

# What if $P(\theta_B) \neq 0.5$ ?

$$p(d|\Lambda) = p(\text{"text"}|\Lambda) p(\text{"the"}|\Lambda)$$

$$= [(1-P(\theta_B)) * p(\text{"text"}|\theta_d) + P(\theta_B) * 0.1] \times [(1-P(\theta_B)) * p(\text{"the"}|\theta_d) + P(\theta_B) * 0.9]$$

$$(1-P(\theta_B)) * p(\text{"text"}|\theta_d) + P(\theta_B) * 0.1 = (1-P(\theta_B)) * p(\text{"the"}|\theta_d) + P(\theta_B) * 0.9$$

$$\rightarrow (1-P(\theta_B)) * p(\text{"text"}|\theta_d) + P(\theta_B) * 0.1 = (1-P(\theta_B)) * [1 - p(\text{"test"}|\theta_d)] + P(\theta_B) * 0.9$$

$$\rightarrow 2(1-P(\theta_B)) * p(\text{"text"}|\theta_d) = 1 - (1-0.9) * P(\theta_B) - P(\theta_B) * 0.1 = 1 - 0.1 * P(\theta_B) * 2$$

$$\rightarrow p(\text{"text"}|\theta_d) = \frac{0.5 - 0.1 * p(\theta_B)}{1 - p(\theta_B)} = \frac{0.4}{1 - p(\theta_B)} + 0.1$$

larger  $P(\theta_B) \rightarrow$  larger  $p(\text{"text"}|\theta_d)$ , lower  $p(\text{"the"}|\theta_d)$