

THE WORK OF LAUSSEDAT
AND
EDUCATION IN PHOTOGRAMMETRY AT THE
NATIONAL SCHOOL OF ARTS AND CRAFTS, PARIS*

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FOREWORD

THE revival of the International Congress of Photogrammetry through the unsparing efforts of the International Society of Photogrammetry again offers to the assembled scientists and technicians a means of comparing their work and sharing their experience. It seems to me, however, that we would be remiss in our sense of intellectual fellowship if we did not also recall on this occasion the inspiring figure of the founder of our applied science, Aimé Laussedat, who established during 1881 to 1900 the first training course in photogrammetry at the School of Arts and Crafts in Paris, where he preceded me as Director.

Inasmuch as the Committee on Education desires to accept this paper for publication, I should also like briefly to review the developments of photogrammetric education at the School of Arts and Crafts and to examine objectively its purposes, means, and limitations.

THE WORK OF LAUSSEDAT

In 1864 Laussedat was invited by the School of Arts and Crafts to teach a course of applied geometry as an assistant to Baron Ch. Dupin, whom he succeeded in 1873. An officer of the Corps of Engineers and a former student of the Polytechnical School, Laussedat had already distinguished himself by his original investigations which constitute the first conclusive experiments in photogrammetry. It was precisely the originality of this work which induced the council of the school to engage him.

In the course, open to the public and intended for all who make use of geometry in their profession, the applications to topography were naturally the largest. Laussedat desired to make the new methods immediately useful here. In his announcement he planned: "To make a ground survey with the aid of perspective views and especially of photographs, discussing the degree of precision of planimetry, usefulness of this procedure in traveling and rapid reconnaissance, and directions helpful to landscape photographers. . . . Also the extension of the photographic method to surveys of buildings and machinery."

What was, then, this method in 1864? We find information in the communication presented by Laussedat to the French Academy of Sciences in 1859, and in the report of Laugier to the Academy in 1860.

After recalling how the illustrious Beautemps-Beaupré succeeded in compiling hydrographic charts by employing panoramic views, Laussedat pointed out that plane tabling by the method of intersections, ordinarily used by topographers, "in essence is nothing else but plotting a map in the field with the aid of natural perspectives."

* These two papers constitute the communication made by the author to the VI International Congress of Photogrammetry at The Hague in 1948. Translation from the original French is by Dr. V. L. Skitsky of the U. S. Geological Survey.

Laussedat's use of the camera clara of Wollaston in 1851 for delineating two perspective views from the extremities of a base of known length and position enabled him, Laugier reported, to draw the corresponding map for the Committee on Fortifications. The progress of photography was offering then the possibility of plotting in the field in a few minutes perspective views infinitely more detailed than had been previously possible. At the same time the line of horizon could be drawn easily for them if the surveyor had been careful to determine with an instrumental level a certain number of points situated on the horizon. Laugier's report explains how Laussedat verified the precision of his method. He took photographs of a section of Paris from two stations, one on the steeple of the Church of Saint-Sulpice and the other on the observatory of the Polytechnic School. Then, measuring on the map of Paris prepared in 1839

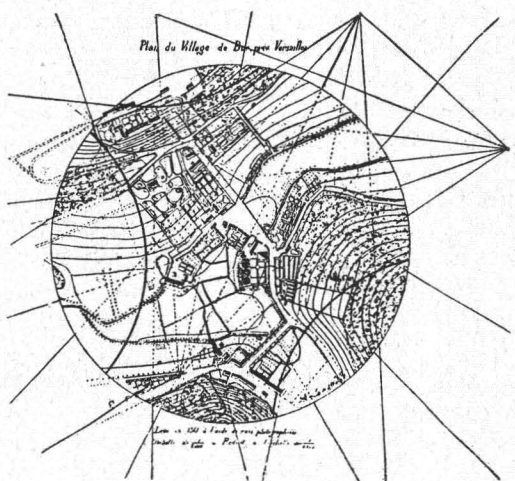


FIG. 1

the distance between the two stations (1233 metres), he determined from the photographs the location of several salient points, such as the Watchtower of the Palace of Justice, spire of the Cathedral of Notre Dame, and so on. These points were placed by him so accurately that they coincided precisely with the map. Similarly, he calculated the altitude of several elevations and obtained very satisfactory approximations. Laugier concluded in his report that the use of "photography in the preparation of maps and especially in military reconnaissance deserves the approbation of the Academy."

Accordingly, the following year the French General Staff invited Captain Laussedat to make in the presence of a commission, composed of officers of the Corps of Engineers of the Imperial Guard, a survey of the village of Buc near Paris. This operation was performed in three hours with the use of eight collodion wet-plate exposures taken from four different stations. The museum of the School of Arts and Crafts preserves the originals of these photographs and the map of a surface of 200 hectares¹ on a scale of 1:2,000, prepared in four days, of which about two days were used for the map and two for the delineation of relief (see Figure 1).

Laussedat himself summarized the conditions for the success of his method

¹ One hectare = 2.471 acres.

as follows: (1) Perspective exposures projected upon rigorously vertical plane surfaces; (2) rigidly standardized focal length for photography; and (3) horizon line and principal point indicated on each exposure.

To satisfy these conditions, Laussedat perfected the camera obscura of his photographic apparatus by equipping it with a level and viewfinder, and had a portable model constructed, which he called a phototheodolite (see Figure 2).

Beginning with the historic date of 1861 a photogrammetric crew, directed by Laussedat or his assistant Captain Javary, was assigned to preparing maps of areas in the Alps, at Toulon, and in the Vosges Mountains, totaling 72,000

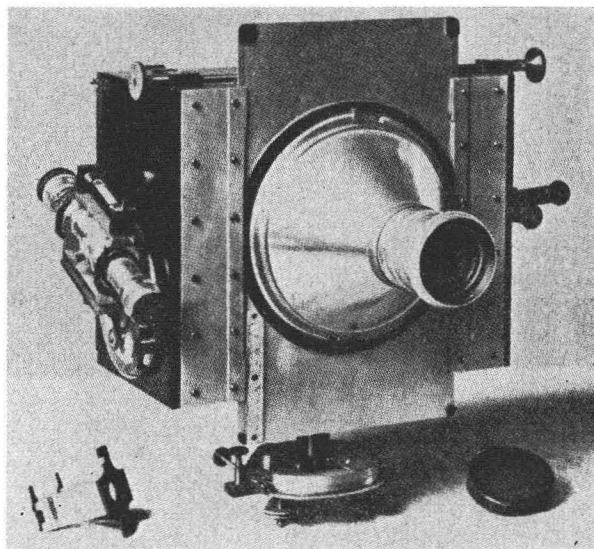


FIG. 2

hectares from 1863 to 1870. During the German siege of Paris the defenders took advantage of the same procedures for directing their artillery fire with precision upon enemy fortifications.

Thus, the School of Arts and Crafts had added to its faculty an innovator of genius. In 1871 Laussedat was entrusted with the painful task of tracing the new Franco-German border. One day at Bussang, at the base of the balloon of Alsace, the chairman of the German Commission, General von Strautz, said upon arriving from Berlin that officers there had spoken enthusiastically to him of the method of Laussedat, reconnaissance with the aid of photography, which they themselves had applied in the war during operations at Strasbourg and Paris.

Thus, Laussedat was not concerned with secrecy and profit, like all true creative spirits. Once his writings were published, he was pleased with their dissemination. No better proof can be given than by quoting from Dr. Guido Hauck's paper published in the Berlin journal, *The Photographic Archives*, in 1884: "In Germany the fundamental works of Laussedat came to be known for the first time in 1865 through an article of Mr. Girard in *The Photographic Archives*. Then Mr. Meydenbauer availed himself of the idea; by profiting from the development of large and rectangular photographic objective plates which gave centrally correct perspective views of 90° in amplitude, he made the method practical and popularized it."

Gradually a stubborn opposition to photogrammetric methods developed within the French military services. But Laussedat was able to rejoice over the international successes of photogrammetry, being in correspondence with scientists the world over. Porro in Italy prepared a map of the Alps on a scale of 1:100,000 starting with 1878. Dolezal worked in Austro-Hungary. Deville, a French-Canadian appointed director of topographic services in Canada, introduced stereophotography and successfully conducted since 1881 remarkable surveys in the Rocky Mountain region.

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Although the strong personality of Laussedat had a world-wide influence, his French followers admittedly were relatively few: the Vallot brothers compiled during 1893-1907 the map of Mont Blanc, and Gustave Le Bon, Legros, and Monet applied the same procedures to archaeology and exploration. Should the causes be sought in a routine spirit of the French Topographic Services, incorporated in the military organization? Or are they, more likely, due to a too slow appreciation of the many essentially peaceful and industrial applications of photogrammetry, to which Laussedat had pointed?

When Laussedat retired in 1900, his course of applied geometry was changed to a mathematics course in view of its many applications to industry, and all public instruction in photogrammetry ceased in France.

More than 30 years elapsed before Parliament finally created in 1937 the chair of photogrammetry at the School of Arts and Crafts on the initiative of de Monzie, Minister of National Education. To this chair was appointed the late, much lamented Henri Roussilhe, who honored me with his friendship. He is well known to all photogrammetrists because he was Commissioner-General of the 3rd International Congress in 1930.

Roussilhe, as he told us in his inaugural address, claimed an intellectual kinship with Laussedat. Like the latter, he was a former student of the Polytechnical School; likewise persevering, independent, and eager; likewise an inventor of ingenious instruments and new methods. Assigned to the artillery fire-control personnel during the first world war, he worked ceaselessly on perfecting suitable equipment for the utilization of aerial photogrammetry in large-scale planimetric mapping. After the end of the war, Albert Lebrun, then Minister of the Liberated Regions, appointed Roussilhe to organize the property reconstruction service, which was established for retracing in the shortest possible time the private property boundaries in ten devastated provinces of France covering an area of four million hectares. Aerial photography with the related plotting methods, perfected in 1915, and the construction of an automatic rectification apparatus gave the solution to this problem. The use of aerial views, which proved so fruitful, had begun.

Roussilhe himself taught with much success from 1937 to 1939. Then the war, and later illness, compelled him to ask Raymond Martin, his most faithful student, to assist him. The latter acquitted himself to this duty with competence and perfect devotion during 1940 to 1945.

In 1946, at the death of Roussilhe, Poivilliers was invited by the council of the school to occupy the chair of photogrammetry, as his entire career had been

devoted to the perfection of photogrammetric techniques and equipment. It is hardly necessary to repeat that, since 1920, Poivilliers had offered to the French Geographic Service a project of continuous plotting of maps from aerial photographs taken under any unknown conditions. The stereotopographic instrument of Poivilliers can now execute very rapidly direct plotting from stereophotographic pairs with exceptional precision.

Thus, the School of Arts and Crafts distinguished itself by selecting in one century for teaching photogrammetry three engineers who brought this science through its three decisive stages: Laussedat, founder of photogrammetry and inventor of instruments for photographing *vertical views*, Roussilhe, the first to take advantage systematically of aerial photographs through their *rectification*, and Poivilliers, who perfected *direct plotting* from aerial exposures. As the teaching experience acquired by these brilliant scientists gave an additional assurance of their success, one might consider that the best conditions existed for the diffusion of photogrammetry and initiation of its applications. The distinctive character of the course, given entirely free of charge and open to the public without restriction, should have also contributed, it would seem, to such diffusion.

Generally speaking, it cannot be surprising that sustained attendance at such a specialized course would be much smaller than at courses of industrial electricity or applied chemistry. However, the fact that the course of photogrammetry has not attracted more than about thirty students remains strange from the outset. In my judgment, it is an indication that the technical evolution of this science has not been completed. When developed to a very high degree, the refined equipment made photogrammetric work a technique for large-scale enterprises and important services to the state. The operation of this equipment requires, on the one hand, a personnel of superior scientific background and, on the other hand, specialized operators who are alert, meticulous, and very quickly trained by practical apprenticeship. Individually, the workers must receive advanced preparatory instruction, which clarifies to them the theory and operation of equipment and gives them accurate knowledge of the work to be done.

At present the operations performed are of sufficient importance to justify the use of aircraft and plotting equipment. They include surveys of terrain for the location of large dams, extensive reclamation or irrigation projects, planning of long communication lines through mountainous country, and preparation of medium-scale maps of extensive or inaccessible regions. Recourse to photogrammetric equipment can also be made by public agencies for which costs are not a decisive factor. Such work may include, for example, surveys of historic monuments and investigations of sea swell or movement of fluids by institutions for scientific research.

But a large clientele of photogrammetry, foreseen by Laussedat, still remains unsatiated. In this category belong surveyors who, for lack of better means, execute with a tachymeter, level, and theodolite the small parochial operations, which they are called daily to perform in connection with construction jobs, layouts of farm roads, and other small projects. In this group can also be counted industrial designers totally ignorant of photogrammetry, the methods of which would doubtless save valuable time in the preparation of plans of machines. Included with them may be likewise surgeons, who are well familiar with X-ray photogrammetry, but find its application difficult in the present stage of available equipment.

I now come to my conclusion. Any subject matter, whatever its nature, has

a potency for diffusion only to the extent that it opens new scientific or practical vistas. Photogrammetric instruction will attract more students in proportion that photogrammetric methods are useful in more segments of human activity. In its historical development, photogrammetry has perfected so far the equipment suitable for large-scale enterprises. This preoccupation naturally came first, because it made possible the saving of much time and the execution of projects impossible of realization by ground surveys. However, improvements of equipment for small-scale work remain almost entirely to be developed in order to achieve innumerable applications.

For the sake of comparison, it may be said that photogrammetry went in part through the same development as the movie industry, which evolved from the Lumière apparatus to the Debrie camera, or the motor industry, which passed from the gas-explosion chamber to the turbo-jet reactor. But photogrammetry did not simultaneously develop small instruments similar either to amateurs' cameras and kodaks for movies, or to small motors which made possible the production of automobiles for everyone.

If it has been justifiable to give preference to aerial surveys over mapping on the ground from insufficiently dense observations, then, by the same reasoning, vast fields of work still remain where the properties of photographs, noted in 1839 by François Arago, can be utilized through the application of relatively simple and easily handled equipment.

Having every confidence in the creative genius of inventors, we on our part wish that the National School of Arts and Crafts continue as a center of free photogrammetric instruction, disseminating knowledge and furthering progress.

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