Carmela Metelli Di Lallo (1914-1976) fu ordinaria di Pedagogia presso le Università di Trieste e successivamente di Padova.

Dopo la laurea in filosofia, l'interesse per le scienze umane determinò un primo orientamento per la psicologia, soprattutto nel settore della psicologia scolastica a cui l'Autrice dedicò gran parte del lavoro svolto presso il Centro di Psicologia del C.N.R..

Dalla composizione tra interessi filosofici e interessi psicologici, integrati da spiccate motivazioni sociali, si delineò ben presto la direttiva verso la pedagogia come luogo elettivo di convergenza di tali indirizzi di studio.

Tra le pubblicazioni sono da ricordare, oltre a numerosi articoli su problemi della scuola - particolarmente sulla scuola del preadolescente, una serie di studi e di ricerche sperimentali, condotti e pubblicati tra il 1955 e il 1959 sul tema Film didattico e apprendimento, e, successivamente, un gruppo di ricerche sui processi logico-linguistici nella preadolescenza, in rapporto alle esigenze di ricostituzione didattica della nuova scuola media: Problemi psicopedagogici. Scuola e linguaggio, Bari, Laterza, 1964. L'interesse per la componente filosofica della pedagogia è attestato da un gruppo di lavori sul pensiero di J. Dewey, tra cui: La dinamica dell'esperienza nel pensiero di J. Dewey, Padova, Liviana, 1958. Le diverse articolazioni di studio e di ricerca si compongono unitariamente nel complessivo riesame del discorso pedagogico in Analisi del discorso pedagogico (1966) da cui è tratto il presente volume. In una linea metodologica aderente a quella seguita in tale saggio va ricordato inoltre Componenti anarchiche nel pensiero di J.J. Rousseau (Firenze, La Nuova Italia, 1970), in cui l'A. propone una nuova lettura di Rousseau attraverso un puntuale raffronto con il modello anarchico sui grandi temi della condotta umana.

Tra le discipline che, in epoca più o meno recente, si sono staccate dalla comune matrice filosofica e hanno sviluppato propri campi e strumenti di indagine, la pedagogia è quella che ha incontrato e incontra le maggiori difficoltà a costituirsi come scienza. Una fondamentale causa di tali difficoltà va individuata nel discorso stesso sull'educazione, spesso inficiato nei pedagogisti di varie epoche da componenti speculative e emozionali o dall'influenza di *patterns* culturali che ne limitano la coerenza e validità.

L'*Analisi del discorso pedagogico*, di cui il presente volume costituisce il primo capitolo, rappresenta un punto di raccordo critico tra diverse componenti del sapere pedagogico - dai "classici" come Locke e Rousseau all'attivismo al disegno di utopia - attraverso un'analisi condotta con i moderni strumenti della metodologia della scienza e puntualizzata su questioni tematico-linguistiche sempre attuali.

Nel primo capitolo, che per ampiezza, densità e compiutezza può ben costituire un saggio a sé, l'Autrice propone il "Vocabolario dell'analisi", e cioè alcuni concetti fondamentali dell'epistemologia contemporanea di particolare rilevanza per le scienze del comportamento: termini osservativi e costrutti teorici, modelli e teorie, componenti prescrittive e valutative del discorso, etc..

Per ricchezza di documentazione e chiarezza di sintesi critica il saggio costituisce non solo la necessaria guida all'analisi dei "grandi temi" e dei grandi autori dei capitoli successivi, ma anche, ormai, un punto di riferimento obbligato per una "disciplina metodologica" del discorso sull'educazione.

che la stessa Casa Editrice intendesse in avvenire fare dei singoli contributi al Trattato.

Ai fini della compilazione dell'indice analitico, da disporre nel trattato, i collaboratori forniranno col manoscritto, l'elenco alfabetico dei termini scientifici che compaiono nella parte da essi redatta, con la indicazione degli equivalenti termini in lingua francese, inglese e tedesca.

Allo scopo di consentire la organica preparazione del Trattato i collaboratori, prima di procedere alla stesura del manoscritto, invieranno al Direttore un sommario della parte che essi si accingono a svolgere. L'esame di questo sommario consentirà al Direttore di concordare preventivamente con i collaboratori le modificazioni all'opera di collaborazione che si rendessero necessarie per evitare da un lato i doppioni e dall'altro eventuali lacune.

Indipendentemente da ciò, per la stesura del testo definitivo, il Prof. Musatti è autorizzato ad effettuare quelle modifiche, anche formali, sul testo preparato dai collaboratori che si rivelassero opportune per l'unità dell'opera.

La Casa Editrice, non appena effettuata la distribuzione delle collaborazioni, preparerà i contratti individuali per i Direttori di Istituto e per gli altri collaboratori.

DISEGNO DEL TRATTATO

Il Trattato sarà diviso in quattro Sezioni e 14 Capitoli secondo lo schema seguente:

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Sezione 1^ : introduzione

Cap. 1^ : LO SVILUPPO DELLA PSICOLOGIA MODERNA (breve introduzione storica) pp. 30 circa

Cap. 2 ^: LE FUNZIONI PSICHICHE (sistematica dell'attività psichica, biologicamente inquadrata) pp. 30

Cap. 3^ : FUNZIONI PSICHICHE E SISTEMA NERVOSO (cenni sulle correlazioni fra l'attività psichica e l'attività organica con particolare riguardo al sistema nervoso centrale) pp. 30

Cap. 4^ : I METODI DELLA RICERCA PSICOLOGICA (sistematica delle tecniche della ricerca psicologica) pp. 30

Sezione 2^ : le forme della realtà psichica
(in questa parte la vita psichica verrà considerata prevalentemente da un punto di vista fenomenologico descrittivo)

Cap. 5^ : L'IO COME CI APPARE (Coscienza - Livelli di coscienza Attenzione - Stati crepuscolari - sonno e veglia - le sensazioni organiche in quanto partecipi alla coscienza di sè schema corporeo) pp. 40

Cap. 6^ : IL MONDO COME CI APPARE (tutta l'attività sensorio - percettiva) pp. 80

Cap. 7^ : REALTA' CHE NON E' PIU' E REALTA' CHE NON E' ANCORA (immagini pseudopercettive - immagini oniriche - Memoria - la rappresentazione) pp. 70

Cap. 8^ : L'INTERNO MONDO STRANIERO (sistematica dell'attività psichica inconscia) pp. 30

Sezione 3^ : i modi dell'attività psichica
(in questa parte la vita psichica verrà considerata nel suo aspetto di attività)

Cap. 9^ : L'ENERGETICA DEL COMPORTAMENTO (gli istinti - la affettività - la espressione degli stati emotivi) pp. 70

Cap. 10^: L'AZIONE (attività motoria - Comportamento - Apprendimento) pp. 50

Cap. 11^: IL COMPORTAMENTO MENTALE (Pensiero produttivo - fantasia creatrice) pp. 50

Sezione 4^ : la vita concreta dell'individuo
(in questa parte la vita psichica individuale verrà considerata nel suo concreto sviluppo, nelle sue varietà individuali e nei rapporti interindividuali)

Cap. 12^ : LO SVILUPPO DELL'INDIVIDUO :(lineamenti dello sviluppo dell'io e della formazione della personalità adulta attraverso le varie fasi del suo sviluppo) pp. 50

il linguaggio

Cap. 13^ : LA PERSONALITA' E LE DIFFERENZE INDIVIDUALI (Carattere - attitudini - psicologia differenziale) pp. 60

Cap. 14^: L'UNO FRA GLI ALTRI (Rapporti interindividuali - linguaggio - processi di formazione dei gruppi sociali) pp. 70

L'indicazione del numero di pagine assegnato ad ogni capitolo è del tutto approssimativa e provvisoria.

Esulano dalle finalità dell'opera trattazioni specifiche di psicologia applicata, di psicopatologia, di psicologia sociale e di psicologia infantile. Ad esse si accennerà soltanto per quegli elementi che rientrano nei vari argomenti sopra accennati.

TRATTATO DI PSICOLOGIA
(in collaborazione fra gli Istituti di Psicologia delle Università Italiane)

La Editrice Universitaria di Firenze ha affidato al Prof. Cesare Musatti il compito di dirigere la pubblicazione di un Trattato di Psicologia, servendosi della collaborazione dei principali cultori italiani della materia che svolgono la loro attività negli Istituti Universitari di Psicologia.

Il trattato dovrà avere il carattere di manuale, da utilizzare anche nell'insegnamento universitario. Esso dovrà consistere in un volume di circa 700 pagine. Dovrà essere una trattazione scientifica della materia; ma, sia per la impostazione generale, sia per la forma della esposizione, dovrà anche presentarsi come un'opera di abbastanza agevole lettura.

Benchè modernamente concepito, nel senso che ogni particolare moderno indirizzo di ricerca vi sia contemplato, non dovrà presentare alcun predominio di qualche indirizzo particolare. Per modo che il Trattato possa essere l'equilibrata espressione della psicologia scientifica italiana.

Al Prof. Musatti spetta il compito:

a.) di preparare il disegno generale del Trattato
b.) di organizzare le varie collaborazioni
c.) di raccogliere il materiale preparato dai collaboratori
d.) di esercitare una supervisione su tale materiale (con facoltà di una certa rielaborazione) in modo da conferire al Trattato una sua organicità ed unità anche formale.

Il Prof. Musatti eserciterà queste funzioni accordandosi con i vari Direttori di Istituti per quanto riguarda i compiti a) e b) e con accordi diretti con i collaboratori per quanto riguarda il punto d).

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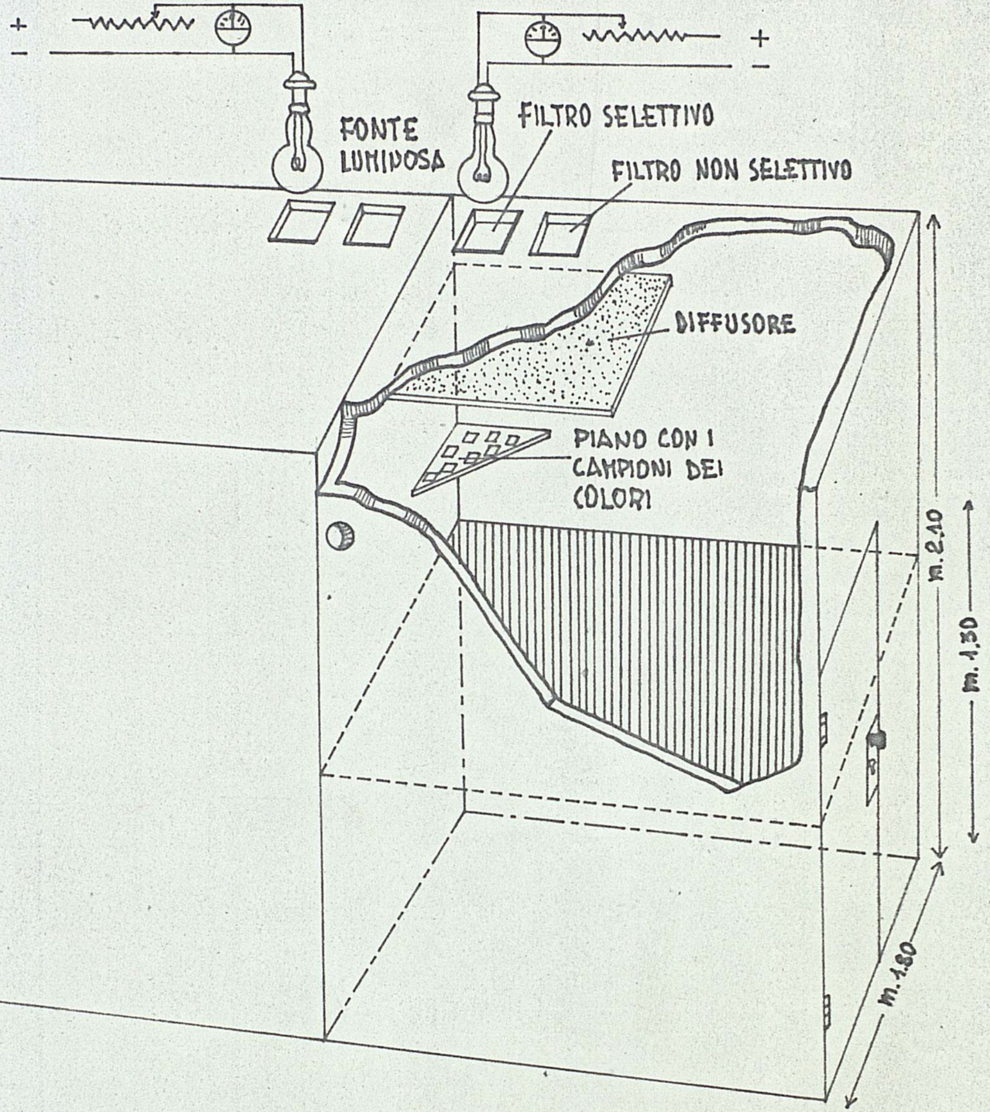
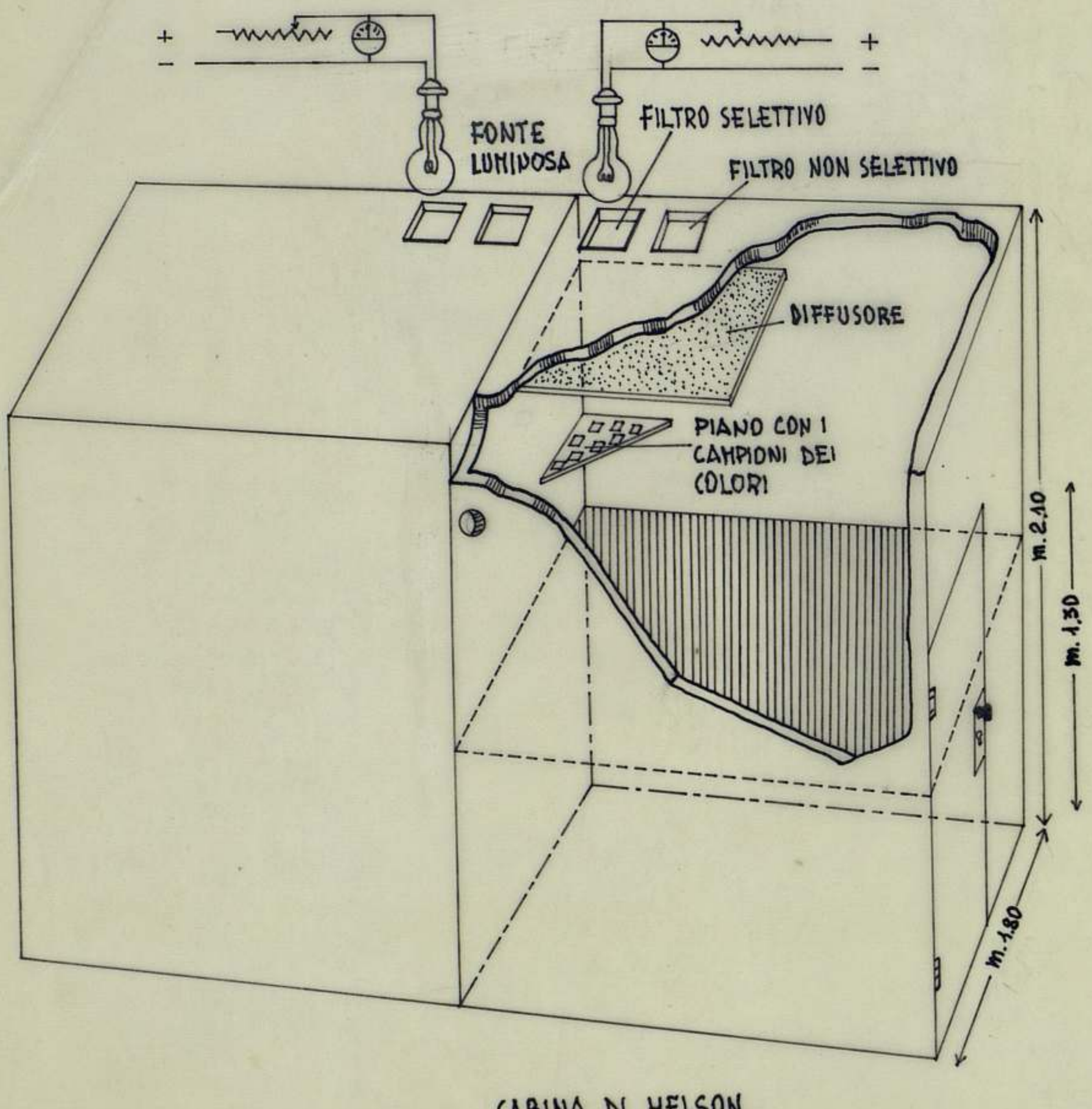


CABINA DI HELSON
(PER LO STUDIO DELL'EFFETTO DELLE VARIAZIONI DI ILLUMINAZIONE SUL MODO D'APPARIRE DEI COLORI)



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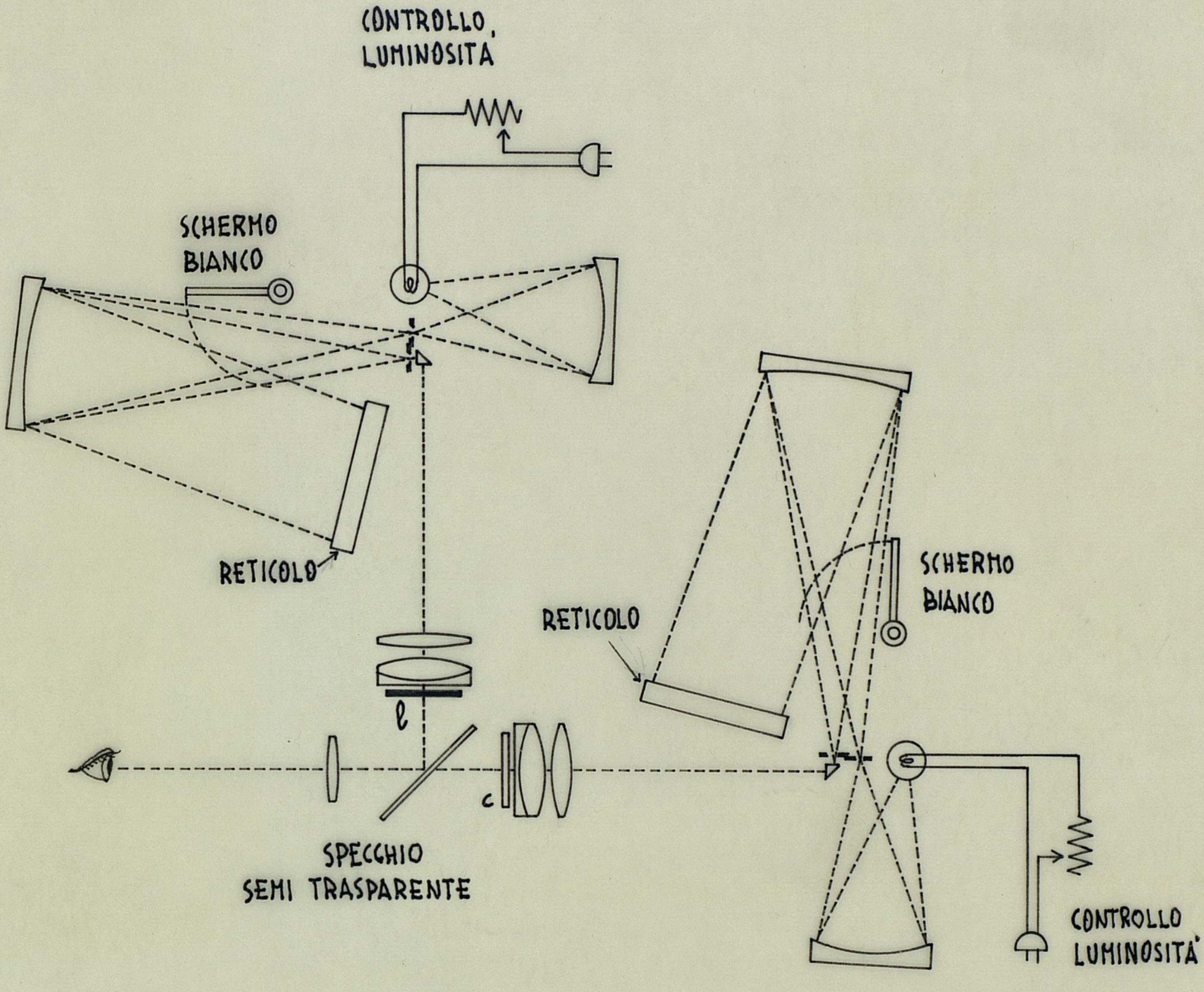

DOPPIO MONOCROMATORE (ℓ, c = DIAPOSITIVE OTTENUTE RISPETTIVAMENTE CON RADIAZIONI LUNGHE E CORTE) right-hand corner of each cell. (These values are shown in heavy black type in Figure II.) Continue the cumulation to the bottom of the column, even if no tallies occur in the few lowest cells.

When the cumulation in any column has been completed, the final value should equal the entry for that column which appears in the "F_X" row, unless tallies occur in the lowest or "0" interval; in this case the final cumulated value plus the number of tallies in the lowest interval should equal the "F_X" entry.[1]

Next, find the sum of the cumulated values (red figures) for each column and enter in the "$\Sigma_X Y$" row. As a check add the numbers in this row and verify its agreement with ΣY previously found. Multiply each of the values in this row by the corresponding "X" value which is printed in the *bottom* row of the scatter diagram, and enter these products in the "$X\Sigma_X Y$" row. The sum of the values in this row is 1st ΣXY. (Step 6) Record this value in the upper right-hand corner of the chart.

7. In the other spaces at the upper right of the chart, record the appropriate values, ΣY, ΣX, S_Y, S_X, etc. If the difference between ΣY and ΣX equals the already obtained $\Sigma(Y-X)$, place a check mark in the box to the right of the space provided for this value. (Step 7)

If they do not agree, an error has been made in at least one of the preceding steps, and this error must be found and corrected before proceeding.

Perform the other operations indicated until 2nd ΣXY is obtained. This value must check with 1st ΣXY.

8. Fold over the left-hand edge of the chart so that the section marked "Work Sheet" is visible. (See Figure II.) Enter in the first column the proper values, transferring them from the front of the chart. If a calculating machine such as the Monroe or Marchant is being used, set the reciprocal of N in the keyboard, and most of the values in the second column can be readily obtained by multiplication; the others may be read from a table of squares.

The remaining operations necessary for arriving at "r" are clearly indicated. Two independent derivations of the coefficient are possible, thus furnishing a valuable check even to the final computation. The values obtained may, if desired, be transferred to the front page of the chart, to the spaces provided. (Step 8)

9. M_X, M_Y, σ_X, and σ_Y should be computed as indicated in the upper right-hand corner of the chart, and the values recorded in the appropriate places. (Step 9)

10. If the Correlation Ratio is desired, it may be obtained in the following manner:

To obtain η_{YX}, square each of the values in the "$\Sigma_X Y$" row and divide by the corresponding value which appears in the "F_X" row in the same column — i.e., the sum of the tallies in the column. Enter the results in the $\frac{(\Sigma_X Y)^2}{N_X}$ row. Find the sum of these values and record in the box immediately to the right of "A ↑." Transfer this value to the back of the chart, and perform the other operations indicated to obtain η_{YX}.

[1] It will readily be seen that if no frequencies occur in the few lowest intervals, a shorter cumulating method, yielding identical results, may be employed. Instead of repeating the highest cumulated value in each of the vacant cells, multiply it by the "Y" value which appears at the left of the scatter diagram in the same row, and record the product in the box immediately below the one in which this highest cumulated value first appears. This is the method which has been employed in the accompanying figures.

In order to find η_{XY}, it is necessary to make an additional cumulation of the tallies in each row in the scatter diagram similar to the one already made for each column. Cumulate from right to left, as shown in Figure III, and record the sums for each row in the proper box in the "$\Sigma_Y X$" column. Square each of the entries in this column, and divide by the corresponding entry in the "F_Y" column, recording the results in the $\frac{(\Sigma_Y X)^2}{N_Y}$ column. Find the sum of these values and record immediately above "B ↑." Transfer this value to the Work Sheet, and solve as indicated for η_{XY}. (Step 10)

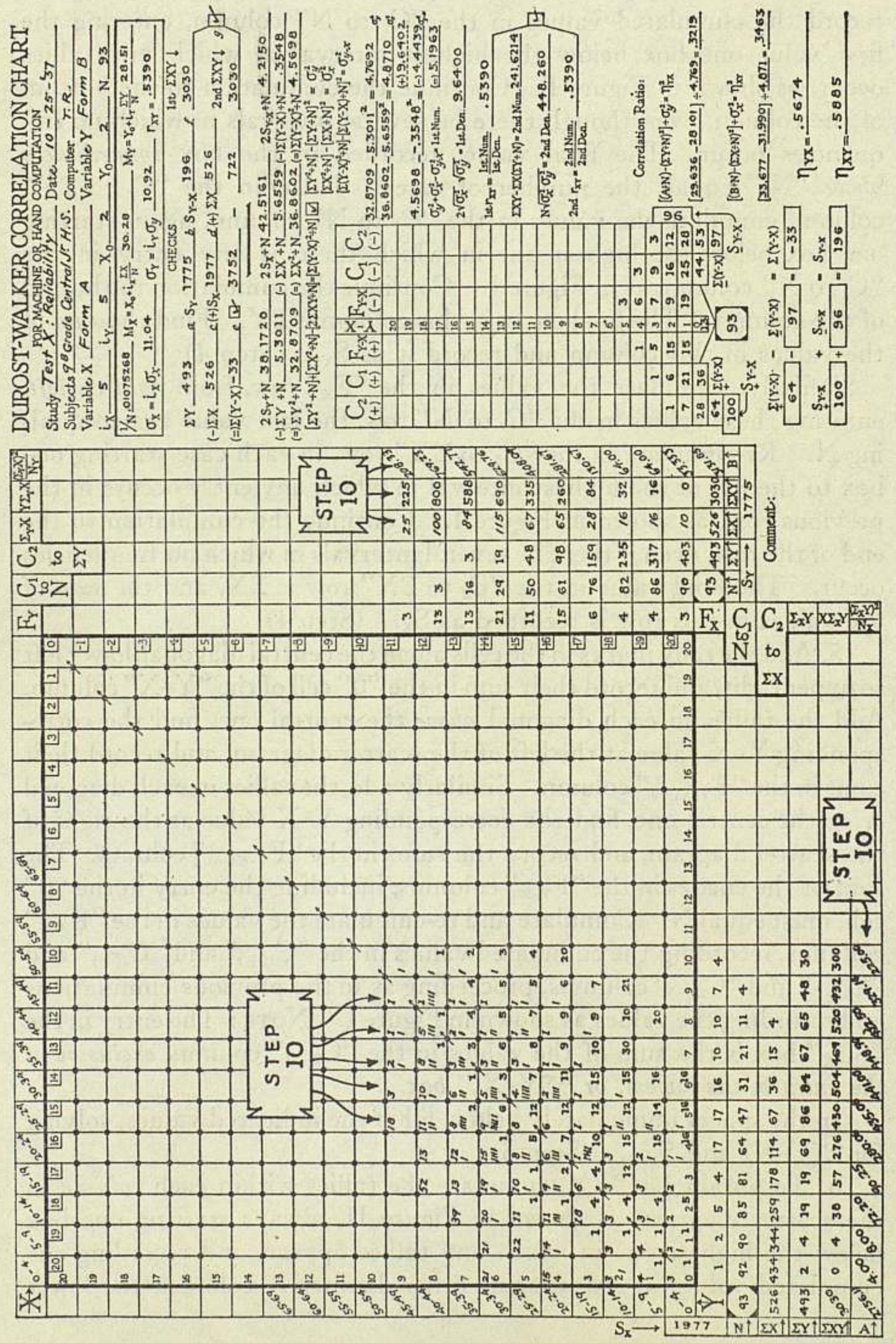

Fig. III. Correlation Chart, showing operations complete through Step 10.

DUROST-WALKER CORRELATION CHART

By Walter N. Durost, Ph.D.
Formerly Research Assistant
Institute of School Experimentation
Teachers College
Columbia University

and Helen M. Walker, Ph.D.
Associate Professor of Education
Teachers College
Columbia University

DIRECTIONS FOR USE

The Durost-Walker Correlation Chart is designed to facilitate the computation of a Pearson product-moment coefficient of correlation. It embodies the following advantages:

1. It can be used either for hand or for machine computation.
2. Checks on the arithmetical processes involved occur at frequent intervals in the course of the computation, thereby making possible the rapid detection of errors.
3. Two independent derivations of the coefficient are possible, thus furnishing a valuable check even to the final computation.
4. The correlation ratios may be obtained with little additional work beyond that involved in the calculation of the coefficient.
5. The operations are indicated both in standard statistical notation and in a simplified alphabetical notation, so that the chart may be used by individuals who have had no training in statistics.

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1. Enter the appropriate information in the spaces provided in the upper right-hand corner of the chart, above the heavy black line. Determine the width of the intervals which are to be used in grouping the X and Y scores, and record these values after "i_X" and "i_Y" respectively. After "X_0" and "Y_0" write the midpoints of the lowest intervals of the X and Y distributions. (Step 1)

2. In the uppermost row, marked "X," enter the upper and lower limits of the successive intervals of the distribution of the X scores, starting with the lowest interval at the left-hand corner. Similarly, in the column at the left-hand side of the chart enter the limits of the intervals of the Y distribution, starting with the lowest interval in the box immediately above the one marked "Y." (Step 2)

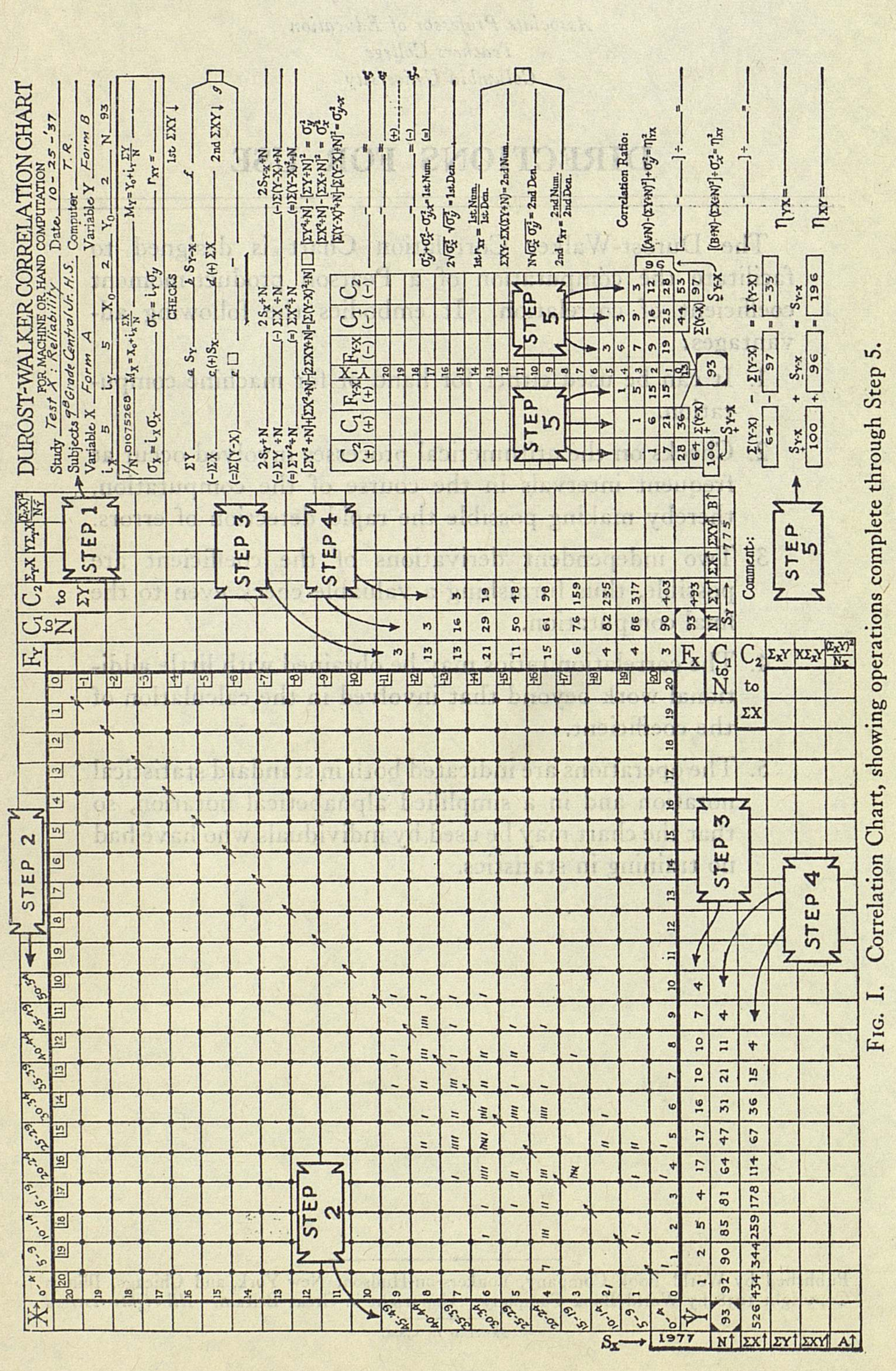

Fig. I. Correlation Chart, showing operations complete through Step 5.

3. Record a small tally mark in the appropriate cell in the scatter diagram for each pair of scores. After the tabulating is complete, the computer may, if he desires, place a numeral in each cell to indicate the number of tallies there; e.g., 𝍸 ⑥. Some computers find it easier to work from these numerals than directly from the tallies. These numerals should be encircled so as to be readily distinguishable from other numbers which will be entered in the cells. This step has not been shown in the illustrations in order to avoid overcrowding the diagrams.

Add the tally marks or numerals in each row, and record their sums in the column headed "F_Y." Add the tallies or numerals in each column, and record their sums in the "F_X" row. (Step 3)

4. Cumulate the values in the "F_Y" column from top to bottom, and record the cumulated values in the "C_1 to N" column, entering the first value one box below the highest interval in which any tallies occur, as shown in Figure I. Continue the cumulation to the bottom of the column, even though there be several intervals in which no frequencies occur. The final value, recorded in the box *immediately above* "N," equals the number of cases. Then, in the "C_2 to ΣY" column, cumulate the values in the "C_1 to N" column, again starting one box below the highest one in which there is any entry in the "C_1 to N" column, as in Figure I. Continue the cumulation to the end of the column. The final entry in this column is ΣY. Find the *sum* of the values in this column and record it as S_Y. (Step 4)

Similarly, cumulate the values in the "F_X" row, from ***right*** to ***left***, entering these values in the "C_1 to N" row, the last value again equaling N. Re-cumulate in the "C_2 to ΣX" row, in each case starting one box to the left of the highest interval in which any entry occurs in the previous row, as shown in Figure I. Continue the cumulation to the end of the row, even if there be several intervals in which no frequencies occur. The final value in the "C_2 to ΣX" row is ΣX, and the *sum* of the values in this row is recorded as S_X. (Step 4)

5. Add the tally marks in the cells along the central diagonal, lower left to upper right, and record their sum in the "0" cell of the "Y–X" column. Add the tallies in each diagonal *above* the central one, find the corresponding Y–X value at the left of the scatter diagram, and record their sums in the "$F_{Y-X(+)}$" column. Similarly add the tallies in each diagonal *below* the central one, find the corresponding Y–X value at the right of the scatter diagram, and record the sums in the "$F_{Y-X(-)}$" column. The sum of the entries in the "F_{Y-X}" columns, including the entry in the "0" cell, must equal N. Cumulate and re-cumulate the values in the "F_{Y-X}" columns, recording the cumulated values in the "$C_{1(+)}$" and "$C_{2(+)}$" and "$C_{1(-)}$" and "$C_{2(-)}$" columns, proceeding as in the previous cumulations and recording the values as shown in Figure I. Note: The entry in the "S_{Y-X}" box is the sum of the values in the "$C_{2(-)}$" column, ***exclusive of the entry in the lowest, or "ΣY–X," box.***

In the spaces immediately below, fill in the indicated values, solving for Σ(Y–X) and S_{Y-X}. (Step 5)

6. To obtain 1st ΣXY, cumulate the tallies within each *column* in the scatter diagram, as shown in Figure II, always starting one box below the highest one in which any tallies appear, and recording the cumulated values in red or some other distinctive color, in the lower

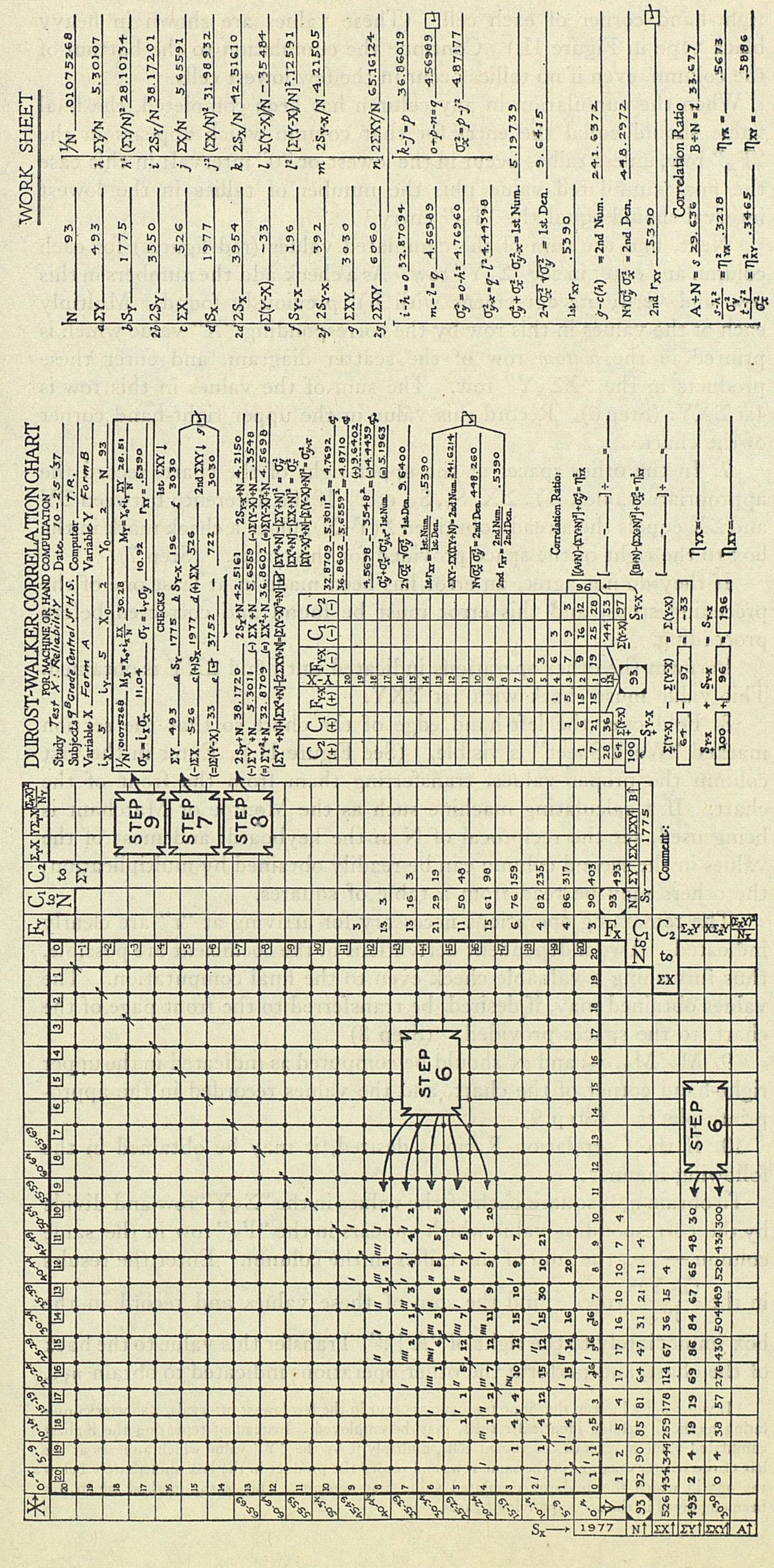

Fig. II. Correlation Chart, showing operations complete through Step 9, and completed Work Sheet.

NORMAL PERCENTILE CHART

By Arthur S. Otis

MANUAL OF DIRECTIONS

Introduction

Need for interpreting the scores of a group. There are many purposes for which it is necessary to observe and interpret the scores of a group of individuals as a group. For most such purposes it is advantageous to represent the distribution of scores graphically. (All that is said herein regarding scores applies equally to ages, school marks, ratings, or any other measures.)

Purposes of the Normal Percentile Chart. The purposes of the Normal Percentile Chart are twofold: first, to accomplish all the purposes of graphic representation and interpretation of the scores of a group, and second, to do so in the simplest and easiest manner.

Among the needs for graphic representation and interpretation of the scores of a group which are served by the Normal Percentile Chart in common with other percentile charts are the following:

1. To see at a glance what the central tendency of the group of scores is, and also to obtain a measure of the central tendency.
2. To see at a glance how widely the scores are distributed, and to obtain a measure of the variability of the scores in the group.
3. To compare quickly and easily the central tendencies of two or more groups of scores.
4. To compare quickly and easily the variabilities of two or more groups of scores.
5. To find what portion of a group of individuals attain any given score.
6. To find the score that is attained by any given portion of the group.
7. To discover the peculiar characteristics of a distribution as to normality, skewness, etc., and to test the equality of units in various parts of the range of scores. (This is difficult with ordinary percentile charts but very easy with the Normal Percentile Chart for reasons which will appear.)
8. To divide a group of individuals into subgroups or otherwise classify them on the basis of scores.
9. To assign scholarship marks or letter ratings to pupils on the basis of scores, etc.
10. To find the correspondence between scores in two or more tests; that is, to find the score in one test that represents the same amount of ability as is represented by a given score in some other test.
11. To find the correspondence between scores and scholarship marks, scores and ratings, scores and ages, etc.; that is, to find the correspondence between any two measures whatsoever.
12. To convert raw scores into standard scores.
13. To set up norms of performance in terms of scores attained by pupils of various ages or grades or of given percentages of pupils of large "unselected groups."

The methods by which these needs are met by the ordinary percentile chart, such as the Universal Percentile Graph,[1] are explained fully in Chapter V of Otis's *Statistical Method in Educational Measurement*.[2] The improved methods by which the Normal Percentile Chart meets these needs is described in part below and in part in Test Method Help No. 4.[2]

UNIVERSAL PERCENTILE GRAPH

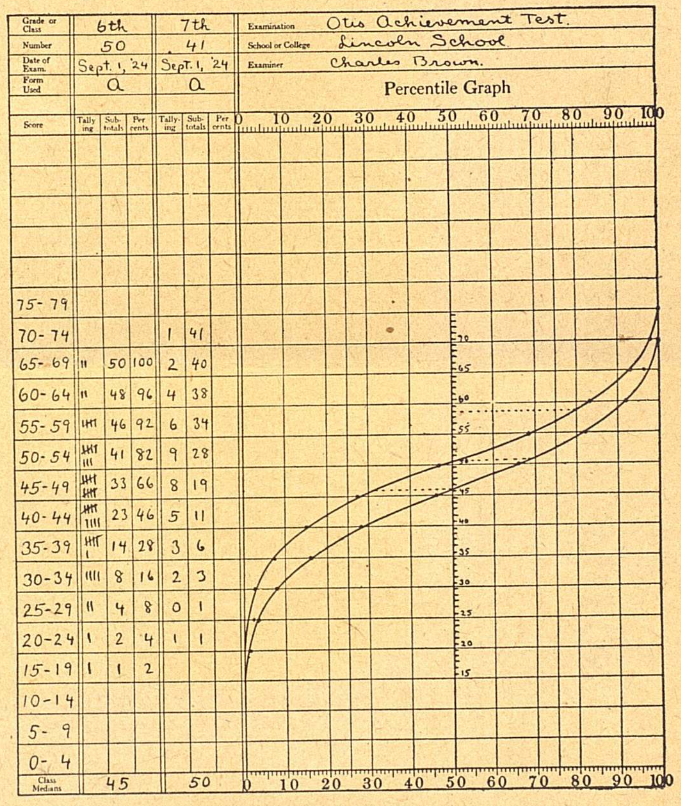

Fig. 1

Revision of the Universal Percentile Graph. The Normal Percentile Chart is a revision of the Universal Percentile Graph. A reproduction of the Universal Percentile Graph, which accompanied the directions for its use, is shown in Figure 1. The Normal Percentile Chart has four very decided advantages over the Universal Percentile Graph and all similar percentile charts.

The first advantage is that it is no longer necessary to draw a curve to represent a normal distribution. The percentile

[1] Published originally by World Book Company in 1924.
[2] Published by World Book Company.

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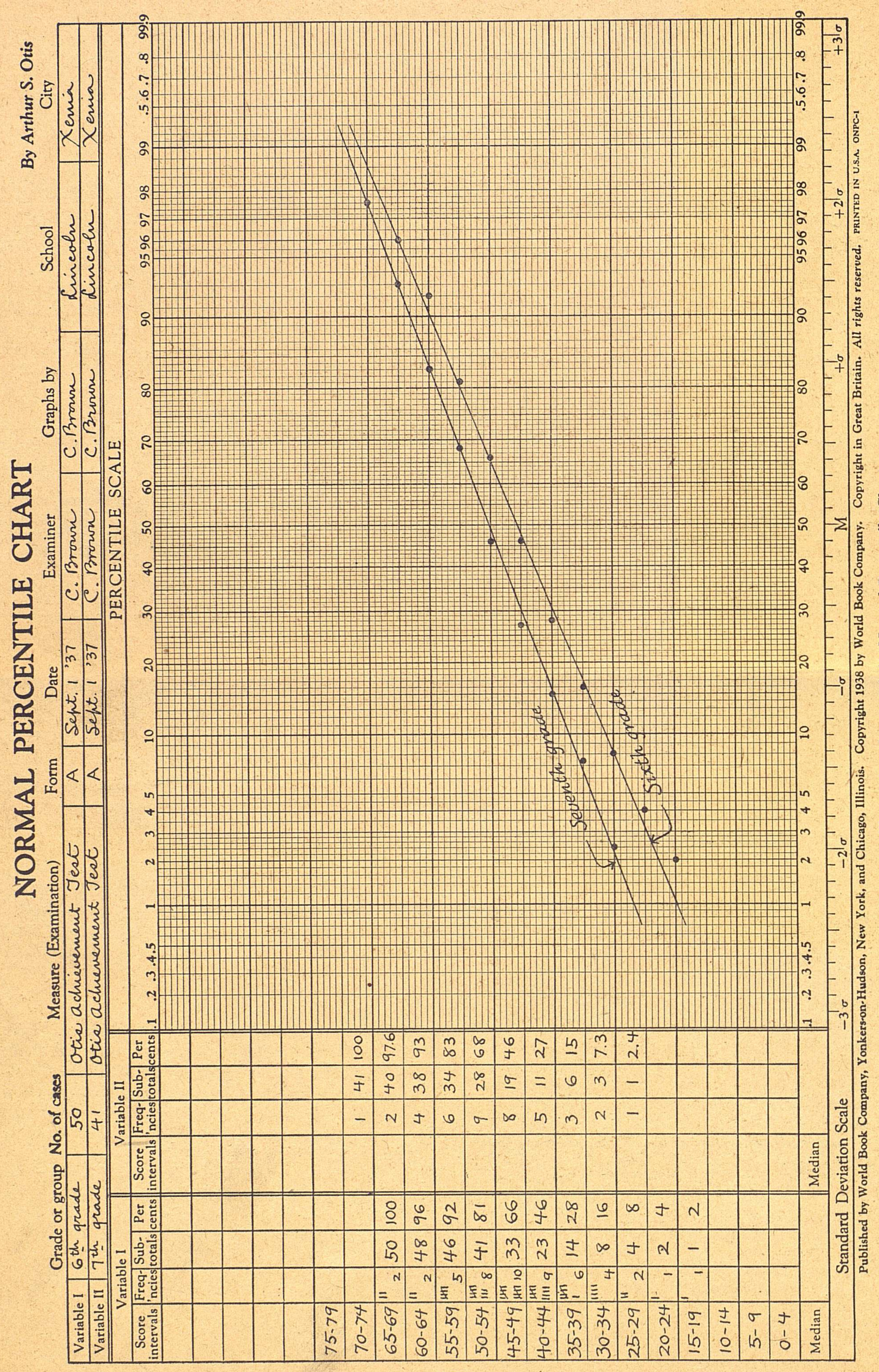

FIG. 2 Illustrating the use of the Normal Percentile Chart.

scales at the top and bottom of the chart are so constructed that when a normal distribution is plotted, what was formerly a "percentile curve" becomes a straight line. This is a great aid to "curve fitting," for if the plotted points appear to lie in an approximately straight line, the distribution is presumably normal and it is merely necessary then to fit the best straight line to the plotted points. This can be done in a few seconds. Thus, Figure 2 shows the representation on the Normal Percentile Chart of the same distributions that are represented on the Universal Percentile Graph in Figure 1.

Those who are familiar with the so-called "logarithmic paper" and other special types of cross-section paper with units of variable size will recognize immediately how the principle of variable units (units getting larger as they recede from the center) was used in the percentile scales to achieve this advantage.

A second advantage lies in the fact that it was formerly very difficult, not to say impossible, to determine the correct percentile scores at the upper and lower extremes of the "percentile curve" which became almost parallel with the edge of the graph, whereas with a straight or nearly straight "percentile curve" the percentile scores can be read as precisely at the extremes as in the middle.

A third advantage is that the values of plus and minus sigma of a distribution and multiples and fractions thereof can be read directly from the "percentile curve" of the distribution. Each sigma unit equals two inches. (See Standard Deviation Scale.)

A fourth advantage is that the correspondence between scores in two tests can be read directly from the "percentile curves" of the two tests drawn on the same chart; that is, without plotting corresponding percentiles in the two distributions on a separate sheet of cross-section paper and drawing a line of relation.

How to Draw a Percentile Curve

General procedure. The steps taken in drawing the percentile curve are: (1) distributing the scores, (2) finding the subtotals — number of cases to and including those in each interval of score, (3) reducing these subtotals to per cents, (4) locating points on the chart representing these per cents, and (5) drawing a smooth curve through these points.

Provision is made for distributing on one Percentile Chart two sets of data, such as the scores of two groups of individuals or the scores of the same individuals in two tests, and from these distributions two percentile curves may be drawn. Other scores may be distributed on other percentile charts, or any sheet of paper, and as many curves drawn on one chart as may be conveniently distinguished.

The blank spaces at the top of the sheet should be filled as shown in Figure 2.

Distributing the scores. Note that for each of two variables (tests or other measures), designated as I and II, there are four columns at the left. For each of these variables, first choose a suitable interval of score (number of units to be grouped into one interval), so that the distribution will not be too long for the graph or so short as to be unduly cramped. Next, enter in the column headed "Score intervals" for that variable the intervals of score chosen, such as 0–4, 5–9, 10–14, etc., as shown in Figure 2. Next, in one of the columns headed "Frequencies" write opposite each score interval the number of scores falling in that interval. Each such number is called the "frequency" for its interval.

If desired, the scores of a class may be distributed directly into the "Frequencies" column by putting a short tally mark for each individual in that column opposite the interval of score within which the score falls. The number of tally marks falling in each square of the column constitutes the frequency for that interval of score. For example, Figure 2 shows that in the 6th grade two pupils made scores between 65 and 69 in the Otis Achievement Test,[1] two pupils made scores between 60 and 64, five made scores between 55 and 59, the frequency of scores of 6th-grade pupils between 50 and 54 is 8, etc.

It will be seen that in the body of the chart every fifth horizontal line is a heavy line, and these heavy lines mark the limits of the score intervals in the "Score intervals" column at the left. The finer horizontal lines between the heavy ones are included in the chart for convenience in interpreting percentile curves when the interval of score is 5 units, as in Figure 2.

It should be understood, however, that it is not necessary that 5-unit score intervals be used; that is, the chart may be used when score intervals are 1 unit, 2 units, 3 units, 4 units, 5 units, 6 units, or any other number. However, if score intervals of other than 5 units are used, then the finer horizontal lines of the chart will be disregarded when interpreting percentile curves and use will be made of special scales printed on the edge of page 4 of this Manual.

Finding the subtotals. Begin at the bottom of the column of frequencies and place in the square to the right of each frequency the sum of the frequencies up to and including that frequency. In the subtotal column under 6th grade (Variable I in Figure 2) there is 1 score in the first interval, a subtotal of 2 to and including the second interval, a subtotal of 4 to and including the third interval, etc., and 50 to and including the last interval. This last "subtotal" (50) should equal the number of pupils in the class, as entered under "No. of cases" at the top of the chart.

Reducing subtotals to per cents. In the column headed "Per cents" write opposite each subtotal the per cent that subtotal is of the whole number of pupils in the class. In Figure 2 under 6th grade, 1 is 2 per cent of 50, 2 is 4 per cent of 50, 4 is 8 per cent of 50, etc., and 50 is 100 per cent of 50. (See below regarding the use of a calculating machine.)

Plotting the points on the chart. This will be explained with reference to the distribution of 6th-grade scores in Figure 2. Points are to be plotted representing the per cents: 2, 4, 8, 16, 28, etc., in the "Per cents" column under I.

To plot the first point (representing 2%), first locate the horizontal line marking the upper limit of the interval 15–19 within which the 2% fell. Then put a dot on this line above 2 in the Percentile Scale (the scale at the foot that goes from .1 to 99.9). (See Figure 2.)

Next, plot the 4 by placing a point on the horizontal line marking the upper limit of the interval 20–24 in which the 4(%) appears, and above the 4 in the Percentile Scale, etc.

It is not possible, of course, to plot a point representing 100%, because the Percentile Scale goes only to 99.9.

Use of a calculating machine. If a calculating machine is available, it is not necessary to fill in the "Subtotals" column, since it is possible to fill in the "Per cents" column directly from the "Frequencies" column. The method as applied to the Variable II scores in Figure 2 would be as follows:

(1) Find the reciprocal of the number of cases (41). (This

[1] This is Part I of the Otis Classification Test.

DUROST-WALKER CORRELATION CHART

For Machine or Hand Computation

By Walter N. Durost, Ph.D.

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WORLD BOOK COMPANY

Yonkers-on-Hudson, New York

WORK SHEET

	N ______		$1/N$ ______
a	ΣY ______	h	$\Sigma Y/N$ ______
b	S_Y ______	h^2	$(\Sigma Y/N)^2$ ______
$2b$	$2S_Y$ ______	i	$2S_Y/N$ ______
c	ΣX ______	j	$\Sigma X/N$ ______
d	S_X ______	j^2	$(\Sigma X/N)^2$ ______
$2d$	$2S_X$ ______	k	$2S_X/N$ ______
e	$\Sigma(Y-X)$ ______	l	$\Sigma(Y-X)/N$ ______
f	S_{Y-X} ______	l^2	$[\Sigma(Y-X)/N]^2$ ______
$2f$	$2S_{Y-X}$ ______	m	$2S_{Y-X}/N$ ______
g	ΣXY ______		
$2g$	$2\Sigma XY$ ______	n	$2\Sigma XY/N$ ______

$i-h=o$ ______	$k-j=p$ ______
$m-l=q$ ______	$o+p-n=q$ ______ ☐
$\sigma_y^2=o-h^2$ ______	$\sigma_x^2=p-j^2$ ______
$\sigma_{y-x}^2=q-l^2$ ______	

$\sigma_y^2+\sigma_x^2-\sigma_{y-x}^2=$ 1st Num. ______

$2\sqrt{\sigma_x^2}\sqrt{\sigma_y^2}$ = 1st Den. ______

1st r_{XY} ______

$g-c(h)$ = 2nd Num. ______

$N\sqrt{\sigma_y^2\,\sigma_x^2}$ = 2nd Den. ______

2nd r_{XY} ______ ☐

Correlation Ratio

$A \div N = s$ ______ $B \div N = t$ ______

$\frac{s-h^2}{\sigma_y^2}=\eta^2_{YX}$ ______ $\eta_{YX}=$ ______

$\frac{t-j^2}{\sigma_x^2}=\eta^2_{XY}$ ______ $\eta_{XY}=$ ______

X

X: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Y: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

−1 −2 −3 −4 −5 −6 −7 −8 −9 −10 −11 −12 −13 −14 −15 −16 −17 −18 −19 −20

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

F_Y	C_1 to N	C_2 to ΣY	$\Sigma_Y X$	$Y\Sigma_Y X$	$\frac{(\Sigma_Y X)^2}{N_Y}$

S_X ←

Y

N↑

ΣX↑

ΣY↑

ΣXY↑

A↑

F_X	C_1 to N	C_2 to ΣX	$\Sigma_X Y$	$X\Sigma_X Y$	$\frac{(\Sigma_X Y)^2}{N_X}$

N↑	ΣY↑	ΣX↑	ΣXY↑	B↑

S_Y

Comment:

DUROST-WALKER CORRELATION CHART

FOR MACHINE OR HAND COMPUTATION

Study ________ Date ________

Subjects ________ Computer ________

Variable X ________ Variable Y ________

i_X ____ i_Y ____ X_0 ____ Y_0 ____ N ____

1/N ____ $M_X = X_0 + i_X \frac{\Sigma X}{N}$ ____ $M_Y = Y_0 + i_Y \frac{\Sigma Y}{N}$ ____

$\sigma_X = i_X \sigma_x$ ____ $\sigma_Y = i_Y \sigma_y$ ____ r_{XY} = ____

CHECKS — 1st ΣXY ↓

ΣY ____ *a* S_Y ____ *b* S_{Y-X} ____ *f* ____

(−)ΣX ____ *c* (+)S_X ____ *d* (+) ΣX ____ 2nd ΣXY ↓ *g* □

(=)Σ(Y−X) ____ *e* □ ____ − ____

$2S_Y \div N$ ____ $2S_X \div N$ ____ $2S_{Y-X} \div N$ ____

(−)$\Sigma Y \div N$ ____ (−) $\Sigma X \div N$ ____ (−)$\Sigma(Y-X) \div N$ ____

(=) $\Sigma Y^2 \div N$ ____ (=) $\Sigma X^2 \div N$ ____ (=)$\Sigma(Y-X)^2 \div N$ ____

$[\Sigma Y^2 \div N] + [\Sigma X^2 \div N] - [2\Sigma XY \div N] = [\Sigma(Y-X)^2 \div N]$ □

$[\Sigma Y^2 \div N] - [\Sigma Y \div N]^2 = \sigma_y^2$

$[\Sigma X^2 \div N] - [\Sigma X \div N]^2 = \sigma_x^2$

$[\Sigma(Y-X)^2 \div N] - [\Sigma(Y-X) \div N]^2 = \sigma_{y-x}^2$

C_2 (+)	C_1 (+)	F_{Y-X} (+)	Y−X	F_{Y-X} (−)	C_1 (−)	C_2 (−)
			20			
			19			
			18			
			17			
			16			
			15			
			14			
			13			
			12			
			11			
			10			
			9			
			8			
			7			
			6			
			5			
			4			
			3			
			2			
			1			
			0			

$\underset{+}{\Sigma}(Y-X)$ $\underset{-}{\Sigma}(Y-X)$

$\underset{+}{S}_{Y-X}$ $\underset{-}{S}_{Y-X}$

____ − ____ = ____ σ_y^2

____ − ____ = ____ σ_x^2

(+)____

____ − ____ = (−) ____ σ_{y-x}^2

$\sigma_y^2 + \sigma_x^2 - \sigma_{y-x}^2$ = 1st Num. (=)

$2\sqrt{\sigma_x^2}\ \sqrt{\sigma_y^2}$ = 1st Den. ____

1st $r_{XY} = \frac{\text{1st Num.}}{\text{1st Den.}}$ ____

$\Sigma XY - \Sigma X(\Sigma Y \div N)$ = 2nd Num. ____

$N\sqrt{\sigma_x^2\ \sigma_y^2}$ = 2nd Den. ____

2nd $r_{XY} = \frac{\text{2nd Num.}}{\text{2nd Den.}}$ ____ □

Correlation Ratio:

$[(A \div N) - (\Sigma Y \div N)^2] \div \sigma_y^2 = \eta_{YX}^2$

[____ − ____] ÷ ____ = ____

$[(B \div N) - (\Sigma X \div N)^2] \div \sigma_x^2 = \eta_{XY}^2$

[____ − ____] ÷ ____ = ____

$\underset{+}{\Sigma}(Y-X)$ − $\underset{-}{\Sigma}(Y-X)$ = $\Sigma(Y-X)$

____ − ____ = ____

$\underset{+}{S}_{Y-X}$ + $\underset{-}{S}_{Y-X}$ = S_{Y-X}

____ + ____ = ____

η_{YX} = ____

η_{XY} = ____

NORMAL PERCENTILE CHART

By Arthur S. Otis

	Grade or group	No. of cases	Measure (Examination)	Form	Date	Examiner	Graphs by	School	City
Variable I									
Variable II									

Variable I				Variable II				PERCENTILE SCALE
Score intervals	Freq-'ncies	Sub-totals	Per cents	Score intervals	Freq-'ncies	Sub-totals	Per cents	.1 .2 .3 .4 .5 1 2 3 4 5 10 20 30 40 50 60 70 80 90 95 96 97 98 99 .5 .6 .7 .8 99.9
Median				Median				.1 .2 .3 .4 .5 1 2 3 4 5 10 20 30 40 50 60 70 80 90 95 96 97 98 99 .5 .6 .7 .8 99.9

Standard Deviation Scale −3 σ −2 σ −σ M +σ +2 σ +3 σ

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G.M. anni 15 II magist. sup.

9 Giugno 1954

ore 17.20

I

14"
Λ 1 Grande uccello con due punte ed ali disordinate; 1 G F+ A
2 ci sono 4 buchi nelle ali. (perchè lo sfondo è bianco) (Db F- (buchi))

II

15"
3. Scheletro di un uomo, soltanto la parte
superiore e bacino, manca la parte centrale.(infatti c'è un buco) 2 G. F- Anat.

III

8"
4. Due bambini vicino ad una pentola 3 G M U Ban.

IV

19"
V 5. Un granchio con due antenne grosse e due sottili
e la testa allungata. (ha la forma piatta ed i tentacoli) 4 G F- A

V

46"
Λ 6. Grotta sostenuta da due pali (per i contorni sinuosi
e l'impressione del muschio 5 G Fc Nat.
che cresce sopra le pietre)

VI

23"
7. Bestia che scappa lasciando una scia scura (parte sup. e centro)
(c'è un movimento : prima è largo poi si fa
stretto, nel mezzo è scuro poi si va facendo 6 D FM A
più chiaro)

VII

30"
8. Due piante che crescono da uno stesso centro (come il cactus
per le punte e le diramazioni) 7 G F+ Pt

VIII

18"

9 Due bestie che si arrampicano (il movimento è irreale perchè si arrampicano verticalmente)	8 D	FM	A	Ban
10 Un tronco a colori qualche volta interrotto (tutto meno le bestie)	9 D	FC	Pt	

IX

8"

11 Una fontana che sale (base e asse cent.);	10 Dd	Fm	Ogg	
12 sprazzi di luce verdi ed arancione	11 D	C	luce	

~~(piedestallo~~

X

32"

13 Il fondo del mare (per l'insieme dei colori ed anche per la forma)	12 G	FC	Nat	
14 2 granchi bleu	13 D	F+	A	Ban
15 conchiglie giallastre (i gialli)	14 D	F-	A	
16 coralli (rossi centrali)	15 D	CF	A	

ore 17.31

N = 15

M. G. anni 15

LOCALIZZAZIONE	Tot.	1	2	3	4	5	6	7	8	9	10
G	7										
Γ											
DG											
DdG											
GDb											
D	7										
Dd	1										
Do											
Db											
DDb											
	15										
Ban	3										
Orig.+											
Orig.-											

DETERMINANTI	Tot.	1	2	3	4	5	6	7	8	9	10
F +	3										
F ±											
F -	3										
M	1										
FM	2										
Fm	1										
m											
FC	2										
CF	1										
C	1										
Cn											
FC'											
C'F											
C'											
Fcho											
choF											
cho											
Fc	1										
cF											
c											
Po											
descr											
rif											
din											

CONTENUTO	Tot.	1	2	3	4	5	6	7	8	9	10
A	7										
Ad											
U	1										
Ud											
Anat	1										
Rx											
Sex											
Sg											
Ogg	1										
Sce	2										
Geogr											
Pt	2										
Astr.											
[illegible]	1										

Percentuali

G %	47%	F %	40%
D %	47%	F+%	50%
Dd%	7%	A %	47%
Db%		Ad%	
		U %	7%
		Ud%	
Ban%	20%		
Orig%			

Erlebnisstypus

I $\frac{1}{3\frac{1}{2}}$

II $\frac{3}{1}$

III $\frac{8}{15} = 53\%$

Erfassungtypus

G D Dd Db Do DD= (G D Dd)

Successione

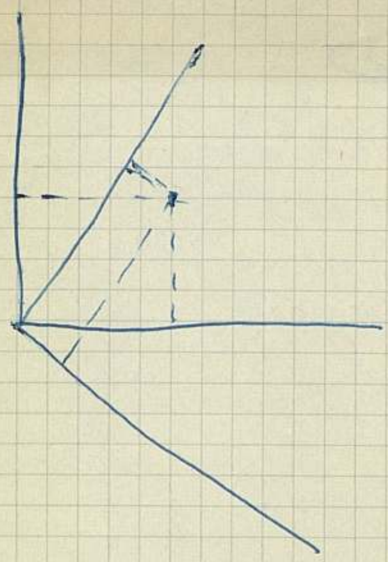
INTERPRETAZIONE

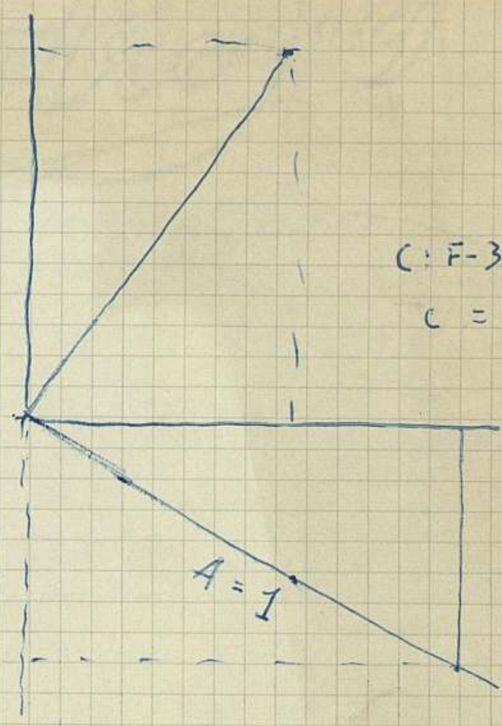
Personalità fondata sull'affettività, a volte dominata a volte labile e non controllata. Spunti di incertezza e di insoddisfazione emotiva - Intelligenza di tipo intuitivo, con scarsa precisione (tedianza) dell'ideazione e difficoltà di controllo dell'attenzione. Le risorse personali sono spesso represse e restano allo stato di tendenze non utilizzate, cioè, socialmente e praticamente. Adattabilità superficiale, in cui non si impegna la parte più viva e profonda della personalità. (Crisi di adolescenza)

Fare il Rosenzweig -

Vin

37968





$C : F-32 = 100 : 180$

$C = \frac{100(F-32)}{180}$

$540 : 18 = 30$

$78 \cdot 3$

$\frac{460}{180} : 18 = 25$

$1 = \cos^2\alpha + \text{sen}^2\alpha$

$A = \sqrt{\cos^2\alpha + \text{sen}^2\alpha}$

$\text{sen}\,\alpha = \sqrt{1-\cos^2\alpha}$

NB essendo h sempre positivo, una correlazione negativa si ha soltanto se l'angolo fra i vettori test è ottuso.

E siccome i vettori test non possono essere zero, la correlazione zero si ha soltanto con un angolo retto.

quando i vettori sono unitari $r_{ik} = \cos \varphi_{ik}$; ma il coseno è la proiezione di un vettore sull'altro.

$v = d \quad I = x$

$b = d \quad 0 = x$

$b < d < v$

$$\frac{b - v}{b - d} = x$$

$7 = b$

$b = 7$

$7 < b < d$

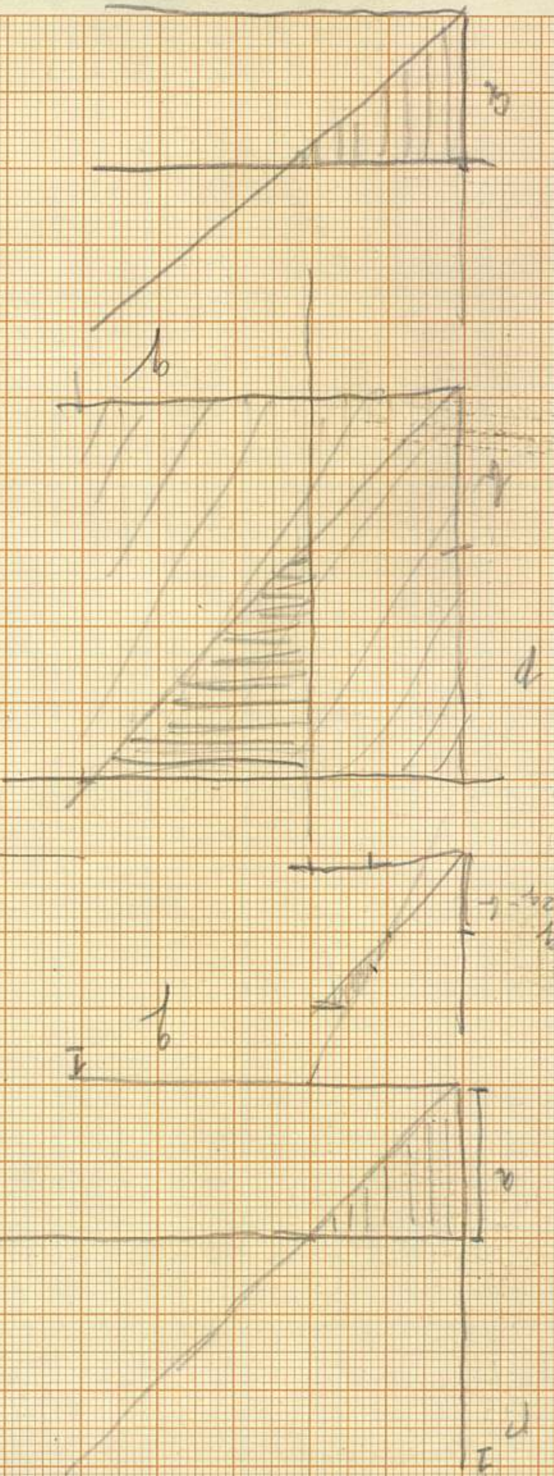
$7 = d$

$b = 7 \quad I = x$

$b = d \quad 0 = x$

$$\frac{7 - d}{b - d} = x$$

$d = v$



$7 - b = d \quad 1 = x$

$b = d \quad 0 = x$

$$\frac{7 - b}{b - d} = x$$

$b = v$

$b < d \leq v$

$v = d \quad I = x$

$b = d \quad 0 = x$

$$\frac{b - v}{b - d} = x$$

$b = 7$

may be found from a table of reciprocals, or in this case by dividing 1.000000 by 41. The reciprocal of 41 is .024390.)

(2) Express the reciprocal as a per cent. (.024390 = 2.4390%.) (This means that 1 case is 2.4390% of the 41 cases.)

(3) Multiply the reciprocal per cent by the lowest frequency, round off the product, and enter it in the "Per cents" column. (The lowest frequency is 1. 1 × 2.4390 = 2.4, as shown at the foot of the "Per cents" column.)

(4) Multiply the reciprocal per cent (2.4390) by the next frequency (2) and let the product be added to the initial product (2.4390) which is left in the machine. (2.4390 + (2 × 2.4390) = 7.3170.) Round off and write the sum in the "Per cents" column. (7.3170 rounded off = 7.3, as shown in the figure.)

(5) Continue until the last frequency has been used. The last per cent should equal 100; that is, it should be between 99.999 and 100.001; if it is not, the work is incorrect. (In this case the last per cent equals 97.560 + 2.4390 = 99.999.)

Drawing the percentile curves. There are two methods of drawing the percentile curves (the lines that represent the distributions). One method is merely to draw lines joining each pair of consecutive dots on the chart. This method usually results in the "curve" becoming a zigzag line. Such a line preserves, of course, all the irregularities of the distribution itself.

There is a second method of drawing the percentile curve, however, which is preferable, in that it irons out the slight irregularities and may be thought of as presenting the appearance of the distribution more nearly in its true characteristics. This second method is to draw a smooth line through the dots. By "through the dots" is meant as nearly through the dots as possible without drawing a wavy or kinky line. In order to draw a smooth line, it is often necessary to miss certain of the dots by small amounts, as shown in Figure 2. Let those dots missed above the line approximately balance those missed below the line. Draw a very light line first and then adjust it if necessary.

If the distribution is approximately normal, the dots will tend to lie in a straight line. In such a case, a straight line may be drawn to constitute the smooth line through the dots. However, if the distribution is slightly skewed, the dots will tend to lie in a curve — the greater the skewness, the greater the curvature.

Interpretation of a Percentile Curve

Finding the median score of a class. The heavy vertical line under 50 of the Percentile Scale is called the 50-percentile line. The point where the percentile curve cuts the 50-percentile line represents the median score of the group. This point of intersection is to be interpreted, of course, in the light of the score intervals that have been written in the score-interval column at the left pertaining to the percentile curve in question.

The method of finding the median score of the 7th-grade distributions, as shown in Figure 2, is as follows: First, note that the curve cuts the 50-percentile line in the space between the horizontal lines that mark the limits of the interval of score, 50–54. This shows that the median score of the group is some score in this interval.

Next, notice that the interval is a 5-score interval. Therefore the vertical space on the 50-percentile line, between the two heavy horizontal lines, represents five scores, and since this vertical interval is already divided by the fine horizontal lines into five equal spaces or units, each such unit space represents one unit of score. The first unit represents the score of 50, the second a score of 51, and so on.

Now, since the curve cuts through the first unit, which represents the score of 50, it follows that the median score of the distribution is 50. If the curve had cut through the second unit, the median would have been 51, and so on.

If some other score interval than a 5-unit interval has been used, it is necessary, as explained above, to disregard the fine lines on the chart and interpret the curve by means of one of the "Scales for Interpreting Curves" given on the margin of this page.

Figure 3 shows a small section on the middle of a percentile chart in which a percentile curve cuts the 50-percentile line in the upper portion of one of the score intervals. The figure shows the score interval to be 47–49, which is a 3-unit interval; hence the figure shows a small portion of the 3-unit interval scale on the margin of this page, superimposed upon the chart in such a way as to show the vertical spaces between heavy horizontal lines divided into three equal parts instead of five. (The fine lines are omitted from this figure, since they are to be disregarded in making an interpretation of this kind.) It will be seen in Figure 3 that the percentile curve cuts the 50-percentile line in the upper one of the 3 units of the interval 47–49. Hence the median score in that case is 49.

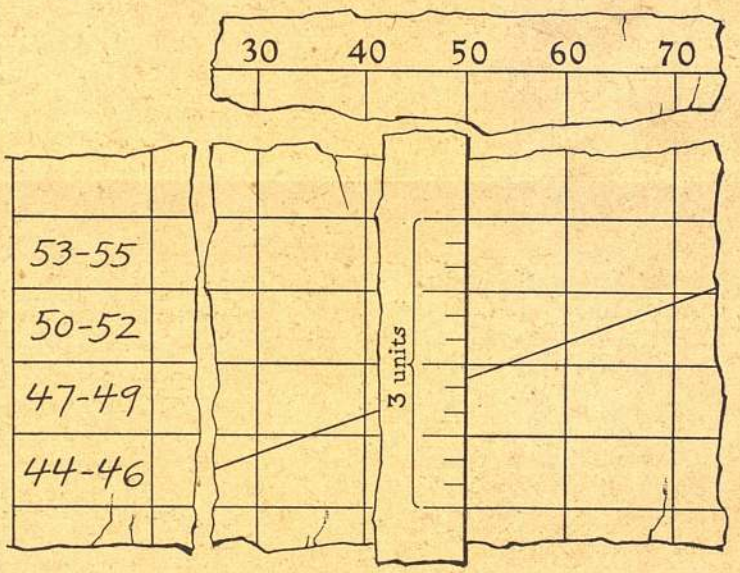


Fig. 3

In this way the score-interval spaces on the chart may be divided into two equal parts, or three or four or six or ten equal parts, using the proper scale on this page.

It might be explained that if the percentile curve in Figure 3 had cut the 50-percentile line in the exact middle of the unit, then the median score would be considered to be precisely 49; but since the intersection is slightly below the middle, we may think of the median as slightly less than 49, but nearer 49 than 48. In other words, the median is 49 to the nearest whole number.

To find the median of the 6th-grade distribution in Figure 2, observe that the curve cuts the 50-percentile line in the interval 45–49. It is seen that this curve also cuts in the lowest unit of the interval; hence the median score of that group is 45.

The value of the median found from a percentile curve in this fashion may not be exactly the same as the median found in the usual way by counting to the middle paper in order of score; but the median score found by means of the curve is

Scales for Interpreting Curves

considered to represent the distribution better than the actual middle score, which we might call the accidental median, and for that reason it is considered preferable.

Finding other percentile scores. The score that exceeds 70% of the scores of a group is called the 70-percentile seore of that group. The score that exceeds 80% of the scores of a group is called the 80-percentile score of the group, and so on. The 70-percentile score of the group is found in exactly the same way as the median, or 50-percentile score — except, of course, that the 70-percentile line is used instead of the 50-percentile line.

For example, it will be seen that in Figure 2 the 7th-grade "curve" cuts the 70-percentile line in the interval 55–59 and that this intersection falls in the lowest fifth of this interval. Hence the 70-percentile score in the 7th-grade distribution is 55. The 6th-grade curve cuts the 70-percentile line in the second unit of the 50–54 interval; hence the 70-percentile score of the 6th grade is 51.

If some other interval of score than 5 units has been used, the appropriate scale on page 4 will be used, of course, for finding the score corresponding to any percentile.

Finding the variability of the scores of a class. The points at which the curve cuts the 25- and 75-percentile lines represent the *lower and upper quartile scores* of a distribution. The interval between these is the *interquartile range* — a very convenient measure of the scatter of the distributions. The interquartile ranges for the 6th and 7th grades are, respectively, 15 and 14 points (6th grade from 38 to 53 and 7th grade from 43 to 57). This shows the variability of the scores of the two grades to be about equal. (If the percentile curve cuts a percentile line exactly on a horizontal line between two score spaces, it is customary to take the higher one of the two scores.)

The 25-percentile score of a distribution is sometimes designated by the symbol Q_1 and the 75-percentile score by the symbol Q_3. The interquartile range is then expressed as $Q_3 - Q_1$. One half of this value is sometimes called the *semi-interquartile range* or the *quartile deviation* and is represented by the symbol Q. This means that $Q = \frac{Q_3 - Q_1}{2}$.

Percentile ranks in class. If a pupil makes a score exceeding just 75% of the scores of his class, he is said to have a *percentile rank* of 75 in his class; if his score exceeds 90% of the scores of his class, he is said to have a percentile rank of 90 in his class, and so on. A percentile rank of any individual among the members of his class may be found from the percentile curve representing the scores of his class, as follows: Suppose an individual in the 7th grade (see Figure 2) has made a score of 57, and it is desired to find his percentile rank. Now the score of 57 lies, of course, in the interval 55–59, and it is the third one of these five scores, counting upward. Hence the score of 57 is represented by the third unit in the interval 55–59. The procedure, then, is to find the percentile line which is cut by the percentile curve at a height exactly in the middle of the third unit in the interval 55–59. Perhaps the best way is to move the pencil along the percentile curve until it reaches the exact middle of the third unit in the interval 55–59, and then put a dot on the curve. This dot will be seen to lie approximately on the 76-percentile line. Therefore a pupil making the score of 57 has a percentile rank of 76 among the pupils of this 7th grade.

Overlapping of classes. It will be seen by a glance at the percentile curve that the 7th grade is only slightly better than the 6th and that the distributions of scores of the two grades overlap very markedly. A convenient way of expressing this overlapping is to find the per cent of pupils of the 7th grade who fall below the median of the 6th, or the per cent of the 6th grade who exceed the median of the 7th. Thus the median of the 6th grade is 45, and the score of 45 represents a percentile rank of 32 in the 7th grade. Hence 32% of the 7th-grade pupils fall below the median of the 6th grade. Also, since the median score of the 7th grade is 50 and the score of 50 represents the percentile rank of 67 in the 6th grade, it follows that 33% of the 6th-grade pupils exceed the median of the 7th grade.

Finding the standard deviation of a distribution. The standard deviation is one of the measures of variability of a distribution; that is, the degree to which the scores are scattered out. The standard deviation of a distribution is analogous to the average deviation, by which is meant the average of the amount by which the several scores deviate from the mean of all the scores. The standard deviation, however, is technically defined as the square root of the average of the squares of these deviations.

Although the standard deviation of a distribution is more complicated and more difficult to determine than the mere average of the deviations (not squared), it enters into the formula necessary for finding a coefficient of correlation and is therefore commonly used as a measure of variability.

Now it so happens that in a strictly normal distribution the standard deviation embraces approximately 34% of the cases. In other words, if a distribution of scores is normal and the mean is 50 and the standard deviation 10 units, it would be found that about 34% of scores lay between 50 and 60 and about 34% lay between 50 and 40.

For ordinary purposes, however, it is sufficient to consider the standard deviation of a distribution as that range of scores between the median score and the 84th-percentile score ($50 + 34 = 84$), or that range of scores between the median and the 16th-percentile score ($50 - 34 = 16$). If the distribution of scores is skewed so that the percentile curve is not a straight line but is actually a curve, then these two values of the standard deviation will not come out the same, and to obtain a single measure of the variability of the group, we may take the average of these two values and call it the standard deviation of the distribution.

It will be seen that there is at the foot of the chart a scale called the Standard Deviation Scale. The symbol for the standard deviation of a distribution is σ (sigma). Note that plus σ is opposite the 84th percentile and minus σ is opposite the 16th percentile. Since the plus σ or 84th-percentile score in the 7th grade is 60 and the minus σ or 16th-percentile score in the 7th grade is 40, we may consider the standard deviation of the 7th-grade distribution as half the difference between 40 and 60, which is 10 points. Similarly, the minus σ and plus σ scores of the 6th grade are, respectively, 34 and 56. Hence we may consider the standard deviation of the 6th-grade distribution as one half the difference between 34 and 56, which is 11 points.

Other Uses of the Percentile Chart

Classifying pupils on the basis of score. The pupils of a class may be divided very simply and easily into two, three, or any other number of classes on the basis of score by means of the percentile curve.

For example, if it were desired to divide the 7th-grade pupils whose scores are represented in Figure 2 into two equal classes, placing the mature pupils in one class and the less mature pupils in another, this might be done by noting that the median score of the class was 50 and by placing all those pupils in one class whose scores are above 50 and in the other class the remaining pupils.

If it were desired to divide the pupils into three classes, a convenient method would be to find the 33d-percentile score and the 67th-percentile score. The 33d percentile seems to be about on the dividing line between the scores of 45 and 46. Hence we would put into the lower class all those whose scores were 45 or less. The 67th-percentile score seems to be 54. Hence we might put in the upper class all those whose scores were 54 or higher and the remaining pupils in the middle group.

To divide pupils into four groups, we would use the 25-percentile score, 50-percentile score, and 75-percentile score as the dividing points; to make five equal classes, we could use the 20-, 40-, 60-, and 80-percentile scores as the dividing points, etc.

How to assign letter ratings on the basis of scores. In a normal distribution[1] approximately equal intervals of score lie in the following five percentile intervals: below the 5-percentile score, between the 5-percentile and 30-percentile scores, between the 30- and 70-percentile scores, between the 70- and 95-percentile scores, and above the 95-percentile score. Hence, if it is desired to give 5-letter ratings, such as A, B, C, D, and E, to pupils on the basis of their scores in a test, this may be done by giving those pupils who exceed the 95-percentile score a letter rating of A, those whose scores fall between the 70 and 95 percentiles a rating of B, those in the middle 40 per cent — that is, those whose scores lie between the 30 and 70 percentiles — a rating of C, and so on,[2] as shown in the following table:

Per Cent of Group	Percentile Rank	Rating
5%	95–100	A
25%	70–95	B
40%	30–70	C
25%	5–30	D
5%	0–5	E

How to convert scores in one test into terms of another test. This is sometimes called finding the correspondence between two tests or finding the scores in one test that correspond to the various scores in another test.

In Test Method Help No. 4, published by World Book Company, there is described in detail the method of finding the correspondence between the Myers-Ruch High School Progress Test and the Otis Quick-Scoring Gamma Test. The correspondence is based on the scores of over nine thousand 11th-grade pupils who took these two tests in a state survey. The explanation is accompanied by a reproduction of the Normal Percentile Chart, showing percentile curves representing the distributions of scores in these two tests. For lack of space in this Manual we can give but a brief description of the method of finding the correspondence between scores in two tests.

Referring to Figure 2, let us assume for the moment that the two percentile lines in the figure represent distributions of the scores of the same group of pupils in two tests, which we may call Test A and Test B. (Let us say the upper "percentile curve" represents Test A and the lower one Test B.) These might be, for example, two arithmetic tests by different authors, but covering the same general subject matter.

Now the comparison which it is natural to make first is a comparison of the two medians. That is, since the median score in Test A is 50 and the median score in Test B is 45, our first inference is that a score of 50 in Test A corresponds to a score of 45 in Test B. This means that, theoretically, the score of 50 in Test A represents the same degree of ability as the score of 45 in Test B.

Next we might compare the 40-percentile scores in the two tests. These being respectively 47 and 42, our inference is that a score of 47 in Test A corresponds to a score of 42 in Test B. Similarly, by examining the two 60-percentile scores, we find that a score of 52 in Test A corresponds to a score of 48 in Test B.

It will be seen that by examining a sufficient number of percentile lines, the correspondence may be found between these two tests throughout the ranges and a table of correspondence may be drawn up from which may be read the score in Test B corresponding to each score in Test A, or vice versa.

Correlation as distinguished from correspondence. The reader will distinguish, of course, between *correspondence* and *correlation*. The scores in two tests are said to be correlated when there is a tendency for pupils who score high in one test to score high in the other test also. It is presumed that when scores in two tests are correlated to some extent with one another, the tests are to that extent measuring the same trait. Two tests that are quite similar tend to correlate highly because they measure the same trait to a considerable extent, but tests that are very different correlate less highly, and some pairs of tests are not correlated at all — as, for example, a test of intelligence and a test of ability to cross out *e*'s.

Two measures are said to be positively correlated if there is a tendency for pupils making high scores in the one case to make high scores in the other also. They are said to be negatively correlated if high measures in one case are associated with low measures in another, and vice versa. Positive correlation is measured by some decimal between .00 (representing no correlation) and 1.00 (representing perfect positive correlation).

We think of the correspondence between tests, however, as entirely independent of the amount of correlation between them; that is, given a sufficiently large group of individuals, the median score in one test is defined as corresponding to the median score in the other test, and the same for the other percentile scores, regardless of whether the correlation is .90, .60, or only .30.

As already explained, when two tests are correlated they presumably measure in part some single trait common to the two tests; and theoretically the corresponding scores in the two tests, found as described above, indicate the same amount of that trait which is measured by the two tests.

[1] Strictly speaking, that portion between the .3 and 99.7 percentiles.

[2] It is sometimes suggested that the percentages to use in this case are 5, 20, 50, 20, and 5 respectively for the 5-letter rating. This would mean using the percentiles 5, 25, 75, and 95 as the dividing points, but this is not strictly in accord with a normal distribution. If the 5 and 95 percentiles are chosen as the two outer division points, then the two inner ones, strictly speaking, must be the 29th and 71st percentiles. Hence, to use round numbers, it is preferable to use 30 and 70 percentiles instead of the 25 and 75 percentiles. However, if we begin by taking the range from the 25 to the 75 percentile as the middle range, then to be in accord with a normal distribution the two other division points must be the 3 percentile and 97 percentile.