

$$\begin{aligned}
\Pr(\mathbf{s}, \mathbf{D} \mid \mathbf{r}) &= \prod_{c=1}^C \Pr(\mathbf{s}_c, \mathbf{D}_c \mid r_c) \\
&= \prod_{c=1}^C \left[ \pi_{s_{c1}} \prod_{b \in \mathcal{I}} P_{s_c \psi(b) s_c \phi(b)}^{(r_c)}(t_b) \right. \\
&\quad \left. \times \prod_{b \in \mathcal{E}} P_{s_c \psi(b) D_c \phi(b)}^{(r_c)}(t_b) \right]
\end{aligned}$$