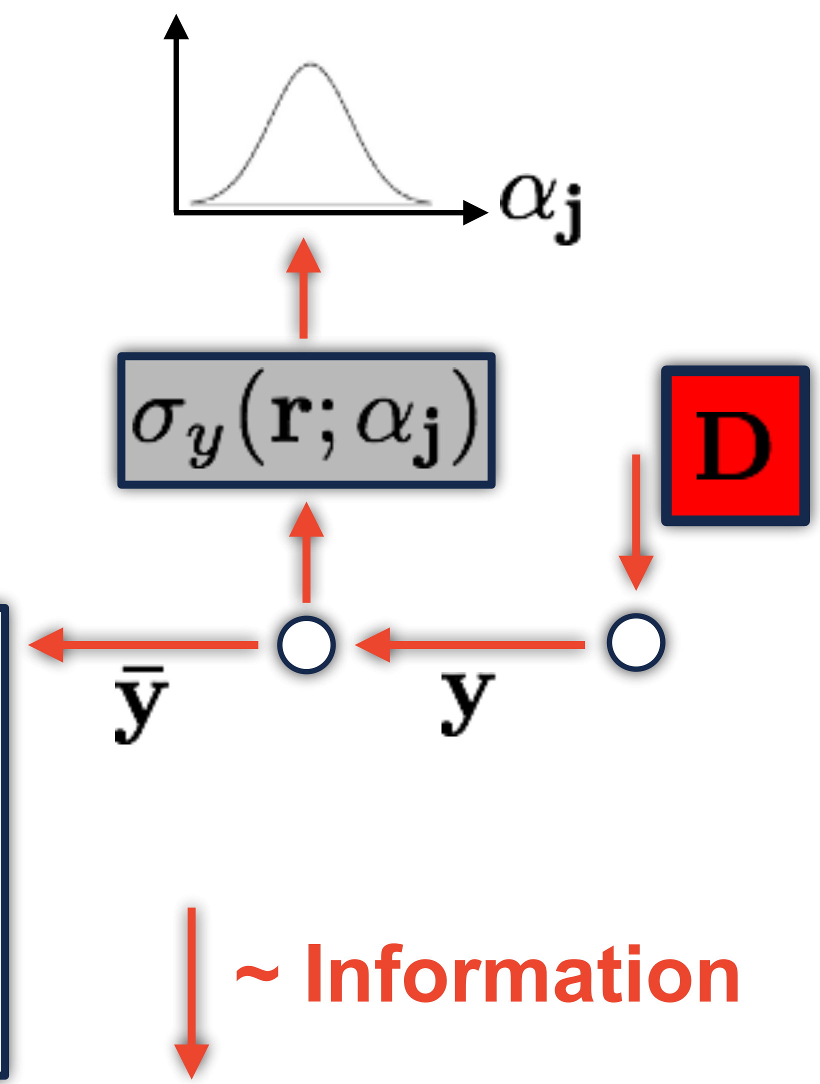
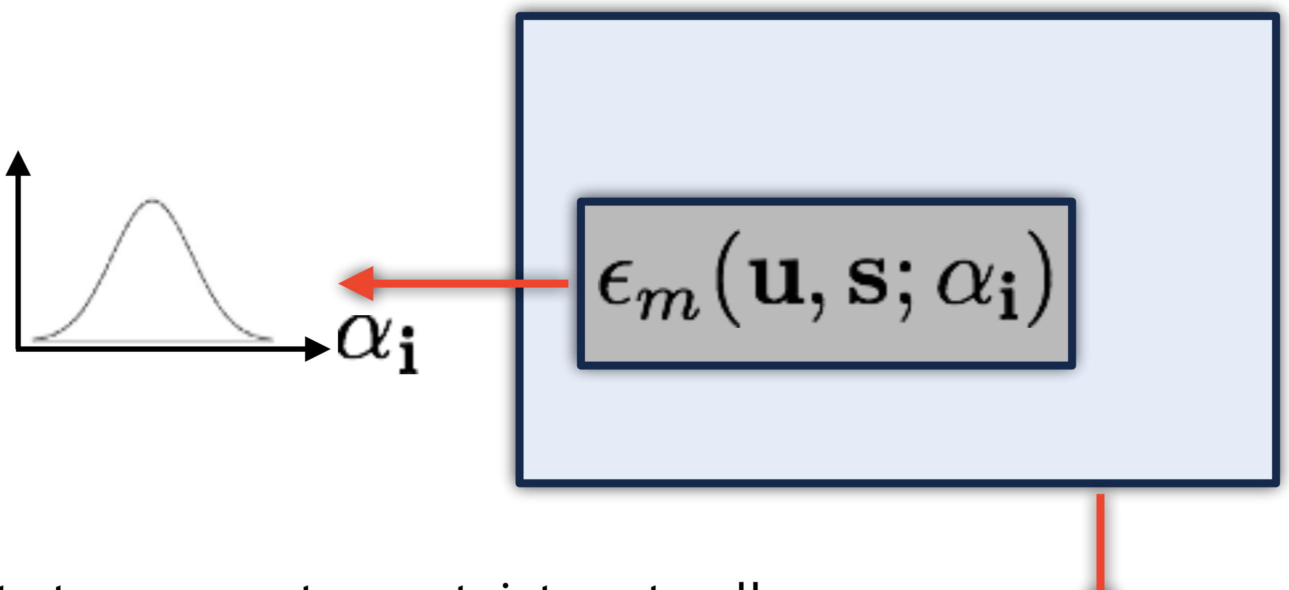
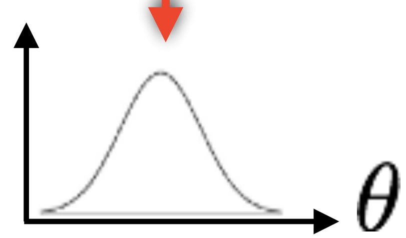
# Last Class …

- **Calibration or Inverse Problem**
- **Validation**
- **Predictive Assessment**

The model is **informed by data.** Parameter values and their uncertainties are inferred from available observations by **solving an inverse problem.**




The use of probability to represent uncertainty naturally leads to the formulation of the calibration problem as Bayesian (**Bayesian Inference**):

Posterior — Likelihood — Prior

$$\underbrace{p(\theta,\alpha|\mathbf{D},\mathcal{M})}_{\text{Posterior}} = \frac{\overbrace{\mathcal{L}(\theta,\alpha;\mathbf{D},\mathcal{M})}^{\text{Likelihood}}\ \overbrace{\mathbf{p}(\theta,\alpha|\mathcal{M})}^{\text{Prior}}}{\int \mathcal{L}(\theta,\alpha;\mathbf{D},\mathcal{M})\ \mathbf{p}(\theta,\alpha|\mathcal{M})\ \mathbf{d}\theta\mathbf{d}\alpha}$$

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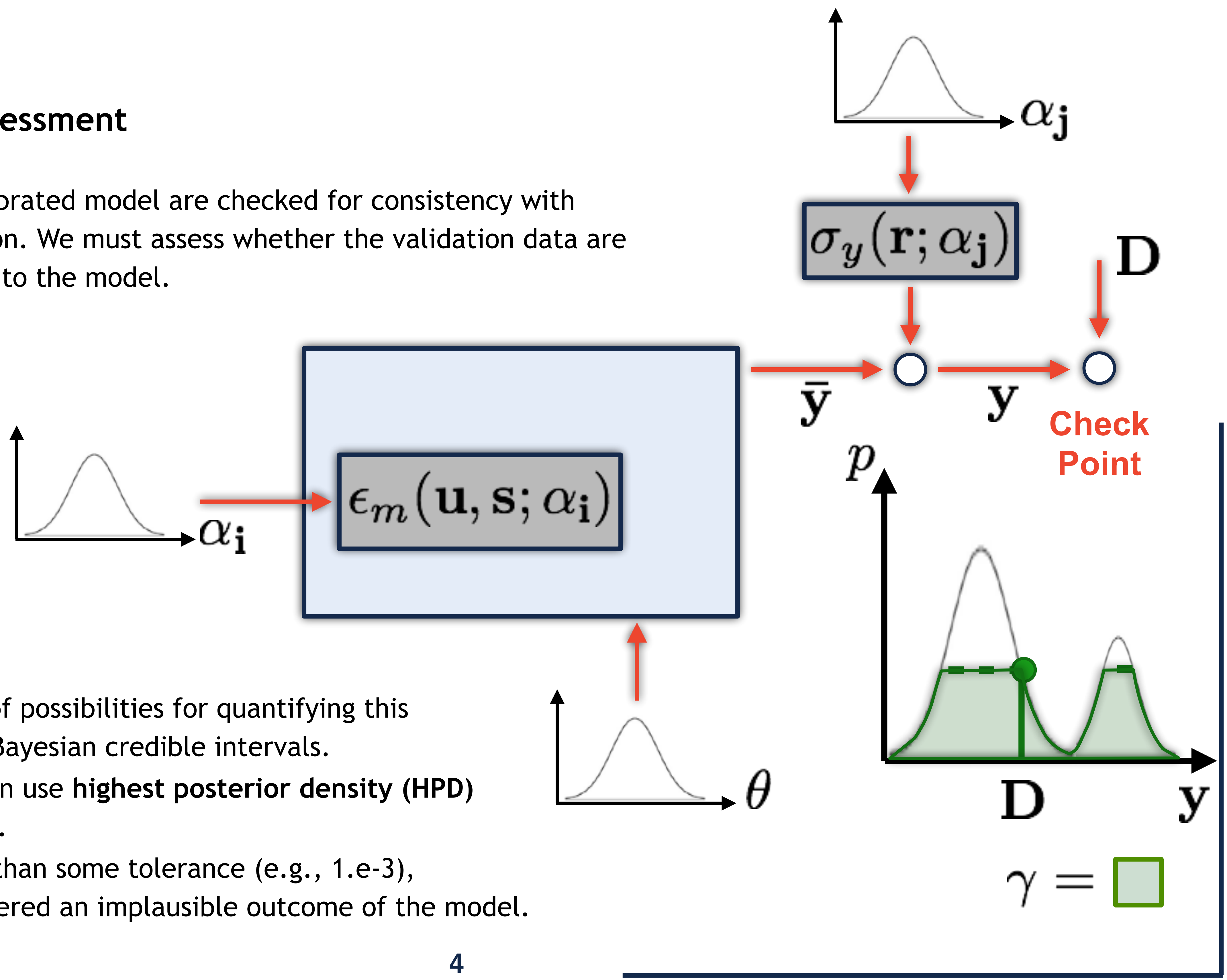
Outputs from a calibrated model are checked for consistency with available observation. We must assess whether the validation data are plausible according to the model.




There are number of possibilities for quantifying this plausibility, as the Bayesian credible intervals.

For example, we can use **highest posterior density (HPD)** credibility intervals.

When $\gamma$ is smaller than some tolerance (e.g., 1.e-3), the data are considered an implausible outcome of the model.