## NEGATIVE SKEWNESS AND ITS SIGNIFICANCE IN RELATION TO DISTRIBUTIONS OF PERFORMANCE RATINGS OF CIVIL SERVICE EMPLOYEES

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In the social and behavioral sciences it has been said that frequency curves skewed to the left or in a negative direction are uncommon, and that data which are characteristically so skewed are so rare, so unusual, or of such infrequent occurrence as to be practically nonexistent. It, furthermore, appears to be the opinion of some authorities that frequency distributions of performance ratings are apt to be either moderately skewed to the right or nearly symmetrical in conformation.

This paper reports the findings resulting from analyses of more than 250 frequency distributions of performance ratings of Civil Service employees, representing the Departments of Navy, Agriculture, and the Veterans Administration. These analyses were carried to the point of determining the criteria of curve type. Of the total number of distributions, coming within the scope of this study, only 12 were skewed in a positive direction. In other words, fewer than five distributions out of a possible 100 tended to be skewed to the right. From the standpoint of size it is important to observe that one hundred distributions of ratings were representative or 500 or more individuals. Over-all distributions in certain instances (See Table 1) were sufficiently large to be regarded as parent populations or universes in and of themselves.

Table 1.	Negative	Skewness	and Degi	ee of	Signi	ficance	as l	Measured	by	Normal	Deviate	!
of T Tes	t, Perform	mance Rat:	ings of (	ivil	Servic	e Emplo	yees,	, Depart	men	ts of Na	ivy and	
Agricult	ure, and a	Selected a	Services,	Data	for Y	ears En	ding	March 3	1, 3	1942 and	1 1943.	

	Measures descriptive of certain aspects of a frequency distribution						
Governmental agency and service	Total frequency or N	Criterion of curve type	Alpha 3	Standard error of Alpha 3	Normal deviate or T value		
Navy Department: Mar. 31, 1942 Mar. 31, 1943	17078 15178	I I	-0.1045 -0.9463	0.0187 0.0199	5.58 47.60		
Agriculture, Departmental Service: Mar. 31, 1942 Mar. 31. 1943	12832 10870	I I	-0.6540 -0.3764	0.0216 0.0235	30.25 16.02		
Field Service: CAF Mar. 31, 1943 P Mar. 31, 1943	15771 10900	I I	-0.6162 -0.7125	0.0196 0.0235	31.44 30.37		

For example, performance ratings covering 17078 employees were reported by the Navy Department as of March 31, 1942. The Clerical, Administrative and Fiscal personnel, comprising the Field Service of the Agriculture Department, numbered 15771 as of the same date. On March 31, 1942 CAF personnel, constituting the Departmental Service of the Department of Agriculture, numbersome 12832 individuals. The Navy Department reported performance ratings on 15178 Civil Service employees for the year, ending March 31, 1943. The Departmental Serivce of the Department of Agriculture reported rating on employees to the number of 10870 on March 31, 1943. Comparable numbers for the Professional personnel in the Field Service of the Agriculture Department amounted to 10900 as of the same period.

Of those 12 distributions of Navy Department personnel, which were skewed to the right or in a positive direction only four such distributions numbered in excess of 500 individuals. (See Table 2 which follows:

Organizational Unit	Total frequency or N	Curve type	Alpha 3	Standard error	Normal deviate
New York Navy Yard Regular employees, 1944	5319	I	0.2601	0.0336	7.74
Bureau of Supplies and Accounts, 1942	2640	I	0.4156	0.0477	8.72
EXOS & OS, 1942	2283	IV	0,0982	0.0513	1.92
Marine Corps	1059	I	0.2235	0.0753	4.71

In the above table those normal deviate of T values marked with an asterisk indicate that the distributions with which they are associated are highly significantly skewed. In other words, three out of four distributions were characteristically skewed to the right or in a positive direction. Performance ratings of EXOS & OS combined gave rise to a frequency curve, conforming to the Karl Pearson Type IV criterion. Skewness in this instance was not so great but what it could be accounted for on the basis of chance. (Consult Table 2.)

Alpha 3 is a coefficient of relative skewness and possesses the desirable quality of being independent of the unit of measurement. Inasmuch as it is not restricted in range, it is a very sensitive measure. For the purpose of this study Alpha 3 has been used.

A deviation from any statistical measure in terms of its standard error is called a normal deviate. The normal deviate is otherwise designated by the letter T. In calculating the T value the deviations are always considered to be positive. For any symmetrical distribution the value of a coefficient of skewness is always zero. To measure the departure from absolute symmetry we divide Alpha 3 by its standard error. For example, the value of Alpha 3 descriptive of the distribution of performance ratings for the Navy Department as a whole, for the year ending March 31, 1943, was -0.1045. The standard error of this measure was 0.0187. Diving the former by the latter we obtain a quotient of 5.58.

The value of the normal deviate or T for the .95 probability level is 1.960, and for the .99 probability level, 2.576. Deviations are said to be significant when T is equivalent to 1.960 or more, and highly significant when T is equivalent to 2.576 or more. Since the computed value of T for this particular frequency distribution is 5.58, the departure from absolute symmetry of form is to be interpreted as highly significant. We conclude that the data from which this measure derives are characteristically skewed in a positive direction.

Certainly insofar as the Departments of Navy and Agriculture, and the Veterans Administration, Branch Area 7, are concerned the evidence at hand fails to support the hypothesis with respect to symmetry, or direction and extent of departure from symmetry, as expressed in the introductory paragraph of this paper. Negative skewness very definitely gives evidence of being a dominant characteristic of such data as does conformity with respect to shape to the Karl Pearson I or III criteria.

The research of this writer leads him to the conclusion that the distributions of raw scores tend to conform to the same pattern as described above. Only when the examination upon which the raw scores are based has been constructed by a person trained in the technicalities of psychometrics have we a right to expect even approximate symmetry of form of these scores. It is likewise true that having passed through a socalled "normalizing" or adjustment process at the hands of a person so trained the distribution of the resulting scores may be roughly summetrical. It is important to remember in this connection, however, that first line supervisors in government agencies and members of the teaching profession have neither the time, the technical "know how," nor the computing machines for such refined analyses and adjustment.

As submitted to the writer for analytical treatment the performance ratings of Civil Service employees of the Navy Department for the year ending March 31, 1943 were coded and in the form of frequency distributions, concerning of nine classes. This statement is equally true of the Department of Agriculture for the same time period. In other words, in both instances the original ratings were in numerical form. However in the case of the Navy Department, Departmental as well as Field Services, for the year ending March 31, 1942, and in the case of the Veterans Administration, Branch Area 7, the original measures of performance were reported as adjective ratings. These data were coded by the writer in order to make statistical manipulation possible. Intervals along the base line were equally or uniformly spaced. Through the use of logarithmic transformations no doubt these Pearson Type I or Type III frequency curves would have assumed in approximation of normality. In this event the intervals along the base line of course would no longer have been uniformly spaced.