Physiological neuron parameters.

The purpose of the presented model architecture is to capture dynamics and adaptation of the system states to yield insights on neural circuitry and functionality. However, to present the model in a physiologically more realistic setting and to provide testable neurophysiological parameter values, we modified Eq. (1) and Eq. (6) by incorporating membrane capacitance $C$ and leak reversal potential $E_l$. The core equations read

$$\frac{1}{\tau} \cdot C \cdot \frac{dV_r}{dt} = g_l \cdot (E_l - V_r) + (\beta - V_r) \sum_{\omega'} s_{\omega'}^{I} \Lambda_{\omega'\omega}^{E-E} - (\gamma - \kappa \cdot (E_l - V_r)) \cdot \sum_{\omega'} g_{\omega'} \cdot \Lambda_{\omega'\omega}^{E-E}$$

for LSO neurons and

$$\frac{1}{\tau} \cdot C \cdot \frac{dV_q}{dt} = g_l \cdot (E_l - V_q) + (\beta - V_q) \sum_{\omega'} s_{\omega'}^{I} \Lambda_{\omega'\omega}^{E-E}$$

for MNTB neurons, respectively. Here, $\tau$ is the membrane time constant and $V_r$ and $V_q$ the membrane voltage of LSO and MNBT model neurons, respectively. With these equations, physiological neuron parameters are derived. Values for these parameters are chosen according to neurophysiological experiments [1, 2, 3] and are in line with other models of LSO neurons (see [4]). Parameter $\gamma_r$ and $\kappa_r$ are chosen to fit default responses shown in Fig. 2:

<table>
<thead>
<tr>
<th>Neuron Model</th>
<th>$\tau$</th>
<th>$g_l$</th>
<th>$g_t$</th>
<th>$E_l$</th>
<th>$C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSO</td>
<td>0.25 ms</td>
<td></td>
<td>26.4 nS</td>
<td>-60 mV</td>
<td>24 pF</td>
</tr>
<tr>
<td>MNTB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Applying these model equations we repeat experiment 1 and demonstrate that the response behavior is similar to our model notation (see S5 Fig B). Model inputs are now in range $0 - 500pA$ (see S5 Fig A). Influence of parameter values $\gamma_r$ and $\kappa_r$ (see S5 Fig C,D) are similar to our model notation.

References

