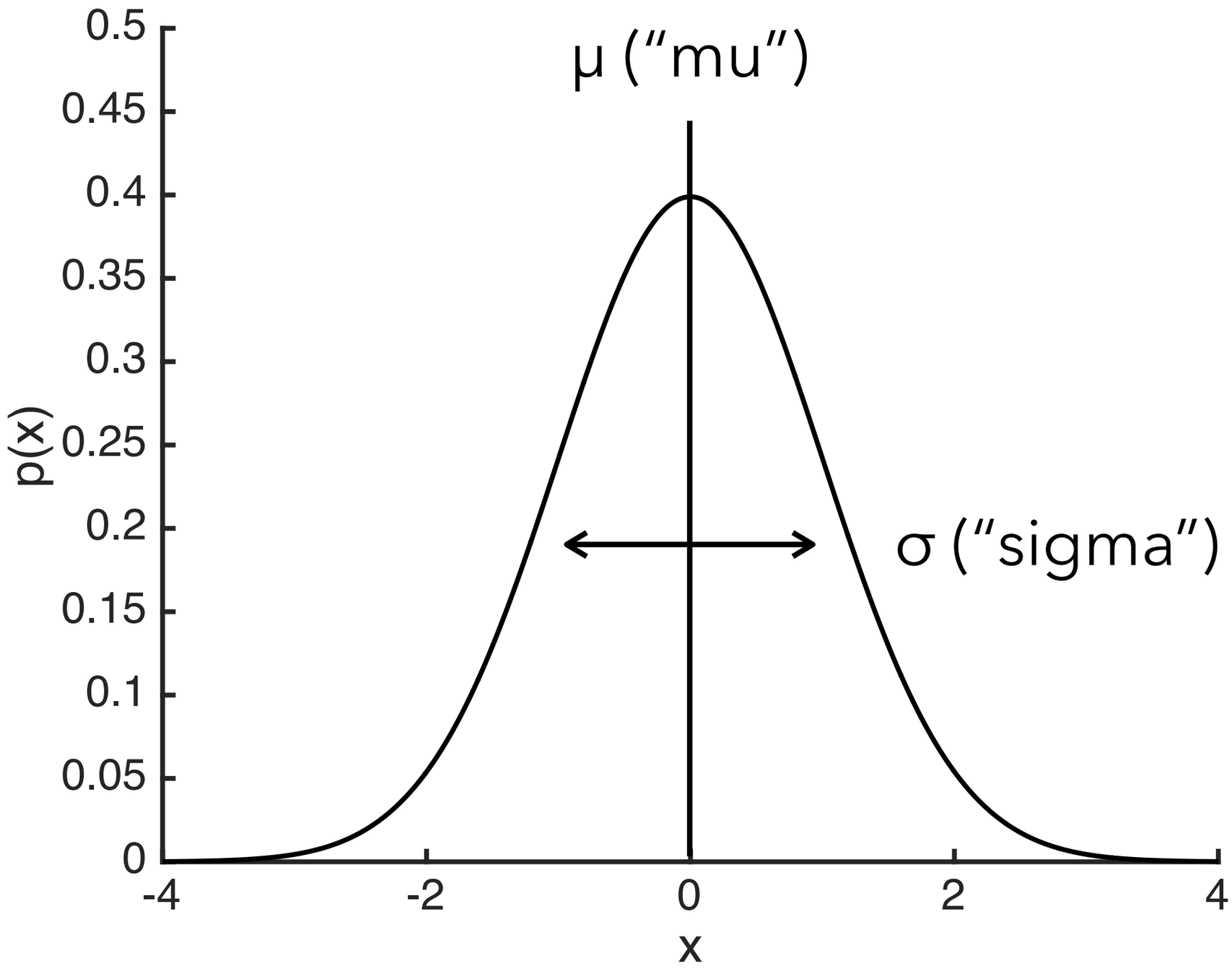
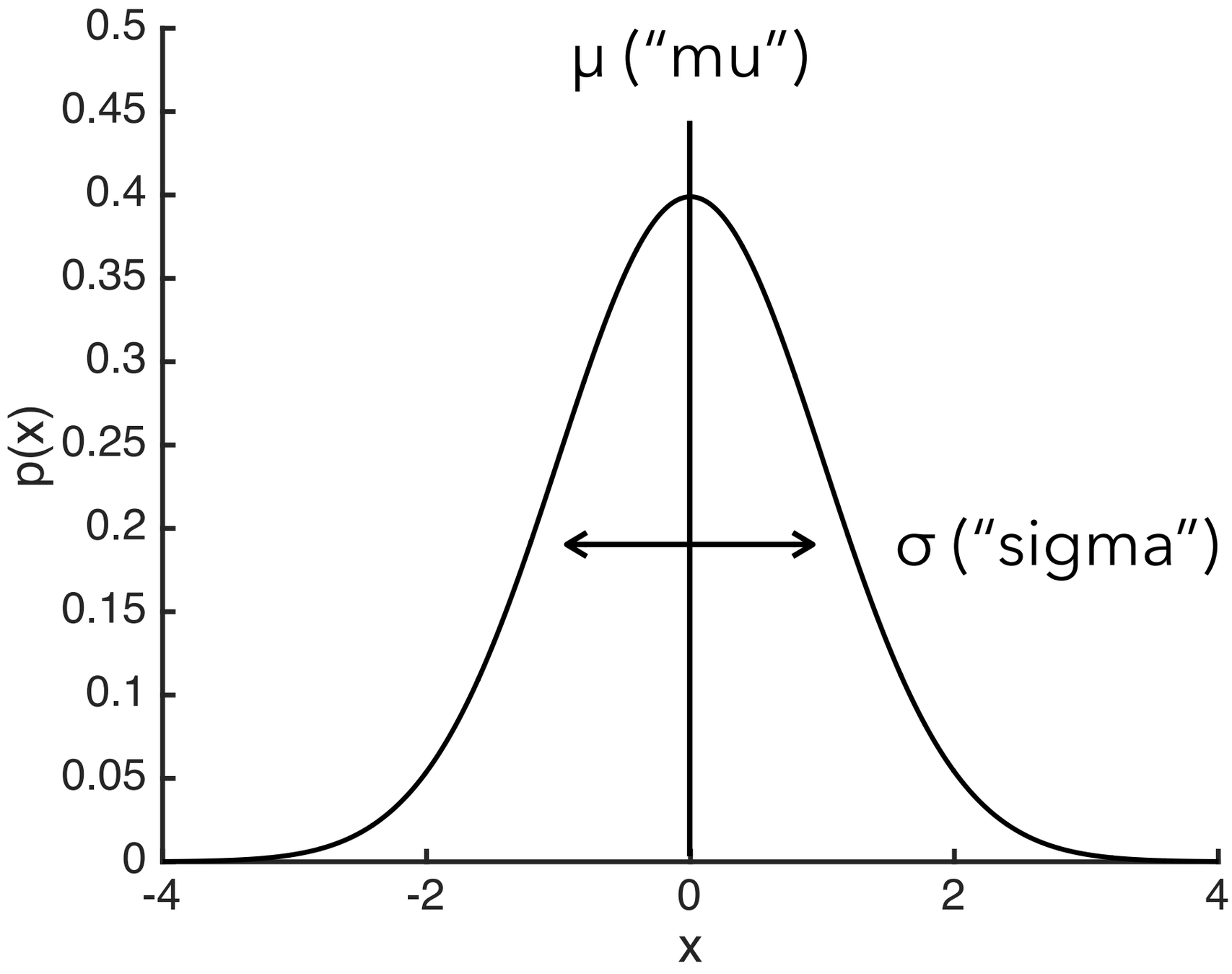
Recap

- Targets vs. lures
- Probability distribution
- Random variable
- Mean
- Standard deviation

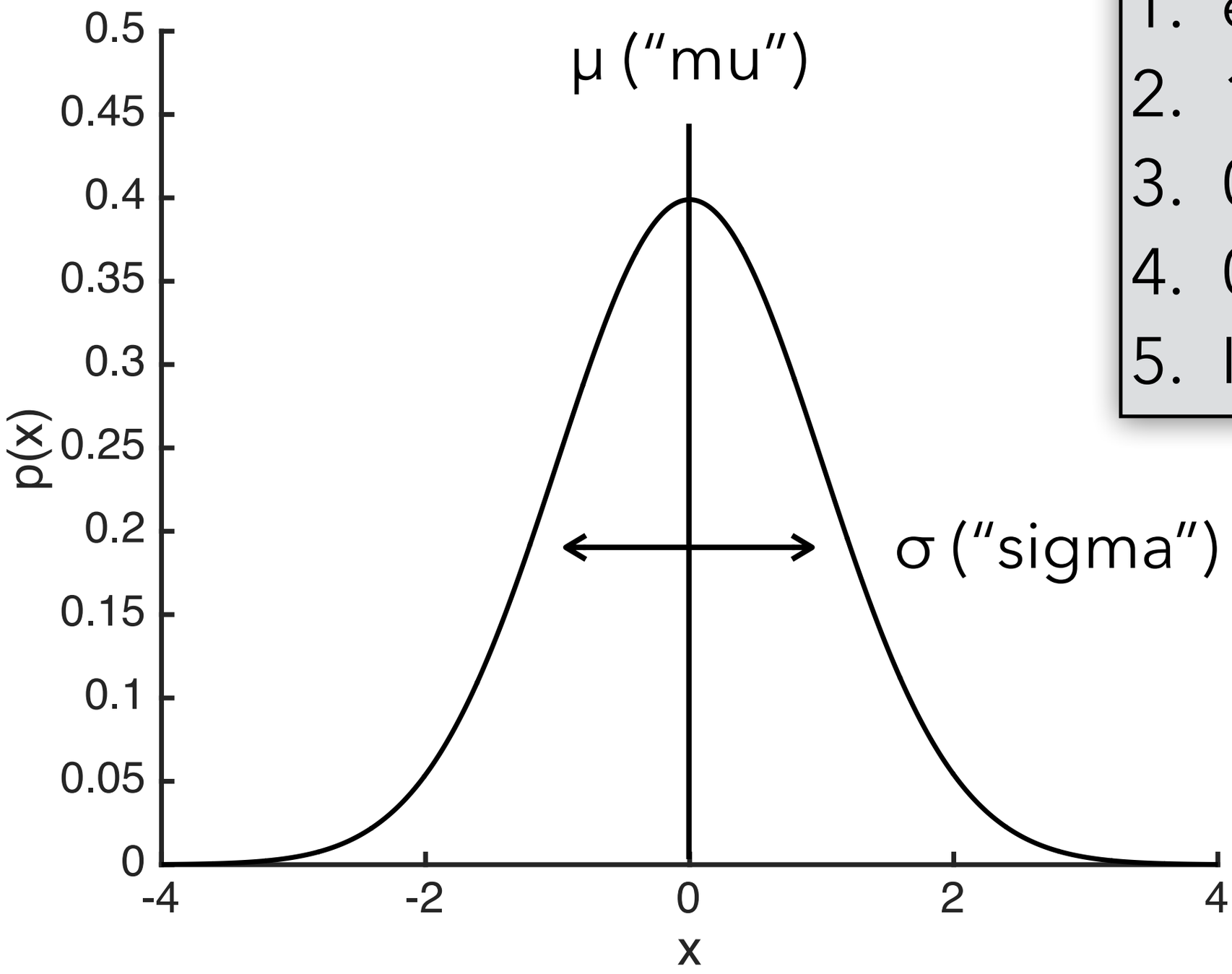
Gaussian distribution



What's the probability that x > μ?

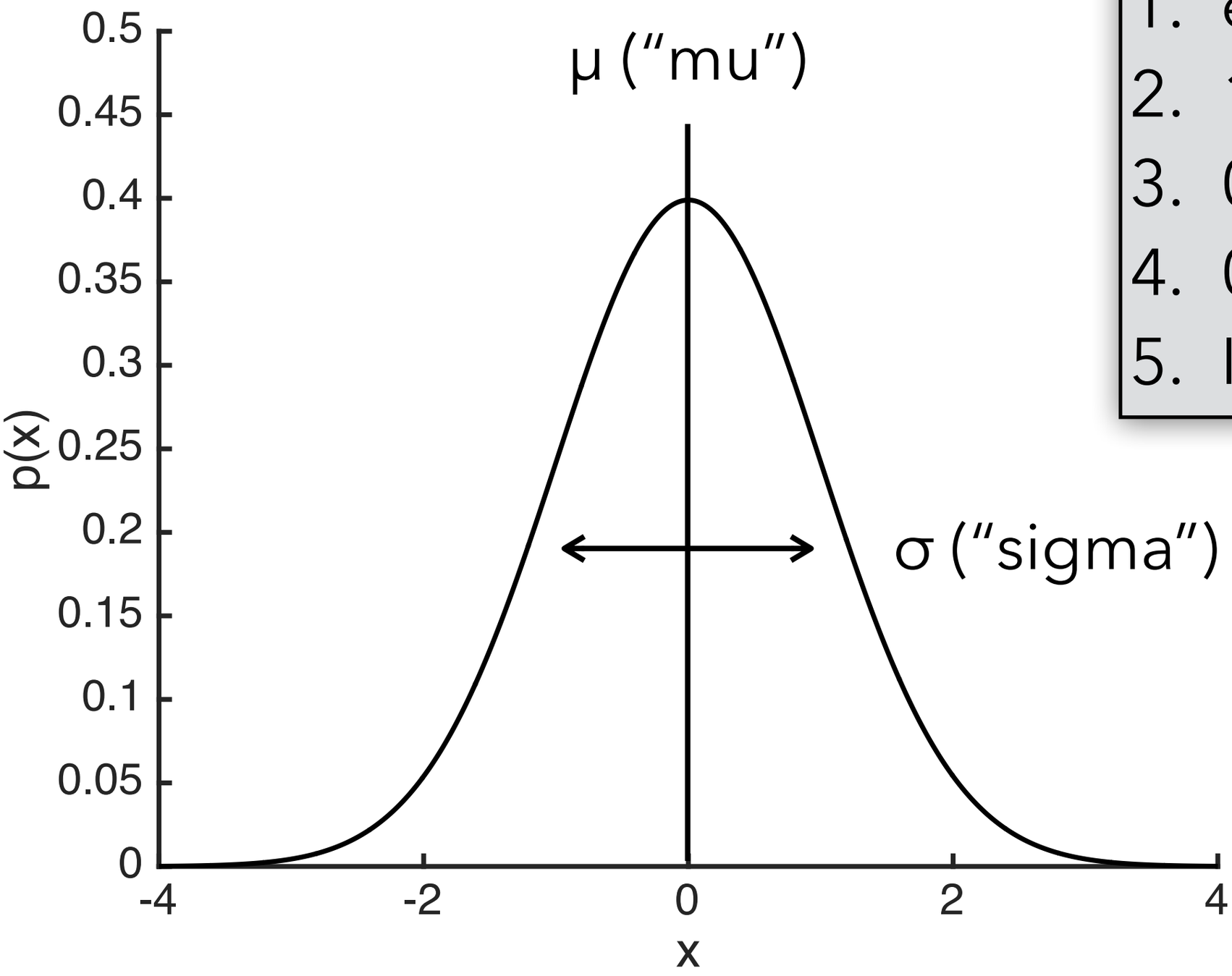


What's the probability that x > μ?



1. e
2. 1
3. 0.5
4. 0.68
5. I need more info!

What's the area under the curve for all values greater than μ?



1. e
2. 1
3. 0.5
4. 0.68
5. I need more info!

Let’s build a model:

Strength theory

CAT – strong! (STRENGTH = 15)

ALABASTER – weak! (STRENGTH = 4)

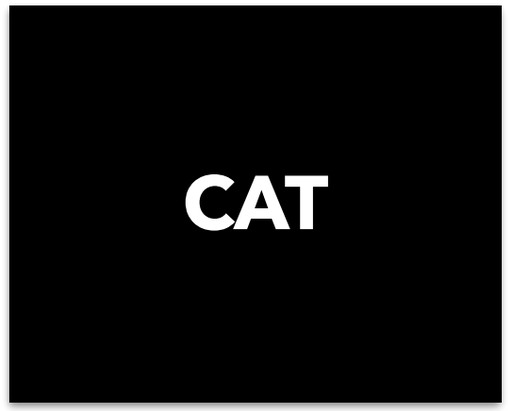
VACUUM – middle (STRENGTH = 10)

Studying a word increases its strength (by *a*)

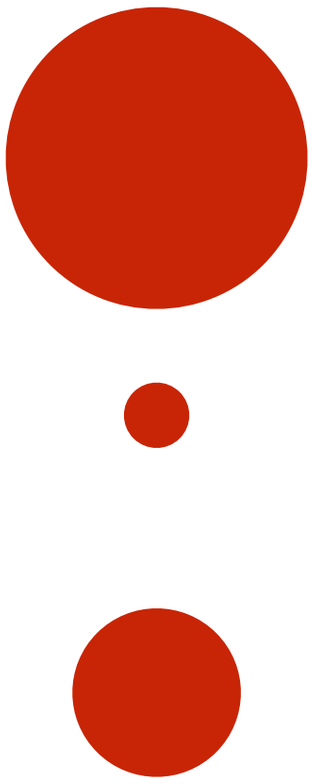
CAT (STRENGTH = 15)

ALABASTER (STRENGTH = 4)

VACUUM (STRENGTH = 10)



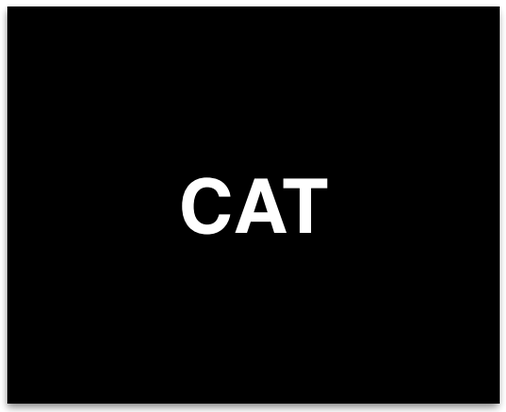
Studying a word increases its strength (by *a*)



CAT (STRENGTH = **18**)

ALABASTER (STRENGTH = 4)

VACUUM (STRENGTH = 10)



Studying a word increases its strength (by *a*)

CAT (STRENGTH = **18**)

ALABASTER (STRENGTH = 4)

VACUUM (STRENGTH = 10)

ALABASTER

Studying a word increases its strength (by *a*)

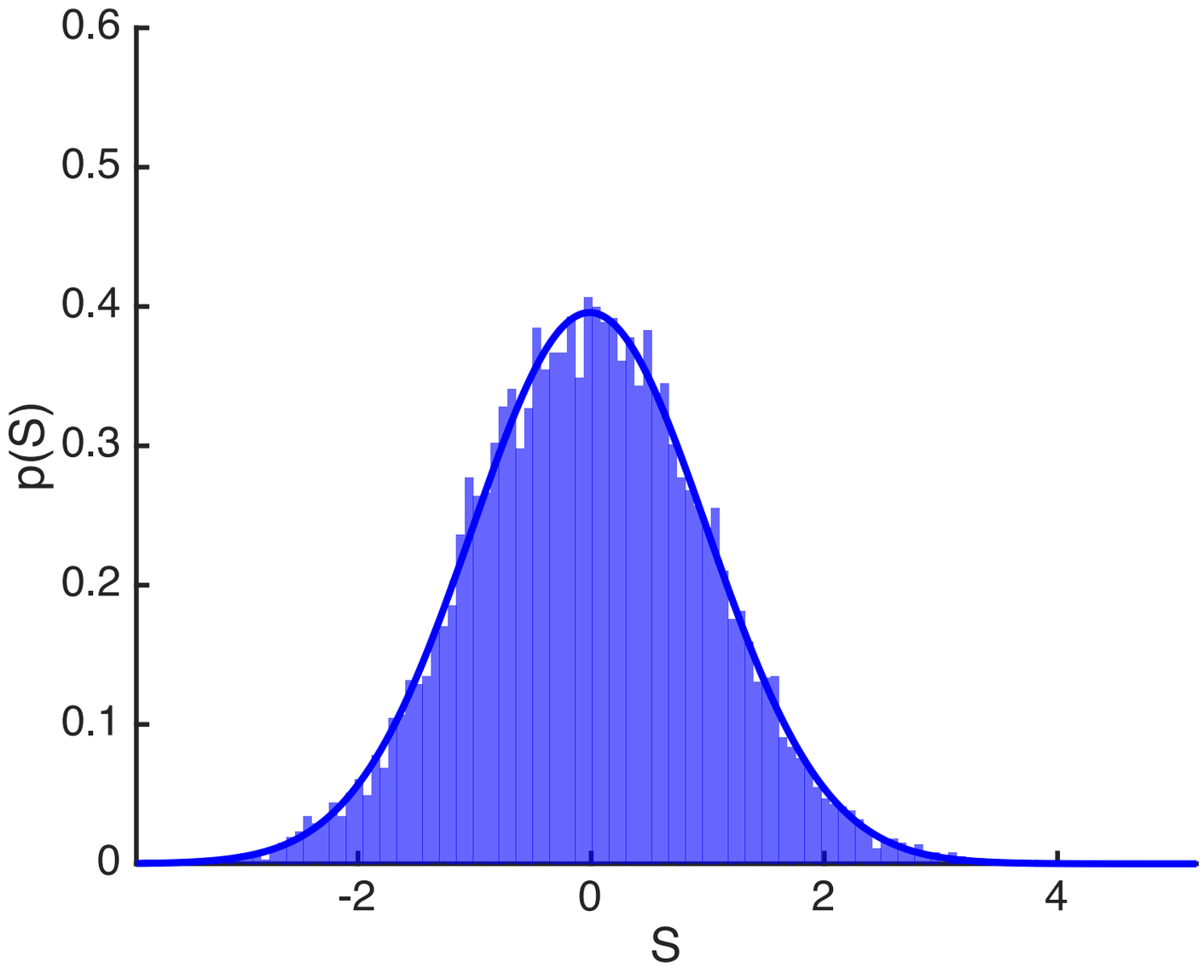
CAT (STRENGTH = **18**)

ALABASTER (STRENGTH = **7**)

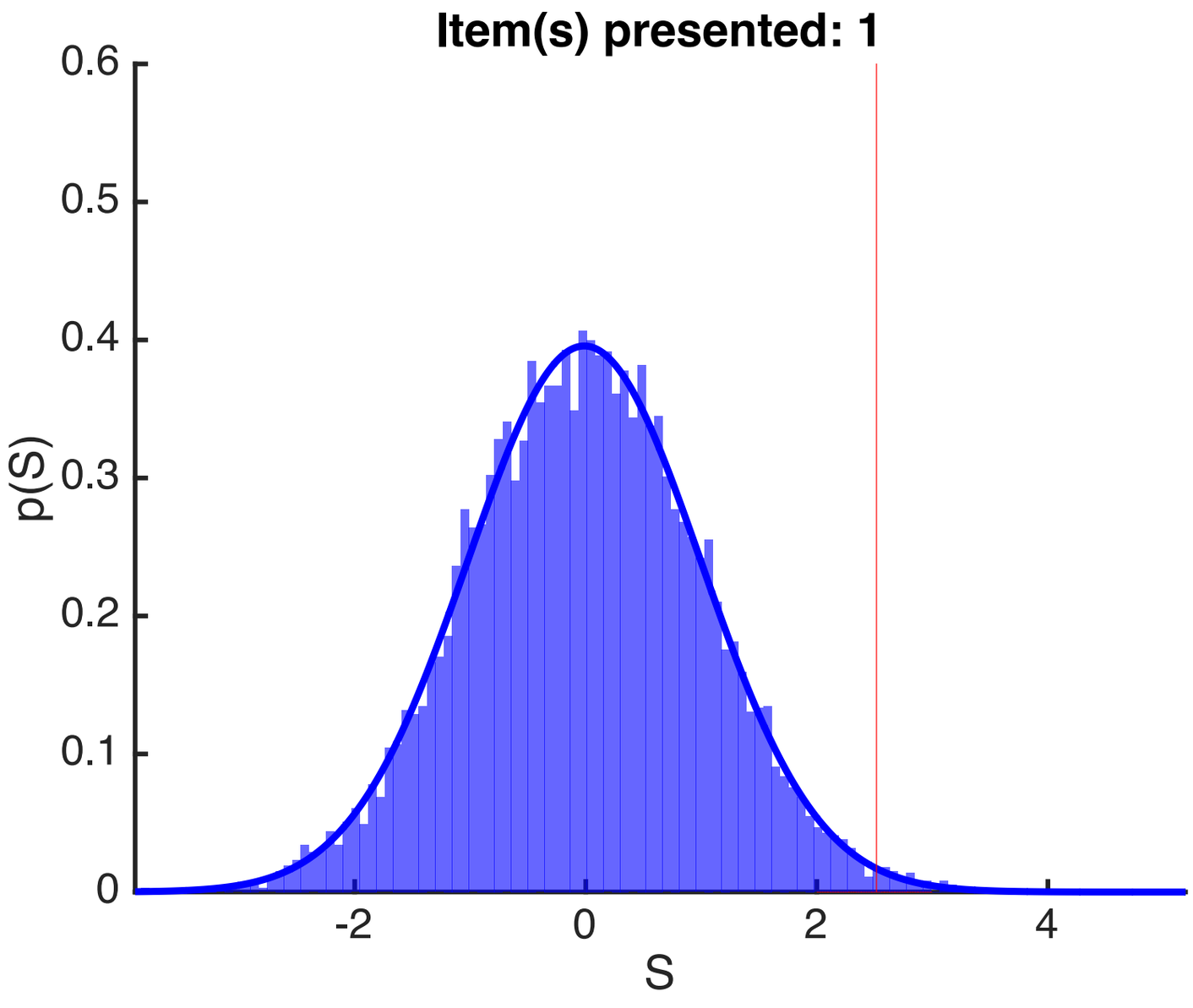
VACUUM (STRENGTH = 10)

ALABASTER

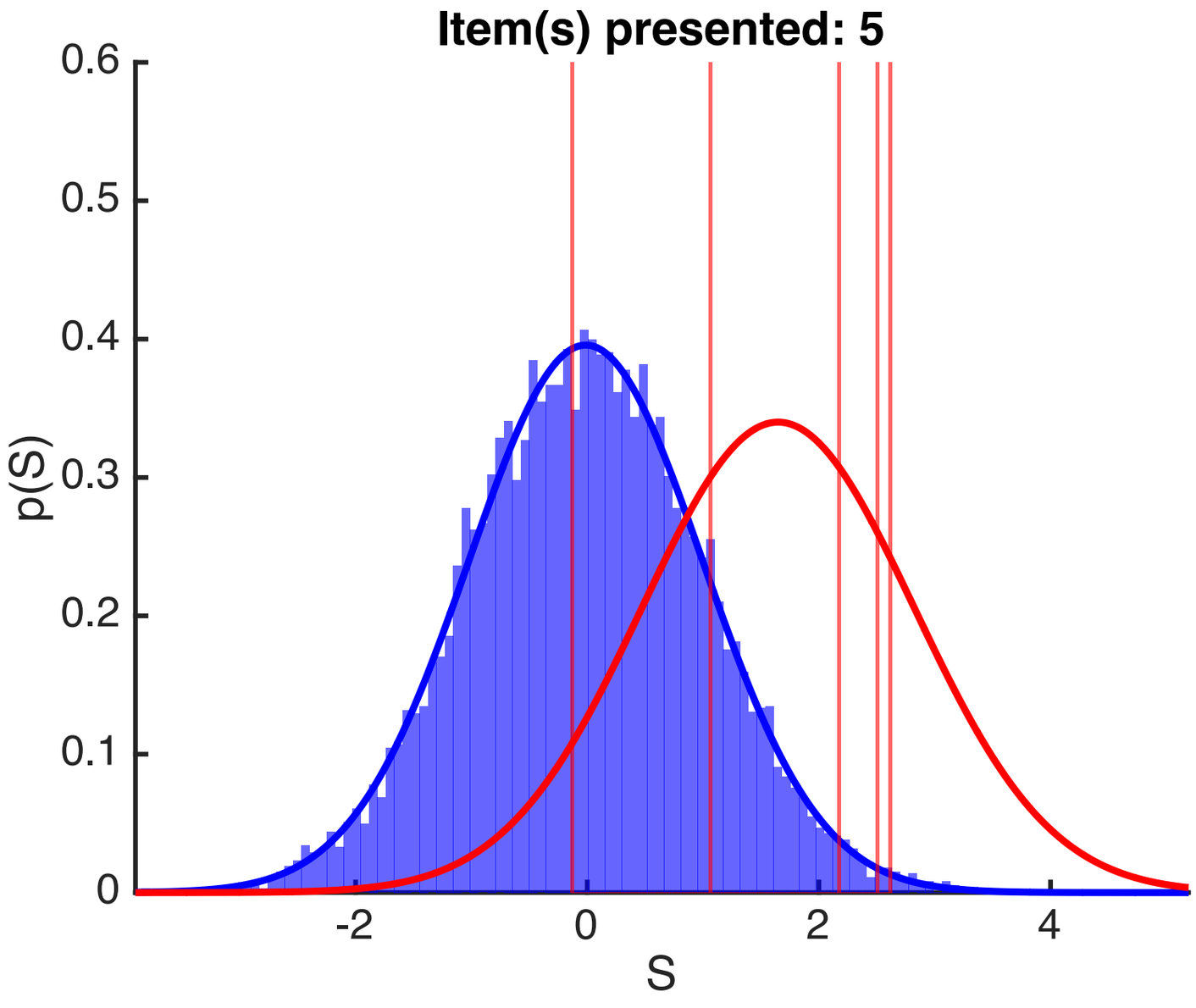
Distributions demo



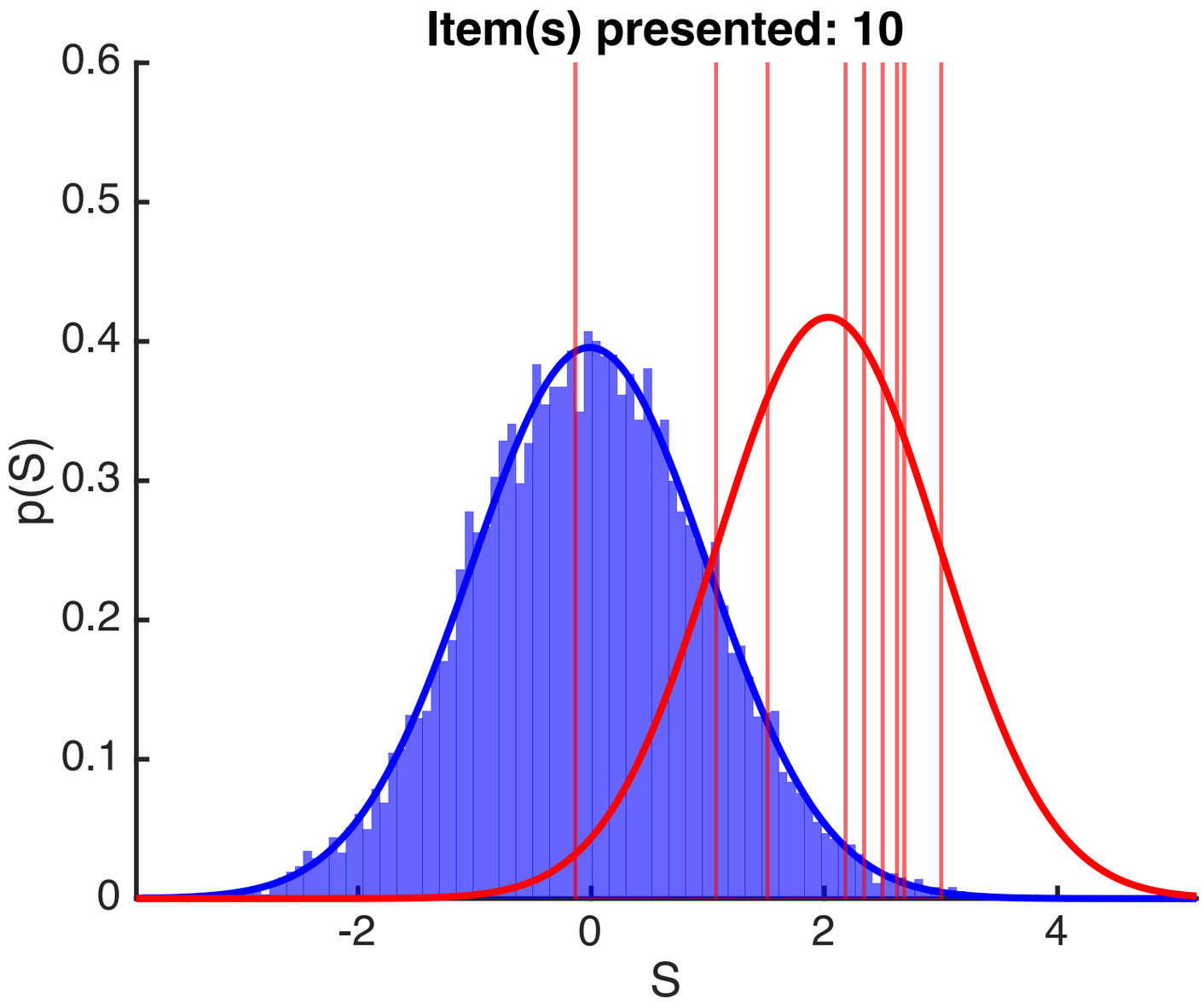
Distributions demo



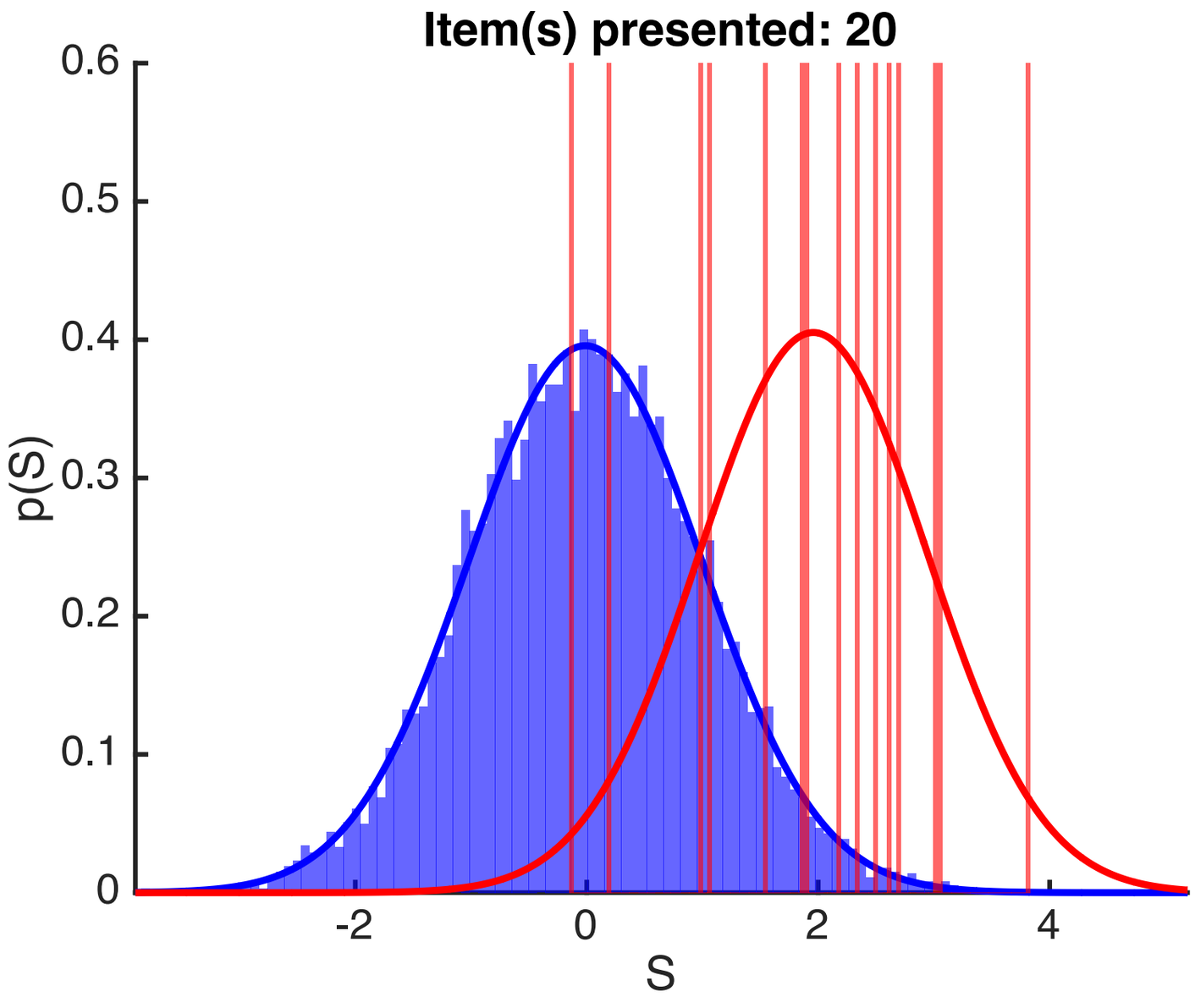
Distributions demo



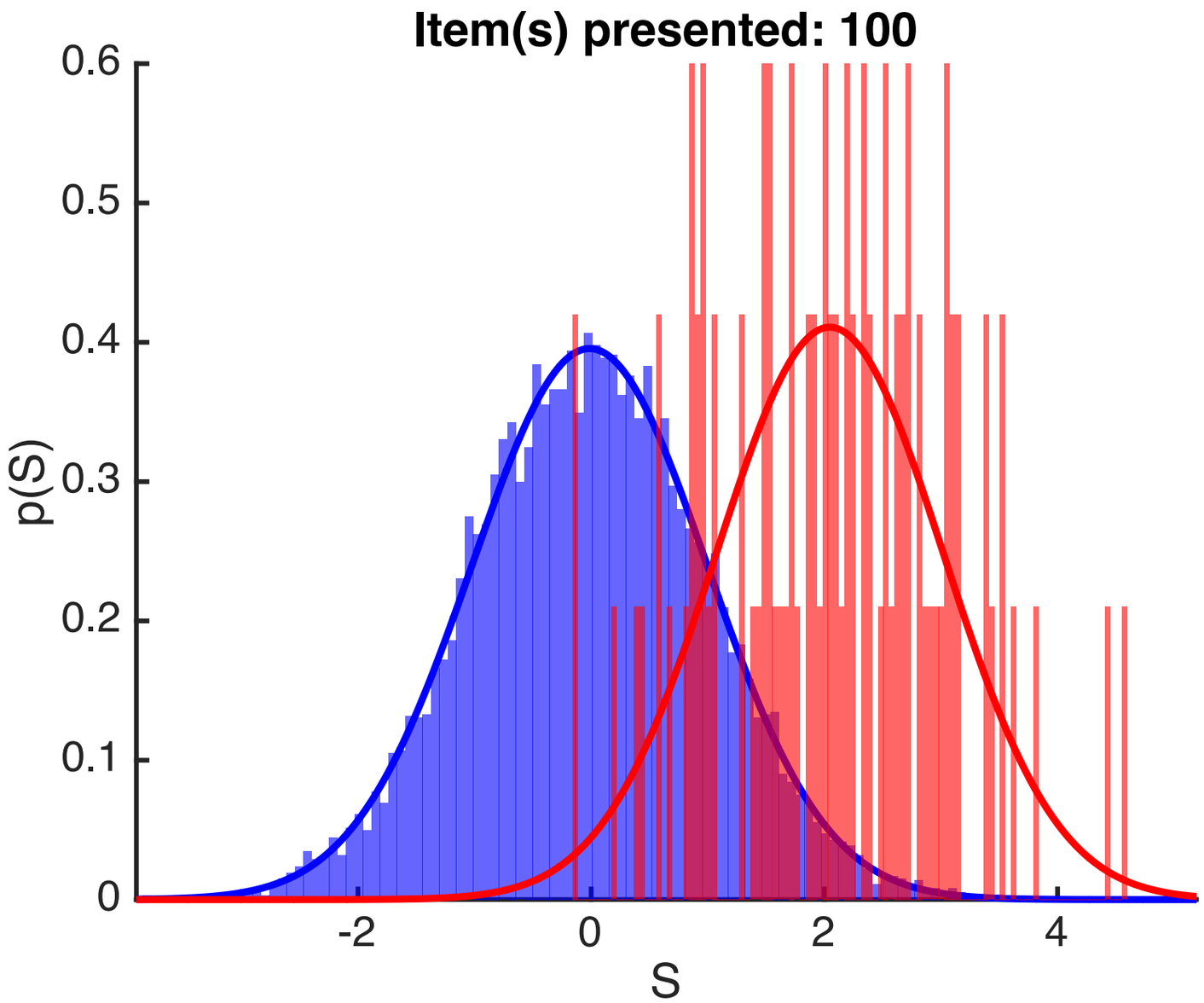
Distributions demo



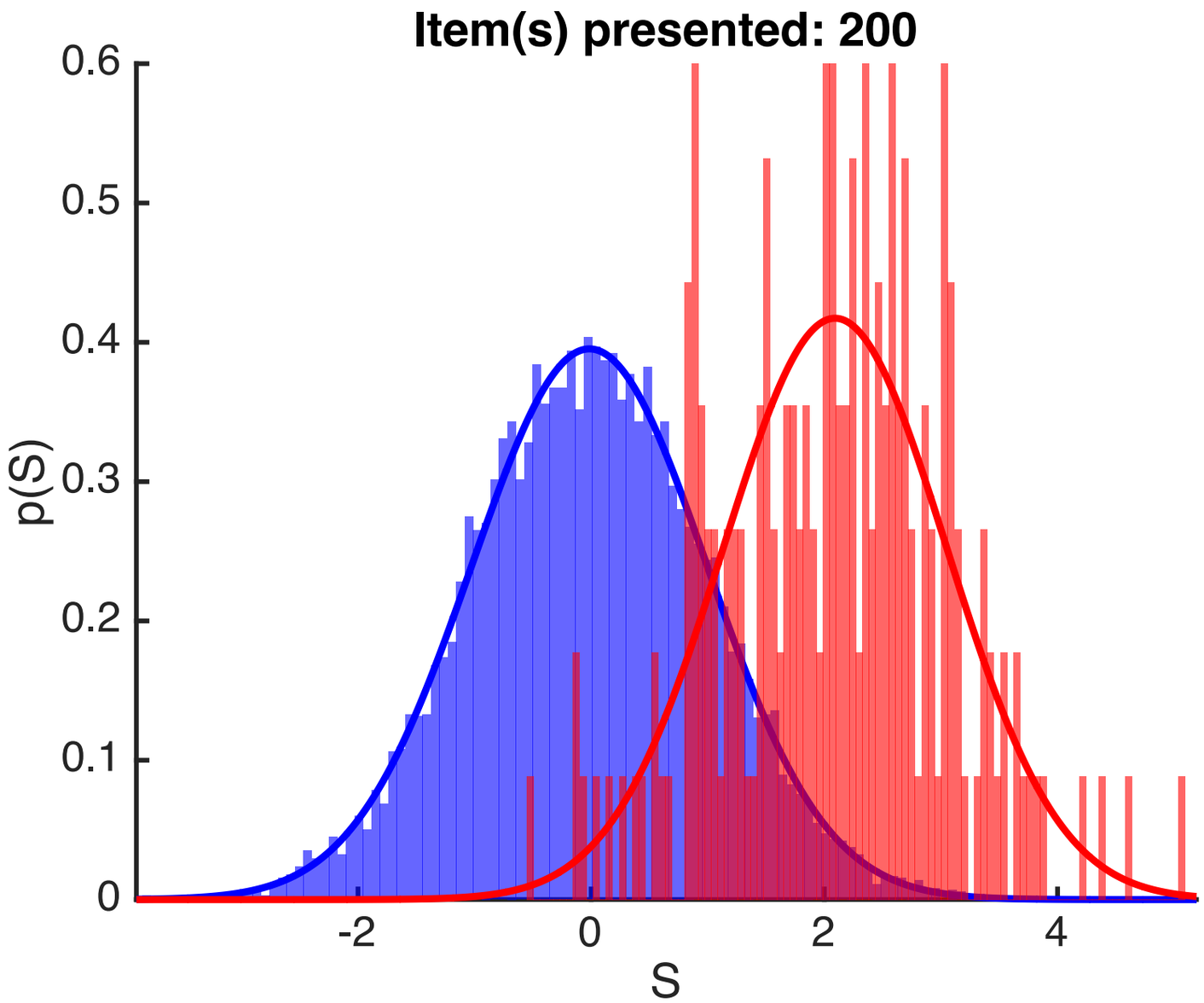
Distributions demo



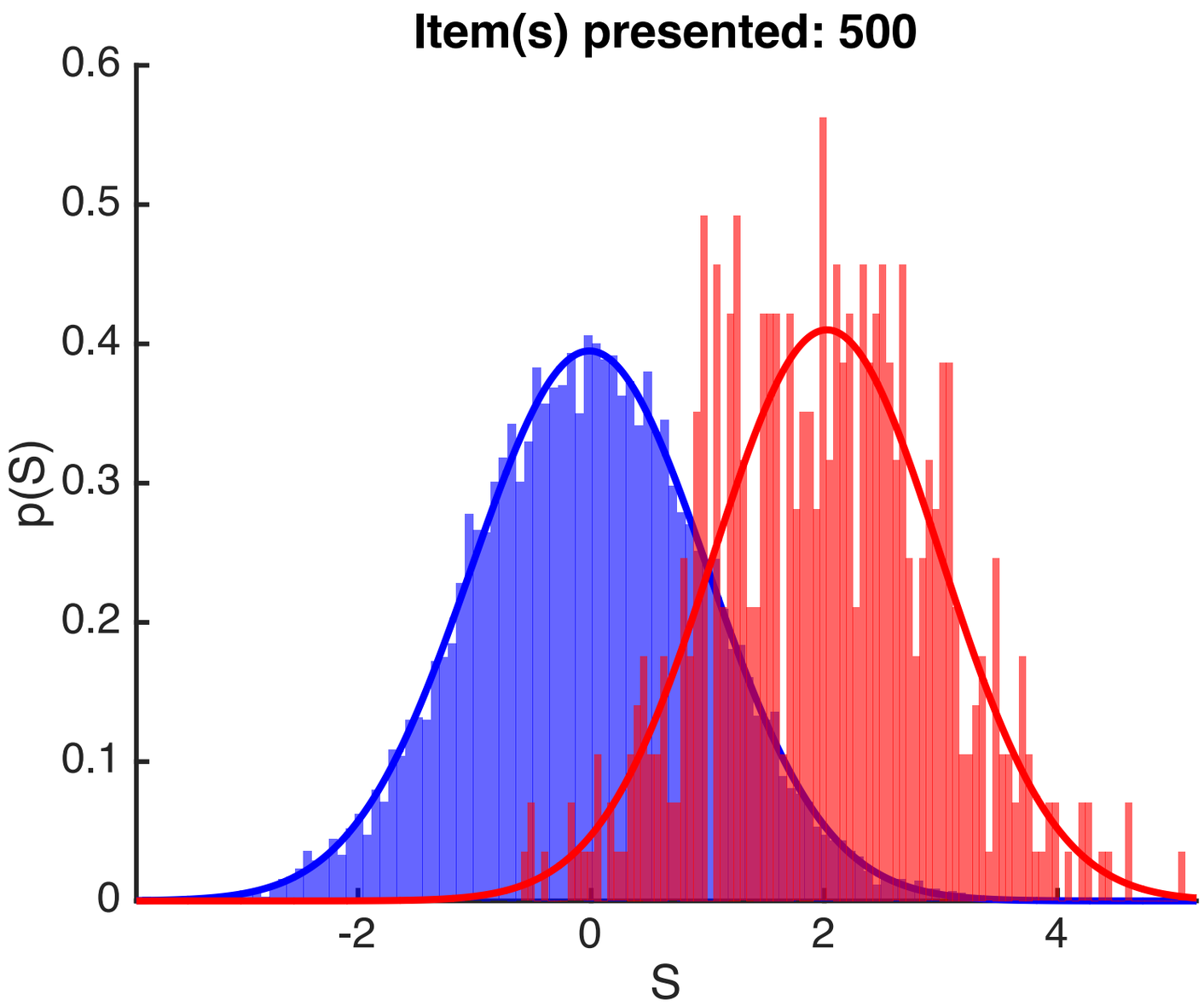
Distributions demo



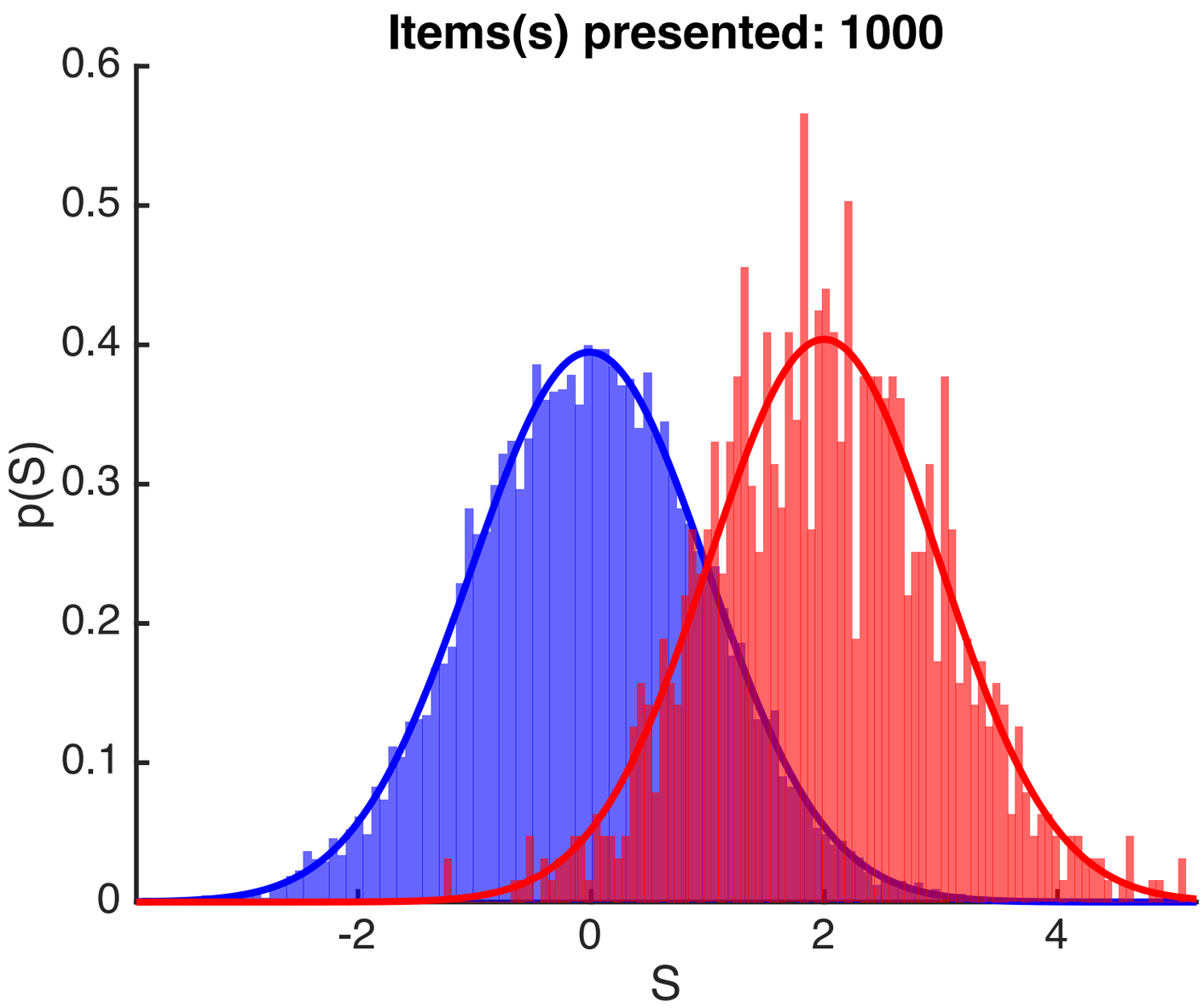
Distributions demo



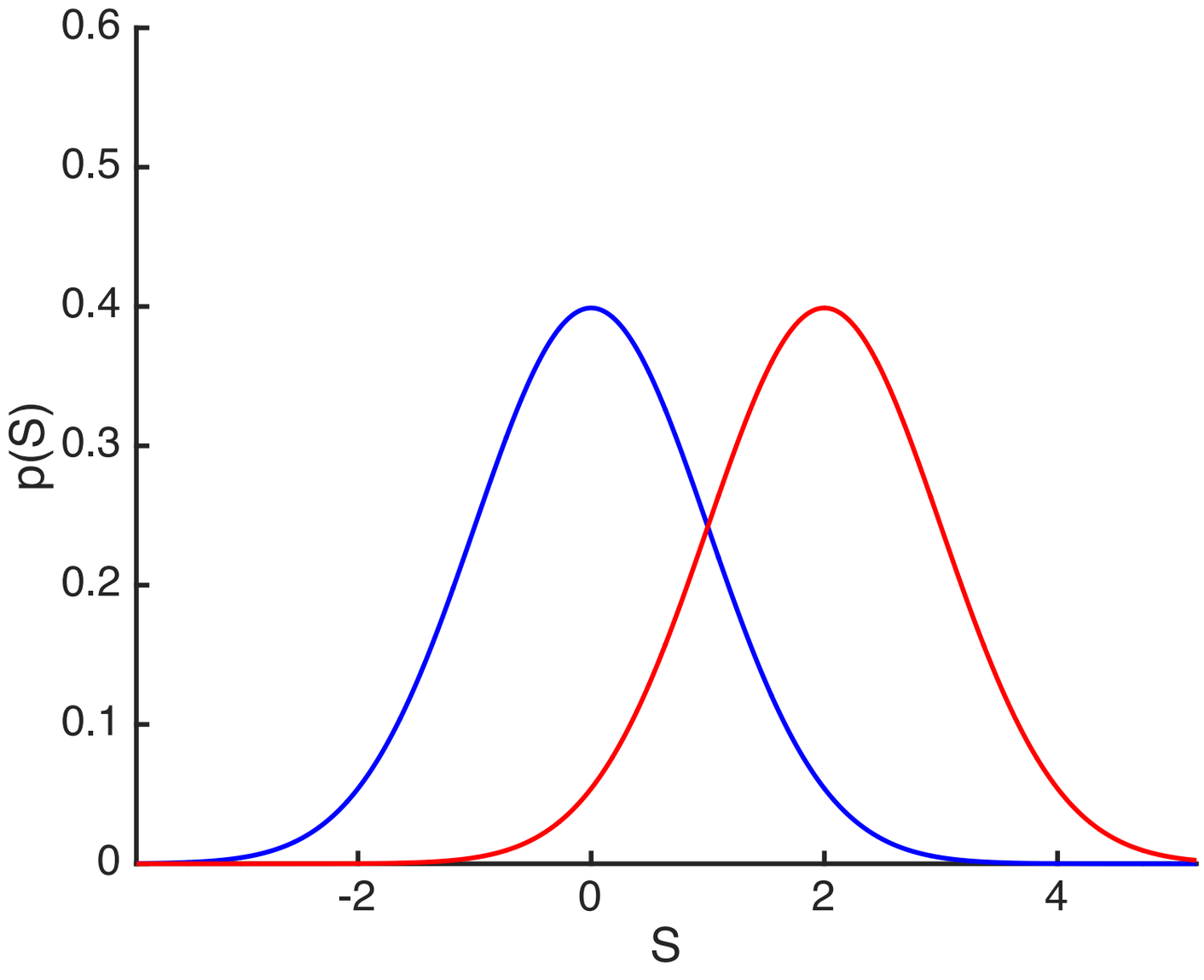
Distributions demo



Distributions demo



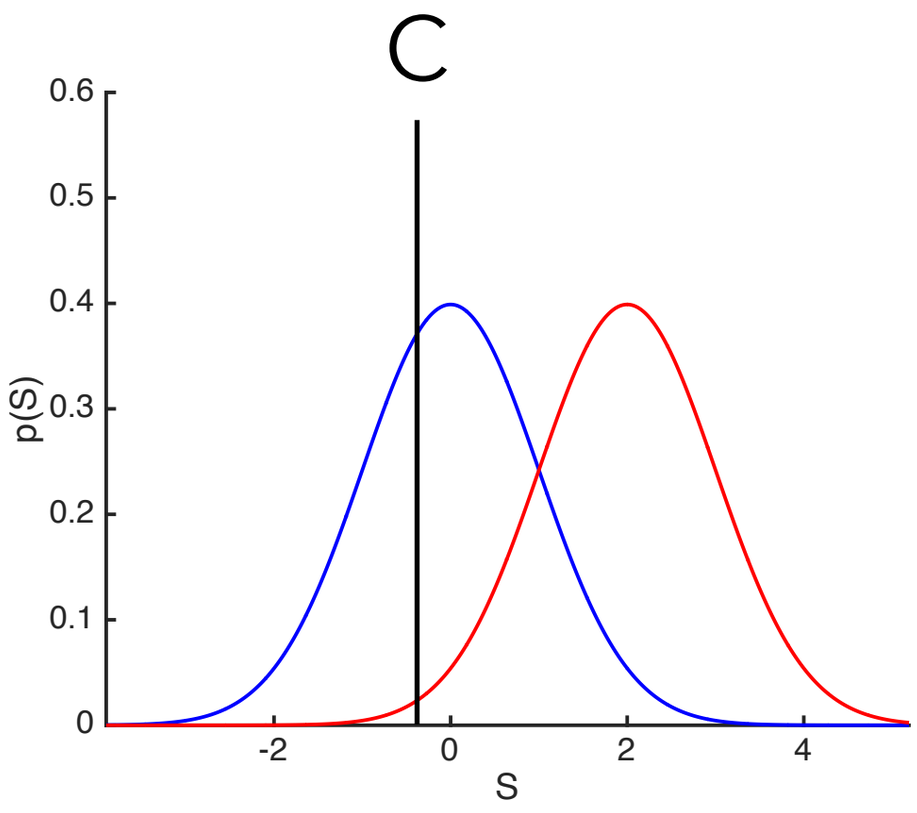
Distributions demo



How will this work?

- **Targets** vs. **lures**

- If strength of an item is high, say you've seen it before (and vice versa). **Need a criterion threshold (C)!**



- Assumption 1: you can read out memory strengths

- Assumption 2: reading out an item's memory strength doesn't change anything else

- **Our model has 4 parameters: μ, σ, a, C**

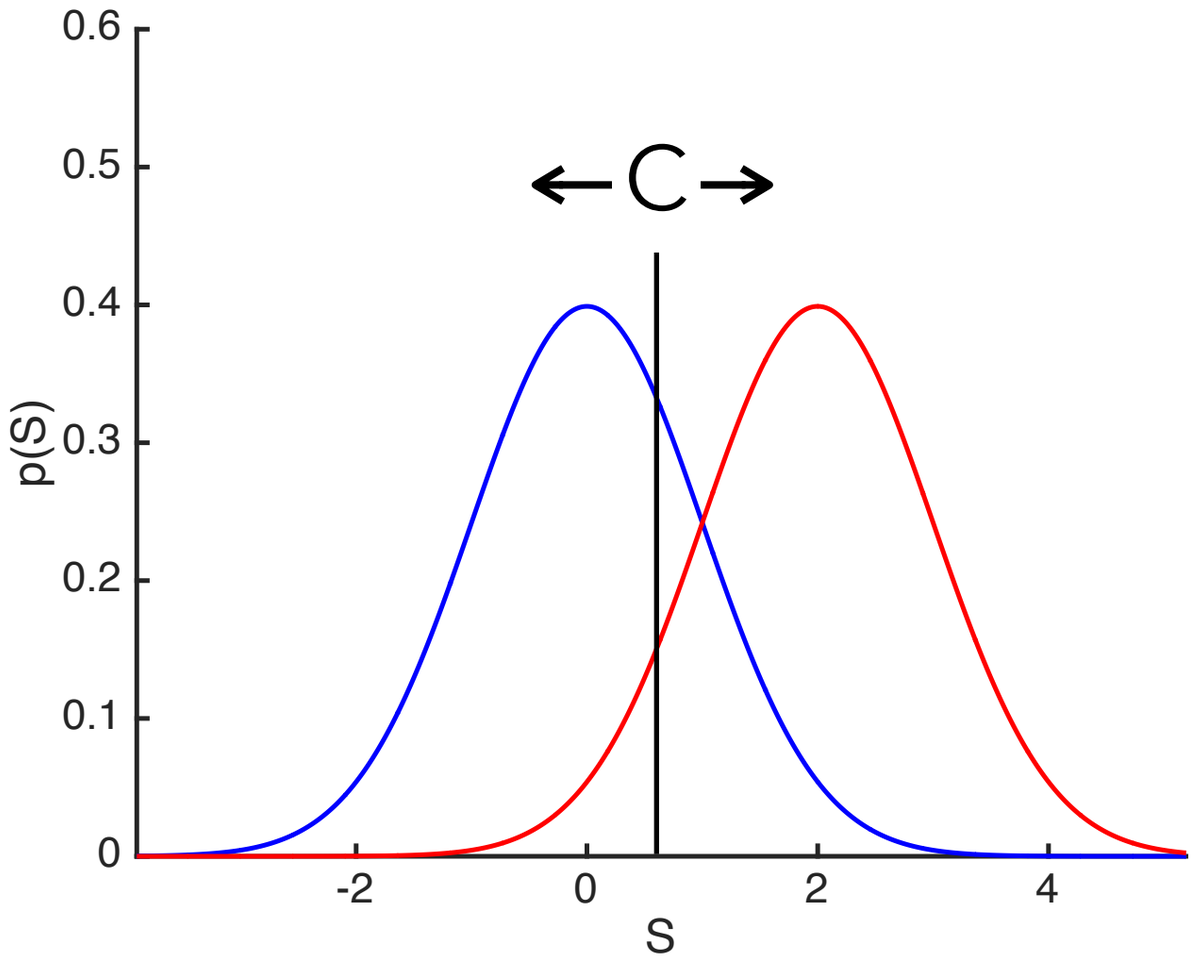
Bias: which threshold?

Suppose I offer you $10 for every **hit** and take away nothing for **false alarms**, where should you put your decision threshold?

1. All the way to the left

2. Between the two distributions

3. All the way to the right



Sensitivity: d’ (“d prime”)

- d’ = ((μ + a) - μ)/σ

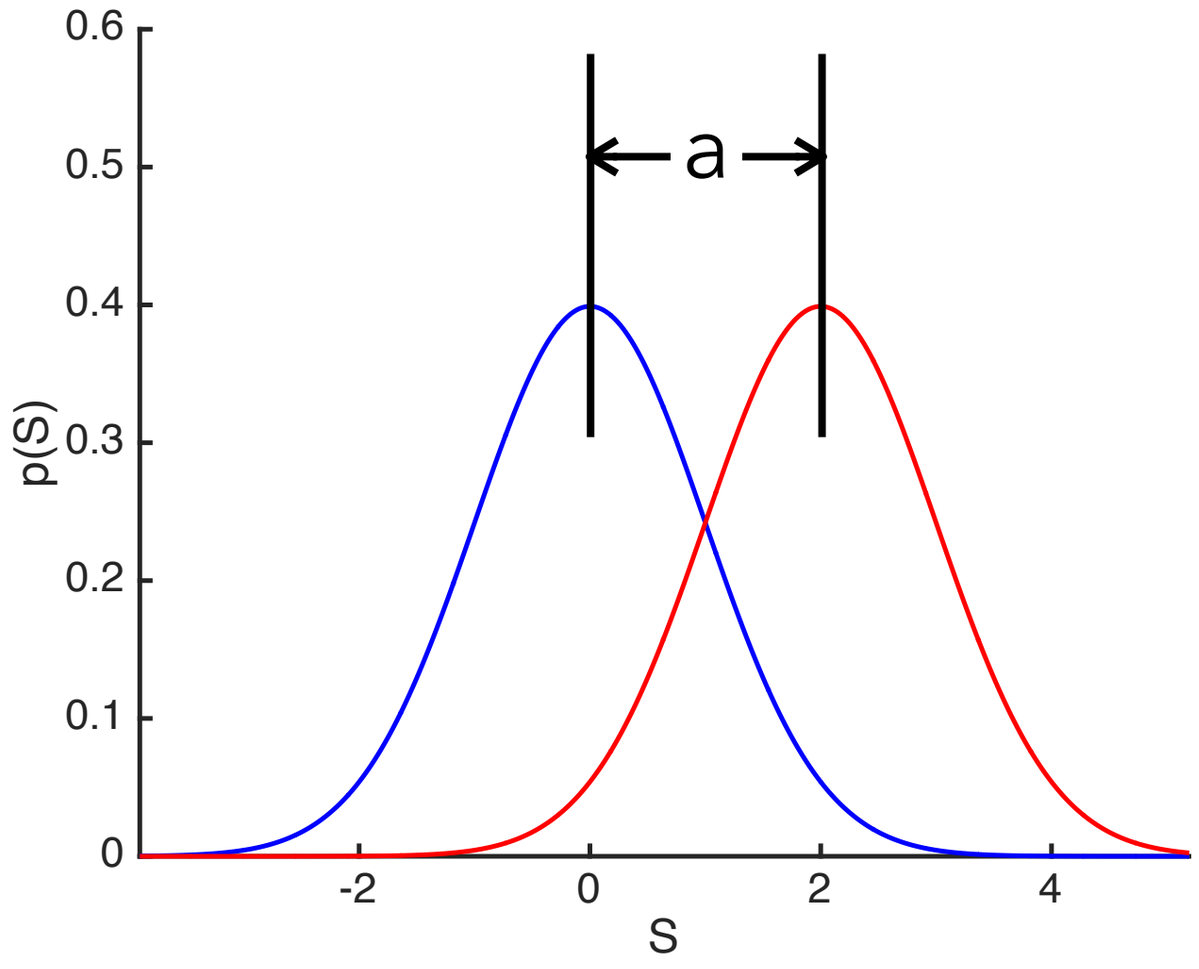
  = a/σ

- d’ is the difference between the means of the target and lure distributions, expressed in standard deviation units

- Measures how separable the target and lure distributions are

- Perfect sensitivity vs. zero sensitivity

- **d’ does NOT depend on the threshold!**



How can we test strength theory?

- In a real experiment, we don't get to see d' or C
- How can we map between this model and the results in an experiment?

- Another logic game: consider the consequences of changing C

The recognition test

WINDOW

"3"

BIRD

"7"

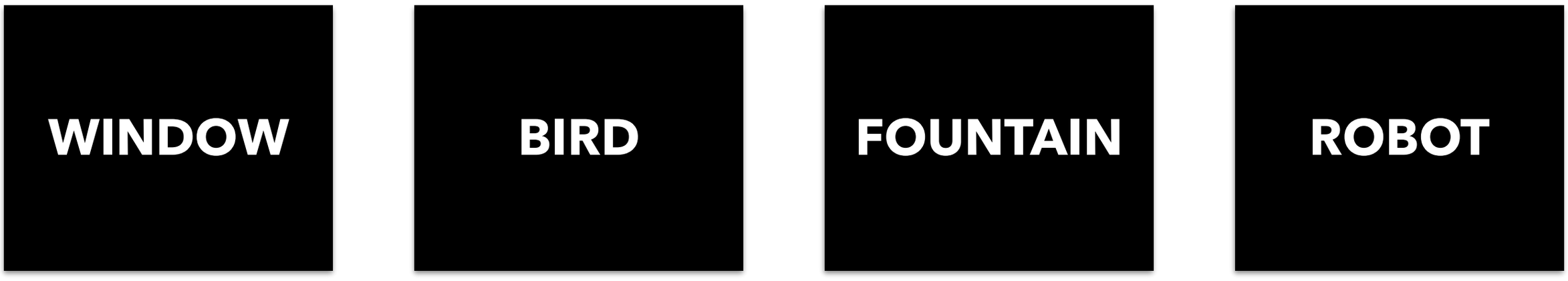
FOUNTAIN

"5"

ROBOT

"8"

The recognition test



"3" "7" "5" "8"

crit. value (C)	called old	called new
8	robot	window, bird, fountain
7	bird, robot	window, fountain
5	fountain, bird, robot	window

Did you see this?

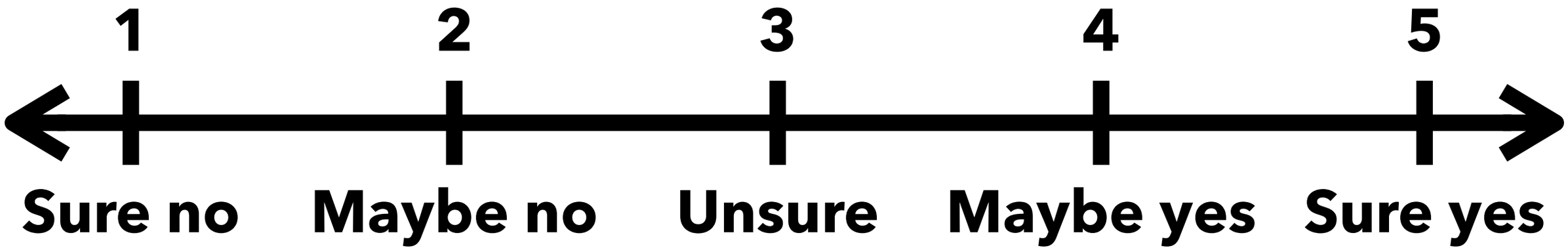
DOG

Did you see this?

CATS

Did you see this?

How sure are you?



The Receiver Operating Characteristic (ROC)

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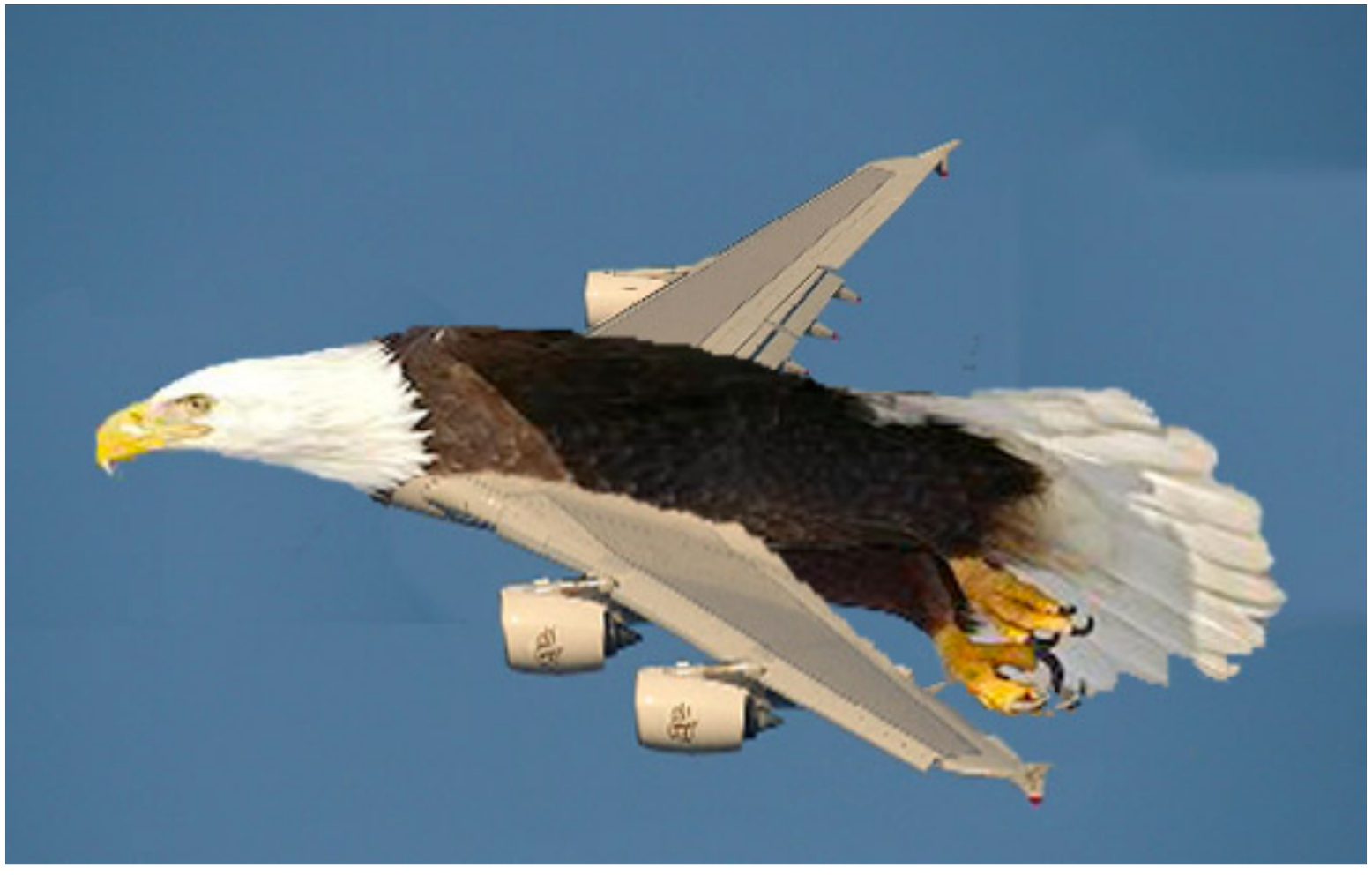
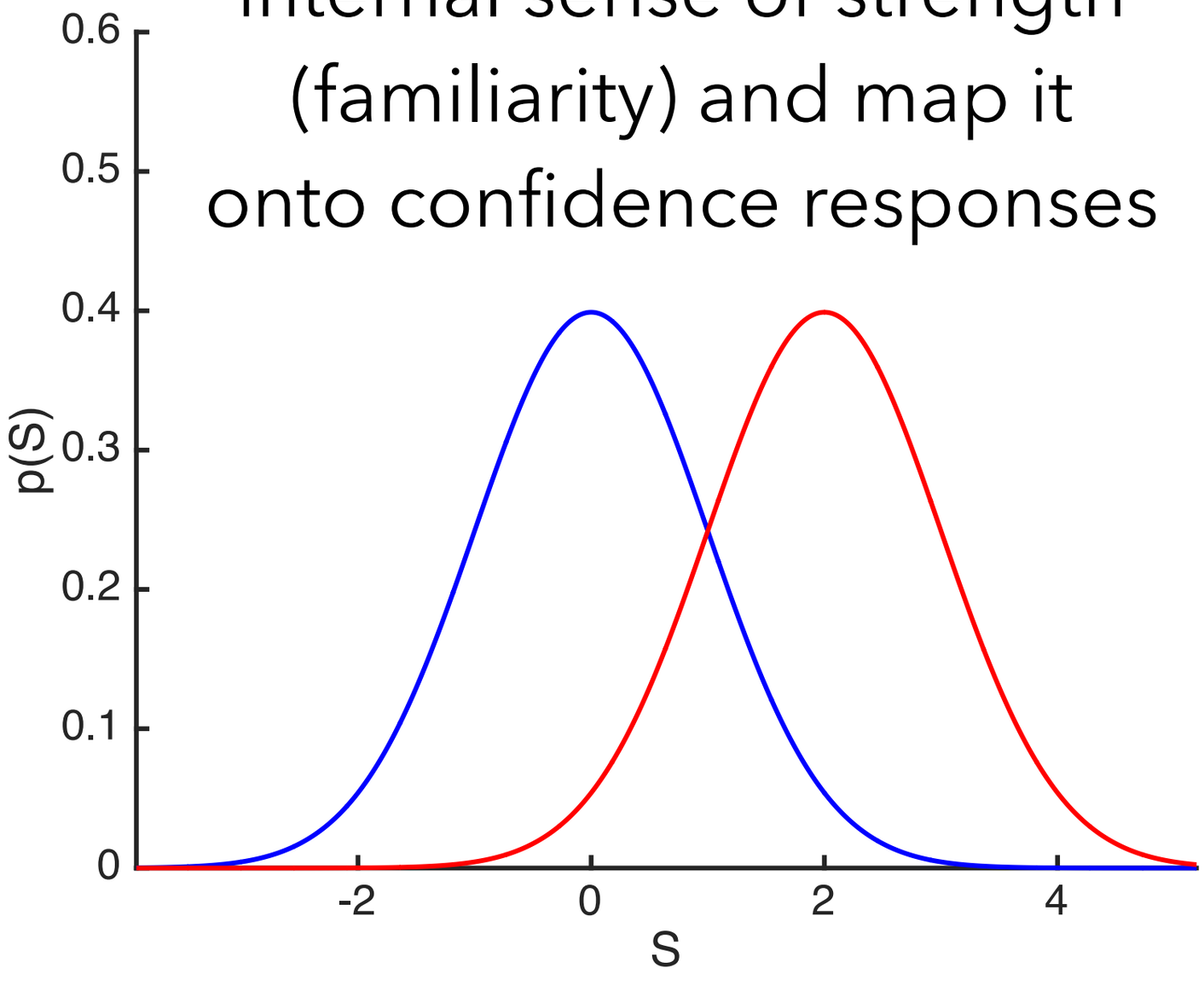
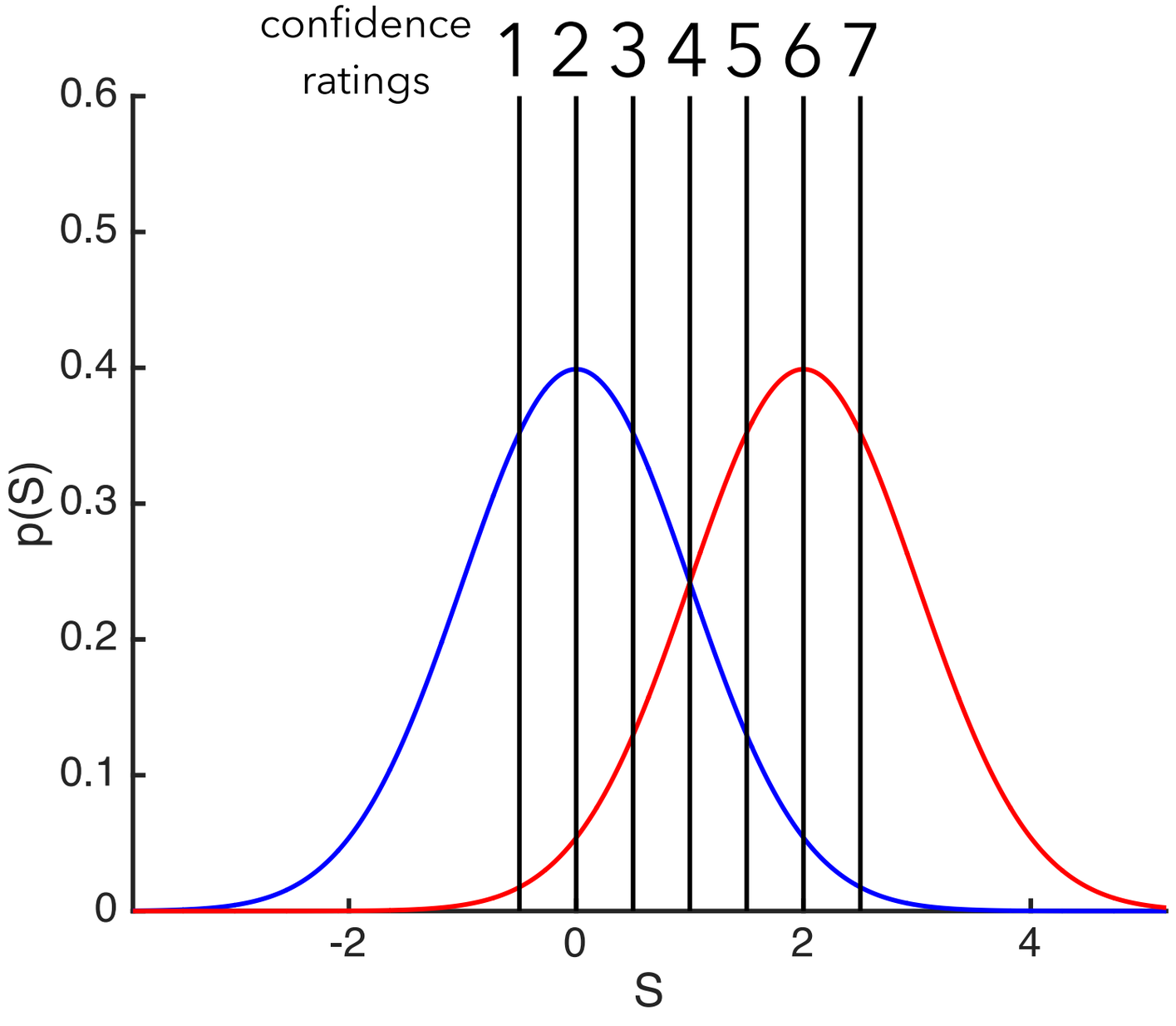


Confidence and criterion

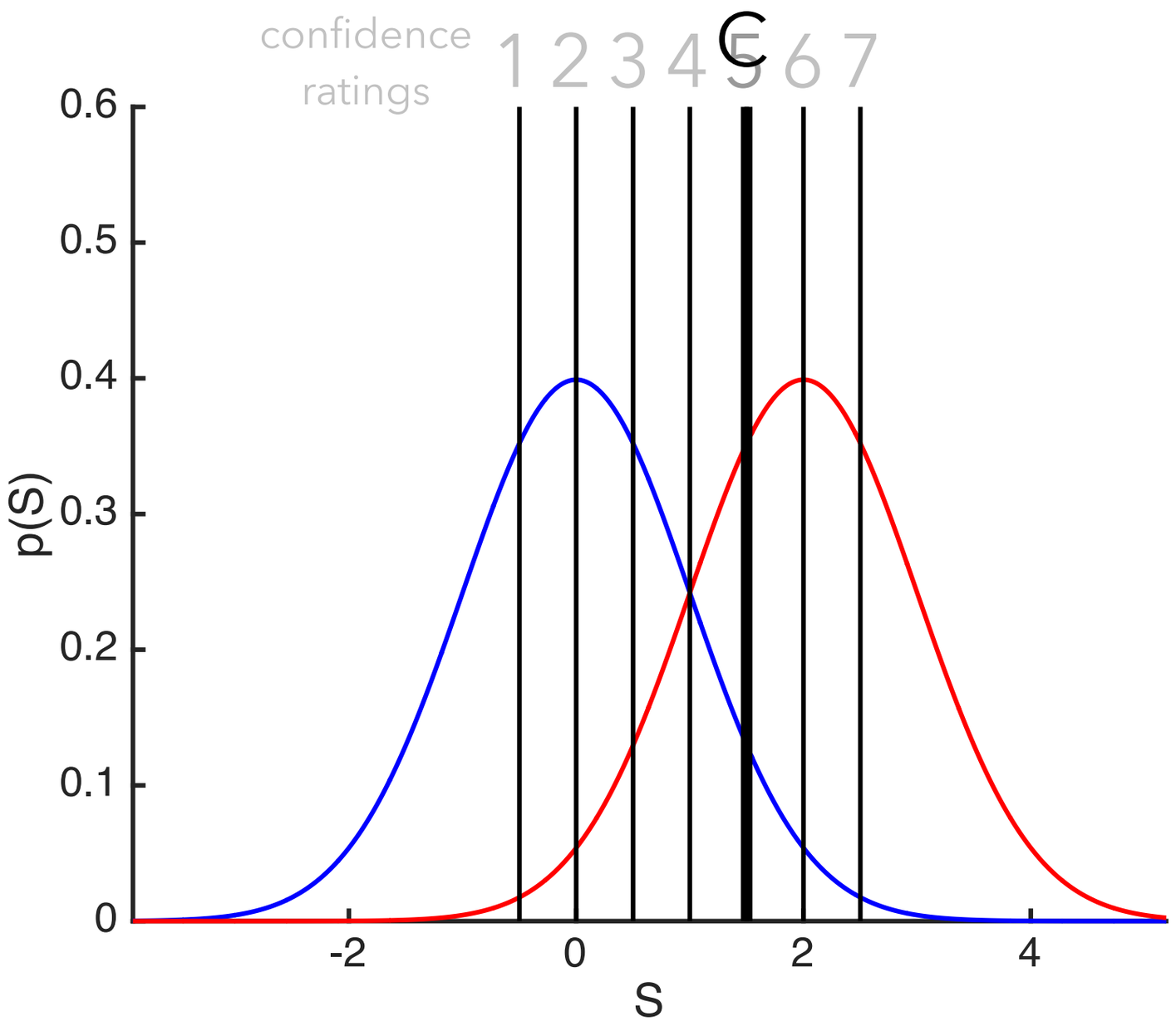
We can take our
internal sense of strength
(familiarity) and map it
onto confidence responses



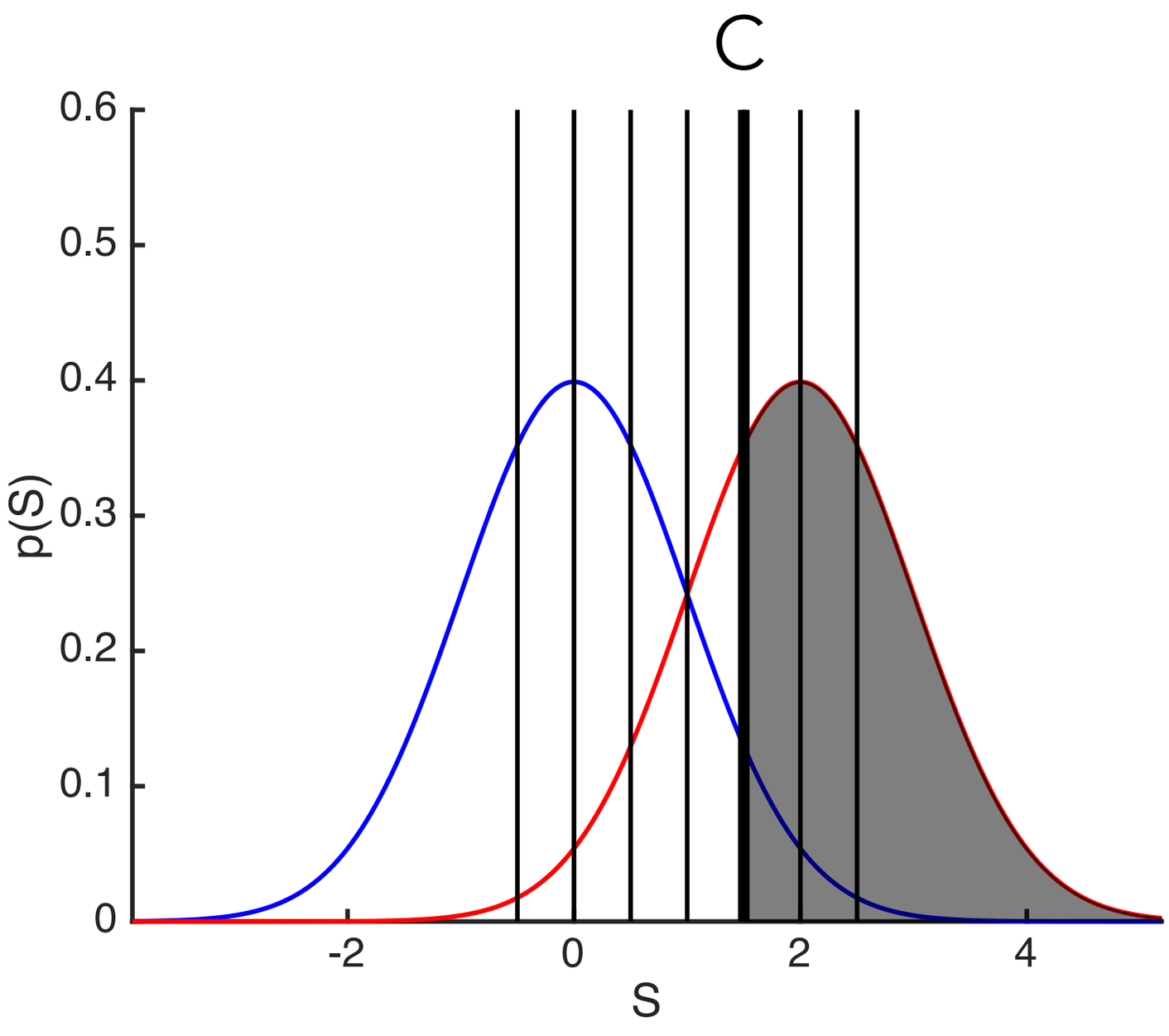
Confidence and criterion



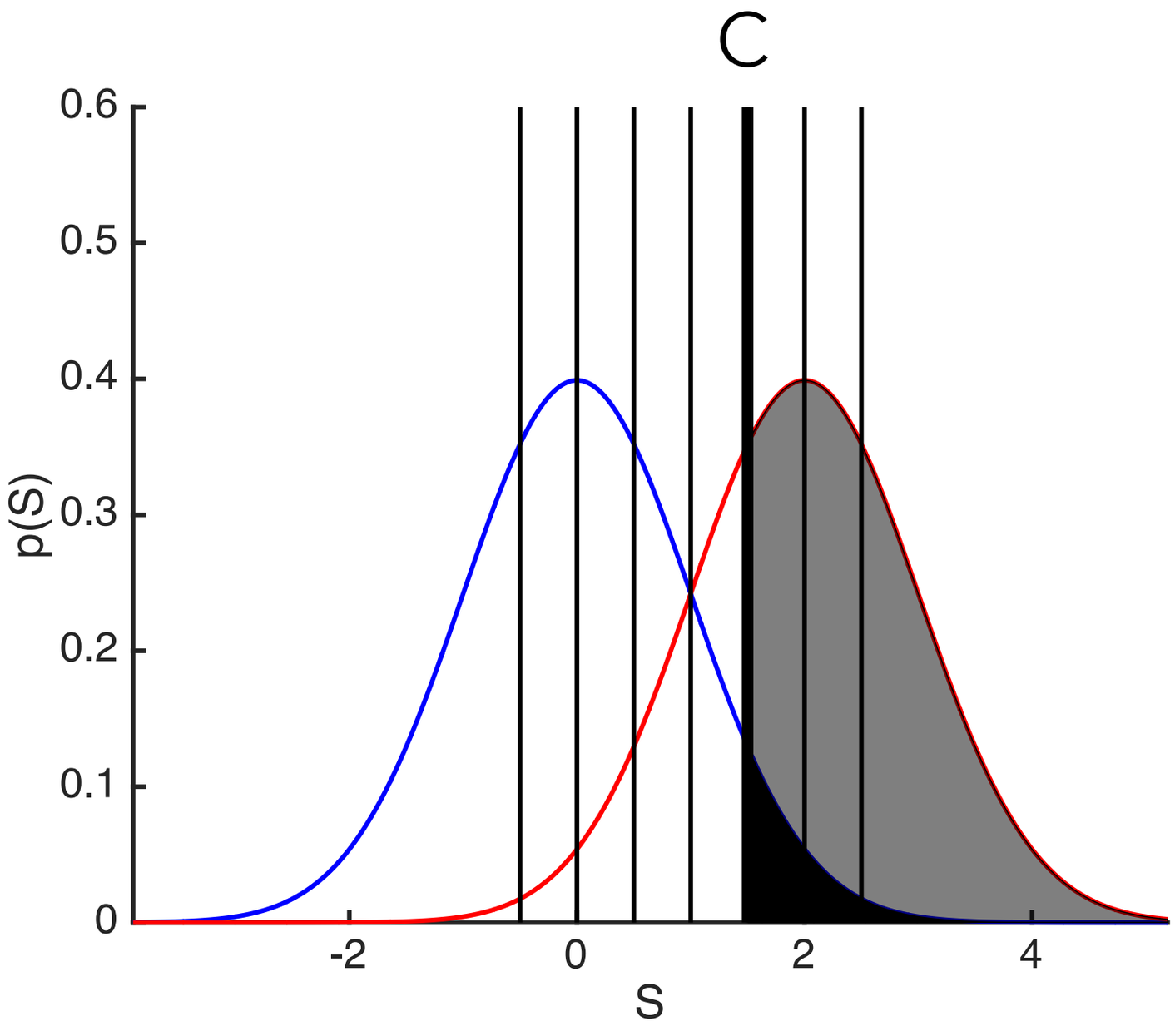
Confidence and criterion



Hits (gray)



False alarms (black)



Hit rate and false alarm rate

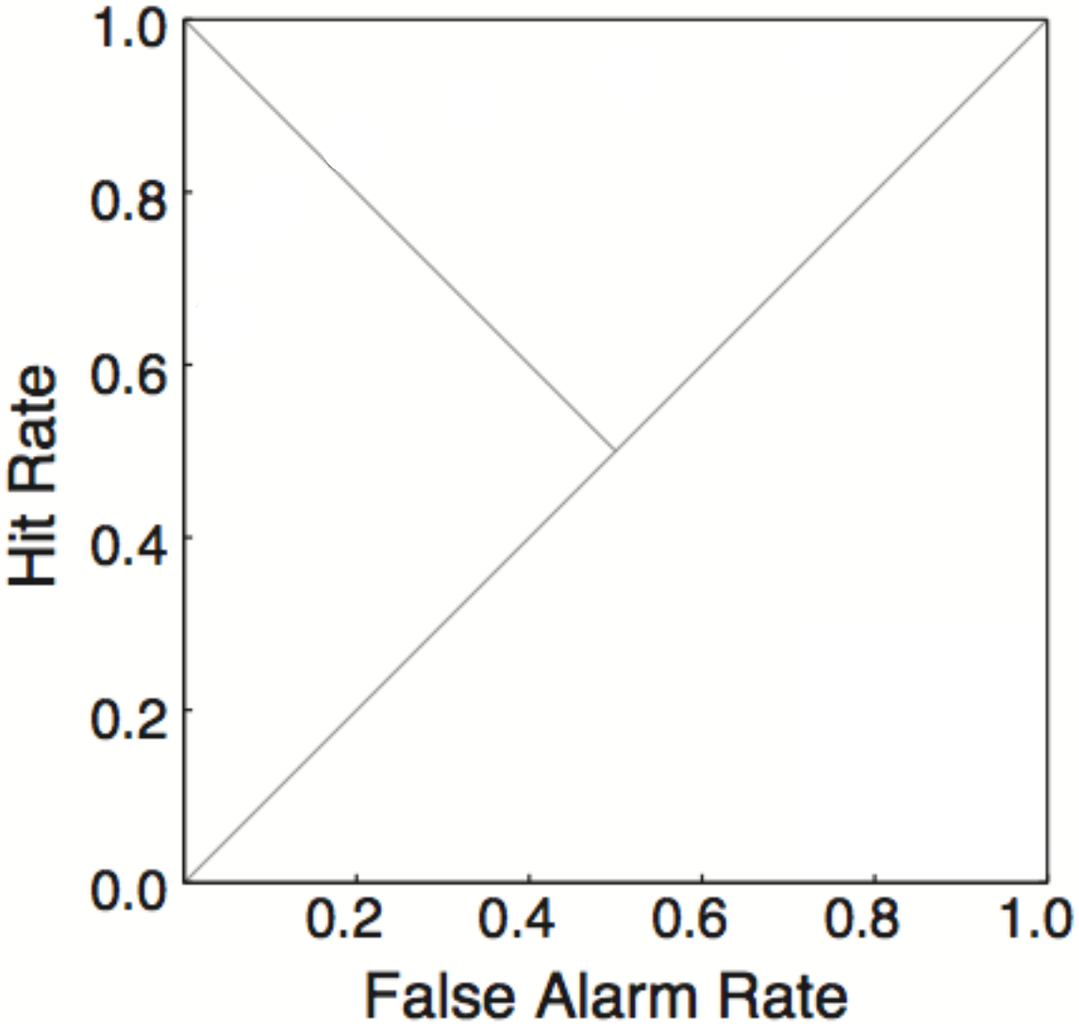
- Hit rate: number of hits / number of possible hits

  = number of hits / number of targets

- False alarm rate: number of false alarms/number of possible false alarms

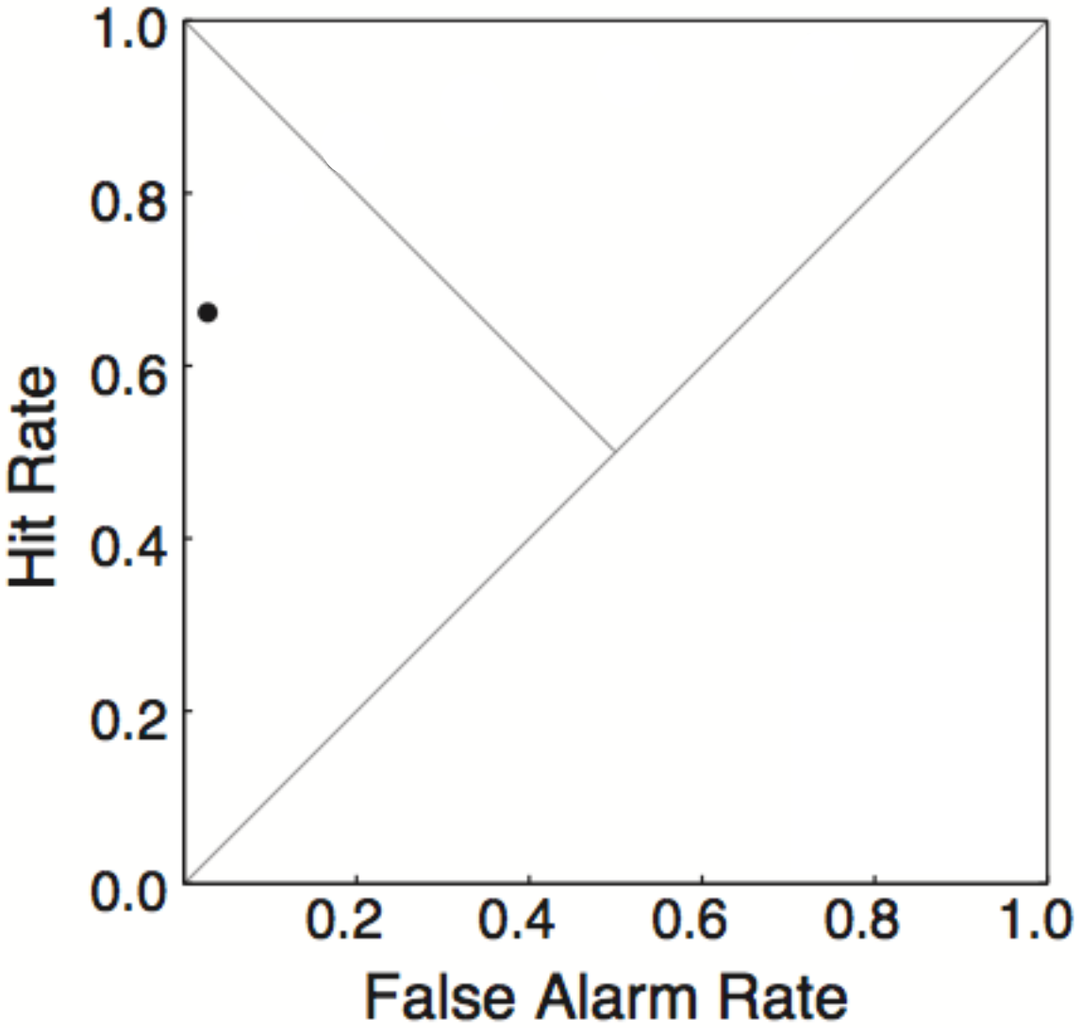
  = number of false alarms / number of lures

The ROC curve



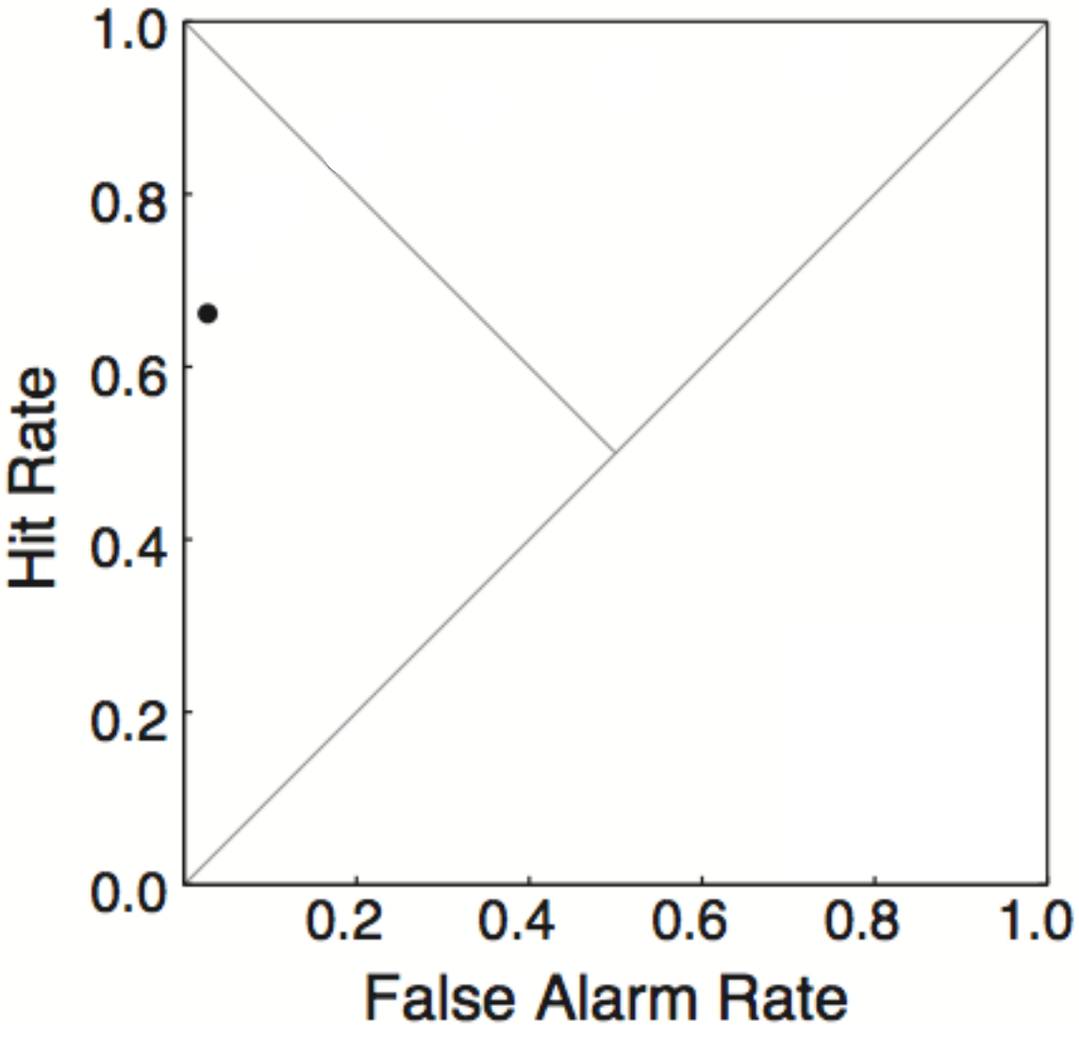
For a given C,
we can calculate
the **hit rate** and
the **false alarm rate**

The ROC curve



"You'll never false alarm with Hi-C!"

The ROC curve



We can sweep C
from high to low values
to fill in the ROC curve

Thought question:

What would the ROC curve look like if you fell asleep during the study period, and you didn’t study anything?

Reasoning with ROCs