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A Note on an Anomalous Area Measurement from Ur III (with a remark about confidence in experts)

It has long been known that Sumerian and Babylonian surveyors calculated the area of irregular quadrangles by means of the "surveyors' formula", i.e., as average length times average width.[1] This formula is evidently but trivially correct for rectangles, and yields too high results in all other cases. For near-rectangular areas, however, the outcome is acceptable, and indeed no worse than those which arise because of imprecision in the determination of right angles.[2]

It is equally well known that the Old Babylonian scribe school teachers constructed mathematical problems from the same formula without caring for its plausibility. In one typical case (YBC 4675, in MCT, p. 44 f), where the sides are 3' 10°, 2' 50°, 17 and 7 n i n d a n, respectively, the area which follows from the formula is 2.45 as large as the maximal area which these sides can contain.

Traditionally it has been believed that this use of the formula in implausible situations was a distinctive characteristic of the school texts, where exactness of the area calculation was less important than the possibility to construct intriguing or elegant problems. Allotte de la Fuÿe[3] regards a pre-Sargonic calculation which is about 10% above the true value as "tout à fait inadmissible", and other known cases are indeed much more satisfactory. Ur III scribes obviously knew that fields which did not come very close to a rectangle or a rectangular trapezium (whose area appears to have been found as the product of the „good" length and the average width) hat to be dissected into adequate pieces – of the 222 fields inventoried in the "round tablets" from the province of Lagaš which are analyzed by Mario Liverani[4], 172 are defined by lenght (m i r, "north") and width (k u r, "east") alone and thus ideally to be thought of as rectangles, while all of the remaining 50 appear to have been thought of as practically rectangular trapeziums.[5] A similar conclusion can be drawn from

[1] See, for instance, F.-M. Allotte de la Fuÿe, RA 12 [1915] 145.
[2] See, e.g., ibid. 141 f.
[3] Ibid. 143.
[4] BSAg 5 [1990] 160–166 (= Figures 8–14).

the calculations based on drawn field plans, e.g. those discussed by F. Thureau-Dangin[6] and Allotte de la Fuÿe[7], both of whom compare the original drawings with possible restorations to scale.[8]

A recently published field plan from the Temple of Inanna at Nippur dated to Šu-Suen year 5[9] is remarkable as an exception to this rule. The tract of land in question is divided into four plots, of which number three is indicated to have lengths equal to $2' 30°$ and $2' 15°$ n i n d a n, respectively, while both widths are 10 n i n d a n. The area is stated to be $14\frac{1}{4}$ i k u, which is in exact agreement with surveyors' formula. The maximum area which the sides can contain, however, is 9.42 i k u, meaning that the stated value is at least 51% in excess of the true value (namely if the trapezium is isosceles). Since one of the widths is indicated by the drawing of the tablet to be perpendicular to the lengths, the excess may rather be 100%. The second and fourth plot may be calculated with greater precision ($5\frac{1}{4}$ i k u and 9 i k u, respectively), while the area of the first is stated to be 49 i k u, at least 15% in excess of the true value (once again, considerably more according to the drawing on the tablet).

These errors become particularly striking when we notice the identity of the persons to whom the fields in question were allotted. The first was held by the chief administrator of the temple, while the third was held by his eldest son and eventual successor. The identity of the holder of the second plot is not known, but the fourth is held by another son of the chief administrator.

The stated possession of the eldest son exceeds that of his younger brother by almost 50%. Their actual possessions seem to have been roughly identical – unless the share of the younger brother is indeed larger. Given the stated difference it is not likely that this equal treatment was intentional. One might assume that the surveyor has believed blindly in his standard formula, and has not made use of that geometrical common sense which is reflected in other Ur III field plans – or that the actual partition of the land has been made without recourse to surveying, the field plan on the tablet being thus a *post festum* reconstruction where adequate numbers have been more or less freely invented which would produce calculated areas corresponding to be intended distribution.

An alternative explanation is that the surveyor-scribe has deceived his superiors deliberately, taking advantage of his monopoly of mathematical knowledge – just as the chief administrator appears to have betrayed the

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[5] The alternative interpretation – that they are practically isosceles, and the one length/width which is stated is thus the identical length of two opposing sides – can be safely dismissed. If such shapes occurred, non-isosceles trapeziums defined by four different sides would certainly also turn up.

[6] RA 4 [1897] 13–27.

[7] RA 12 [1915] 47–54.

[8] Both are reproduced by Liverani, op. cit. 149 f.

[9] 6 NT 777, published and discussed by Richard L. Zettler, ASJ 11 [1989] 305–313.

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temple, allotting land to members of his family with no official position. If this should be the case, we might be confronted with a parallel to the scribe from Alalakh who seems to have inserted his own name in place of that of the king, thus appropriating for himself the divine blessing which was due to his master.[10]

Even in the Bronze Age those who relied upon the service of officials and experts may have realized (or failed at their peril to realize) that *Vertrauen ist gut – Kontrolle ist besser*.

[10] See Nadav Na'aman, OA 19 [1980] 107.