

The  $Q$ -function is then

$$Q(\theta|\theta') = \mathbb{E}[\log \mathbb{P}(\mathbf{O}, \mathbf{X}, \mathbf{C}, \mathbf{G}|\theta, \psi, \mathbf{Z}|\theta')] \quad (1)$$

$$= \sum_{\mathbf{Z}, \mathbf{X}, \mathbf{C}, \mathbf{G}} [\log \mathbb{P}(\mathbf{O}, \mathbf{X}, \mathbf{C}, \mathbf{G}|\theta) \mathbb{P}(\mathbf{G}, \mathbf{C}, \mathbf{X}|\theta')] \quad (2)$$