THE NEW AMERICAN ORDER OF ARITHMETIC: CONTAINING THE PRIMORDIAL SERIES OF INCREASE AND DECREASE; WITH AN AUTHENTIC, PLAIN AND COMPREHENSIVE EXPOSITION OF THE SYNTHETICAL FORMATION AND RELATIONS OF NUMBERS

www.triestepublishing.com

D. MCCURDY

THE NEW AMERICAN ORDER OF ARITHMETIC: CONTAINING THE PRIMORDIAL SERIES OF INCREASE AND DECREASE; WITH AN AUTHENTIC, PLAIN AND COMPREHENSIVE EXPOSITION OF THE SYNTHETICAL FORMATION AND RELATIONS OF NUMBERS

THE

NEW AMERICAN ORDER

OF

ARITHMETIC:

CONTAINING THE

PRIMORDIAL SERIES OF INCREASE AND DECREASE;

WITH AN

AUTHENTIC, PLAIN, AND COMPREHENSIVE EXPOSITION

OF THE

Synthetical Formation and Relations of Numbers,

VARIOUSLY EXEMPLIFIED; IN ADAPTATION TO THE PURPOSES OF

ARTS AND COMMERCE

IN THE UNITED STATES.

BY D. McCURDY,

Late a Clerk in the U. S. Pension Office, Author of an Edition of Euclid's Elements,
Chart of Geometry, First Lessons in Geometry, National Arithmetic,
Columbian Tutor's Assistant, &c., &c.

GEOMETRY—By D. McCurdy.

1. *The Chart of Geometry*, in the Order of Simson's and Playfair's editions, containing the diagrams of six books of Euclid, Plane Trigonometry, and the Quadrature of the Circle; on a large scale, mounted on cloth and rollers, in two parts. The Chart is designed to supersede the blackboard, by presenting all the figures, at one view, required in every demonstration.

2. *First Lessons in Geometry*:—a little book containing the propositions of Euclid, and references to the proofs, but not the demonstrations nor the figures. This work is intended for beginners, who recite the text and draw the figures on slates, before they are expected to enter formally upon the study.

3. *Euclid's Elements, &c.*—This work contains, besides what is represented on the chart, a chapter on the Intersection of Planes, and one on the Comparison of Solids, with figures and demonstrations complete. It is made brief by the omission of the embarrassing repetitions used in other editions; and many of the demonstrations are greatly simplified, without abandoning the synthetic method of the original author. It has been publicly called "the best edition of Euclid's Elements ever issued from the press."

☞ *See Explanatory Notes and a Table of Contents at the end of the book.*

A DIALOGUE

BETWEEN THE BOOK AND THE READER.

Book.—Why dost thou examine me so intensely, and turn me over so rudely? Thy duty is to handle thy book with care.

Reader.—I intended no disrespect; but it seems to me that a book very like you, in some parts, fell into my hands before to-day.

B.—Very probably. My first edition was published in Washington, in 1819; my second in Baltimore in 1826; but my author neglected both the former editions. Me he has renewed so much, that he thinks it sheer injustice not to give me a new name.

R.—But what was your author's reason for publishing your former editions, and now renewing you so essentially?

B.—He had taught in Pennsylvania, New Jersey, Maryland, and in the District of Columbia, from 1810; and found Jess's book the popular one of the time. It was to correct doctrinal errors in that book that he first prepared a system. The same errors were afterward copied by Stephen Pike, and followed by Bennett, Smiley, Lewis, Rose, and other respectable authorities; and they still exist.

R.—And what are those errors to which you allude?

B.—The principal error respects the doctrine of Compound Interest and Annuities, which should be based upon the involution of ratios; making the ratio the amount of a unit for the term of payment. The error, which was small in 1819, on account of the comparatively small business in ground-rents and stocks at that time, has greatly increased in importance. It consists in setting forth a false ratio for terms of payment less than a year. Those authors tell us that the second root of the annual ratio will be the ratio in half-yearly payments, the fourth root in quarter-yearly, &c. Now, either the second power of the second root, or the fourth power of the fourth root, if there should be no loss in extracting it, will restore the original number. So that their rule imposes vain labor; since it makes

quarter and half-yearly the same as annual payments, and even worse; for the numbers being surds will lose a fraction in extracting their roots. The true ratio is found without extracting any root; and it is evident that instalments, rents, or periodical payments resulting from stocks of any kind, are of more advantage to the receiver by short payments than by long ones. It is also certain that most payments of this kind are made half, or quarter-yearly, or monthly.

R.—The statement you make is very plausible; but our books here in the North do not seem to dwell much upon the application of progressions to any purpose of business: will you lead me into the best way of understanding these progressions?

B.—Read the numbers of my pages in order; they form the prime series to some extent; the laws of this series contain the doctrines of arithmetic.

R.—I will follow your counsel. But why are not all these equal pages marked with the same number?

B.—The reason is, that number is the result of order; and the successive names express the distance of each from the first point of the series.

R.—The prime series, then, is a succession of names applied to a line of equal units; each name, or term, expressing in itself all the preceding units?

B.—It is even so; for of what form soever the units may be, arithmetic disposes them into lines or strata, and names them in order, beginning at some point, line, or surface.

R.—You seem to make arithmetic a system of series or progressions, which I have supposed to belong rather to algebra.

B.—The mistake is a very common one; the series are all numerical; every result of increase or decrease must be pursued along the lines of multiples or parts of a unit; the relations of numbers must become known before the symbols of algebra can be used to express them.

R.—What am I to consider proper views of proportions?

B.—Proportions are measured distances upon lines of numbers of the same species; in which the first term, or a part of it, measures the second as often as the third, or the same part of it, measures the fourth. Ratio is the number of times which the measure is applied.

R.—What is to be understood by the inductive system?

B.—Induction should lead by examples into the laws of the several series; passing from one series to another, when they are of different species or powers, furnished with the proper measure, reduced if necessary, to reach at once the required term.

But the Pestalozzian writers make induction a kind of *diluted proportion*; they apply their measure from the first given term to the unit; thence to the second given term and back to the unit; thence to the third and back to the unit; thence to the fourth and back; and so on to the last. Thus they use a double number of ratios, deal in larger measures, are often unnecessarily involved in fractions, and with much simplicity congratulate the system upon its relief from the prolixity of ratios and proportions.

R.—Is not that true induction which dispenses with mechanical rules and forms?

B.—True induction into chaos! The world's business, and its pleasures too, are a connected system of those forms which are reproachfully called mechanical. The measures of wealth and labor, or whatever goes under the name of property, are established by usage or enactment; in the comparison of these measures arithmetic should be practised. Hence will arise uniform movements or mechanical rules; and the Pestalozzian books which reject them are not guides to the regions of light, but mere devices to lead off the exuberant vitality of crowded schools, with the slightest possible explosion.

R.—I have heard many objections made to the use of words in elementary books, which are beyond the comprehension of children. Is it not possible to express in the plain English any sense that is to be conveyed?

B.—The plain English which embraces the arts and sciences embraces all languages, ancient and modern. But it will be very hard to find a word or phrase in any book, the meaning of which is not given by Webster or some of the lexicographers; and to exclude the necessary terms of a science is to break off the handle by which it is held, and transmitted from one to another.

R.—Is it not better to exercise the mind with early discussions than to store it to repletion with simple facts?

B.—Dost thou mean to discuss the mind or the facts? The ox ruminates after he has cropped the herbage. Knowledge increases by observation, experiment, and reflection; to each of these there is a time, and the portions of time are successive. The elements of science are simple sayings expressed in form; the mind which stores them largely, in due season, may use the subsequent times to dispose them in order, and comprehend their use; they are best known from their relations to each other, which are discovered after the mind has possession of them in sufficient number.

R.—What are the peculiar advantages of the mental arithmetic?

B.—Mental arithmetic (so called) is that which is the least mental; it suggests every operation, however minute; it amplifies all that mercantile experience had condensed into forms; and strews about the elements of arithmetic like the dilapidated architecture of a ruined temple. To thee these elements will be mental when they are restored to order, and the forms and process delineated upon thy memory, as the sun-painted image is portrayed upon the polished plate of the artist.

R.—To which of the nations does arithmetic belong?

B.—Spurious patriotism recommends books among us, on the plea that their examples are given exclusively in Federal money; and this may be the bearing of thy question. But arithmetic is based upon duration, extension, and gravitation, which are immunities of the Supreme System. Every country requires certain measures of the labor and wealth of its inhabitants, and being under no restraint, they severally adopt such numbers as they please; and these numbers form their arithmetic. Commercial nations ought to learn each other's systems, especially in regard to money and the measures of such commodities as they exchange with each other.

R.—I perceive at the head of your pages a line of numbers beginning at 1 and increasing by 1; also below each number a fraction having for its numerator 1, and for its denominator the same number; will you state the uses of these two lines?

B.—The lines in question are the multiples and parts of a unit which are the reciprocals of each other. To state their uses would be to solve the science of arithmetic in all its parts; which is possible alone from this arrangement. The want of this illustration has ever been a defect in all systems of arithmetic.

R.—You have furnished a track from which it is hard to deviate; and your directions are sufficiently plain; any one who can read mile-stones may do all that you prescribe.

B.—The simplest process of reasoning is counting; children perform it as soon as they learn to speak. It is also the most certain method and the highest; for Solomon, with all his wisdom, resorted to it. He "counted one by one to find out the matter." Moreover, counting implies being, arrangement, motion, and extension, and puts to flight the delusive notion that the truths of arithmetic and geometry would exist if there were no creation—nothing to be measured or counted. For what is truth but the appropriate relation of one *thing* to another; that which leaves nothing defective, redundant, or disproportioned in the great scale of *beings*. There is no truth where there is nothing to be made true.

1	2	3	4	5	6	7	8	9	10
$\frac{1}{1}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$

INTRODUCTION.

SPACE absolute, or vacuity, is not a subject of arrangement or law, it has no points of beginning or end, and cannot be measured or numbered.

But land, or water, air, light, heat, sound, time, the planets, comets, occupying or passing through space, are subjects of measure or number. Time, however, is not a substantive quantity, and it must therefore cease with the motion of bodies by which it is measured.

Every atom, and every organized body in the universe, counts *one*, a *unit*; a grain of sand, a rose, a house, the state, a star, the universe itself is *one*.

Every unit occupies a space from which it excludes all other units; therefore order and extension are essential to numbers.

Independent units are not properly called numbers; those units only which form the terms of a series are entitled to this appellation. Every unit in a series is similar to the first.

Arithmetic classifies all things, according to their species, magnitude, and other similarities; then places them in lines, calling them *one*, *two*, *three*, *four*, *five*, *six*, &c.

These names, or terms, are numbers. Every number declares its own distance from the first point of the series, in measures or lengths of the first unit.

The *first* or *prime* series is that whose first term is *one*, and constant increase *one*.

The prime series contains all numbers, because a unit is its lowest term, and a unit is the lowest number.

A fraction is not a number, because it is not excluded