$$P\left(s_i \middle| \mathbf{s}_{-i}, \mathbf{y}\right) \propto$$

$$\prod_{\ell} P\left(y_i^{\ell} \middle| s_i, \mathbf{s}_{-i}, \mathbf{y}_{-(\ell,i)}\right) \cdot \begin{cases} \frac{1}{k+\alpha} count(s_i, \mathbf{s}_{-i}) & \text{if } s_i \in \mathbf{s}_{-i} \\ \frac{\alpha}{k+\alpha} & \text{otherwise} \end{cases}$$