

$$p(X_{t+1} = \text{colored} \mid X_t = \text{blank}, U_{t+1} = \text{paint}) = 0,9$$

$$p(z_t = \text{colored} \mid X_t = \text{blank}) = 0,2$$

$$p(z_t = \text{colored} \mid X_t = \text{colored}) = 0,7$$

$$p(X_{t+1} = \text{blank} \mid X_t = \text{blank}, U_{t+1} = \text{paint}) = ?$$

$$S = \{ \text{colored}, \text{blank} \} \quad A = \{ \text{paint}, \text{nothing} \}$$

$$\mathcal{U} = \{ \text{colored}, \text{blank} \}$$

$$p(X_0 = \text{blank}) = 0,5 = \text{bel}(X_0 = \text{blank})$$

$$p(X_0 = \text{colored}) = 0,5 = \text{bel}(X_0 = \text{colored})$$

$$\overline{\text{bel}}(X_1 = \text{blank}) = \sum_{X_0 \in S} p(X_1 = \text{blank} \mid X_0, U_1 = \text{paint}) \cdot \text{bel}(X_0)$$

$$= p(X_1 = \text{blank} \mid X_0 = \text{blank}, U_1 = \text{paint}) \cdot \text{bel}(X_0 = \text{blank})$$

$$= 0,5 p(X_1 = \text{blank} \mid X_0 = \text{blank}, U_1 = \text{paint})$$

$\hookrightarrow p(X_{t+1} = \text{blank} \mid X_t = \text{colored}, U_{t+1} = \text{paint}) = 0$ because there is no way to make a colored object blank again

$$p(X_{t+1} = \text{colored} \mid X_t = \text{colored}, U_{t+1} = \text{paint}) = 1$$

$$p(X_{t+1} = \text{blank} \mid X_t = \text{colored}, U_{t+1} = \text{paint}) = 0$$

$$p(z_t = \text{blank} \mid X_t = \text{blank}) = 1 - p(z_t = \text{colored} \mid X_t = \text{blank}) = 0,8$$

$$p(z_t = \text{blank} \mid X_t = \text{colored}) = 1 - p(z_t = \text{colored} \mid X_t = \text{colored}) = 0,3$$

$$\overline{\text{bel}}(X_1 = \text{colored}) = p(X_1 = \text{colored} \mid X_0 = \text{blank}, U_1 = \text{paint}) \cdot \text{bel}(X_0 = \text{blank})$$

$$+ p(X_1 = \text{colored} \mid X_0 = \text{colored}, U_1 = \text{paint}) \cdot \text{bel}(X_0 = \text{colored})$$

$$= 0,9 \cdot 0,5 + 1 \cdot 0,5$$

$$= 0,95$$

$$p(X_{t+1} = \text{blank} \mid X_t = \text{blank}, U_t = \text{paint}) = 0,1$$

$$\overline{\text{bel}}(X_1 = \text{blank}) = 0,05$$

②

$$\text{bel}(x_1) = \eta \cdot p(z_1 = \text{blank} \mid x_1) \cdot \bar{\text{bel}}(x_1)$$

$$\text{bel}(x_1 = \text{blank}) = \eta \cdot 0,8 \cdot 0,05 = \eta \cdot 0,04$$

$$\text{bel}(x_1 = \text{colored}) = \eta \cdot 0,3 \cdot 0,95 = \eta \cdot 0,285$$

=> irrelevant, after pairing robot always senses colored!

$$\text{bel}(x_1) = \eta \cdot p(z_1 = \text{colored} \mid x_1) \cdot \bar{\text{bel}}(x_1)$$

$$\text{bel}(x_1 = \text{blank}) = \eta \cdot 0,2 \cdot 0,05 = \eta \cdot 0,01$$

$$\text{bel}(x_1 = \text{colored}) = \eta \cdot 0,7 \cdot 0,95 = \eta \cdot 0,665$$

$$\eta = \frac{1}{0,01 + 0,665} = 1,481$$

$$\text{bel}(x_1 = \text{blank}) = 0,01481$$

$$\text{bel}(x_1 = \text{colored}) = 0,9852$$