

REVISITING J.M. GILLISS' ASTRONOMICAL EXPEDITION TO CHILE IN 1849–1852

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Abstract: Between 1849 and 1852 the U.S. astronomer J.M. Gilliss led an expedition to Santiago, Chile, aimed at improving the accepted value for the solar parallax. Although this particular research project was not a success, the astronomers did make other useful astronomical contributions, and the expedition was the catalyst that led directly to the founding of the Chilean National Observatory. Meanwhile, Gilliss later went on to achieve further prominence as Superintendent of the U.S. Naval Observatory in Washington, D.C.

The results of the Chilean expedition were published by Gilliss in a six-volume work titled *The U.S. Naval Astronomical Expedition to the Southern Hemisphere during the Years 1849-50-51-52* that was issued over a 40-year period. In Volume I (published in 1855) Gilliss presented a 'warts-and-all' account of Chile, its politics and its people, which at the time—and subsequently—created considerable controversy. In this paper, after briefly reviewing Gilliss' Southern Hemisphere expedition we focus on the extensive non-astronomical narrative that Gilliss presents in this first volume.

Keywords: J.M. Gilliss, U.S. expedition, Chile, Astronomical Unit, non-astronomical narrative, controversy

1 INTRODUCTION

In 1848, in order to improve the measurement of the distance between the Earth and the Sun (the Astronomical Unit), Lieutenant James Melville Gilliss (Figure 1; Gould, 1866), a U.S. Navy astronomer, proposed to the United States Congress a scientific mission to Chile. The object of the mission was to complete measurements for the solar parallax at the same time these were carried out in the northern hemisphere (Huffman, 1991; Schrimpf, 2014). Chile was chosen for its location, near coinciding in degrees of latitude and longitude with Washington D.C., the location of the U.S. Naval Observatory. At first, Gilliss thought the island of Chiloé (just off the coast of southern Chile) would be the most appropriate place because it corresponded more closely in latitude to Washington, but the inclement climate there led him to select the city of Santiago, where he chose Cerro Santa Lucía as the site for his observatory (Gould, 1866).

Since others have already discussed Gilliss' scientific achievements while in Chile (e.g. see Dick, 2003; Huffman, 1991; Schrimpf, 2014), in this paper we will focus on the extensive non-astronomical narrative that Gilliss presents in the first volume of *The U.S. Naval Astronomical Expedition to the Southern Hemisphere during the Years 1849-50-51-52*. But first, let us learn about Gilliss, the expedition and his six-volume treatise.

1.1 James Melville Gilliss: A Biographical Sketch

James Melville Gilliss was born on 6 September 1811 in Washington D.C. His father was George Gilliss, of Scottish descent, who worked as a Government clerk in the city. When he was fifteen years old, the younger Gilliss joined the

United States Navy, graduating with honors three years later, as a Passed Midshipman on his way to becoming a Lieutenant after three more years service. At this stage he became interested in scientific studies. In a letter that he wrote to the German mathematician Christian Ludwig Gerling (1788–1864; Figure 2), Gilliss explained that



Figure 1: James Melville Gilliss, 1811–1865 (www.usno.navy.mil/usno.library).

Very shortly after I came to Washington for duty as a Passed Midshipman, members of Congress were told in my presence, 'There is not an officer of the navy capable to conduct a scientific enterprise.' The charge was intended prejudicially to the service to which I belonged, and was the more humiliating because the speakers were unknown, and defense was not possible. But from that hour no effort has been spared by which the standard of intelligence in the service might be increased and its service enhanced. (Gould, 1866: 138–139).

From that moment on Gilliss felt duty-bound to pursue a scientific education, and he attended the University of Virginia before health problems interrupted his studies. He took up his studies again during six months in Paris, between 1835 and 1836 (Dick, 2003).

Upon returning from Europe, Gilliss was sent to Washington as Assistant to Lieutenant Edward Hitchcock who was in charge of the Naval Depot of Charts and Instruments (see Leslie, 1866). Shortly thereafter, Gilliss was placed in charge of a small observatory supplied with a transit instrument with which he carried out his first astronomical observations. In 1838 Gilliss assumed new duties on a mission of longer duration. He was to carry out complimentary astronomical observations to the many others performed by the U.S. naval officer and explorer Captain Charles Wilkes (1798–1877) during his expedition to the

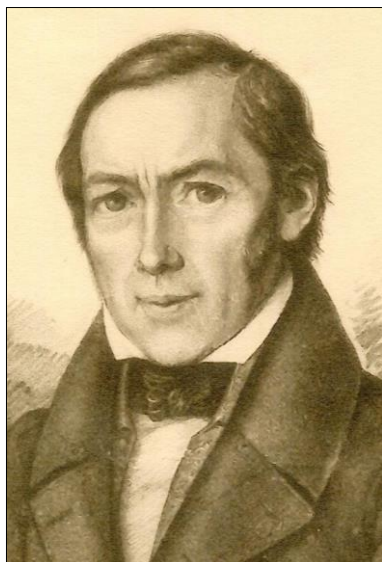


Figure 2: Christian Ludwig Gerling (en.wikipedia.org).

Southern Seas from 1838 to 1842. It was fundamental to his new duties that Gilliss did not leave the Naval Depot observatory for the duration of Wilkes' expedition, and the observations that he carried out at this time marked the beginning of his career as an astronomer (Dick, 2003).

Moreover, his work, continuously and systematically carried out and developed with unflagging energy, laid the groundwork for the founding of the United States Naval Observatory. As Gould (1866: 155) notes, at the time Gilliss "... was the sole working astronomer in the nation". Yet political intrigue prevented his anticipated appointment as the inaugural Superintendent (see Gould, 1866: 155–156 for details), and it was only in 1861 that he was appointed its Superintendent, a post he retained until his death (Dick, 2003). James Melville Gillis died prematurely from a stroke on 9 February 1865, at the age of 53 (ibid.). At the time he arguably was America's foremost

astronomer. He was the first to have carried out *systematic* observations in an astronomical observatory, the first to have worked full-time and for four years in that position, the first, also, to publish a monograph containing his astronomical observations (Gilliss, 1846), and the first to prepare a catalog of stars and to plan and build a national astronomical observatory destined for professional use and not simply for instruction (ibid.). He died after an impressive astronomical career in both Chile and the United States.

1.2 Gilliss' United States Astronomical Expedition to the Southern Hemisphere

Gilliss (1856: iii) describes the origin of his expedition to Chile:

During the summer of 1847 I received a letter from Dr. C.L. Gerling, a distinguished mathematician of the Marburg University in which he says: 'Since the date of my last I have been busy with the volume of astronomical observations, which you have kindly sent me, and it has occurred to me that it might be acceptable to you to receive by letter, in advance of its publication, the content of a brief treatise I shall transmit to M. Schumacher in a few days for its publication in the *Astronomische Nachrichten*'.

The volume to which Dr Gerling referred was the book Gilliss sent him with observations made in Washington between 1838 and 1842. On the other hand, the brief treatise mentioned by Dr Gerling was a manuscript he was about to publish in *Astronomische Nachrichten* about a new method of determining the solar parallax (Gerling, 1847).

As Keenan et al. (1985: 100; my italics) point out, Gerling's proposal was to perfect the established method of parallax, considering that

... in addition to the observations of Mars near opposition, similar observations of Venus, near its stationary phase, would better provide the best determinations of the solar parallax. In order to measure the distance to the planet *simultaneous observations from two points on the earth separated as widely as possible in longitude would be needed*. Gerling suggested that the observations be made for Venus at its stationary points, in September, 1847, and April and May, 1849, and of Mars at its opposition, in 1849.

Clearly, this new requirement made it necessary that the observations conducted in the Northern Hemisphere be matched by equivalent measurements in the Southern Hemisphere. Therefore, Professor Gerling continued in the same letter:

... it is much to be desired that the few delicate meridian instruments in the southern hemisphere should be brought to cooperate with us [Gerling and Gilliss]; and this, perhaps, it is in your power, to facilitate. (Gould, 1866: 159).

In his account, Gilliss tells of his reply to Gerling:

But to prove my interest in the prosecution of the problem to its new solution, I then proposed an expedition to Chile, to observe the planet [Venus] near its stationary terms and opposition, in 1849, should my views receive encouragement from astronomers to justify such an undertaking. (ibid.).

At the beginning of 1848 the proposal that Gilliss had presented to the American scientific community was supported by the American Philosophical Society and the American Academy of Arts and Sciences, and a budget of up to \$5,000 was approved by the Senate of the United States (Rasmussen, 1954).

Paying tribute to the genre of travel writing, customary even in the middle of the nineteenth century (e.g. see Seed, 2004), Gilliss enjoyed describing with a wealth of detail the long journey that brought him from the Hudson River to the slopes of the Andes, via Panama. He dedicated the first six chapters of the second part of his book to this kind of writing, giving it the character of a logbook or diary. Thanks to these notes we know that at 3 pm on 16 August 1849 Gilliss left New York on board the *S.S. Empire City*, to arrive at the capital of Panama fourteen days later, where after moving around the city by various means of transport he was able to find "... one of

the very best beds of Panama—a cot, with one small pillow and two thin sheets." (Gilliss, 1855: 411). From there he left for Callao on 27 September, this time on the *S.S. Nueva Granada*, arriving finally on 9 October at 8 am. He remained in Peru until midday of the 14th of that month, when he set sail, on the same ship that had brought him thus far, for the port of Valparaíso. The ship sailed into Valparaíso on 25 October, "... toward 5 o'clock just seventy days having elapsed since leaving New York..." writes Gilliss in his notes. And then "... in less than four hours since the *Nueva Granada* anchored, I was seated in a *birlocho*, on the summit of the hills at the back of Valparaíso, on my way to the capital." (Gilliss, 1855: 450).

Gilliss arrived in Santiago on 26 October. There he finally saw Cerro Santa Lucía, that "... little rocky hill in the eastern portion of the city which had been indicated by the ambassador at Washington as suitable for our purposes." (Gilliss, 1855: 453–454). Nevertheless, Cerro Santa Lucía (Figure 3) was chosen only after taking into account several of its shortcomings: its proximity to the Andes, its difficult and steep access, and the need to level the ground close to the summit where the observatory would be sited. After viewing several alternatives, such as Cerro



Figure 3: A chromolithograph of Santa Lucía drawn in about 1850 by staff of the U.S. Naval Astronomical Expedition; lithography by Thomas S. Sinclair (after Gilliss, 1855: Plate 1).

Blanco, or even locating the observatory outside the capital, the conclusion was reached that Cerro Santa Lucía was the most appropriate site, in spite of the cost involved in leveling a part of its summit. All this was necessary because of this unprecedented event: to install a sophisticated collection of astronomical instruments on the hilltop in order to scrutinize for the first time and in a systematic manner, those southern skies that were not visible from the United States of America.

Thanks to the joint effort made by local authorities and members of the expedition

... on the morning of the 9th of November our caravan delivered its assorted cargo at the foot of the Santa Lucía, almost uninjured by rough handling and the last eighty miles' journey. (Gilliss, 1855: 454).

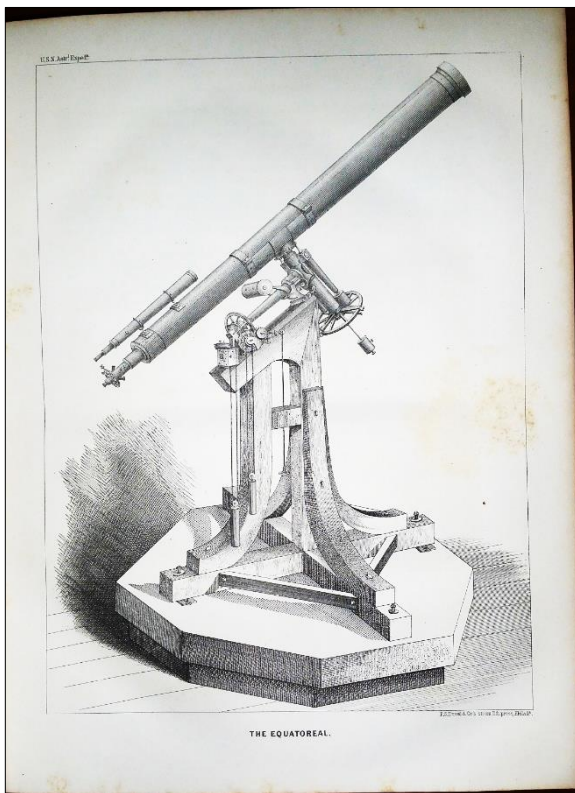


Figure 4: The 6.5-in refractor (after Gilliss, 1856).

Then on 6 December 1849 Gilliss wrote with pride: “I had the satisfaction to obtain a first look through the telescope erected on its pier.” (Gilliss, 1855: 455). By the last days of January 1850, the set of installations consisting of two observatories¹ and buildings for lodgings became available for the astronomers' use. The telescope referred to above and in Note 1 was a 6.5-in (16.5-cm) refractor shown in Figure 4.

In December and January Gilliss and his staff began a series of observations of Mars using the equatorial telescope. From October 1850 to February 1851 they carried out observations of Venus, followed by a second series of Mars observations from December to March 1852. And finally

another series on Venus was undertaken from late May to September 1852, when the observatory was turned over to Chile. The Government of Chile also appointed three Chileans—a Professor of Mathematics and two of his best students, to learn astronomy and how to use the instruments. In addition to those observations undertaken for the original purpose of the expedition—a better determination of the Earth-Sun distance—Gilliss and his staff made thousands of observations of star positions over the four years they were based in Chile.

Gilliss' feelings of pride about these achievements are evident. Neither is it difficult to imagine the stir provoked by these installations among the inhabitants of the capital of Chile. Suffice it to say that the curiosity and wonder caused by the scientific instruments produced a permanent line of local people, old and young, climbing to the top of the hill. Gilliss' words about this situation are illuminating:

As one of the fruits of our expedition here, I hoped to make it burn brightly, and that we might boast that Santiago through our influence established the first national observatory of South America. (Gilliss, 1855: 455).

The results of the expedition are quite remarkable. It is true the scientific results were a partial failure, for the distance from the Earth to the Sun was not improved on,² but this failure was partially offset by the catalogue of southern stars. But of greater importance surely was the fact that Gilliss did indeed, which still thrives today. He also left the earliest description of the culture, geography, meteorology and magnetic observations of Chile.

1.3 Contents of the Six Volume Work

Gilliss' 6-volume work, *The U.S. Naval Astronomical Expedition to the Southern Hemisphere during the Years 1849-50-51-52*, is known to only a few scholars and bibliophiles who specialize in Chilean or astronomical history. Yet apart from its astronomical content it contains his ambitious goal to describe and summarize the vast physical, social, cultural, political and economic reality of Chile in the middle of the nineteenth century.

The first volume (Gilliss, 1855; Figure 5) is titled simply, *Chile*. It is organized into two sections and includes three appendices. The first section, *Descriptive*, is made up of fifteen chapters and its objective is to present Chile as a nation, making the country known in its entirety with one general and unique image. The second section, *Narrative*, is composed of twelve chapters and speaks of the various trips of members of the expedition. Gilliss himself travelled alone via Panama, which allowed him to visit Peru before finally reaching port in Valparaíso. His three assistants, Midshipmen Archibald MacRae, Henry C. Hunter, and the

young student, Edmond Reuel Smith, travelled via Cape Horn, bringing a large part of the scientific instruments to be set up in Santiago.

Volume II, in contrast to Volume I, has a marked scientific nature; its second half describes minerals, animals and collections of fossils. Furthermore, it contains the narrative of the travels of Midshipman Archibald MacRae in Argentina, where he describes his impressions of the roads and cities visited on his trip back to the United States.

Volume III (Gilliss, 1856; Figure 6) is dated 1856 but in fact was not issued until 1858, because of the lengthy calculations required to derive the solar parallax (Huffman, 1991: 213). This volume is devoted entirely to an account of the main objective of the mission. Here astronomical observations to determine solar parallax (and hence the Astronomical Unit) are presented and analyzed; their final scope was to improve the measurement of the distance between the Earth and the Sun and therefore, to improve estimates of the scale of the Solar System. Volume III also offers a detailed explanation of how the expedition came into being, setting out its most important activities. Much of this Volume was written by the U.S. astronomer Benjamin Apthorp Gould (1824–1896; Figure 7; Comstock, 1922), who not only got to know Gilliss well and therefore was ideally placed to write his *Biographical Memoir* (Gould, 1866), but in 1871 was himself appointed founding Director of the National Observatory in neighboring Argentina.

Funding then dried up for a time and the star catalogs, in Volumes IV and V, were not published until much later (in 1871 and 1895, respectively). Part of the reason for the untimely delay in the case of Volume V lay in staffing shortages at the U.S. Naval Observatory and the detailed analysis required to determine star positions.

Finally, Volume VI details the magnetic and meteorological observations carried out in the Cordillera de los Andes, during the return trip of Midshipman Macrae.

In the remainder of this paper we are only concerned with Volume I, and the non-astronomical narrative that Gilliss presents there. But first let us 'set the scene', as it were, by briefly reviewing mid-nineteenth century Chile.

2 REPUBLICAN CHILE

Indisputably, one of the values of *The U.S. Naval Astronomical Expedition* lies in the special moment in the history of its writing: the decade between 1850 and 1860 when Chile was a young republic and many of its main cultural and scientific institutions were at the beginning of their development (see Hidalgo, 2010).

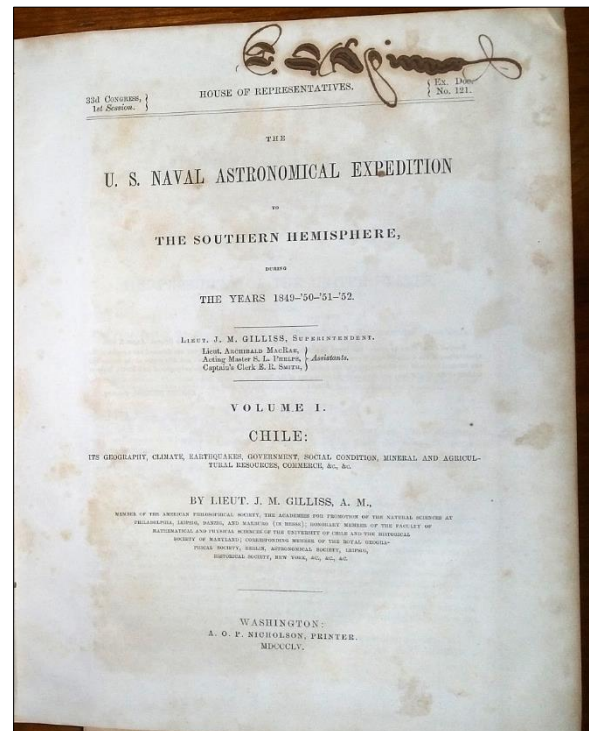


Figure 5: The Title Page of Volume I (Gilliss, 1855).

Preceded by a period of political and economic consolidation, the end of the 1840s and the beginning of the 1850s were marked by attempts to give cultural identity to the new nation. In this context, the arrival of the United States astronomical expedition became precisely a protagonist of these deeds, confirming the climate of the moment.

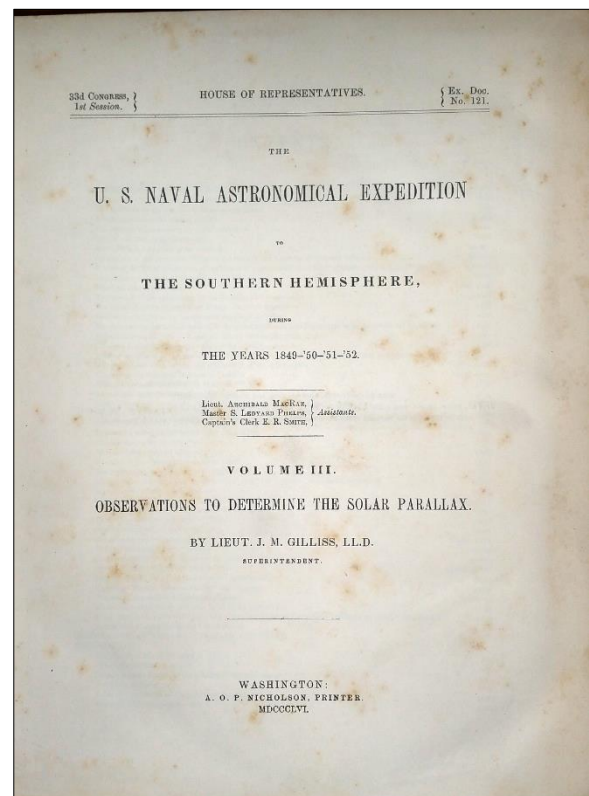


Figure 6: The Title Page of Volume III (Gilliss, 1856).

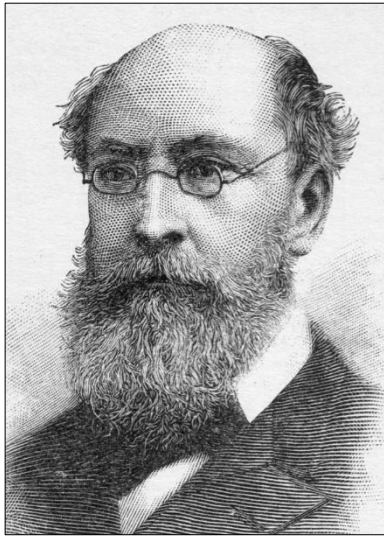


Figure 7: B.A. Gould (after *Harper's Encyclopædia of United States History* ..., 1905: 99).

With the arrival of the expedition, toward the end of 1849, the University of Chile had only been extant for seven years, and for six years had been functioning in one of the salons of the old *Universidad de San Felipe*. The Faculty of Physical Sciences and Mathematics had been created as part of the University. This Faculty was to be fundamental in establishing intellectual networks for the expedition. On the other hand, the creation of the Academy of Painting and the first classes in Architecture are contemporary to the expedition. The importance of these events is confirmed by the visit paid by Gilliss to the Acad-



Figure 8: Claudio Gay (en.wikipedia.org).

emy of Painting. The first steps for the construction of the Teatro Municipal had been taken the year before, and its inauguration was five years after the members of the expedition had left the country.

The first volume of the *Atlas de la Historia Física y Política de Chile*, a project that the French scientist Claudio Gay (1800–1873; Figure 8) had worked on for decades, was published in 1854, only one year before Gilliss published the first volume of his own work.³ This fact is important, because, as can be observed in the first chapters of Gilliss' book, the astronomer made use of information provided by Gay, both in order to write his own reports, and to incorporate unpublished or recently published graphic documents, especially regarding maps of the national territory created by the French sage.

It must also be pointed out that in 1848 the Chilean Government charged the geographer and geologist, Pedro Amado Pissis (1812–1889; Figure 9)—whose works Gilliss also used—with carrying out the titanic labor of mapping the entire national territory, since Gay's mapping was taking too much time (González, et al., 2011).

Meanwhile, other events relevant to the field of knowledge must be mentioned, since they happened at the same time and in some way affected Gilliss' work in Chile. One of these is the publication of the first issue of the *Anales de la Universidad de Chile* in 1844, which from then on and for many years was an exclusive form of communication between Chilean intellectuals. For the same reasons, as we shall see below, these *Anales* contained notes by and about Gilliss, before his arrival and after his departure. A fresh perspective was brought to the *Quinta Normal de Agricultura*, dating back to 1841, with the arrival of the agronomist, Luigi Sada di Carlo, who became Director in 1849. Rasmussen (1954) has pointed out that Sada di Carlo's efficient management encouraged Gilliss' interest in the possibility of developing an exchange of agricultural practices, as well as of native species, between Chile and the United States. This initiative, successful for many years, depended on the intellectual and scientific relationship between Gilliss and Sada di Carlo, and was kept up even after the American's departure (Rasmussen, 1954: 107). Both men were quite certain this bond would permit the 'Quinta' to contribute much, as Gilliss pointed out. The 'Quinta' was an urban space around which a set of cultural, educational and scientific institutions grew, colonizing the westernmost area of the city together with the new *barrio*, Yungay (Gilliss, 1855: 192).

Gilliss also made contact with the Polish-born geologist Ignacio Domeyko (1802–1889; Figure 10), another of the foreign scholars who had made Chile their home. In 1847 Domeyko was

employed as a teacher at the Instituto Nacional and from this position established a relationship of mutual interest with the astronomer. In fact, he accompanied Gilliss in some excursions outside of the city, for scientific reasons (Gilliss, 1855: 111). Later, when Gilliss was about to leave the country, Domeyko was in charge of representing Government authorities in negotiating the conditions of the sale of the instruments and establishment of a new National Observatory (Kennan et al., 1985; Rasmussen, 1954: 108). Years later, as a scientist and expert in geology and mines, the Polish Professor wrote a very critical article about the first volume of Gilliss' work.

One way or another, Gilliss eventually made contact with all the intellectuals and scientists then living in Chile. The American expedition should therefore be considered as another of the cultural and scientific events of the era, confirming that at this time Chile was consolidating its cultural and scientific bases and its identity as a nation.

3 GILLISS' NON-ASTRONOMICAL NARRATIVE

3.1 The Text

In his challenge to reveal Chile as a whole, Gilliss resorted to a narrative writing strategy that consisted of using different voices and registers, which ordered the framework of his discourses. This gave his text a polyphonic character that differentiated it from more traditional travel narratives. In his narrative, Gilliss goes beyond the vision of a traveler, an astronomer, a man of science or a military man. The meticulousness and the breadth of the themes Gilliss attempts to address through his descriptions disclose the ambition of wishing to narrate the entirety of the nation in its formative years. In this work, Gilliss' capacity for collecting documentary evidence is noteworthy, using his intuition to choose pertinent actors and relevant information.

Thus, we observe that sometimes the story of the experience of the trip is transcribed as a personal event as though it were a diary or a log-book (nearly all of the Section II narrative, is organized in this way), while at other times it is more like a newspaper article. On the other hand, the text can be a professional analysis of events of a military sort, impersonally written up; neither is poetical expression absent, inspired by some unusual phenomenon in nature. And certainly, the simple transposition of objective information culled from statistics, is also present. All this is complimented by a few chosen illustrations (e.g. Figures 3, 11 and 12), either produced by the expedition or borrowed from someone.

In collecting his records, Gilliss turned to the most varied sources. In the first place, as we have seen, he made contact with men of science



Figure 9: Pedro Amado Pissis (www.wikipedia.org).

as well as military men and politicians, and although he mingled with local 'high society',⁴ he did not ignore the stories provided by the lower classes. He asked questions of everyone, wishing to learn and find answers to the scenes that he saw or the events that he witnessed: in his view, everything merited explanation.

Gilliss sought the counsel of other scholars on all subjects of interest to him, openly asking for their opinions and data. For his description of Chile's geography in the first chapter, he went to the scholars Claudio Gay and Ignacio Domeyko, whom he quotes repeatedly. In order to substantiate his report, as we have already mentioned, he used maps made by Gay for his *Atlas de la Historia Física y Política de Chile*.



Figure 10: Ignacio Domeyko (en.wikipedia.org).



Figure 11: The Palace, drawn in about 1850 by a member of the U.S. Naval Astronomical Expedition, lithography by P.S. Duval & C^os Steam lith. Press Philadelphia (after Gilliss, 1855: Plate IV).

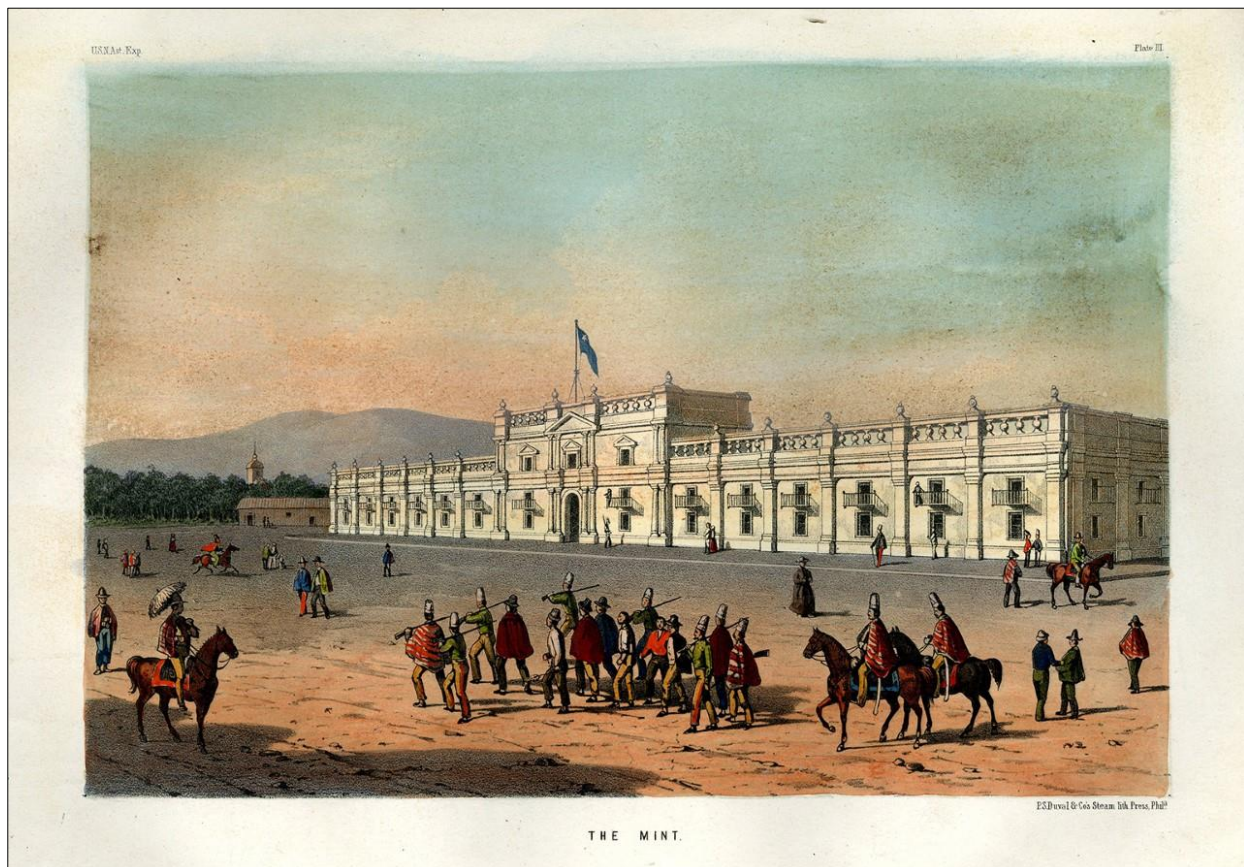


Figure 12: The Mint, drawn in about 1850 by a member of the U.S. Naval Astronomical Expedition, lithography by P.S. Duval & C^os Steam lith. Press Philadelphia (after Gilliss, 1855: Plate III).

Likewise, he refers to Amado Pissis who, as we remarked above, had been working on a similar assignment since 1848. The plan of the Province of Santiago that Gilliss includes in his report derives from Pissis. We can conclude that cooperation between these men of science was not unusual, and if Amado Pissis was willing to share cartographic information with Gilliss, as the plan indicates, it is very likely that Gilliss in turn supplied him with astronomical data, which were essential for determining the positions of geodetic reference points. All things considered this reflects well on Gilliss, for by including the plan of the province of Santiago in his report, he anticipated by twenty years the publication of Pissis' *Geográfica Física de la República de Chile* which only appeared in 1875 (González and Andrade, 2011). It is also worth noting that Gilliss received assistance from the Academia Militar in drawing the plan of Santiago: this plan was achieved with the help of the first Chilean officers trained to draw topographical maps.

On another topics, this time more of a domestic and social nature, Gilliss tells of his encounter with a young country woman surrounded by children, when he was visiting a friend's property in the countryside. He spoke to her to inquire about her situation, and was intrigued to learn that she was not married, and was even more surprised when she recounted her reasons for not marrying (Gilliss, 1855: 344). Gilliss uses this episode to back up his observations about people of the countryside, and then he launches a severe criticism of their beliefs and customs: "It is difficult for one ... to realize how his kind can descend so nearly to the level of brutes as they have done in Chile." (ibid.). As regards the organization of farm work, he adds: "Laborers on estates are of two classes: peons (hired men) and *inquilinos* (tenants) veritable remnants of the feudal system." (Gilliss, 1855: 345). Yet at the same time Gilliss described the harsh reality prevailing in his own country, which in many aspects was equally precarious and horrifying: "Indolence and improvidence render the peons of Chile quite as thoroughly slaves as are the negroes of Cuba or of the Southern States of America." (ibid.).

In relation to medical practices, Gilliss' observations are equally scathing. However, in this case the source from which he chooses to build up his arguments have a sparkle that permits the use of nuance and wit: these writings have irony and sarcastic humor. To analyze and present the subject Gilliss relies on a text written two decades earlier by the cleric José Javier Guzmán y Lecaros (1836). In one of these chapters Guzmán speaks of the gifts of Pablo Cuevas, "... an unlettered disciple of Esculapius ... so famous in his time that Padre Guzmán devotes an entire chapter to an account of his skill and charity." (Gilliss,

1855: 347). All things considered, however, beyond Gilliss' criticisms of a society which in various ways he considered pre-modern, what we are interested in pointing out are the formal gradations that permeate Gilliss' text, producing transitions in judgment ranging from greater severity, to others of a more playful character, as shown here concerning Padre Guzmán.

Gilliss also was a military man, and as such he had broad knowledge in this area. Thus, he spoke with authority on weapons and strategy, and analyzed and offered opinions about political events. We therefore see in him an observer who thinks in geopolitical terms, even as he visits a fledgling and promising nation, situated at the extreme end of the continent. Plenty of examples of this may be found in his remarks about the revolutionary events in Santiago that occurred on 20 April 1851. These were perhaps the most noteworthy political events while he was in Chile and so he wrote of them extensively. He was not in Santiago that day, since he had gone to Valparaíso to pick up his son who had come to visit him. He therefore collected a series of different versions of that fateful morning's events in order to make up his own mind about them. So even though he was not a direct witness to the armed uprising of Coronel Pedro Urriola Balbontín and his Chacabuco Battalion, this is, nonetheless, one of the events most closely described by Gilliss in his memoirs (Gilliss, 1855: 495–505). Gilliss went directly to the different sources, in effect, the notes brought by the official emissaries to the port, as also the official reports made by the press, which backed the Government. Moreover, upon returning to Santiago he also obtained information from his own men who had remained at the Observatory. But he also gathered news from the opposition press, which he tells us had been silenced, and he even interviewed some of the uprising's leaders. All this information, together with his military knowledge, finally allowed him to make his own judgment at to what actually happened. Beyond the objectivity Gilliss achieved in his account, interestingly, he clearly had detailed knowledge of the military quarters situated at the foot of Cerro Santa Lucía. As he was installed near the summit he could easily observe its functioning and was aware of its weaknesses as well as its strengths. One can deduce from the text also, the knowledge he had of the arms stored there and of the possible ways to access them. He knew the role Cerro Santa Lucía had always played in the city's defense. He knew of the strengths and weaknesses of its two terraces, Hidalgo and González, the one looking north and the other, with less strategic advantages, looking south (see Figure 3). After all, the hill had been home to him for nearly two years. Gilliss' information clearly shows the excesses, achievements and errors of a day marked in blood, whose im-

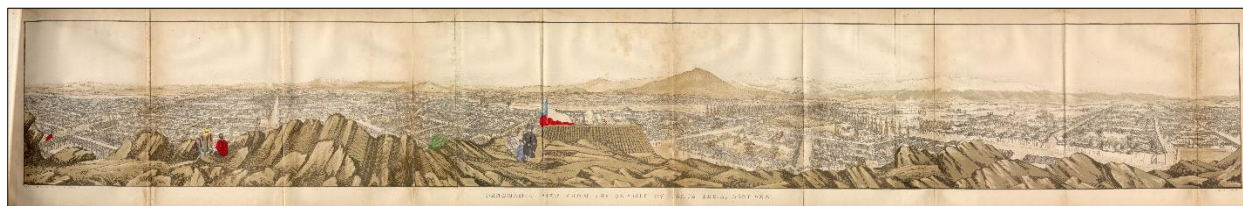


Figure 11: A panoramic view from the summit of Santa Lucia, Santiago, drawn in about 1850 by Edmond Reuel Smith, lithography by Thomas S. Sinclair (after Gilliss, 1855: Plate 5, Frontispiece).

portance had been played down by official reports. In the end, his report is neither a defense of the rebels nor much less a celebration of order restored. It is, on the other hand, a reflection of the danger the city found itself in, under threat of the possible explosion of the ammunitions depot located at the foot of the hill, and of the risk to the population and also of course to his own assistants and scientific instruments had the rebels achieved their goal.

Gilliss was a liberal, moved by the daily conditions of people at large, to which the locals largely were insensible, since they were not alive to any reaction or surprise. Nevertheless, at other moments he tried to be a mere observer, a person who scrupulously reflected only what he saw and felt. This was the case when he addressed the fearsome and frightening subject of earthquakes:

There was yet one other subject for whose intelligent discussion it was hoped we might collect interesting materials, and for which a rude instrument had been brought to assist us, I mean that startling terrestrial phenomenon of whose coming no man knows—the earthquake. (Gilliss, 1855: 508).

For this, he measured the duration of earthquakes, and noted his own and his assistants' reactions as well as those of his neighbors—the latter supposedly being more accustomed to these natural events (Gilliss, 1855: 461–462). He kept records of the phenomena, once he grew used to them. At other times his open sensibility was obvious, as when he admired the landscape and nature in all its breadth and diversity, as when he described the Santiago Valley seen from the Cuesta de lo Prado (e.g. see Gilliss, 1855: 142). Perhaps all of this was simply a reaction to what, on the contrary, human nature provoked in him, which most times was irritation and cause for distress. Such was the case during the visit to the countryside by Laguna Aculeo, where he witnessed the difficult lives of the inhabitants.

The text, then, is presented as a series of voices, through which Gilliss essayed different ways of thoroughly tackling a diverse range of material. Through his carefully planned narrative, Gilliss stressed the fragmentary nature of the reality before him. His approach was critical, and we know that behind each text there was a

choice, and therefore partiality, and in spite of this, there was willingness to show reality in its completeness. No doubt, in this way of seeing and narrating facts, there are also clear symptoms of a change of era and of sensibility. Framed in this way, images play an important role in this work.

3.2 The Role Played by Images

The role played by images in the Gilliss' publications is limited, as was the case for many of the texts dating to this period. Nevertheless, considered individually, images contributed significantly to the work. Each image was of specific interest, but taken together their importance was diluted due in part to their scarcity, and in part to the diversity of their subjects and quality. Furthermore, it must be pointed out that how they were actually produced is an enigma to us, their success or relative achievements notwithstanding.

Considering how responsibilities were initially distributed among the members of the expedition, it is very likely that the task of producing images fell on the young assistant, Edmund Reuel Smith, a recent graduate of Georgetown College who was appointed to join the expedition as an artist (Gilliss, 1856). However, and with the noteworthy exception of the panoramic view of Santiago (Figure 11), where he is clearly identified as the artist of the drawing,⁵ his authorship cannot be guaranteed in any other cases.

Regarding the image of the capital, it is invaluable for its descriptive rigor and verisimilitude. The latter characteristic is proof that it was attained using records captured by some kind of optical instrument. Nonetheless, it is interesting to ask about the original records made by Smith. From which illustrations were the engravings based? How was this high degree of precision achieved regarding observed reality? The answer to this question would be much simpler if we had access to these records, which unfortunately have not come down to us from Gilliss, unlike his maps and notes of astronomical data.⁶

For the most part, the plates show us unique events, many of them experienced by members of the expedition, such as the visit to Laguna Aculeo and a trip to the port of Caldera. Illustrations of noteworthy places in the capital are included, such as the buildings on the north side

of the Plaza, which Gilliss called 'the Palacio' (Figure 11), and the main facade of the Moneda (the Mint—Figure 12), observed with a foreground space disproportionately wide; and of course, the view from Cerro Santa Lucía already showing the northern part of the observatory (Figure 3).

The scarcity of images in the book may be attributed to several reasons. One might be the high cost of including images of any kind in a publication at the time. This refers both to making lithographs and to the design of them and their arrangement in the book. Another hypothetical reason for the small number of images might be that Smith dedicated a great amount of his time to other duties, especially registering meteorological observations, which required constant attention to the pertinent instruments (Gilliss, 1855: 507). However, the remaining volumes of Gilliss' work also have illustrations which complement the first volume, especially those regarding zoology, botany, maps and archaeological topics.

It is also true that there are, apparently, different copies of the book, some with colored illustrations and different kinds of lithographs. An example of the differences may be observed in the plate that is the frontispiece, Cerro Santa Lucía seen from the southeast; there are two

different versions of this, depending on the copy consulted.⁷ The plates vary according to what is represented in the foreground of the image, providing the 'atmosphere' considered appropriate by the lithographer on duty. On the other hand, it seems clear that the information given in the middle ground and background was fundamental, and presumably was included in the original drawing.

We must also consider that some of the images in the book were taken from other sources or were made with the help of local specialists. This is the likely case of the three city plans included: Santiago (see Figure 12), Valparaíso and Constitución. We must add to these plans, the maps mentioned above drawn up using those of Claudio Gay and Amado Pissis and the plan of the Province of Santiago, on which we also have previously commented (Figure 13). Lastly, the image of an Araucanian 'chief' stands out; no doubt included by young Edmond Reuel Smith. After the astronomical mission had come to an end, Smith stayed on in Chile to become better acquainted with the country, and the culture of one of its original peoples (see Smith, 1855).

In summary, the presence of images in this work is not only proof of an original point of view,

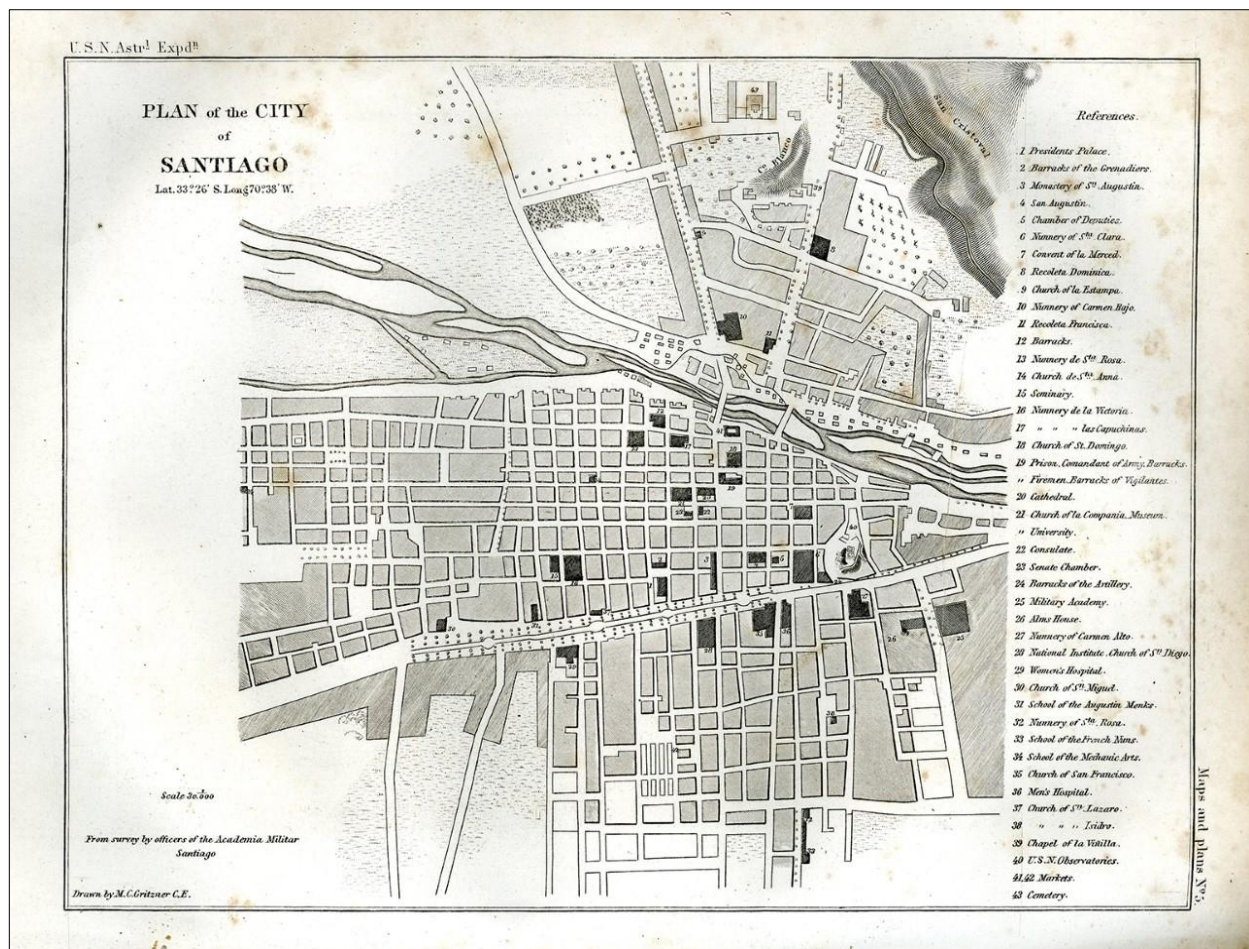


Figure 12: A plan of the City of Santiago, drawn in about 1850 by M.C. Gritzner C.E., following a survey by an officer of the Academia Militar Santiago (after Gilliss, 1855: Maps and plans No. 5).

but also of a highly selective view of reality, which after all was so broad and varied that a large quantity of images would have been required to do it justice. Much of this preoccupation with representation can be said to have culminated in the panoramic view of Santiago which, we believe, has no equal among representations of the capital carried out in the nineteenth century, for its breadth, descriptive thoroughness and its apparent authenticity.

3.3 Critical Acclaim and Cultural Transcendence

It must be said that the responses to and impact of Gilliss' published volumes has been varied, and even given rise to some polemics. This is apparent in the first critical reviews published in the United States and in Chile. But some signs of this may also be noted in recent opinions, both those considering the work's enormous value as testimony of an important mission in the development of astronomy, as also those that consider it a source of information of the process experienced by Chile in its becoming a State and a nation. Regarding the former, Gilliss' work was unsparing and ruthlessly criticized by one of his most prestigious interlocutors during his sojourn in Chile, the Polish scholar, Ignacio Domeyko. In

his critical article published in 1857 in the *Revista de Ciencias y Letras* (1857) and then again, without alterations, in 1859, in the *Anales de la Universidad de Chile* (1859), Domeyko asks:

How much of this first volume, the result of a three year scientific expedition, has contributed to broadening our positive geographic knowledge of Chile before the author arrived to these shores? (Domeyko, 1857: 633; 1859: 20).

Domeyko organized his analysis in order to expose the multiple errors in Gilliss' work. In the first part of his critical commentary, Domeyko took it upon himself to demonstrate the multiple of errors in Gilliss' description of Chile's physical geography; in the second part, he referred to the mistakes regarding the climate; and the third and last part was dedicated to the astronomer's comments on earthquakes. From the opening comments, Domeyko announced that only these three headings could be considered the 'serious, scientific part' of the first volume of *The U.S. Naval Astronomical Expedition*. He considered that that

... part of the trip should be left aside, in which the author, as most travel writers on picturesque trips so abundant in modern literature, who speak of an infinity of personal events, depicts the personality of the traveler and not the country of his travels. (ibid.).

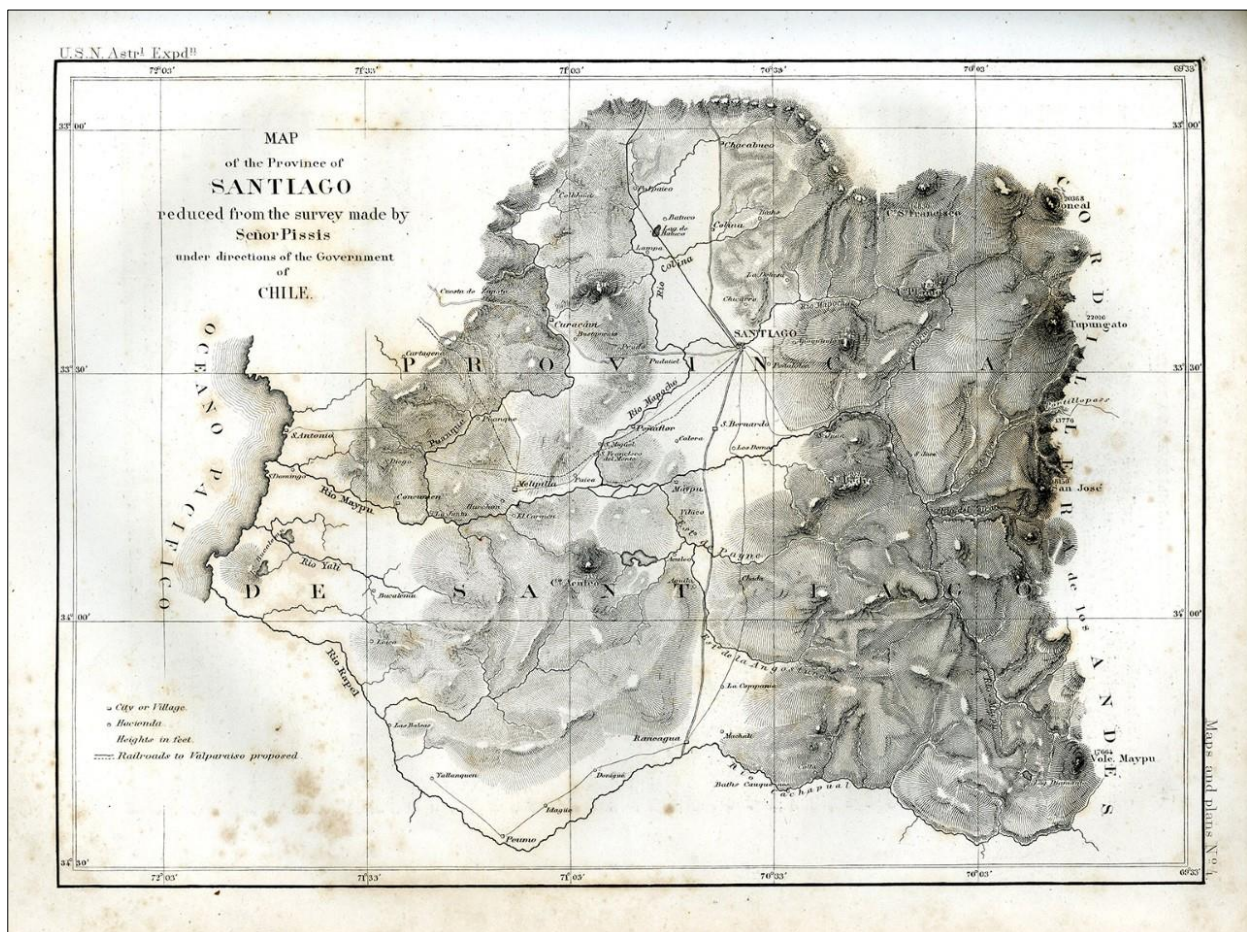


Figure 13: A map of the Province of Santiago, drawn in about 1850 by a member of the U.S. Naval Astronomical Expedition, and reduced from the survey made by Amado Pissis (after Gilliss, 1855: Maps and plans No. 4).

Nevertheless, by the end Domeyko's commentary takes on a more conciliatory tone:

I hope, and I have reason to do so, that the three volumes of the American Expedition, which shall contain all the astronomical, meteorological and magnetic observations made by Mr. Gilliss and his companions in Chile, will compensate for the defects in his general geographical description of the country which I have noted. (Domeyko, 1859: 61).

As can be imagined—and Domeyko was well aware of this—the three years that Gilliss spent in Chile were mainly dedicated to his astronomical observations: measuring the motions of Mars and Venus, and cataloguing thousands of stars. Gilliss hardly had time to travel and observe the physical characteristics of the country with the scientific rigor of a naturalist—which, of course, he was not. In the best of cases, Gilliss saw fit to draw on the few writers who had begun this task, including Gay, and Domeyko himself. However, for Domeyko this was not enough, as he considered that Gilliss seasoned his writings with his own 'phantasy'. Beyond Domeyko's correct critical appraisals, his comments show his grievances provoked by Gilliss' contempt and irony regarding Chileans of the mid-nineteenth century.

Gilliss' comments were not only read in Chile. In his paper about the expedition, the agronomist Wayne D. Rasmussen (1954) agrees that the report was full of Gilliss' personal opinions, hinting that something more might have been expected of a representative of the United States. In effect, Gilliss' sometimes disagreeable comments about Chile and its people did not go unnoticed by his fellow countrymen. As Rasmussen (1954: 112) noted:

A reviewer for a literary magazine, *Putnam's Monthly*, suggested that the narratives could have been much condensed and that the descriptions of social, civil and religious comments, might well have been omitted.

In Gilliss' favor, Rasmussen states that in agriculture, a field in which Gilliss wished to point out the contributions made by the expedition,

Gilliss was in Chile for three years and he was a careful observer. If the reader discounts his prejudices, which are obvious, there is much material of value. (Rasmussen, 1954: 111).

Regarding Gilliss' alleged competence to interpret the social reality he observed, we have the more recent views of historians Simon Collier and William E. Sater. Certainly, in order to describe and analyze the behavior of Chilean society in the mid-nineteenth in the context of their *Historia de Chile 1808–1994*, Collier and Sater counted on "... the sharp-eyed Lieutenant Gilliss, an American visitor, whose account of mid-nineteenth century Chile is singularly comprehensive." (Collier and Slater, 1996: 91). These authors also made use of Gilliss' statistics (Collier

and Slater, 1996: 92) and his descriptions of urban life in the capital, where, as we can see in Chapter 8, Gilliss went into great detail. In doing so, Collier and Sater (1996) advocate Gilliss as a source of historical information on nineteenth century Chile.

Toward the end of his writing, Gilliss also introduces nuances into his thoughts about Chile, highlighting its potentialities and stating that what had previously been written did not reflect its most recent improvements and transformations. Together with this, and in spite of his limitations as an author, Gilliss justifies his work as a writer who shows the world Chile as a living nation. This can be deduced from the "Prefatory", which is also a final assessment:

Within the preceding quarter of century Chile has advanced far more rapidly than any other nation of Spanish America in intelligence, good order, agricultural and mineral wealth, and commercial importance. But all or nearly all, the volumes of information we possess of it were written before the era of progress, and what Chile was, not what it *is* ... and in course of time, an account of its geography, ethnography, and statistics will probably follow. Until then, the present volume may supply some deficiencies. But I beg it may be remembered that no pretensions are made to elegance of literary composition, and if the most trustworthy information which other duties permitted me to obtain is detailed comprehensibly, it is all that it was expected to accomplish. (Gilliss, 1855: 4).

But this is not all; Gilliss was very aware of the thoughts and opinions expressed throughout his work, and in the end perhaps he was even counseled or warned about them. In Chapter XII of Section II, that is, in a sort of appendix, "A Brief Account of our Work", Gilliss wishes to be fair to the Chilean people, and in his own way, offers an apology for his earlier harsh words:

A word more and I have done. Many things may have been told in the preceding pages apparently ungracious from one who acknowledges so many attentions, so many acts of courtesy, and such valuable assistance, but I claim justification and pardon ... Constant occupations prevented much of the intercourse that would have imparted some of these softening influences and it may be that I continue scarcely more competent to truly estimate Chile and Chilenos than in 1849 ... and next to my own, there is neither land nor people for whose prosperity and happiness I feel such earnest desire none whose advancement I would make such efforts to promote. Will these sentiments give me a right to indicate faults, not as a censor regardless of the pain he inflicts, but as the friend who details errors that they may be the better corrected by the admirer who desires to perfect the object of his esteem? On these grounds I ask the indulgence of friends in Chile, praying they will ever believe me grateful for their untiring kindness and hospitality. (Gilliss,

1855: 511).

Notwithstanding the initial criticism, with the passage of time Gilliss' work has become known and valued as a source of information, while his strongly worded appraisals of the Chilean people are not reason enough to doubt the quality of his detailed descriptions. Proof of this is that, nearly one hundred years since the publication of the first volume of Gilliss' work, Carlos Peña Otaegui, in his classic *Santiago de Siglo en Siglo*, used it as a main source for one of his chapters (Peña Otaegui, 1944: 213–233).

Gilliss' work is an important contribution to the field of the history of astronomy, not only as concerns Chile, but also the United States and Germany, the latter nation also being involved in the project carried out by the naval expedition. In this regard, in their *El Observatorio Astronómico Nacional de Chile: 1852–1965*, Keenan, Pinto and Álvarez (1985), give Gilliss' expedition a leading role in their first chapter.

In the United States, Gilliss' relevance is even greater. The astronomer and historian, Steven J. Dick, dedicates part of his book, *Sky and Ocean Joined, the U.S. Naval Observatory 1830–2000*, to Gilliss' expedition (Dick, 2003: 140–144), and one of his chapters describes the period when Gilliss directed the United States Naval Observatory (Dick, 2003: 140–160). Gilliss appears prominently in the frontispiece of this book, heading a row of four distinguished American astronomers (from left to right: James Melville Gilliss (1811–1865), Asaph Hall (1829–1907), Matthew Fontaine Maury (1806–1873) and Simon Newcomb (1835–1909)), in recognition of his role in the development of astronomy in North America. In fact, the library of the U.S. Naval Observatory itself bears Gilliss' name.

As for Germany, Gilliss' name is tied to that of Christian Ludwig Gerling, the astronomer who gave origin to the mission, and to Carlos Moesta, who took charge of the Chilean National Observatory once the Americans left. Meanwhile, Professor Andreas Schrimpf (2014) from Philipps University of Marburg has written about the scientific results of Gilliss' expedition.

In quite another field, a study of the élite and underprivileged in nineteenth century Santiago, the historian Luis Alberto Romero (2007: 57) calls Gilliss' work one of the "... principal testimonies about Santiago in the middle of the century."

4 CONCLUDING REMARKS

The contributions of the Gilliss expedition are not open to doubt. When the expedition came to an end, the Chilean Government purchased both the astronomical instruments and the buildings, and these marked the origin of the Observatorio Astronómico Nacional de Chile (Keenan et al., 1985).

The facilities were placed under the care of a young German mathematician, Carlos Moesta (1825–1884), who on 17 August 1852 by Presidential Decree was officially appointed the founding Director of the new national observatory (see Keenan et al., 1985). Moesta worked alongside members of Gilliss' expedition during the last two weeks of their time in Chile, a reasonable amount of time, apparently, to become familiar with the instruments. This was the beginning of uninterrupted astronomical observations of the Southern skies from Chile, extending from Gilliss' day through to the present time.

As is well known, in the mid-nineteenth century the United States was also in the process of consolidation regarding its territories and institutions. In writing about the history of the United States Naval Observatory, Steven J. Dick makes use of a bird's eye view image of Washington in 1861, where the Capitol is seen as only half built, as a metaphor of this circumstance. At the same time, this choice of illustration also expresses well Gilliss' new role—the latter finally being able to bring the Observatory that he founded under his own management, having been appointed Superintendent of the Observatory that very year (Dick, 2003: 140).

Given the perspective of time we have to question the success of Gilliss' primary mission—the astronomical measurements. His observations certainly did not lead to an improved value for the Astronomical Unit (see Table 1 in Dick et al., 1998), but he did make useful observations of the Southern sky. However, Gilliss was instrumental "... in the beginnings of two national observatories thousands of miles apart." (Dick, 2003: 141), one in the United States and the other in Chile. In the case of our national Chilean observatory his account in *The U.S. Naval Astronomical Expedition ...* is detailed, and his critical role in its founding is very clear (for details see Keenan et al., 1985). His 1849–1852 Expedition therefore represents a very early example of cooperative relations between two young American nations. Today, because of its clear skies and dry conditions in places like the Atacama Desert, Chile has become the astronomical capital of the world, with almost half of the world's major astronomical instruments. It all began with the work of James Melville Gilliss, and his successors at the Observatorio Nacional in Santiago.

Finally, as we noted previously, others have already discussed Gilliss' astronomical achievements while in Chile, so in this paper we have tended to focus on his extensive non-astronomical narrative contained in the first volume of *The U.S. Naval Astronomical Expedition to the Southern Hemisphere during the Years 1849-50-51-52*. Despite their somewhat controversial nature, these writings provide one of the most complete portraits available of the physical, cultural, social

and political traits of mid-nineteenth century Chile, and as such are a unique historical document.

5 NOTES

1. The telescopes were a meridian circle by Pistor & Martins of Berlin and an American-built 6.5-in (16.5-cm) Young equatorial refractor with a Fitz objective (Gould, 1866: 163–164; Huffman, 1991: 201–211). At the time it was manufactured, the latter instrument was the largest refracting telescope that had been made in America. In Chile, the meridian circle was used to determine the positions of reference stars while the refractor was employed for micrometric measurements of the positions of Venus and Mars (for the parallax program) and Southern stars (for the star catalogue).
2. In their report on the scientific programs of the expedition Gilliss and Gould blamed this on the lack of simultaneous supporting observations from Northern Hemisphere observatories, but after reviewing the evidence Huffman (1991: 214–217) arrived at a somewhat different interpretation. In fact, there were many Northern Hemisphere observations (including from the U.S. Naval Observatory), but few of these coincided in time with Gilliss' own observations. Also, there was a problem observing Venus because of its relative proximity to the Sun; the opposition of Mars was unfavorable; and bad weather in both Hemispheres limited the number of observations. All-in-all, the Chile program failed because of "... insufficient planning and poor coordination of effort ..." (Huffman, 1991: 216).
3. In fact Gay's *Historia Física y Política de Chile* was published in 30 volumes, between 1844 and 1871.
4. Gilliss (1855: 142) wrote that:
Though letters of introduction are not absolutely indispensable to obtain for one to gain access to the first circles of society, still, as in every other country, they greatly facilitate the intercourse of a stranger at the capital.
5. A note at the lower right hand corner of the plate fold-out reads as follows: "Drawn from camera sketches by E.R. Smith".
6. Gilliss' letters and details of his astronomical observations are now in the United States National Archive in Washington D.C. (Archive II, College Park).
7. We have consulted the following copies: one kept in the Biblioteca Nacional de Chile; one in the Library of the Astronomical Observatory of the United States in Washington D.C.; one in the Archivo Bello of the Universidad de Chile and, finally, one belonging to a private collector in Santiago, Chile.

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