Hints to the decipherer of The greatest work of Sir Francis Bacon, Baron of Verulam, Viscount St. Alban.

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"the Greatest Work of Sir
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Riverbank Laboratories
Geneva, Illinois

FROM AMONG THE BOOKS
1867 OF 1930
Dr. ERNEST LEWIS McEWEN

Hints to the Decipherer

OF

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Riverbank Laboratories
Geneva, Illinois

c 1916 ɔ

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GEORGE FABYAN

HINTS TO THE DECIPHERER OF THE GREATEST WORK
OF SIR FRANCIS BACON

The purpose of the following pages is to show as clearly as may be the method to be pursued by the student in deciphering or translating the Biliteral Cipher. The first requisite is good eyes; the second, a careful and observant attitude of mind; the third, much devoted patience. (A good reading-glass, preferably oblong in shape, is a highly useful, indeed an almost indispensable mechanical adjunct.)

The first step to be taken is to acquire familiarity with Bacon's description of the Biliteral Cipher as first explained by him in the 1623 edition of his *De Augmentis Scientiarum*, translated by Gilbert Wats in 1640 and by James Spedding in 1857; for his explanation there set forth and illustrated is the one and only basis of all use of the Biliteral Cipher, as that term is here employed. No departure from the directions he there gave is recognized or implied; nor is any essential idea or even explanation added to what he there set down. It is true that after about 1616 extra devices and complicating touches seem occasionally to have been introduced, as though to baffle the too confident decipherer and thus to make the cipher still more safely obscure; for in the *De Augmentis* Bacon specified, just before explaining the Biliteral Cipher, that two of the three "virtues required" in ciphers were "that they be safe, and impossible to be deciphered; and . . . . that they be, if possible, such as not to raise suspicion."[1]

To simplify the approach to the subject, we may divide the explanation of the cipher into two parts. We shall describe first the two-letter code, or "biliteral alphabet," as Bacon calls it; and then add the supplementary explanation of how he resorted to the use of letters of two forms of type, closely resembling each other yet differing in minute though distinct particulars, for the purpose of "infolding" and serving as a vehicle for this two-letter code.

[1] Spedding's translation (ed. 1857), Vol. IV, p. 444.

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First, then, the "biliteral alphabet." Bacon's words of explanation are these:

First let all the letters of the alphabet be resolved into transpositions of two letters only. For the transposition of two letters through five places will yield thirty-two differences; much more twenty-four, which is the number of letters in our alphabet [since *i* and *j*, and *u* and *v* were then interchangeable].

That is, any two letters (or other symbols, such as circles and squares), if arranged in groups of five, can be combined in thirty-two different ways; of which the first twenty-four, we may say, can be taken to represent respectively the twenty-four letters of the Elizabethan alphabet. This "resolving" of "the letters of the alphabet" "into transpositions of two letters only" he then makes in specific form, and produces this "example of such an alphabet":

<div align="center">

EXAMPLE OF AN ALPHABET IN TWO LETTERS

A	B	C	D	E	F	G
aaaaa	aaaab	aaaba	aaabb	aabaa	aabab	aabba
H	**I**	**K**	**L**	**M**	**N**	**O**
aabbb	abaaa	abaab	ababa	ababb	abbaa	abbab
P	**Q**	**R**	**S**	**T**	**U**	**W**
abbba	abbbb	baaaa	baaab	baaba	baabb	babaa
X	**Y**	**Z**				
babab	babba	babbb				

</div>

This, then, is the two-letter code by which each group of five letters (or other symbols of two kinds) can be used to represent one letter of a cipher message. This code is first to be thoroughly learned by the decipherer; and the best memorizing method is to arrange the groups vertically, so as to show their relative likenesses and differences:

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[1] Spedding, p. 445.

A = aaa aa
B = aaa ab
C = aaa ba
D = aaa bb

E = aab aa
F = aab ab
G = aab ba
H = aab bb

I, J = aba aa
K = aba ab
L = aba ba
M = aba bb

N = abb aa
O = abb ab
P = abb ba
Q = abb bb

R = baa aa
S = baa ab
T = baa ba
U, V = baa bb

W = bab aa
X = bab ab
Y = bab ba
Z = bab bb

This "methodized" arrangement makes memorizing easy, because it shows systematic likenesses in several directions. First, each group of fours, as spaced horizontally, is alike in the first three letters of each five. Next, the final pair in the *A, B, C, D* quartette are in the same combination in every other quartette—merely repeated each time:

aa
ab
ba
bb

And again, if we read down the vertical columns, beginning at the *right*, we get the *a, b* combination successively to the bottom; in the next column, *two a*'s alternating with *two b*'s; next, *four a*'s and *four b*'s; then eight *a*'s and eight *b*'s; and last, sixteen *a*'s and sixteen *b*'s, but stopping, of course, with twenty-four.

Now it seems clear that this code, if used as it stands, would not only be cumbersome but also seriously obvious; for since a useful cipher must "be, if possible, such as not to raise suspicion," this cipher could not possibly avoid suspicion, since it is meaningless except as capable of carrying a *hidden* message. And, more seriously still, it would not be difficult to solve or discover, even without a key, by determining, say, first the *e*'s, then the *t*'s, and so on, on the basis of the ratio of alphabetical frequency of occurrence.

Therefore, doubtless, Bacon superposed upon this two-letter code the further complication of a "bi-formed alphabet," in which every letter has two distinguishable forms—"any forms," says he, "that you find convenient."[1] By such means, then, the *a-b*, or two-letter code will drop quite out of sight, and thus remove the disadvantage of suspicion and obviousness, since the external or "infolding" matter will have a complete sense of its own and seem entirely honest and innocent—or even partisan in the opposite direction; and the risk of decipherment will be almost nil, with the *a-b* code known only to the correspondents and not even suspected by the casual reader. That the substance and meaning of the "external" message may be anything, quite regardless of the inner message—in a different language, indeed—is helpfully illustrated by Bacon, when he makes the external message "Do not go till I come" spell in cipher the message "Fly."[1]

This brings us, then, to our last step: the way of combining the two-letter or biliteral code and the "bi-formed" alphabet—of using the *biliteral code within the bi-formed alphabet* in the practice of the Biliteral Cipher. The method is this: one of the two forms of each letter is arbitrarily called the "*a*-form," and the other the "*b*-form"; and these—regardless of what the letter may be, or the word—are used in such *a-b* combinations as to spell in the two-letter code the concealed message desired. So, in "Do not go till I come,"[1] the first two letters are printed in the "*a*-form," the third in the "*b*-form," the fourth in the "*a*-form," the fifth in the "*b*-form" of the type used—reading *aabab*—which in the two-letter code stands for *F;* the next five letters distinguished thus according to form spell the group *ababa*, standing in the code for *L;* and the next five, *babba*, standing for *Y*. This may as easily be written in Latin: *Manere te volo*

[1]Spedding, p. 446.

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Ego omni officio, ac potiùs pietate erga te .
caeteris satisfacio omnibus : Mihi ipsenun=
guàm satisfacio . Tanta est enim magni=
tudo tuorum erga me meritorum, vt quoni=
am tu, nisi perfectâ re, de me non conquiês=
ti; ego, guia non idem in tuâ causâ efficio,
vitam mihi esse acerbam putem . In cau=
sâ haec sunt : Ammonius Regis Legatus
apertè pecuniâ nos oppugnat . Res agitur
per eosdem creditores, per quos, cùm tu ade=
ras, agebatur . Regis causâ, si qui sunt,
gui belint, gui pauci sunt, omnes ad Pompe=
ium rem deferri volunt . Senatus Reli=
gionis calumniam, non religione, sed ma=
leuolentia, et illius Regiae Largitionis
inuidia comprobat . &c .

FIGURE 1

From *The Advancement of Learning*, translated by Gilbert Wats 1640 p. 269.

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donec venero, and be so printed (or written) as to spell the hidden Latin message *Fuge*—or its English equivalent "Fly." This flexibility is what Bacon means by "the writing of anything by anything"[1]—*omnia per omnia*.[2]

To illustrate his complete device more extensively, Bacon adds a longer example, in which he uses a 97-word extract from what he terms Cicero's first epistle as the "external" message, and conceals within it the word message sent, by means of a Scytale or round-ciphered staff, and commonly known as the Spartan message. This specimen of the Biliteral Cipher is shown in the earlier editions of the *De Augmentis* (1623, Latin; and 1640, Gilbert Wats' English translation) in script letters of *a*- and *b*-forms (Fig. 1); but in Spedding's translation (the 1857 edition) the whole is shown with equal clearness in type, by the simple expedient of using "modern" italic type for the *a*-form letters and "old-style" italic for the *b*-form (Fig. 2).

In all duty or rather piety towards you I satisfy every body except myself. Myself I never satisfy. For so great are the services which you have rendered me, that seeing you did not rest in your endeavours on my behalf till the thing was done, I feel as if life had lost all its sweetness, because I cannot do as much in this cause of yours. The occasions are these: Ammonius the King's ambassador openly besieges us with money: the business is carried on through the same creditors who were employed in it when you were here, &c.

FIGURE 2
From *The Advancement of Learning*, translated by James Spedding, 1857, p. 447.

It happens, however, that the Biliteral Cipher is most commonly found in italic type; and the italic letters of the Elizabethan and Jacobean times were strikingly like such bi-formed alphabets in script as that shown in Fig. 3, designed by the Spaniard, Francisco Lucas, and published in 1577, as well as that in Fig. 4, reproduced from the Wats translation of *De Augmentis* with its *a*-forms and *b*-forms indicated. In fact, italic type was

[1] See Spedding, as above, p. 446.
[2] Gilbert Wats translation, p. 268.

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Aaabbccddeeffgghhiijllmmnnoop
pqqrrſſßſſſtssſtvvvuuxxyyzzz.ſp:
AABB CCDDEEFF G
GH HISLLKMMN:
NOOPP2QRR SS:
TTVXXYYZZ &&
Letra del Grifo que eſcreuia Franⁿ, Lucas En-
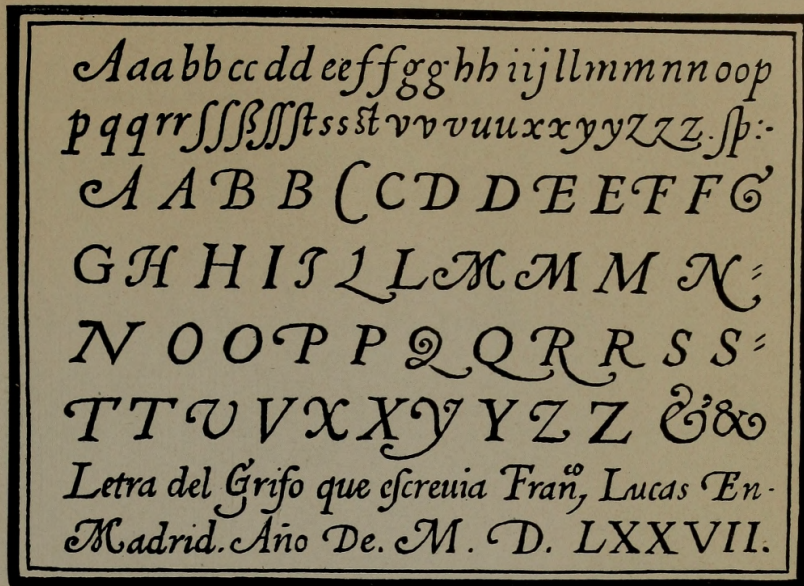Madrid. Año De. M. D. LXXVII.

FIGURE 3
[Strange's Alphabet, *Italics*, by Lucas.]

but these script forms cast in type. Therefore the apprentice decipherer can hardly do better than first to study the fine yet deliberate differences in these script forms, by way of preparation for distinguishing the later italic type forms.

He will see at once that the two forms of the capitals are generally very unlike, but that the two forms of the small letters (lower case) are more subtly and delicately distinguished: as in the sharper, more angular *b*-forms of *i*, *m*, *n*, *u*, *v*, and *w*. Such differences as show in these letters in the little "seriph strokes" where the pen leaves the letter (e. g., *i*, *m*, *n*) will be specially useful in training the eye to distinguish between the two forms of the italic type letters. In general, the following distinctions hold true:

1. The *a*-form letters are larger, rounder, more upright, and more robust than those of the *b*-forms.

2. In the *a*-form *c*'s and *e*'s the up-stroke from the bottom curves in as though to meet the top-stroke; the *b*-form stroke points out.

3. Letters with two or more limbs are squarer, more upright, less angular or sharp in the *a*-forms than in the *b*-forms.

4. Of the long-tailed letters, the *b*-form usually slopes more and has longer flourishes.

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An Example of a Bi-formed Alphabet.

a. b. a.b. a. b. a. b. a b.a.b. a. b. a. b.
A A a.a. B. B b.b. C. C c.c. D. D. d. d.

a b. a.b. a. b. a.b. a. b. a.b. a. b.a.b.
E. E.e.e. F. F f.f. G. G. g.g. H. H.h.h.

a. b.a.b. a. b. a.b. a.b. a.b. a. b.a.b.
I. J. i.i. K. K k.k. L L. l. L. M. M. m. m.

a. b. a.b. a. b.a.b. a. b.a.b. a. b. a.b. a.
N. N.n.n. O. O.o.o. P.P. p.p. Q. Q. g.g. R.

b. a.b.a.b. a.b. a. b.a.b. a. b.a.b. a.b.
R.r.r. S. S. s.s. T. T. t.t. V. V. v.v. u. u.

a. b. a. b. a. b. a. b. a. b. a.b. a.b. a.b.
W. W. w. w. X. X. x.x. Y. Y. y.y. Z. Z. z. z.

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5.   Circular letters, like *o* and *q*, are best judged by the slope or slant, which is likely to be greater in the *b*-form. The slope is of course determined by a line drawn so as to bisect the longest diameter of the letter.

If, for example, we take our Latin sentence, *Manere te volo donec venero*, and its message, *Fuge*, as they are reproduced from the 1640 edition
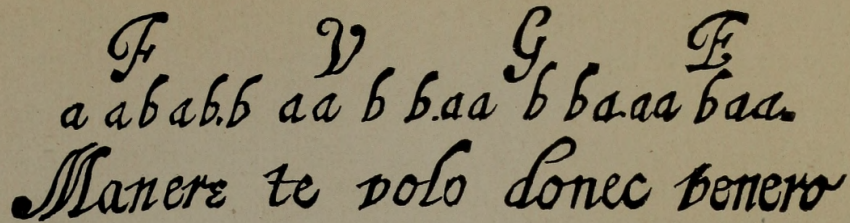

FIGURE 5

of Gilbert Wats (Fig. 5), and compare the letters of both forms here with those in Fig. 3, we should notice such differences as these:

Biformed Alphabet		Biliteral Alphabet	Result	
M	—Straight	a		
a	—Straight, round	a		
n	—Sloping, sharp	b	a a b a b = F	
e	—Straight, round	a		
r	—Sloping, sharp	b		
e	—Greek *ε*	b		
t & e	—Straight, round	a a	b a a b b = U	*Fuge* = "Fly"
v o	—Pointed, flourished	b b		
l o	—Upright, unflourished	a a		
d o	—Sloping, flourish, loop	b b	a a b b a = G	
n	—Upright, round	a		
e c	—Upright, round	a a		
v	—Sloping, sharp	b	a a b a a = E	
e n	—Straight, round	a a		
e r o	—All "nulls," too few to form a letter.			

In an earlier paragraph mention was made of the "slope" of the letters as a means of distinguishing between the forms. The decipherer soon learns that the shape of the letter is not always sufficient in itself to enable him to determine the form to which the letter belongs; nor is it always possible to judge a single letter apart from its neighbors. In the early efforts of Mrs. Elizabeth Wells Gallup, the pioneer student of this subject, it was sometimes necessary to pass over doubtful letters,

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leaving their assignment to either form to be accomplished later, by the assistance of the context. This plan, though legitimate, is, of course, unscientific, and too much open to adverse criticism to be satisfactory as anything more than a temporary expedient. It must be altogether eliminated from any permanent system of decipherment. There must be devised a method more incontestable which may be relied upon to carry us through the difficulties, and to explain the anomalies and apparent discrepancies as well.

It is believed that in the scientific use of the quadrant to measure the slope of the letters and their angles with the horizontal, a very near approach has been made to such a method. The principle is geometrical: "go by line and level," and "act upon the square."[1]

First, it should be remembered that roman type means letters that stand perpendicular to their base (Fig. 6), whereas italic letters are those that slope from the base-line toward the right (Fig. 7).
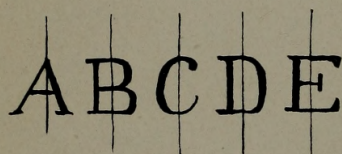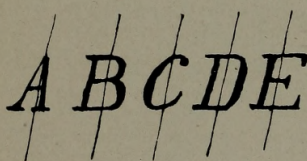
ABCDE

FIGURE 6

ABCDE

FIGURE 7

Naturally, then, italics of different fonts (or forms) are likely to show their difference chiefly in their slope—as can be seen by Fig. 7 where the *A* and *B* slope less than the *D* and *E*. Now, as a rule the *a*-form letters show an angle of about ten degrees between their chief upright lines and the perpendicular, while the *b*-forms show a slope of about fifteen degrees.

[1] The decipherer should equip himself with a small quadrant or projector, a fine 4-inch rule, or some cards cut to right angles.

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It happens, also, that in many of the old books the letters are very irregularly placed above the level of what seems to be the usual base line. In other words, they are, in the language of the printer, "out of alignment." Parts of a letter—as in the *n* and the *u* of Fig. 8—or an entire letter—as the third *i* and the second *l* of Fig. 8—are above the base line used by their neighbor letters.

Individuall

FIGURE 8

This matter of *level*, however, is but another application of the principle, just described, of *slope* from the perpendicular. For if a line be drawn from the true base line at such a slant as to touch the raised letter or the raised part of the letter, it will mark what might be called its false base; and a perpendicular then erected on this false base shows that the distinguishing difference is still one of slope. This can be seen clearly illustrated in Fig. 9.
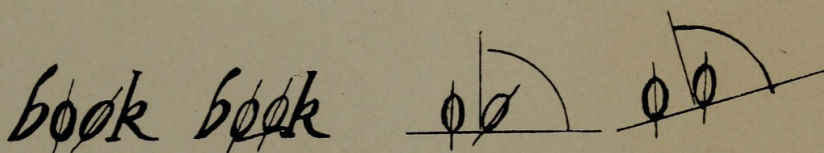
book book

FIGURE 9

In the first of the two words, "book," the two *o*'s, on the same base, are clearly of different slope. In the second of the two words, the slope seems to be the same; but the second *o* is higher than the first (i. e., out of alignment), and when the false base is drawn and its perpendicular erected, the second *o* is found to slope thirty-nine degrees, or twelve degrees more than the first *o*, whose slope is twenty-seven degrees. In letters like *m* and *n*, which have more than one limb or down-stroke, the *b*-form is often one with the last stroke shortened; in *i* the position of the dot may decide the slope; in letters having a "hole" or circle—such as *a*, *b*, *d*, *g*, *o*, *p*—a line drawn through this open space is often the best means of distinguishing the shape or slope, and hence, also, the "form." Tall letters, like *b*, *d*, *h*, *k*, *l*, may be classified by the slope and direction

of the seriphs or fine cross-strokes at the top; in *f* and *t* the cross-strokes perform the same useful office. Even in the capitals and in script the ruler and its invaluable substitute, the "Templet,"[1] will spare the decipherer much eye-strain and uncertainty. In Fig. 10, reproduced for the purpose of illustrating some of the differences just pointed out, the distinctions actually found have been exaggerated to show their form and nature.
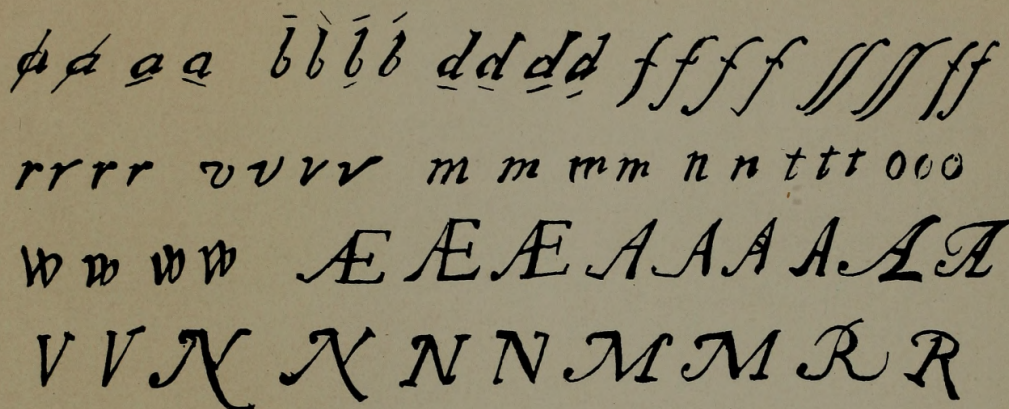

FIGURE 10

The only truly scientific and satisfactory method of studying the problem of deciphering the Biliteral Cipher is first, thoroughly to grasp the principles laid down by Bacon himself; then, when the early and simple books have been gone through, and the system has been thoroughly conquered up to that point, the student may begin to observe the anomalies, the discrepancies, and the stumbling-blocks cast in his way, and to perceive that the first simple instructions do not suffice for advanced work. He will observe strange marks introduced; fresh devices, apparently grafted on to the original stock. Such hints, signs, and landmarks are neither to be overlooked nor explained away; rather, by patient collation, and indefatigable note-taking, he must find out how to utilize these tiny pebbles dropped in the labyrinth as guides for him to follow.

[1] For an illustrated description of this device see "The Keys for Deciphering the Greatest Work of Sir Francis Bacon," etc., to be obtained from Riverbank Laboratories, Geneva, Illinois.

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NOTE:—It may seem disheartening to the student to find that now and then the alphabets are *reversed*, i. e., the *a*-form is used for the *b*-form and vice versa, perhaps only for a few words, or in a short passage, yet enough to put a beginner off the scent. Sometimes, too, more than one variety of the *a*-form or *b*-form may be introduced—as was done in the case of the capitals of a 1623 Paris edition of the *De Augmentis*. But these are but useful obstacles to train the decipherer to unfailing keenness in following the scent, and are accepted by the skilful worker as devices to make the cipher more effective because safer.

———————

We know that at least six kinds of cipher have to be found out. Of these, so much is known about four or five as to leave little doubt that the next generation will be able to unravel their long concealed secrets.

To beginners it must be said in conclusion that this entrancing work "drinks much time," and needs (besides keen eyes, and the kind of genius which Michelangelo defined as "endless patience") a free, open, and "nimble mind, apt to perceive analogies"—ready to take in a hint or a new idea, and capable of putting two and two together—a faculty most desirable for all who are engaged in Baconian research. If things turn up which cannot be accounted for, or which may uncomfortably disarrange preconceptions, it is not necessary to lose confidence in ascertained facts, or to begin to discredit the labors of those who have been more successful. Rather, let the difficulties be frankly faced, let previous shortcomings be acknowledged and rectified, and the sensible advice of old Polonius be followed:

> Now remains
> That we find out the Cause of this Effect,
> Or, rather say, the Cause of this Defect,
> For this Effect defective comes by Cause.

———————

The following booklets are recommended to the serious student of this subject, as affording valuable assistance in the work: "The Greatest Work of Sir Francis Bacon," and "The Keys for Deciphering the Greatest Work of Sir Francis Bacon," which may be obtained of Riverbank Laboratories, Geneva, Illinois.

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