One comes at it in this way in very much the same position as the person reading it for the first time. As a result the ambiguities, the omission of logical steps, the redundancies, are likely to be caught.

The most important points to consider, then, in preparing a paper so that it will be read are (i) to make it as brief as posible; (ii) not to be too hasty in sending it away, but to set it aside for a time before making the final revision; and (iii) to include an informative summary or abstract that succinctly outlines the major findings and conclusions. I believe that even a short paper should include such a summary; in fact, I believe that all editors should require summaries for all papers that exceed a page or two in length.

The late C. R. Stockard used to classify people into what he called "linears" and "laterals." Linears had as one of their traits a tendency to be conscious of the impression they were making when speaking or writing—they were conscious of listener or reader reaction. The laterals tended to be too much wrapped up in themselves and their ideas to think much about how others were reacting toward their speeches or writings. The plight of the scientific reader, and that includes all of us, would be much improved if more authors were more conscious of their readers when they put their thoughts on paper—logical sequence, clarity, and brevity would become more characteristic of our literary efforts if we had more ability to look at what we have written from the standpoint of the person reading the material for the first time.

Human nature being what it is, however, perhaps we will not reach the point where the needs of the reader are fully met until we devise some system for the publication of shortened forms of scientific articles supplemented by devices for making full length publications available to those who need them. Possibly the suggestions that I have offered, while too radical in the eyes of many, will start some individuals with more fertile imaginations and more technical knowledge than I possess to thinking and planning, and maybe we will in time achieve a world which will be at least as much a reader's as a writer's world.

Papers of Wilbur and Orville Wright

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FEW, if any, technical developments have brought about changes in transportation, commerce, international relations, and warfare to the same extent as the airplane. Since the greatest contribution to this development was made by Wilbur and Orville Wright, a detailed account of their lives, work, and thoughts is of immediate interest to every educated man. The story of the Wrights has been presented in two volumes under the title *The Papers of Wilbur and Orville Wright.** The particular attraction of this presentation is that the story is told by the Wrights and by their friends and business acquaintances in their own words; almost the entire book is a verbatim reproduction of correspondence and of diary entries in chronological order. Even though the papers are full of technical detail, the human story emerges from them in a dramatic manner.

In the late 1890's two young men became interested in the possibility of human flight. Fortunately, their business, a bicycle shop in Dayton, Ohio, provided them with a long slack season beginning in September and allowed them to devote a good deal of their time to developmental work on airplanes without undue financial loss. At the very outset, in 1899, they invented the device of warping the wings for control about the longitudinal axis of the airplane; this became the foundation of their later patent claims. In the spring of 1900, Wilbur Wright approached Octave Chanute, 35 years his senior, a successful civil engineer and businessman as well as author of the famous book on aviation, *Progress in Flying Machines*. His letter began with these words:

> For some years I have been afflicted with the belief that flight is possible to man. My disease has increased in severity and I feel that it will soon cost me an increased amount of money if not my life.

This was the beginning of a long friendship in the course of which many problems of aerodynamic lift and drag, wind-tunnel measurement, airplane stability, glider design, performance calculation, and the like, were discussed in a correspondence that takes up the greater portion of the first volume.

As is shown by the letters, the Wright brothers attacked the problem of flight in a systematic manner. They started by reading all the relevant literature, continued by constructing and flying model airplanes, and proceeded to gliding and soaring. At Kitty Hawk, North Carolina, chosen for its soft sands and steady winds after a careful survey of the reports of the U.S. Weather Bureau, they were disappointed in the performance of their first glider in 1900. To discover the reasons for the discrepancy between expected lifting power and that realized, they constructed, after their return to Dayton, a wind tunnel

* *The Papers of Wilbur and Orville Wright.* Including the Chanute-Wright letters. 2 vols. Marvin W. McFarland, Ed. McGraw-Hill, New York–London, 1953. 1278 pp. $25.

in the room behind their shop and measured aerodynamic quantities deviating considerably from accepted values. Their ingenuity and their manual dexterity are evident from the measuring instruments built during this period. Details of the wind tunnel, of the instrumentation, and of the aerodynamic coefficients obtained are given in the appendixes to the first volume; the material is illustrated by many excellent sketches and photographs.

The scientific approach brought success; from 1901 to 1903 the Wrights made many glides at Kitty Hawk and, on 17 December 1903, Orville Wright was able to send the following telegram to his father, Bishop Milton Wright:

> Success four flights Thursday morning all against twenty-one mile wind started from level with engine power alone average speed through air thirty-one miles longest 57 seconds inform press home Christmas

Since the Wrights have been attacked widely for their commercial attitude and for their efforts to make a monopoly out of aviation and to exploit the monopoly to their personal advantage, it is interesting to follow the development of their thought on this matter in the contemporaneous documents published in these volumes. In 1901 Wilbur Wright wrote:

> The labors of others have been of great benefit to us in obtaining an understanding of the subject and have been suggestive and stimulating. We would be pleased if our labors would be of similar benefit to others.

In a letter to Wilbur Wright, Octave Chanute said in 1901:

> The view which you take, that the time spent in aeronautical investigations is a dead financial loss, is eminently sagacious and wise.

But after their success in 1903 they tried to establish their rights to a financial exploitation of the results of their work. An explanation for this change in attitude is given in a letter to Albert F. Zahm written on 22 December 1905:

> When my brother and I began experimenting in 1900 it was purely for the pleasure of it. We did not expect to get back a cent of the money we spent. Consequently we agreed with each other that it should under no circumstances be permitted to infringe upon the time and money needed for our business.
>
> The results of the experiments were made public promptly for the encouragement of others. But after several seasons we found ourselves standing at a fork in the road. On the one hand we could continue playing with the problem of flying so long as youth and leisure would permit but carefully avoiding those features which would require continuous effort and the expenditure of considerable sums of money. On the other hand we believed that if we would take the risk of devoting our entire time and financial resources we could conquer the difficulties in the path to success before increasing years impaired our physical activity. We finally decided to make the attempt but as our financial future was at stake were compelled to regard it as a strict business proposition until such time as we had recouped ourselves.

Volume II begins with the year 1906. A few letters to Chanute still discuss technical problems, but most of the material between 1906 and the death of Wilbur in 1912 reflects the increasing business activities of the brothers. These include their fight for patents in the major countries of the world, their efforts to sell their invention in these countries, and their suits for damages against persons infringing upon their patents. The letters also give a lively account of Orville's serious accident in 1908, of the brothers' travels in Europe, of the enthusiasm generated by their flights, of entertainment by aero clubs, scientific societies, and representatives of governments, of their training of pilots in Wright planes all over the world, and of prizes won and world records established. In 1911 Orville found time for some more soaring at Kitty Hawk, and excerpts from his diary give a terse account of wind, weather, and length and duration of the flights. In 1912 Wilbur writes:

> It is much more pleasant to go to Kitty Hawk for experiments than to worry over lawsuits. We had hoped in 1906 to sell our invention to governments for enough money to satisfy our needs and then devote our time to science.

Bishop Wright's diary contains this entry for 2 May 1912:

> Wilbur began to have typhoid fever; first diagnosed, by Dr. D. B. Conklin, as probably malarial fever, and later as typhoidal fever.

On 10 May Wilbur wrote his will, which contains this dignified and moving tribute to his brother:

> The entire balance and residue of my estate remaining after the satisfaction of the foregoing bequests . . . I give, will, devise and bequeath to my brother Orville Wright of Dayton, Ohio, who has been associated with me in all the hopes and labors both of childhood and manhood, and who, I am sure, will use the property in very much the same manner as we would use it together in case we would both survive until old age.

On 30 May 1912, Bishop Wright entered this obituary in his diary:

> This morning, at 3:15, Wilbur passed away, aged 45 years, 1 month and 14 days. A short life, full of consequences. An unfailing intellect, imperturbable temper, great self-reliance and as great modesty, seeing the right clearly, pursuing it steadily, he lived and died. Many called—many telegrams (probably over a thousand).

Orville lived to be 77, but the drama of the Wright brothers and of human flight ended with Wilbur's death. Consequently, the period from 1912 to 1948 is covered in the book by only 122 pages. They contain some interesting information on the Wright companies and on airplane manufacture in the United States during World War I. The appendix of volume II gives a description of all the Wright airplanes and engines (with many diagrams) and a complete listing of the published writings of Wilbur and Orville Wright, of their patents, and of relevant court rec-

ords; to these is added a bibliography of publications on the Wrights.

No book, however well written by another, can convey the same feeling of intimacy with the characters of the story as personal letters do. The Wrights live, think, fight, and love in these two volumes. They emerge from the pages as persons of great intellect and character. In spite of their lack of a formal education in science and engineering, they were outstanding engineers and scientists. At the same time, their protracted negotiations in Europe showed them to be energetic and hard-headed businessmen. The playfulness of many of their letters to their younger sister Katharine reveals their love for their family, and the interest manifested by their family in all their affairs shows that this love was returned. Their interest in matters other than aeronautical can be seen from many remarks. On free days between fatiguing business talks, Wilbur used to visit the famous picture galleries of Paris and Berlin. Orville often described the beauty of the sunset at Kitty Hawk in his letters to Katharine, and the whole family had a great deal of fun from the witty stories of the hardships the brothers had to endure when camping out. A quotation from Orville's diary reads:

> At 11 o'clock last night I was awakened by a mouse crawling over my face. . . . I found on getting up that the little fellow had only come to tell me to put another piece of corn bread in the trap. He had disposed of the first piece.

The right of Wilbur and Orville Wright to claim the invention of the airplane has often been challenged in the United States as well as abroad. The Smithsonian Institution conceded this claim only in 1942; previously it considered its own former secretary, the outstanding scientist, Samuel P. Langley, as the inventor of human flight in a heavier-than-air machine. Some Frenchmen wanted to establish Clément Ader, and some Englishmen considered Hiram Maxim as the first designer of successful airplanes, and the claim of the Brazilian, Alberto Santos-Dumont, that he carried out the first documented flight persisted for a long time. Of course, these men, and many others before them, contributed a great deal to the development of the airplane. The Wrights often acknowledged their indebtedness to Lilienthal, Chanute, and Langley. But all success in human endeavor depends on the experiences of those who lived before. Lindbergh's achievement is not lessened by the earlier flight of Alcock and Brown, nor is the fame of Columbus endangered by Leif Eriksen. Today, more than 50 years after the flight at Kitty Hawk, there are few people, if any, who do not want to do homage to the memory of Wilbur and Orville Wright.

This review would be incomplete without a few words on the work of the editor, Marvin W. McFarland. It was his duty to select for publication the material that was of importance to the history of aviation; in his task he has succeeded fully. He has also written an excellent 17-page introduction, and with his associates, Fred S. Howard and Arthur G. Renstrom, prepared the appendixes and added the copious footnotes. These latter are of particular importance. They follow up, in a truly amazing manner, references in the text to many now defunct periodicals that were published in the United States and in the countries of Europe. They also contain historic and bibliographic data on all the persons mentioned in the letters and diaries, and thus make the two volumes an exciting history of the early days of aviation. The presentation of the material is greatly aided by the 236 beautiful reproductions of early photographs.

A great advance in science, though nothing could at first sight seem less poetical, inevitably results in a change both in the style and in the substance of poetry, as well as in the taste that judges it. A whole book might be written on the influence of Copernicus on poetic production, and another on poetry as modified by Darwin. In Memoriam, *for instance, though written before the* Origin of Species, *is full of the thoughts which were soon to be clarified by that work, and could never have been written had not the* Vestiges of Creation *appeared shortly before; while, though Milton still hankered after the Ptolemaic cosmogony,* Paradise Lost *is in part the work of Galileo and Kepler. It is hard—if we may leap to a later date—to imagine the loss the literature of Germany and the world would have sustained if Goethe had not been a student of science. Faust is informed throughout by the new scientific spirit, alike in its doubts and in its certainties; the philosopher is the physicist of the early nineteenth century, and Mephistopheles is the darker aspect of the same philosophy.*—E. E. KELLETT, The Whirligig of Taste.