The Hotel that Became an Observatory: Mount Faulhorn as Singularity, Microcosm, and Macro-Tool

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> Touched by the sun's departing rays
> That steep in gold the western sky—
> These too are themes for joy and praise,
> To warm the heart and melt the eye.
>
> That setting sun! that rising moon!
> That blue ethereal arch above!
> No,—till our latest day has flown,
> We'll ne'er forget this feast of love!
>
> — from a poem composed in the summer of 1834 by Dr. Hutton, during his stay at the Berghaus Faulhorn.[1]

Introduction

One of the first high-altitude astronomical stations was a hotel. On September 16, 1864, the astrophysicist Jules Janssen was quite happy with the work he had just carried out at the Faulhorn Berghaus, in the Swiss Alps: "I consider my ascent a success. I obtained results that I consider very important. We shall see what the Academy [of Sciences] thinks."[2] On the summit of the mountain, at more than 2680 meters above sea level, Janssen had made significant progress in his program to demonstrate that some lines of the solar spectrum were indeed due to the atmosphere of the earth as opposed to that of the sun. This result was essential not only to secure the foundation of solar spectroscopy just established by Robert Bunsen and Gustav Kirchhoff in 1859 but also to open up possibilities for analyzing the chemical constitution of the high atmosphere as well as that of other planets of the solar

[1] Quoted in J. J. T. "The Late Dr. Hutton," *The Christian Reformer; or, Unitarian Magazine and Review* 16 (1860), 297–305, on 303.

[2] « je considère mon ascension comme une réussite. J'ai obtenu des résultats que je considère comme très importans. Nous verrons ce qu'en pensera l'Académie. » Jules Janssen to Henriette Janssen (16 September 1864). Bibl. Institut.

system.[3] A week later, Janssen explained in more details to his wife Henriette the sufferings he had been through in order to achieve this result:

> My stay on the Faulhorn was rather tough. I was there, in snow and ice, forced to wake up before the sun and to observe from the summit, for 5 and 6 hours, exposed to the wind and the freezing cold. […] I faced great difficulties in transporting my equipment so high up and through such bad roads. I nevertheless managed, at advantageous cost, as [I did with respect to] my stay here. The climb up took from 6½ in the morning to 4 in the evening and I myself carried 4 to 5 kg (barometer, etc.). The rarefaction of the air breaks your legs; when I arrived I could not walk more than twenty paces without resting.[4]

How can a hotel be an observatory? The idea of setting up an observatory high up in the mountain had been around for some time. Travelling in the same area as Janssen, almost a century earlier, the Geneva naturalist Jean-André Deluc thought "that if an observatory was established at such altitude, new telescopic stars and new comets might perhaps be discovered whose weak rays would never break through the vapours of Greenwich."[5] Established in 1823, the rudimentary chalet opened by Samuel Blatter on the top of Mount Faulhorn certainly became a highpoint in the landscape of nineteenth-century science. Cited by François Arago and Alexander von Humboldt in their science bestsellers, *Astronomie populaire* and *Cosmos*, the Faulhorn was called by the natural history professor at the University of Montpellier, Charles Martins, a "true meteorological observatory" and an "*observatoire aérien.*" It enjoyed, said Janssen, "some sort of scientific reputation due to the

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[3] For more on Janssen's early carreer, see David Aubin, "Orchestrating Observatory, Laboratory, and Field: Jules Janssen, the Spectroscope, and Travel," *Nuncius* 17 (2003), 143–62.

[4] « Mon séjour au Faulhorn a été assez dur. J'étais là au milieu des neiges, de la glace, obligé de me lever avant le Soleil et de rester en observation sur le sommet 5 et 6^{h}. durant par un vent à tout renverser et un froid glacial. Enfin, j'ai découvert des choses importantes et j'ai conservé une bonne santé.
« Il y avait de grandes difficultés pour le transport de mon bagage si haut et par des chemins si mauvais. Je m'en suis tiré cepend^{t}. et économiquement ainsi que mon séjour là haut. La montée a duré depuis 6½ du matin jusqu'à 4^{h}. du soir et je portais pour mon compte 4 à 5^{k}. de bagage (baromètre, etc.). La rareté de l'air vous casse les jambes ; quant [sic] je suis arrivé je ne pouvais faire une vingtaine de pas sans me reposer. » Jules Janssen to Henriette Janssen (23 September 1864). Bibl. Institut.

[5] « J'ai souvent pensé que si l'on établissait un observatoire à ces hauteurs, on découvrirait peut-être de nouvelles étoiles télescopiques, ou des comètes, dont les faibles rayons n'ont jamais percé les vapeurs jusqu'à Greenwich. » Jean-André Deluc (1778), in *Le Voyage en Suisse*, 291. On Deluc, see Martin Rudwick, "Jean-André de Luc and Nature's Chronology," in *The Age of the earth: From 4004 BC to AD 2002*, ed. C. L. E. Lewis and S. J. Knell (London: Geological Society, 2001), 51–60; repr. *The New Science of Geology: Studies in the Earth Sciences in the Age of Revolution* (Adelshot: Ashgate, 2004), VI.

remarkable work of which it was the theatre."[6] Indeed, due to its exceptional location, the Berghaus Faulhorn not only was one of Switzerland's major tourist attractions—which it remains to this day—but also a place where various observations were gathered and experiments carried out for nearly fourty years in a great number of scientific domains: meteorology, botany, zoology, glaciology, physiology, and, of course, spectroscopy.

With the Enlightenment, the mountain started to play an important part in the European imagination. It has since that time given rise to a wealth of complex representations—literary, picturesque, and scientific. Much has been written about the way in which in the second half of the eighteenth century the mountain was jointly "discovered" by writers, painters, and especially scientists.[7] The development of tourism and alpinism went hand in hand with a rising fashion for the trip to Switzerland and the mountains, which was popularized by major novelists. In France, Chateaubriand, Victor Hugo, Balzac, George Sand, Sainte-Beuve, Stendhal, and so on devoted many pages, not always highly original, to their descriptions of the Alps, which they crossed most often on their way to Italy. The French Romantics, such as the poet Lamartine, followed German and British predecessors in thinking

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[6] Charles Martins, "Remarques et expériences sur les glaciers sans névé de la chaîne du Faulhorn," *Bulletin de la Société géologique de France* 14 (1843), 133–45, on 134–5; Charles Martins, *Du Spitzberg au Sahara : étapes d'un naturaliste au Spitzberg, en Laponie, en Écosse, en Suisse, en France, en Italie, en Orient, en Égypte et en Algérie* (Paris: J.-B. Baillièr et fils, 1866), 311; Jules Janssen, "Mémoire sur les raies telluriques du spectre solaire (Rapport d'une mission dans les Alpes confiée par M. le Ministre de l'Instruction publique, 1864)," *Archives des sciences physiques et naturelles* 22 (1865), 69ff; repr. in Janssen, *Œuvres scientifiques*, 2 vols. (Paris: Société d'éditions géographiques, maritimes et coloniales, 1929–30), 1:81–96, on 81.

[7] « Seule une élite de l'esprit, ou un personnage appartenant lui-même au monde du sacré et du merveilleux, peut prétendre imposer son regard comme un intermédiaire entre les choses et leur sens, c'est à dire transformer en un paysage les merveilles des montagnes. Nous avons tenté de montrer que ce rôle revenait successivement à deux des personnages clefs des temps modernes: le roi et le savant ». Serge Briffaud, "Naissance d'un paysage, la montagne pyrénéenne à la croisée des regards (XVI^{e}-XIX^{e} siècle)" (Archives des Hautes Pyrénées et CIMACNRS-Université de Toulouse-Le Mirail, 1994), p. 459 cité par B. Debarbieux, "Les montagnes de la science, prises entre nature et sociétés, " *Revue de géographie alpine* 82 (1994), 107–14, on 109. See also, for example, Walther Kirchner "Mind, Mountain, and History, " *Journal of the History of Ideas* 11 (1950), 412–47; Numa Broc, *Les montagnes vues par les géographes et les naturalistes de langue française au XVIIIe siècle* (Paris: CTHS, 1969) and *La Montagne au siècle des lumières* (Paris: CTHS, 1991); Philippe Joutard, ed., *L'Invention du Mont-Blanc* (Paris: Gallimard, 1986); Jean-Claude Pont and Jan Lacki, *Une cordée originale : histoire des relations entre science et montagne*, and *Le Voyage en Suisse*, ed. Claude Reichler et Roland Ruffieux (Paris: Laffont, coll. "Bouquins," 2002). The role of mountains in the history of geology is emphasized in Gabriel Gohau, *Les Sciences de la Terre aux XVII^{e} et XVIII^{e} siècles. Naissance de la géologie* (Paris: Albin Michel, 1990).

that mountains were "God's altar" from which one could contemplate the world, even the sublime itself. With the foundation of the first Alpine Clubs (in London in 1858) by pioneer mountaineers such as geologist James David Forbes and John Tyndall, scientific motivations mingled with moral values and sportsmanship.[8] The sufferings endured in conquering one summit after another went hand in hand with cool-blooded observations of scientific facts under extreme duress: just another facet of the white man's burden. Towards the end of the nineteenth century, astronomers and meteorologists, in particular, strove to established permanent stations at high altitude. At that time, the mountain simply seemed to be a new instrument to be placed in the service of science.

The mountain, in short, always stood for something else than it was. In this paper, I want to reverse the viewpoint and take a specific mountain as my entry point into the examination of the special attractiveness that mountains exerted on scientists. It might be meaningful, I want to argue, to see the Berghaus Faulhorn as one of the first semi-permanent mountain observatories in the world. The hotel moreover provides an interesting observatory for the historian of science as well, wherefrom one may retrace transformations in the representations of the mountain. Mount Faulhorn was the hybrid construction of all its visitors. Scientists from a great variety of fields as well as tourists of different origins and means took part in this construction. In the imagination of the period I will examine here, roughly from the early 1830s to the late 1860s, Mount Faulhorn came to stand for a few specific images: a breathtaking panorama, violent and thunderous storms, astonishing sunrises and sunsets, and promiscuity with raucous travellers. The same images structured the scientific perception of the mountain and the studies one could make there.

The time of a generation, Mount Faulhorn held a peculiar place in the scientific imagination. Meteorological data gathered there figured in most treatises written at the time. Chemical analyses of air samples taken near the top were analyzed in Paris and seemed to indicate that the composition of the atmosphere was independent of altitude. The special flora of the mountaintop was gathered, classified and duly compared with arctic vegetation. Soil temperature was measured and attributed a great role in favouring the resemblance between arctic and alpine vegetation. New species of voles were observed living at unexpected altitudes and named. The role of protein for physical exertion was measured in hikers. And the spectrum of water vapour was observed on top of the Faulhorn.

[8] About mountaineering, see Peter H. Hansen, "Albert Smith, the Alpine Club, and the Invention of Mountaineering in Mid-Victorian Britain," *The Journal of British Studies* 34 (1995), 300–24.

Accessibility was crucial. In Janssen's letters, the special attraction of the mountain clearly transpires. His climb up the Faulhorn was hard enough to ensure that only few determinate scientists could make it. It required considerable physical exertion during the walk up (and one has to remember here that, having been dropped on the floor as a baby, Janssen was during his entire life limping), but also during the long periods of observation in cold and windy weather. Moreover, as the letters also attest, a trip to the Faulhorn required non-negligible logistic organization. For the independent scientist, to afford the trip to the valley and then to organize the transfer of instruments up to the mountaintop could be problematic, but not altogether unthinkable. For all these reasons, there were few places more attractive than the Faulhorn hotel, where the required infrastructure in terms of food and lodging as well as guides and carriers could be found at reasonable prices. Neither too remote nor too easy to reach, the mountaintop offered exceptional conditions for observation and the promise of reaping new scientific results.

The mountain therefore was exoticism in Europe's background. For roughly one century (1750–1850), independent European scientists found in the Alps or the Pyrenees rather accessible regions that could nonetheless offer a prospect of displacement congenial to the discovery of new scientific facts. One could say that exploring alpine regions represented a middle ground between botanizing around the city during the weekend and participating to official—and very expensive—naval expeditions oversees. For the botanist, a trip to the mountain could very conveniently complement, or even altogether replace, more costly arctic explorations. For the meteorologist, temperature and atmospheric pressure in extreme weather at high altitude could be measured and compared with nearby stations in the valley. For the astrophysicist, special atmospheric conditions could ensure a clarity of observation otherwise impossible to achieve.

In this paper, I do not want to discuss the way in which the mountain became an object of diverse sciences such as meteorology, botany, or glaciology as much as the reasons advanced by scientists who went to the mountain for studying phenomena that were in no way specific to the Alpine environment. During its period of scientific activity, I want to say, Mount Faulhorn stood for three different conceptions of the usefulness of the mountain in the scientific enterprise. Appearing roughly in chronological order, but overlapping in important ways, these conceptual representations also expressed the general ideas about the relationship of the mountain with the globe. (1) In vast observation networks put up at that time by John Hershel, Adolphe Quetelet, or Carl Friedrich Gauss, stations were usually chosen for pragmatic reasons (pre-existing astronomical observatories, seaports, sailing ships, telegraphic

stations, schools, etc.). In this type of "cinematographic" geography, reminiscent of Henri Bergson's definition of "cinematographic knowledge," the quantitative expansion of the network was usually valued over the qualitative selection of the stations.[9] In the conception dear to the pioneers of the Enlightenment, mountains however represented *singular* spots in such "cinematographic" observation networks—stations chosen *a priori* because of the exceptional types of measurement one could make there. In this conception, mountains were *singular spots* of the Earth deserving special attention, that is, key nodes in observation networks that were especially revealing of the general laws one wished to uncover. (2) In the second conception, the mountain was a *microcosm*. According to Martins, who had himself taken part to an expedition to the North of Norway and to Spitzberg Island, there was a "rigorous parallel of influences [due to] latitude and altitude."[10] Directly inspired by Humboldt, this vision was especially true for the study of botanic geography. Incomparably small compared to the Earth, the mountain could thus be taken as representative for the globe as whole. As the French geographer Élisée Reclus noted, "the walker who, in the space of a few hours, hikes up from the base of the mount to the rocks at the summit, in reality travels further and more fruitfully than if he would devote years to circle the earth, through the seas and the low regions of continents."[11] (3) In the third conception that emerged with the work of Janssen and others, the mountain became no more than a *macro-tool* for the pursuit of science. Going back to Saussure's conception of the mountain as the "laboratory of nature," this conception however denied any specific interest in the mountain other perhaps than its reluctant acknowledgment as the antechamber of outer space, but no more, really, than the telescope already was a middle ground between the heaven and the earth.

Whether it was explored for itself or as substitute for even less accessible places on earth, the mountain remained, during this period, a destination not a station. At the beginning of the nineteenth century there was no scientific station in altitude where observations were continually performed. By 1900, however, mountain observatories devoted to meteorology,

[9] Bergon, *Creative Evolution*, chap. 4. For a further discussion of cinematographic geography, see below.

[10] Martins, *Du Spitzberg au Sahara*, 310.

[11] « Le piéton qui, dans l'espace de quelques heures, s'élève de la base du mont aux roches de la cime, fait en réalité un voyage plus grand, plus fécond en contrastes que s'il mettait des années à faire le tous du monde, à travers les mers et les régions basses des continents. » Élisée Reclus, *Histoire d'une montagne* (Paris: J. Hetzel, "Bibliothèque d'éducation et de récréation," 1880), 73. See also Jules Michelet, *La Montagne* (Paris: Librairie internationale, 1868).

astronomy, or vulcanology had become common.[12] There was nothing self-evident about the wish to observe the sky from a mountaintop. In his plea for mountain observatories, Edward Pickering himself had to acknowledge that as far the advantageous atmospheric conditions for astronomical observation were concerned "evidence so far collected is somewhat contradictory."[13] Living conditions in high altitude climates were uncomfortable, perhaps unhealthy. And as far as expenses were concerned, they were—well—astronomical. How were astronomers convinced to establish permanent stations in altitude?

A Precedent: The Fathers of the Grand Saint-Bernard

In reports written about observations carried out on the Faulhorn, scientists always made sure to emphasize that the Berghaus was located at a higher altitude than the Grand Saint-Bernard hospice. Since the Middle Ages, a small religious community, well know for the help they provided to stranded travellers, was installed near the famous pass between Switzerland and Italy.[14] In 1817, the Geneva scientist Marc-Auguste Pictet, a pioneer of alpinism with Horace-Bénédict Saussure and others, came up with the idea of setting up a meteorological station at the top of the Grand Saint Bernard pass. A typical observatory scientist from that time, Pictet's scientific interests were varied, his correspondents many. His main field of study was perhaps the "*physique du monde*" Humboldt suggested to him in 1796.

To scientists in the nineteenth century, dependability and regularity of observations became an obsession. While many considered that only military men had the discipline required for carrying out the task, more and more scientists designed self-registering machines for the task. A few, such as Jean-Baptiste Biot and Pictet, believed monks represented a good alternative.[15] On 14 September 1817, a series of observations was launched at the Grand Saint-Bernard, which underwent almost no break up to the present. There had been two previous attempts to establish a weather station there, respectively by the Turin Academy of

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[12] A. S. D. R. "Mountain Observatories," *Monthly Notices of the Royal Astronomical Society* 53 (1893), 289–90; and Edward C. Pickering, "Mountain Observatories," *The Observatory* 6 (1893), 287–93. On the Pic du Midi Observatory, see Jean-Claude Sanchez, *Le Pic du Midi de Bigorre et son observatoire: histoire scientifique, culturelle et humaine d'une montagne et d'un observatoire scientifique* (Pau: Cairn, 1999); and Emmanuel Davoust, *Observatoire du Pic du Midi: Cent ans de vie et de science en haute montagne*(Paris: CNRS, 2000).

[13] Pickering, "Mountain Observatories," 287.

[14] Cf. Horace-Bénédict de Saussure (1786), in *Le Voyage en Suisse,* 293.

[15] Cf. papers by Mazzotti, Widmalm, and Werrett in *The Heavens on Earth,* and by Stéphane Le Gars in a forthcoming issue of the *Cahiers François Viète.* On Biot's opinion of monks, see D. Aubin, "The Fading Star of the Paris Observatory in the Nineteenth Century", in *Osiris* 18 (2003).

Science and by the French Empire but neither was successful.[16] So, to ensure the success of his initiative, Pictet personally delivered meteorological instruments (barometers, thermometers, and hygrometer[17]), which he gave to the clergymen in exchange from their pledge to perform daily measurements, to carefully report them on a register never to leave the hospice, and to make on a monthly basis a copy to be sent to him by mail. Pictet also gave instructions for the regularity with, and the way in which, observations were to be carried out. For measuring the snow falling on the pass, Pictet provided no instrument, relying on the fathers to find a means of their own: any approximation, he wrote, would be better than nothing. As for the wind and the sky, Pictet provided a qualitative scale. Wind was to be observed in 8 directions and its strength in 4 degrees (4 being the strongest). The state of the sky would be stated as: clear, sun and clouds, covered, fog, rain and snow.[18] Pictet also provided the fathers with printed skeleton to fill in. Every day, observations were to be made at the same time as in the botanical garden in Geneva, that is, at sunrise and at 2 o'clock. Each month, observations were published in Pictet's *Bibliothèque universelle*, and later in the *Archives des sciences physiques et naturelles.*

Contingency ruled over the choice of this location. The only thing that was important for Pictet was altitude. He believed that the progress of meteorology required an investigation of the third dimension of the atmosphere. "But where to find, in our Europe, a dwelling [occupied] all year long, close to the limits of perpetual snows? Where to find men devoted enough to live there, and learned enough to appreciate the usefulness of such observations and to carry them out with the required regularity and precision?"[19] While scientific reasons were

[16] Cf. Inventaire des archives de l'hospice du Grand Saint-Bernard (http://www.aasm.ch/agsb/0114.html).
See AGSB 0120. Letter from Tuglure (?) baron de l'Empire to the prévôt (Ivrée, 30 décembre1809): Le préfet du département de la Doire propose au prévôt du St-Bernard de lui faire envoyer des observations météorologiques à faire à l'hospice du St- Bernard. Signé:. Papier, 2 fol., 18,8 x 25,5 cm, français.
See also AGSB 0124. Chanoine Deléglise, " Notice sur les observations météorologiques faites au Gd-St-Bernard depuis 1817" (1852).

[17] Instruments: 1 baromètre à réservoir, auquel est attaché un thermomètre dit de Réaumur (80 parties), un thermomètre à mercure portatif (observations de l'air extérieur), un hygromètre à mercure portatif (observations de l'air extérieur), un hygromètre à cheveu de Saussure, de construction perfectionnée. Le professeur Pictet changera le cheveu au bout de 2 ans environ.

[18] Inventaire des archives de l'hospice du Grand Saint-Bernard (http://www.aasm.ch/agsb/0114.html). AGSB Météo 01.

[19] « Les observations journalières n'ont lieu pour l'ordinaire que dans les couches inférieures de l'atmosphère qui reposent sur les lieux habités ; elles ne se rapportent guères qu'aux deux coordonnées horizontales de latitude

invoked for arguing that continuous series of high altitude observations were needed for the progress of meteorology, convenience was solely responsible for the selection of this specific observation post. Among the most important factors speaking for the Grand Saint-Bernard was that it was settled by clergymen: reliable observers who permanently lived on the spot. As opposed to the Faulhorn, however, the Grand Saint-Bernard never was particularly attracting to visiting scientists and tourists. For nineteenth-century sensibilities, as we shall see, a religious establishment overlooking a mountain pass was bound to exert less of a pull than a rustic hotel on an isolated mountaintop.

Mount Faulhorn: The Tourist's Perspective

"For a few years, ascents have been in fashion: every summer tourists leave all parts of Europe, flock to the Alps, and climb up the most inaccessible summits. […] Healthy and vigorous bodies [find in] the Alps […] an arena to deploy every physical and moral qualities."[20] As tourism developed in the Alps, the accessibility of certain hitherto out-of-reach spots of the Earth suddenly increased. Mount Faulhorn is a prime example of such place which suddenly rose into public prominence as a result of its increasing accessibility. After the Berghaus was opened and maintained by the Blatter family, this summit became a "meeting point of plants and travellers belonging to countries often far apart and to various climates."[21] Franz Liszt slept there with his lover Madame d'Agout in 1830. Mark Twain, Henry James, and Richard Wagner also spent the night there.[22] But as opposed to the hospice, it was not occupied all year round and not staffed by clergy.

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et de longitude, et l'influence de la troisième, de la coordonnée verticale, ne peut être exactement appréciée dans les petites différences de hauteur…

« Mais où trouver, dans notre Europe, une habitation de toute l'année, voisine de la limite des neiges perpétuelles ? Où trouver des hommes assez dévoués pour y vivre, et assez instruits pour apprécier l'utilité de ces observations et pour les faire avec la régularité et la précision requises ? Toutes ces conditions sont heureusement réunies dans l'hospice célèbre connu sous le nom du convent du Grand Saint-Bernard. »

Marc Auguste Pictet, *Bibliothèque universelle de Genève,* 6 (1817), 109 ; quoted in V. Raulin, "Sur les observations pluviométriques faites dans l'Aquitaine (Sud-ouest de la France) de 1714 à 1860. Appendice alpin," *Actes de l'Académie nationale des sciences, belles-lettres et arts de Bordeaux* 25 (1863), 621–636, on 627.

[20] Martins, *Du Spitzberg au Sahara*, 261.

[21] "De la géographie botanique," *Magazin pittoresque* 11 (1843), 282–4.

[22] Walter Benjamin also planed to go there with Gerhard Scholem in the fall of 1918. See Benjamin to Scholem (18 September 1918), in *The Correspondence of Walter Benjamin 1910-1940,* ed. Gershom Scholem and

The Faulhorn is a mountain in the Bernese Oberland, close to the Lake of Brienz. The top of the conic summit culminates at an altitude of 2,680 meters above sea level, roughly 2000 meter above the village of Grindelwald, the easiest point of access down in the valley, which was already famous among travellers for its impressive glacier. Up there, one found an inn established in 1823, open all summer long ever since, welcoming all sorts of tourists. The rudimentary hotel set up there was well located. From Grindelwald, itself easily accessible by road and boat from Bern, the summit could be reached in a half-day walk.[23] Paths were well marked and well kept, and guides who could be hired in Grindelwald were deemed useful but not necessary. For another fifty years at least, the Faulhorn hotel was reputed as the highest spot where accommodation was found in the Alps—if not the world, as Eurocentric commentators were then prone to say—and as such it drew an unusual crowd of travellers.[24] In fact, as early as 1855, a small hotel was built at the Saint-Théodule pass, in the Valais, which reached an altitude of 3350 meters above sea level.[25] Another famous hotel, not far from the Faulhorn but more accessible was opened : the *Rigi Kulm*(alt. ca. 1800 m) by Caspar Bürgi.[26] There was also a hotel, built by doctor Costallat, close to the conic summit of the Pic du Midi in the Pyrenees. But none had exactly the same cachet as the Faulhorn.

What made the Faulhorn's reputation was the view. The author of the *Decline and Fall of the Roman Empire,* Edward Gibbon, for example had a hand-painted panorama of the Faulhorn in his possession.[27] An isolated peak facing a breathtaking panorama of giant mountains, the Faulhorn stood for a mixture of exertion, accommodation at an altitude rarely accessible to the occasional tourist, and contemplation (especially of the sunset and sunrise that had become famous): "The traveller who can make up his mind to a steep walk," a British guide book from 1852 stated, "will in fine weather be well rewarded for making the ascent of

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Theodor W. Adorno, trans. Manfred R. Jacobson and Evelyn M. Jacobson (Chicago: Univ. of Chicago Press, 1994), 134.

[23] Already in 1811, Grindelwald was said to be a mere day and half from Bern, in Johann Gottfried Ebel, *Manuel du voyageur en Suisse,* trans. Jean Gaudin, 2nd ed. (Zurich : Orell, Fussli et Compagnie, 1811) 3:178–9.

[24] Even its status as the highest chalet in Europe was disputed to the Faulhorn hotel by William Harrison Ainsworth, "The High Alps," *New Monthly Magazine* 108 (1856), 285–305, on 293.

[25] Martins, *Du Spitzberg au Sahara,* 311.

[26] « Au sommet du Rigi, il n'y a que trios choses: une auberge, un observatoire et une croix. » Victor Hugo (1890), in *Le Voyage en Suisse,* 808.

[27] Dulau & Company, *Catalogue Number 231: Association Books, Manuscripts, Autograph Letters & Documents, Old and Modern Including Recent Purchases Made at the Disposal of the Library of Edward Gibbon* (London, n.d.), 41.

the Faulhorn. Before setting out he must understand that he should sleep at the top of the mountain: the chide object being to see the sun-rise from thence."[28] Among those who climbed up the mountain was the author of the *Three Musketeers,* Alexandre Dumas, who made the ascent in 1832—or at least he claimed he made it. As in most of his novels, the story of his trip to the Faulhorn is overfilled with picaresque adventures and picturesque descriptions. The panoramic view he described from the top owes much to the kind of "coup d'œil" studied by Charlotte Bigg.[29] It certainly was one of the attractions of the Faulhorn to offer a panorama over higher mountains to the South side dominated by the Jungfrau: "colossi with white shoulders and hair […] personify[ing] centuries holding hands and circling the world" and a panorama embracing half of Switzerland to the North.[30]

Of course disappointment was great when the weather was not up to expectations. On August 8, 1836, the young O'Flanagan found the Berghaus swimming in thick fog. "The uncertainty of weather," he wrote, "is a great drawback in this country, for it is very dispiriting not to obtain a good view, when you toil up to an eminence eight or nine thousands feet."[31] Like other alpine destinations, the Faulhorn became famous for the violence of its storms. Many visitors such as Alexandre Dumas took pleasure in spicing up their accounts by vividly painting apocalyptic pictures of advancing clouds overtaking the mountaintop, suddenly conjuring images of men at the mercy of the elements such as ships caught by the storm. In bad weather, sea and mountain were competing for the trophy of the most dangerous place for the traveller.

The grandiose contemplation of nature, whether at peace or in fury, was not the main character of the mountain as it was described by Dumas: hectic hunts, noisy drinking

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[28] *Bogue's Guides for Traveller,* vol. 2: *Switzerland and the Alps of Savoy* (London: David Bogue, 1852), 54. See also Thomas W. Hinchliff, *Summer Months in the Alps, with the Ascent of Monte Rosa* (London: Logman, Brown, Green, Longmans & Robert, 1857), 31.

[29] A first panoramic view from the top of the Faulhorn was apparently drawn by M. Weiss before 1811. See Johann Gottfried, Ebel, *Manuel du voyageur en Suisse: ouvrage où l'on trouve toutes les directions et les renseignemens necessaires pour recueillir tout le fruit et toutes les jouissances que l'on peut se promettre en parcourant ce pays-là,* 2nd ed. (Zurich: Orell, Fussli et Co., 1811), 3:183. See Charlotte Bigg, "Das Panorama, oder La Nature A Coup d'Oeil," *Nach Feierabend* 1 (2005), 15–33.

[30] Alexandre Dumas, *Impressions de voyage en Suisse,* 2 vols. (Paris: François Maspero, 1982), 1:343. See also Auguste Bourjot, "Un tour dans les Alpes," *Revue littéraire* 7 (1838), 60–98 and 377–419, on 385–8.

[31] James Roderick O'Flanagan, *Impressions at Home and Abroad; or, A Year of Real Life,* 2 vols. (London: Smith, Elder and Co., 1837), 2:82.

Germans, thunderous mountain storms, and a "macedoine" of travellers gone astray and to be rescued in the middle of the night. Accommodation was rustic and the company mixed:

> The company encountered by the tourist is a very miscellaneous character. German students, English and French gentlemen, travelling Americans, and Russian noblemen, enter into the composition of the groups which meet round the deal table in a sort of kitchen, which forms the only *salle à manger* of the establishment. The bed-rooms are small and crowded with beds, which are, at times, as crowded as the house. […] there is a certain amount of satisfactory entertainment: food and wine, which would be rejected in the valleys, are relished here, after the long walk.[32]

To maintain a hotel there obviously required much work, which, though crucial, was mostly invisible to tourists and scientists attracted by the place. In 1855, before the start of the summer season, the British chaplain at nearby Interlaken, reverent William Grendon Heathman, met "some twenty porters and female servants […] carrying at their back the commodities and requisites necessary to commence inkeeping. They had started as early as two o'clock in the morning from Grinderwald [sic], and had consumed just fifteen hours in their labour. […] Most of these Alpine porters, who carried everything at their backs, bore great weights" (one no less than 134 pounds). The work was by no means over after the ascents. "The first thing after arrival was to set to work and clear the habitation of the snow and ice with which the rooms were filled. After thus operation they kindled a blazing fire, and cooked the provisions."[33] In fact, visitors mostly noted the Spartan conditions of life on the Faulhorn, which stood in strong contrast to the beauty of the spectacle to be admired from there. "You must not for a moment imagine," reverent Heathman went on, "notwithstanding all our toil and discomfort, that we at all regretted our labour. Far from it, we were most amply rewarded. In the evening and in the morning we enjoyed one of the most extensive and astonishing views of the Alps, near and far, which are to be found in this land of wonders."[34]

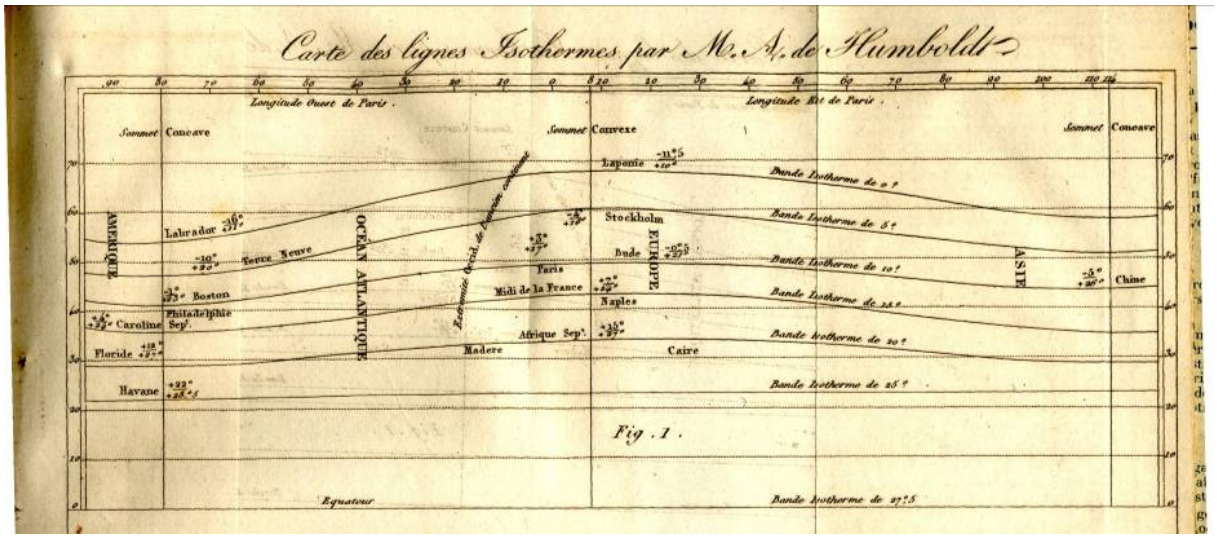
Singularity

In view of the above description, the lack of comfort, the promiscuity with loud visitors, and the inclemency of the weather, the Berghaus Faulhorn hardly seemed to have been a natural place for scientists to visit—except of course for the same reasons Victorian tourists did. The

[32] *Bogue's Guides for Traveller*, 2:55. See also Charles Packe, *The Spirit of Travel* (London: Chapman and Hall, 1857), 81–91.

[33] William Grendon Heathman, *Switzerland in 1854-55: A Book of Travel, Men, & Things* (London: Hope & Co., 1855), 135–6.

[34] Heathman, *Switzerland in 1854*-55, 136.



reasons for selecting Mount Faulhorn as a notable observation station in the growing networks put in place in the nineteenth century must therefore have been important. In the 1820s and 1830s, Humboldt, Gauss, Hershel and Quetelet endeavoured to put together various extensive networks of observers, especially in the fields of geomagnetism and meteorology, which would use comparable instruments and standard observing procedures. Other scientists, such as Auguste Bravais and Charles Martins, travelled abroad, to Lapland and Spitzberg Island, on board ships belonging to the French Navy, in order to study extensively certain particular spots on the Earth. As Fabien Locher noted, the magnetic crusade or the "landed ship" provided two models for the constitution of meteorology.[35]

To criticize the way in which discrete observations were used to gain knowledge about continuous processes (such as development or evolution), Henri Bergson introduced the concept of the "cinematographic" method in 1907. In *Creative Evolution*, Bergson emphasized that older methods for gaining knowledge about continuous process (of "becoming," as he called it) also existed. Classically, change was not approached by associating indistinct snapshots, each of them meaningless in themselves, but rather by focusing on singular moments. In the first decades of the nineteenth century, scientists engaged in extending the knowledge of the Earth were facing a similar dilemma. Humboldt's isotherm lines imposed an artificial continuity on scattered, "cinematographic" observations stations whose various singularities were actively erased (figure). While a complex story could be told about each point pictured on Humboldt's graph, none of their particularities (except name and coordinates) appeared. Admittedly, most stations Humboldt could gather

[35] Fabien Locher, "The Observatory, the Landed Ship and the Crusades: Earth Sciences in European Context, 1830-1850," *British Journal for History of Science*, forthcoming (March 2008), and Fabien Locher, "Le Nombre et le temps. La météorologie en France (1830-1880), " doctoral thesis (EHESS, 2004).

data from had never been chosen for purely scientific reasons. Only political and contingent rationales could explain why Paris and China figured, but not Madrid or Siberia. In fact, even in cinematographic observation networks, all stations were chosen because they were highly singular.[36]

Like other famous observation stations, the Faulhorn was chosen, for contingent reasons, as a representative of general trends. The dramatic spectacle visible from the mountaintop was said to inspire great questions about natural history and man's place in nature, well in tune with a Romantic conception of science. One stormy night on the Faulhorn, Auguste Bourjot for example reported to have been transported to semi-mythic origins of the earth.[37] On the "high altar of the Faulhorn," visitors believed to engage in a communion with nature.[38] This type of feeling was shared by scientists drawn to the Berghaus for reasons as diverse as the laws of meteorology, the influence of soil temperature on the flora, the motion of glaciers, or the influence of ingesting proteins on muscular exertion. To survey the scientific activities engaged at a specific location such as the Faulhorn helps to unpack the relationship between travel and science in the middle decades of the nineteenth

[36] Alexander von Humboldt, "Sur les lignes isothermes," *Annales de Chimie et de Physique* 5 (1817), 102–12; the figure appears on a folded sheet between pages 112 and 113.

[37] « Sur le Faulhorn, par une de ces soirées orageuses, si riches d'effets et de beautés fantastiques, on peut facilement se transporter aux premiers temps de l'histoire du globe, lorsque les grandes eaux venaient de se retirer, et que le soleil commençait à se remontrer au milieu des nuages. C'est bien là l'aspect d'une nature bouleversée, à peine sortie des convulsions de l'enfantement. La terre y est travaillée en tous sens ; de profondes rides ou d'énormes soulèvements de rochers attestent les luttes de toutes les puissances intérieures et extérieures. » Auguste Bourjot, "Un tour dans les Alpes," *Revue littéraire* 7 (1838), 60–98 and 377–419, on 407–8. Some physicists argued against the common perception that modern science was opposed to artistic sensibility to the sublime: Le public commence à revenir sur cette idée absurde émise autrefois, et que quelques personnes soutiennent encore aujourd'hui. L'étude des sciences exactes, disent-elles, est incompatible avec le goût des beaux-arts ; celui qui se passionne pour une découverte physique ou mathématique, est impuissant à apprécier un tableau ou une symphonie, il est incapable même de jouir des beautés naturelles, tant il est occupé de rechercher leurs causes. Il est réduit à ne voir partout que la science dont il s'occupe ; la seule idée qu'excite en lui une belle fleur odorante est sa composition en charbon, en oxygène et en hydrogène ; s'il voit les bas-reliefs mutilés du Parthénon, il examine la qualité du marbre, et si on joue l'adorable sérénade du *Don Juan*, il pense au nombre de vibrations qu'exécute dans une seconde chacun des instruments, qui se moquent si joyeusement du ton doux et tendre de la chanson. C'est précisément l'inverse qui est vrai. » P.-P. Déhérain, "La composition de l'atmosphère, à propos des travaux récents de MM. Boussingault et Pasteur," *Revue nationale et étrangère, politique, scientifique et littéraire* 9 (1862), 275–301 and 413–48.

[38] Martin Barry, *Ascent to the Summit of Mont Blanc in 1834* (Edinburgh: William Blackwood & Sons; London: T. Cadell, 1836), 3.

century. In particular, one is then able to underscore the delicate balance that existed between local specificities and opportunistic contingency. The relative accessibility and affordability of staying at the Berghaus Faulhorn, together with the obvious tourist attraction of the spot, were compounded with the special studies possible there.

The first person to go up the Faulhorn with a scientific resolve was the meteorologist Ludwig Friedrich Kämtz, from the University of Halle and later Dorpat. A dedicated reader of Humboldt, Saussure, and Deluc, Kämtz was bound to be attracted by the mountain. In 1832, he spent one month from 27 May to 24 June on top of the Rigi and from 11 September to 5 October on the Faulhorn. The following year, he would spend more time in both places.[39] Following precedents set by Eschmann on the Rigi and Horner in Zurich in January 1827, Kämtz observed a rigorous program of thermometric, barometric and hygrometric measurements at every hour of the day and organized similar measurements to be taken simultaneously in Zurich, Bern, and Geneva (table). The meteorologist was looking for laws that would apply even under extreme conditions. The singularity of the mountain environment is obvious in his treatise written in 1840. Storms and winds are said to be more violent on the mountain than in the valley. With respect to when the daily maximum temperatures are reached, the climate on the summit of a mountain is compared to seashore. A hypothesis conjectured by Humboldt, Saussure and Deluc, according to which the dryness of the atmosphere would be higher in mountain climates, is tested on the Faulhorn.[40]

[39] L. F. Kämtz, "Über die täglichen Barometer auf dem Rigi und dem Faulhorn. Aus einem Schreiben an Hrn. Leopold v. Buch," *Annalen der Physik* 103 (1833), 345–361; "Ergebnisse einer Reihe hygrometrischer Beobachtungen auf dem Rigi und dem Faulhorn. Schreiben an Herrn Leopold von Buch, von L. W. Kämtz," *Annalaen der Physik* 106 (1833), 43. See L. F. Kämtz, *Cours complet de météorologie*, trans. Charles Martin, with appendix by L. Lalanne (Paris: Paulin, 1843). Cf. Martins, *Du Spitzberg au Sahara*, 399.

[40] Kämtz, *Cours complet de météorologie*, 19n (daily maximum); 93 (dryness); 114 (for clouds) ; 253 (for Eschmann and Horner); on stroms, see L. F. Kämtz, "Beschreibung eines auf dem Faulhorne beobachten Gewitters," *Journal für Chemie und Physik* 59 (1833), 310–5.

Faulhorn.

Stunde.	Faulhorn.		Zürich.		Genf*).		Höhendifferenz.		Höhenabnahme für 1° R.
	Barom.	Therm.	Barom.	Therm.	Barom.	Therm.	Zürich.	Genf*).	Mittel.
0	247‴,308	4°,34	324‴,305	13°,83	322‴,465	13°,08	1158ᵗ,0	1129ᵗ,2	126ᵗ,8
1	7 ,251	4 ,26	4 ,159	14 ,53	2 ,313	13 ,73	58,8	29,5	114,8
2	7 ,210	4 ,09	4 ,044	15 ,00	2 ,205	14 ,03	58,5	29,5	108,8
3	7 ,174	3 ,69	3 ,917	15 ,14	2 ,124	14 ,08	56,5	28,4	103,8
4	7 ,136	2 ,82	3 ,891	14 ,62	2 ,057	14 ,01	53,4	25,9	99,0
5	7 ,128	2 ,10	3 ,937	13 ,61	2 ,065	13 ,38	48,8	22,1	99,3
6	7 ,142	1 ,64	4 ,014	12 ,28	2 ,123	12 ,31	45,1	19,0	106,2
7	7 ,093	1 ,45	4 ,137	11 ,14	2 ,257	11 ,69	44,0	18,5	113,7
8	7 ,104	1 ,45	4 ,278	10 ,36	2 ,393	11 ,06	44,4	18,2	122,6
9	7 ,108	1 ,21	4 ,363	9 ,81	2 ,483	10 ,37	43,2	16,6	127,6
10	* 7 ,097	* 1 ,14	4 ,401	9 ,04	2 ,532	10 ,01	* 41,2	* 16,4	* 136,3
11	* 7 ,074	* 1 ,08	* 4 ,390	* 8 ,55	* 2 ,527	* 9 ,75	* 40,0	* 15,9	* 139,9

*) Die Höhendifferenz zwischen Genf (Chougny) und Zürich ist noch nicht berechnet; eben so wenig sind die Berner Beobachtungen (fünf Mal täglich) benutzt.

As shown in the graph reproduced here, an important conclusion reached by Kämtz was that the daily variations of the instruments taken up to the Faulhorn did not follow those of the instruments in Zurich.[41] This graph is reproduced from Élisée Reclus, *La Terre: description des phénomènes de la vie du globe* (Paris, 1868). Note that the 1843 French edition of Kämtz's treatise was followed by a very interesting note by the civil engineer Léon Lalanne, a friend of Bravais' and Martins', about the graphic representation. As far as Kämtz was concerned, Mount Faulhorn was a highly singular site of observation from which special insights about meteorological laws could be gained. "These few results," Kämtz concluded, "show us that even such complex phenomena are ruled by some precise laws."[42]

[41] See Léon Lalanne, "Appendice sur la représentation graphique des tableaux météorologiques et des lois naturelles en général," in Kämtz, *Cours complet de météorologie.*

[42] Kämtz, "Ergebnisse," 44.

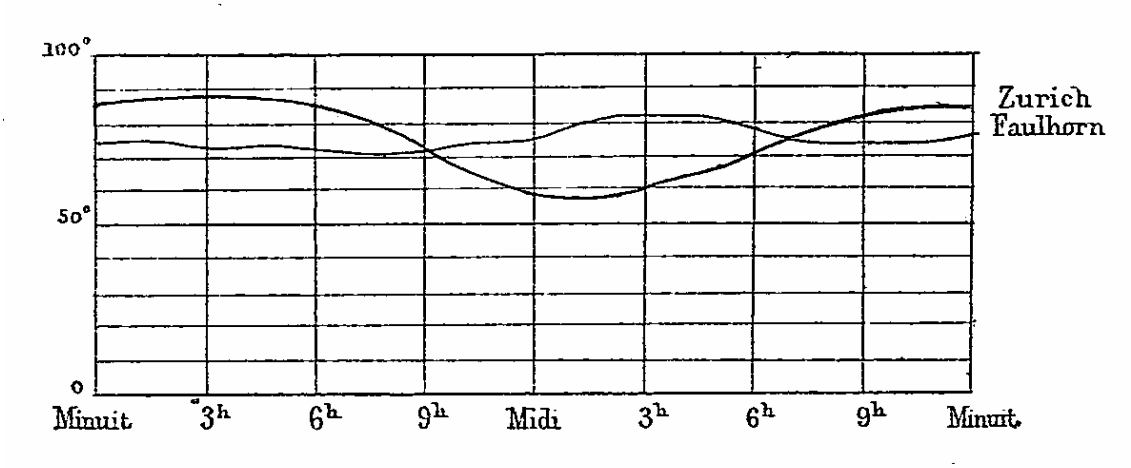


Fig. 124. Variations des degrés hygrométriques à Zurich et sur le Faulhorn.

The 1830s was a busy decade for the Berghaus Faulhorn as far scientific activity was concerned. In September 1832, James David Forbes, who was with Kämtz, measured the transparency of the atmosphere at Brienz and on the Faulhorn, showing that solar infrared radiation was composed of various types of rays that differed with respect to the way they were absorbed by the atmosphere.[43] In 1833, Professor C. Brunner, a chemist from the University of Bern, measured the composition of air samples taken at the top of Mount Faulhorn.[44] The young naturalist Edward Forbes botanized on the Faulhorn in 1835.[45] A Russian botanist also published the result of observations on several mountains including the Faulhorn.[46] Finally, in September 1837, J. D. Forbes brought a magnetometer with him up to the mountaintop magnetic and made some observations.[47]

After Kämtz's visits a second high-profile series of observations to the Faulhorn was undertaken by a group of French scientists in the early 1840s. From 19 July to 4 September

[43] J. D. Forbes, "On the transparency of the Atmosphere and the Law of Extinction of Solar Rays Passing Throught it," *Philosophical Magazine* (September 1842); Kämtz, *Cours complet de météorologie*, 150n.

[44] "Ueber die Bestimmung des Wassergehaltes der Atmosphäre," *Annalen der Physik* 96 (1830), 274–281. See Charles A. Culotta, "Respiration and Lavoisier Tradition: Theory and Modification, 1777–1850," *Transaction of the American Philosphical Society* 62 (1972), 3–41.

[45] Archibald Geikie and George Wilson, *Memoir of Edward Forbes* (Cambridge: MacMillan; Edinburgh: Edmonston and Douglas, 1861), 223.

[46] M. de Chaudoir, "Description de quelques genres nouveaux et de quelques espèces nouvelles ou inédites de carabiques," *Bulletin de la société impériale des naturaliste de Moscou* (1837), no. 3, 3–18, on 16 (with M. Lasserre).

[47] Discussed by A. D. Bache, "Observations of the Magnetic Intensity at Twenty-One Stations in Europe," *Transactions of the American Philosophical Society* 7 (1841), 75–100. Cf. *Edinburgh Transactions* 1841. For French trans., see J. D. Forbes, "Théorie des glaciers," *Annales de chimie et physique* 6 (1842), 220–301.

1841, Auguste Bravais, his companion Charles Martins and his brother Louis Bravais, worked with M. Wachsmuth who tended the hotel. The following summer, from 26 July to 18 August, Martins went back accompanied by an original meteorologist Athanase Peltier and another brother of Auguste, the abbé Camille.[48] They would come back in 1844 and 1846. Bravais and Martins' scientific program was especially broad. Discussing another ascent they made at that time, Élie de Beaumont wrote:

> After having admired the magnificient panorama, MM. Bravais, Martins and Le Pileur hastily installed their instruments: barometer, thermometer, hygrometer, psychrometer, pyrheliometer, actinometer, compass; instrument to measure the horizontal magnetic intensity; instrument to measure the inclination of the magnetized needle; instrument to measure electric tension; instrument to measure the boiling temperature of water; instrument to observe the tints of the sky and the transparency of the atmosphere, etc.[49]

Carrying so many instruments up the mountain of course required a consequent effort of organization. Martins and Bravais' accounts of their several mountain expeditions bear witness to the tasks facing scientists in the organization of their ascents:

> We had to oversee ourselves the preparation of the ascent; divide objects of lots of equal weights and draw lots among carriers in order to avoid quarrels and reclamations; busy ourselves with the preparation of food, buy bread and wine, distribute them ourselves the day of our departure. Thereby, instead of spiritual calm, instead of the meditation which the man of science requires so much before he undertakes his work, we were distracted by thousands of vulgar details, thousands or irritating difficulties that do not occur in ordinary circumstances of life, and which assailed us at the very moment when we felt the need of being free from all preoccupations.[50]

On the Faulhorn, on the other hand, as Janssen's letters quoted at the beginning of this article show, some of these worries would be eased or altogether avoided. Among the non-obvious advantages the Berghaus Faulhorn had was the possibility of recruiting local help among "the large swarm of licensed mendicants, who make their annual living out of strangers who throng their country during the summer months."[51] Indeed, the personnel of the chalet together with more transient local help was not only helpful in guiding scientists around the country, in carrying food, wood, water, and materials up to the mountain, and in preparing meals. Members of the Blatter family themselves were also recruited as technical assistants by

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[48] Charles Martins, "Remarques et expériences sur les glaciers sans névé de la chaîne du Faulhorn," *Bulletin de la Société géologique de France* 14 (1843), 133–45, on 134–5.

[49] Élie de Beaumont, *Éloge historique d'Auguste Bravais, lu à la séance publique annuelle du 6 février 1865* (Paris: Firmin Didot, 1865), 38.

[50] Martins, *Du Spitzberg au Sahara*, 274.

[51] Packe, *The Spirit of Travel*, 72.

many visitors. The glaciologist Daniel Dollfus-Ausset acknowledged the help of Jacob and Melchior Blatter in carrying out some observations for him.[52] Kämtz says that Samuel Blatter was useful assistant.[53] Reliance on the Blatter family however stands in stark contrast with other witness accounts emphasizing the alpine roughness of the hosts.[54]

On 30 August 1835, Gustav Bischoff, professor of chemistry and technology at the University of Bonn, placed an apparatus to track the temperature of the soil on the south side of the Faulhorn inn. This apparatus consisted in a wooden case filled with earth and sand in which a bottle filled with water was placed. The case was buried four feet deep and the hole dug up was filled with heat insulator. There was a small opening allowing a thermometer to be plunged in the water and the temperature of the soil was inferred from that of the water. Bischoff compared his observation at the Faulhorn with those he made in his chemical laboratory in Bonn and on the nearly hill of Löwenburg, 1173 feet above the Rhine. But according to his own procedures, one had to wait four weeks for thermal disturbances caused by digging the hole to subside. Bischoff therefore hoped he could rely on visitors to take regular measurements for him.

> I, therefore, request all natural philosophers and other travellers accustomed to such observations, who may happen to visit the Faulhorn, so celebrated for the grandeur of its scenery, to devote a few minutes to similar observation, and to have the goodness to communicate to me the result. For this purpose I have committed a thermometer to the care of the innkeeper on the Faulhorn, Hans Bohren, of which the observer may make use. The landlord will have the kindness to direct the observers to the spot where the box is buried, and will draw out the bottle.[55]

There was a Mr. Ziegler living in Grindelwald who took an interest in Bischoff's measurements and he observed a temperature on top of Mount Faulhorn on 22 September, 1835. In his scientific publication, Bischoff suggested his readers who might be passing by to pay a visit to pastor Ziegler in Grindelwald. This perhaps was not an unfounded hope. In his "hints to pedestrians," Alfred Wills recommended "a telescope, a compass, and a book for

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[52] See Daniel Dollfus-Ausset, *Matériaux pour l'étude des glaciers*, 8 vols. (Paris: F. Savy, 1864-1870).

[53] Kämtz, "Über die täglichen Barometer," .

[54] See e.g. George William Curtiss, *Lotos-Eating: A Summer Book* (London: Richard Bentley, 1852), 29–31.

[55] Gustav Bischof, *Physical, Chemical, and Geological Researches on the Internal Heat of the Globe*, 2 vols. (London: Longman, Orme, Brown, Green, and Longmans, 1841), 1:167; *Die Warmlehre der intern users Erdkörpers* (Leipzig, 1837). Note that on 12 April, 1835, Bischoff also wrote the superior of the hospice at the Grand Saint-Bernard to ask him to do the same kind of observations using an apparatus he would furnish the monastery. Cf. his letter, AGSB 0121.

pressing flowers" as "pleasant additions to the necessary outfit."[56] In the Alps, the tourist might be a nuisance to the scientist, but among the hikers flocking to the Berghaus there might be some amateur observers who would prove valuable to science.

As any other important stations in the growing observation networks of the middle decades of the nineteenth century, Mount Faulhorn exerted an ascendance that was due to its singularities only few of which were purely scientific in nature: an attractive environment, adequate infrastructure, local help, frequent visitors, etc.

Microcosm

As opposed to this more or less amateurish exploitation of the Faulhorn hotel by travelling tourists with diverse scientific interests, Bravais, Martins, and their companions, in the 1840s, turned the place simultaneously into an observatory, a laboratory and a botanical garden that they systematically exploited for a great variety of purposes. A few years earlier, Bravais and Martins had taken part in an expedition to Lapland and the Spitzberg sponsored by the French Navy on board a ship called *La Recherche*. Fabien Locher has characterized the type of station they established in Bosekop as "landed ships," because their routine of observation in the station was modelled after upon the watch on board ships. Bravais and Martins' expeditions to the Faulhorn form an important chapter in the birth of high altitude observatories.

> Every summer thousands of tourists climb up that peak [the Faulhorn], in order to enjoy the magnificent view of glaciers and snows of the Oberland. The inn set up to host them became the meteorological stations of MM. Martins and Bravais. They recreated the observatory of Bossekop and from 17 July to 5 august, they made a series of observations similar to those of Lapland.[57]

Struck by the similarity of the flora in both places, they were especially thorough in their botanizing. Louis Bravais, Auguste's brother, played an important role in this activity. With Martins, he collected samples of 132 different species, from which they conclude that the flora of the Faulhorn corresponds to that of Northern Lapland. To find vegetation similar to that of the Spitzberg one had to go above the line of eternal snows (and thus higher than the

[56] Alfred Wills, *Wandering among the High Alps* (London: Richard Bentley, 1858), 404.

[57] « Des milliers de touristes montent chaque été sur ce pic, afin de jouir de la vue magnifique des neiges et des glaciers de l'Oberland. L'auberge établie pour les recevoir devint la station météorologique de MM. Martins et Bravais. Ils y rétablirent l'observatoire de Bossekop, et, du 17 juillet au 5 août, ils firent une série d'observations semblables à celles de la Laponie. » Élie de Beaumont, *Éloge historique d'Auguste Bravais*, 34.

Faulhorn).[58] This explains in part why they later organized a scientific expedition sponsored by the French Ministry of Public Instruction up to the Mont Blanc in 1844. Twenty years later, Martins reaffirmed his strong belief in the rigorous parallel between latitude and altitude. The Mont Ventoux was a microcosm: "all the climates of Europe, from that of Provence and the North of Italy to that of Lapland, are gradually represented on the flanks of the Ventoux."[59] Compared with the studies they had made in the polar region, their investigation of high altitude climate was precious, allowing to "distinguish between phenomena produced by the lowering of temperature from those that can be especially explained by a great elevation above the level of the seas. In a word, they lead us to a *rigorous parallel between the influences of latitude and altitude*; and thence to the most varied and the most fruitful applications […] to agriculture, hygiene and consequently to the well-being of the population destined to live in mountainous countries."[60]

To explain of the parallel between altitude and latitude, Bravais and Martins devoted much effort to the study of all aspects of that environment. Bravais and Martins dutifully repeated observations made by Kämtz. More, they made 152 barometric measurements, day and night, every three hours. Not only were these confronted with Kämtz, they also serve to measure the height of the mountain. In "the great struggle between the barometer and the theodolite," they declared no winner: the means obtained by the first and second methods being 2862 meters and 2683 meters, respectively.[61] Complete series for temperature, atmospheric pressure and humidity were obtained. Although definite conclusions eluded them, they remained optimistic: "the time will come when science will know why certain vegetal species venture so far from their native countries, while others seem stuck within the limits of a narrow location."[62]

Like Forbes, Bravais was interested in testing whether the magnetic needle would exhibit a singular behaviour at high altitude. For this he used the same needle whose oscillations he had measured in Paris, Orléans, Dijon, Lyon, Besançon, Bern, Basel, Soleure, Thun, Brienz, and later on the Mont Blanc. The result of such effort however was disappointing:

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[58] Martins, *Du Spitzberg au Sahara*, 95, 273. They also observed animals, a part of their account to appear in the popualr press : See "Le campagnol des neiges," *Le Magazin pittoresque* 11 (1843), 15–16.

[59] Martins, *Du Spitzberg au Sahara*, 401

[60] Martins, *Du Spitzberg au Sahara*, 309–10. My emphasis.

[61] Martins, *Du Spitzberg au Sahara*, 305.

[62] "De la géographie botanique," *Magazin pittoresque* 11 (1843), 282–4.

> The influence of altitude on the intensity of terrestial magnetism did not manifest itself in an obvious manner. No law emerged from the data thus obtained. […] What should be concluded from such uncertainties? Nothing, other than the need to perfect our means of study with respect to magnetic forces.

Martins held on to the positivistic belief that when means of observation would be precise enough, "the law will manifest itself: thus does science itself teaches us the nature of the gaps that remain to be filled and show us the type of improvement they demand."[63] Negative results were also meaningful. Similarly, the French scientists had brought with them several tightly sealed glass jars, which they filled with air sampled on Mount Faulhorn. Analyzed in the laboratory of Jean-Baptiste Dumas in Paris, the content of the jars showed, contrary to claims made by John Dalton, that the proportion of oxygen was not sensibly different from the air of Paris.[64] Similarly, using an apparatus designed by Victor Regnault, of the Collège de France, careful experiments were made to determine differences in the temperature at which water boiled as a function of atmospheric pressure and altitude.[65] Even the beautiful sunrises and sunsets of Mount Faulhorn could not escape their measuring frenzy.[66] If the mountaintop differed from the valley neither in the composition of its air, nor in the characteristic of its magnetic field, the parallel between altitude and latitude seemed established.

In his book, Martins summarized the impressive but seemingly incoherent list of topics observed above 2000 meters by Saussure, Agassiz and Desor, by Bravais and Martins, by the borthers Shlagintweit and Dollfus-Ausset: "Oscillations of the barometers and the thermometers; the relative humidity of air at various depth; the radiance of snow surfaces at night, as well as that of plants and other bodies in nature; the relative intensity and the speed of ascending and descending sound; the complex and interesting phenomena of glaciers; vegetation and animal life in these high regions; and, at last, the physiological phenomena

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[63] Martins, *Du Spitzberg au Sahara*, 300–1.

[64] "Analyse comparative de l'air à Paris, à Berne et sur le Faulhorn," *CRAS* 13 (1841), 634–7. See P.-P. Déhérain, "La composition de l'atmosphère, à propos des travaux récents de MM. Boussingault et Pasteur," *Revue nationale et étrangère, politique, scientifique et littéraire* 9 (1862), 275–301 and 413–48.

[65] A. Peltier and A. Bravais, Observations faites dans les Alpes sur la températire de l'eau," *CRAS* 18 (1844), 572–83.

[66] Bravais, "Observations crépusculaires faites en Suisse, à une élévation de 2680 mètres au-dessus de la mer," *CRAS* 18 (1844), 727–9. See also : Charles Martins, "Remarques et expériences sur les glaciers sans névé de la chaîne du Faulhorn," *Bulletin de la Société géologique de France* 14 (1843), 133–45 ; "Note sur le groupe du Faulhorn dans le canton de Berne," ibid. 13 (1842), 372–4.

manifesting themselves in man." The results of these observations were now inserted in treatises of "physics, meteorology, *physique du globe*, botanic and zoological geography."[67]

Macro-Tool

A microcosm of the climates of Europe, as well as a singular environment to be studied for itself, Mount Faulhorn was moreover turned by the multidisciplinary practice of Bravais, Martins and their collaborators into a gigantic instrument. It was not only an observatory for the meteorology of the extreme, not only a botanical garden for the arctic flora; it was also a huge open-air laboratory where special experiments could be attempted. One of the most interesting experiments they performed on 24 –27 September 1844 was to measure the speed of sound (see figure).

The speed of sound had already been measured several times, including in 1822 by a commission composed of Prony, Bouvard, Mathieu, and Arago, together with Gay-Lussac and Humboldt. But Bravais and Martins thought it was useful to insure that the velocity would be the same for ascending and descending sound waves. They carried a small cannon weighing 23 kilos to the top of the Faulhorn, while another was left near the Lake of Brienz. A small light flashed whenever they were fired and the time between the appearance of the light flash and the perception of sound was measured using Breguet chronometers. Weather data was moreover gathered; personal equation measured. Once more, however, the result of the experiment was nil: that is, it failed to reveal anything new, except that interesting experiments could be carried out in such environment.[68]

In 1864, for a physiological experiment, Mount Faulhorn was preferred to the treadmill. Adolf Eugen Fick (1829-1901), a physiologist at the University of Zurich, and Johannes Wislicenus (1835-1903), professor of chemistry at Zurich, climbed up the Faulhorn to validate a hypothesis advanced by the chemist Justus Liebig according to which protein alone powered muscular contraction. The German-trained spectroscopist Edward Frankland who was Fick's brother-in-law and also related to Wislicenus went up with them. Prior to the climb, they eliminated protein from their diet. They collected urine three times: before, immediately after reaching the hotel and the morning after. "We preferred the mountain to a

[67] Martins, *Du Spitzberg au Sahara*, 309.

[68] Bravais and Martins, "Experiences relatives à la vitesse du son dans l'atmosphère," *CRAS* 19 (1844), 1164–74; Bravais and Martins, "De la vitesse du son entre deux stations également ou inégalement élevées au-dessus du niveau de la mer," *Annales de chimie et de physique* 13 (1845), 5–28. See also Maurice Girard, "Le son dans l'air et dans l'eau," *La Nature* (1877), 103–6, 137–9, and 145–6, figure on 145.

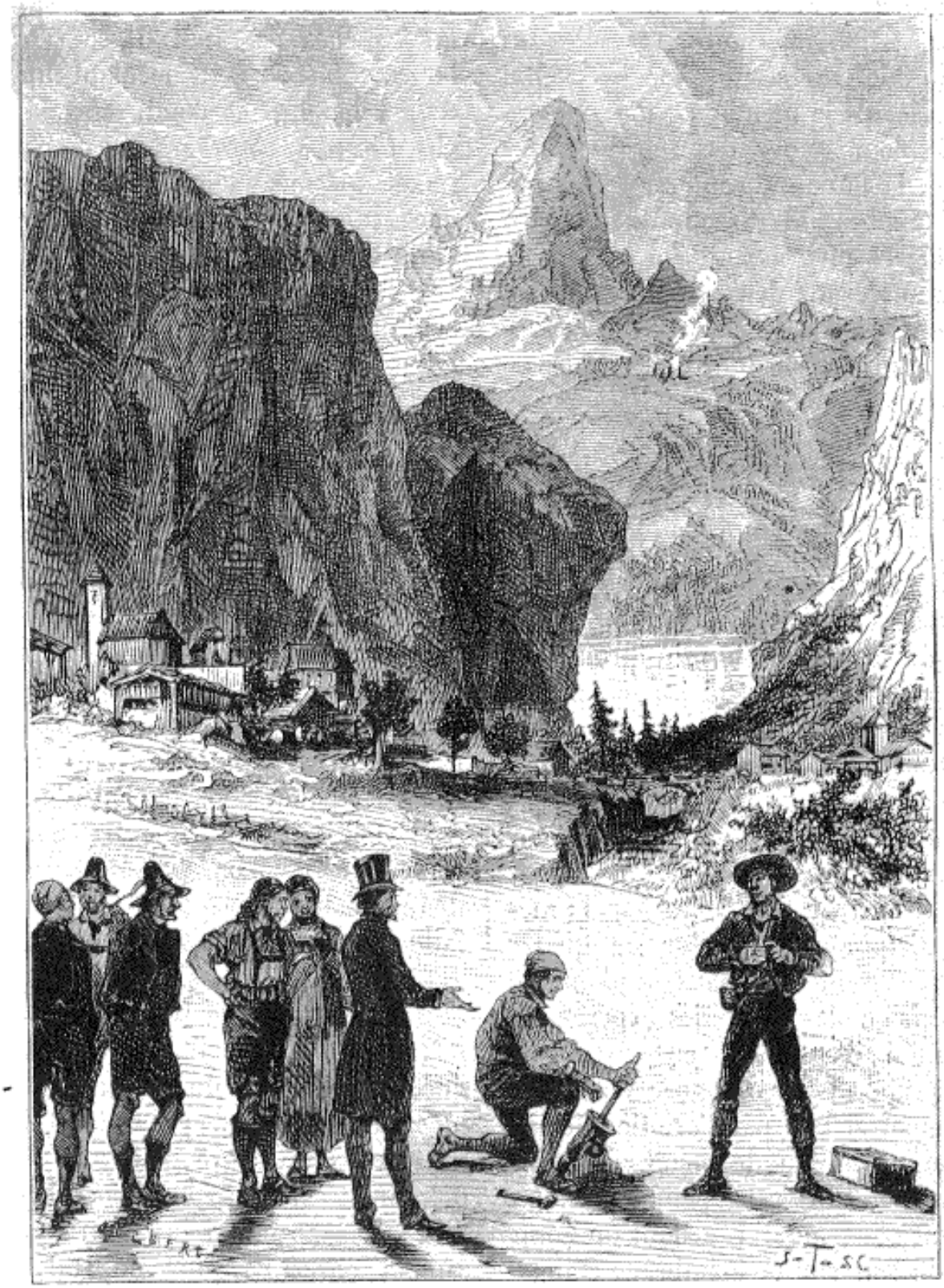
treadmill, not merely because the ascent is more a entertaining employment, but chiefly for the reason that was had no suitable treadmill at our disposal."[69]

Let us now go back to Janssen who also climbed the Faulhorn that same year, on 16 September. It is not known whether he met Frankland on that occasion, or read the poem entitled "Muscular power, or the Ascent of the Faulhorn, A Diuretic Ditty" of which a handwritten copy apparently remains in in Frankland's papers.[70] A Humboldtian at heart, Janssen had missed his chance to follow in the footsteps of his model when he fell sick with dysentery in Peru before he could observe an eclipse in the Andes. As soon as the possibility of using spectral analysis to determine the chemical constitution of the sun and other celestial bodies was demonstrated by Kirchhoff and Bunsen, Janssen devoted his energy to this art. Observing in Paris in the evening and in the morning, he suspected that some lines, which he named "telluric lines," were due not to the sun, but to the atmosphere of the earth, and more specifically to water vapour in the atmosphere. In 1862, he requested and obtained funds from the Government to go and study the phenomenon in Italy in a dryer climate. But the evidences he gathered failed to satisfy him.[71]

[69] Colin Archibald Russel, *Edward Franklin: Chemistry, Controversy and Conspiracy in Victorian England* (Cambridge: Cambridge Univ. Press, 1996), 423. See also Frank I. Katch, William D. McArdle, Victor L. Katch, and James A. Freeman, "Exercise Nutrition: From Antiquity to the Twentieth Century and Beyond," *Nutrition in Exercise and Sport*, 3rd ed., ed. Ira Wolinski (Boca Raton, NY: CRC Press, 1998), 1-48.

[70] Russel, *Edward Franklin*, 438, n. 45.

[71] Aubin, "Orchestrating."



Expérience sur la vitesse de son dans le sens oblique, entre Tracht et le Faulhorn, en Suisse. (MM. C. Bravais et Martins. Septembre 1844.)

On 18 June 1864, he asked for more money, this time to go to study solar spectra viewed from the top of a mountain. He wished to choose a station at high altitude, but where

the temperature would nonetheless allow him to observe. The Faulhorn imposed itself as the obvious choice. Kämtz, Bravais and Martins had already lauded the clarity of the air and the remarkable sunlight observable there: "The transparency of the air was so great, that I frequently saw Jupiter before sunset; the polar and some other stars near the zenith were visible, at a mean, ten minutes after sunset."[72] Although the weather was not favourable at first, the sky soon cleared and Janssen could confirm his hypothesis. But the evidences again required further confirmation. In Geneva, he observed the spectrum of a bonfire he had ignited on the other side of the lake. The same lines were observed. But Janssen still was not totally satisfied. Back in Paris, he was allowed to conduct some experiments in the pipes of the gas experimental factory in La Villette. In conditions that seemed to be entirely under his control Janssen was at last satisfied with the evidence he had obtained.[73]

The moral of Janssen's story, as I see it, was the temporary disqualification of the mountain as far as astrophysical observations were concerned. The great tradition of outdoor experiments now was on the wane. The physical sciences were in the process of being enclosed in the confines of elaborate laboratories whose walls would eliminate as much as possible external disturbances. In Janssen's case, the mountain had been a useful tool for showing, once more, the absence of an effect, or at least the diminution of an effect—while telluric lines were *not* observed on the mountaintop (which was the expected result), the water vapour spectrum *was* observed in the laboratory at La Villette. Significantly, the mountain observatory of the Faulhorn had now run its course and, as far as I am aware, would not be the site of major scientific adventures again.

Conclusion

In July 1862, the great man of mountain science John Tyndall climbed up the Faulhorn with the biologist T. H. Huxley. He was far from sharing the universal enthusiasm for what he

[72] L. F. Kämtz, "Meteorological Observations Made on the Summit of the Faulhorn in Switzerland," *Edinburgh New Philosophical Review*, (1833), 335–338, on 336 [excerpts from a letter to Gautier published in *Bibliothèque universelle* (September 1832)].

[73] Archives nationales F17/2972 and 2977. On La Villette, see Émile Sainte-Claire Deville, *Manuel de chimie gazière : méthodes et procédés des essais et analyses en usage à l'usine expérimentale de la Villette de la Société du Gaz de Paris*, 2nd ed. (Paris: Dunod, 1933 [1921]). The Miniister of Public Instruction, Victor Duruy, seemed happy with the report he received from Janssen two years later, but did not know what to do with it, scribbling in the margin: « Voilà un mémoire très important. Comment se fait-il qu'on ne m'en ait point parlé ? Qu'en fait-on ? »

called the "ignoble Faulhorn."[74] Four years later, Tyndall repeated Janssen's experiment on the Faulhorn.[75] But Tyndall seems never to have been comfortable on that mountain: "I disliked the ascent of the Faulhorn exceedingly, having followed a monotonous pony-track up the ugliest of mountains."[76] One may conjecture that the mountaineer was repelled by the lack of challenge this hike presented and by the excessive crowd encountered there. The Alps that attracted him were not easy to reach. Like Tyndall, Bravais and Martins had praised adventurous science as a nice and appropriate reward for the young:

> Nights spent in shacks, even under a stone, near the limit of eternal snows; the true difficulties and the serious danger of glaciers; the unexpected obstacles, the vertical rocks blocking the way to the desired peak, the sudden cold, the effects of air rarefaction; the clouds suddenly covering the mountain in a thick fog; the storms and the lightening that so often hits the peaks, darkness catching the traveller in the middle of these deserts if snow and ice: here are adventures worthy of the vigour and aspirations of the masculine and hardened youth. What pleasure it is to triumph over the obstacles and to face perils where life, in the end, is rarely at stake, and what reward after the victory![77]

With the foundation of the Alpine Clubs, mountain science was professionalized, and exploration more physically demanding. The mountain was no longer a singular station in observational networks, no longer microcosm or macro-tool. A huge playground, the mountain attracted for what it was.

Astronomers and meteorologist would soon be drawn to the mountain again to establish permanent stations at high altitudes. When Janssen drew astronomers' attention back

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[74] John Tyndall, *Hours of Exercise in the Alps* (London: Longmans, Green and Co., 1871), 258. See Leon Huxley, *Life and Letters of Thomas Henry Huxley*, vol. 1 (London: MacMillan, 1900), 234.

[75] John Tyndall, *Hours of Exercise in the Alps* (London: D. Appleton, 1872), 272; repr. In *New Fragments* (London: D. Appleton, 1896), 459.

[76] John Tyndall, "From Lauterbrunnen to the Æggish-horn by the Lauwinen-thor," *Vacation Tourists and Notes of Travel in 1860,* ed. Francis Galton (Cambrdige: MacMillan, 1861), 307.

[77] « Des nuits passées dans les chalets, et même sous une pierre, près de la limite des neiges éternelles ; les difficultés réelles et les dangers sérieux des glaciers ; les obstacles imprévus de rochers verticaux barrant l'accès de la cime désirée ; le froid subit, les effets de la raréfaction de l'air ; des nuages, enveloppant tout à coup la montagne dans une brume épaisse ; les orages, dont la foudre frappe si souvent les sommets ; l'obscurité surprenant le voyageur au milieu de ces déserts de neige et de glace : voilà des aventures dignes de la vigueur et des aspirations d'une jeunesse virile et bien trempée. Quel plaisir de vaincre des obstacles et de braver des périls où la vie est en définitive rarement en jeu, et quelle récompense après la victoire ! Du haut du sommet vaincu, on voit le monde à ses pieds, l'œil se promène au loin sur les vallons et sur les montagnes. » Martins, *Du Spitzberg au Sahara*, 261–62.

to the usefulness of mountain observations again in 1888, his goals were as elevated as always promising nothing less than solving the riddle of extraterrestrial life:

> Astronomy and above all Physical Astronomy will be led to use more and more elevated stations. […]The mountain and above some mountains will therefore play a great role in the Astronomy that is coming. This Astronomy will no doubt solve very high questions: […] whether the stars we see are inhabited, whether life exists beyond the earth, and whether beings similar to us live in other worlds.[78]

Soon, Janssen started to lobby intensely in favour of setting up an observatory on the Mont Blanc—a huge public, if not scientific, success.[79] And mountain observatories started being built everywhere around the world. But the adventurous spirit seemed to have been left far behind. He himself had "climbed" up the Mont Blanc on a chair carried by several men! Scientists Janssen, as much as Tyndall, were tourists no more.

[78] Janssen, "Le spectre de l'oxygène et l'atmosphère terrestre," *Revue scientifique* (15 décembre 1888) and several other places ; repr. *Œuvres scientifiques*, 2:115. See also "Compte rendu d'une ascension scientifique au Mont Blanc" *CRAS* 111 (1890), 431 ; repr. *Lectures académiques, discours*, 71–92 and *Œuvres scientifiques* 2: 195–214. One year earlier, Janssen went to the Pic du Midi meteorological observatory: Jules Janssen "Sur l'application de la photographie à la meteorologie," *CRAS*, 105 (1887), 1164 ; and "Sur des photographies météologiques prises au Pic du Midi," *Comptes rendues des séances de la Société de géographie* (1888), 38 ; both repr. in *Œuvres scientifiques*, 2:50–4 and 66–70.

[79] Jean-Paul Richalet, "The Scientific Observatories on Mont Blanc," *High Altutude Medicine and Biology* 2 (2001), 57–68.