

An examination of the century question : To which is added, a letter to the author of 'Outlines of astronomy' [Sir J.F.W. Herschel], respecting a certain peculiarity of the Gregorian system of bissextile compensation / [By A.G. Brae?].

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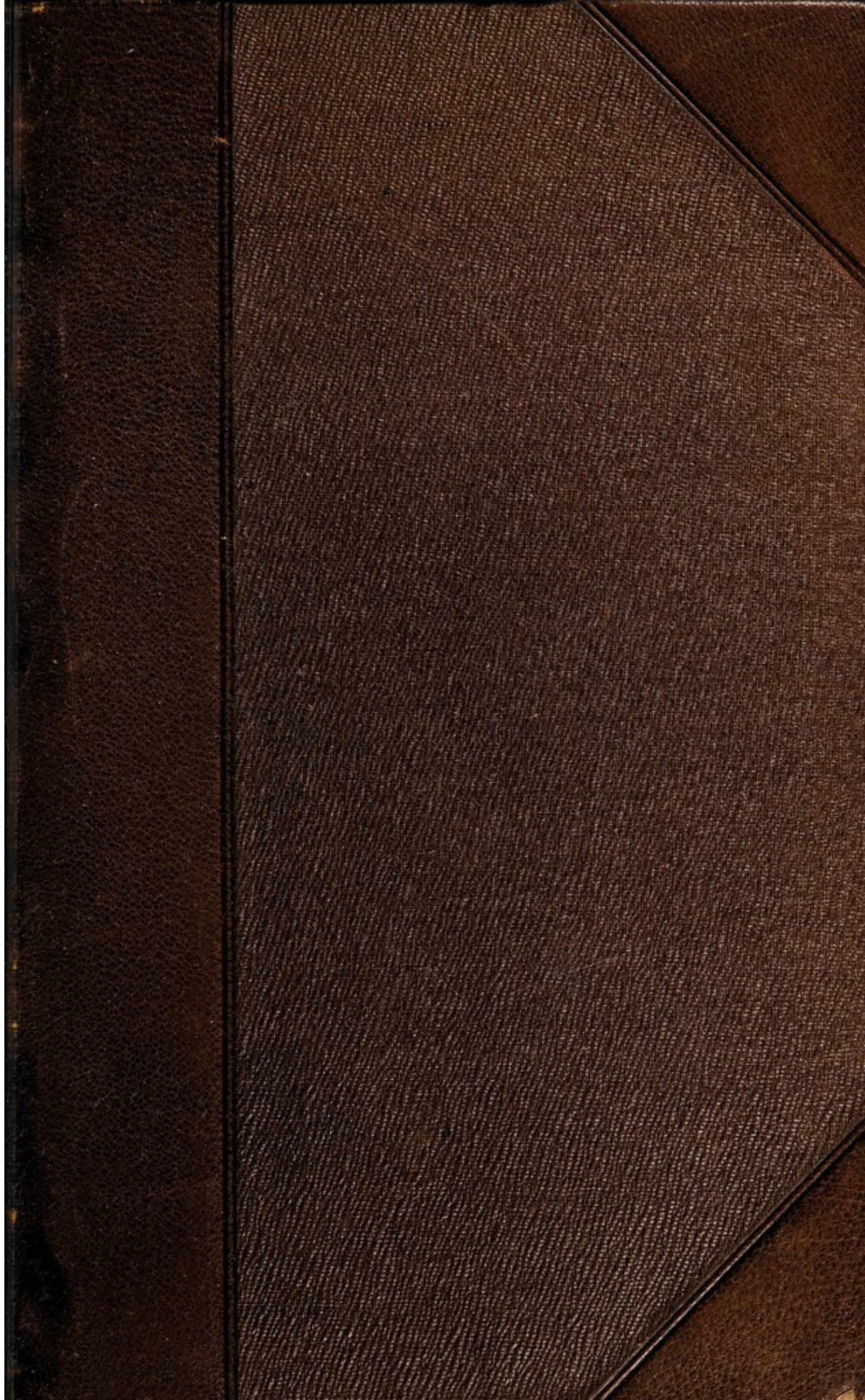
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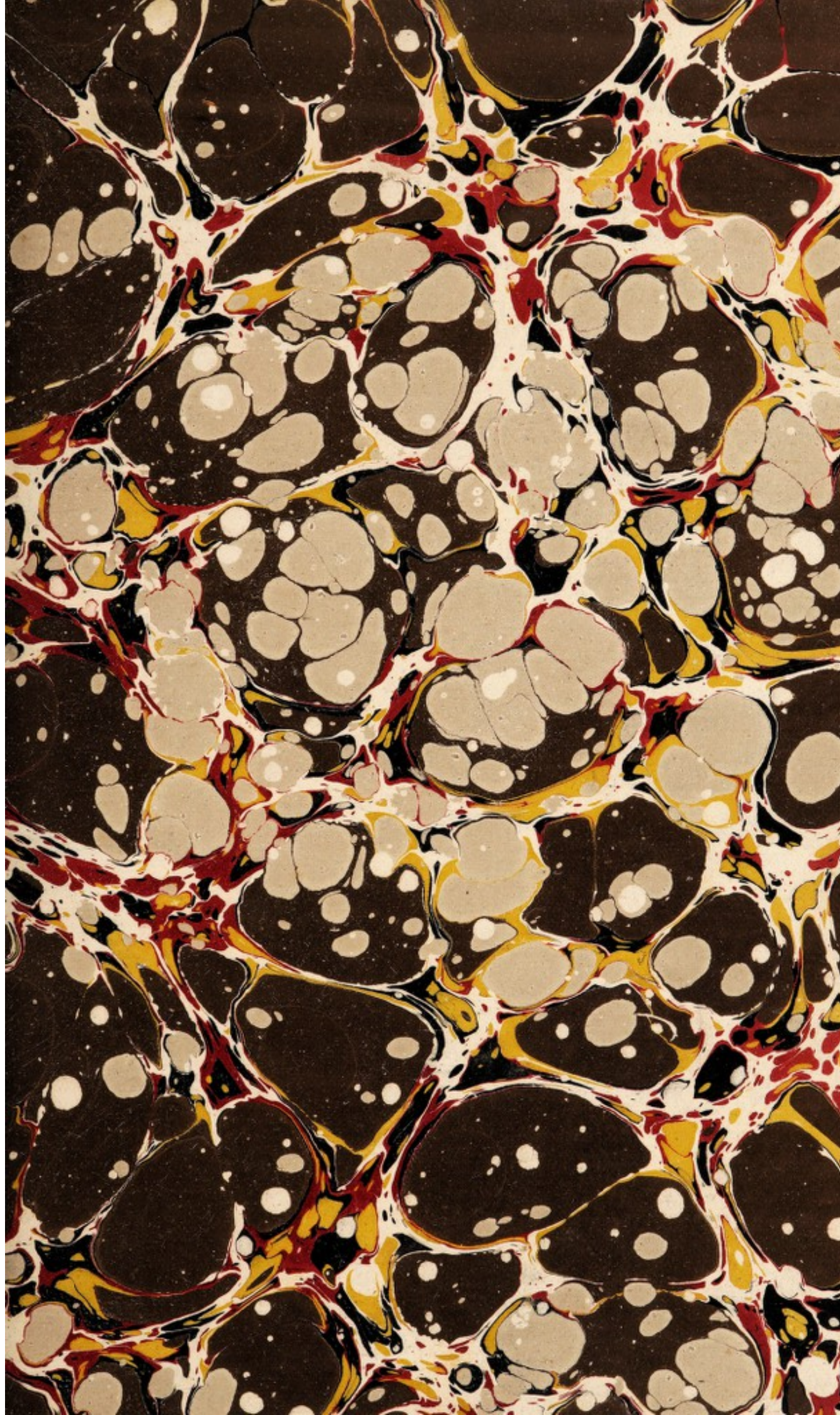
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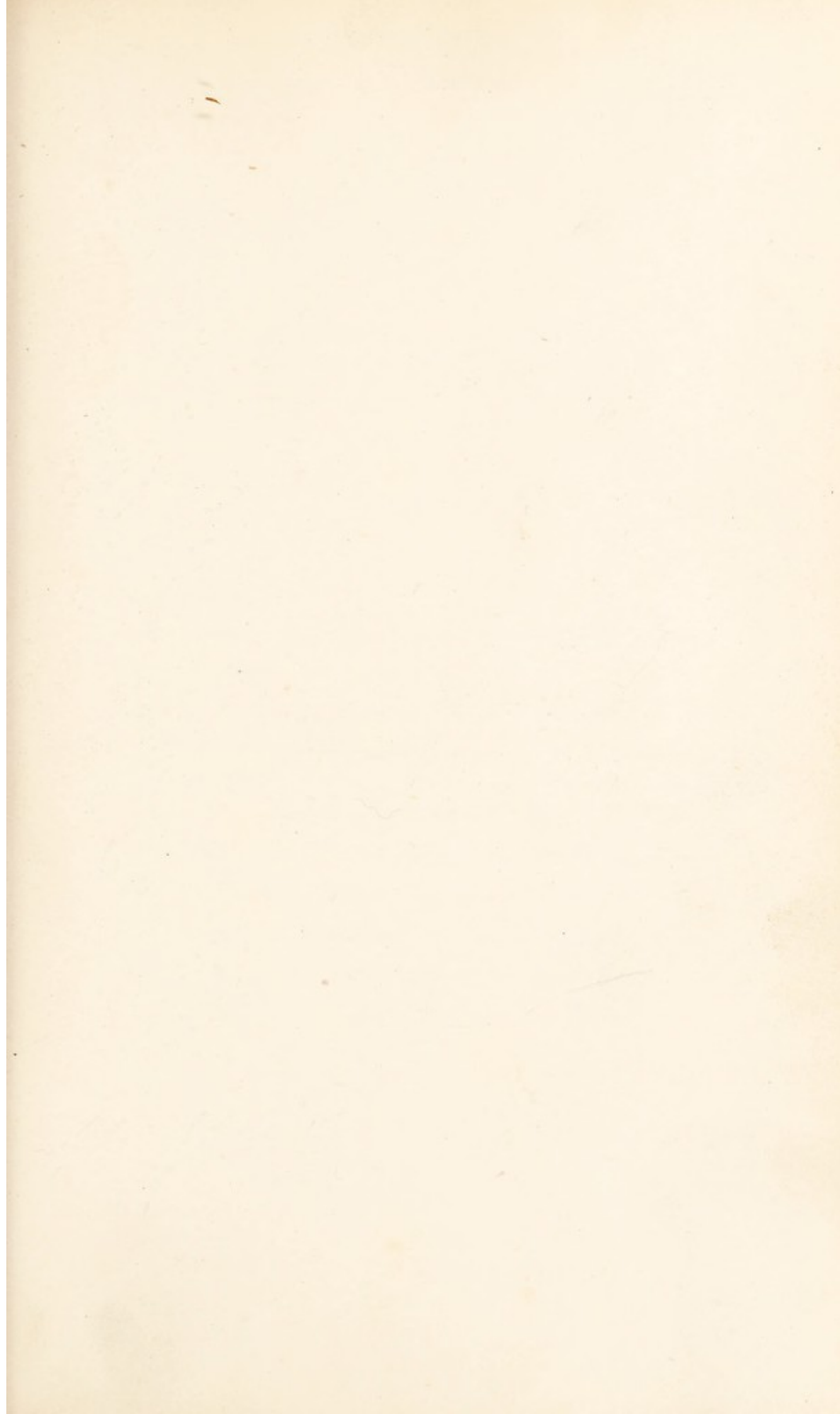
VALENTINES.




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Examination

By A. G. Buse?





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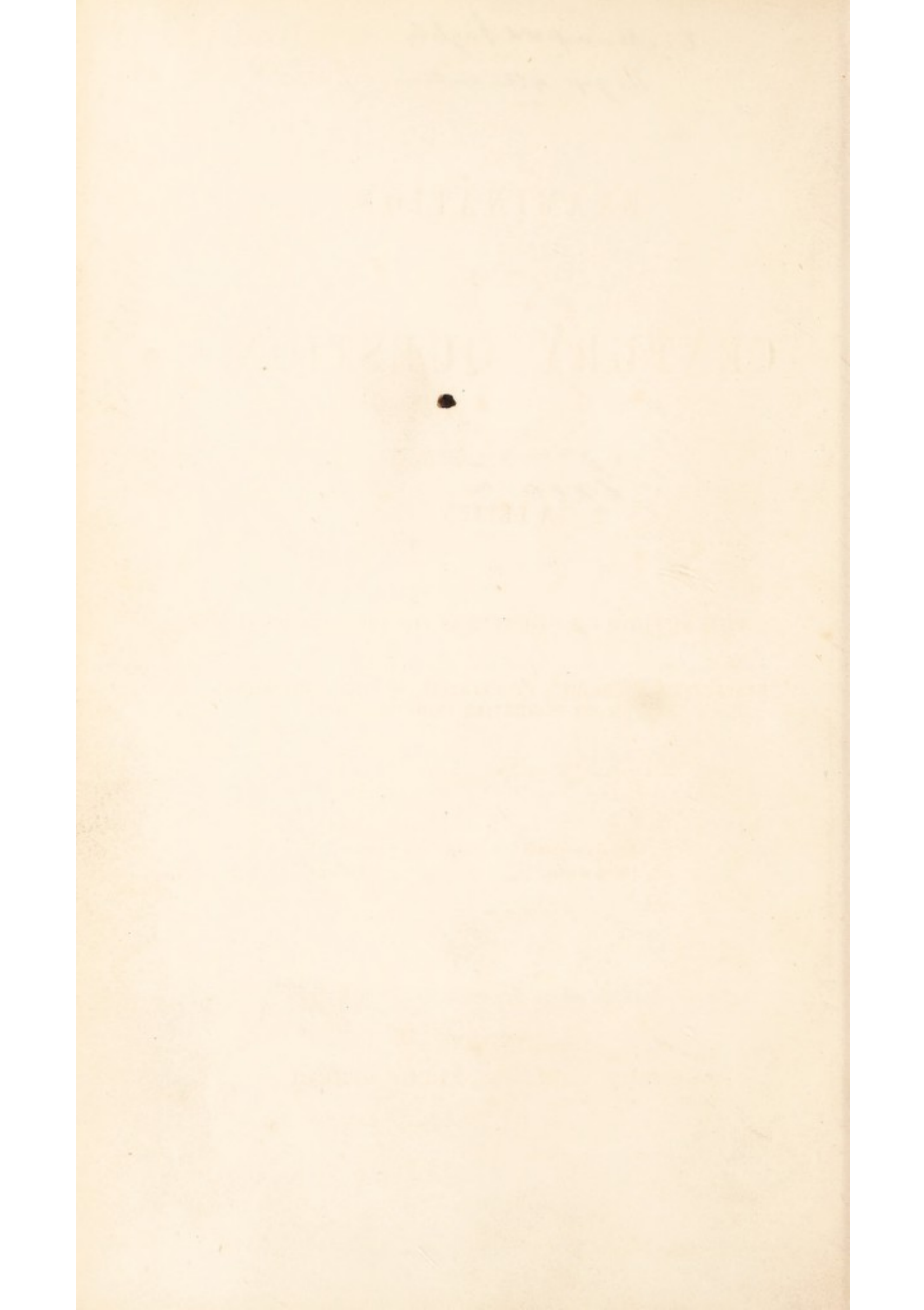
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C. Mansfield Fugate
The gift of the author

Errata

Page. Line.

- 6 - 429. For listyone read fifty nine
17 (In quotation) - dele "si"
18 - 1. For "fuisse" read fuisse
36 } For "modus loquendi Marcellinus
read " " Marcellianus
57 - 11 For twelve read ten
i - 28 For twelve & fourteen read eight and ten
63 - 9 For 6295 read 2295
" - " " 6294 " 2294
65 - 1. " 1733 " 1633
" - 2 " 6446 " 6346



AN
EXAMINATION
OF THE
CENTURY QUESTION.

TO WHICH IS ADDED,

A LETTER

TO

THE AUTHOR OF "OUTLINES OF ASTRONOMY,"

RESPECTING A CERTAIN PECULIARITY OF THE GREGORIAN
SYSTEM OF BISSEXTILE COMPENSATION.

"Judicio perpende: et, si tibi vera videntur,
DEDE MANUS."

LUCRET.

LONDON:
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AN
EXAMINATION
OF THE
CENTURY QUESTION.

THE old chronicler, Gervase of Canterbury, complains, in his prologue, of great dissensions existing in his day (A.D. 1200) from different methods of naming the current year of any event. And, after describing the solar year as commencing with the first of January, and concluding "in diebus natalis Domini," at the end of December; he exclaims, "How then can the computations of both parties be correct, if one commence the years of the incarnation with the beginning of the solar year and the other with its end? both, nevertheless, applying one and the same title to the years of the Lord?" (*Quomodo ergo utriusque vera poterit esse computatio cum alter in principio, alter in fine anni solaris annos incipiat incarnationis? uterque etiam annis Domini unum eundemque titulum apponit?*)

Now Gervase could not intend to describe in this way anything short of a total discrepancy in name throughout the whole year. He could not allude, as some have supposed, to the slight difference in the title of the year (enduring for seven days only) that would arise from commencing it on Christmas day instead of the first of January; nor is the interpretation of the authors of "*L'Art de Verifier les Dates*," who reject the first interpretation, at all more

satisfactory ; they maintain that Gervase meant to describe one party as commencing the year in the usual way, and the other with the day of the Annunciation, nine months previously ; but, if such were his meaning, Gervase would scarcely describe the parties as commencing "*alter in principio alter in fine anni solaris*," especially as he had taken care to define in the first place what he meant by the *beginning* and *end* of the solar year.

But a discrepancy that would exactly suit the words of Gervase, might arise from one person commencing to MARK ONE from the beginning, and the other not until the end of the first year of the Christian æra. In this way two parties might be said to apply "one and the same title to the years of our Lord : " but if one applied that title at the beginning, and the other at the end of the same solar year, there would necessarily exist between them an apparent discrepancy of which Gervase might well complain, being no less than twelve months : and any event they might record would be referred by them *actually* to the same instant of time, but *nominally* to two different years.

It may be assumed, then, as a highly probable fact, that even in those days there existed a partial and imperfect effort to assert, as a principle, that years of the Christian æra ought not to enter into effective enumeration until their respective terminations : at the same time it is quite possible that such an impression might at that time rest upon no better grounds than vague tradition, the true meaning and explanation of which had become lost in the ignorance of the Middle Ages.

It is singularly corroborative of this being Gervase's true meaning, that the same hypothesis affords a reasonable explanation of passages in contemporary chronicles, which otherwise are not easily explainable.

Thus, in Roger of Wendover's "*Flowers of History*," the following sentence occurs with reference to the *cycle* of Dionysius. "Now because the *second* year of this work

ought to agree in computation with the *first* year of the Nativity of Christ: so ought the three hundred and *fifth* year of the same work to agree in computation with the three hundred and *third* year of the Nativity." (*Dr. Giles's Translation.*)

Here is an apparent contradiction; because if one agree with two, 303 cannot in the same series agree with 305. The only way of solving the difficulty is by supposing that by "the first year of the Nativity" the writer did not mean the year 1, but the year previous to it, which he understood as the year of Christ, or Zero. Interpreting in this way the expression "first year of the Nativity," the statement becomes consistent, because there is the same difference between 0 and 2 as there is between 303 and 305; that difference being two years in either case:—and moreover it is apparent, from many other passages in the same writer, that he did estimate the difference between the cycle of Dionysius and the Christian æra at two years; although the difference now usually acknowledged is only one year, a difference that would disappear altogether by the adoption of the zero principle under the arrangement about to be proposed.

The first and most obvious objection to the zero principle arises from the very reasonable opinion that, if adopted, it would lead to a confusion of dates similar to that complained of by Gervase. And it is because this objection has not been met in the right spirit—that is, first by acknowledging its apparent justness, and next by showing how its consequences may be avoided; that much of the hopeless discussion and endless torturing of idiomatic meaning, by which disputes about the commencement and close of centuries have become characterized, are perpetuated.

If two persons were to differ as to the *name* to be applied to the *first month in the year*, one contending for January and the other for March, it would follow that so long as

both of them commenced their years on the same day, so long would they continue to apply different names to the same monthly intervals. But if the advocate for January would consent to commence his year ~~sixty one~~ days before the advocate for March, the *nominal* discrepancy between them would disappear; they would now call the same months by the same names, and the only remaining difference between them would be, that one party would always consider his year as beginning and ending ~~sixty one~~ days sooner than the other. /59

So it is with the æra—so long as they who differ as to the *name* to be applied to the *first year* start simultaneously with their opponents, at the same absolute instant of time, so long must the original nominal discrepancy between them continue to exist; but if they, who contend that the first year while current should be recognised by the title of 0 or Zero, also make that year anticipate the epoch of their opponents by twelve months, the result would be, that when the first has arrived at the proper time for marking 1 (at the expiration of the first twelve months) the second party will also be commencing to mark 1, so that in all future years their numbers would run parallel, and would be applied to identical spaces of time.

Now this concession, or arrangement, the supporters of a zero year are willing to make; nay, they are anxious to do so, considering that a year earlier than the present recognised commencement of the Christian æra would be in many respects *a better epoch*, and one more consistent with known facts. It would be nearer to the real birth of Christ; it would be more consonant with what is asserted by very competent authority to have been the original intention of the Founder of the æra; and it would most undoubtedly be assimilating its commencement with that of the Paschal cycle, which, as before observed, is now commonly supposed to precede the æra by one year. So

arbitrary and uncertain, moreover, are B.C. dates, *which could alone be affected by the proposed arrangement*, that no confusion or reversal of preconceived notions could arise from it, that would not be far outweighed by the harmony and convenience that would ensue.

It is to the absence of *this very essential preliminary understanding* that much of that irreconcilable assertion and hopeless misconception, that invariably arise whenever this question is agitated, may be attributed. So long as those on both sides are partly right and partly wrong, agreement is impossible and neither can succeed in convincing the other. Those who repudiate the idea of a zero year are right in denying that a century of years can be completed until the hundredth year (in the true ordinal acceptation) had fully run out; but they are wrong in denying the possibility of a zero year, which they term in derision "a nothing year," since the zero principle, when properly understood, is undoubtedly the most correct basis of reckoning. Their opponents, on the other hand, are right in the idea of a zero year, but wrong in its application, *most especially wrong in asserting the possibility of commencing at the same point of time with their adversaries, and yet of arriving at the end of one hundred years twelve months before them.* They seem to forget that concurrent periods of equal length, if they begin together, must necessarily end together.

An excellent illustration of this last error may be cited in the reasons given by Mr. Pye, the Poet Laureate at the time, as those which induced him to publish his "*Carmen Sæculare*," or Ode to the New Century, on the first of January, 1800, in preference to the first of January, 1801.

He commences by stating, that being called upon in his official station to testify in his act of publication an opinion upon the controversy as to the commencement of the nineteenth century, then agitating the public mind, he had given the subject deep and anxious consideration.

That he had at first adopted the opinion that the first of January, 1801, would be the first day of the nineteenth century; but that, upon further research, finding all former precedent and authority against him, not only in the practice of his own official predecessors, but in other matters, he had seen cause to abandon that opinion, and to adopt the opposing one. He then proceeds as follows:—

“There is yet stronger authority arising from the history of the institution of the Christian æra.”

“A native of Scythia, Dionysius Exiguus, so named from his stature, who exercised the functions of Abbot at Rome in the sixth century, thinking it disgraceful that the Christians should reckon their years from the foundation of a city which was the seat of their persecutors, resolved to introduce a new æra from the birth of Christ, *which he fixed on December 25th, in the year of Rome, 753; but, to accommodate it to the Roman calendar, he reckoned from the first of January ensuing.*”—(*Preface to Carmen Sæculare.*)

Now here Mr. Pye takes particular pains to fix the epoch of Dionysius, on which he professes to found his conviction, at the same actual starting point with that of his opponents; and he goes on to explain that Dionysius did not begin to mark A.D. 1 until the first of January twelve months *subsequent* to his epoch, while those who contend for commencing the century with the year 1801 mark A.D. 1 immediately *from the epoch itself*: and to this sole cause he attributes the difference of opinion respecting the close and commencement of centuries. But it does not appear to have occurred to Mr. Pye that, if this statement had been correct, the real result would have been a nominal discrepancy only, precisely similar to that already described as complained against by Gervase; while in the absolute time, in which each century should commence or terminate, it could not justify or explain *any* difference. So long as he adhered to the same starting point with his

adversaries, so long also must his terminus have been the same with theirs: and so far from justifying the publication of his ode on January 1st, 1800, his statement, if correct, ought to have compelled him, on his own showing, to have deferred it to the following year, which, although by his opponents reckoned 1801, *ought by him, according to his own system, to have been accounted 1800.*

This will be readily understood if it be considered that, according to Mr. Pye's statement, the first twelve months of the æra was by one party noted 1, and by the other 0. If so, it follows that the second twelve months would have been noted 2 by the one and 1 by the other. Pursuing these two consecutive series for 1800 years, it necessarily results that when Mr. Pye's adversaries were marking 1st January, 1800, Dionysius, according to him, would be marking 1st January, 1799, *both being still twelve months short* of the fulfilment of a century. Therefore, by publishing his ode upon that day, he was, by *both accounts*, publishing it a year too soon; the true difference between himself and his adversaries being in the name that should be applied to the year, not, as he supposed, in the number of years elapsed since the commencement, which, so long as he made his starting point identical with theirs, must have been the same at any absolute point of time.

Thus, while the Laureate was right as to his authorities, precedents, and practice, he was ignorant of the only true ground of defending them, by asserting an earlier commencement to the æra than was assigned to it by his adversaries; and this point has been, perhaps, unnecessarily dwelt upon, because it is to this day the besetting oversight that renders the advocacy of such arguers as Mr. Pye rather injurious than serviceable to the cause of a zero year.

Now, inasmuch as this term, "*zero year*," may not be sufficiently intelligible to all who may chance to read these

remarks, it will be as well before proceeding further to attempt a familiar illustration of its meaning.

Supposing a quantity of liquid were required to be measured off, in pints, by means of a vessel of uncertain capacity, the quantity of a pint in which could only be ascertained by previously transferring into it twelve smaller measures, each of the capacity of one-twelfth of a pint, the number of pints measured to be registered by tally—when would the first pint be notched upon the tally? Undoubtedly not until the twelve smaller measures had been transferred to the larger, and the latter either poured off or ready to be poured off. In point of fact, a *minor tally* would be necessary to keep count of the smaller measures, that it might be known when the quantity of a pint had actually been transferred to the larger vessel; and until the completion of that minor tally no item upon the larger could properly be registered. Supposing, then, that instead of actually scoring down these tallies they were to be kept altogether by memory, how would the measurer proceed? He would, during the progress of the first *minor tally*, mentally register its items, by saying—*nought-one*, *nought-two*, *nought-three*, &c., until he came to *nought-eleven*, after which he would say *ONE* as the first item on the larger tally. He would next proceed as before, by repeating *one-one*, *one-two*, *one-three*, &c., for the items of the second smaller tally. Or, what would be precisely the same thing, he would in the first instance *omit* the word *nought*, which, in that case, would be understood.

Now a little consideration will show that this is the very principle on which we proceed in ordinary counting by tens. We begin with one, two, three, &c., as far as nine (the expression “no-ten” being understood), after nine we say ten (or one-ten), proceeding with one-ten-one (or eleven), one-ten-two (or twelve), until we come to one-ten-nine (or nineteen), after which we say two-ten, or

twenty, and so on to one hundred ; and if it were not for this artifice *we could no more recollect our tens and units than the measurer could recollect his pints and ounces.*

This then is the *zero system* which we are practising every day of our lives ; and when we hear people ridiculing the idea of “ a nothing year,” we may be sure they do not understand the subject ; since they might as well ridicule the idea of nineteen shillings being a nothing pound, no pound being in existence until the twentieth shilling has been added.

It can scarcely be necessary to point out the analogy between the tally of pints, just described, and the register of years called the Christian æra. It has been seen that, during the subsidiary filling of the first pint, the item of the greater tally, if expressed at all, would be nought, or zero. In the æra the pints become years, and the ounces months ; and the expression “ zero year ” signifies that space of twelve months in the first year *before one was scored or registered upon the tally.* Indeed, the analogy is still more strict than at first sight appears, or than is absolutely necessary to the reasoning ; because, in point of fact, the year *is* a measure of uncertain extent, and we should know neither when it ends nor when it begins, if we did not strictly keep the *minor tallies* of months, days, and hours.

The Christian æra, or account, was a human contrivance, devised long after its supposed commencement ; and even admitting that the ignorance of its designer, as to the true principles of arithmetic, precludes the probability of his having rendered it as perfect as it ought to be, that circumstance, *if true*, is no more a valid reason why it should not be amended, than the same circumstance would have been for the continuance of the errors of the Julian Calendar, the Gregorian amendment of which was certainly not contemplated by its original founder.

Now supposing the advantage and reasonableness of a

zero year fully admitted, it may be asked why there should not be one *at both sides* of the epoch, since we count years both ways, before as well as after Christ? or why *after* the epoch should be chosen for the zero year rather than *before* it?

This is a reasonable question, and it is the more necessary to answer it, inasmuch as the zero year has actually been attempted to be placed before the epoch—the aim of those so placing it having evidently been to secure the convenience of a zero year without, at the same time, being obliged to grapple with the prejudice against it as the first year of the æra.

In order, therefore, to show that subsequent to the epoch is the only proper position for the zero year, it will be necessary to apply somewhat different reasoning to that already advanced, but nevertheless so nearly resembling it that some appearance of repetition is unavoidable.

The course of time is in but one direction,—it does not flow from the epoch with opposite currents, like two streams issuing at opposite points from one common source, and whose progressive advance might therefore be noted in both directions;—but it may be likened to a mighty river, the sources of which are obscure and undiscovered; its epochs to land-marks set up upon the banks; and its progress to the current, ever in one unvarying direction. Supposing an exploring party, gliding down such a stream, were to measure progress by counting off yard for yard until a sufficient number of yards were enumerated to constitute a mile, the terminus of which being marked, a fresh reckoning for a second mile were to ensue, to be marked in its turn, and so for an indefinite number of miles:—supposing, furthermore, that after such indefinite number of miles had been marked, a conspicuous object were set up, *at the terminating point of some one of them*, representing an epoch; passing which the measurement should continue as before, with this difference, that now the number-

ing of the miles should recommence from the epoch (those previous to it being disregarded, except that the character originally impressed upon them of *individually* commencing towards the source should be unalterable).

The situation of circumstances would then be this; the measurement above or before the epoch would necessarily be complete and terminated, while that below it would still continue in an inchoate and progressive state: that is to say, there would ever remain in progress of measurement (the passing moment of the completion of one mile and the commencement of the next excepted) a certain space, not yet entitled to rank as a mile, and yet constituting some portion of one, but with no absolute certainty of ever being fully completed.

The proper title strictly due to this incomplete portion, while yet in a state of fulfilment, would be the inchoate sign 0, or zero. But in order to keep the number of finished miles, hitherto registered, constantly in view (which could not so well be effected if zero were to be the *working title* of each during measurement), the artifice might be resorted to of retaining the inchoate sign as the distinguishing title of the first item only; and borrowing in lieu of it, for the use of each of its successors while incomplete, the title really belonging to the item immediately preceding, now at liberty by the removal of the whole series one step lower down, owing to the retention of the inchoate at the commencement.

Here, then, *the practice* resolves itself into the same thing as has been already described in the tally of pints. The rationale is perhaps different, but the analogy between it and the æra is not less obvious.

The number of items occurring before the epoch having been unnoted or forgotten, they would naturally be reckoned backwards from the epoch towards the source, still however preserving their individual or subsidiary reckoning in the opposite direction. The epoch would consequently be, with respect to them, a *terminus*, not a

commencement; so that there could be no idea of inchoateness, no necessity for a zero year, on that side of the epoch, where the account, as a measurement, had been closed and terminated.

It is true, that we do not know with certainty that such was the arrangement contemplated in our æra; *but we do know that it is the only arrangement by which it is possible correctly to close the century with the last moment of item ninety-nine*; and since it is certain that this latter was the practice until the introduction of the fancied refinements in reckoning which has disturbed the commencements of the last two or three centuries, we must either imagine that the ancients blundered at both ends of the account, or that they commenced it with a zero year.

But whether they did or did not, or whether the founder of the æra could or would in any case have so arranged it, are questions that ought to be no obstacles to our doing so, provided convenience and consistency require it, and that no objection more formidable, than that it would be in discordance with the prejudices and ignorance of our ancestors, can be urged against it.

It is greatly to be regretted that this subject should be so much shunned by really scientific and practical men. They seem to look upon it with that sort of shrinking, though indulgent avoidance, they would evince towards the aberrations of lunacy.

Yet it is quite certain that so long as the verdict of science remains unpronounced upon it, so long will it remain a fruitful subject for the inconclusive squabbling of newspaper discussion.

Even in those questions wherein the internal evidence of right is much more obvious and resistless, that right is seldom acknowledged by the mass of mankind until backed by the weight of authority: how much more necessary is authority to a question like the present, where the decision must to a great extent depend upon abstract expediency?

And yet, how is such authority to be manifested, if the subject itself is to be tabooed as unworthy of consideration? Or in what way are the opinions of scientific men to be ascertained, if they must be sought for only in vague and casual expressions in their writings, that may or may not have been inadvertent?

That it is a subject generally and popularly interesting is sufficiently manifested in the continual demands for decisions with respect to it, addressed to those newspapers which profess to deliver judgment in such matters. Up to the commencement of the present year the replies to these demands may have been observed to be pretty equally divided in favour of both sides of the question; but, during these last six months, not only have the applications for decisions enormously increased, but the replies have evinced a remarkable leaning to the anti-zero side—and so much has this been the case, that one of these popular oracles has reversed, in the present year, its own decision of precisely twelve months previously, and that, too, without assigning any reason for its change of opinion. (*Vide Illustrated News, January 13th, 1849, and January 12th, 1850.*)

Nor has this been the only remarkable reversal of opinion in the present year. One of the leading weekly journals (*The Examiner*) in its opening address for the new year had treated this present 1850 as the commencing year of the second half of the nineteenth century: presently, however, it publicly recanted that opinion, declaring that it had become sensible of its error, and, with the invariable intolerance of a new proselyte, it forthwith became unusually severe in censuring those whose opinions were not so suddenly convertible as its own. In the course of its animadversions it adopted the following curious mode of *settling the question*:—

THE HALF CENTURY. — The following extracts from Bishop Burnet's "History of his Own Time" set in a true

light the question which has confused some muddy brains so much. "But before I conclude the relation of this year (1700), at which the century ends," &c.; and, in the next page, "The eighteenth century (1701) began with a great scene that opened with it." (*Examiner*, of January 26th, 1850.)

To ordinary comprehension such a dictum appears to be worth even less than any indifferent individual opinion, providing the latter came from a source less open to suspicion of undue bias in expressing it. The Bishop of Sarum's opinion upon any subject was not in such good odour with *The Examiner* of his own day; nor would its then editor, the immortal Dean, have willingly cited him, unless to ridicule and refute. With respect to the Bishop's opinion so exultingly quoted as setting the present question "*in a true light*," the truth most probably is, that Dr. Burnet gave not a thought to the real merits of the question, but adopted his view of it *solely in opposition to Prior's "Car-men Sæculare,"* which was based upon the opposing opinion. There existed great animosity, personally and politically, between them, so much so that the slighting allusion of the Bishop to "One Prior," on another occasion, called forth the following epigram from Dodsley:—

"One Prior! and is this, this all the fame
The poet from th' historian's pen may claim?
No!—Prior's verse posterity shall quote,
When 'tis forgot *one Burnet* ever wrote."

This unwonted leaning of newspaper arbiters to the anti-zero side of the question, in the present year,* would

* The great leader of them all, *The Times*, is however a signal exception. Without directly entertaining the question, it has nevertheless significantly expressed an opinion; not only in its opening address, or retrospect, at the beginning of the present year, but also more recently, in the following extract from an historical sketch in that paper:—

"At the beginning of the present century the treasures and power

induce to the opinion that they must be actuated by some new and powerful arguments recently put forth, which no longer leave any pretence to the supporters of the other side to continue their advocacy.

But the only regular treatise in which an argument upon the subject has been attempted, is the essay upon "Ancient and Modern Usage in Reckoning," by Professor De Morgan, which forms the most prominent article in the "Companion to the Almanac" for the present year, and which was prepared, apparently, to meet the exigency of the subject at the approach of 1850.

It is necessary, therefore, to examine whether this essay of Professor De Morgan is really worthy of being regarded as an authority on which public opinion might rest, or whether it is not rather a meaningless catalogue of mediæval prejudices and usages; some of them unfounded in fact, others at utter variance with the inference they are adduced to support, and almost all of them obsolete in the present day.

Himself a distinguished arithmetician, it might reasonably be supposed that Mr. De Morgan would say something as to comparative convenience in computation; that he would give an opinion as to which method he would recommend in case the Christian account were to be reorganized; in fact, that he would treat the subject as a question of propriety as well as of precedent. But, no! he declares that "*what ought to be*" is altogether beside the question; and that "*what was*" is the sole point for consideration. In fact, he would seem to adopt as his maxim,

"Mi satis est ~~N~~ traditum ab antiquis morem servare."

and to disregard altogether its converse,

of Ahmed were vested in the person of Zemann Shah, subject to the incessant assaults of his kinsmen. One of these at length proved successful, and in the year 1800 Zemann found himself a prisoner at the disposal of his brother Shah Shuja."—(*Times*, 1st July, 1850.)

“ Si tam Graiis novitas invisa fuisse
Quid nunc esset vetus ? ”

Here are his own words on the subject :

“ We have looked through many of the pieces of this controversy, and have found little or no allusion to how people *did* count ; the matter was assumed to demand settlement by the way in which people *ought* to count. Great pains were taken to prove that there must have been a year 0 after the Christian æra ; and those who could attribute the habits of a modern mathematician to the old computers—who reckoned I., II., III., IV., &c., and had never dreamed of a zero symbol—made a very plausible figure with those who could not correct them. The astronomers Maskelyne and William Herschel took the side of 1800 as the first year of the century, and of course led many, who did not see that the question is for the antiquarian to decide, not the astronomer, as such.”—(*Companion to the Almanac*, 1850, p. 26.)

But, after this decided repudiation of the competency of astronomers to entertain the subject, the Professor, in the very next sentence, takes the following singular method of proving that they have not only entertained it, but decided it.

“ But, if astronomers may decide, they have settled the point by what is now universal consent, and not without having had it frequently before them. For they never open the proper page of any common account of the progress of their science without seeing themselves invited to deny, if they think fit, the statement that the planet Ceres was discovered on *the first day of the present century* : it was discovered January 1, 1801.”—(*Ibid.*)

If it were indeed possible that this negative assent could possess any weight, a much more plausible example of it might have been cited in the tacit acquiescence of astronomers to the inconvenient epoch adopted by De Bode, in his catalogue of stars, which he fixed for the first of Ja-

nuary, 1801, in obedience to the opinion that it was the first day of the nineteenth century. It may be quite true that no conclave of astronomers met for the purpose of entering into a formal protest against it; but, if philosophers of the present day may be judged of from their practice, they have paid homage to *the convenience* of the zero principle by assigning the epoch of the present catalogue of the British Association to the first of January, 1850.

We have already seen Mr. De Morgan citing against his own opinion that of two great astronomers of the age just past; and there is little doubt, that a careful search through the writings of the present generation would so much increase the list as to render the groundlessness of his singular assumption of universal consent even still more glaring than it is. Take, for example, these words of a distinguished living historian of science.

“Gerbert afterwards (in the last year of the first thousand from the birth of Christ) became Pope by the name of Sylvester II.”—(*Whewell, Hist. Ind. Sciences*, I. 257.)

This was in A.D. 999, and the peculiar manner in which Professor Whewell has chosen to record the fact forbids any other conclusion, than that he intended it as the expression of a deliberate opinion upon the present subject.

But, setting aside for the present every other consideration but that on which alone Mr. De Morgan consents to argue the question, viz. the prejudices and usages of the ancients, even then his premises appear unsound, and his inferences untenable. His prevailing argument is based upon what he terms the monadic idea of indivisibility entertained by the ancients, whereby they reckoned everything by monads, or finished and completed entities.

“The earliest process of arithmetic is that of counting units, the unit being considered both as the commencement and the ultimate subdivision of the process: in such manner that between ten and eleven, for example, there is nothing imaginable; nothing more between ten and eleven

feet than between ten and eleven horses. As to the latter instance, we should still agree with the ancients: we should refuse to admit of any number of horses to ride upon between ten and eleven, being wholly unused to see such chargers as Baron Munchausen's; though we might admit *ten and a half* horses as a possible sale of dog's meat. "—

"Down to the beginning of the sixteenth century, the Romans, and all the Europeans who used Latin, were so strange to the idea of fractions of numerable units, that the books of arithmetic hardly contain a notion of them. "—

"In our day, some notion of fractions is learnt so early, and has become so familiar, that the *monad*, or *indivisible unit*, has almost disappeared. We have accordingly forgotten the old maxim—that unity has no parts—which was so well fixed in the minds of our forefathers that they likened *unity* in arithmetic to the *point* in geometry."—
(*Companion to the Almanac*, 1850, pp. 7, 8.)

Now the analogy between this elaborate structure of monadism and the question upon which it is meant to bear is altogether inadmissible. The former refers to the simple enumeration of individual wholes, each of which is either perfect or non-existent; but the latter is a question of running or progressive *meting out*; each stage of which is subdivisible into smaller portions, certain aggregations of which form larger items for registration. But the smaller items must pre-exist for a space during which the larger are inchoate and imperfect—structures, as it were, in progress of erection. To say that the ancients had no idea of fractions, but treated everything as a whole, is simply a straining of the technicalities of arithmetic. As soon as a *contemplated whole* is capable of estimation into quantities smaller than itself, and as soon as the value of those smaller quantities is ascertainable by reference to the value of the whole, so soon does the notion of fractional or fragmentary parts, by whatsoever name they may be designated, begin to exist.

By what else than by a notion of fractional parts could a Roman vintner estimate the wine consumed by his guests, in case his tap were to run dry in the midst of some contemplated measure? he surely would not reckon such measure as full because the running had commenced? or, if he did, his guests would soon teach him the folly of his reckoning.

But, even in a purely theoretical sense, it is inconceivable how Mr. De Morgan can deny a knowledge of fractions to the ancients in the face of Pliny's "*horæ dextante sicilico*," by which he expressed the respectable fraction of $\frac{4}{18}$ ths of an hour; or of the expression of Frontinus, in explanation of the ratio of a square orifice to a circular of the same diameter—that the first is three-fourteenths greater than the second (*tribus quartisdecimis suis major*), and the second three-elevenths less than the first (*tribus undecimis suis minor*).—Or, above all, in the face of absolute fractional operations, many instances of which are to be found in the same author; as, for example, the product of five multiplied by one and three-quarters, amounting to eight and three-quarters (*inveni altitudinem pedes quinque, latitudinem pedis unius dodranti, fiunt pedes octo dodrans*).

In fact, the "as" was the unit of ancient duodecimal arithmetic, and it was theoretically fractionable to any extent; so much so, that Horace upbraids the Roman youth with *over expertness* in the art, to the destruction of their poetic feeling,—

"Romani pueri longis rationibus assem
Discunt in partes centum diducere —."

(*De Arte Poetica.*)

Another peculiarity of the ancients, strenuously insisted upon by Mr. De Morgan (with, perhaps, better foundation in truth), was their proneness to terminate one series and commence the next with the same individual item: thus he expressly declares that—

"The reader must not understand us as supporting the

position that the day from which reckoning was made was held as belonging *more* to time *after* than to time *before*. According to the principles of ancient counting, it would have belonged to *both*, as now to *neither*. We have seen that the unit of reckoning was, from being held indivisible, regarded in the same light as the point, which equally belongs to the line it terminates and the continuation which it commences."—(*Companion to the Almanac*, 1850, p. 18.)

Here one scarcely knows which to admire most—the completeness of the dilemma, or the apparently unconscious facility with which Mr. De Morgan has fallen into it. According to this principle, there can be no such year as 1 B. C. *apart from* 1 A. D. ! both must be represented by one and the same individual year !

Nevertheless, the principle is such an extraordinary favourite with Mr. De Morgan that he is constantly recurring to it under various phases. Thus, at page 21, he repeats that—

"This is the necessary consequence of a strict, but usual, rendering of the maxim, that the last of the old reckoning is the first of the new, to which Roman enumeration so strictly adhered that there is no first day before the Kalends except the day of the Kalends itself."

Exactly so—but since the second day before the Kalends, the second day after the Kalends, and the first day on either side of the Kalends, together made but three days ; by a parity of reasoning the second year before Christ, the second year after Christ, and the first year on either side of Christ, should, in like manner, make but three years—a mode of reckoning that even Mr. De Morgan will scarcely sanction. Are we then, or are we not, strictly to follow THIS peculiarity of ancient reckoning ? If we are, then 1 B. C. and 1 A. D. express but one and the same year ; if, on the other hand, we are not to follow it, wherefore has Mr. De Morgan cited so many examples of it ?

Nothing can more clearly show, than this dilemma, how dangerous it is to meddle with the Roman Kalends as a precedent; and yet, perhaps, there is no precedent more hackneyed, no example more eagerly pointed to, by those who insist upon prolonging the 18th century to the year 1801.

Nor is the difficulty just described the only unavoidable inference from the same principle. Another is, that the same year that concludes one century must necessarily commence the next. Therefore, if 1800 be the concluding year of the 18th century, it must, according to this ancient usage, be also the commencing year of the 19th; and if Mr. De Morgan insist upon following the precedent in commencing the first century with 1st January, A.D. 1, he must also follow it in commencing the second with 1st January, A.D. 100. They are two branches of the same precedent, and must stand or fall together. He cannot be permitted to adopt one and abjure the other; above all, the portion repudiated must not be that upon which he most strenuously insists, and of which he reiterates example after example. Thus he makes it, in another place, the vehicle of a not over modest criticism upon the antiquarian lore of Sir Walter Scott, as though these unqualified assertions of the invariableness of a usage, which all the time is necessarily undermining his own argument, proceeded from a species of infatuation!

“In Walter Scott’s ballad of ‘The Noble Moringer,’ said by him to be translation from old German, the translation has what we should not believe to be in the original, unless we saw it. The lady has engaged to await her husband’s return seven years and a day, according to which, by the old method of counting, she would be at liberty to marry again on any hour of what we should call that day seven years. But the ballad (the translation at least) makes the lady, who is true to the letter of her word, sit waiting till twelve o’clock at night on that day seven years, before she

will have the ceremony performed with her new bridegroom. The husband arrives just in time, and the lady says—

‘ Count the term howe’er you will,
So that you count aright,
Seven twelvemonths and a day are out
When bells toll twelve to-night.’

We will answer for it, that, in the fourteenth century, the lady would not have waited till the odd day was *finished*.”
—(*Ibid.* page 13.)

It would be no very difficult task to show the utter unsoundness of this criticism, and to refute it by evidence of authentic antiquity: but it serves the purposes of this argument infinitely better that Mr. De Morgan should, in this instance, be permitted to prove a case that recoils only on himself.

Because, if the husband’s term had expired with the first moment of the last day, why should not the century terminate with the first moment of the last year? If Mr. De Morgan will have it that the lady had no right, according to ancient usage, to wait until twelve o’clock at night, why should he attempt to uphold from the same usage that the century ought to wait until the 31st of December? He cannot defend both; he must perforce relinquish either his precedent or his argument.

But he has not even yet exhausted this favourite theme.

“ A person who is born on the 10th of June, in our day, counts a year as completed so often as a 10th of June arrives. He says, I shall not be of age until the 10th of June; ask him how old he is on the 9th, and he will say, I shall not be of age till to-morrow. If he were born at noon, it is true that he does not complete twenty-one years of days divisible into fractions until noon of the 10th. Nevertheless, in the law, which here preserves the old reckoning, he is of full age on the *ninth*: though he were born a minute before midnight on the 10th, he is of age to exe-

cute a settlement at a minute after midnight on the morning of the 9th, forty-eight hours all but two minutes before he has drawn breath for the space of twenty-one years. The law reasons thus:—there are no parts of days; he who is born on the 10th takes the whole of the 10th as part of his life; he is a year old when he has completed 365 days; the 9th of next year is his 365th day; as soon as he has commenced the 9th, he has lived through the whole of it, for a day has no parts; therefore he has lived a complete year, or is one year old as soon as the 9th arrives. And the conclusion is unavoidable so soon as it is granted that a day has no parts.”—(*Ibid.* page 9.)

A very slight paraphrase changes the concluding logic of this extract into these words:—

“There are no parts of years; a century is complete when its hundredth year is finished; as soon as it has commenced it has finished, for a year has no parts; therefore it is a complete century as soon as the year 100 arrives! And this conclusion is unavoidable as soon as it is granted that a year has no parts!!”

Notwithstanding all this, the very next sentence in Mr. De Morgan’s essay is in direct contravention of this usage upon the universality of which he so strongly insists,—

“The anniversary of birth used to be celebrated as the first day of a new year; it is now considered as the completion of the old one.”—(*Ibid.*)

Here we have an alleged discrepancy between ancients and moderns, in which *the former* were clearly in the right notwithstanding their own usages to the contrary. Because the *three hundred and sixty-fifth* day being the “last of the old reckoning,” it ought, according to the foregoing alleged usage, also to have been “the first of the new;” but here we have it acknowledged that the first of the new was not celebrated until the following day, or “the anniversary.” To assert, however, that in this

respect moderns differ from the ancients, is a libel upon moderns which they certainly do not deserve. There is no difference in respect of birthday usage. It is with moderns as it was with ancients, the celebration of *renewed birth*; and the very meaning of the expression "New Year's Day," the anniversary of the year, is of itself sufficient to show that Mr. De Morgan's *modern instances* are as incorrect as his ancient inferences. That the ancients should not in this case have followed their own general usage is one of those anomalies which prove that ancient reckoning was guided by no fixed principles, but rather by accidental circumstances: it has been before observed that the monadic rule was by no means so invariable as Mr. De Morgan assumes, and the deviation from it in the present instance would seem to admit of explanation in this—that as each day of the year had a distinct and separate name, the return of the same day by the same name would naturally be looked upon as the commencement of another year. But no such accidental corrective existed in the case of the Kalends; in them the monadic system flourished in full luxuriance—the same day was not only the last of the old and the first of the new, but it was at one and the same time itself, the first before itself, and the first after itself; and, as if this were not sufficiently anomalous, although the Kalends was *the first day before itself*, yet it was not *the day before itself*, because "*dies secundus ante Kalendas*" was also "*pridie Kalendas*."

Now it cannot be too often repeated, nor too strongly insisted upon, that these singular *idiomatic* anomalies in reckoning, if attempted to be set up as precedents, must necessarily lead to that very practice in commencing centuries, to oppose which they are brought forward. The more Mr. De Morgan reiterates instances of what he terms the monadic usage of beginning and ending with one and

the same item, the deeper he becomes involved in the dilemma of supporting a practice it is the object of his essay to deny.

The fancied refinement of correctness in making the whole of the nominally hundredth year a portion of the old century, which is always alleged to be in deference to the prejudices of the ancients, is, in point of fact, *itself* a gross innovation upon ancient prejudice.

It is a comparatively modern attempt to get rid of only the most obvious half of an erroneous practice, leaving the other half untouched; and probably it was not dreamed of before the approach of the seventeenth century. Previously to that, granting that the account was wrong at both ends in the true ancient fashion, still the two errors, like the mutual destruction of two negatives, counteracted each other, and produced an effect as though neither had existence.

Once, and only once, does Mr. De Morgan evince the slightest consciousness of the dilemma in which he was involving his argument; and, even then, the whole passage is so obscure that it is impossible to discover its precise object, or how far the admission is intended to extend: especially, it is difficult to imagine to what age of the world that state of things is referred, when the year "*had not a beginning distinct from its end, nor any intermediate parts.*"

"Remembrances of the monadic system of counting have been before now made to appear in the following statement; that a date, such as 1843, does not mean the whole year 1843, but the indivisible moment at which a certain year begins. If this had been the case, and the term century had been used, then, probably, the moment at which A. D. 100 begins would have been made to terminate the century. That the year ranked as a moment, in reckoning year after year monadically, is true enough; but it had not then a beginning distinct from its end, nor

any intermediate parts. It has been urged in support of the above view, that the hours of the clock are reckoned in the same way; thus four o'clock refers to a moment of time, not to an amount of duration. But the phrase contains its own answer, for *four of the clock* merely refers to the place where IV. is written."—(*Ibid.* p. 26.)

The principal reason for citing this extract is because its last two sentences contain the sole and solitary allusion to horary notation to be found in the whole essay "on ancient and modern usage in reckoning." And yet it might be supposed that so great and signal a departure from "monadic" usage as the horary system presents, would have elicited some better attempt at explanation than that "four of the clock merely refers to the place where IV. is written!"

Can it be possible that Professor De Morgan is serious in attempting to explain away a universal usage by an idiomatic form of expression *peculiar to the English language*? But, even if the phrase "four of the clock," had been a universal instead of an individual idiom, still the question would remain—how *came* the clock, and the sundial before it, to be so marked in opposition to the monadic prejudices of the ancients? This is a question it is not necessary to discuss; it is sufficient for the present purpose that the usage was so, and that it cannot be denied.

That usage is as remarkable for extraordinary constancy and invariability as other estimates of time were for variation and uncertainty; a circumstance that in itself would seem to prove some inherent excellence in the method.

It must be recollected that horary notation, in the most cribbed and confined signification that the prejudice of commentators can assign to it, is, viewed in any light, an ample and sufficient precedent for deferring the numerical noting of an item until the completion of the minor parts

of which it is composed. It must also be recollected that most of the commentators upon Roman writers lived in times that were more susceptible to the monadic prejudices described by Mr. De Morgan than the Romans themselves. Therefore they have always endeavoured to strain the meaning of every passage into a sense the most conformable with these prejudices. And hence, although they found it impossible to remove *the point* "sexta hora" from the meridian, or from the *completion* of six elapsed hours from sun rise, they *have* succeeded in removing *the space* sexta hora from the afternoon to the forenoon. But there are excellent grounds for believing that the former was its true place; or, in other words, that the running hour immediately subsequent to the point of noon *retained* the name sexta hora until it had fully run out. If that can be established the precedent becomes infinitely more close, and authorizes not only *deferred notation*, but also the zero principle in its strictest integrity—that of retaining the title of the preceding item in the service of its immediate successor during the meting out of the latter.

It must be premised that the Romans did not by any means look upon the cardinal and ordinal forms of numerical expression as so distinct in meaning as moderns do. To be satisfied of this, it is only necessary to consider attentively the manner in which Suetonius records his estimation of the ages of the Roman Emperors. Caligula lived twenty-eight years and not quite five months, yet the historian's phrase is "Vixit annis undetriginta," a cardinal numeral being here used in an ordinal sense. But of Vespasian he says, "Extinctus est VIII. Kal. Julii annum gerens ætatis sexagesimus et nonum, superque mensem et diem septimam;" meaning thereby, not that he was in the seventh day of the seventh month of his sixty-ninth year, but that he was in the seventh day of the eighth month of his seventieth year. This explains how the same numeral expression, sexta hora, could be used,

not only in the ordinal sense of "the sixth hour," but also in the cardinal sense of six elapsed hours.

Similarly, the word "hora" had two distinct and separate meanings. One, a point, or line upon the dial (the "linea" or "nota" of the Romans) constituting the boundary to a certain space; the other, that space to which the first was a boundary. Thus, one signification of "hora" was a point between two spaces; the other, a space between two points. It had yet a third signification, much used by Pliny to denote an azimuthal space in the horizon, but with that the present subject has no concern.

Since, therefore, the construction of Roman idiom admitted of the first two meanings of the word *hora* being expressed by one and the same numeral, and since it cannot be denied that the instant of noon, or meridies, was called *sexta hora*; the question is, at which side of that point was the other *sexta hora*, *the hour's space*? did it precede the point or follow it?

That this is a question open to discussion is acknowledged by Dr. Schmitz, who thus quotes from Becker.

"Another question, which has often been discussed, is—Whether, in such expressions as *prima*, *altera*, *tertia*, &c., we have to understand the hour which is passing, or that which has already elapsed?

"From the construction of ancient sun-dials, on which the hours are marked by eleven lines, so that the first hour had elapsed when the shadow of the gnomon fell upon the first line, it might seem as if *hora prima* meant after the lapse of the first hour. But the manner in which Martial (iv. 8) speaks of the hours leaves no doubt that the expressions *prima*, *altera*, *tertia*, &c., mean the hour which is passing, and not that which has already elapsed." —(*Article "Hora" in Smith's Dictionary of Greek and Roman Antiquities.*)

Now, with great deference to this authority, it is equally certain, that in maintaining a directly contrary conclusion,

a better groundwork for the argument need not be chosen than this very eighth epigram of the fourth book of Martial. But the present purpose will be fully answered, if it can be shown that *any* Latin author has authorized an opposite reading. Now there is a certain passage in Ausonius that is admirably suited to the purpose, because it fortunately happens that so broad a distinction is drawn therein between the space and the point, the one being expressed by "hora" the other by "nota," that no cavil or uncertainty can arise as to the true meaning of the author.

The passage is moreover interesting in another way, by presenting a curious illustration of that close observation and minute attention bestowed by the ancients upon what we should deem trifles, but which so often assist in unveiling the meaning of obscure passages in their writings.

In the Ephemeris of Ausonius, of which, unfortunately, only fragments remain, in order to hasten the operations of his cook, he exclaims:—

— "Quartam jam totus in horam
Sol calet: ad quintam flectitur umbra notam."

Now what is the meaning of "sol totus" in these lines? undoubtedly *entire sunshine*: that is, entire sunshine is upon the *fourth hour*, and the shadow is urged upon the *fifth point*! can anything be more significant? It must be recollected, that it is one of the properties of the sun-dial, that from sunrise to noon the shadow is pursued by the sun, but from noon to sunset he retires before the shadow: that, in the forenoon, time to come is in the shade; time past, enlightened: but, in the afternoon, time past is in the shade; and time to come, enlightened. It follows, therefore, that Ausonius could not have used the same form of expression in the afternoon that he does with so much meaning in the forenoon. Had he said, for example, entire sunshine is upon the *eighth* hour, and the shadow is

driven upon the *ninth point*, the position so described would have been impossible. Because, if the shadow verged upon the ninth point, no possible interpretation could enlighten the eighth hour, already past.

To return, then, to the argument—the time to which Ausonius refers is the fifth point, or indisputably what we call eleven o'clock, A.M., upon which he says the shadow is urged or turned—which assertion he strengthens by adding that the fourth hour is now *wholly enlightened*. What, then, can he mean by the fourth hour? Undoubtedly, the space immediately preceding the fifth point, and consequently *subsequent* to the fourth point!

This evidence is so irresistible that it can scarcely leave a reasonable doubt that *hora*, the space, was subsequent to *hora*, the point.

But since the point *prima hora* was seven o'clock, A.M., if the space *prima hora* was subsequent to that point, then the hour's space preceding it from sunrise must, if named at all, have had some title equivalent to zero: just as, at the present day, we commonly allow the hour's space preceding *one* o'clock to retain the name of twelve, although more correctly it is denominated 0.

If anything were wanting to confirm the foregoing view of horary notation, it would be afforded by a passage in the works of St. Augustine, who, singularly enough, is himself endeavouring to prove a contrary practice amongst those who *to him* were “the ancients.” In explaining away an apparent contradiction as to the exact time of the crucifixion, as reported by the different Evangelists, he says, with reference to that verse of St. John, wherein Pilate is represented as still sitting in judgment “about the sixth hour” (chap. xix. vers. 13, 14), that the time so referred to is not the sixth hour *all out*, but shortly after the fifth, and a little way into the sixth. “For,” says he, “Nunquam isti dicerent quinta et quadrans, aut quinta et

trians, aut quinta et semis, aut aliquid hujusmodi. Habent enim istum morem scripturæ ut A PARTE TOTUM PONANT, maximè in temporibus!" (*De Consensu Evangelist.* lib. iii.)

Would St. Augustine have considered this explanation necessary if the practice of his own time was the same as that he attributes to *isti*? Or would he have pointed out as singular the habit of reckoning *a part as the whole*, if he himself, as Mr. De Morgan wants his readers to believe, had no idea of any other practice?

Here we have St. Augustine, about the year of grace 400, putting on the robe of "the antiquary" and forestalling Mr. De Morgan's arguments of 1850; and, as if to give the finishing touch to the picture, we have the Venerable Bede, some three hundred years afterwards, in his Chapter "*De Ratione Unciarum*," (for he too, although necessarily ignorant of fractions, had the presumption to write "On the Doctrine of Twelfths,") citing the very passage above quoted to prove how clever St. Augustine was at fractions.

Now, whatever may be thought of the Saint's antiquarian researches, this much, at least, is certain—that he himself (and he was long antecedent to the institution of the Christian æra) had a very familiar idea of five and a quarter, five and a third, five and a half, and "*all that sort of thing*," as measurements of time short of six complete hours.

Moreover, does not such a method of noting the hours receive still further confirmation from the common expression remaining proverbial in the present day, that anything protracted *to the last* is "put off till the eleventh hour?" and from the circumstance that seldom, if ever, is the expression "twelfth hour" to be met with in ancient authors, which could hardly fail of being the case if it were an expression extending over an hour's duration.

It is remarkable that all the subdivisions of an hour follow the same principle of notation—one minute is not

named until sixty seconds have been completed, nor do repeating watches (although invented so far back as the reign of Charles the Second) announce the first quarter until fifteen minutes have elapsed, after which one quarter only continues to be announced up to the completion of thirty minutes. Here, then, is a trite illustration of the zero item—if the repeating knob be pressed during the first quarter, it replies NOTHING; therefore the *first quarter* is the *zero quarter*.

Altogether, the chronometry of hours is a perfect little system in itself; a sort of imperium in imperio, which *ought* to demonstrate the true principle on which the larger system of the æra should be based; just as the miniature system of Jupiter and his satellites visibly demonstrates the solar theory!

It has been observed (*ante*, p. 6) that one of the advantages that would accrue from a setting back of the Christian epoch to a point twelve months antecedent to that wherein it is at present usually placed (that is, to the first of January in the year of Rome 753), would be, that it would thereby be made coincident with the Paschal cycle of Dionysius. On this point, the following evidence of Mr. De Morgan is quite satisfactory and conclusive:—

“The table tells us that A.D. 532 is 248 of Diocletian, and 1 of the cycle of Dionysius: accordingly A.D. 1 would have been 2 of the preceding cycle of Dionysius. And the rule given by Dionysius confirms his table.

“According to the received mode of counting, we are to presume that Dionysius meant A.D. 1 of his own æra for the year of the Incarnation. But, some time after Dionysius, it is certain that the year commonly received as that of the Incarnation was not the first year after (or *of*, if the reader please,) the Dionysian æra, but the first year before it. Three accounts have been given of this discrepancy.” (*Companion to the Almanac*, p. 30.)

Of these three accounts, the first and third, according to Mr. De Morgan, are worthy of no attention; the second he thus explains:—

“Secondly, it has been thought that he intended to have a *zero reckoning*, calling 0 the year of the Incarnation, and A.D. 1 the year following.

“As to this second supposition, it is for those who affirm Dionysius to have made departure from usual methods to prove it. He explains himself so clearly, and gives the circumstances of the existing state of things, and his own proposed alterations, with so much precision, that it is exceedingly improbable he should have made a departure from usage in his mode of reckoning, without giving the most express warning.” (*Companion to the Almanac*, p. 31.)

But, surely, the *bare possibility* of Dionysius having so intended is all that the advocates of a zero year can be called upon to prove, even if they professed to consider his consent a necessary preliminary, which they do not.

But Mr. De Morgan, after thus asserting that the onus of proof lies with his adversaries, relieves them from it by himself undertaking to prove the converse. This he does by citing three examples from the rules of Dionysius, which he numbers 1, 2, and 3. No 1 favours his own view of the subject; No. 2 is opposed to it.

“And so,” he says, “the question would be left perfectly balanced, if it were not for No. 3; but the intent of the whole passage marked 3 is very obscure.” (*Ibid.* p. 32.)

Here Mr. De Morgan leaves the subject “*perfectly balanced*,” with the exception of the casting vote afforded by No. 3, which he himself admits to be very obscure: but he has forgotten to notice a usage in full force about the time Dionysius was compiling his rules. Baronius, in his “*Dissertatio Hypatica*,” complains that a good deal of embarrassment was caused in dates by two contempora-

neous methods of reckoning years from certain consulates (those, in particular, of Belisarius and Basilius, about the earlier part of the sixth century).

These two conflicting methods (*which strongly bring to mind those complained of by Gervase of Canterbury*) Baronius describes as having been used, one by Marcellinus and others, the other by Victor Tununensis and others. The latter reckoned the year of consulate itself as No. 1; the former reckoned the year succeeding it as No. 1; and this is *precisely the same distinction as is now at issue between the advocates of a zero year and their opponents.*

Baronius places the two methods in parallel contrast in this way :—

Modus loquendi Marcellinus.

An. Christi.

541. Basilio Consule.

542. Post Basilium, 1.

543. Post Basilium, 2.

Modus loquendi Victorianus.

An. Christi.

541. Basilio Consule.

542. Anno 2do, post Basilium.

543. Anno 3tio, post Basilium.

Now the advocates of a zero year have a perfect right to assume, if necessary to their argument, that Dionysius may have been tinctured with this Marcellian method. That it prevailed amongst the ecclesiastics of Rome appears in the double datings of those letters addressed by Gregory the Great to Saint Augustine and his associates in the conversion of England, whereof the following is an example (*Bedæ, Hist. Eccles.*)—

“Data die decimo Kalendarum Juliarum, (22nd June, A.D. 601,) imperante domino nostro Mauricio Tiberio piissimo Augusto anno decimo nono, *post consulatum ejusdem domini anno decimo octavo*, indictione quarta.”

The Emperor Maurice began his reign in August, A.D. 582, and his consulship on the 1st of January next ensuing; that is, the 1st of January, A.D. 583. Therefore, in

reckoning the years "post consulatum," the year 583 was accounted 0, and 584 was reckoned as 1; otherwise 601 could not be the 18th.

A closer precedent than this could not exist.

The first year of the Christian æra may have been *in fact*, as, in the zero system, it is *in theory*, called annus Christi, or annus Incarnationis; and the year following it may have been called annus post Christum 1:—just as the first year of Basilius was called by Marcellinus the year of Consulate, and the year following it "annus post Basilium 1," or post consulatum Basili.

This at once affords a clear and satisfactory explanation of the apparent discrepancy of a year between the cycle of Dionysius and his æra. He may have reckoned the years,

Of the cycle.	Of the æra.
1	0
2	1
3	2

Such a distinction in the method of noting the two series would be in strict accordance with the idea that the first, like the pages of a book, are *names of identification* for reference, subject to no numerical process; but the second are the numerical items in an account. And it is quite certain that at the present day the same distinction ought, on correct and philosophical principles, to be made between them.

Either Mr. De Morgan was not aware of this close precedent, or, knowing it, he considered it unsafe to allude to it.

With strange perversity, he can perceive and draw inferences from circumstances when favourable to his own views, but remain blind to the same circumstances when adverse to them; in what other way is it possible to account for the following strange oversight?

Julius Cæsar's leap-year system, of adding a day *every*

fourth year, was a clear recognition of the zero principle ; and how does Mr. De Morgan get over this stumbling-block of Cæsar's fourth year ?

By calling it an "*imported phrase*," because Cæsar was assisted in his calculations by Sosigenes, an Egyptian astronomer. But afterwards, in speaking of the Dionysian rules, in the interpretation of which he relies altogether upon what he assumes to be "the manner usual to the time," he mentions "a collection of calendar rules, framed by the skill of certain *Egyptians*, and *adopted by Dionysius*." Are not the circumstances the same ? and what is there to prevent the supposition of the *imported phrase* having been again adopted, together with the Egyptian rules ? (Vide *Companion to Almanac*, pp. 23, 30.)

While on this subject of leap year, we naturally revert to a portion of Mr. De Morgan's treatise, wherein he announces a new arrangement of the bissextile years of Julius Cæsar and Augustus. And, if one may judge from the elaboration bestowed upon it, and the synoptical table by which it is accompanied, it is regarded by its author as a discovery of no small importance.

The brief history of the bissextile institution is this :—

Julius Cæsar ordained that an additional day should be added to every fourth year, to compensate for the unreckoned surplus of six hours remaining over at the end of each year of 365 days. He was unfortunately assassinated before the completion of the first bissextile cycle, so that his philosophical arrangement was left, in the confusion of events immediately subsequent to his death, exposed to the misconstruction of ignorance and prejudice. The pontiffs, a class of persons with whom it is not denied the absurd numerical ideas described by Mr. De Morgan may have existed in full force, misunderstanding Cæsar's prescript, counted wrong at *both ends* (a dilemma shewn to be inevitable in the true anti-zero method of counting); that is, they finished one period and commenced the next

with the self-same item. The result of such a course was the anticipation of a year in every period ; so that the day was added to the third instead of to the fourth year.

Afterwards, when Augustus arrived at the undisturbed possession of the empire, and had leisure to turn his attention to civil affairs, this error in the application of the bissextile was discovered, after its repetition through twelve of these three-year cycles had, by forereaching a year upon each, anticipated the compensation of twelve years.

The obvious remedy for this was that compensation should cease for twelve years ; and, accordingly, Augustus "jussit annos XII. sine intercalatione decurrere." All this appears to be plain enough ; but it would not suit Mr. De Morgan's crochet of admitting no exception to his alleged general usage. He accordingly would force Augustus to commit the very error that occasioned the necessity for his correction.

To this end he asserts that the true meaning of the words "annos XII. sine intercalatione decurrere" is that intercalation *must take place* in the twelfth year !

"In asserting the probability of the system we have advanced, it will be observed that we maintain *no leap year for twelve years* to be a phrase synonymous with *leap year in the twelfth year.*" (*Companion to Almanac*, p. 21.)

This supposition, to borrow a phrase from Mr. De Morgan himself, "is one of the most forced and unnatural that was ever pressed into the service of an explanation."

In the first place, it is necessary to believe that Augustus, although wise enough to be aware that intercalation due to twelve years had been anticipated and paid in advance ; yet, in the second place, was so stultified and ignorant as to frame his edict in a way that would repay back the intercalation due to eleven of these years only. And not only that, but it must be believed that Augustus—living at the time when these eleven years had expired—was still so deprived of the acumen that had led him to

discover and amend the sacerdotal error, as to be incapable of perceiving the precisely similar error committed by himself.

The historian Macrobius takes such particular pains to make the subject intelligible, that he almost appears to have had a sort of prescience of the misinterpretation that would be attempted after the lapse of so many ages. He says that Augustus ordered these twelve years to remain uncompensated—"ut illi tres dies, qui *per annos triginta et sex*, vitio sacerdotalis festinationis excreverant, *sequentibus annis duodecim nullo die interkalato*, devorarentur."

Now, in no hypothesis, wherein it is assumed that the first leap year was observed *correctly*—that is, that the first actual observance was in the same year that Cæsar himself intended it to be—could any error accrue from that observance, because no error could exist until some discrepancy had commenced. Hence, in the common arrangement, wherein B.C. 45 is assumed to have been correctly observed as bissextile, no error could accrue until the next observance in B. C. 42; which, by being one year too soon, would produce an error in anticipation of six hours; and that error repeated twelve times would amount to seventy-two hours, or three days.

But Mr. De Morgan most unaccountably assumes that the *first observance*, in B.C. 45, *contributed to the error*; because he charges it as a fault against the common method, that, in it, there are thirteen actual and ten intended leap years previous to the intervention of Augustus; thus reckoning in both cases the first observance in B.C. 45. But when the historian mentions that the error had arisen from the observance of twelve years where there ought to have been nine only, he must necessarily refer to *erroneous* observances:—"Hic error sex et triginta annis *permansit*: quibus annis interkalati sunt dies duodecim cum debuerint interkalari novem." Consequently, to justify the supposition that the first twelve observances were

really those referred to, it is necessary to assume that the error commenced with the very first of them.

Strange to say, Mr. De Morgan neglects this very obvious necessity, even in his own "improved system." He makes his first true and his first sacerdotal leap years CONCUR in B.C. 43; no error, therefore, could commence until the following year, the first of the second observance; and if to B.C. 43 the thirty-six erroneous years be added necessary to the consummation of the three-day error, the resulting year is B.C. 7. But Mr. De Morgan states that the edict for the non-observance of intercalation was in force from the previous year, so that the three-day error could not, in his system, have been consummated at all.

Thus, he again commits the extraordinary oversight of reckoning his first sacerdotal observance *as contributing to the error*, although he assumes its correctness by placing it concurrent with what he states to have been the first Julian, or correct leap year. So placing it, without the least explanation how such a miraculous phenomenon could be brought about, as that two periods of different duration (the true Julian and the false sacerdotal), starting from the same point, should still be in conjunction at the end of the first revolution!

In addition to this insurmountable objection to the "*proposed system*," another, not less fatal, is, that in it the *restored* leap year in A.D. 4 differs by two years from that which, by the same system, should have been the true leap year of Julius Cæsar, had no error of observance occurred: and yet it must have been the object of Augustus to restore the order of leap years to their *original integrity*, as intended by Cæsar. This obvious necessity is recognised in every system, *that of Mr. De Morgan excepted*, who would seem to care not what amount of ignorance and absurdity he fathers upon Augustus, so that it assist in helping out his own immediate crotchet.

There is but little probability, therefore, that this "*im-*

proved" system will supersede the old method. There are but two of the allegations brought against the latter that possess any show of truth or reason, and these admit of easy correction: the first fault consists in placing a leap year at the head or beginning of the account, "when, if ever," as Mr. De Morgan remarks, "all was straight to begin with:" the second, which arises out of the first, consists in beginning the compensation in advance with the first year; but afterwards, when the interruption by Augustus had ceased, assuming it to be made only when due.

The mode in which these defects may be remedied is this. Let the application of the bissextile be understood LITERALLY as laid down by almost every authority; that is, not IN, but AFTER, the fourth year. Thus Censorinus declares that the application was to be made "*peracto quadrennii circuitu.*" Macrobius, in describing the error of the priests, says, "*illi quarto non peracto sed incipiente interkalabant.*" And Petavius more plainly still describes the institution to be "*ut post annos 4, dierum 365, unus, quinto ineunto anno, dies intercalaretur.*"

According to these authorities, four whole years were to pass away *completely* before the application of the bissextile, which in that case must necessarily fall to the fifth year. And this appears to be the only rational way of accounting for and justifying the expression, "every fifth year," attributed to Augustus; and that too without necessarily obliging him to succumb to sacerdotal prejudice. Because, a little consideration will show that the idea of absurdness, in speaking of compensation in the fifth year, ceases so soon as we cease to look upon leap year as belonging to the same quadrennial from which its extra day has accrued. Each leap year then becomes understood as a year *as yet uncompensated so far as respects itself*; it is therefore necessarily No. 1 of the series to come.

In this view of the case, the first four *uncompensated*

years of the Julian account were B.C. 45, 44, 43, and 42, forming the first quadrennial, the day accruing from which should have been added in the beginning of the fifth, that is, in February, B.C. 41, which thus ought to have been the first true leap year; but it was also the first year of the second quadrennial, consisting of the years B.C. 41, 40, 39, and 38, the day accruing from which would in its turn fall to the fifth year, or to B.C. 37, constituting it the second true Julian bissextile; and so of the rest.

Hence the first *nine* true bissextiles would have been B.C. 41, 37, [33], 29, 25, [21], 17, 13, and [9]. The first *twelve* false or sacerdotal observances would, in like manner, have been B.C. 42, 39, 36, [33], 30, 27, 24, [21], 18, 15, 12, and [9], being precisely the same years to which both series have been always assigned in what Mr. De Morgan calls the old or common system; but with this improvement, that now not only is the objectionable leap year removed from the commencement, but also the first twelve observances are those which constitute the error.

In the two series it may be observed that there are three concurrent or synodical years common to both (in brackets), in each of which the accumulating error becomes a complete number of days; thus, in B.C. 33, the sacerdotal error amounted to *one* complete day; in B.C. 21, to *two* complete days; in B.C. 9, to *three* complete days. It is by far the most reasonable supposition that Augustus would choose one of these synodical years, when the anticipation became a complete number of days, to begin paying it back again. Consequently we find that he issued his edict in B.C. 8; that is, in the year immediately succeeding one of those concurrent periods.

It has been shown that it required twelve errors of six hours each to accumulate the sacerdotal error of three days; therefore, to balance the account, twelve times six hours must be paid back on the contra side. To do this, twelve years must be left *uncompensated*, and it can

scarcely be conceived how such a process could be more plainly indicated than when Augustus "*jussit annos XII. sine intercalatione decurrere.*"

It has also been shown that each leap year was an uncompensated year; that is, it was not included in the compensation by which a day was added to itself.

Therefore B.C. 9 was the first of the twelve uncompensated years, and A.D. 3 (speaking according to anti-zero reckoning) was the last of them, when all would be straight and balanced as at first. The new account would now begin with A.D. 4, as the first year *to be* compensated; whence, reckoning as before, the first quadrennial would consist of the years A.D. 4, 5, 6, 7, the day accruing from which would be again applicable to the beginning of the fifth year, A.D. 8; which thus, becoming the first observed leap year after the correction of Augustus, would transmit its successors to our own days. All this, notwithstanding Mr. De Morgan's denial, is in strict accordance with the words of Macrobius, who thus continues his description:—

"Post hoc"—after this, (that is, after the twelve-year omission,) he, Augustus, ordered that one day should, *according to the regulation of Cæsar*, be added to every fifth commencing year." Could any words more clearly indicate that it was the aim of Augustus to create a starting point, whence Cæsar's institution might recommence as at first?

Thus, twelve years were parenthesised, or cut off as though they had no existence—"post hoc"—everything was to go on as it ought to have done at first. Therefore, whatever number of years were required to complete a new bissextile cycle from the last actual observance, so many must now be increased by twelve, the contents of the parenthesis, in order to arrive at the next observance. But the number that should have been added to B.C. 9, the year of last observance, was *four*, increased by the parenthetical years to *sixteen*; and these, added to B.C. 9, bring us to A.D. 8, as the first restored observance.

It has been the more necessary to enter into the foregoing defence of the "common system" of allocating leap years before and after Christ, inasmuch as the effect produced upon that system by the admission into it of a zero year has a very close relation to the general subject in discussion. Because, if it shall appear that the peculiar method and consistency evinced in that arrangement, as just explained, so far from being disturbed by the admission of a zero year, would, on the contrary, be confirmed and increased by it; that circumstance affords another reasonable argument for the adoption of such a year in the Christian account.

Its effect, then, would be to realize that harmonious disposition of leap years, before and after Christ, into which, as will afterwards appear, Playfair was seduced, and which he adopted by mistake. By mistake, because, although excellent in itself, it was in no wise consistent with *his* principles as an anti-zeroist. This desirable arrangement is, that leap years before as well as after Christ should be evenly divisible by four; and, as in the preceding explanation of the common system, the true leap years before Christ were assigned to the years B.C. 1, 5, 9, &c.; so, if a zero year were admitted, it would itself take the place of B.C. 1, and its predecessors would consequently be allotted to B.C. 4, 8, 12, &c.; so that these leap years before Christ would become, like those after Christ, evenly divisible by four, without in the least disturbing the reasoning on which the "common system" has been defended.

One more extract from Mr. De Morgan, to prove how completely he must have permitted his judgment to become warped by zeal for the particular object in view, since it cannot for an instant be supposed that he would have recourse to wilful misrepresentation. With reference to the choice of years of even hundreds for the Gregorian omission of the bissextile, he says:—

“Clavius gives it as the reason why *centesimal years* should be chosen for omission of leap years, that these are years of great note, being observed by the church as years of jubilee. Had he attached to 1600, 1700, &c., any idea, either of commencement or termination of a century, as a unit of reckoning, he would surely have made allusion to it here. What there is shows that, in common usage, the centesimal years were terminations and not commencements; for a jubilee is a festival of commemoration, not of anticipation. In the year 1800, Mr. Pye, then poet laureate, published his ‘*Carmen Sæculare*,’ with a preliminary dissertation in defence of 1800 being the first year of the new century. Among other arguments, he urges that Prior had done the same in 1700; but he forgets that secular odes have always been retrospective, and properly belong to the last of the old century, not the first of the new. Hear Prior:—

‘Hardly the muse can sit the headstrong horse,
Nor would she, if she could, check his impetuous force;
With the glad noise the cliffs and valleys ring,
While she through earth and air pursues the king.’

But Prior’s noisy muse was riding on horseback after William III., not to bring him tidings of future events, but as a convenience for the contemplation of the past.

‘She now beholds him on the Belgic shore,
Whilst Britain’s tears his ready help implore;’

and a great deal more.” (*Companion to the Almanac*, 1850, p. 26.)

Now Mr. De Morgan must have known that Prior published this ode on or before the first of January, 1700. Why on the first of January, if he was then only commencing the last year of the century of which Mr. De Morgan asserts there were twelve months yet to run, and of which the ode was *retrospective*?

Mr. De Morgan must also have known that the ode is dedicated to JANUS, the pater *matutinus*, whom Prior classically assumes as presiding over the *turn* of the century as over the turn of the year.

Whom he addresses as,

“Closing the volume of a *finished* age;”

and whom he invokes to

“Bid the great months *begin* their joyful round.”

He must also have known that Prior imitates and takes his motto from Virgil's fourth Eclogue, which professedly and exclusively hails a commencing age; the first line of that motto being,

“*Aspice venturo lætentur ut omnia sæclo.*”

Mr. De Morgan must have known all this, and yet he wishes his readers to infer that Prior published his ode in 1700, as the last year of the old century, and not as the first of the new; and the reason he assigns why they should do so, is, because the deeds sung in secular odes are those which had been enacted in the past century. How could it be otherwise, unless modern laureates were, like those of old, prophets as well as poets?*

The same hackneyed argument is used to explain away the Church celebration of jubilee in years of even hundreds (such as 1300, 1400, &c.)—that these years were considered, not as initial, but as terminal of centuries: and perhaps Mr. De Morgan's singular assertion that birthday is now considered as the *completion* of the old year (*ante*, page 25), may have been intended as a forerunner or preparative to

* Pye's ode is much more decidedly retrospective than Prior's: in the former, a complete review of the events of the past century is entered into; so that, were it not for the author's own express declaration to the contrary, it would be still more open to the deduction attempted to be drawn by Mr. De Morgan.

this argument. But the jubilee is known to have been an imitation and revival of the sæcular games of the Romans, to which Krantzius bears witness when lamenting the obscurity in which the year 1000 was suffered to pass away.

“Mirum silentium de millesimo Christi anno nulla solemnitate quod sit scriptum peracta ut ad exemplum saltem veterum Romanorum sæculares ludi qui in centesimo quoque urbis anno exhibebantur tum solemniter peracti leguntur.

“*Jubileus* autem annus necdum venerat in mentem pontificibus.

“Bonifacius VIII. anno trecentesimo post millesimum primus illum instituit.”

Now, if the *model* was celebrated in honour of a new century, so must also have been the *copy*. But that the former was so may be proved in this way:—

Among the medals, still extant, that were struck on the occasion of the grand celebration of the millenarium of Rome under the Philips, some are inscribed “PIETAS AVGVSTORVM;” others, “MILLIARIVM SÆCVLVM:” but others again, “NOVVM SÆCVLVM.” This last being a clear assertion of a new age being the object of celebration. (*Vide Akermann’s Roman Coins.*)

It would have been more consistent in Mr. De Morgan to have supported, than to have denied, this usage of regarding centesimal years as initial of centuries; since it has been shown (*ante*, p. 23 *et seq.*) to be a necessary consequence of his own theory—of that system of counting has been at such pains to fix upon the ancients.

The hypothesis contended for in these pages is somewhat different. Whilst it is admitted that prejudices and anomalies in reckoning existed to a great extent, it is denied that they universally prevailed. Exceptions arose sometimes in practice, as in the horary system and other instances that have been brought forward; sometimes in individuals, as in Julius Cæsar, Augustus, and doubtless

many of the more enlightened Romans. To the difference in opinion arising from this cause may be attributed all the uncertainty and variation in the estimation of the true value of certain periods of time, such as lustrum, Olympiad, and the bissextile cycle.

The two former would seem to have had some remote origin in the quadrennial correction of the solar year, and to have shared, in common with the latter, the erroneous value of five complete years often attributed to all three, and even to this day retained by the first; but which, in all, is equally traceable to the custom of reckoning both ends of the account.

In Volney's *Chronologie des Douze Siècles* such an origin is directly attributed to the Olympic period, and the signification of Elis (where the games were wont to be celebrated), being in the Phœnician language "the city of the sun," is adduced in corroboration. This being the case, it is not a very extravagant supposition that lustrum, a word having analogy with cleansing from imperfection, may have had a like origin.

It is quite certain that all three periods have been identified as alike and equivalent, both in their four-year and five-year values.

Ovid, who was more of a poet than a philosopher, must have supposed that the bissextile cycle consisted of five complete years, since he describes it as equivalent to "lustrum," which *with him* meant five years; speaking of Julius Cæsar, he says:—

"Is decies senos trecentum et quinque diebus
Junxit, et è pleno tempora quarta die.
Hic anni modus est; in lustrum accedere debet,
Quæ consummatur partibus, una dies."

This passage has proved so great a stumbling-block to the five-year value of lustrum, that in some of the first editions "tempora quarta" were changed into "tempora

quinta," with a view to reconcile the apparent contradiction. But the true explanation appears to be, that Ovid partook of the prejudice then prevalent, that all these series were five-year periods.

Everywhere throughout his writings he attributes a consistent value of five whole years to lustrum, and also to Olympias, which he identifies with it as an equivalent term. Thus, he describes his own age of fifty years as of ten lustra (*Ibis*, v. 1); and again, as a space of time in which *the Olympic prize* had been ten times gained (*Tristium*, iv. 10). His father's age of ninety he computes as of eighteen lustra (*Ibid*). In one place he computes the age of Arcas by "tria lustra," and in another by "ter quinque natalibus actis," &c.

It is amusing to observe how entirely commentators acquiesce in Ovid's five-year value of lustrum, because of its being still in accordance with their own prejudice: but when he assigns the same value to the Olympiad, they explain it as poetical license; and when he makes use of the phrase "quinquennis Olympias," they treat it as a joke somewhat similar to the Greek Calends.

But there is another Latin author who is just as consistent in assigning a *four-year* value to these periods, agreeing with Ovid only in this, that they both, unlike moderns, assign an *equal value* to the Olympiad and the lustrum.

We refer to Ausonius, who shows his equivalent estimation of the two periods in the following lines:—

"Fors erit, ut, lustrum cum se cumulaverit istis
Confectam Proculus signet Olympiadem."

He next marks the value of the Olympiad at four years, by assigning to his father's age "undecies binas Olympiades," eleven double Olympiads; which, since he limits him in another place to ninety years, must clearly be reckoned at four years each Olympiad.

The duration he assigns to the lustrum differs from most

other Latin writers, and is altogether denied by commentators, who would twist his meaning into any shape rather than admit it as adverse to their own notions. Here is an epitaph "upon a matron of sixteen," "*sedecenni matronæ*," and the title must be particularly attended to:

SEDECENNI MATRONÆ.

Omnia quæ longo vitæ cupiuntur in ævo,
Ante quater plenum consumpsit Anicia lustrum.
Infans lactavit; pubes et virgo adolevit:
Nupsit, concepit, peperit, jam mater obivit.
Quis mortem accuset? quis non accuset in ista?
Ætatis meritis anus est, ætate puella.

All things that in a life's age are desired,
Fell to Anicia's lot ere she had seen
Her fourth full lustrum out!
Nursling—child—girl—woman; she was wooed
And wed—a matron and a mother—and she died!
Who shall blame death when he old age attacks?
It is but meet. But when he slays the young,
Who then shall blame him not?

With reference to these lines, it is sufficient to remark that, notwithstanding the significant title "*sedecenni*," and notwithstanding the point and keeping with that title evident throughout; the commentator's note to the words "*ante quater plenum lustrum*" is "*ante vigesimum annum ætatis*." Is it wrong, therefore, to say that these commentators lived in an age much more susceptible to prejudice than that in which the writers themselves lived?

There is another passage of Ausonius that has also been warped from its true meaning by the commentators, but it must be confessed with a much greater show of reason and fairness.

Ausonius, in estimating the length of reign of each of the twelve Cæsars, says of that of Augustus, "*Augustus post lustra decem sex prorogat annos*;" which, of course, is explained by the commentators as a period of fifty-six years.

Such a reading is in this instance plausible enough, because fifty-six years happen to form the interval between the first consulship of Augustus and his death.

But when the *two triumvirates*, each of five years' duration, are deducted, the reign, properly so called, of Augustus, cannot be said to exceed forty-six years—equal to ten lustra of *four years* each and six added: and even this estimate exceeds by two years the length of reign usually attributed to him, which is forty-four years, commencing from the battle of Actium*.

Now, what is the object of pointing out those discrepancies?—It is to show that there did not exist among the Romans such a fixed and determined understanding, as to the interpretation of their methods of counting, as would justify an argument founded upon the assumption that any one act must necessarily have been in accordance with any one usage. And if we come down to later times we shall find a similar struggle between prejudice and truth still more prominently existing. Towards the close of the fifteenth century we find the Olympic interval reckoned at the value of *five full years*, and that too, by the early printers, who generally were learned and well informed men. But what is still more extraordinary, this erroneous value is affixed to an edition of the very author we have been just quoting, Ausonius, who, of all others, is most consistent in assigning to the Olympiad its true value of four years.

The edition referred to was printed at Venice, in 1472, that date being expressed as follows:—

“A nativitate Christi ducentessimæ nonagesimæ quintæ Olympiadis Anno II., VII. Idus Decembris.”

Now 294 Olympiads and two years, if reckoned at the

* Censorinus, too, may be quoted as authorizing the four-year value of lustrum:—“Quaternorum annorum circuitus quos vocant Olympiadas, Idem tempus anni magni Romanis fuit, quod lustrum appellabant.” (*De Die Natali.*)

correct value of four years each, would result in the date A.D. 1178, or about two centuries and a half before the introduction of printing. Wherefore they must be reckoned at five full years each to make out the date, 1472, at which the book is supposed to have been printed.

Another example exists in a book printed in the University of Oxford, in A.D. 1485, as is thus expressed, "Hoc opusculum in alma universitate Oxoniæ a natali Christiano ducentesima et nonagesima septima Olympiade feliciter impressum est."

A century later, we find Holinshed estimating in the same way :

"For in anno 996, in King Ethelred's time, who wrote himself 'Rex Anglorum et Princeps Northumbrorum Olympiade tertia sui:' for so he wrote the account of his reign then, which was *the fifteenth yeare*."

But Sir Henry Spelman, who was nearly contemporary, appears to estimate more correctly :—

"Ethelredus Rex Anglo. Sax. per Olympiades regnum suum in charta quadam computans, 'Consentiens' (inquit) 'signo sanctæ crucis subscripsi in Olympiade IV., regni mei.' Videtur ex synchronis conscribentibus fuisse annus regni 16, Domini nostri J. C. 994, vel hunc circiter."

It would appear too, if Spelman's "*concurrent evidence*" is to be relied on, that Ethelred himself reckoned the Olympiad at its true value. Hence we have Ovid at variance with Ausonius, Ethelred with the early printers, and Holinshed with Sir Henry Spelman ! and yet Mr. De Morgan argues that there was but one recognised and general usage in reckoning ; which could be in no danger of misinterpretation, because no idea of any other existed !

An equally notable example is presented in the interval of the old Roman week, the termini of which were called *nundinæ*. This week consisted of eight days, to each of which one of the first eight letters of the alphabet was prefixed, precisely in the same manner that the first

seven letters, known as dominical letters, became afterwards affixed to our own week of seven days. And in the same way that we now sometimes hear one Sunday called the *octave* of another, so was each of the *nundinæ* the ninth day from its predecessor—whence the name.

But so little did Macrobius understand the *ancient universal* system of reckoning, that, *misled by the name*, he mistook the length of the interval for *nine full days*.

He professes to quote from Rutilius, but there can be little doubt that the misinterpretation is his own. He states the institution to have been “*ut octo quidem diebus in agris rustici opus facerunt, nono autem die, intermisso rure, Romam venirent,*” (that for eight days the country people were to work in the fields, but on the ninth, field labour being discontinued, they were to come into Rome). These words convey precisely the same mistake as though the Jewish dispensation were rendered in this way, “*seven days shalt thou labour, &c., but on the eighth,*” &c.; and yet it is just the mistake into which a person at the present day might be led, had our own weekly institution become obsolete, its interval forgotten, and its termini only remembered as “*octaves.*”

But what then becomes of Mr. De Morgan’s theory of the universality of ancient usage in reckoning? He will doubtless answer that Macrobius was a stranger, and therefore not imbued with Roman prejudices.—How is it then that the estimate of Macrobius was generally adopted in preference to that of Varro, whose more correct account is as follows:—

“*Itaque annum ita diviserunt ut nonis modo diebus urbanus res usurparent, reliquis VII., ut rura colerunt?*”

How is it that it was proposed to add another stroke to Varro’s VII. days so as to make eight of them to *agree* with Macrobius? How is it that Forcellinus, the lexicographer, attributes 27 days to three *nundinæ*, “*Trinundinum—spatium dierum vigintiseptem*”? In short, how is it

that a knowledge of the true value to which the nundine interval is now restricted should appear to be due, not so much to a better understanding of the ancient peculiarities of reckoning as to the ocular demonstration afforded by the remains of actual Roman Calendars with the eight letters, before referred to, engraved upon them in recurring rotation?

As to the true signification of the word "*Æra*," which Mr. De Morgan wishes to restrict to that of a mere point or epoch, its defence may safely be left to his own exposition. He has cited such a preponderance of authority in favour of the continuous sense of *æra*, that its friends need desire no better advocate. They may even afford to disregard some slight misrepresentation, such as the assertion that Petavius used the word *doubtfully*, the truth being that its mention by that author is constantly suggestive of duration,—"*caput æræ*," "*initium æræ*," "*æra iniiit*," "*æra incipit*," "*in æra Christi quos annos Christi vocant*," &c. &c.

As for *arguments* against this extended sense—so much at a loss does Mr. De Morgan seem to have been, that he frames one out of the observation that a certain year is "the 39th before our vulgar *æra*,"—because, quoth he, if the continuous sense of *æra* were intended, the expression ought to have been, "the 39th year before (*the beginning of*) our vulgar *æra*."

But, according to the same reasoning, if we speak of any event as having happened two years "before the reign of Queen Victoria," unless we qualify the sentence by inserting "the beginning of" we may be subject to the imputation of disloyalty in attempting to limit her Majesty's reign (which may Heaven prolong) to the duration of a mathematical point.

The integrity of *æra* is in no danger from such assaults, the attempt to undermine it and to rob it of its best signification is as little likely to succeed as though it were directed against the word reign itself, the meaning of

which it would be as reasonable to limit to the first moment of a monarch's accession as to cripple down æra to the sense of a mere motionless starting point.

But since the title æra was adopted in the Christian account, probably for no other reason than that it had long been identified with the reckoning of years, its true signification can in no other way affect the estimation of that account excepting in this—that if any peculiar meaning should appear to have been attached to æra as distinguishing an *unusual* method of counting years, then it would become a fair inference that the title was adopted because the method it indicated was to be the same in both accounts.

Amongst the derivations that have been from time to time suggested as applicable to the word Æra, Mr. De Morgan has cited two, both of which are of that class which may be termed the initial-letter class, viz.

“Some have suggested an abbreviation of *Annus ERat Augusti*, by picking out the letters here given as capitals; as if two letters had been selected from the unimportant verb. The following conjecture (which is mentioned without source by D'Alembert in the *Encyclopédie Méthodique*, and which we do not find in the old chronologers) is far more respectable, almost even plausible: it derives æra from the initials of *Ab Exordio Regni Augusti*.”

The first of these two is Sepulveda's derivation, which was so unmercifully criticized by Scaliger; one of whose charges against it is, that whereas all the ancient monuments and records of Spain authorize the spelling of the word with a single E—Era, Sepulveda's derivation would have perpetuated the diphthong. But since the second derivation (from D'Alembert) is equally open to that objection, it is very probable that Scaliger would have included it also in his exclamation:—

“Ridicula, ridicula, et puerilia sunt ista.”

Nor is the origin of the word, as imagined by Isidorus, (lib. v. *De Annis*,) more satisfactory, since it may be charged with two anachronisms. First, that of supposing Augustus to be engaged in imposing taxation upon the whole Roman empire at a time when he was at best the master of a third only; and next, that of supposing a census of the Roman people in progress under Augustus when we have his own assurance (in the *Marmora An-cyrana*) that the first census taken for a period of forty-two years was instituted by him in his Sixth Consulate, A.V.C.

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726, ~~twelve~~ years later than the commencement of the Spanish æra. There is, however, one fact to be inferred from Isidorus, that at the early age when he wrote (before the end of the sixth century) the opinion then entertained was that the designation era, or æra, had some analogy with money accounts, although his origin of the word, built upon that fact, may (like many others of his) have had existence only in his own imagination.

Now a very probable origin of the title æra is, that it may have arisen in an experimental endeavour on the part of Augustus, or of whomsoever may have been the founder, to assimilate the reckoning of time to the reckoning of money accounts; and thereby to correct those prejudiced and erroneous methods of counting we have all along been discussing. It is by no means certain that Augustus *was* the founder. Had he been so it seems scarcely probable that he would have instituted two other accounts, the Actian and the Augustan, ~~twelve~~ and ~~fourteen~~ years afterwards, to either of which the description of Isidorus is much more applicable in point of circumstance than to the Spanish account. They are often confounded with it by a mistake into which many authors have fallen, but of which perhaps the most signal example is the learned and critical Niebuhr, who thus alludes to it in the first volume of his history: "Different eras are suited to different times; thus, the Spanish from the battle of Actium, was appropriate so

right
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long as the western empire lasted; afterward it ought to have given way to the general Christian æra much sooner than it did." (*Cambridge Translation.*)

Again, had Augustus been founder of the Spanish æra, it is not probable that Censorinus would have omitted all mention of it in his list of concurrent dates, wherein he includes the Julian, the Actian, and the Augustan, had it also been, like them, of imperial institution.

But, if not Augustus, who then was the founder of the Spanish æra? We fear it is a point not likely to be determined; but why not Pollio? More extravagant suggestions have often been hazarded.

Pollio was a governor in Spain, and he may have strenuously endeavoured to establish a correct system of reckoning years in that country.

He was a learned and distinguished patron of science, the intimate friend of Julius Cæsar, whose associate he may have been in the correction of the calendar.

After Cæsar's death the continuous account of years intended to receive his name was neglected, his bissextile institution was misinterpreted, and it was not until Pollio became the friend and companion of Augustus after the downfall of Mark Anthony, that the calendar was again reformed.

The idea of the æra system of reckoning years may have been a darling project with Pollio. And Virgil may have been complimenting him upon its approaching fulfilment in that mysterious Fourth Eclogue, on the true object of which there have been such various conjectures. There are some expressions in it scarcely reconcileable with any other idea than that of the opening of a new leaf in time-keeping:—

“Magnus ab integro sæclorum nascitur ordo.”

Then the beginning of the æra account coincides with the very year of, or after, Pollio's consulship.

— “Decus hoc ævi, *te consule inibit*
Pollio ; et incipient magni procedere menses.”

These “magni menses,” and “magnus ordo,” have been supposed to refer to the great Platonic year ; but wherefore not to the solar year, as distinguished from the lunar ? Virgil says, just before, “Jam regnat Apollo ;” meaning that the year, in the new system, would be wholly governed by the sun ; and Macrobius says :—

“Vergilius, annum, qui circumcursu solis efficitur, significare volens, ait—

‘Interea *magnum* sol circumvolvitur *annum*,’

magnum vocans solis comparatione lunaris.” (*In Somn. Scip.* lib. xi.)

By the “*vestigia sceleris nostri*,” to which Virgil alludes in the next line of his eclogue, he must doubtless mean the remains of that blundering habit of reckoning which Mr. De Morgan wants to perpetuate, but which had been already partly cleared away by the exertions of Julius Cæsar. “Under thy guidance,” he exclaims to Pollio—

“‘Te duce, si qua manent sceleris vestigia nostri,’
Irrita, solvent —.”

But let the founder of the Spanish account be who he may, it is a possible supposition that the practical example of the misinterpretation caused by the anti-zero usage of reckoning in the observance of Cæsar’s bissextile, may have led to the establishment of an experimental system in Spain, where it would perhaps be less exposed to opposition than if encountering the veteran prejudices of Rome.

The title *æra* becomes in that case intelligible as a word identified with the arithmetical summation of parts conferred upon that particular account, to denote that each year must, before being noted, have its minor parts fully made up and completed.

The sum of minor parts thus rendered complete became an *æra* or item in the general account, and was noted off accordingly.

Thus, *æra* became synonymous with *annus*, was independent of that word, and had its numerals agreeing in gender with itself, as appears in the following record, "Anno trabeationis D.N.J.C. millesimo XVII. Era millesima quinquagesima quinta, Indictione XV.," &c.

The Spanish account continued in use for nearly fifteen centuries, and always retained an exclusive right to the title *æra*; as may be proved by that word, when used as a date, being always found alone and unaccompanied, as though it possessed an acknowledged and recognised meaning, *per se*, and required no other designation of the account referred to.

If the suggested origin here assigned to *æra* be admitted it becomes an additional argument in favour of the adoption of its principle, together with its name, in the Christian account. But if it be not admitted, the other arguments which have been advanced in support of a zero year are by no means invalidated thereby.

These arguments shall be here briefly recapitulated.

- 1st. That there have long existed in certain branches of chronology considerable doubt, misconception, and error; arising from efforts on the one side to establish, on the other to prevent, the acknowledgment of the zero principle.
- 2nd. That, consequently, it is open to the present age to sanction whichever side of the question may appear the more reasonable and useful.
- 3rd. That should the decision be in favour of a zero year it might be introduced almost tacitly, without disturbance of existing dates; nor would it have any difficulties to contend against more formidable than prejudice and habit.
- 4th. That the allegation, that it would be opposed to

ancient usage and precedent is untrue ; because, in the horary system, there is at least one good, ancient, and complete precedent in its favour, which has always existed without change or variation ; and because the Marcellian method of reckoning years of consulates was a close and *contemporaneous* example for a similar method in the Christian æra.

- 5th. That those precedents adduced against it are often, when strictly and properly interpreted, indirectly in favour of the same practice to which the zero year would tend.
 - 6th. That so much simplicity of idea and facility of practice attend upon the principle of making the real simultaneous with the numerical and apparent change in centuries ; that is, of changing to a new century when the notation changes from ninety-nine to one hundred ; that the few events in history, from which the practice of the ancients in such matters may be gathered, all concur in showing that it was in accordance with that principle.
 - 7th. That, although such a practice was most certainly erroneous, so long as the anti-zero method of commencing the account was persisted in, it becomes on the contrary correct and necessary on the true principle of a zero year.
 - 8th. That the zero year, if adopted, would greatly tend to the harmony and symmetrical arrangement of the leap-year series, by enabling leap years before as well as after Christ to be evenly divisible by four.
- And, Lastly. That the insertion of a zero year would *restore* the commencement of the æra of Dionysius to that of his paschal cycle, the existing difference between them being of itself sufficient evidence that a departure from the original design of the founder has somewhere occurred.

These arguments are all, for the most part, of a defensive

character. The advocates of a zero year are not, in general, of that class who are intolerant of opinions opposed to their own. They are contented if they can defend themselves from the assaults of prejudice and misrepresentation, by showing that they have grounds for their opinions as good if not better than those opposed to them. But there is one argument exclusively their own, which having nothing to do with precedent and being independent of usage, must necessarily be tendered in the shape of a simple proposition, viz., "A zero year would simplify the practice and conduce to the convenience of Chronology." The best demonstration such a proposition is capable of, is the unconscious practical adoption of a zero year, even by those avowedly opposed to it in principle—a circumstance explicable on no other supposition than that of its affording superior convenience and facility.

To proceed then to the proof.—Scarcely any one practical work upon chronology can be produced, wherein mistakes and inconsistencies may not be detected, arising from the contention continually existing between precept and convenience.

Chronological writers all repudiate the zero principle, but there are very few of them who have not unwittingly acted upon it so soon as they had ceased precept and commenced practice. They all inculcate the precept of placing 1 A.D. in immediate succession to 1 B.C.; but they are all beguiled by convenience into a practice at variance with that principle.

A great test of this occurs in the estimation of an interval extending through years before and after Christ; that is, an interval commencing *before* and terminating *after* the epoch. Here the anti-zero principle almost invariably breaks down.

Convenience holds out the temptation of the simple addition of years before to years after the epoch, but precept forbids; because it is clear that such a process must

necessarily admit the idea of a zero year. If 2 B.C. be added to 2 A.D., the resulting interval of four years is one too many, if 1 A.D. immediately follow 1 B.C.

So well aware is Sir John Herschel of the general tendency to this error that he especially cautions his readers against it.

"The sum of nominal years must be *diminished* by one. Thus, from January 1st, B.C. 713, to January 1st, 1582, the years elapsed are *not* ~~2~~295, but ~~2~~294." (*Outlines of Astronomy*. Art. 916.)

It is, nevertheless, easy to adduce examples of eminent chronological writers whose neglect of this rule in practice well illustrates the folly of persisting in adherence to a principle so manifestly inconvenient, that the very writers engaged in upholding it forget its observance before the end of their own treatises.

To begin with Petavius, who may be styled one of the fathers in Chronology, it will be proper to show, first, that he was opposed to the zero in principle before proving that he admitted it in practice. In his *Rationar. Temp.* lib. 1, cap. xi., he gives the following "exemplum":—

Julius Cæsar occisus est, An. Per. Jul.	.	.	4670
deductis annis	.	.	3960
relinquitur	.	.	A.V.C. 710
<hr/>			
Annus primus Æræ Christianæ	.	.	4714
deductis annis	.	.	3960
relinquitur	.	.	A.V.C. 754
<hr/>			

Hence, the interval between these dates is forty-four years: that is, from the ides of March, when Cæsar was slain, to the ides of March, A.D. 1; the interval was, according to Petavius, forty-four years.

In continuation of the same paragraph he says:—
 “Rursus, si de annis 753 subducas 710, et *unitatem adjicias*; residuus erit annus 44 ante natalem Christi, in quem annus 710 Varronis incurrit.”

Hence, Petavius places Cæsar’s death in B.C. 44; but if B.C. 44 be added to A.D. 1, the resulting interval is forty-five years, or one more than the former interval. Therefore Petavius did not acknowledge the zero year, but placed B.C. 1, A.D. 1, in immediate succession; indeed his expression “*et unitatem adjicias*,” is the very essence and embodying of the anti-zero principle, being in fact the converse of Sir John Herschel’s precept, that “the sum of nominal years must be diminished by 1.”

Let us now turn to the *practice* of Petavius *when off his guard*. In the most conspicuous situation in his book, emblazoned as it were upon the title page, is an exordium or declaration of the result of his investigation; it is entitled;—

“Summa Temporum ab Orbis initio ad ætatem
 nostram.”

“Annus ab rerum primordio ad eum qui Christi putatur 1633, numeramus 5116.” Which he makes out in the following way:—

“Fiunt ab orbe condito ad natalem Christi anni 3983, ad quos additi 1633, summam explent annorum a mundi conditu 5616.”

Here le Pere Petau, beguiled by convenience, forgets to *deduct* in this instance the same “*unitas*,” the addition of which he so carefully prescribes in the former example.

The mistake is the more signal, inasmuch as Petavius everywhere throughout his work refers his epochs to their places in the Grand Julian Period.

Hence he refers the year 1 of the World to the 731st of the Jul. Per. (“Igitur annus Periodi Julianæ 731, primus

est mundi in nostra chronologia," and the year ~~1483~~, he refers, in like manner, to A. P. J. ~~6446~~. Between these two Julian years the obvious interval, 5615, would have saved him from the error of his title-page, had not precept been completely hoodwinked by convenience.

1633
6346

Coming down more nearly to our own time, we find Doctor Vince falling into the same mistake at p. 5, vol. iii. of his *Astronomy*. But instead of citing the example itself, it will be, perhaps, more illustrative to quote the following note respecting it from Mr. Francis Bailey, the late highly esteemed president of the Astronomical Society. It may be found at foot of page 220 of the volume of *Philosophical Transactions* for 1811.

"It is to be regretted that Mr. Vince did not adapt his tables to the English tables of chronology. For the years before Christ, according to the English mode of computation, exceed by unity the corresponding years given by the French chronologists, since they make the year of Christ equal to 0, whereas the English reckon it as 1 B.C. Without a proper attention to this circumstance, we may be led into an error of one whole year in the calculation of the places of the heavenly bodies, for any period prior to the Christian æra."

It does not appear upon what authority Mr. Bailey made the foregoing statement, that French chronologists "make the year of Christ equal to 0." Petavius was a French chronologist, and yet it has been shewn that he was an *anti-zeroist*; so also was Pagi; and so also were the authors of "*L'Art de Vérifier les Dates*," the textbook of French as well as English chronologists. It is much more probable that in both countries the mistake arose from the difficulty of always recollecting an inconvenient precept; and in the case of Dr. Vince it is quite certain that he was previously well disposed for it, since examples of a similar mistake may be found in the first

volume of his Astronomy, published fifteen years before.— (Vide chap. V. art. 144; chap. XII. art. 239.)

Amongst chronological compilers of smaller note similar examples of the neglect of Sir John Herschel's caution, that 1 must be deducted from the sum of the extremes, might be multiplied to almost any extent. Thus, in Major Bell's tables, dedicated to her present Majesty, the heading of the fourth chart is announced in large type,— "From B.C. 30, to A.D. 476, *a period of 506 years.*"

In a still later publication, "The Oxford Tables," the mistake is presented under another phase:—the following are made parallel dates, "B.C. 200 to A.D. 476, *Julian period 4514 to 5190.*" Here the difference of the two Julian dates is the interval 676; and that will be found to be produced by the addition of the extremes in the dates of the Christian account.

Even Playfair, the great English standard, may be similarly caught *napping at intervals*, as may be observed in those "Tabular Charts" with which his work concludes. In one he makes "from B.C. 500 to A.D. 100" represent an interval of 600 years.

But a far more signal and deliberate mistake was fallen into by Playfair, and one that very remarkably commits him in an unconscious admission of the principle of the zero year. At page 318 of his folio work are two parallel tables, entitled:—

"No. 1, shewing the dominical letter for 4200 years B.C."

"No. 2, shewing the dominical letter for 4200 years A.C."

In the first of these tables double dominical letters are affixed to the years 4, 8, 12, 16, &c., marking them as leap years before Christ. In the second table the same nominal years are in the same way marked as leap years after Christ. This would be possible only upon the supposition of an intervening zero year, as has been already explained in these remarks, at page 45.

Perhaps the most recent instance of involuntary homage to the zero principle is afforded by Dr. Schmitz, in his method of reducing the Greek Olympiads to the Christian æra.—(Vide *Smith's Dictionary of Greek and Roman Antiquities*, article "*Chronologia*.") This will readily appear if his process be used to find the year of Christ corresponding to the 195th Olympiad. Dr. Schmitz says it must be obtained by multiplying 194 by 4, and deducting the product from 776! The resulting year is unquestionably the year 0!

These instances are too numerous and *too various* to be the result of chance; they must have proceeded from a natural proneness to one mode of practice, when not restrained by immediate care or design. It must therefore be admitted that these examples, collectively, afford a very strong demonstration of the convenience and practical facility of the zero principle.

It will fitly conclude this "Examination of the Century Question," to exhibit at one view the relative situations of the years of the Christian æra under the zero arrangement, as advocated therein, and under the common arrangement.

It is proposed—

That the 1st of January, in the year of Rome 753, shall be accounted the Christian epoch.

That the twelve months from the 1st January, 752, to the epoch, shall be accounted as B.C. 1.

That the twelve months from the epoch to the 1st of January, 754, shall be accounted as A.D. 0.

That the twelve months from the 1st of January, 754, to the 1st of January, 755, shall be accounted as A.D. 1, *as at present*.

That B.C. 4, A.D. 0, and A.D. 4, &c., shall be accounted as leap years.

Therefore, the comparison in the disposition of the years of the Christian account will be as follows :—

Year of Rome.	Common Arrangement.	Zero Arrangement.
		—Epoch.
753	B.C. 1 —Epoch	A.D. 0
754	A.D. 1	„ 1
755	„ 2	„ 2
756	„ 3	„ 3
757	„ 4	„ 4
758	„ 5	„ 5
759	„ 6	„ 6
760	„ 7	„ 7
761	„ 8	„ 8
762	„ 9	„ 9
	—	—
	9 { years from Epoch.	10 { years from Epoch.
	—	—

In the zero system the first decade expires with 31st December, A.D. 9. The first century with 31st December, A.D. 99. And the 18th century with 31st December, A.D. 1799.

POSTSCRIPT.

A question is frequently asked, in triumph, by those opposed to the zero arrangement ; viz.—

“Is it not extremely inconsistent in those who advocate the principle of deferring the numbering of the year until it has fully run out, to transgress their own rule by anticipating the numbering of the century in calling 1701 the *eighteenth* century?”

The answer is this. When the 18th century is spoken of, it is a name of identification ; but when it forms *part of the account*, it strictly follows the zero rule : for example, to say 1701, is the same thing as to say seventeen centuries and one year.

It is also asked, why the advocates of the zero should not assert its adoption in the days of the month as well as in the years of the æra ; since, if desirable in the one, it must be equally so in the other.

The answer is—that, in the æra, the practice of the past, and even of the present age, is doubtful and still open to inquiry ; while, in the case of monthly notation, no doubt whatever exists as to what was, and is, the practice.

And if this fact may not, in itself, seem a sufficient excuse for continuance in error, other good and strong reasons for acquiescence exist—some of which are these :—

Firstly.—Because any attempt to alter, *by mere persuasion*, a custom so firmly ingrafted upon our everyday habits as monthly notation, would be vain and absurd.

Secondly.—Because monthly notation, being ephemeral, is, in itself, of less actual importance than annual notation, which is enduring.

Thirdly, and above all.—Because other, and more objectionable defects exist in monthly notation, such as the anomalous and irregular distribution of days,

which would render any attempt at improvement, short of absolute reorganization, useless and abortive.

If the year were divided into months of equal days, with five (or six) odd days, or "terminalia," at the end; and if the bissextile day, instead of being in the midst, were the very last day in leap year, it might then be worth while to assert the still further improvement of a zero commencement in every month.

Such a disposition of the months was practised by the early Coptic Christians, whose calendar was infinitely more rational and more consonant with common sense than that retained by the present enlightened age.

It is greatly to be regretted that the change of style was not seized upon as a favourable occasion for adopting such a calendar in Europe. It is a singular fact, that had Gregory XIII. made a reformation of the months, the *prominent feature* of his emendation, the change of style might have been effected in a manner far more gentle and less arbitrary than it was. The Christian world might have been cheated into correctness without that violent dislocation of its time-honoured festival, which excited so much opposition then, and which, perhaps even to this day, stands in the way of the universal reception of the Gregorian correction.

Had Gregory ordained that the next following Christmas-day should be accounted the first day of January, and that all succeeding first days of January should be observed as anniversaries of Christ—the displacement would have appeared to be, not in the Christian festival, but in the Pagan nomenclature.

Thus seven days, out of the ten required, would have been easily and *quietly* obtained; and, more than all, the absurd anomaly, still existing between the anniversary of Christ and the epoch founded upon it, would have been done away with.

Nor are these the only advantages that would have resulted;—such a mode of getting rid of seven days would have preserved undisturbed the previous disposition of the dominical letters (seven days being a complete week): and the necessity for a double dominical letter in leap years would also have been obviated by removal of the bissextile day to the end of those years.

The reduction of the remaining three required days might, with equal quietness, have been effected by an exact imitation of the expedient of Augustus; that is, by reckoning as common years the three next following leap years.

This was the golden opportunity, which may never again occur!—

Every month should have had an allotment of thirty days; with the exception of December, which should have had thirty-five or thirty-six. And if to this disposition the further refinement of the zero arrangement had been added, the first day in January would have been called Christmas-day, or New Year day, or January-day. January 1 would have been the second day in that month, and January 29 the last.

Thus, the first day in each month would have become known by the title of the month itself; of which we have already familiar examples in "April-day" and "May-day."

But this scheme of months is now utopian. We must be content with defending so much of the zero system as we do possess; that is, the notation of hours, and the notation of the æra!

THE HISTORY OF THE
CITY OF BOSTON
FROM THE FIRST SETTLEMENT
TO THE PRESENT TIME
IN TWO VOLUMES
BY NATHANIEL BENTLEY
OF THE BARR

THE FIRST VOLUME
CONTAINING THE HISTORY
FROM THE FIRST SETTLEMENT
TO THE YEAR 1780
IN TWO VOLUMES
BY NATHANIEL BENTLEY
OF THE BARR

THE SECOND VOLUME
CONTAINING THE HISTORY
FROM THE YEAR 1780
TO THE PRESENT TIME
IN TWO VOLUMES
BY NATHANIEL BENTLEY
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THE HISTORY OF THE
CITY OF BOSTON
FROM THE FIRST SETTLEMENT
TO THE PRESENT TIME
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A LETTER
TO
SIR J. F. W. HERSCHEL, BART.,
RESPECTING
A CERTAIN PECULIARITY OF THE GREGORIAN SYSTEM
OF BISSEXTILE COMPENSATION.

SIR,—Some years since, after the publication of the first edition of your admirable “Treatise on Astronomy,” I had occasion to write a short defence of the Gregorian emendation of the calendar, in the course of which I had the advantage of quoting your commendation of that system as “of remarkable simplicity and neatness.”

In describing its properties I explained that its peculiar spirit consisted in *reciprocating the corrections* by the alternate addition and subtraction of a day: or, in other words, that the signs + and — were essentially alternate in the several corrections. Furthermore, I observed that this peculiar necessity of the system had been apparently overlooked by you in your *then* recently published work, wherein 4000 was suggested as the next step after 400 years, where the rules at present terminate; insomuch that such an arrangement, by deferring the correction until the accumulated error *had exceeded unity*, would interrupt the necessary change of sign, and consequently violate the spirit of the system.

A second and enlarged edition of your work has lately been published, under the title of "Outlines of Astronomy," and, in it, I observe that the same suggestion of 4000 years, as the fourth stage of correction, is repeated.

I therefore take the liberty of making known to you my slight criticism upon a point which, as compared with the more abstruse and important portions of your work, is, indeed, but as the latchet of the sandal; nevertheless, that very circumstance may save me, a mere chronologist, from the imputation of venturing in this instance "*ultra crepidam*."

There are two fundamental laws essential in the Gregorian system:—

1st.—No two corrections can be applied *successively in the same direction* (or with the same sign of plus or minus), since the effect of so doing would be to increase the year to 367 days, or to diminish it to 364.

2nd.—Therefore, the corrections must in all cases be applied before the accumulating fraction of error *shall exceed unity* (or an entire day), since otherwise a transgression of the first law is unavoidable.

It may be necessary to explain that the *corrections* here spoken of are those rendered necessary by imperfection in the previous correction.

PRELIMINARY NOTES.

A year of 366 days may be termed a *plus year*, being in excess of the true value.

A year of 365 days may be termed a *minus year* for the converse reason.

A plus correction changes the latter into the former;

A minus correction the former into the latter.

The first correction instituted by Julius Cæsar was a plus correction; but that being found to be imperfect, a minus correction, once in 100 years, was ordained by Gregory, forming the second stage of correction; to which he again added a plus correction once in 400 years, forming the third stage.

The fourth stage is proposed by you as 4000 years. But this would be deferring the correction too long, because it would lead to an infraction of the laws already laid down, as may be made to appear thus:—

Value of tropical year in days	365·24224
Common year	365
<hr/>	
Accumulating fraction	0·24224
First period	4
<hr/>	
Error	+ 0·96896
Correction	+ 1
<hr/>	
Accumulating fraction	— 0·03104
Second period (in items of the first)	25
<hr/>	
Error	— 0·776
Correction	— 1
<hr/>	
Accumulating fraction	+ 0·224
Third period (in items of the second)	4
<hr/>	
Error	+ 0·896
Correction	+ 1
<hr/>	
Accumulating fraction	— 0·104

Hence, after the third correction, there remains an accumulating minus fraction of -0.104 in every stage of 400 years. But 4000 years comprise ten such stages, and if the fraction 0.104 be multiplied by 10 it would *exceed unity*. Therefore, 3200 years, or eight of the previous periods, are as many as can safely be taken for the fourth stage of correction, which would then proceed as follows:—

Accumulating fraction . . .	— 0.104
Fourth period (in items of the third) . . .	8
<hr/>	
Error	— 0.832
Correction	— 1.
<hr/>	
	+ 0.168
Fifth period (in items of the fourth) . . .	5
<hr/>	
Et cetera.	

The result here noticed might not, it is true, ever arrive at a practical issue; but every system ought to be, if possible, *theoretically as well as practically correct*. Besides, the ordinary tables in Books of Common Prayer are of sufficient extent to comprise two periods *in the fourth stage*, although in them it is entirely neglected.

Furthermore, if Bessel's reduced value of the tropical year be at present the received one, the error of a 4000 year stage becomes even more apparent; while, on the other hand, it happens singularly enough that with the steps of correction herein proposed, Bessel's fraction resolves itself into unity, or performs a complete cycle, in the sixth stage; viz.—

Bessel's tropical year . 365·2422175

Common year . . . 365·

Accumulating fract. 0·2422175

First period . . . 4 years.

Error . . + 0·96887

Correction . + 1·

— 0·03113

Second period . . . 25 = 100 years.

Error . . — 0·77825

Correction . — 1·

+ 0·22175

Third period . . . 4 = 400 years.

Error . . + 0·887

Correction . + 1·

— 0·113

Fourth period . . . 8 = 3200 years.

Error . . — 0·904

Correction . — 1·

+ 0·096

Fifth period . . . 10 = 32,000 years.

Error . . + 0·960

Correction . + 1·

— 0·04

Sixth period . . . 25 = 800,000 years.

Error . . — 1·

Correction . — 1·

Thus the system may be epitomized in the following table, wherein the reciprocating nature of the corrective sign is apparent:—

All years of the Christian æra are, —
Except
Even multiples of 4, which are, +
Except
Even multiples of 100, which are, —
Except
Even multiples of 400, which are, +
Except
Even multiples of 3200, which are, —
Except, &c.

I am, Sir,

*With profound respect for your distinguished position
as the first philosopher of the age,*

THE AUTHOR OF THIS BOOK.

