present work is a suggested method for incorporating, with due weight, observations additional to those upon which the catalogue results are based, thus, for a time at least, keeping it abreast of ever accruing observation. In contrast with this laudable innovation is the author's marked conservatism at other points, *e. g.*, in adhering to the system of star magnitudes established by Argelander in preference to the results of more modern photometric research, and in refusing to credit, even when extraneously confirmed, the result of his own investigation, that the fainter component of a binary star may be more massive than its brighter companion.

But criticism of the volume must be of very minor character and extent. In plan and execution the work must long stand as a monument to its distinguished author and a worthy first fruit of the Department of Meridian Astrometry of the Carnegie Institution of Washington, destined to stand as the court of first instance for the determination of disputed matters of stellar motion, such as the excessive average motion of stars remote from the galaxy; the two group theory of the stellar system, etc. While in the volume itself, a prudent reticence is maintained with respect to such applications, there is extraneous suggestion of discord to come.

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SPECIAL ARTICLES

A STUDY OF THE METHODS OF DETERMINING FAME

SOME time ago I became interested in the study of historiometry (quantitative history). In this connection I undertook some research work in the family records of celebrated Americans along lines laid down by Dr. F. A. Woods in his "Heredity in Royalty" (New York, 1906).

The question at once arose, which are the hundred, the seventy-five, or the fifty leading American names? In short, which families should be studied? The object in seeking the leading names, of course, was not the list *per se* but to secure a basis for further study. This study will include the traits and characteristics of ancestors and descendants, their birthplaces, education, achievements, etc. The material lies for the most part in histories and biographies. These "measurements in history" statistically and objectively treated, and followed by scientific analysis of causes, constitute "historiometry." (Woods.)[1]

The Hall of Fame movement, so far as it goes, would seem on account of the remarkable personnel of the electors, their geographical distribution and other considerations, to afford an easy way out of the difficulty. Undoubtedly the electors have done a great work which in general the thinking public must accept. Certain peculiarities disclosed in the Hall of Fame reports, however, together with the fact that the Hall of Fame selections include only a very limited number of names, led to a search for some other methods of rating fame. Several objective methods have been proposed. A desire to learn how some of these methods compare, led myself and others to undertake a test by means of tabular comparison.

We thought it would be instructive to compare the Hall of Fame electoral votes with two objective methods. The first method taken was a so-called adjective method and the second was the space method. The "adjective method" of determining fame, as we applied it, consists in simply counting the descriptive adjectives of praise applied to the name in a given work or number of works. The adjective method in another form has been successfully employed by Woods. The space method consists in counting the lines of space devoted to this name in a given work or group of works. This method has been successfully employed by Cattell and Ellis.

Upon referring to the totals of the votes cast by the electors we find that 50 American-born men have received more than 30 votes (in case a name has been voted on twice, the second total only is considered here). The four reference titles chosen as being fairly representative were Lippincott's "Pronouncing Biographical Dictionary" (Thomas), Jameson's "Dictionary of U. S. History,"

[1] See SCIENCE, November 19, 1909.

"New International Encyclopædia" and "Encyclopædia Britannica." All the standard American histories were examined but not one could be used, owing to flagrant omissions. Philosophers as a class suffered most frequently by these omissions.

In the table below the first column to the right of the names, headed "Hall of Fame," contains the totals of votes given that name by the electors, the names being arranged in the order of the number of votes received. The second column, headed "Adjectives," contains the totals of adjectives of praise applied to each person in the four reference works, named above, and the third column, headed "Space," contains the totals of lines (space) devoted to that name in the same books of reference.

Errors in arithmetic or judgment doubtless exist but it is believed that the errors are not sufficiently great to materially affect the conclusions. In this table it will be observed that some disagreement occurs especially when the subject is a scientist, inventor, preacher or philanthropist. For example, Peter Cooper totals only 7 adjectives and 313 lines, Morse 6 adjectives and 227 lines, Fulton 11 adjectives and 75 lines, Whitney 7 adjectives and 75 lines (no sketch in "Encyclopædia Britannica"). This is scarcely to be wondered at. A career is frequently theatrical out of all proportion to its importance. Another career may be remarkable more for length and variety than worth. Sometimes a brief but great career, especially if it be that of a statesman or soldier, gets a fair relative amount of attention, as in the cases of Lincoln and Grant, but the chances appear to be decidedly against this in the less picturesque callings. The public demands the details of the lives of the leaders of men. Again, moral qualities in the Hall of Fame selections play a part which they do not in the objective studies, for obvious reasons; and sectionalism is always a disturbing element in both. As respective illustrations, consider Edgar Allen Poe, W. L. Garrison and Jefferson Davis. The latter two never received a creditable number of electoral votes. Moreover, these

	Hall of Fame (Votes)	Adjectives (Descriptive)	Space (Lines)
Washington	97	85	1,785
Lincoln	96	70	1,285
Webster, D.	96	31	784
Franklin	94	83	1,595
Grant	93	69	1,311
Jefferson	91	35	1,149
Marshall	91	28	363
Emerson	87	58	872
Fulton	86	11	215
Longfellow	85	55	780
Irving	83	36	456
Edwards	82	25	628
Morse	82	6	229
Farragut	79	16	374
Clay	74	22	516
Peabody	74	4	172
Hawthorne	73	43	588
Cooper, P.	69	7	313
Whitney	69	7	75
Lee	68	26	587
Audubon	67	35	321
Mann	67	11	279
Kent	65	20	132
Story	64	22	169
Beecher	64	18	295
Adams, J.	62	24	633
Adams, J. Q.	60	34	481
Lowell	59	53	662
Sherman, W. T.	58	24	565
Channing, W. E.	58	20	510
Maddison	56	38	623
Whittier	53	20	277
Stuart	52	11	136
Gray	51	24	244
Holmes	49	32	462
Brooks	49	20	116
Motley	47	21	192
Parkman	47	27	294
Bryant	46	28	347
Calhoun	46	27	322
Henry, P.	46	34	405
Jackson	46	47	703
Cooper, J. F.	43	30	494
Poe	42	26	547
Hopkins	40	6	68
Bancroft	40	31	422
Boone	36	19	111
Webster, N.	34	3	193
Greene	34	27	263
Choate	31	46	208

apparent inconsistencies in the electoral votes, if they are not points in favor of the objective methods, certainly do not tend to discredit them. As for agreement in general, let it be remembered that "all things are relative." In consideration of the millions of Americans who have lived and died, it is a rare distinction to receive from such sources *any* votes, *any* adjectives or *any* praise. Even among

the leaders this will be found true. Lippincott's "Dictionary" contains sketches of some 3,000 Americans. Each of these persons, it is fair to say, attained high distinction. Of *all* Americans they may be said to be at the top within a fraction of one per cent. of the highest. From this work (Lippincott's) I took at random and regardless of any consideration 25 names, counted the adjectives of praise applied to them, and the lines of space devoted to their sketches. The average number of adjectives found was .64 and the average number of lines of space, 8.68. Many hundred names may be found without a single adjective. Again, in the above table it will be observed that only 9 men received less than 16 adjectives and only 10 received less than 200 lines. This shows an agreement little short of remarkable. In this study of historiometry it is not a question of *order* within the series. It matters little in a list of 50 or 500 whether a name holds tenth or fortieth place. Any apparent disagreement in the above then is really negligible.

The fact that a certain name received on the first ballot 47 electoral votes (notwithstanding the fact that it requires but 51 votes to elect a name to the Hall of Fame) and on the next only 29, the same occurring in several other instances only to a less marked degree, is strong evidence in favor of the reliability of the objective methods. It should also, in all fairness, be kept in mind that the electors were not granted absolute freedom to select whomsoever they would. The sixth rule governing the proceedings required that the first fifty names chosen must include one or more representatives of a majority of the fifteen classes of citizens therein enumerated. Just how great an influence this attempt to insure the "recognition of the multiformity of human activity" had, we do not know. There is, however, reason to believe that the figures, showing the final votes received, afford a fair résumé of the electors' judgments of the relative standing of America's great men.[2] The Hall of Fame votes have been useful in giving us something reliable to work by in our study of the objective methods. The mere "relative standing" feature aside from this has been more interesting than useful. As stated above it is not, for historiometrical purposes, a question of *order* but rather of groups "objectively compiled."

By the above comparisons and others which I have undertaken, including a study of Cattell's list of great men (space method) I am in spite of my original prejudice convinced that either of the objective methods (adjective or space) may be successfully employed in the selecting of a list of indefinite length. Indeed I know of no other method that even approaches them in efficiency. They promise invaluable aid to students of historiometry as the science develops.

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[2] See "Hall of Fame Official Book," by H. M. McCracken, New York, 1901; also subsequent reports.

LIME AND LEGUME INOCULATION

IT has been long recognized that liming produces different effects on different soils, and it has been pointed out[1] that for the growth of flowering plants, lupins especially, there is an optimum relation of lime to magnesia. In certain portions of the coastal plain it has been observed that oyster-shell lime is markedly superior to stone lime, especially in its effect on securing stands of alfalfa and clover. The stone lime, in many cases at least, was found to be derived from dolomite and therefore highly magnesian. Soils from some of these regions are rather high in magnesia.[2]

The effect of magnesium carbonate on nitrifying organisms was studied in connection with one of these soils. In our tests magnesium carbonate and calcium carbonate in quantities varying from 0.25 per cent. to 2.00 per cent. were added to a sandy loam showing the above-mentioned characteristics; ammonium sulphate was also added. At the end of an incubation period of fourteen days the

[1] Oscar Loew, "The Relation of Lime and Magnesia to Plant Growth," Bureau of Plant Industry Bulletin No. 1, 1901.

[2] Bureau of Soils Field Operations, 1901, pp. 186.