

Decomposition of \bar{y}_j^2 for repeated observations:

$$\text{var}(y_{ij}) = \underbrace{\text{var}(u_i) + \text{var}(p_i)}_{\text{constant across all observations for animal } i} + \text{var}(e_{ij})$$

□ Repeatability t : Tells us the ratio of variance components that are permanent compared to the total variance of all observations

$$t = \frac{\text{var}(u_i) + \text{var}(p_i)}{\text{var}(y_{ij})} \Rightarrow \underline{\text{var}(u_i) + \text{var}(p_i) = t \cdot \bar{y}_j^2}$$

$$1-t = \frac{\text{var}(y_{ij})}{\text{var}(y_{ij})} - \frac{\text{var}(u_i) + \text{var}(p_i)}{\text{var}(y_{ij})}$$

$$= \frac{\text{var}(y_{ij}) - \text{var}(u_i) - \text{var}(p_i)}{\text{var}(y_{ij})} = \frac{\text{var}(e_{ij})}{\text{var}(y_{ij})}$$

\Downarrow

$$\underline{\text{var}(e_{ij}) = (1-t)\bar{y}_j^2}$$