Algorithm 1 Select Effective Time Units

function EFFECTIVESTUSMAP(S, R, T, D, L, s, ρ)
Input: Stimuli S, responses R, times T, delays D, trials L, stimulus s, and threshold ρ
Output: Map of effective STUs B
  for all $t \in T$ **do**
    for all $d \in D$ **do**
      $I \leftarrow \emptyset$ ▷ Trials when stimulus s is presented
      $I' \leftarrow \emptyset$ ▷ $L \setminus I$
      for all $l \in L$ **do**
        if $S_{t-d}^{(l)} = s$ **then**
          $I \leftarrow I \cup \{l\}$
        else
          $I' \leftarrow I' \cup \{l\}$
        end if
      end for
      $P_{t,d} \leftarrow$ SENSITIVITYINDEX(I, I', Y, t)
      if $P_{t,d} \geq \rho$ **then**
        $B_{t,d} \leftarrow 1$
      else
        $B_{t,d} \leftarrow 0$
      end if
    end for
  end for
  $B \leftarrow$ DOWNSAMPLE($B, 7$)
  return B
end function

Algorithm 3 Spike Count

function SPIKECOUNT(L, R, t)
Input: Trials L, Responses R, Time t
Output: Number of spikes r
  $r \leftarrow 0$
  for all $l \in L$ **do**
    if $R_t^{(l)} > 0$ **then**
      $r \leftarrow r + 1$
    end if
  end for
  return r
end function

Algorithm 2 Sensitivity Index
Two-proportion z-test, pooled for $H_0 : p_1 = p_2$

function SENSITIVITYINDEX(I, I', R, t)
Input: Set of trials when target stimulus is presented I, and when it is not I', responses R, and time t
Output: Sensitivity value s
  $r_1 \leftarrow$ SPIKECOUNT(I, R, t)
  $r_2 \leftarrow$ SPIKECOUNT(I', R, t)
  $n_1 \leftarrow |I|$
  $n_2 \leftarrow |I'|$
  $\hat{p}_1 \leftarrow \frac{r_1}{n_1}$
  $\hat{p}_2 \leftarrow \frac{r_2}{n_2}$
  $\hat{p} \leftarrow \frac{r_1 + r_2}{n_1 + n_2}$
  $z \leftarrow \frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\hat{p}(1-\hat{p})(\frac{1}{n_1} + \frac{1}{n_2})}}$
  $s \leftarrow \Phi(z) - \Phi(-z)$
  return s
end function

Algorithm 4 Downsampling

function DOWNSAMPLE(B, s)
Input: Binary matrix B, downsampling scaling factor s
Output: Scaled down binary matrix B'
  $m, n \leftarrow$ Size of matrix B ▷ $B \in \{0,1\}^{m \times n}$
  for $i = 1$ **to** $\lfloor \frac{m}{s} \rfloor$ **do**
    for $j = 1$ **to** $\lfloor \frac{n}{s} \rfloor$ **do**
      $v \leftarrow \frac{1}{s^2} \sum_{x=0}^{s-1} \sum_{y=0}^{s-1} B_{i+x,j+y}$
      if $v \geq \frac{1}{2}$ **then**
        $B'_{i,j} \leftarrow 1$
      else
        $B'_{i,j} \leftarrow 0$
      end if
    end for
  end for
  return B'
end function