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RECENT INSIGHTS INTO MESOPOTAMIAN ACCOUNTING OF THE 3RD MILLENNIUM B.C. — SUCCESSOR TO TOKEN ACCOUNTING

Abstract: This paper examines from an accounting perspective recent work by Nissen et al. [1993], here regarded as an extension of the archaeological research of Schmandt-Besserat [1977, 1992] and its analysis by Mattessich [1987, 1994]. The transition from the 4th millennium B.C. to the 3rd millennium B.C. featured the use of proto-cuneiform and cuneiform accounting techniques to replace the older token accounting. This research reinforces the previously made hypothesis [Mattessich, 1987] that the inserting of tokens into a clay container during the last phase of token accounting corresponded to debit entries, while the impressing of tokens on the surface of the container was meant to convey the credit total of an equity. Similarly, in proto-cuneiform bookkeeping, debit entries appear again on one side while the credit total appears on the reverse side, but this time on the clay tablets. Yet, the research also leads to the hypothesis that the "*closed* double-entry system" of token accounting could *not* be maintained in the archaic bookkeeping of the subsequent period where, apparently, a debit/credit scheme was used in which only some but not all entries had counter-entries. Finally, the paper illustrates important labor production aspects of archaic bookkeeping and cost accounting which are contrasted to modern budgeting and standard costing.

"The best way to know a thing, is in the context of another discipline" L. Bernstein [1976, p. 3].

Acknowledgments: Financial support from the Social Sciences and Humanities Research Council of Canada for this paper is gratefully acknowledged. Furthermore, I want to express gratitude for permission to reproduce the passages quoted and Figures 1 to 3 from Nissen, H. J., Damerow, Peter, and Englund, R. K. (1993), *Archaic Bookkeeping — Early Writing Techniques of Economic Administration in the Ancient Near East*, Paul Larsen (translator), courtesy Chicago University Press (copyright) as publisher. My thanks extend also to Professor Denise Schmandt-Besserat for reading the original manuscript and for valuable advice on the dating of archaeological periods. Final thanks for many suggestions go to the editorial team (including two reviewers and, above all, the editor) of the *Accounting Historians Journal*.

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Studying the early phases of accounting, we are not merely faced with the technological achievements of ancient people, but also experience their need for stewardship and control which they satisfied in relatively simple, yet ingenious ways. Schmandt-Besserat [1977, 1979, 1983, 1992] (hereafter SB) is the predominant researcher on prehistoric or "preliterate" token accounting, and Nissen et al. [1993] (NDE hereafter) can be regarded as an extension of this research for the "literate" period through 2000 B.C. This book has hardly attracted the attention of accounting historians and deserves to be examined.[1] Discussing the relation between "token accounting" and "archaic bookkeeping" may be a proper introduction. These two accounting systems, despite their fundamental differences, possess similarities that enable us to interpret archaic bookkeeping on the basis of my previous analysis of token accounting [Mattessich, 1987, 1994, 1995]. The literature on Mesopotamian accounting is fairly limited; the most prominent book, dealing in a relative comprehensive way with this subject, is probably Melis [1950, pp. 34-71, 111-284]. But the new archaeological evidence on administrative matters, subsequently accumulated, cries out for further expertise and analysis by academic accountants.

As to the differences between SB [1992] and NDE [1993], the latter was primarily concerned with proto-cuneiform and cuneiform accounting of the 3rd millennium B.C., while the former dealt with token accounting from 8000 B.C. to 3000 B.C. NDE [1993] did provide an overlapping section dealing with token accounting which, however, was only cursorily developed. Despite having cited two SB [1988, 1992] publications, it disregarded most of SB's findings about the original function of tokens. NDE [1993, p. 11] also expressed the belief that the "large quantities of clay tokens found in various simple geometric shapes such as spheres, rhombuses, discs, and tetrahedrons, may therefore each be thought of as the representations of different specific numerical values." This contradicts SB's evidence, which clearly indicates that the shape of a token stood for the type of commodity or a *combination* of commodity and quantity, as in the case of bulk goods such as grain where different tokens stood for different quantities of one and the same

[1]Vollmers' [1996, p. 4] article referred fleetingly to NDE [1993], but dealt with a much later period of accounting history.

commodity. Hence, tokens were not merely *counting symbols* but mainly *accounting symbols*, a point only hesitatingly acknowledged by NDE [1993].[2]

In many other respects, NDE were in agreement with SB's research. For example, these authors admitted that accounting tokens were originally kept in perishable containers, such as leather pouches, but later in less perishable clay envelopes (*bullae*). Those authors also confirmed SB's thesis that token accounting was a precursor to writing as well as counting and economic control.[3] Furthermore, they acknowledged the impressing of tokens onto the surface of the envelopes, stating that "occasionally, impressed signs on the outer surface of the hollow clay balls referred to the tokens stored inside them" [NDE, 1993, p. 12]. However, they failed to mention that this impressing was a crucially new development in the evolution of token accounting, constituting a "counter-entry" to the input of token-symbols into those clay receptacles. This ancient practice led Mattessich [1987, 1989, 1995] to regard token accounting as the first prototype of double-entry. Such an assumption is justified by the combination of a series of circumstances. First, the inserting of individually movable tokens, representing assets, into clay envelopes corresponds to a debit entry. Second, the impressing of the very same tokens on the surface of the clay envelope as an "inseparable totality" constitutes a credit entry, manifesting the corresponding equity. Third, the symmetry between the tokens on the inside and the impressions on the surface of the envelope confirms the correspondence to modern

[2]This reluctant admission is reflected in the following question and its answer: "Did these tokens already contain information about the type of the counted product, or did this information have to be added? The latter assumption may be supported by the evidence of a large number of scattered clay objects with incised patterns on their surface. Some of these clay objects were even formed into shapes that closely resemble later written signs. In such instances, these clay objects may be assumed to identify the counted object" [NDE, 1993, p. 12]. This ultimate admission brings those authors closer to SB's evidence.

[3]"Originally, however, the proto-cuneiform script was almost exclusively restricted to bookkeeping; it was an 'accountant's script'. . . . On one level, the archaic accounting script later developed into language-functional cuneiform, while on a second the system of accounting itself became more and more effective, eventually turning into a powerful instrument of formalized control of economic procedures, employing sign systems and document forms" [NDE, 1993, p. 30].

double-entry where most physical manifestations are recorded on the debit side while social relations appear on the credit side. Fourth, the token envelope can be regarded as a self-contained entity, summarizing the periodic accounting of a firm, just as a balance sheet does in contrast to an archaic accounting tablet which is neither a "closed" accounting system nor part of one. Fifth, a token envelope permits a *tautological control* (i.e., a precise matching of the tokens inside the envelope with the impressions on its surface), similar to the mathematical control of modern accounting where the debit total of a trial balance must match its credit total. Sixth, a token envelope is also amenable to a *physical control* (i.e., the "taking of inventory") by trying to match the tokens inside the envelope with the available commodities they were supposed to represent.

PROTO-CUNEIFORM BOOKKEEPING

NDE [1993] may not be the best source on token accounting of the preliterate period, but it is an excellent one on the "archaic bookkeeping"[4] of the late 4th and the entire 3rd millennium B.C. The authors carefully researched and documented this period with exciting material and new interpretations of great relevance to accounting history. They did not merely attend to the early development of "debit and credit" techniques, but also to early cost accounting, budgeting, and other accounting aspects. This work also offered discussions on several topics concerning the commercial history of Sumer and Akkad, such as prehistoric means of administration, the emergence of writing, the cuneiform script, archaic numerical sign systems and the development of arithmetic, the education of scribes, and the hierarchy of professions. Above all, it offered detailed information about the bookkeeping in the production and distribution of grain, beer, and animals, as well as the record keeping of real estate (fields) and labor services.

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[4]Since cuneiform clay tablets are occasionally regarded as the "first books" [cf., Bram et al., 1979, Vol. 4, p. 80], the expression "archaic bookkeeping" of NDE [1993] seems to be acceptable. On the other hand, the term "token bookkeeping" would *not* be appropriate since clay *bullae* are not recognized as books; hence the term "token accounting," as used in SB [1992], is appropriate. As to the term "archaic accounting," it refers here (as it does in NDE, 1993, p. 35) to proto-cuneiform as well as early cuneiform bookkeeping and related accounting techniques.

NDE [1993] distinguished four different types of cuneiform tablets. First, small perforated tablets serve merely as tags. Second, somewhat larger tablets with numerical notation also fulfill merely auxiliary tasks. Third, and most importantly, there are larger tablets with characteristic divisions of columns and partitions, each of which reveals one specific informational unit related to the other units of the same tablet. The obverse side of these tablets, with data identified by NDE as debits, contains, in addition to verbal texts, various pieces of numerical information. The reverse side, referred to by NDE as the credit, contains the sum total of the numbers listed on the obverse. This category of tablets are the actual accounts of archaic bookkeeping. Finally, there are tablets similar to those just mentioned, but without the numerical total on the reverse, again apparently serving some auxiliary function.

According to NDE [1993], no less than ten different numerical systems were used to designate not only the units of a commodity but also its type. Indeed, for different goods and purposes different sets of numerical signs were used — one to count "discrete" objects and persons, another to count slaughtered animals, a third to count rations or wages, a fourth for measuring weights, a fifth for measuring surfaces, a sixth for time and calendar measurements, etc. These number systems used some 60 different symbols.

As to the "tautological control" present in token-envelope accounting, Mattessich [1994, p. 22] suggested that subsequent accounting systems, such as the archaic bookkeeping of the early or later 3rd millennium lost such control as they could no longer be regarded as *closed* double-entry accounting. This seemed to be confirmed by NDE [1993]. But there is sufficient evidence that later bookkeeping systems retained at least some aspects derived from the double-entry prototype of the preceding period. First, counter-entries are frequently enough found which, however, are no indication for the existence of a closed double-entry system; and second, those proto-cuneiform tablets (see Figure 1) bear the individual entries on the obverse, showing the debits, while the total is shown on the reverse side, indicating the corresponding overall credit entry. Most likely the accounting tablets emerged from the envelopes of token accounting as a kind of "unfolding" those clay balls. This is reinforced by this separate recording of individual assets on one side, with their sum total on the other side of the tablet. Token accounting also recorded individual assets on one side, inside the clay envelope, in the form of separate tokens, while on the other side (i.e., the outside surface), the set of inseparable token indentations revealed a sum total. At any rate, archaeologists have left no doubt that entries on the obverse of an entire category of cuneiform tablets are individual charges, while entries on the reverse constitute the corresponding total as a discharge, at least for proto-cuneiform bookkeeping. NDE [1993] supplied plenty of evidence for the similarity of this kind of record keeping to modern accounting.[5]

The resemblance of recording the *total* on the outside of the clay envelopes during the 4th millennium B.C. with the recording on the reverse of clay tablets during the 3rd millennium B.C. may be taken as reinforcing my hypothesis that impressing the tokens (i.e., making those inseparable indentations) on the outside constituted a collective credit, while inserting the individually movable tokens into the same clay envelope connoted the corresponding debit entry. However, if archaic bookkeeping maintains an analogous procedure, the latter need not be a closed double-entry system. Bookkeeping of the 3rd millennium B.C. matches only some but not all charges to some of the discharges, just as modern single-entry systems may do. Thus, it is very different from the closure of such a simple recording device as a clay envelope, which can be considered a *self-contained unit*. In contrast, a clay tablet of archaic bookkeeping is *not* self-contained and must be seen in context with other recordings. So far, there is no evidence that those other recordings provided closure. But had they done so, it would be extremely difficult to unearth all the matching cuneiform tablets, which are typically found broken and badly damaged in ancient city dumps.

[5]NDE [1993, pp. 30-32] wrote: "The tablets were seldom isolated information transmitters; rather, they almost without exception represent a part of running bookkeeping procedures in which pieces of information from one tablet were transposed to another. . . . Such texts document the most rudimentary level of accounting operations in early redistributive city-states, namely, the bookkeeping control of the receipts and expenditures of storage facilities and stocks belonging to the palace and temple households. . . . This summarizing entry [on the reverse] demonstrates another characteristic of the archaic tablets. In most cases, such entries can be identified as totals, with an accompanying sign summarizing an economic category. . . . We are aware that the sign . . . (NINDA) was used as a comprehensive sign for the distribution of various kinds of cereal rations. . . . "

EARLY DISTRIBUTION AND PRODUCTION COST ACCOUNTING

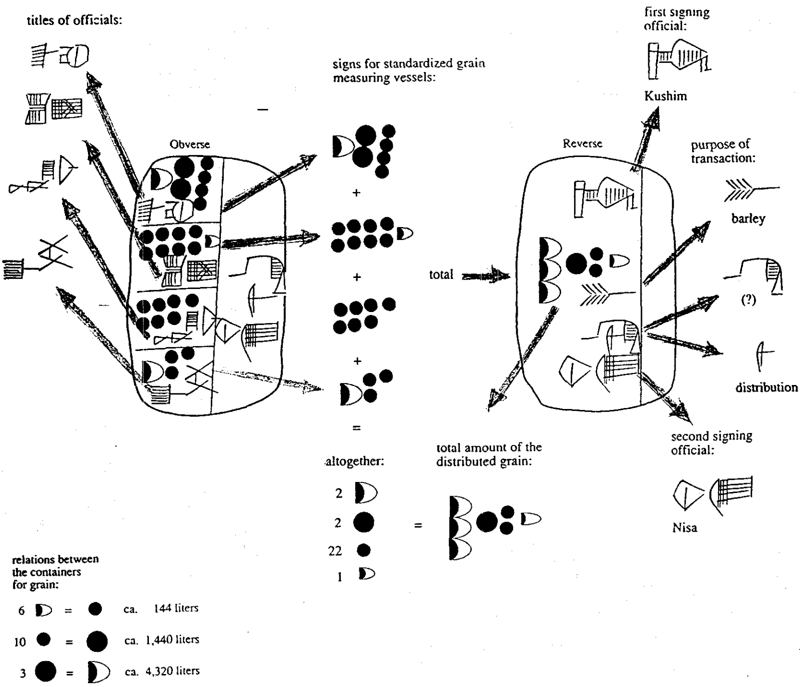
The wealth of information presented by NDE [1993] goes beyond the constraints of this paper; here I merely summarize the gist of the bookkeeping aspects presented by these authors, together with some commentary and criticism from an accountant's point of view. One of the more complete systems (of 18 tablets), discussed and illustrated in NDE [1993], refers to an administrator, Kushim, responsible for the storage and production of beer. Some of these tablets charge the distribution of barley to several officials as various debits, with the summation on the reverse as a single credit for the discharge of Kushim's liability (e.g., figures 33 and 39 on pp. 37-39, here omitted).[6] Beside ideograms for quantities and for names of officials receiving goods, the tablet also contains an entry for the administrator and usually entries for the date or period(s) of transactions. The lack of an ideogram for zero, crucial for any numerical place-value system, resulted occasionally in arithmetical errors. The zero notion was to be expressed by an empty space which, alas, was sometimes forgotten or overlooked.

Another relatively simple account shows the charging of various amounts of barley to three officials on the obverse, while Kushim was credited on the reverse for the total amount distributed to those three officials (illustrated in figure 34, here reproduced in Figure 1). Each of the three sections on the obverse charges a different official with a specific amount of barley. Thus, each section could, alternatively, be regarded as a separate debit account. As the supply of grain was delivered by Kushim, he was credited with the sum total delivered to the other persons. The reverse side could, alternatively, be regarded as Kushim's account. Other accounts are more intricate and show the input of various ingredients (malt, hops, etc., on the obverse side) in the production of beer, as well as different kinds of beer as output on the reverse side.

[6]In this paper, the term "figure" refers to NDE [1993] or other sources, while "Figure" refers, throughout, to the present paper.

FIGURE 1

Sketch of Both Sides of a Proto-cuneiform Tablet Recording the Distribution of Barley to Four Officials (on the obverse, left) and the Discharge of the Administrator Kushim (on the reverse, right)



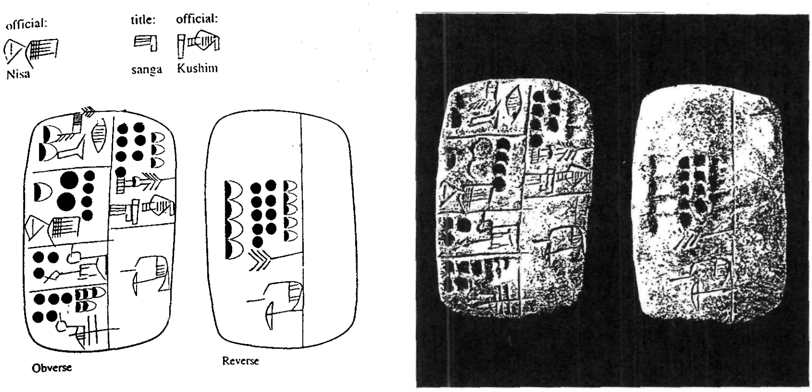
Source: Nissen et al., 1993, p. 38, Courtesy University of Chicago Press

Figure 1 contains four types of impressed numerical symbols. The smallest unit represents ca. 24 liters, the next ca. 144 liters, then ca. 1,449 liters, and finally ca. 4,320 liters. As explained in Figure 1, these numerical symbols must not be confused with the volume measures mentioned in footnote 10. Furthermore, Figure 1 reveals several incised ideograms, most of them representing names of persons or commodities. Finally, it explains the particular addition process which results in the sum total of about 14,712 liters of barley supplied by Kushim, for which he was properly discharged. Regrettably, a photograph of the proto-cuneiform tablet, on which Figure 1 is based, is not available. However, Figure 2 offers a sketch as well as the corresponding photograph of both sides of a similar tablet, likewise from Kushim's accounts.[7]

The evolution of early accounting systems can be recognized by the marked difference between the proto-cuneiform clay tablets (archaic texts from the Late Uruk period to the Early Dynastic I period; i.e., 3100 B.C. to 2900 B.C.) of Figures 1 and 2; the cuneiform clay tablet (of the Early Dynastic III period; i.e., ca. 2500 B.C. to 2400 B.C.)[8], shown in Figure 3; and the even more sophisticated cuneiform tablets (of the Ur III period, ca. 2100 B.C. to 2000 B.C.) of NDE [1993, p. 101], here omitted, on which the (translated) Figure 4 is based.

FIGURE 2

Sketch and Photograph of Both Sides of a Proto-cuneiform Tablet Recording the Distribution of Barley to the Officials Kushim and Nisa



Source: Nissen et al., 1993, p. 39, Courtesy University of Chicago Press

[7]Kushim's signature (or sign) can be found on top of the reverse side of Figure 1, as well as in the right uppermost field of the obverse side in Figure 2 (Does this indicate that Kushim himself received some barley?), while the signature of the official Nisa can be seen at the bottom of the obverse and reverse side of Figure 1, as well as in the second section of the obverse side of Figure 2 (but apparently no signature appears on the reverse of this tablet).

[8]There may be some controversy in assigning precise dates to certain periods; according to my correspondence with SB, for example, this period should extend from 2600 B.C. to 2334 B.C., instead of 2500 B.C. to 2400 B.C. as in NDE [1993].

FURTHER DEVELOPMENTS AND THE USE OF BUDGETARY PROCEDURES

The improvement of the proto-cuneiform script and the transition to cuneiform writing allowed scribes to impress and incise more details and information on clay tablets:

> Whereas during the archaic age [ca. 3000 B.C. to 2800 B.C.] the addition of further information concerning product quantities was restricted to placing a numerical sign at a predetermined place within the text format, such information was incorporated into grammatically structured sentences in later Old Sumerian texts from pre-Sargonic Lagash [i.e., before 2300 B.C.], . . . [NDE, 1993, p. 47].

For the last phase of the Old Akkadian period (ca. 2250 B.C.), NDE showed tablets recording the production and distribution of various quantities of bread as well as jars of beer rationed to various individuals. What is particularly notable, from at least this period onward, is an *ex post* juxtaposition of budgeted amounts, called "theoretical" in NDE, to actual amounts produced and the recording of the discrepancy in the form of a "balancing" entry [see NDE, 1993, p. 49].

Some illustrations in NDE [1993] showed the juxtaposing of budgeted and actual data, not merely during one year but over several consecutive years, often in terms of the amounts of labor. Frequently the foremen's quotas were overdrawn, which may indicate tight budgeting with standards set at maximal performance. It also shows that the setting of standards and equivalent values, as well as the standardization of measures and budgeting procedures, had attained a surprisingly high level of sophistication. "There can be no doubt of the existence of explicitly formulated norms which were strictly adhered to. They can be reconstructed from conversions of labor performances and products into equivalent products specific to the respective sector of the economic organization" [NDE, 1993, pp. 49-51]. This is confirmed by an example from the Ur III period which shows the annual account, based on "female labor days," of a foreman supervising 36 female workers engaged in the milling of grain. The authors pointed out that the settling of a foreman's deficit was a serious matter and could result in such retribution as the confiscation of his property. The incorporation of budget standards into the regular accounting system (as illustrated in Table 1), the comparison with actual performance, the charging of a deficit to the person responsible, and the carrying forward to future periods were typical for state-run organizations of this time (occasionally resembling the accounting and budget procedures of 18th century cameralism and even later). However, some of these ancient records may remind us of modern standard costing systems, especially those versions that combine actual material inputs with standard (budgeted) labor inputs (see Table 1 and comments below).

THE DEVELOPMENT OF LABOR AND PRODUCTION COSTING

Although most labor costs during the 3rd millennium B.C. were incurred in agriculture (see next section), I shall discuss their recording here. Those records concern the distribution of food rations to a strictly and centrally directed labor force. NDE pointed out that those rations were likely to be kept at a subsistence level and should not necessarily be regarded as "wages" since those workers might have been a kind of "state property." The daily rations per person, usually one "bevelled-rim bowl" of barley, a standard capacity of ca. 0.8 liters or more, were distributed by public granaries, through high-ranking officials, to foremen, and finally, to the workers. Particularly noteworthy are the following statements from NDE [1993, pp. 74-75]:

> Three . . . texts from the administrative building of Jemdet Nasr [around 3000 B.C.] offer a good description of the way books were kept on captives employed in forced labor. At the same time, they provide a convincing example for the practice of setting up balance sheets based on individual documents. . . . This balance sheet again lists all the entries from both individual documents, totaling 27 male and female laborers. Once the scribe had filled the obverse side of the tablet, he turned it over (according to the orientation chosen in the figure) by making a half rotation around its vertical axis [a custom probably introduced for the sake of convenience] and then completed another column on its reverse . . . . [9] After having booked the entries, the

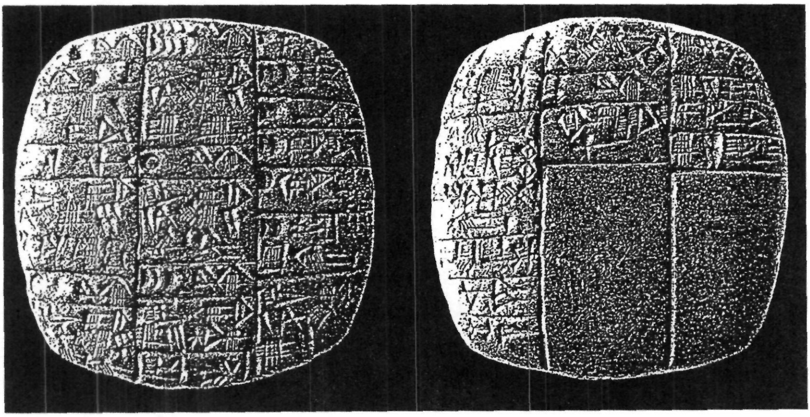
[9]The use of the term "balance sheet" in NDE [1993, pp. 74-75] must be clarified. What was meant is rather a "balancing tablet" which lists individual workers or slaves on the obverse side of a clay tablet and their totals (apparently with subtotals) on the reverse side. From the text I discern neither any

scribe proceeded by turning the tablet upside down, recording two subtotals within the central column of the reverse. In a last step he entered the grand total of the recorded laborers in the left column of the reverse.

Again, administrative progress can be noted by comparing the "labor accounts" of the archaic period (ca. 3000 B.C. to 2800 B.C.) with those of the Early Dynastic III period (which according to NDE [1993, p. 5] seems to extend from ca. 2500 to 2400 B.C.) and, even more so, with the Ur III period (ca. 2100 B.C. to 2000 B.C.). Not only are the accounts of the latter two periods more explicit about food rationing, they also reveal the calculation process in setting standards for labor budgeting. Figure 3 shows an Old Sumerian tablet in which, again, the obverse is regarded as the debit side and the reverse as the credit side. As pointed out in a previous section, a comparison with Figure 2 reveals the change from proto-cuneiform to early cuneiform writing.

FIGURE 3

Old Sumerian Text Citing Labor Quotas in Canal Construction



Source: Nissen et al., 1993, p. 83, Courtesy University of Chicago Press

evaluation of the slaves in equivalent units of barley, silver, etc., nor an integration of this inventory with that of other commodities as would be done in a proper balance sheet.

Not only can such accounts be interpreted as a juxtaposition of *ex post* expectation and actual performance, it must also be regarded as the juxtaposition of production input to output, as encountered in modern cost accounting and illustrated in NDE [1993, pp. 84-85, figure 69 with translation], here reinterpreted in our Table 1. The pertinent commentary from NDE [1993, pp. 83-86] averred:

> The account is divided as usual into two distinct sections. The first section running from the beginning of the text to the fifth line of the second column . . . deals predominantly with quantities of processed raw materials, the number of employed laborers and the time they were employed. This section forms the 'debit' part of the account since raw materials as well as the labor force, expressed in (female) laborer days . . . , had to be balanced at the end of the accounting period against real delivered products and the work actually performed. In the second section of the text, the 'credits,' all finished products produced within the stated period are noted, plus the theoretical time of work necessary for their processing, the other jobs performed, all of which were totaled at the end of the section. The final step was then to calculate the difference between debits and credits. The amounts of grain and work days calculated as deficits [balance] were then recorded as such (Sumerian LÁ+NI); these probably formed the first entry of the 'debit' section . . . of the account of the following period. In some cases, such deficits had to be cleared directly, a procedure which is attested by corresponding administrative documents (the so called LÁ+NI su.ga texts = 'replaced deficit' [balance transferred]).

NDE [1993, pp. 83-85, figure 69] contained both sides of a cuneiform tablet from Umma together with a translation. But the text was presented in a highly complicated fashion, partly due to the unfamiliar arrangement of the account, and partly due to various strange measures and measure units. Some effort is required to achieve contemporary compatibility. For this reason, I have tried in Table 1 to translate this presentation into a T-account and approximate the numbers through modern measure equivalents (conversion into liters seems to be a meaningful way of explaining the clay tablet). This permits the disclosure and analysis of various discrepancies and offers an opportunity for future research.

The original translation of figure 69 into English in NDE [1993, pp. 84-85] was said to document the production accounting of a foreman, Ur-Šara, in charge of 36 female laborers processing grain, as well as doing some secondary tasks, over a period of approximately one year. The records were kept in terms of various types of cereal with conversions into barley equivalents.[10] These fixed conversion ratios may also have fulfilled a function similar to prices, especially to transfer prices

[10]This laborious footnote may be skipped by readers not interested in verifying Table 1 on the basis of Nissen [1993, figure 69 and translation, pp. 84-85]. Since this book fails to concentrate all of those data in a single place, I have summarized in the following the "conversion rates" necessary for such verification by serious students of Mesopotamian accounting.

Barley seems to have been one of the basic measures or "currency units" (others were labor hours, fish, and silver — cf., NDE, 1993, p. 51). Cereals, flour, and many other commodities were expressed in volume measures (one gur = 300 sìla; one barig = 60 sìla; one bán = 10 sìla; one sìla = approximately 1 liter in modern terms) at least for the Ur III period, while during the earlier Old Sumerian period, 1 sìla was about 1.5 liters, etc. [cf., NDE, 1993, pp. 82, 142]. As far as the conversion of "breads" into barley equivalents is concerned (see Table 1), I have relied on the following passage from NDE [1993, p. 47]: "With some reservation one would therefore translate the sentence: '40 kagu-breads baked at the rate of 50 per bán'" which would mean 1 bread is about equivalent to 0.25 sìla (or one-quarter of a liter) of dabin flour. Another passage, "3 bán of flour are needed for 90 loaves of bread" [NDE, 1993, p. 49], yields a result only slightly different, namely 0.3 sìla of dabin flour per loaf of bread.

As to the conversion of labor hours, first a distinction between female labor days and male labor days was made. This difference manifested itself, for example, in regard to "free time." Female workers got one-sixth of their total labor time off as free (cf., Table 1, lower debit side), while male workers got only one-tenth. Furthermore, the wages or rations (in barley) for labor varied greatly: "The sizes of the registered monthly rations vary between 2 bán and 2 barig (i.e., 12 bán). The great majority of the rations, however, amount to figures between 1 barig and 1 barig 2 bán, hence between 6 and 8 bán" [NDE, 1993, p. 82].

Finally, as to the conversion of finished goods into barley equivalents, NDE [1993, p. 88] provided the following conversion ratios, but I wonder whether these conversion ratios might not be contradictory. On one hand, NDE [1993, p. 88] stated, as regards various *cereals*, that "1 unit measure of dabin (flour) = 1 unit measure of še (barley)" and "1 unit of eša = 2 units of še" while, on the other hand, the book stated that "the work times required to process a unit measure of the noted grain products are . . . : for dabin 10 sìla [ca. 10 liters] per day [of female labor?]" and "for eša 20 sìla per day [of female labor?]." What puzzles me is that, according to the first statement, eša flour would have double the value of dabin flour; while according to the second statement, twice the quantity of eša can be processed in the same time as dabin. Hence, one would assume that dabin has, at least from a labor point of view, twice the value as eša (in barley equivalents). I do not claim that there is so important in an economy of regulated and manipulated values.

For several reasons, this account (Table 1) is particularly fascinating and may prove rewarding for the serious student of archaic bookkeeping. However, the reader must be warned that the rest of the current section and next section requires concentration and constant reference to the details shown in Table 1. A first glance at this table reveals that, in contrast to a modern work-in-process account, only the raw materials (upper part of the debit side) and the finished products (upper part of the credit side) are endowed with "values" (expressed in liters of barley equivalents — see second figure column; the first figure column indicates actual liters of the grain specified). The labor input is merely shown in "female labor days" (FLD, lower part of the account), but is not evaluated in barley equivalents. Furthermore, unlike the upper part, the lower debit side contains a *global budgeted* figure (plus an adjustment near the bottom), while the lower credit side shows *actual* FLD, detailed by type of work. Finally, the deficit (to be brought forward to the next period) on the lower credit side and the ultimate total (valued in equivalent barley liters) also exclude the labor contribution. From this we may conclude that the purpose of such accounting was mainly *stewardship,* not the determination of the "true" cost or value of goods.[11] The foreman's production account is charged with those amounts of grain he received from various sources or persons (Ir, Lugal-usur, and Nin-melam) for which he gave account on the credit side by showing what he had produced and distributed. The balance of these commodity values was shown as a *deficit* (or surplus) and, usually, carried forward to the next accounting period for settlement. To account for the labor days consumed, the foreman had to include

a contradiction here because it might be that, precisely because eša could be processed faster, it was more highly valued. Nevertheless, this seems strange and should be reevaluated.

[11]NDE [1993, figure 43 and the pertinent text, p. 51] presented a general schema of a "flow chart revealing the structure of the accounts . . . , " in which only the budgeted and actual labor days are taken into consideration, while neglecting the actual raw material input (dr.) as well as the output of finished products (cr.) based on actual (not on budgeted) data. If the raw material input would also have been on a budgeted basis, the actual input of those items would have to be shown somewhere in the account which, however, was not the case. This is surprising and contrary to NDE [1993, figure 69] where raw materials and finished goods, instead of labor, appeared to dominate the account.

in this account, as a kind of side calculation, a comparison of budgeted labor hours (dr.) with actual labor hours (cr.).

TABLE 1

The Author's Accounting Interpretation of Nissen et al., 1993, pp. 84-95.

Debit Side (in ltr.)		*in barley eqiv.*	**Credit Side** (in ltr.)		*in barley eqiv.*
Inputs/From Ir:			Produced and distributed:		
barley	92,665	92,665	dabin flour	89,325	89,325
emmer	18,240	18,240	sig flour	26,069	52,138
wheat	15,840	31,680	esa flour	1,091	2,121
From Lugal-usur:			fine gr.bread	44	150
barley	1,935	1,935			
spelt	525	1,050	Total (in barley equivalents):		143,734
emmer	100	100			
From Nin-melam (rest. deficit of Bida):					
spelt	101	202			
Total in barley equiv.:		145,872			
unexpl. discrepancy		2,186	**unexpl. discrepancy**		343
Total (from Nissen et al.)		148,058	*Total (from to Nissen et al.)*		144,077
Budgeted Work (in FLD):			**Actual Work (in FLD)**:		
Processing flour, etc.		11,304 FLD	Allow. for free time		1,884 FLD
			For flour filling		7,226 FLD
			For grinding barley		238 FLD
			For loading flour signed: Še-šani.		30 FLD
			For carrying straw		19 FLD
			For other work signed: Šara-zame.		188 FLD
			For bala(-service)		270 FLD
			For weaving mill work signed: ADU		96 FLD
			For sieving flour signed: Ur-zu.		30 FLD
			For ar<za>na fl. proc.		240 FLD
Allow. for free time of dec. lab. (1/6 of 187)		31 FLD	Allowance for FLD of deceased labourer		187 FLD
			Actual. labour total		10,408 FLD
			unexpl. FLD-discrep.		304 FLD
Total adj. lab. budget		*11,335 FLD*	*Total (according to Nissen et al.)*:		10,715 FLD
			Lab. budget variance		620 FLD
			Deficit (to be br. forward)		3,981
Total (in ltr.)		148,058	**Total** (in ltr.)		148,058

Note: For lack of better information I have identified "sig" (top Cr-section) as "zì-sig$_{15}$" (which is double the barley value equivalents versus "ninda àr-ra-sig$_5$" which is only 1.5).

A further interesting aspect of this particular account is a recording procedure made necessary by the death of a female laborer during the budget period. As the FLD were budgeted in advance, though recorded *ex post* for comparison with actual data, the foreman was responsible for all the projected FLD of the deceased, even for days she could no longer work. Thus, after her demise, the remaining, but budgeted, 187 FLD had to be cancelled by a credit entry. Yet, this was complicated by the fact that each worker had a budgeted allowance for free days (for females, usually one-sixth of her total budgeted work). Hence, one-sixth of the 187 FLD had to be reversed by a debit entry. In referring to this example, NDE [1993, p. 88] emphasized that "no detail of this text exemplifies so drastically the high level of formalization achieved by bookkeeping of labor performance during the Ur III period."

UNEXPLAINED DISCREPANCIES AND OTHER ITEMS TO BE CLARIFIED

To balance the account in Table 1 in terms of barley equivalents,[12] I had to insert on the *debit side* an "unexplained discrepancy" of minus 2,000 liters. It results from the difference between the total of 92,618 liters (in the original: 308 gur, 3 barig, 3 bán, and 8 sìla) *minus* the sum total (94,618 liters) of the individual items listed on the top of this account. Although this discrepancy, not noted in NDE [1993], is merely slightly over two percent of the total, it would require clarification.

The upper half of the *credit side* shows an "unexplained discrepancy" of 60 liters (90,076 liters according to the total versus the 90,016 liters derived from adding the individual items — see upper credit side of Table 1 and NDE, 1993, p. 85). Furthermore, considerable discrepancies seem to exist with regard to "sig flour" and "ground bread" when comparing the individual items [NDE, 1993, p. 85, section II] with the totals (in its section IV) of these two products (55,905 liters of dabin flour and 16,349 liters sig flour, shown in the upper credit side of Table 1). Above all, the labor for excavation (270 FLD indicated in the lower part of the credit side of Table 1) seems to have, in contrast to the milling labor, no equivalent output data on the upper credit side of this Table 1 and its corresponding

[12]All amounts in Table 1 are rounded up or down to whole liters (sìla) of actual grain or barley equivalents.

data in NDE [1993, p. 85]. This movement of about 1,189 cubic meters of soil, 20.5 volume-šar per laborer, would correspond to a barley equivalent of about 200 liters, assuming minimum rations, that might have to be inserted on the upper credit side.

As to the lower part of Table 1, the accounting for labor appears to be proper on both sides of the clay tablet, including the correctly inserted discrepancy of 620 FLD, called "deficit" by NDE [1993]. However, that last point requires clarification. How can this discrepancy be a deficit if the actual female labor hours used, hence contained in the output, are less than the budgeted ones? It rather appears to be a "surplus" or, more expertly expressed, a "favorable budget variance." The confusion may have been due to something that may, indeed, be puzzling to archaeologists. In accounting with *actual* data, a loss (deficit) is balanced on the credit side when expenses (dr.) are larger than revenues (cr.). But in accounting with *estimated data* (budgeting, standard costing, etc.), a "deficit," more appropriately called "unfavorable variance," is balanced on the debit side, provided the budgeted amounts are recorded on the debit side and are larger than the actual amounts on the credit side. And since our account, Table 1, contains actual data in the *upper part* (different cereals and ingredients as input and different flour types as output) with budgeted data of FLD in the *lower part*, the "deficit" for the commodity data and the "favorable budget variance" for the labor hours have both to be balanced (i.e., separately inserted) on the credit side. No wonder that NDE [1993] took a favorable budget variance for a "deficit" (i.e., an unfavorable budget variance). But perhaps the term "LÁ+NI," translated by NDE [1993, p. 49] as "deficit," merely means "discrepancy;" but this only a language expert could decide.

There still is another problem to be resolved. As hinted at, the commodity deficit of 2,542 liters is a genuine deficit because it concerns the discrepancy between larger input values versus smaller output values in real terms. It was mentioned by NDE [1993, p. 85, figure 69] in the last section of the credit side and is shown in barley equivalents in Table 1. It constitutes the foreman's debt, be it because of inefficiency or embezzlement, vis-à-vis the state at the end of the accounting cycle. This deficit is brought forward to the next period for settlement. However, apart from the question why the actual labor hours used are not converted into equivalent barley units and added to the total input, as would be done in modern production accounts, a special dilemma arises. Since the production output (i.e., the various flour types milled) is evaluated in barley equivalents, this "value" should also include the labor input besides that of raw material. But if that were the case, this entire enterprise of milling flour would appear to have been an unprofitable affair as the value of raw material input alone, apart from labor input, already exceeds the value of the total output by some 2,542 liters of barley equivalents.

Might it be possible that the workers (or slaves) received their standard rations from the same production process without having been recorded? Given this situation, the total of those labor rations (which, as footnote 10 shows, were much lower than the labor/product conversion rates there indicated) would have to be added on the credit side as an additional output. Perhaps the budgeted amount (including the unexplained discrepancy and labor deficit), in addition to figuring out the budget variance and the commodity deficit (or surplus), fulfilled a second task; namely, implying (instead of actually recording) the output of labor rations consumed by the workers during the production process. If this was the case, there are no indications that NDE addressed this particular problem or considered the need for entering actual labor values on the upper part of the credit side. It is also possible that the fixed conversion ratios were so distorted, in comparison to potential free market values, that the finished products were "undervalued" relative to raw materials. But if the foremost goal of the Sumerians was stewardship and its monitoring, such a scheme might have accomplished this task regardless of manipulated values or "transfer prices." Nevertheless, all those unexplained items and problems show that further inquiry is necessary. This may indicate that archaeologists alone might not be able to discover and resolve the pertinent intricacies involved, and that accounting expertise could play a vital role in this kind of research.[13]

[13]An excellent illustration of archaeologists drawing advantageously on the expertise of other scientists is the recent discovery of details in brewing beer by the ancient Egyptians. The "beer of Nefertiti," as it is jokingly called, yielded its secrets only after chemists and brewing experts were called upon.

AGRICULTURAL ACCOUNTING: REAL ESTATE AND ANIMAL HUSBANDRY

Apart from clay tablets manifesting the surveying and measurements of arable land, there exist tablets containing the management and bookkeeping of real estate, usually public fields. Some tablets show on the obverse side the amount of grain necessary for seeding the fields based on systematic economic planning or budgeting, while the reverse side contains the pertinent field area based on standardized measurement techniques or approximations. Sometimes these measures are accompanied by a name or title indicating tradesmen, scribes, fishermen, and other professions. One such tablet contains no less than 104 such "allotments" for seed grains, probably from a central public granary. In Lagash (ca. 2400 B.C.), for example, fields were either (1) the domain of the ruler, (2) allotted to public officials, or (3) leased to farmers. The pertinent tablets contain such details on agricultural cultivation as expenditures, yields, and property status ("current rights of disposition"). In the agricultural area, no less than in the previously discussed non-agricultural recording techniques, progress over time can be observed: "In the Ur III period, field administration was improved by better documentation of the results of surveying. From this period on, sketched plans of the fields were included with the documents, annotated with length measures and calculated area measures like a modern land register. Similar plans have been found referring to buildings and, in rudimentary form, even to entire cities" [NDE, 1993, p. 68].

Bookkeeping for animal husbandry (sheep, goats, bigger cattle, donkeys, and, occasionally, horses and pigs) was another crucial component of ancient agricultural accounting. Of special interest is the recording of the holding and the annual productivity of some of those animals. The accounting dealt not only with productivity in terms of the production of milk, cheese, wool, fleece or fur, and textiles, but even processed dung for building or heating material and the propagation of the animals themselves. One text, for example, reveals that one-third of the ewes lambed during the year. To account for all this, the tablets had to reveal the sex as well as the age of the various animals cared for by the herdsman named in the record. Some of these records are quite comprehensive and, occasionally, refer to thousands of animals. In budgeting the production of such agricultural products as dairy fat and cheese, the number of cows in the care of a particular herdsman was the criterion for calculating the expected output:

> One unusual document preserved from the Ur III period discloses crucial information on the calculations carried out in connection with cattle breeding and the expected output of dairy products of that time (see fig. 76). In this document, the annual production of 'dairy fat' and 'cheese' are calculated over a period of ten years based on the hypothetical growth of a cattle herd consisting, at the beginning of that period, of four milk cows [NDE, 1993, p. 97].

FIGURE 4

Schema of Budgeting the Growth of a Cattle Herd and its Dairy Output during a Ten-Year Period

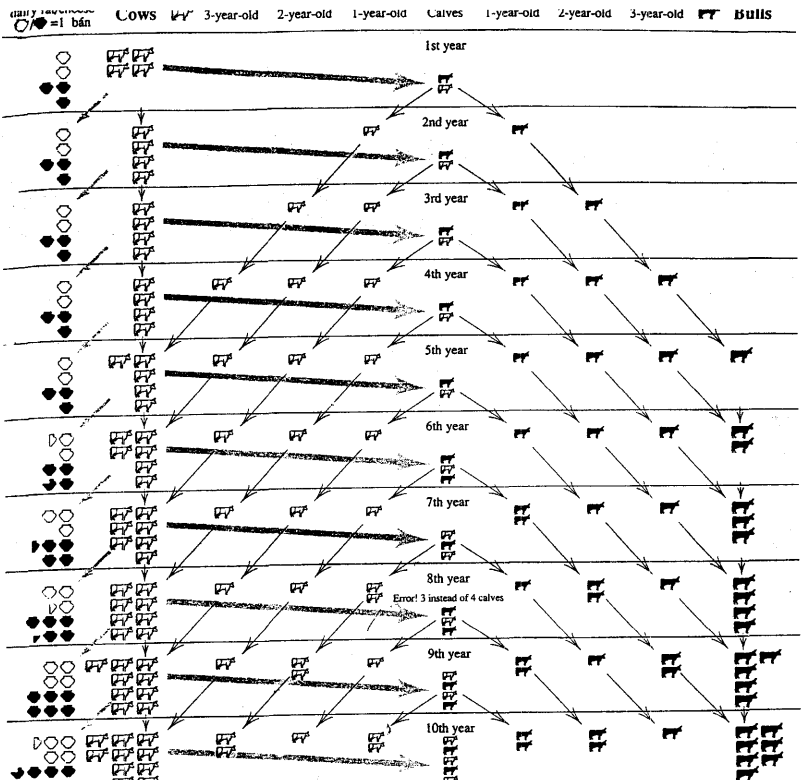


Figure 78 The growth of cattle herd according to the text illustrated in figure 76.

Source: Nissen et al., 1993, p. 101, Courtesy University of Chicago Press

Figure 4 offers the schematic-graphical presentation of a cuneiform tablet and illustrates the budgetary technique employed. It shows the anticipated development of a herd of cattle over a period of ten years. This tablet not only projects the growth of calves, cows, and bulls, but also the anticipated output of dairy fat and cheese from the first year (which starts with four cows on the left-hand side, but apparently with no bull until the fifth year) to the tenth year (which ends with ten cows and seven bulls; the latter indicated on the right-hand side). The left-hand side also shows the yearly expected output (in bán = ca. 10 liters) of dairy fat as well as cheese. Apart from the fact that the annual dairy production seems small from our modern point of view, it is surprising that no bull is recorded until the fifth year. As calves were produced in the first year, this was ostensibly with the aid of a "borrowed" bull, not revealed in the budget. The reader will also notice that, quite appropriately, the production of female and male calves is assumed to be equal over the entire decade, but not necessarily for each individual year. To maintain this long-term balance the sixth, seventh, eighth, and tenth years showed unequal numbers of male and female calves (see Figure 4).

A further tablet from Uruk III not only records on its reverse the total amounts of dairy fat (possibly butter or cream) and cheese, but converts these quantities into their equivalent silver values based on exchange rates such as 10 sìla (1 sìla = ca. 1.5 liters during the Old Sumerian period and about 1 liter during the Ur III period) of dairy fat per shekel of silver (1 shekel = ca. 8.3 g) and 150 sìla of cheese per shekel of silver.[14] This indicates that silver equivalents were occasionally used as an accounting or quasi-monetary unit (together with certain volumes of grain, animals, etc.) over four thousand years ago.

CONCLUSION

Historical research of early accounting and bookkeeping has brought forth a series of exciting and surprising results during the last two decades. Since SB's [1977, 1978, 1992] publications on this subject, we have been made aware of the ar-

[14]Note the difference in "price" or assigned value between cheese versus dairy fat (perhaps cream or butter) which, according to these ratios, would have been 1 to 15. Such a difference may seem to us extreme but was apparently appropriate in those times.

chaeological evidence of small clay tokens that were used by the peoples of the Fertile Crescent for recording the transfer of goods and the accumulations of debts or similar obligations from about 8000 B.C. to 3000 B.C. and occasionally later. The most decisive of these innovations was the idea to impress the tokens onto the outer surface of the clay envelope, the token content of which could thus easily be revealed without breaking the seals that identified the debtor and other features. This practice of "impressing" was antecedent to cuneiform writing, and constituted a particular kind of double-entry. Impressing the tokens on the surface of the container recorded, as an inseparable totality, a credit or ownership claim, while the inserting of those same tokens into the clay envelope recorded individually separable assets, including silver and claims to labor units, as charges. For a concise survey of token accounting, its evolution and discovery, see Mattessich [1995, pp. 23-32, figures 2.2 to 2.4].

Another decisive step, occurring in the late 4th millennium B.C., refers to the substitution of clay envelopes by more convenient flat clay tablets. At this stage clay tokens were merely impressed onto the tablet, indicating the individual goods and total debt owed, together with the appropriate seals revealing the debtor and possibly other information. Although the token shapes still continued for some time to represent types of commodities, this approach reduced the clay tokens from three-dimensional ideograms for commodities to *mere tools* for impressing two-dimensional ideograms. While the budding idea of a closed double-entry system as encountered in the token accounting of the 4th millennium B.C. disappeared, the legacy of debit/credit entries without systematic double-entry, as still found in some 20th century, single-entry accounting systems, was preserved in the archaic bookkeeping of the subsequent millennium.

The present paper dealing primarily with this legacy encountered in the proto-cuneiform and cuneiform record keeping of the 3rd millennium B.C. demonstrates the further development of early accounting into a relatively sophisticated system. In the late 4th and early 3rd millennia B.C., a transition seems to have taken place in which, increasingly, the form of the clay impression was determined by the commodity type in *combination* with a specific quantity of this commodity. Furthermore, some information about commodities and other data was incised instead of impressed and led, during the 3rd millennium, to proto-cuneiform and cuneiform writing. But beyond this development, which concerns more the history of writing, a series of important accounting innovations occurred. In the beginning of the 3rd millennium B.C., the practice of proto-cuneiform recording of commodity and labor transactions is characterized by placing the individual debit entries on the obverse side of the clay tablet while placing the sum total as a credit entry on the reverse side. This practice became less frequent during the late 3rd millennium B.C.; it might have been a residual from token accounting where individual tokens were put into hollow clay containers while those very tokens were impressed on the outer surface as the sum total of its content. From the middle of the 3rd millennium B.C. onwards, relatively sophisticated budgeting procedures with their *ex post* juxtaposition of budgeted amounts (particularly labor times) and actual data are encountered. If the stewardship function, between individuals or between them and a powerful temple administration, stood at the cradle of token accounting, this function became all the more important in times of centralized and highly bureaucratic governments. Therefore, the recording of a "surplus" or "deficit," the transfer of those balances to the subsequent period, and their ultimate settlement became a pivotal feature. This bureaucratization of economic life in the 3rd millennium B.C. (well known to the historically interested public through the names of such potentates as Mes-anni-padda, Sargon of Akkad, Gudea of Lagash, Ur-Nammu, etc.) was apparently the driving force for the development of more and more refined accounting and budgeting procedures, such as better calculation and surveying records, "transfer prices," and standard setting. Above all, the subsidiary information to the quantitative-numerical entries became much more sophisticated and semantically structured. The move from proto-cuneiform accounting to different stages of cuneiform accounting finally led to writing in general, and ultimately to literature and poetry.

A major incentive for discussing here crucial aspects of NDE [1993] is the fact that this book contains important evidence for conceiving new hypotheses and for strengthening those previously made [e.g., SB, 1983, 1992; Mattessich, 1987, 1994]. Such reinforcement is especially important in hypotheses that are not amenable to statistical testing. Another justification for this paper lies in novel insights concerning the Sumerian archaeology of accounting and some necessary reinterpretations beyond NDE [1993]. The challenge, be it to the archaeologists' or the accountants' traditional way of thinking, may be summarized as follows:

(1) This book and my paper present evidence that strengthens the hypothesis that *Sumerian token-envelope accounting of the 4th millennium* B.C. *is linked to the very different proto-cuneiform and cuneiform bookkeeping of the subsequent 3rd millennium* B.C. This link lies not merely in the acceptance of many results of SB's research in NDE [1993], but in a specific similarity between those two systems. It was originally hypothesized in Mattessich [1987, 1994] that (i) the inside of the envelope contains clay tokens representing individual assets, and (ii) that the *total* of these "asset values" is shown on the reverse; i.e., on the surface of the envelope, as a totality and equity in form of a set of inseparable token impressions. The similarity between this practice and proto-cuneiform or cuneiform bookkeeping is too striking to be coincidental. Those latter systems also carry on the obverse side individual entries as debits, while on the reverse side they carry the sum totals as credits, clearly evidenced in NDE [1993]. But this specific, yet decisive link between two very different debit-credit systems and its implication for the new hypothesis that *the way of making entries in "archaic bookkeeping" evolved directly from token accounting* are neither articulated in NDE [1993] nor in any other publication known to me.

(2) The above-mentioned evidence and hypothesis establishing the debit-credit character of both systems and their link, together with the fact that every token-envelope accounting can be considered a closed and self-contained system, reinforce the other previously made hypothesis [cf., Mattessich, 1987, pp. 80-81, 1994, pp. 18-21]; namely, that *token-envelope accounting constitutes a prototype of systematic (i.e., "closed") double-entry*, in which every entry has a counter-entry, and is not to be confused with a mere debit-credit system where only some but not all entries have a counter-entry.

(3) The preceding items, together with further evidence in NDE [1993] from proto-cuneiform and cuneiform bookkeeping, support and reinforce a third claim [cf., Mattessich, 1994, pp. 21-22]; namely, that those later record-keeping systems, despite having debit and credit features and showing occasional counter-entries, were not systematic double-entry systems. Here another pertinent difference to observe is that the counter-entries of token-envelope accounting represented

exclusively equity claims (either from debtors or owners, thus "closing" the system), while those of proto-cuneiform and cuneiform bookkeeping often represented transfer entries (outputs to other accounts).

(4) Furthermore, the paper translates (in Table 1) a fairly typical cuneiform account into a more conventional format, thereby revealing additional details as well as errors of interpretation, pardonable for archaeologists but important for accountants to observe. For example, what NDE [1993] called a "deficit" is, in one case, a "surplus" (or more precisely, a "favorable budget variance"). Also, the pertinent account contains, on several levels, "unexplained discrepancies" and deviates crucially from modern accounts in that it is a combination of a current account, of raw materials input and finished goods output, with a budget account, juxtaposing only labor input projections with actual output. None of those items were analyzed in the text of NDE [1993] which, therefore, requires some reinterpretation and further analysis.

(5) I hope this paper also dispels the conventional view that cuneiform record keeping was so primitive that such terms as "bookkeeping" and "accounting" cannot be properly applied to it. This misconception is compounded by the erroneous belief that accounting requires writing and abstract counting as prerequisites, as stated in conventional accounting texts [cf., Skinner, 1987]. Above all, this paper shows that accounting has deep cultural roots to be explored in cooperation with such subjects as archaeology. Should our discipline aspire to overcome its parochial tradition, then accountants ought to concern themselves with a broader range of knowledge and must take the effort to look at the pertinent research with a critical eye. Above all, those doing this work must convey their insights to the academic accounting community in general, not merely to specialized groups.

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