe), 15-38 (Ediciones Doce Calles, Madrid, 2004), at pp. 32-35. For the report see Domeyko, ‘Duexième Partie – Volcàn d’Antuco’, *Annales des Mines* **XIV** (1848) available via [https://archive.org/stream/analesdesmines124minegoog/analesdesmines124minegoog\\_djvu.txt](https://archive.org/stream/analesdesmines124minegoog/analesdesmines124minegoog_djvu.txt)
- <sup>32</sup> Amunátegui, *op. cit.* (note 25), pp. 74-76. Besera was a ‘capitán de amigos’. On the role of the ‘amigos’, see Andrea Ruiz-Esquide Figueroa, *Los indios amigos en la frontera araucana* (Dirección de Bibliotecas, Archivos y Museos and Centro de Investigaciones Diego Barros Arana, Santiago, 1993).
- <sup>33</sup> Amunátegui, *op. cit.* (note 25), pp. 77-78.
- <sup>34</sup> Amunátegui, *op. cit.* (note 25), p. 79.
- <sup>35</sup> See also Bruce Hevly, ‘The Heroic Science of Glacier Motion’, *Osiris*, **11**, 66-86 (1996), at pp. 67-68.

- <sup>36</sup> Amunátegui, *op. cit.* (note 25), pp. 9-10. Quotations p. 10. On the conflict around Domeyko's appointment, see Schell, *op. cit.* (note 5), p. 171.
- <sup>37</sup> Rafael Sagredo Baeza, 'Ciencia, historia y arte como política. El estado y la *Historia física y política de Chile* de Claudio Gay', in *Ciencia-Mundo. Orden republicano, arte y nación en América* (ed. Rafael Sagredo Baeza), 165-233 (Santiago, Editorial Universitaria, 2010), at p. 194.
- <sup>38</sup> 'Constitución de la República de Chile', Article 10, *op. cit.* (note 11).
- <sup>39</sup> Catalina Valdés E., 'La medida de lo sublime. La Cordillera de los Andes vista desde Chile durante el siglo XIX', *Concinnitas* **2**, 139-168 (2012), at pp. 140-143, 146-49. Quotation p. 140.
- <sup>40</sup> Ignacio Domeyko, *Araucania i sus habitantes. Recuerdos de un viaje hecho en las provincias meridionales de Chile, en los meses de enero i febrero de 1845* (Imprenta Chilena, Santiago, 1846), 'advertencia preliminar'.
- <sup>41</sup> Domeyko, *op. cit.* (note 40), pp. 65-66.
- <sup>42</sup> Domeyko, *op. cit.* (note 40), pp. 65-66, 97-106. See also Joanna Crow, *The Mapuche in Modern Chile: A Cultural History* (University Press of Florida, Gainesville, 2013), p. 19, regarding Domeyko and chapter 1 on the conquest of this region.
- <sup>43</sup> On the War of the Pacific and natural history exploration see Rodulfo Philippi to Minister of Public Instruction, May 30, 1884 Archivo Histórico Nacional, Fondo Ministerio de Educación (hereafter AHN ME) 531-25; November 19, 1884 AHN ME 531-26 and Federico Philippi to Minister April 23, 1885 AHN ME 531-32. See also Patience A. Schell, 'Capturing Chile: Santiago's *Museo Nacional* during the Nineteenth Century', *Journal of Latin American Cultural Studies*, **10**, 45-65 (2001), at pp. 51-52.
- <sup>44</sup> Schell, *op. cit.* (note 43), at p. 52.
- <sup>45</sup> On women in U.S. biological field surveys see Kohler, *op. cit.* (note 2), pp. 168-170, 215-220. On Claudio Gay's scientific collaboration with his wife Hermance see Schell, *op. cit.* (note 5), pp. 55-57, 153. On women collectors in Chile see Schell, *op. cit.* (note 5), pp. 203-204. On Eloísa Díaz see 'Memoria Chilena' 'Eloísa Díaz' <http://www.memoriachilena.cl/602/w3-article-92520.html>.
- <sup>46</sup> Kohler, *op. cit.* (note 2), p. 68.
- <sup>47</sup> On Claudio Gay's depiction of these sites, see Sagredo Baeza, *op. cit.* (note 9), at p. 137.
- <sup>48</sup> Luz María Méndez Beltrán, 'Paisaje y costumbres recreativas en Chile. Valparaíso en el siglo XIX,' *Historia*, **22**, 151-188 (1987), at pp. 180-188. For quotation see Maria Graham, *Journal of a Residence in Chile during the Year 1822, and a Voyage from Chile to Brazil in 1823*, ed. Jennifer Hayward (University of Virginia Press, Charlottesville, 2003), p. 55. For further discussion of the development of leisure, holidays and beach-going in Chile see Álvaro Góngora, 'De jardín privado a balneario público. Veraneando en Viña del Mar', in *Historia de la vida privada en Chile. El Chile moderno de 1840 a 1925*, tomo 2 (ed. Rafael Sagredo Baeza and Cristián Gazmuri), 303-331 (Penguin Random House Grupo Editorial, Barcelona, 2006).
- <sup>49</sup> Carlos E. Porter, 'Instrucciones para la colecta i preparacion de objetos de historia natural', *Revista Chilena de Historia Natural* **IV**, 31-32 (1900), at p. 31.
- <sup>50</sup> Porter, *op. cit.* (note 49), at p. 31. Porter's *Breves instrucciones para la recolección, conservación y envío de ejemplares de Historia Natural para los museos* went to three editions. The third was published in Santiago, by the Imprenta Cervantes, in 1918.
- <sup>51</sup> Porter, *op. cit.* (note 49), at p. 32. *Instrucciones para coleccionar* was written by Federico Puga Borne, who had been an assistant at Santiago's Museo Nacional and went on to become a politician, minister of justice and public instruction, vice-president of the senate and an important figure in public health. To date, I have not been able to find a copy of this pamphlet in repositories in Chile, the UK and the US, or in any bookstore.
- <sup>52</sup> Carlos Porter, *Breves instrucciones para la recolección, conservación y envío de ejemplares de Historia Natural para los museos*, 3<sup>rd</sup> ed (Imprenta Cervantes, Santiago, 1918), p. 10.
- <sup>53</sup> Porter, *op. cit.* (note 49), at p. 32. On Porter and the *Revista chilena* see Zenobio Saldívia Maldonado, *La ciencia en el Chile decimonónico* (Universidad Tecnológica Metropolitana, Santiago, 2005), pp. 115-116, 171-173.
- <sup>54</sup> See Carlos E. Porter, 'Las especies chilenas del viaje del buque de S.M.B. 'Challenger' extractadas i adicionadas con varias notas', *Revista Chilena de Historia Natural* **VII**, 193-194 (1903); R.E. Latcham, 'Notes on Some Ancient Chilean Skulls and Other Remains', *Revista Chilena de Historia Natural* **VII**, 203-217 (1903).
- <sup>55</sup> William Bartlett-Calvert, 'Como i donde su buscan mariposas', *Revista Chilena de Historia Natural* **IV**, 32-39 (1900), at p. 32. Italics in original.
- <sup>56</sup> Kohler, *op. cit.* (note 2), at p. 70.
- <sup>57</sup> Bartlett-Calvert, *op. cit.* (note 55), at p. 33.
- <sup>58</sup> Delfín, *op. cit.* (note 1), at p. 148. On the difficulties that fish presented see Anne Laurine Larsen, 'Equipment for the Field', in *Cultures of Natural History* (ed. N. Jardine, J.A. Secord and E.C. Spary), 358-377 (Cambridge University Press, 1996), at p. 370.

- <sup>59</sup> On Delfín see Antezana and Bahamonde, *op. cit.* (note 8), at p. 158 and Jorge Muñoz Sougarret and Francisco Ther Ríos, ‘El pescador en el imaginario científico durante la etapa de formación de la academia ictiológica chilena, 1829-1909’, *História, Ciências, Saúde – Manguinhos* **20**, 1621-1633 (2013), at pp. 1626-1627.
- <sup>60</sup> Delfín, *op. cit.* (note 1), at p. 148.
- <sup>61</sup> Anne Laurine Larsen, ‘Not Since Noah: The English Scientific Zoologists and the Craft of Collecting, 1800-1840’, PhD thesis, Princeton University (1993), pp. 54-57.
- <sup>62</sup> Delfín to Rodulfo A. Philippi, November 10, 1893, Dirección Museológica de la Universidad Austral de Chile (Valdivia, Chile), Colección Documentos Históricos (hereafter DMUACH) 3473-32.
- <sup>63</sup> Muñoz Sougarret and Francisco Ther Ríos, *op. cit.* (note 59), at p. 1627.
- <sup>64</sup> Muñoz Sougarret and Francisco Ther Ríos, *op. cit.* (note 59), at p. 1628.
- <sup>65</sup> Eduardo de la Barra, ‘El el Taller del Museo’, 1890, Biblioteca Nacional de Chile (Available electronically via the library catalogue). The manuscript includes penciled in changes to the original handwritten poem. These quotations are from the original draft.
- <sup>66</sup> Adolfo Murillo, ‘Dos palabras’ in Adolfo Murillo, *Apuntes para la introducción al estudio de la Historia Natural* (Imprenta Nacional, Santiago, 1863), n.p.
- <sup>67</sup> Buffon quoted in Murillo, *op. cit.* (note 66), p. 16.
- <sup>68</sup> Murillo, *op. cit.* (note 66), p. 17.
- <sup>69</sup> Rodulfo Philippi, ‘Informe pasado a la Universidad’, in Murillo, *op. cit.* (note 66), n.p.
- <sup>70</sup> Rodulfo Philippi, *Elementos de Historia Natural*, 3<sup>rd</sup> ed (Librería Colon de Salas y Pesse, Santiago, 1877), p. vi.
- <sup>71</sup> Márquez Bretón, *op. cit.* (note 12), pp. 20-28.
- <sup>72</sup> Márquez Bretón, *op. cit.* (note 12), pp. 71-72. Quotation p. 71. On the *Revista Católica* see Serrano and Jaksić, *op. cit.* (note 6) and Carolina Cherniavsky Bozzolo, *La Religión en Letra de Molde: Iglesia y practicas de lectura en la Arquidiócesis de Santiago 1843-1899* (Ediciones Universidad Católica de Chile, Santiago, 2015), pp. 62-64. On the reception of Darwin’s work in Chile see also Guillermo Latorre C. and Zenobio Saldivia M., *Chile y Darwin: La respuesta al evolucionismo desde 1869* (Ril Editores, Santiago, 2014).
- <sup>73</sup> Barros Arana, *op. cit.* (note 5), pp. 149-155; Márquez Bretón, *op. cit.* (note 12), pp. 31-32. On other conflicts prompted by textbooks see Allen Woll, *A Functional Past: The Uses of History in Nineteenth-Century Chile* (Louisiana State University Press, Baton Rouge, 1982), chapter 8.
- <sup>74</sup> On the museum’s collecting under Philippi see Carlos Sanhueza, ‘El Museo Nacional de Chile: Un espacio local desde una red transnacional (1853-1897)’, in *El carrusel atlántico: Memorias y sensibilidad, 1500-1900* (ed. Oscar Álvarez Gila, Alberto Angulo Morales and Alejandro Cardozo Uzcátegui), 189-217 (Editorial Nuevos Aires-Universidad del País Vasco, Caracas and Vitoria Gasteiz, 2014).
- <sup>75</sup> Domingo Amunátegui Solar in *Homenaje al Señor Doctor Rodulfo Amando Philippi en su cumpleaños, 1808-1898* (Imprenta, Litografía i Encuadernacion Barcelona, Santiago, 1898), p. 19.
- <sup>76</sup> Jaksić, Camus and Castro, *op. cit.* (note 5), pp. 92-95; Schell, *op. cit.* (note 5), pp. 133-137, 210-211.
- <sup>77</sup> Germain to Philippi, 15 Feb. 1894, DMUACH 3477-16.
- <sup>78</sup> On the sociable elements of natural history work see Schell, *op. cit.* (note 5), and Erika Lorraine Milam and Robert A. Nye, ‘An Introduction to Scientific Masculinities’, *Osiris*, **30**, 1-14 (2015), at p. 10.
- <sup>79</sup> Rodulph Amandus Philippi, *El orden prodigioso del mundo natural* (Pehuén Editores, Santiago, 2003), p. 94.
- <sup>80</sup> See Schell, *op. cit.* (note 5), pp. 104-107 for more discussion of this conflict. Quotations pp. 104-105.
- <sup>81</sup> Adolfo Murillo, *Discurso del Dr A. Murillo al tomar posesión de la presidencia de la Sociedad Científica de Chile* (Imprenta de Emilio Pérez L., Santiago, 1897), pp. 7, 9.
- <sup>82</sup> Murillo, *op. cit.* (note 81), p. 10.
- <sup>83</sup> Serrano, *Universidad y nación*, *op. cit.* (note 12), p. 141. On these students, see also Schell, *op. cit.* (note 5), pp. 101-107.
- <sup>84</sup> Stefanie Gänger, ‘Colecciones y estudios de historia natural en las colonias alemanas de Llanquihue y Valdivia, c. 1853-1910’, *Historia* **396** **1**, 77-102 (2011), at pp. 89-90.
- <sup>85</sup> Schell, *op. cit.* (note 5), pp. 133, 219.
- <sup>86</sup> Ignacio Domeyko, *Introducción al estudio de las ciencias naturales. Discurso pronunciado en la apertura de la clase de física en el Museo Nacional* (Santiago, Imprenta Nacional, 1847), pp. 11, 15.
- <sup>87</sup> Domeyko, *op. cit.* (note 86), p. 22. On this lecture see also Saldivia Maldonado, *op. cit.* (note 7), pp. 47-48.
- <sup>88</sup> Serrano, *op. cit.* (note 12), pp. 184-186 and María Soledad Zárate, ‘Notas preliminares sobre profesión médica y masculinidad, Chile, siglo xix’, in *Hombres: Identidad/es y violencia* (ed. José Olavarría A.), 73-90 (FLACSO-Chile, Santiago, 2001), at p. 82.
- <sup>89</sup> Márquez Bretón, *op. cit.* (note 12), pp. 34-35.

- 
- <sup>90</sup> Barros Arana, *op. cit.* (note 5), pp. 140-42. On the importance and tensions of generating interest in science for its survival and propagation see Anne Secord, *op. cit.* (note 3), at p. 35.
- <sup>91</sup> Barros Arana, *op. cit.* (note 5), p. 158.
- <sup>92</sup> Barros Arana, *op. cit.* (note 5), pp. 141, 159-160. In the UK, illustrations had been used in teaching since the early nineteenth century, as a way to attract students and respond to the difficulty of teaching a subject which required so much detailed knowledge and technical terminology. See Anne Secord, *op. cit.* (note 3), at pp. 40-48.
- <sup>93</sup> Barros Arana, *op. cit.* (note 5), pp. 105-106. On the boom of botany field classes in Britain see David Elliston Allen, *The Naturalist in Britain* (Penguin Books, Harmondsworth, 1976), pp. 107-08.
- <sup>94</sup> Barros Arana, *op. cit.* (note 5), p. 160.
- <sup>95</sup> Bernardo Gotschlich, *Biografía del Dr. Rodulfo Amando Philippi* (Imprenta Central, Santiago 1904), p. 46.
- <sup>96</sup> Gotschlich, *op. cit.* (note 95), p. 47.
- <sup>97</sup> Barros Arana, *op. cit.* (note 5), p. 4.
- <sup>98</sup> Fernando Santa María and Benjamín Dávila L., ‘Rodulfo Amando Philippi’, *El Santa Lucia*, 17 Aug. 1874, quoted in Gotschlich, *op. cit.* (note 95), p. 47.
- <sup>99</sup> Muñoz Sougarret and Ther Ríos, *op. cit.* (note 59), at p. 1625.
- <sup>100</sup> Adolfo Murillo in *Homenaje al Señor Doctor Rodulfo Amando Philippi en su cumpleaños, 1808-1898* (Imprenta, Litografía i Encuadernación Barcelona, Santiago, 1898), p. 5.
- <sup>101</sup> Murillo in *op. cit.* (note 100), p. 6.
- <sup>102</sup> Murillo in *op. cit.* (note 100), p. 8. It is possible that Philippi taught Eloísa Díaz, as she enrolled at the Universidad de Chile in his last years as the professor of botany, but if he did, his teaching of the first female medical student was not remarked upon during the formal parts of this birthday event.
- <sup>103</sup> Murillo in *op. cit.* (note 81), p. 10.
- <sup>104</sup> Domingo Amunátegui Solar in *op. cit.* (note 75), p. 19.
- <sup>105</sup> Milam and Nye, *op. cit.* (note 78), at p. 11.
- <sup>106</sup> Barros Arana, *op. cit.* (note 5), p. 5.
- <sup>107</sup> Barros Arana, *op. cit.* (note 5), p. 4. On school textbooks see Sol Serrano, Macarena Ponce de León and Francisca Rengifo with Rodrigo Mayorga and Josefina Silva, *Historia de la educación en Chile (1810-2010)*, tomo 1 (Aguilar Chilena de Ediciones, Santiago, 2012), pp. 312-313.
- <sup>108</sup> Barros Arana, *op. cit.* (note 5), p. 155.
- <sup>109</sup> Gänger, *op. cit.* (note 84), at p. 97.
- <sup>110</sup> Rodulfo A. Philippi, ‘Mein Leben’, unpublished manuscript, Archivo Histórico Emilio Held Winkler, Liga Chileno-Alemana (hereafter AHEHW), p. 194.
- <sup>111</sup> Schell, *op. cit.* (note 5), p. 123.
- <sup>112</sup> Philippi, *op. cit.* (note 79), p. 104.
- <sup>113</sup> Philippi to Guillermo Frick, July 26, 1867, AHEHW Fondo Philippi, 7o.
- <sup>114</sup> Philippi, *op. cit.* (note 110), p. 126.
- <sup>115</sup> Schell, *op. cit.* (note 5), pp. 133-137, 209, 217-219. See Secord, *op. cit.* (note 4), at pp. 158-170 for the challenges of fitting a complex individual into the mould of model behaviour.
- <sup>116</sup> Muñoz Sougarret and Ther Ríos, *op. cit.* (note 59), at p. 1627.