

The Special Problem of Average Heart Rate

The following information was extracted from the 1990 PO-NE-MAH manual.

For all derived parameters, except Heart Rate¹, the *Ponemah* program computes the average values during a logging period by simply summing the beat-by-beat values from all complete cardiac cycles within the logging period and dividing by the number of cycles involved. This is the standard definition of an arithmetic mean. The method works fine except in the special case of "instantaneous" heart rate which is computed from the reciprocal of the time *interval* over which a cardiac cycle occurs. As it turns out, adding up all of the reciprocals from the individual cardiac cycles and dividing by N does not give the same answer as counting the number of beats during the logging period and dividing by time. The latter method is the way heart rate is normally measured in experimental animals or human patients and provides the correct value for "average heart rate". The error disappears when all of the *intervals* in the average are identical but becomes quite large if they vary within the sample. The sinus arrhythmia normally exhibited by a dog in a relaxed state is an example of the latter situation. The consequences of this error in an experiment in which the effects of heart rate on a derived parameter are being evaluated could be substantial.

The Ponemah program has protected investigators from this error in the computation of logged heart rate data by summing all of the individual intervals within a logging period and dividing by N and then computing the reciprocal. Therefore the values for "average heart rate" during a logging period from any of the Ponemah algorithms are actually computed as the reciprocal of the average interval for all of the complete cardiac cycles multiplied by sixty. This is the correct number which will correlate with the number of "beats per minute" counted by the conventional method.

Sarazan, R.D. (1990). PO-NE-MAH Model HD-4 User's Guide and Reference Manual (pp. 4-10 – 4-11).

¹ There are more derived parameters in current versions of Ponemah that calculate harmonic mean versus arithmetic mean