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Biography of Leonard P. Ayres

Cora A. Trefz

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BIOGRAPHY OF LEONARD P. AXRES

By
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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree Master of Science

COLLEGE OF EDUCATION
BUTLER UNIVERSITY
1938
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BIography of Leonard P. Ayres

CHAPTER I

INTRODUCTION

Leonard P. Ayres--to educators this name means the creator of the first practicable scales in handwriting and spelling for the elementary school child. To those who served in the World War, his name brings back memories of statistical reports concerning men, munitions, and supplies. Financial and business men throughout the country say, and have said, for almost twenty years that the name, Ayres, is simultaneous with unbelievably correct business and stock market predictions.

It is quite evident that Mr. Ayres is a definite personality in three varied spheres. Because of this, material concerning his life is very difficult to find. Although he has made an outstanding record for himself in each of these fields, he is so retiring and quiet that he tends to slip into the background without the fact being noticed. As a result, very little has been written about him. Much has been written lauding his work but ignoring the man himself.
At present, none of the details of his life have been put into book form, with the exception of the prosaic information found in the various types of "Who's Who" books. This material gives in concise, definite statements the outstanding achievements of his life but fails to give the slightest inkling of the character or personality of the man. Magazine writers have humanized him more, but, even they have written far too few articles, and many of these pertain more to Ayres' work than they do to him as an individual.

There is, at present, no biography of his life. This study is an effort to collect all the pertinent facts from such material as has been written, and, by careful study and analysis to rewrite it in such a way that it may serve as an accurate source of information concerning the life of Mr. Ayres. Not only is the attempt made to prepare a report as exact as possible, but, also, to present Ayres as an individual. Illustrious achievements alone cannot make a great man. They are but the framework around which is hung a personality which designates the rank to which a man belongs.

So the scattered facts pertaining to the accomplishments of his life and the human interest stories which have been written about Leonard F. Ayres were gathered together and compiled into one paper with a two-fold purpose: first, to write a biography of Ayres that would serve as an accessible source of information for future reference work, and,
secondly, to present that material in such a manner that the reader will realize the character and individual personality of the man, so that his name will no longer express great ability in one field alone but rather interest and accomplishment along many lines.

In the small village of Simsbury, Connecticut, on November 27, 1879, Leonard Porter agrees first to be the light of this world, the father, Allen Church agrees, and his mother, Georgiana [full], both were evidently proud of their young son, and continued to be, in spite of the fact that he was not a model student but rather an ordinary normal preparatory school, a deep-excitement seed in desiring all fields of experience. The fact that these experiences were seldom appreciated and more generally encouraged, the sun often set in the heart.

Even as a very small boy the mathematician ability became apparent. His father was an extremely interested in the children, until young Leonard's fascination for figures. One afternoon, after watching the boy work the simple sums and find the exact product of some of the arithmetic problems, he thought it would be interesting to see how quickly Leonard really grasped the mobility of figures, according to...

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CHAPTER II

CHILDHOOD AND YOUTH

In the small village of Niantic, Connecticut, on September 15, 1879, Leonard Porter Ayres first saw the light of this world. His father, Milan Church Ayres, and his mother, Georgiana (Gall), both were extremely proud of their young son, and continued to be, in spite of the fact that he was not a model youth; but rather an ordinary, normal youngster with a keen mind which he used in devising all kinds of experiments. The fact that these experiments were seldom appreciated and most generally misunderstood, did not deter him in the least.

Even as a very small boy his mathematical ability became apparent. His father who was extremely interested in his children, noted young Leonard's fondness for figures. One afternoon, after watching the boy work his simple sums and find the easy products of some of the schoolbook problems, he thought it would be interesting to see how quickly Leonard really grasped the usability of figures. Accordingly,

he sat down and taught the boy all the complicated processes of long division.

Leonard listened avidly as his father explained each step; then with keen eagerness, he began to solve one problem after another until he had thoroughly mastered the process, to the satisfaction of both his father and himself. Then, because he was so filled with enthusiasm for the mechanics of the operation that he had just learned, and so filled with pride to think that he had so far surpassed the other boys of his group, who had up to that time learned no division at all, either long or short, he felt that he must pass the new knowledge along.

To Leonard the thrill of his new findings was not in exploiting it before the others but rather in sharing it. Therefore, he immediately rounded up the "gang" and volunteered to impart his latest epochal discovery. Had he been a modern youth, by that is meant one born later in the twentieth century, he, no doubt, would have led the "gang" from the street corner to the seclusion of a near-by sign board and there with a pencil and his agile mind, he would have had adequate facilities for his explanations.

The fact that he was born a decade too soon for such conveniences, did not deter him. His mind quickly solved the difficulty, and he led the gang away to the village graveyard. For privacy and seclusion, what better spot
could he have chosen?

Here he proceeded to expound the intricate mechanism of long division until it grew so dark that the figures could no longer be read. Yes, read, for whenever the process became too involved and visual demonstrations were necessary, any near-by tombstone served the purpose adequately. So absolutely interested was the gang in their teacher and his teachings or perhaps it was the fun of figuring in this novel way, that many went home late for supper to irate parents.\(^2\)

The village was thrown into a commotion; and the ire of some of the more devout church members was fully aroused when the graphic demonstrations on the tombstones were discovered. Even the fact that the sons of many of these men had learned painlessly the art of long division did not compensate to them for the sacrilege done to the graveyard. Such is the diversity of human nature.

It is not surprising that young Leonard became widely learned in many and various fields of knowledge, and learned well the cultured art of being an interesting conversationalist, for his father was editor of the Boston "Daily Advertiser." Naturally, Mr. Ayres was interested in the

\(^2\)Ralph Hayes, "Shole Flocks of Figures Eat Out of His Hand," American Magazine 98 (October, 1924), pp. 24-5.
current events of any note, and expected his family to share that interest. Each evening, the family group would gather around the fireplace to discuss the editorials for the next day. It was an extremely uncomfortable spot for anyone who was not fully prepared to talk on the topics of the day with clear forethought and good reasoning. Many were the phases of all subjects which were brought into the discussion and an intelligent conversation had to be preserved.

In preparation for these discussions, he was prone to read page after page of facts in the encyclopedia. It is quite commonly agreed that such a book could prove only a very fine and safe pastime for a boy; but it proved a dangerous possession in the hands of Leonard. He read the printed words, but that was not enough; he had to find out about them for himself. For instance, when he was about eleven years old, he read about gunpowder. The words fired his imagination. As a result, he decided to make bullets for his own use. With this intent in mind, he carefully began to collect all of the necessary materials, which for the most part, were not difficult to find. At last, every necessary ingredient except lead was accumulated. He searched everywhere, but in vain. One day it occurred to him that the roof of the church was made of lead. He and his conscience argued the matter for some time, much to the disadvantage of his conscience. His desire to experiment, and the necessity within himself to
complete a task once begun, won the battle and the much coveted and needed lead was then "snitched" from the church roof, resulting in an enormous leak which both puzzled and vexed the congregation. However, the immeasurable pleasure of squirrel hunting with self-made bullets more than compensated for the occasional qualms within himself that were brought about by the leaky roof each Sunday morning.

This was not the only trouble that the encyclopedia caused for the Ayres' boy. Or, perhaps, in this instance, it should not be designated as trouble but rather as sheer pleasure. The pleasure of a prank so well devised and carried out that the desired effects were achieved and the culprit remained unknown—what greater success could a prankster ask?

For a full understanding of the situation it is necessary to go back to the day that he discovered such an unusual chapter about clocks. Curious about the material that he had read, he began to experiment on the mantle clock. He tied a string with a weight attached to it, to the ratchet controlling the striker of the clock. At the next hour when the clock began to strike, it continued to strike until it ran down.

The results with the mantle clock were so perfect that he went out in search of bigger game. He tried it on the town clock in the church tower. It worked beyond his fondest dreams. At the first interval of striking the villagers
looked puzzled, then thoughtful, and finally worried. After about twenty minutes, practically every man, woman, and child physically able to be up and about was gathered around the church. No one knew what to do. The volunteer fire brigade was there, but even they could not stop the striking clock. At last, they did fold blankets and put between the striker and the gong so that the weary population could go to sleep. The next day an expert repair man from Boston was called. His work lasted about thirty seconds; he merely untied the cord. This still is one of the unsolved mysteries of the village of Newton Highlands.  

Do not be misled by these incidents, for Leonard Ayres was not the type of boy who filled his time playing mischievous pranks. Rather, he was the average normal school boy of his time who occasionally was led into trouble by the activities of a precocious mind. He had great ability but did not always use it to its fullest extent. This his college professors would vouch for emphatically.

As a growing lad, Ayres became interested in bicycles. Whenever he entered his interest on one project it was with such thoroughness and tenacity that he was able to uncover all its secrets. So it was with bicycles. He not only became an expert cyclist but also an expert bicycle repair

3Ibid.
man. He opened up a little bicycle repair shop in a tiny almost dilapidated building in Newton Highland. Here in a very small window he displayed a sign proclaiming his newly chosen profession, along with various and sundry parts for a bicycle.

At first he was kept busy repairing only the minor injuries found in the bicycles of the villagers, and selling small needed parts. As he became more interested, he collected old and new parts and began to assemble his own machines. He showed the careful methodical reasoning of a thoroughly mathematical mind in his work. He would take the various parts out into the sunlight and examine each one with meticulous care, sorting out the most perfect. From these best parts he would then construct a bicycle. It was from this careful precision and extreme thoroughness, that he acquired the reputation of being an uncommonly good bicycle builder.

Ayres believed that the color of the bicycle was one feature calling for keen discrimination. Therefore, it was with the greatest care that he mixed his paints and blended his colors, before he began to paint. This won him renown in the village and surrounding country as an expert at enameling.\(^4\)

\(^4\)Ibid.
Once a thing had been perfected, it lost its charm and
Leonard Ayres turned his attention to less perfect fields
which would furnish interest and employment to his agile
mind. He enjoyed riding his bicycle but with all his care
and work he could not make it run fast enough; so he began
to tinker with what later turned out to be a motorcycle. A
friend of Ayres who saw a picture of the machine described
it as a "buggy having the appearance of a cross between a
spinning jenny and a wheelbarrow."

His love of the bicycle and his craze to make it go
faster, led him to be the champion cyclist of his day. In
one race he pedaled two hundred fifty-six miles in a driv­
ing rain over muddy country roads all for a gold medal. He
also held the one mile record on a six loop track.

Many years later when he attended the bicycle races
at Madison Square Gardens his interest was as active as in
former years. The enjoyment of watching the race as a
spectator lasted for only a few brief minutes, however.
Almost immediately the problem of whether music was of any
value to the riders presented itself to his mathematical
mind. He watched for a while, mulling over the idea. Later
he came back to the Gardens with a stop watch. With this he
timed the racers first as they were riding with the music
and then again without it. After he had sufficient timings
to make his findings correct, he very quickly figured the
difference that music made in the speed of the riders.

This craze for bicycles and for riding them almost proved fatal to Ayres as a student. When he entered Boston University, he gave such a small portion of his mind to his studies and so much of his interest to bicycles that at the end of three years, he was the despair of all his professors. He was warned that he had so far failed to meet so many of the requirements, that it would be impossible for him to graduate with the rest of his class the next year.

This fired the youthful Leonard with the zeal and enthusiasm that he always experienced at a hard problem. This one he met with the drive and force so characteristic of his personality even at this early date. He went back to the University for his fourth year and enrolled in enough extra classes to earn for himself credits in those subjects in which he had previously failed. At some periods he had three classes occurring simultaneously. He attended each class once every three weeks and borrowed other students’ Notebooks for the intervening two weeks lectures. To the astonishment of everyone, unless it was Ayres himself, he passed in everything and received his degree. As a result, the faculty then made a ruling that henceforth, no student could cram all of his work into one year no matter how capable he was. Yet all must have been either forgiven or forgotten, for twenty years later, this same University
presented Ayres with a Phi Beta Kappa key.⁵

It is supposed by many that at commencement the youth ceases to be a child and becomes a man. Yet in reality, the transition is much more gradually accomplished and the youth is not a man until he has accepted a man's work to do and shouldered a man's responsibility. So young Leonard stepping forth from the portals of his University with his degree, sought to meet the world and find his position as a man with a man's work to do. He was armed not only with a college diploma but also with an agile mind, a keen perception, and a tenacity of purpose. These last three were his greatest assets then and have continued to be through all the intervening years.

⁵Ibid.
CHAPTER III

PORTO RICAN EPISODE

After Leonard Ayres graduated from the Boston University in 1902 he began a search for some promising occupation. His interest became centered in the small island of Porto Rico which had just come under the supervision of the United States. The whole place was in a turmoil of unrest and confusion. The government of the United States was making a valiant attempt to establish schools to educate the 250,000 children on the island.

All American institutions were joyously welcomed by the Porto Ricans. However, American teachers were not so joyous over the prospect of attempting the difficult task of teaching in such poorly equipped schools, especially since the language was different.

Whether it was the desire to go away from home and fend for himself which seems an instinctive trait of young manhood or whether it was just a chance happening, would be hard to determine. Regardless of the reason, young Ayres started forth to teach in the school of Porto Rico.

His trip was uneventful with the exception of one incident. The night before the ship was to land, Ayres,
evidently getting himself "Beau Brummelled" for the occasion, prepared to take a bath. After filling the tub, he tested the water with his big toe, thereby removing all of the skin. The next morning when the boat docked, he did manage to get his shoe on and hobble to shore. There he met the school Commissioner with whom he was to visit the schools. All day he tramped over sun baked pavements, inspecting schoolrooms. It is questionable which held supremacy in his thoughts, his throbbing toe or the throbbing needs of the schools.

The fact that he spent the next ten days in bed recuperating gives an idea of the intensity of his will power to carry on, for he refused to give up the inspection until he was forced to. At least he had the satisfaction of knowing that the commissioner neither knew of his illness nor its cause.

His first school was in PensaLa, a small village where Spanish was spoken exclusively. As this was the general situation throughout the country, the American teachers were forced to learn Spanish in order to be able to teach. This made the difficult task of teaching in poorly equipped schools even more difficult. Many teachers began to teach in English and upon finding that the natives liked it, gradually the transition from Spanish to English came about.

However, in 1902 the progress of the country was in
its infancy, and Spanish was the language of the people. When Mr. Ayres arrived in Penuelas, he found that the village was the proud possessor of one and only one English book, namely, *A Census of Manufacturers*.

The country spoke Spanish, Penuelas spoke Spanish, the children that he was to teach spoke Spanish and Ayres spoke English. Even a mind far less mathematically inclined than that of Mr. Ayres could see that this ratio was entirely out of proportion and the only practicable way to balance it was to swing to the side of Spanish. That is exactly what he did. He began an exhaustive study of Spanish, trying to learn enough to be able to teach his school.

In accordance with his characteristic procedure, he attacked this new situation with calmness and deliberation. After he had studied it from all angles, he laid his plans carefully and followed them intelligently. By such methods he was able to organize his work in the tiny village school so well that he immediately won recognition for himself from the authorities. In acknowledgement of this, he was made superintendent of the schools in the district of Caguas, which position he held during 1903 and 1904.

Once more his keen perception of the difficulties presented to the teachers over a wider spread area, drove him to greater efforts to improve the whole situation. He attempted plans of schooling that were later to result in
organized courses of study. He backed the movement already becoming popular that American teachers teach in English rather than Spanish, by showing that the Porto Rican youngsters could as easily begin schooling in one language as another; while on the other hand, an English speaking adult would not and could not be as efficient by attempting to teach in an unfamiliar tongue. The very fact that the natives of Porto Rico were so enthusiastic about anything American, aided this movement greatly, for they were very anxious for their children to learn English.

After his two years as district superintendent, Mr. Ayres was once more advanced. This time he was given the position of superintendent of all the schools in San Juan, the capital of Porto Rico. His interest in the schools was unfailing. Carefully studying the material being taught, he tried, both by suggestions and, by orders, to eliminate all unsuitable subject matter. He felt that much that was being taught was absolutely useless to the child, and yet there was much that should be taught which was omitted.

This was a Herculean task to attempt, but no task seemed too heavy to be borne on the slender shoulders of this light haired, keen eyed young man. The seeming impossibility of the necessary work, acted as a spur to drive him forward to greater efforts. In proportion to his efforts were his rewards, for in 1906 he was made the general superintendent
over all of the schools in Porto Rico.

During his two years as general superintendent, he continued his work toward improving the schools. With the help of Luther H. Gulick, he worked out and published a book called "A Course of Study for Schools of San Juan" in 1906. This marked one of the outstanding milestones in the progress of Porto Rican education.

To have risen to such heights in so brief a time would have satisfied most men. Mr. Ayres, however, was not the type of person to sit back and bask in the glory of laurels already won. Rather, it was necessary for his peace of mind for him to be always striving toward a goal a little farther upward. Since he had reached the top of the ladder, there was naught to strive toward. In 1908 he gave up his position and returned to the United States for further study. He enrolled in Columbia University where he received the degree of Doctor of Education, planning toward achieving still greater things in the field of education. No matter to what heights he might now rise or what fame he might now acquire for himself, it would never have the same tang to it that he had found in his adventure in school teaching on the small island of Porto Rico.
CHAPTER IV

Armed with his wide training in the educational field of Porto Rico, and with his newly acquired Columbia degree, he began a search for an educational field to conquer, for he realized that education was in the transient stage. He had returned to New York where the educational system was quite different from what it had been when he left. For so many years, schools had been accepted merely as a place where children might be sent to learn if both they and their parents so desired. Any child, who was not normal, was either sent to school along with the other normal children or kept at home with no chance for any education of any type. The school officials of New York had at last reached the conclusion that this situation was all wrong. Following the example set by Great Britain, a study of child care degenerates was begun. The number of such children, who were handicapped either mentally or physically, was so great that immediately forces were set in motion to care for them. However, this proved to be such a gigantic task that
the authorities were overwhelmed. They realized that before actual solutions to the problem could be reached, they must have more information from which to work. It was apparent that no help could be given to the slow individual who was unable to progress with the others although he was not defective, until some disposition was made of those who were handicapped.

To secure the data needed, the authorities asked the Russell Sage Foundation for a grant of money to be used in making the preliminary survey.

The Russell Sage Foundation was endowed by Mrs. Russell Sage with a sum of $10,000,000 to be used as was stated in the charter, for "the improvement of social and living conditions in the United States of America." This money was to be used at any time for research, publication, education, and the establishment and maintenance of charitable activities and institutions, or for the aid of such institutions already established, if such aid seemed expedient to the trustees.

The aim of the foundation was to undertake those tasks which were deemed necessary to the general good of all, and which no other organization or individual would be likely to undertake. It was to handle larger and more difficult problems, not just charity in the form of family relief, but rather they were to attempt to eradicate in so far as
possible the causes of poverty and ignorance.

The fundamental idea of the Foundation is to place in the hands of qualified trustees the income of its large endowment and the power to use it in any way that they think will best make for the improvement in social and living conditions. The Foundation is not confined to any single form of social betterment. The provisions of its charter are sufficiently elastic to provide for any modification made necessary through the shifting of social conditions.

Therefore, it was quite logical that the Russell Sage Foundation be asked for a grant of money to be used in making a survey that might:

1. Put together material having bearing on these topics.
2. Develop a mode of attack on the problem.
3. Analyze a sufficiently large number of cases to demonstrate the utility of the method and give answers of at least a provisional nature to some of the questions. This grant had been allowed in the fall of 1907.

Dr. William H. Maxwell, superintendent of the schools of New York City, offered his cooperation and also access to the schools and school records. All that was lacking was someone to do the actual investigation. To do the type of work contemplated, and do it satisfactorily would be a most difficult task, for it involved a technical knowledge of how to handle statistical material so as to avoid the many pitfalls that it presented, and at the same time get results.

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that would be trustworthy and constructive. It would also require extensive experience and school administration and the widest possible knowledge of the literature bearing on the subject.

This seemed to be a post ready made for Ayres, for his duties as superintendent of schools in Porto Rico gave him ample school administration training, and the fact that he was, at that time, Chief of the Division of Statistics of the Insular Department of Education qualified him from the statistical standpoint. When approached on the subject, Ayres accepted. Everyone was pleased, Ayres, because the work was so thoroughly the type that he enjoyed, and the Foundation, because they had found a person so well qualified for such a difficult task.

Ayres quickly systematized his work and began to gather as complete records as possible of the medical inspection of children. In these records were the number of children with various types of defects, both physical and mental. Then he checked these for the number found in each class blind, deaf, crippled, etc.

He also attempted to check the number in each group that were born defective and those who had become afflicted since birth. Attempts were made both to catalog and to segregate the curable from the incurable. For those, that it would benefit, medical treatment was given. This
material, when collected seemed sufficiently valuable to warrant its publication. Therefore, in 1908, he wrote it up as a preliminary report.

Recognition should also be given to Dr. Roland P. Falkner who gave the work of the investigation from its inception the great assistance of his keen insight into the methods of social investigation and of his thorough knowledge of educational statistics.

A report of the study, in so far as it related to New York, was submitted to Dr. William H. Maxwell, and it was published by him as a part of his annual report for 1908. Besides this partial publication of the findings, many chapters appeared in part or whole as Mr. Ayres contribution to the educational press. Many of his reports were both a shock and a revelation to a somnolent nation.

Within the study, he gathered and analyzed material, not only for New York but for the United States as well. He found the conditions within schools deplorable. Efforts were beginning to be made to care for the defective child, and medical attention provided as a result of his book Medical Inspection of the Schools, but the child who was merely slow was still a subject of investigation.

To determine the cause, effect, and result of this situation, he studied the conditions found in the schools and figured the per cent of pupils retarded. He found wide
variations with no set standards, the extremes being, Medford, Massachusetts, retarding 7 per cent, against Memphis, Tennessee, retarding 75 per cent.

He checked the grade distribution to find how it was effected by death and increase in the population. A great amount of time was given to studying the rates of progress of children, and attempts were made to aid in explaining the utility of this material. He also studied the nationality problem in the schools, along with those problems presented by physical defects, irregular attendance, and sex. The nation was startled by the report that the average youngster left school before he had finished the sixth grade. This threw the educational world into an uproar and only a few believed that things could be as bad as they were pictured until Ayres proved his assertions by definite, unyielding figures. This mass of material, he published in 1909 as a book entitled, Lagarde in Our Schools.

It was a revolutionizing volume for in it he showed that the following facts were true as proved by the findings of the investigation:

1. That the most important cause of retardation can be removed.

2. That the old fashioned virtues of regularity of attendance and faithfulness are major elements of success.

3. That some cities are already accomplishing excellent results by measures that can be adopted by all.
4. That relatively few children are so defective as to prevent success in school or in life.  

The fact that such information as he had to give was sorely needed, made both the legislative and the administrative bodies receive his books with considerable acclaim.

In many instances, the facts that he revealed seemed too shocking to be true, and only because he could produce actual, concrete figures to back his statements, was he able to make educators realize how much the schools needed complete reorganization.

Once Ayres began a task, he carried it to completion, if for no other reason than the satisfaction produced by a thing well done. Therefore, in 1910, he published his next book entitled *Open Air Schools*, which was still a part of his original investigation. This might be called a side issue of his book on *Medical Inspection in the Schools*. In this, he considered only children with weak lungs or those who were consumptive, and showed the need for schools in which there was a continual source of fresh air and sunshine. As a result of this last treatise, practically all of the larger cities now have at least one "fresh air school."

Then in about 1914, the Cleveland Foundation was established by Mr. Fredrick H. Goff through the agency of

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the Cleveland Trust Company, for the purpose of forwarding social progress, and human welfare in the city. Funds were collected; and because they were not for any one person, but rather, for the benefit of all the funds grew rapidly. These funds were the bestowment of a community that wished to see the entire city reap the benefits. Soon the amounts that were pledged to the Foundation mounted into millions of dollars. Very small portions of this amount were used for the trustees who shouldered extremely heavy responsibilities. These trustees adopted as their guiding principle the proposition that accurate, and ample information, and wise interpretation are first steps toward success in any undertaking.

Besides the trustees, the active members of the Foundation were the permanent investigators of the staff. These consisted of a director, his secretary, and ten other assistants. For the position of director, was needed a man who had had experience in school work, and who understood and could use statistical devices and measures, and who also knew how to conduct a thorough investigation in order to obtain pertinent and accurate information. Without much hesitation, the Cleveland Foundation decided that Ayres was the person that they needed. Especially so, since the Russell Sage Foundation was to pay the salaries of the investigators and Cleveland was to furnish only enough to cover the actual cost of materials and research.
The Cleveland Foundation committee were anxious to have a thorough investigation of the city schools, considering every angle, so that they might have a basis from which to begin improvements. Field work was begun by the Survey Committee in April, 1915. Each of the members had special designated assignments which he was supposed to investigate. The members of the committee were: Leonard P. Ayres, the director, May Ayres (his sister), Franklin Bobbitt, Alice C. Boughton, Edna Bryner, Earle Clark, Ralph D. Fleming, Shattuck O. Hartwell, Walter A. Jessup, George E. Johnson, Charles H. Judd, R. R. Lutz, Adele E. McKinnie, Herbert A. Miller, David Mitchell, Iris F. O'Leary, Clarence Arthur Perry, Frank Shaw, and Bertha M. Stevens. These special investigators, along with several stenographers and clerks did all of the work of the survey.

As each of the members collected enough data to make a report, he wrote it in such a form that it could be submitted to the director and staff members in its completed form. This was then checked for accuracy and for harmony with the other reports already finished. Mimeographed copies of the corrected report were then made, one for each member of the Survey Committee, and one for each of the members of the Board of Education, the Superintendent of Schools, etc., making twenty in all. A week's time was allowed for the individual examination of the report, at the end of which,
A meeting was held for the express purpose of criticisms, corrections, and suggestions. Every minute detail of fact and form was discussed and made agreeable to all. Differences of opinion were permitted to remain differences of opinion. All final decisions were referred to Mr. Ayres. Some of the reports had to be rewritten as much as five times before they were pronounced satisfactory.

After each paper was accepted, Ayres devised a novel plan for putting the material before the public. A lunch, having for its express purpose, a chance for the public, or at least, those of the public who were interested, to hear the findings before they were released to the world in printed form. This lunch cost sixty cents and was served at twelve-thirty sharp. After the meal, either Mr. Ayres or the investigator gave a half hour talk on the monograph.

The lunchroom would accommodate about three hundred people, and the hall was always filled for each discussion. It is interesting to note that at each lunch the assembly was composed of an entirely different clientele. Each group came to hear the monograph which was most closely affiliated with his work. For instance, the reports on child health, and medical attention drew doctors and nurses to the hall. When schoolroom methods, or school building needs were the topics, teachers and educators of every sort composed the audience. Business men were drawn to the discussion on
finance, and so on. Thus was the work brought to the recognition of the public in such a way that it was fully appreciated by all.

During the year of the active work of the survey, Cleveland had the distinction of being the only city in which news of the great World War was relegated to the second page so that school news might predominate the first.

Twenty-five sections of the report were written, and twenty-three sections have been published as separate monographs. In addition, there is a volume entitled "Wage Earning and Education" which gives a summary of the section relating to industrial education. The final volume, "Cleveland School Survey" was written by Ayres to give the highlights of the entire investigation. In it he explains why the work was started, how the material was collected and tabulated, the cost, etc. The major portion of the volume is given over to a brief summary of each of the other reports. This book holds all the pertinent facts of the entire survey.

For the monograph "Health Work in the Public Schools," and "School Buildings and Equipment," he worked in partnership with his sister, May Ayres. She held the S.B. degree and was then a graduate student at Columbia University, where her Ph.D. was pending. She, like Ayres, had had training in the field of teaching. Also, like her brother, her experience
had not stopped there. She had been a member of the social service department in the Psychology Clinic of the University of Pennsylvania, a research worker in Boston, worker in a Psychopathic Hospital, and a special agent of the Russell Sage Foundation. Therefore, it is quite evident that she was amply qualified to be co-author of these monographs with her brother.

The health report had much in common with the type of research that Ayres had carried on in New York previously, and it did more to aid the physically defective than any preceding efforts had ever accomplished. It also resulted in the establishment of school nurses, and doctors for the daily check and supervision of the health of the boys and girls. A movement which has now become widespread.

In the same manner, the history of the types of buildings and equipment used for the last seven decades was shown, and the needed improvements pointed out and discussed, not from the standpoint of opinion, but rather, from definite facts which pointed out the need as based on safety, sanitation, and cost.

Public Library and Public School was also written in partnership with another author, Adele McKinnie. It was a treatise on the need for the library in the school. The location, the amount of time that should be allotted to library use, and the training of the librarian were all
During the winter of 1911-12, the Division of Education of the Russell Sage Foundation conducted a study of the handwriting of children, having as its purpose, the production of a scale which would measure the quality of the handwriting of school children in the upper elementary grades. This investigation was under the direct supervision of Mr. Ayres.

In order to secure the necessary material, Ayres first had to get the cooperation of the superintendents of schools in various cities so that he could select, at random, writings of children. He secured samples from forty systems of thirty-eight states. By this method, he could make a scale which would be usable over the entire country, rather than in a small section.

In order that all of the samples of handwriting should be produced under conditions as nearly uniform as possible, all of the writing was done on sheets of unruled paper of uniform size and quality. This was furnished by the Foundation for all use in the investigation. At the top of each sheet were fifteen typewritten lines. The pupils were given ten minutes to copy as much as they could at their ordinary
rate of speed. Selections from Washington Irving's "Rip Van Winkle" and "The Legend of Sleepy Hollow" composed the typewritten lines. In an effort to obtain sensible samples for the final scale, the first twenty words were in logical order. All of the remaining words were jumbled together so they would convey no meaning. This was done so that the readers could not be aided by the context, but, rather, must decipher each word separately.

No point was overlooked. For fear that the material might be memorized, thirty different sets of copy, each with a varied combination of words was made. No unusual words or names were used. These sheets were given to the most nearly normal classes in each city. The children were set to work with no suggestions from the teacher that they were to write either unusually well or unusually rapidly.

From the samples of writing received, 1,578 satisfactory papers were secured. Each of these was given a serial number and stamped with spaces in which all the data concerning that sample was to be written. The next step was to sort the specimens in groups of twenty-five so that there were no duplications. Each of the ten readers, who were paid investigators in this field, was then given one of these packages, so that he might read every sample, or rather, those words in the sample that were thrown out of context. The exact time needed for each reading was checked by means of a stop
watch and this was recorded in the proper space on the sheet.

Each sample was read by the entire ten people who composed the staff, and the exact time of every reading was recorded. The sum of all of these results was found so that the average could be computed. After counting the exact number of words in each sample and dividing that by the average time required to read it, the rate in words per minute at which the reading had been done resulted.

Since each sample was checked by every investigator, the work entailed 15,780 readings.

All of the samples were classified according to the style of the letters. First, the heaviness or thickness of the lines used was considered, but this was found impracticable. Next, the attempt to classify the samples as being written with large, flowing letters, medium ones, and small ones, was made. This proved no better than the first. Finally the classification was made according to the slant.

Three different slants have been included in the writing on the scale, for it has been found that 95 per cent of the writing of school children can be found in these groups.

In true Ayres fashion, not even the slightest detail was overlooked. He had the scales printed in blue ink which matched, as nearly as possible, the ink used in the schools; and he also had the paper corresponding to school paper.
This proved a great help to those attempting to check samples of school children's writing with the scale.

The scale itself is a sheet of paper measuring 9 by 36 inches and having eight divisions from end to end. In each division are samples of handwriting. As one proceeds along the strip from left to right these samples are progressively better. They have been so chosen that each one is as much better than the one before it as that is better than the preceding. That is to say, all of the steps are equal (to within one-tenth of one step). These samples or steps have been assigned the values 20, 30, 40, 50, 60, 80, and 90. These values have been chosen rather than any others because teachers are familiar with them as marks used in scoring school children's work.

In order to measure the value of any given sample of writing all that is necessary is to slide it along the scale until a writing of the same quality is found. By looking at the top of the scale the number corresponding to the quality of the writing will be found and this number represents the value of the writing being measured.¹

Ayres' writing scale was not the first. Thorndike had previously made a scale in which he used "general merit" as a criterion. "General merit" could not be measured and put into figures, therefore, it was not satisfactory to so mathematical a mind as Ayres possessed. For that reason, he devised his scale with legibility as a criterion. This could be measured and computed as he proved by his series of accurately timed test readings.

Basing his judgment on these results, Ayres said that

writing, which was entirely unreadable should be placed at zero. Since this was almost impossible to find in children once they have learned to write at all, he concluded that there was no need to include zero in his scale. The rating began at twenty and as the legibility of the writing increased, the score increased accordingly. Also, one hundred should represent perfect accomplishment, and since none of the samples were perfect, this score was also omitted.

In 1914, the Municipal Civil Service Commission of New York City requested the Foundation to develop some means of measuring the handwriting of adults who applied for positions in the city's service. Once more, Ayres was assigned to this particular task. Again he used ten people to do the actual rating. Nine of these were employed by the Foundation and the other, Anna H. Crocker, who was an experienced examiner in the employ of the Civil Service Commission.

First, one hundred samples of the handwriting of adults were rated carefully, resulting in the evident fact that many more samples were necessary to secure a wider range of qualities and style. The files of the two organizations furnished about one thousand more samples, but still the investigators did not feel that this was satisfactory.

They further increased the number of samples by securing writings from the Bushwick High School, the Commercial High School, and the Hoffley Institute of Brooklyn, the Wood's
Business School of New York City, the Eastman Business College of Poughkeepsie, and from the office of the corresponding editor of the New York Globe. Thus, 2,817 samples of writing were collected and only twenty-four of these were used in making the new scale.

As in the handwriting scale for children, slant was also used in the adult scale as a basis of classification. However, in this instance, five classes were defined, "vertical," "medium slant," "extreme slant," "backhand," and "mixed." These classifications were determined by actual measurements. "Vertical" was writing in which the characteristic slant lay between eighty degrees and ninety degrees from the horizontal. "Medium slant" was between eighty degrees and fifty-five degrees and "extreme slant" was defined as ranging from fifty-five degrees downward. The characteristic slant of "backhand" was to the left of the vertical, and "mixed" was what the name implies, a mixture of two or more of the other slants.

In order to be absolutely accurate, protractors of transparent celluloid were constructed and used to rate each of the 2,817 samples of writing according to slant. Using these classifications, samples of the vertical, medium slant, and extreme slant writing is included in each division on the adult scale, so that the writing to be analyzed can more easily be classified.
Upon completing the adult handwriting scale, Ayres immediately began to study "spelling." In other words, he began to check on the works already finished in the effort to determine what words were used most frequently by the general public. From these, he hoped to make a spelling list that would teach children the commonly used words in an attempt to substitute these for the words which had hitherto been taught only because they were difficult.

In order to determine which words were the most common, he referred to information that had already been published. Reverend J. Knowles of London had checked passages containing 100,000 words, from which he made a list of the 353 words that occurred most frequently, and the number of times each one was found.

R. C. Eldridge of Niagara Falls had published a pamphlet containing a vocabulary of 6,002 words which he said contained the common English words. The Division of Education of the Russell Sage Foundation had also made a tabulation of the words used in 2,000 letters written by 2,000 people and found that in them all only 2,001 different words made up the entire vocabulary.

The last of the studies that Ayres used was a book entitled A Child and His Spelling by W. A. Cook and M. V. O'Shea. This was 200,000 words taken from a family correspondence of thirteen adults. In these letters was found a
total vocabulary of 5,200 words and the number of times each word occurred was tabulated.

Since in each case, the number of times that each word was used had been recorded, it was not a difficult task for Ayres to combine these lists and find which words appeared the most frequently. He discovered that the ten most commonly used words in the English language are probably: the, and, of, to, I, a, in, that, you, for. The repetitions of these constitute more than one-fourth of the words that we write. There is a list of about fifty words that are repeated so often that they make up about one-half of all the words that are written.

By finding the frequency with which each word appeared in the tabulation of the studies, the 1,000 most commonly used words were selected. Various forms of the same verb were included in some instances, and both forms of some words such as "man" and "men" because they present spelling difficulties. Only those plurals and verb forms which do present difficulties are used.

It was then necessary to discover in what grades children should be expected to spell certain of these words. Ayres secured the cooperation of the city superintendents of schools throughout the country.

He made fifty lists of twenty words each to be given as dictated spelling tests at mid-year. Each list was first
spelled by the children of two consecutive grades in many cities. As a check, words were taken from each of the fifty lists and recombined in new sets of twenty words each and sent out as tests in four consecutive grades in different cities. These two sets of testing continued until 1,400,000 spellings had been secured.

To make it usable and valid, the scale for measuring attainment in spelling should consist of a series of groups of words so arranged that all of the words in each group are of equal difficulty. To arrange the scale in this manner, the step from any one group to the next group higher up will have the same relative value as to the group lower down.

Ayres considered words to be of equal spelling difficulty if they were correctly spelled by an equal proportion of children who had had the same amount of training, which is to say, those in the same grade. High school students would have little difficulty with words that present real trouble to a second grade younger. Therefore, the degree of difficulty in turn depends greatly upon the amount of training of the child.

Also, as a result of these tests, it was possible for Ayres to ascertain the score that should be made by the pupils in each grade, if he were given any one of the lists of words. These scorings, he placed at the top of the "Spelling Scale," that was the product of this research.
Below the scores are columns of words classified according to their varying degrees of difficulty.

This scale, like the handwriting scales, especially the one for children, met with the enthusiastic approval of the educators of the day. Ayres was the explorer marking out the paths for future educational leaders to follow. These scales were the forerunners of many of the present day scales now in use.

From Ayres, the statistician, we have a statistical device which in more recent times can also be used to measure the intellectual capacity of the student in the schools and the progress in the educational system of the state. An index number is a statistical device that can be used to measure the variation in the size and value of the stock market, the number in the factories, and the number of deaths in the annual reports of a long period of time. To measure such a matter, a long and complex process is needed. The average price for each stock is then aggregated and this is averaged over the index number.
CHAPTER VI

AN INDEX NUMBER FOR STATE SCHOOL SYSTEMS

During the winter of 1919-20, the Department of Education of the Russell Sage Foundation was engaged to sort out and select the pertinent information concerning the schools of the United States from the mass of material which was on file in the governmental records. This data had been collected over a period of fifty years and represented the larger and more important phases of the educational effort and attainment of the states.

Once again, Ayres had a gigantic problem with which to cope. True to form, he reduced it to its mathematical basis and then began to work. That is, he set out to find an index number for the state school systems.

An index number is a statistical device which is used commercially to measure variation in the rise and fall of the stock market, or the changes in the wholesale and retail prices over a long period of time. To secure such a number, a long list of prices kept over a series of months is needed. The average price for each month is then computed and this is termed the index number. Since some articles in the list
of prices are more commonly used or are more important than others, the values must be weighted to make each exert the proper influence on the final result. Such numbers are commonly reduced to percentages, so as to be compared with previous per cents.

Using this as a basis, Mr. Ayres set out to compile such a number to represent the standing of the various school systems of the individual states. To do this, he needed certain definite points to serve as a foundation for his index number. After careful study and consideration, he chose the following ten points as the educational phases most important and, therefore, those which would best serve as a basis of comparison:

1. Per cent of school population attending school daily.
2. Average days attended by each child of school age.
3. Average number of days schools were kept open.
4. Per cent that high school attendance was of total attendance.
5. Per cent that boys were of girls in high schools.
6. Average annual expenditure per child attending.
7. Average annual expenditure per child of school age.
8. Average annual expenditure per teacher employed.
9. Expenditure per pupil for purposes other than teachers' salaries.
10. Expenditure per teacher for salaries.

The index number was the average of the figures
corresponding to these ten statements after they have been either multiplied or divided by constants in such a way as to give them a comparable relation with the standard 100.

For example, the average number of days the schools were kept open in the United States as a whole in 1910 was 157.5. The standard or "par value" length of term is taken as 200 days. Hence the actual number of days for 1910, or 157.5, is divided by two, which gives the figure 78.75 as one of the ten components of the final index number. In a similar way an average monthly salary of $100 is taken as the standard for the last of the ten items. The actual average in 1910 was $485.22 for the year, or $40.44 for each month and this number is included as one of the components without further change.

Similar treatment was given to the other items and the average of the sum of all ten was taken as the index number. In order to relate these items to a common basis the following methods were used:

1. The per cent of school population attending school daily. The per cent of the average daily attendance is the whole number of children of school age (that is, those over five years of age and under eighteen). This figure could never exceed 100.

2. Average days attended by each child of school age.

This was found by dividing the aggregate days of attendance by the number of children of school age. The schools were open 200 days; therefore, the number would be 200 days to

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a child. In order to compare it with the percentage figure this number was divided by two.

3. Average number of days school was kept open. This figure in the index was one-half the figure given in the report of the Bureau of Education.

4. Per cent that high school attendance was of total attendance. Since there are eight elementary grades and only four high school grades, it is possible for the high school to have only one-third of the entire enrollment of public schools to make a perfect record. Therefore, the high school attendance was multiplied by three before it was included in the index.

5. Per cent that boys were of girls in high school. Since there are more girls than boys in high school, the per cent of girls to boys has been used.

6. Average annual expenditure per child attending. This was the quotient found by dividing the total expenditures by the average daily attendance.

7. Average annual expenditure per child of school age. The total expenditure divided by the number of children from five to eighteen years of age make up this item.

8. Average annual expenditures per teacher employed. The result found by dividing total expenditures by the whole number of teachers and then dividing this by twenty-four gives this index item.
9. Expenditure per pupil for purposes other than teachers' salaries. This item is the quotient found by dividing the expenditures other than teachers' salaries by the number of children in average daily attendance and multiplying this by two.

10. Expenditure per teacher for salaries. This is the total expenditure for salaries divided by the whole number of teachers employed during the year divided by twelve.

The multiplication and division found in some of the above items was the weighting necessary to give each item a value which would be comparable to the other items in the list. All of these elements are inter-related and to a degree, inter-dependent. Yet, they have been treated in such a way as to bring them to the common theoretical standard of 100. That is, if each of the ten items has a score of 100, the conditions for the index would be as follows:

<table>
<thead>
<tr>
<th>Value entered in index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One hundred per cent of the children of school age would attend school and all would have a perfect attendance</td>
</tr>
<tr>
<td>2. Each child would attend school 200 days each year</td>
</tr>
<tr>
<td>3. The school term would be 200 days</td>
</tr>
<tr>
<td>4. Thirty-three and one-third per cent of the pupils would be in high school</td>
</tr>
<tr>
<td>5. The boys in high school would be equal to 100 per cent of the girls</td>
</tr>
</tbody>
</table>
6. The annual expenditure would average $100 for each child in average attendance.  
   Value entered in index 100

7. The annual expenditure would average $100 for each child of school age.  
   Value entered in index 100

8. The expenditures would amount to $200 per month for each teacher employed.  
   Value entered in index 100

9. The expenditures for purposes other than teaching would amount to $50 per year per child attending.  
   Value entered in index 100

10. Teachers' salaries would average $100 per month for 12 months in the year.  
    Total divided by 10—the index number 100

Although all of the items are comparable to 100, this limits only the first, fourth, and fifth. The other seven items may, and sometimes do, exceed that amount. This is possible just as the price of stock may exceed its par value of $100.

Having worked out an index number for the school systems, Ayres then found the percentage for each item for various years beginning at 1871 and making his findings accurate up to, and including 1918. All data and material of any sort was supplied by the Federal Bureau of Education. For accuracy every figure was checked carefully and all calculations reworked in an attempt to exclude all errors.

To make a single number that would represent each school system, the following method was used. The percentage of
each item was found for two different periods as is shown in Table I.

The figure represents the educational conditions in the United States as a whole in the years 1900 and 1910. For each list, the ten numbers were added and averaged thereby making a single number, which in this case is 33.68 for 1900 and 42.41 for the year 1910. The increase for those ten years is 8.73 and is the difference between the above averages.

### TABLE I

<table>
<thead>
<tr>
<th>Ten Index Items</th>
<th>Index Item 1900</th>
<th>Index Item 1910</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Per cent of school population attending school daily</td>
<td>49.68</td>
<td>52.65</td>
</tr>
<tr>
<td>2. Average days attended by each child of school age</td>
<td>39.50</td>
<td>41.46</td>
</tr>
<tr>
<td>3. Average number of days schools were kept open</td>
<td>72.15</td>
<td>78.75</td>
</tr>
<tr>
<td>4. Per cent that high school attendance was of total attendance</td>
<td>14.65</td>
<td>21.40</td>
</tr>
<tr>
<td>5. Per cent that boys were of girls in high schools</td>
<td>71.35</td>
<td>77.85</td>
</tr>
<tr>
<td>6. Average expenditure per child attending</td>
<td>20.21</td>
<td>33.23</td>
</tr>
<tr>
<td>7. Average expenditure per child of school age</td>
<td>10.04</td>
<td>17.50</td>
</tr>
<tr>
<td>8. Average expenditure per teacher employed</td>
<td>21.17</td>
<td>33.95</td>
</tr>
<tr>
<td>9. Expenditure per pupil for purposes other than teachers' salaries</td>
<td>14.54</td>
<td>26.87</td>
</tr>
<tr>
<td>10. Expenditure per teacher for salaries</td>
<td>27.12</td>
<td>40.44</td>
</tr>
<tr>
<td>Average of ten items—index number</td>
<td>33.68</td>
<td>42.41</td>
</tr>
</tbody>
</table>
By subtracting the 33.68 from 42.41 the difference of 8.73 is found. This is done to get a single number which expresses the average increase in ten different measures of the diffusion, the quality, and the quantity of public education received by the children.

Ayres did not claim that educational efficiency was determined by any or all of these measures, rather he pointed out that there was a real relationship between expenditure and results in education.

Not satisfied with having found the index number and applying it to the data of the various states as basis of comparison, Ayres made from the information many charts and tables, among these are the following:

1. The components and index numbers, United States 1871 to 1918

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Index numbers for divisions, Seven periods</td>
</tr>
<tr>
<td>3.</td>
<td>Components and index numbers of states, 1890</td>
</tr>
<tr>
<td>4.</td>
<td>Components and index numbers of states, 1900</td>
</tr>
<tr>
<td>5.</td>
<td>Components and index numbers of states, 1910</td>
</tr>
<tr>
<td>6.</td>
<td>Components and index numbers of states, 1918</td>
</tr>
<tr>
<td>7.</td>
<td>Index numbers of states at four periods</td>
</tr>
<tr>
<td>8.</td>
<td>Ranks of states as shown by index numbers for four periods</td>
</tr>
<tr>
<td>9.</td>
<td>Ranks of states as shown by index numbers for five periods</td>
</tr>
<tr>
<td>10.</td>
<td>Rank of each state in each component of the index in 1918</td>
</tr>
</tbody>
</table>
11. Changes in the index numbers and in ranks of states, 1890 to 1918

12. Index numbers of states, 1918

13. Sum of five educational components and sum of financial components of the index number for each state in 1918

This review of the book *An Index Number For State School Systems* gives an insight into Ayres’ work as a writer. First, everything had to be reduced or changed in some way so that it could be handled by figures. Once this was done, the manipulation of those figures was not so much a task, as an enjoyable pastime for his mathematical mind. Statistical information in any form was merely another problem for his keen, analytical reasoning to sort out and arrange in such a way that those not so gifted in the understanding of figures could grasp its meaning.

He analyzed his material, and then made it into charts and diagrams that were clear, concise, and to the point. Masses of pertinent information would be put into a very concentrated form on such a chart or table. Probably the most widely used portion of his book on index numbers is the illustrations.

This book, like all of the others which he wrote while a part of the Russell Sage Foundation set forth in a direct and accurate manner all of the facts that he felt pertained to the subject at hand. For this reason, it proved to be
quite a disturbing element in many states because they did not like to fall lower in the rank than the other states and all could not be first. Even though for some time this book had the educational world in quite a furor, the index number as Ayres had worked it out gave a definite basis of comparison for the various state school systems, leaving small room for dispute. It might be called just another display of the ingenuity of the man.
CHAPTEB VII

WAR ACTIVITIES

At the declaration of war by the United States, Mr. Ayres immediately became intensely interested. His keen mind sensed many and varied problems which were thus created and the need for clear thinking, clever individuals. Ayres would never have called himself by any of these adjectives, yet he knew the value and ability of his own mind.

Therefore, he immediately presented himself at the war office asking for a position there as statistician. When told that they did not need a statistician, he was not deterred, but he asked them what they did need, in a scene such as this.

'Ve need a smart young fellow to help around,' was the answer that he received.

'And what would you have such a fellow do?' asked Ayres.

'To begin with I'd have him prepare a chart of the entire organization here; yet to prepare such a chart is well nigh impossible, because the organization changes from day to day. It has to be an elastic chart and that is a hard thing to make.'

'Well, I'm a smart young man,' confided Ayres, 'and I'll bring in your chart tomorrow.'

Using large sheets of cardboard, pins with different colored heads, and tape, he made the chart. The narrow tape on the pins could be changed at will as drawn lines could not. The most interesting thing about the chart Ayres thought was a little card in the corner of the chart on which was neatly lettered:

DIVISION OF STATISTICS — — DR. AYRES

Thus a division of statistics was created.

He also offered the services of the "Statistical and Educational Division of the Russell Sage Foundation" of which he was director. His offer was accepted and he was made director of the Division of Statistics of Council of National Defense. Here he was to furnish those in control of war activities, with data and material as a basis for their thinking and acting. His work expanded and he became director of the Division of Statistics of the War Industries Board, the Priorities Board, and the Allies Purchasing Commission.

His war time program was as neatly ruled as one of his graphs. Saturday, his bureau furnished a secret statistical report of forty or fifty pages to the Secretary of War and the chief of staff. Monday, the war council considered the statistics of men, munitions and supplies. Wednesday, the maritime council perused his statistics of shipments of men and supplies. Friday, the Senate military commission received similar material.2

Thus he organized and conducted the service by which the

department transmitted each week to the military committees of the Senate and the House the salient information regarding the progress of the war.

As Ayres oversaw and carried on not only ably but cleverly the intricate machinery that kept the military commission capable of efficient service, his work became constantly more confidential in nature. He was given a uniform and made a part of the regular army. Pershing hearing about Ayres work, asked that similar services be organized in France. Ayres, who had been made a lieutenant colonel on March 18, 1918, went to France to organize a like statistical service over there. He took with him a selected body of officers and statistical assistants to undertake the work.

Once in France, he was stationed at Colonel Pershing's headquarters. Here he organized the information for the General Headquarters in the zone of the advance and the Supply Services behind the advanced zone. In this service he made reports on the available fighting men, their location and equipment, losses and sick rate, shortage in arms and ammunition, etc.

Also in the eventful year of 1918, he went with Woodrow Wilson as the statistical officer of the Peace Commission, in the supreme war council at Paris. Here he helped to decide what types and how much information the allies should exchange with the enemies.
Later he was present at the Shipping Conference in London by which the United States borrowed British ships for moving the American Army and its supplies.

He returned home in October after having been present at the battle of St. Mihiel and seeing active service at other points on the front. As the result of his accomplishments, he was promoted to colonel on his return to the United States. He was also appointed Chief Statistical officer of the American Commission to negotiate peace. He was the only officer from civilian life at the head of a division of the General Staff.

Colonel Ayres also had the distinction of being the only member of the Dawes committee, who belonged to the American commission to negotiate peace in 1919. This committee drew up the reparations and economic clauses of the peace treaty. For his outstanding work throughout the war, he was given the Distinguished Service Medal.

During the stress and strain of the years of the war, many a man who had been an outstanding personality before the boys went overseas, lost his standing entirely. Many reputations had been junked, but Ayres' had held its place. As a result, he expressed his thoughts and opinions more or less freely, for he had proven his worth.

Therefore, he dared to criticize the work of the Peace Committee. He said,
America ought to support the plan but at the same time insist upon several changes; the German bank of issue should be on a gold basis; some method of deciding when Germany is in default ought to be provided; and sooner or later some decision of the total of the German debt must be arrived at.

He even revealed that there had been differences among the members of the committee and their advisor.

He checked the amount of German money held abroad and found that of $2,000,000,000 worth of foreign mark credits in German banks, the greatest part was held by Americans.

After the war, the duties of Technical Advisor Ayres in Europe differed very radically from those Colonel Ayres performed in Washington and Chaumont during the war. Then he was measuring a moving attack, this time he is gauging a prostrate nation.4

Following his usual method of procedure, at his return to the United States, Ayres immediately began to write a book that would contain all the statistical facts concerning the war. It is safe to say all, for who would have better access to the necessary information? So under the direction of Secretary Baker, he prepared a hundred and fifty page book called The War With Germany: A Statistical Summary.3

In this book he told that there were 4,800,000 men who served in the war of whom 4,000,000 served in the army. Physical examinations were given to all and from the records

3 Survey 52 (July 1, 1924), pp. 417-18.
4 Ibid.
he found that the country boys did better than the city boys, that whites did better than colored, and that natives did better than foreign born. Even though all this material was on file in the records, it was an enormous task compiling it into usable form.

He figured the number of divisions that went to France and how many men were in each. He discovered that almost all of the troops left from New York in cargo ships and that each ship averaged one trip about every seventy days. In checking the materials, the clothing requirements came under his consideration, along with the facts that the signal corps strung up over 100,000 miles of telephone and telegraph wires for their own use, and that 2,500,000 rifles had been purchased for use along with 227,000 machine guns. In this study, he also checked the number of aviators and the number of training schools at which they had been trained. In compiling the number and causes of deaths he found that more men were killed by pneumonia than were killed in battle.

Although the checking of the records for data and the compiling of the material once obtained meant weeks of very tedious and exacting work, yet it was an occupation that appealed greatly to Mr. Ayres. The more complicated the figuring, the more pleasure that he derived from bringing it to a successful conclusion. In some form or other he had been able to apply this mathematical ability of his in every type
of work in which he had been employed.

Also in whatever fields of activities he found himself, whether it was bicycle rider, school teacher, statistician, or war diplomat, Ayres had the force of personality and energy that could not help making him an outstanding leader. It was this driving force along with his ability at figuring out situations and thereby predicting future trends from his figures, that resulted as well in his leadership in the field of business, namely banking.

was able to figure out situations and thereby predict future trends from his figures, that resulted as well in his leadership in the field of business, namely banking.
In 1920 Ayres became vice president of the Cleveland Trust Company, a logical position for a man so intrigued by figures. Since his reputation had remained intact throughout the war, he now found himself in the position that all men hope some day to achieve for themselves, the advisor of men. By that is meant that Ayres made his calculations carefully and deliberatively, and then predicted business conditions of the future with almost uncanny accuracy. Naturally, his fame grew widespread, for he foretold the record breaking year of the automobile industry in 1921.

When asked how he was able to make his predictions, he answered that that problem was comparatively simple. He figured out the least amount on which a family could be maintained. After which, he checked the governmental statistics to ascertain how many families earned that much or more. Using these two items as a basis for his calculations, he figured that every family that could possibly purchase a car would in all probability buy one. Comparing this number with the total of the nation's car owners the difference was
so great that he felt quite safe in acting soothsayer and foretelling the automobile "boom."

The public received this and other predictions in the form of a four page monthly, called the "Business Bulletin." Or rather about 40,000 persons of the general public interested in business read the 3,500 word bulletins. It was, and still is often quoted by the press.

He began the bulletin with the purpose of giving his bank standing, but in the process, acquired fame for himself as well. He gives simple word pictures of economic conditions of the day. It has sometimes been called the monthly barometer for the small investor, for "he tells things which bank directors and customers want to know."\(^1\)

This does not mean that he is infallible. Far from it, but he can analyze a situation with such clearness and accuracy that he has made for himself the title of the best known vice president in banking. In fact, he is much more widely known than President Greech, his cautious "boss."

During these days after the war, Ayres wrote many articles concerning the business world and the stock market, which were published in periodicals. One of these articles entitled "The Great Bull Market of 1925" which he had consented to write for the Review of Review magazine, presented a need

\(^1\)Time, April 27, 1936, p. 71.
for statistical material which he did not have at hand. Without such material he felt that he could not draw true conclusions. Therefore, undauntedly, he set forth to create for himself the necessary working material. Here is an excerpt from the letter which he wrote to the Review of Reviews concerning the article.

When I agreed to write an article for you about the stock market I realized there ought to be an accompanying chart showing the course of the stock market prices during recent bull and bear markets over perhaps the past twenty-five years. As all of the existing index numbers of stock prices are seriously defective and even misleading, it occurred to me that this would be a good opportunity to compile a new index number that would be definitely superior to those commonly in use.

With this idea in mind, I started some weeks ago to work with my office force on the compilation of an index number that would take into account all the common stocks that had been dividend payers since 1900. When this material was put together the years would not join. We then made a new one based on the prices of twenty-five dividend paying stocks each year, and when that was finished it was but little better than the previous one. On the third trip, we started with the dividends and let the prices follow along where they would, and while this was an improvement, it was not good enough to use. On the fourth trip, we made a price index number based on the harmonic means of the yields. This was so complicated that no one could understand it and, all in all, the results were pretty sour.

By this time we were doing a lot of overtime work, and the office force was beginning to develop complexes about index numbers. Then two of my girls got sick.

This past week we have worked all day Sunday and Thanksgiving, and finally produced an index number which is far from being perfect, but at least, is better than any of the other indexes. Now that I am no longer laboring under the handicap of realizing that I am completely stumped by a straightforward statistical problem, my mind is sufficiently relieved, so that I can think about your
article to which this futile labor was a preliminary. I have started writing it, and hope to finish within the next two days. I am also having two diagrams drawn. I hope it will be satisfactory, and trust you have not worried lest I leave you in the lurch. I should not bother you with this description of our domestic difficulty if I did not know that you have often wrestled with problems of this kind; and while it is your habit to crowd them to a solution, I do not doubt that some of them have got you down and trampled on you before you finally conquered them. 2

This letter gives an insight into the personality of the man, his tenacity of purpose, his clear, keen understanding of a situation, and his ability to solve the problem in hand. It shows the extraordinary command the man has of himself, which in turn accounts for his ability to work under high pressure. He does not spare himself when there is a hard task at hand; he is more apt to shoulder the whole problem in his enthusiasm for hunting a solution. He never asks a subordinate to do work which he could not perform for himself. He has actually done every job in the business of banking with the exception of stenography.

For his bulletin, he was forced to observe the trends in the business world so carefully, that he truly had an almost uncanny perception of events about to happen. On October 23, 1929, while industry hummed at top speed, Ayres warned the people that America's golden age of business had come to an end. Naturally, since to the eye of the layman, business was

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"booming," his statements were received with scepticism. Because his prophecy was doubted, it was also ignored. If those who had believed in his forethought and depended upon his judgment for the previous few years, had continued to listen to him, in all probability much of the catastrophe of the depression might have been averted. At least hundreds of businesses could have been prepared to meet the emergency.

Yet he was subject to mistakes also. He predicted the world was in the last phases of the depression as early as 1930. When the fallacy of this became apparent, he increased his scrutiny of the conditions round about and searched for more concrete evidences than previously used, upon which to base his next statements. Aside from this instance, he has been amazingly accurate. He seeks facts and facts alone upon which to base his conclusions. It is his belief that opinions offer little, unless backed by concrete evidence. He can analyze other people's analyses of a situation often with devastating results. This was proved in 1932, when tired and thwarted individuals were insisting that "prosperity was just around the corner." He knew that this was based on hope alone, for he stated, accurately enough, that "the depression is not half through yet."
frequently his vision is narrow. Yet this narrowness does not impede his keen insight into a seemingly impossible tangle of business relationships. He detects inaccuracy and wonders at a public which stupidly believes only what it wishes to believe.

He has demolished many a popular economic delusion with one swift paragraph. His prestige grew uninterruptedly throughout the depression, while the statue of other economic prophets was shrinking rapidly. As a result, he is now one of the most quoted bank economists in the land.

In a recent book, The Economics of Recovery, he gave a critical analysis of the measures adopted and planned toward national recovery. He compared the last depression with those of previous years that have always come as an aftermath of a war in the United States. He made a diagnosis of the depression and its effects, both here and abroad, by carefully considering its characteristic symptoms. Because he believed that debt was the basic cause of the depression, he analyzed the relationship between debt and prices. He studied carefully various acts of the government in its attempts to relieve the situation, and with the help of diagrams to illustrate his points, he stated his reasons for disapproval.

Basing every statement on facts which could be proven, he makes his points. He has never believed that theory was of any value unless it was supported by facts. This he shows
very plainly in the Preface of his book when he states,

This is the time when appraisal of public measures contemplated or undertaken promises to be of more value in the common effort than mere acquiescence or approbation, and when evidence is more availing than enthusiasm.

True to the Ayres' form, he predicted what the result of all of these governmental acts will be, and suggested plans to be used for recovery. He made definite statements concerning the points that he believes to be requisite. Although he wrote the book primarily for business men, bankers, and political leaders, it is a book that can be read and appreciated by all who were old enough to realize the effects of the late depression. The book, like the man and his business acumen and accomplishments, is concise, definite and much to be admired.
Leonard Porter Ayres is now a slender man with greyish hair and keen, penetrating, blue eyes. He works constantly and persistently. Even after his full day has been spent at the bank making decisions, directing others, and advising those who depend upon the action of his capable mind, he carries much work home with him.

His home is a large, eight room apartment on East Ninety-sixth Street close to the edge of Cleveland's negro district. It is a place of comfort and relaxation, for here many of the biggest decisions in the banking world are reached. Here also, he writes his books. All this occupies his time so fully that he seldom goes out. Yet, in spite of these vocations, he has a consuming avocation, reading. He reads much because he reads so rapidly.

When working or reading, he smokes large black cigars, the larger and blacker, the better. His idea of perfect enjoyment is: a good book, a comfortable chair, and six big black cigars, laid out in a row within easy reach.

Ayres is never in want of amusement or diversion. First,
because his work so occupies his mind that he has little time for other pastimes and secondly, because it takes only the smallest and simplest things to give him keen enjoyment. For a time, he spent his summer hours tinkering with and sailing in an old second-hand boat.

Although he now drives a huge Cadillac, he has not always been so prosperous. For the first few years after he became a banker, he persisted in driving an old automobile that became a portable rattle at twenty-two miles an hour. He drove for himself then as he does now, and his greatest delight was in picking up casual strangers whether "richman, poorman, beggarman, or thief."—

Once in his driving, he met a hobo who wanted a lift. Instantly the old auto stopped and the hobo was picked up with no prying questions asked. He sat beside Ayres mumbling about how long it had been since anyone had treated him "regular." As he left the car, he plunged his hand deep into his pocket and turning to Ayres said, "There's darn little I can do for you, stranger, and this ain't much, but take it,—I never had a brush for it anyway." For many years Ayres kept the can of tooth powder that the tramp gave him and no doubt may still have it.

Even though he enjoys driving his big car as well as the old one, he seldom goes driving for pleasure. Rather, he must generally have a definite place to go with a definite
reason for going. He has never been interested enough in anything aside from his work, to make a hobby of it, yet in the most boresome situations, he can find amusement for himself. At a most important meeting or banquet, one is apt to see him draw a watch from his pocket and look at it keenly and long. If the watch were examined closely, it would be found to be a stop watch. With it Ayres likes to time the speakers to see how long it takes to state an idea. This same watch has served on many an occasion as an aid in helping Ayres tabulate the speed of bicycle riders in a race. Anything which can be converted into figures interests him.

Even during the time that he was so fully occupied with the work of the Russell Sage Foundation, he did a little work on the side for diversion. Part of the time it was market forecasting, an interest which probably led to his present position. Among his other ventures, he studied the methods by which manufacturers estimate the trade demands for sizes in shoes and collars. And once he made a study of the relative wearing qualities of four fifty cent neckties in comparison to one two dollar tie. He checked in the same manner a ten dollar pair of shoes against two five dollar pairs.

At another time, he made a graph of the weather changes in one city and another graph of the stock market changes. The variations on these two graphs he found almost identical. From this he said that the rise and fall of prices on the
stock market had much in common with the varying changes in the weather. That is, after an intense hot spell, cool weather is certain to follow, or in other words, there will be a drop in the temperature. Also warm weather always follows an extremely cold spell. So it is with the stock market, when prices either rise to extraordinary heights or sink to frightfully low depths the following reaction will be in the reverse order. In fact, nothing that concerned human variations and the flow of measurable units is foreign to this genius.

Much of this type of figuring he does at night. Most of his concentrated thinking and real hard work is done between eight P.M. and two A.M. As a result, he never wants to get up in the morning. No little boy is harder to get out of bed. At breakfast he is likely to mull over the ideas thought out the night before.

Once, shortly after the war, Ayres decided that the schools were asking very foolish questions on their examinations. Just what focused his attention to this fact would be hard to say, but once his attention was caught, it could not be shaken from the problem in mind until a solution was reached. Therefore, he selected many of the examples of what he termed foolish questions from some school examination papers in history, geography, and spelling for grades five, six, and seven and made a test of them. This test he gave to business men to answer. Among these men were a state senator,
a former lieutenant governor, a president of a manufacturing concern, a former superintendent of parks, bankers, physician, merchant, lawyer, newspaper editor, efficiency engineer, clergyman, and not one obtained a passing mark. He had proved his point.

Many of these experiments have given a basis for magazine articles, sometimes even books. Ayres, as a writer, turns out good clean copy, not only from the point of view of content but also from the side of form. His thinking is as neat and orderly as the routine of his life, a life in which he says he has three luxuries: a black mustache, a negro housekeeper (said to be one of Cleveland's best cooks) and his big black V16 Cadillac. His luxuries all have rather a dark sound, do they not?

Following is a brief summary of the highlights in the life of Leonard F., Ayres:

1897--Born in Niantic, Connecticut, of Milan Church Ayres and Georgina (Call) Ayres.
1902--Ph.B., Boston University
1902--Began to teach in schools in Porto Rico
1903-4--Superintendent of schools in the District of Caguas, Porto Rico
1904-6--City Superintendent of Schools, San Juan
1906-8--General Superintendent of Schools of Porto Rico and Chief of the Division of Statistics
1908--"A Course of Study for the Schools of San Juan"
   (written with Luther H. Gulick)
1908--"Medical Inspection of Schools"
1909--"Laggards in Our Schools"
1910--"Open Air Schools"
1911--"The Binet-Simon Measuring Scale for Intelligence: Some Criticisms and Suggestions"
1911--"Seven Great Foundations"
1913--"Psychological Tests in Vocational Guidance."
1914--"The Public Schools of Springfield, Illinois"
1915--"The Measurement of Spelling Ability"
   "School Buildings and Equipment"
   "Health Work in the Public Schools"
   "Child Accounting in the Public Schools"
   "Organization and Administration"
   "Handwriting Scale"
1916--"Summary of the School Survey of Cleveland, Ohio"
1918--(Throughout the war)
   Director of the Division of Statistics of the War Industries Board
   Priorities Board Council of National Defense
   Allies Purchasing Board
   Made a colonel
   Member of the General Staff (only civilian to hold such a position)
Chief Statistical Officer of the United States
Chief Statistician of A.E.F.
Chief Statistical Officer with American Committee to negotiate peace

1919--"The War With Germany"

1920--"Index Number for State School Systems"
Became vice president of the Cleveland Trust Co.

1921--"Price Changes in Business and Prosperity"
"The Automobile Industry and Its Future"

1922--"Business Recovery Following Depression"
"The Nature and Status of Business Research"
"The Prospects for Building Constructions in American Cities"

1924--Economic Advisor for Dawes Plan Committee
1925--Made a member of Business Council of the War Department

1926--Member of the Economic Policy Commission of the American Bankers Association
President of American Statistical Association

1928--Predicted the depression
1932--Chairman of the Business Council of War Department

1933--"Economics of Recovery"
1935--"Chief Causes of This and Other Depressions"
With all his prominence, fame and fortune, he still is very retiring and quiet. He is seldom seen outside the bank except when he makes a speech. He says about himself that he is just a "drab old man, who has never done anything interesting and is not interesting." It is a shame at times that we can not see ourselves as others see us, is it not?
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