

## Selection of numbers for magnitude production\*

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Two procedures for the selection of numbers for use in a magnitude production experiment are discussed. The first set of numbers was derived from the numbers used by Ss in magnitude estimation; the second set of numbers, having the same range as the first, was generated in an equal-ratio series. Both sets of numbers yielded the same magnitude production curve.

The method of numerical magnitude balance (Hellman & Zwislocki, 1963) involves the nonnormalized combination of the methods of magnitude estimation and magnitude production (Stevens, 1955, 1956, 1957, 1958). The magnitude estimation procedure requires the S to assign numbers directly to a series of physical magnitudes presented in random sequence. Magnitude production is the inverse of magnitude estimation in which the S adjusts the physical magnitude of the stimulus so that it subjectively corresponds to a series of numbers presented in randomized sequence by the E. This paper deals with the latter procedure only.

The numbers presented by the E for magnitude production can be selected in several ways. Some investigators have used numbers previously established by the Ss themselves during testing by the method of magnitude estimation (Hellman & Zwislocki, 1963; Verrillo, Fraioli, & Smith, 1969). Others have suggested that the numbers should be selected in such a way that equal ratios are preserved throughout their range (Stevens, 1971; Stevens & Guirao, 1962). The current experiments were undertaken to establish empirically whether the method of selecting numbers affects the outcome of the magnitude production procedure in a vibrotactile experiment.

### METHOD AND PROCEDURE

Six Ss were tested using the method of magnitude production. The Ss had previously been participants in a vibrotactile experiment in which numerical magnitude balance curves had been established for a number of different stimulus conditions. Thus, the magnitude production curves for these Ss were available. The curves were based on numbers that had been assigned by the Ss to 10 physical magnitudes during the magnitude estimation phase of the experiment.

The Ss were then retested with a second set of 10 numbers which were generated in a strict ratio of 2.33 so that they covered the same numerical range as the first set. This method of selection (a 2.33 ratio) insured that the range and absolute number of numerals employed in the two sets was equal.

All measurements were made over the thenar eminence of the right hand, using a frequency of 250 Hz, with a 2.9-cm<sup>2</sup>

contactor. Details of the procedures and experimental apparatus have been described elsewhere (Verrillo, Fraioli, & Smith, 1969).

### RESULTS

Figure 1 shows the geometric mean values for the six Ss. The solid circles refer to the vibration magnitudes produced by the Ss in response to numbers obtained from their magnitude estimation results. The Xs reflect the magnitude adjustments made by the Ss when responding to equal ratio numbers. It is evident that there is no appreciable difference between the resultant curves.

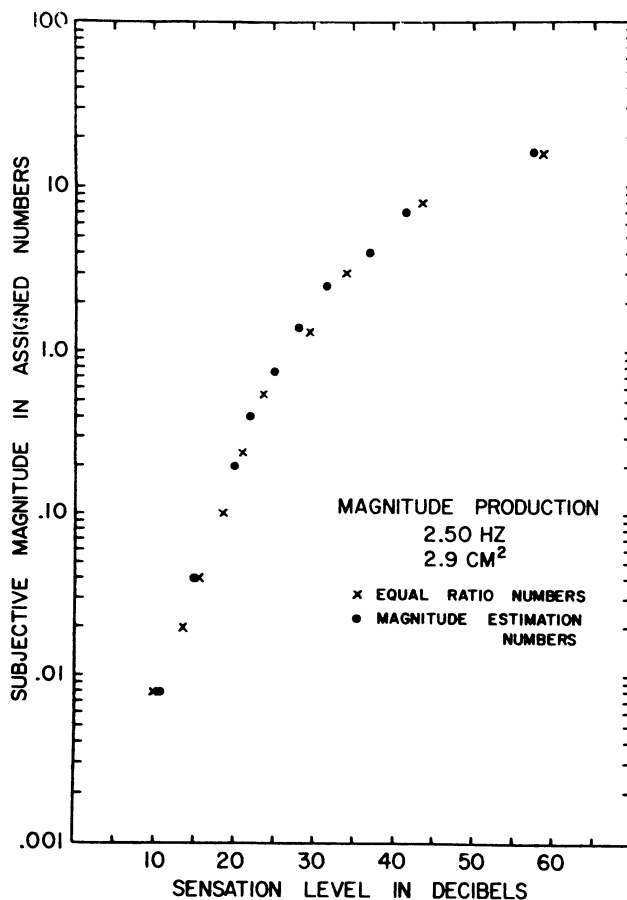


Fig. 1. Results for the magnitude production procedure comparing the use of a set of numbers derived from magnitude estimation with a set generated in an equal-ratio series.

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## DISCUSSION

The data show quite conclusively that identical results for magnitude production may be obtained either by using numbers derived from the procedure of magnitude estimation or by generating a set of equal ratio numbers. The limitation set by this experiment is that both sets of numbers be of equal size and range. It is probable that an extended or restricted range of either of the sets would produce a different result (Poulton, 1968). The effect of altering the size of the set is not known.

It is apparent that, in the use of the numerical magnitude balance procedure, the data for magnitude production may be obtained either by selecting numbers assigned by the Ss when they estimated magnitudes directly or by generating a set of equal ratio numbers.

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