



U.S. Department
of Veterans Affairs



WENTWORTH
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Programming Weakly Informative Prior Distributions in SAS

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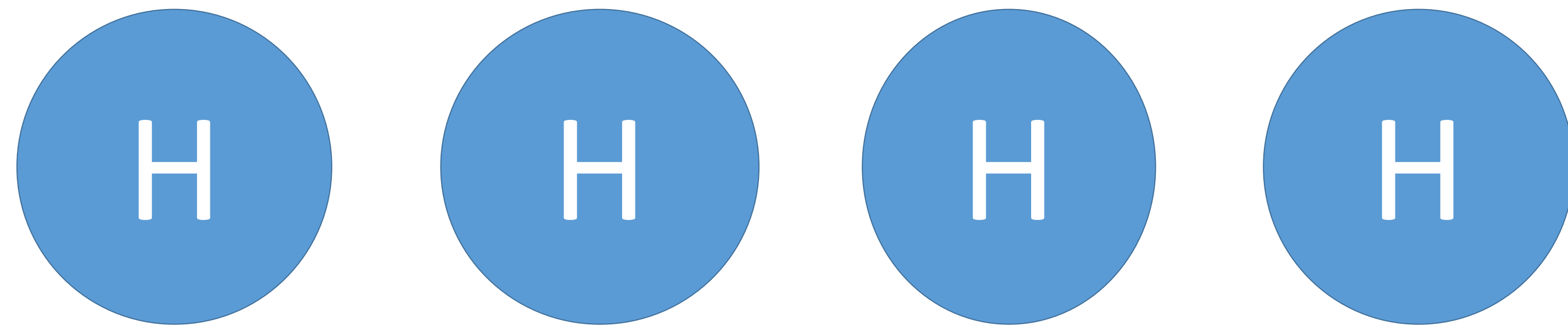
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The process

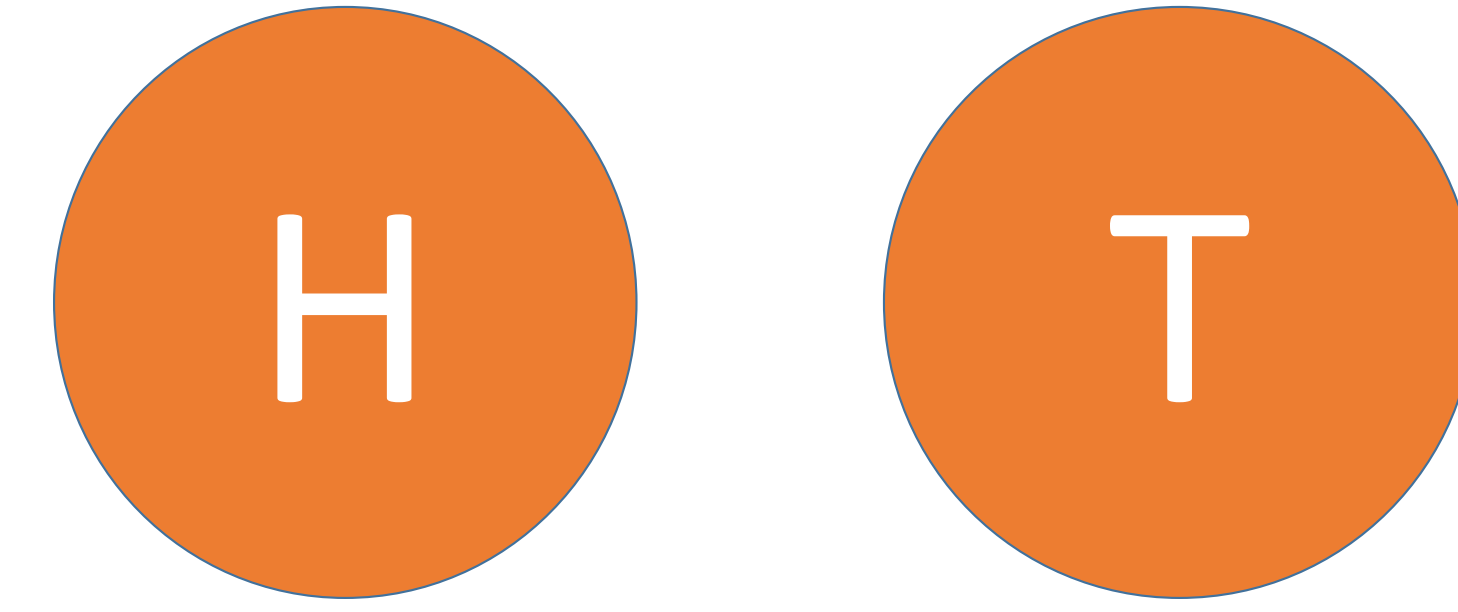
- The GUI elicits prior beliefs and converts them into a prior distribution.
- SAS pools the prior with real data to obtain a posterior distribution.
- SAS checks that the result was obtained in a careful and conservative way.

How Bayes theorem pools data

- Hard data: flip a coin and get 4 heads and no tails in 4 tosses.
- Do we believe $P(\text{heads}) = 4/4 = 1$? NO – $P(\text{heads}) \sim \frac{1}{2}$..
- **Pretend** you flipped the coin twice and gotten 1 head and 1 tail.
- Pool the data: $4+1 = 5$ heads and 1 tail, so that $P(\text{heads}) = 5/6$.

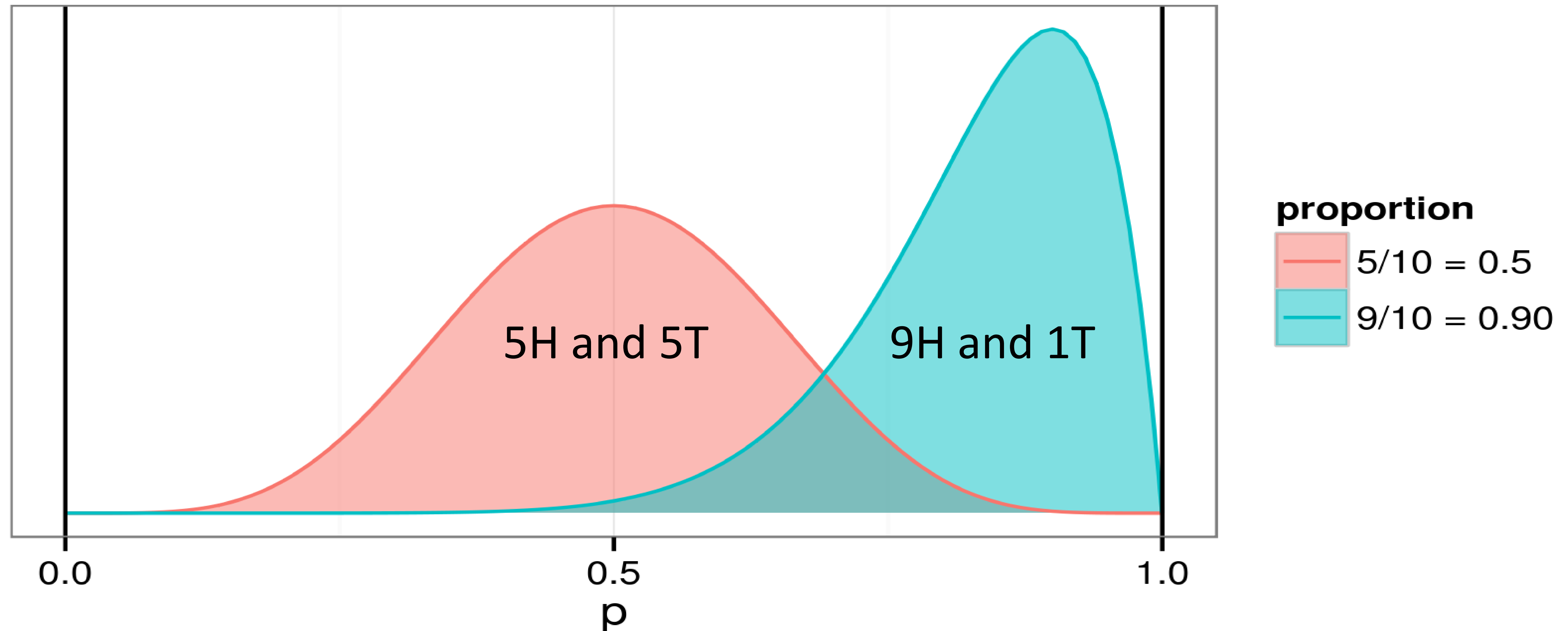


Hard data about the coin



Pretend data

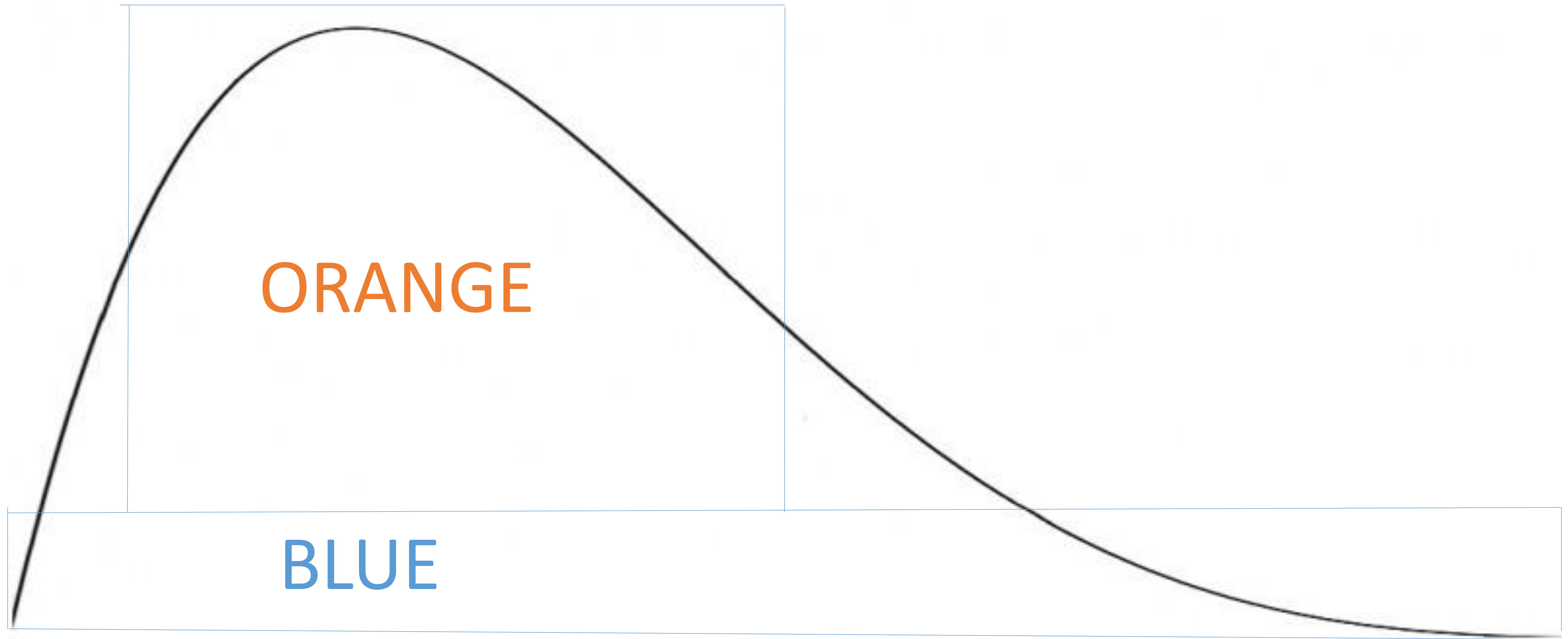
Display strength of belief as a distribution.



Pink: strong belief that $P(\text{Heads})$ is near to 0.5

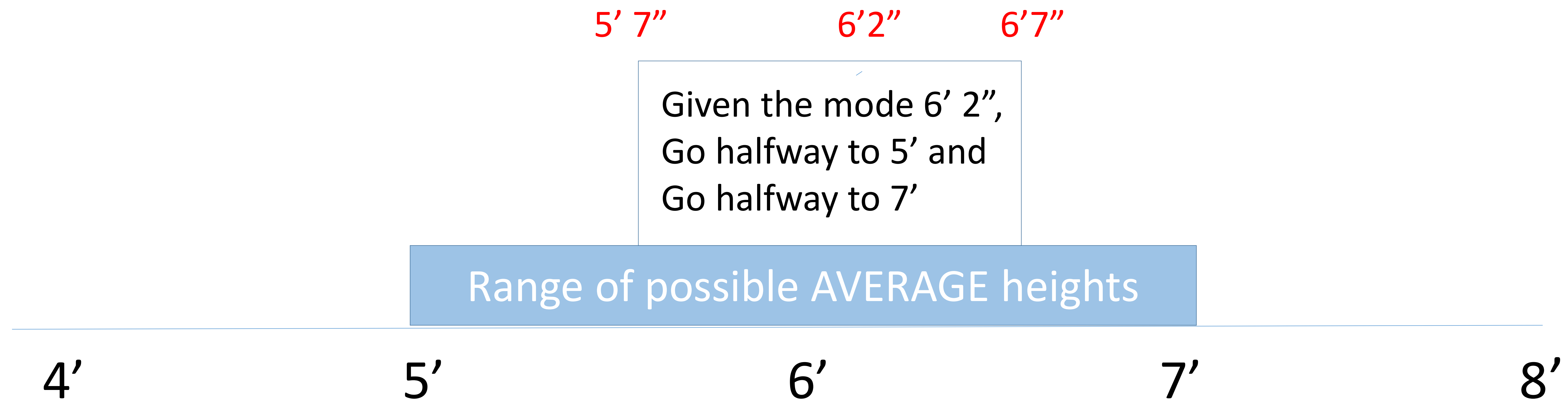
Blue: strong belief that $P(\text{Heads})$ is near to 0.9

Approximate smooth curve with rectangles



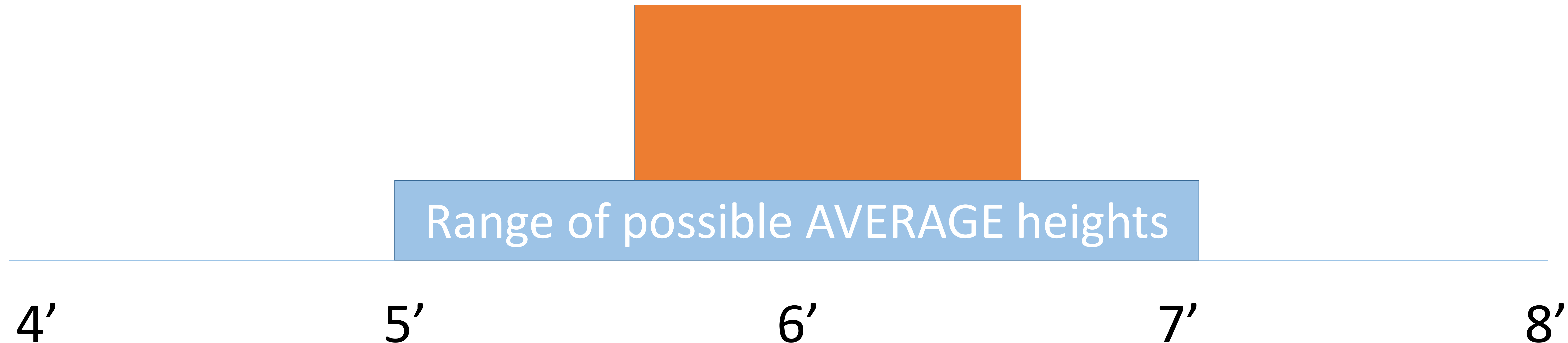
Visual elicitation of beliefs about the average height of Cro-Magnon man.

- *Most likely average* height of Cro-Magnon men is 6' 2".



- Lower bound is **halfway** between 6' 2" and 5': 67 inches = 5' 7"
- Upper bound is **halfway** between 6' 2" and 7': 79 inches = 6' 7"

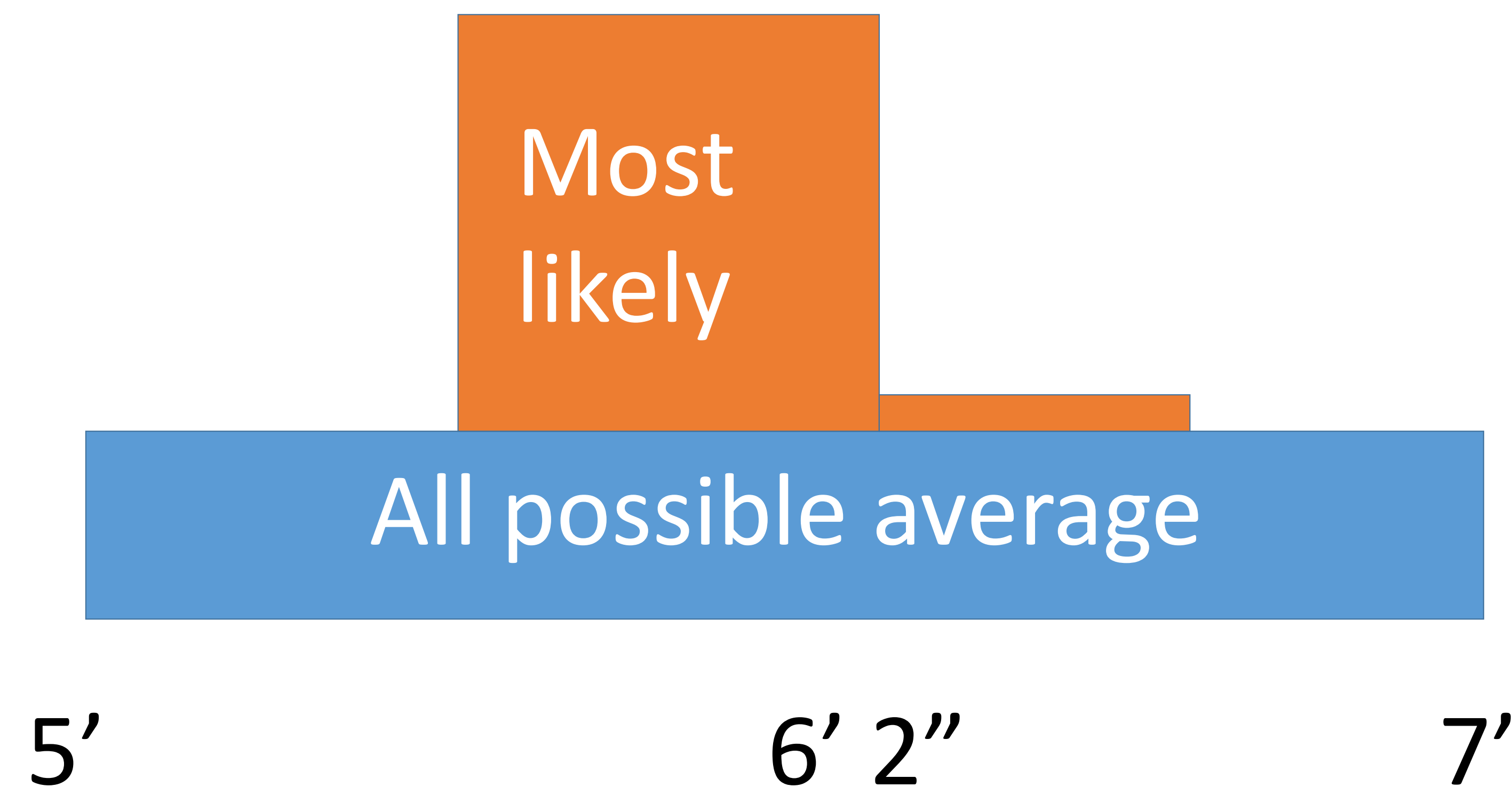
The GUI raises or lowers, **H**, the height of the orange rectangle. This shows strength of belief.



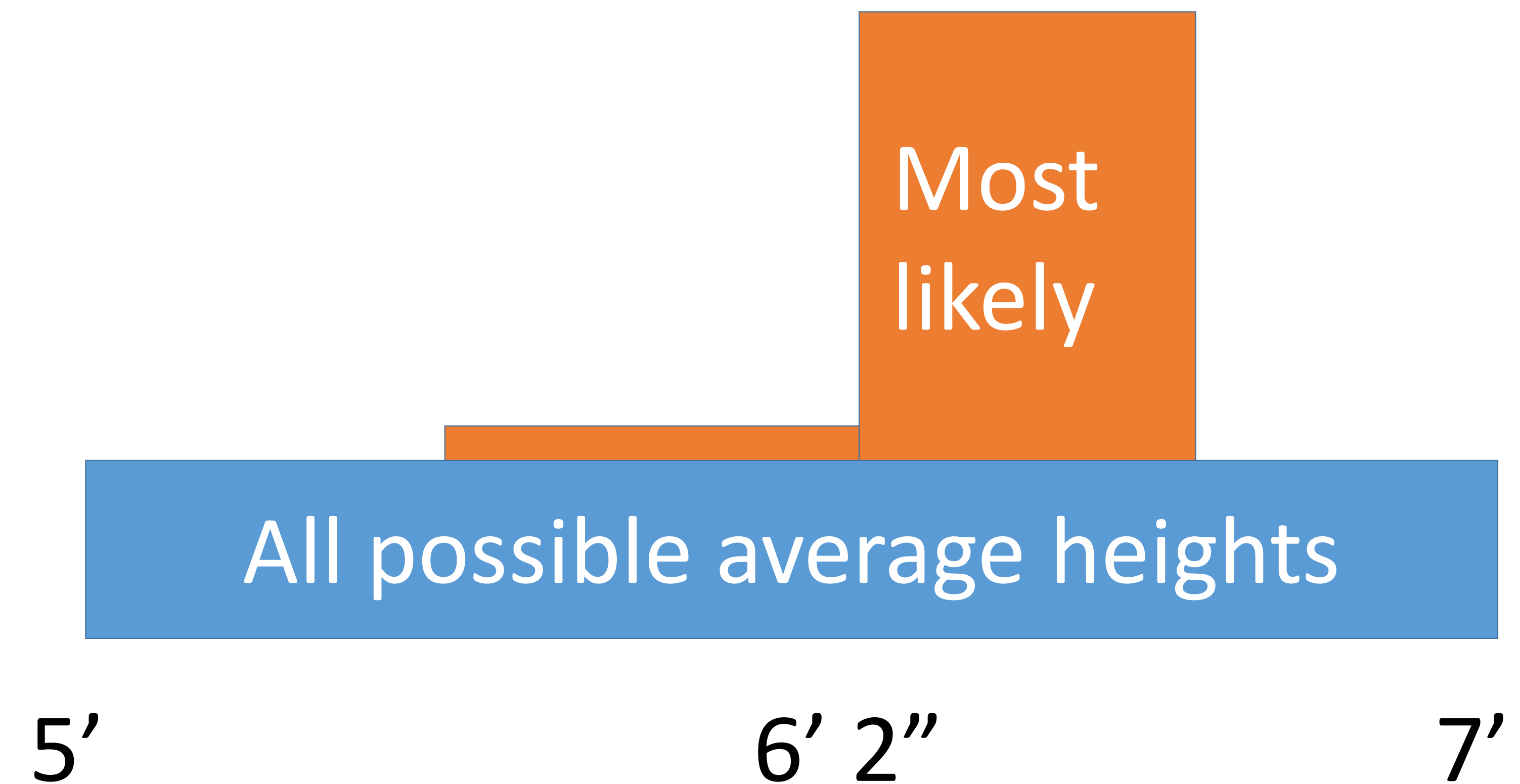
We call this image a **PLATFORM PRIOR**;
the blue platform supports the orange rectangle

Extremes with the same range and mode

Mode is 6' 2" but smaller average.
Cro-Magnon man was small.



Mode is 6' 2" but larger average.
Cro-Magnon man was huge.



Robustness of platform prior

- The platform prior and the two shifted extreme priors:
- Platform mean centered: 74.8"
- Platform pushed left : 74.1"
- Platform pushed right : 75.4"
- The choice is robust because the prior mean and sample mean are so close.