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Communication From Readers

Where is the Median Center?

Comment on Enedy (92:23-27)

Measurements of central tendency are more complex in two-dimensional space than for one-dimensional data. The additional complexity results not only from the second dimension but also from the arrangement of data. These conditions mean that some linear statistics cannot be converted automatically into areal statistics without careful consideration of their properties. It also means that there has been confusion about the definition of the median center.

The author of the article on areal centers states that "the median is the middle item when all items are arranged according to size" (Enedy, 25). This property, however, fails to determine a unique position when items are arranged in two-dimensional space because the division into halves is dependent on the orientation of the divisional lines. In Figure 1, for example, Point B is the "median" when the five points (A, B, C, D, and E) are divided by the pair of orthogonal axes labeled Orientation I. But, if the position of the axes is turned to Orientation II, then an entirely different point—Point C—is the "middle item." This illustration is kept simple to make the demonstration easy to see; but the same indeterminacy of the "median" position applies to any number of points. Because this definition based on finding the middle position is dependent on an arbitrary placement of coordinate axes, "it is of very limited utility in spatial analysis" (Taylor 1977, 30).

Another property (besides dividing ranked data into halves) characterizing a linear median is its minimization of the sum of absolute deviations from itself. Similarly, when this property is applied to *areal* data, it continues to provide an important characteristic: it determines a *single, unique position*. Therefore, the standard definition of the median point for an areal distribution is this minimization point—or "the point of minimum aggregate distance."

Unfortunately, there is no method for deductively calculating the location where the sum of absolute deviations (distances) is the minimum. Instead, the task of finding the median position requires an inductive algorithm that converges on the point where the aggregate distances are minimized. In the accompanying illustration, it is fairly easy to determine that Point B is closer to the median center than Point C, but this does not necessarily determine the true median center (Figure 1 and Table 1). By trial and error, it can be shown that Location M is an even better approximation than either B or C; but more precise measurements might find a position that further minimizes aggregate distances and, thus, be *the* median.

Table 1
Distances Between Points

	B	C	M
A	85	80	84
B	0	62	30
C	62	0	33
D	46	98	65
E	118	80	91
Sum	**311**	**320**	**303**

According to Neft, the weakness of the midpoint definition of the median center was first recognized in 1902. Nevertheless, this misleading procedure for finding the median has continually crept back into print. In his 1966 classic presentation of statistics for areal distributions, Neft stated (1966, 31) that "it is dismaying to read a recent paper by Hart (page 31) in which he says that 'the median point [defined by the old faulty method] is probably the best single index of centrality for a single areal distribution'." Again, this inappropriate definition of the median has been revived by Enedy, who proposed activities that "draw heavily on the work of Hart" (page 23). Given the importance of the geographic concept of centrality, it is regrettable that the definition of this particular central position has not become completely standardized.

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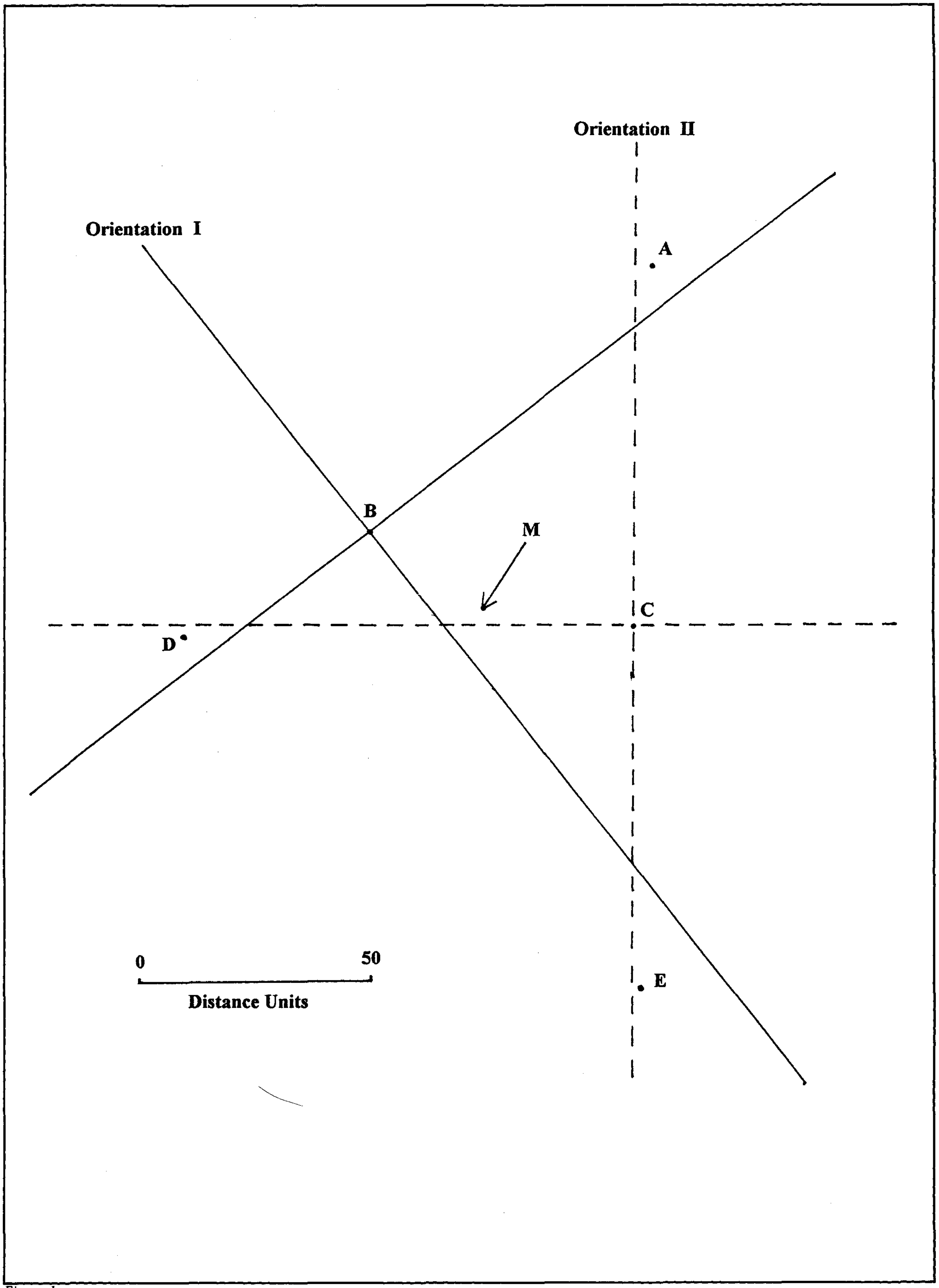

Figure 1.