elicitation

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binomial distribution

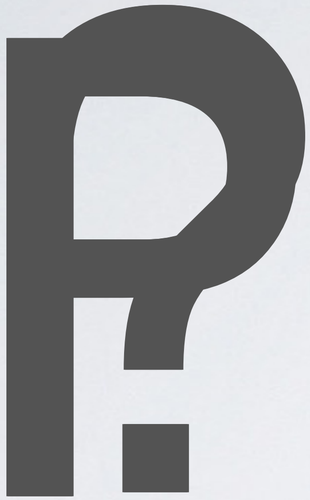
you know n but not p

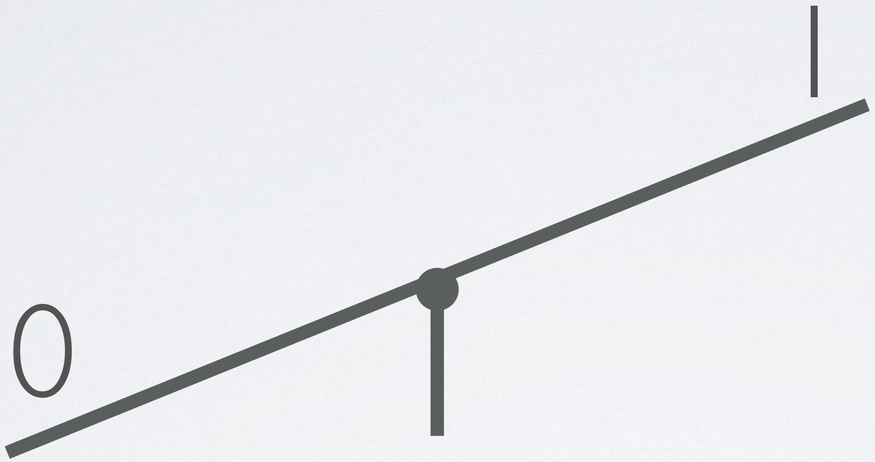
normal distribution

you know neither μ nor σ

personal probabilities

- incorporate everything the Bayesian knows or believes
- must obey **all laws of probability**
- be consistent with all of Bayesian's **knowledge**





toothpaste by Nhung Tang from the Noun Project

personal probability

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uniform distribution

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pdf = flat

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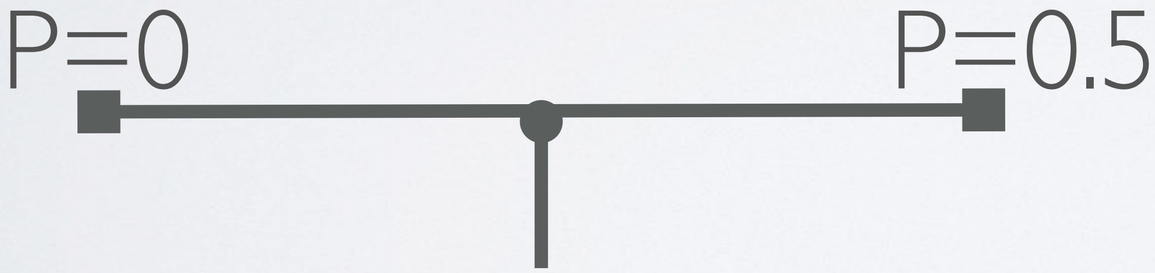
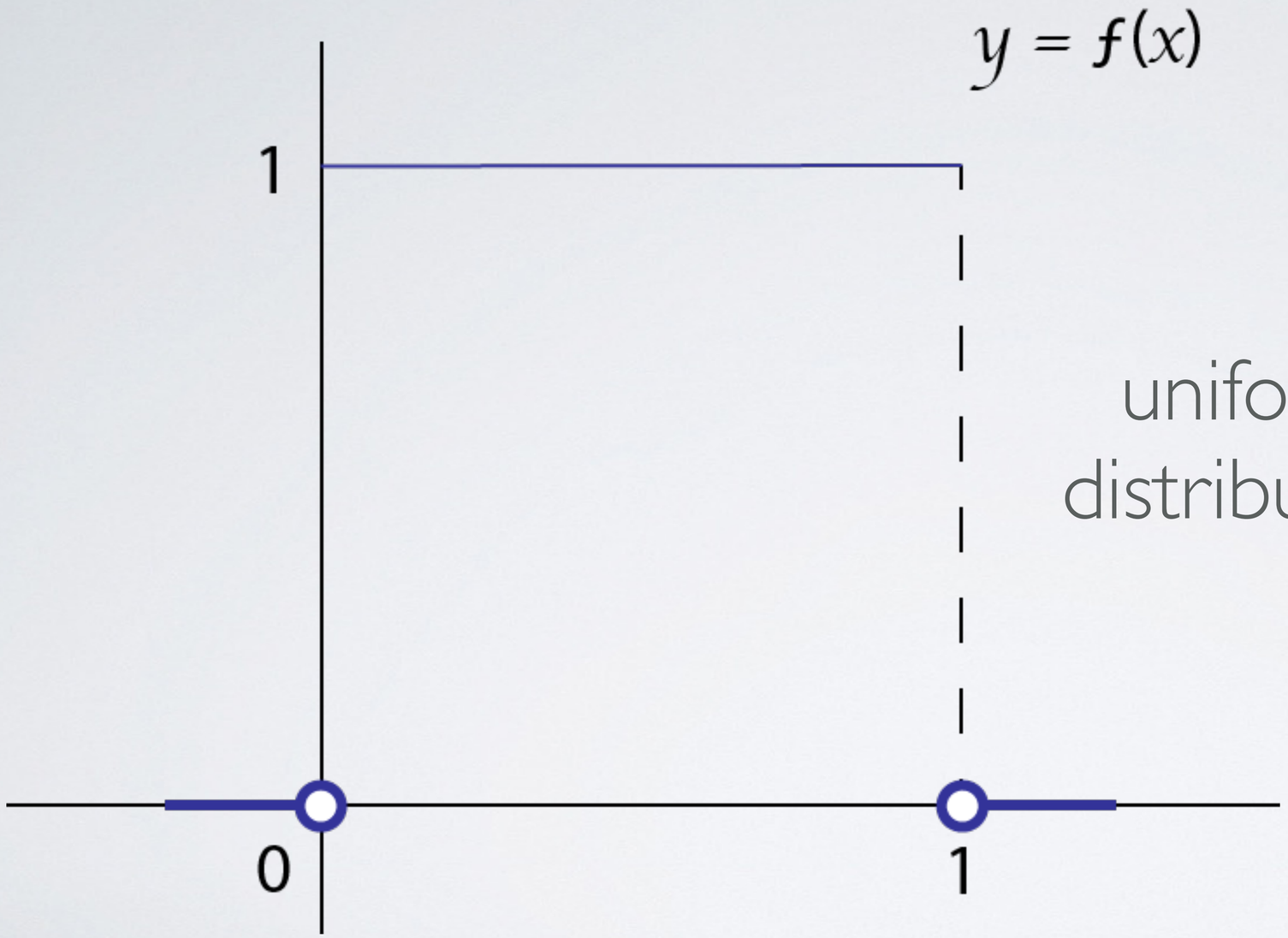

P=0
P=0.5

beta family

- the pdf of a beta distribution is specified by two parameters, α and β

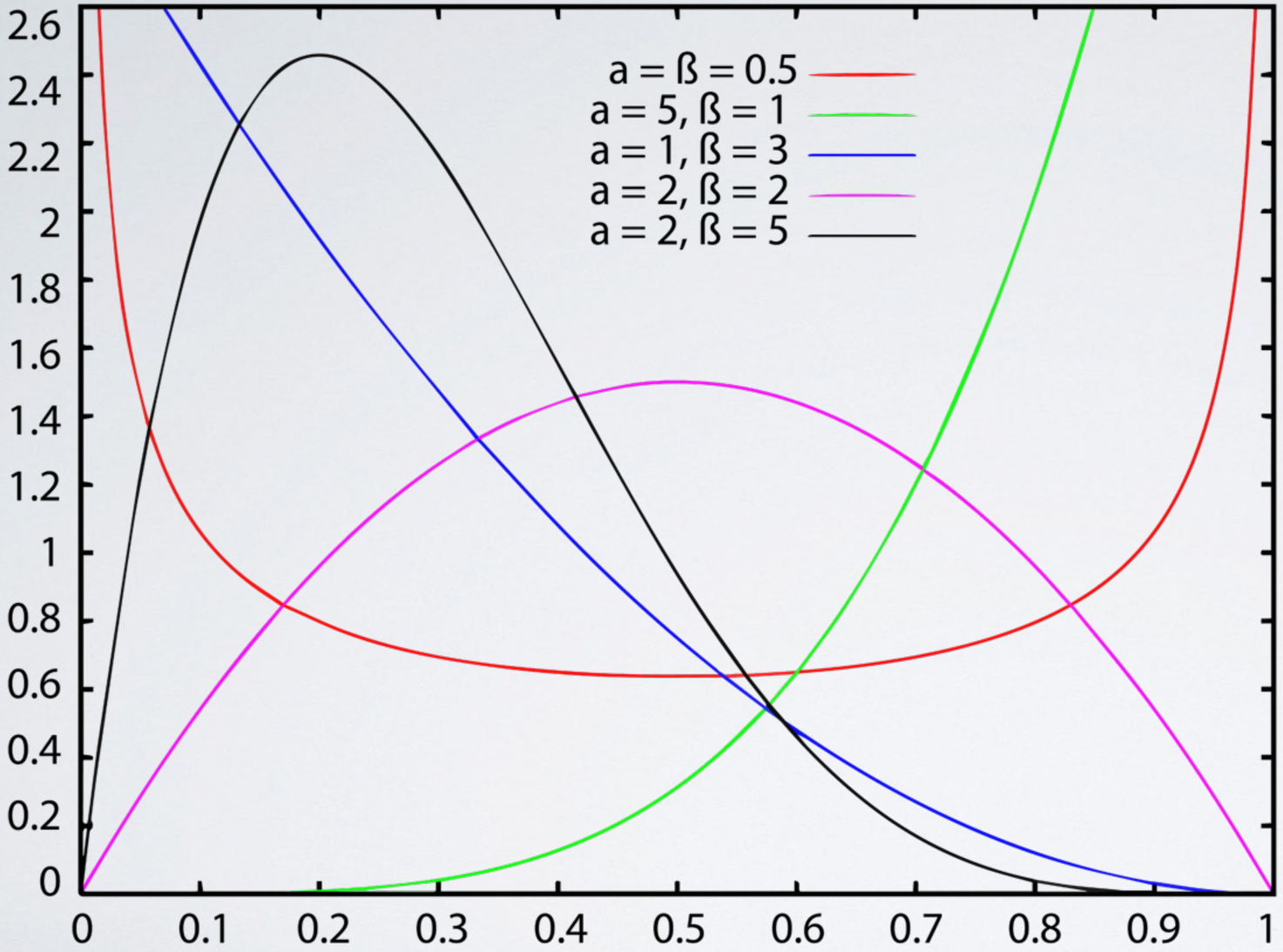
$$f(p) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} p^{\alpha-1}(1-p)^{\beta-1}$$

- where $0 \leq p \leq 1$, $\alpha > 0$, $\beta > 0$, and $\Gamma(n) = (n\text{-}1)\text{x}(n\text{-}2)\ \text{x}\ldots\text{x}1$



uniform
distribution

beta family


a = ß = 0.5
a = 5, ß = 1
a = 1, ß = 3
a = 2, ß = 2
a = 2, ß = 5
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Bayes' rule

prior $\Rightarrow$ posterior

binomial data

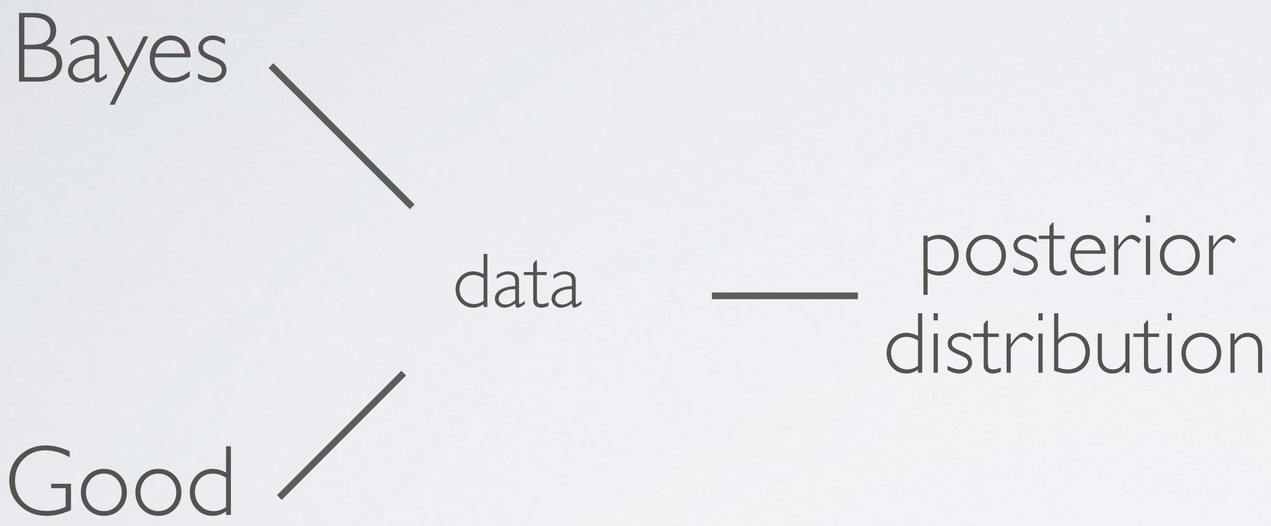
Bayes' rule

beliefs about p

opinion about p

rational

coherent


Bayes
Good
data
posterior
distribution

summary

1. Bayesians express uncertainty through **probability distributions**
2. one can self-elicit a probability distribution that reflects your **personal probability**
3. personal probability should change as **new data** are observed
4. the **beta family** of distributions can flexibly express many possible beliefs about p