Counting every quantum

B. Sakitt

Abstract

1. Human subjects were asked to rate both blanks and very dim flashes of light under conditions of complete dark adaptation at 7° in the periphery. The ratings used were 0, 1, 2, 3, 4, 5, and 6.

2. For one subject (B.S.) the distributions of ratings were approximately Poisson distributions. The data were consistent with each rating being the actual number of effective quantal absorptions plus the number of noise events. This subject was presumably able to count every rod signal (effective absorptions plus noise).

3. For two other subjects, the data were consistent with the ratings being one less (L.F.) and two less (K.D.) than the number of effective absorptions plus noise. They were able to count every rod signal beginning with 2 and 3 respectively. A fourth subject's erratic data could not be fitted.

4. The fraction of quanta incident at the cornea that resulted in a rod signal was estimated to be about 0·03 which is consistent with physical estimates of effective absorption for that retinal region.

5. A simulated forced choice experiment leads to an absolute threshold about 0·40 log units below the normal yes-no absolute threshold. This and other results indicate that subjects can use the sensory information they receive even when only 1, 2 or 3 quanta are effectively absorbed, depending on the individual. Humans may be able to count every action potential or every discrete burst of action potentials in some critical neurone.