

# prior beliefs and projection

## an RSA-based approach

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UC Irvine

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workshop on “background beliefs in the construction of meaning”

University of Tübingen, January 9-10, 2025



The Guardian, April 26 2004

“Geographically, Europe can be divided in two parts: Europe of the hare and Europe of the squirrel. Estonia is the latter: a squirrel could, without too much trouble, go from one end of the country to the other, jumping from tree to tree. Of course, **the squirrel doesn't know that Estonia includes hundreds of islands**, small and big. Estonia is a land of islands and forests. [...]”

~ Estonia includes hundreds of islands



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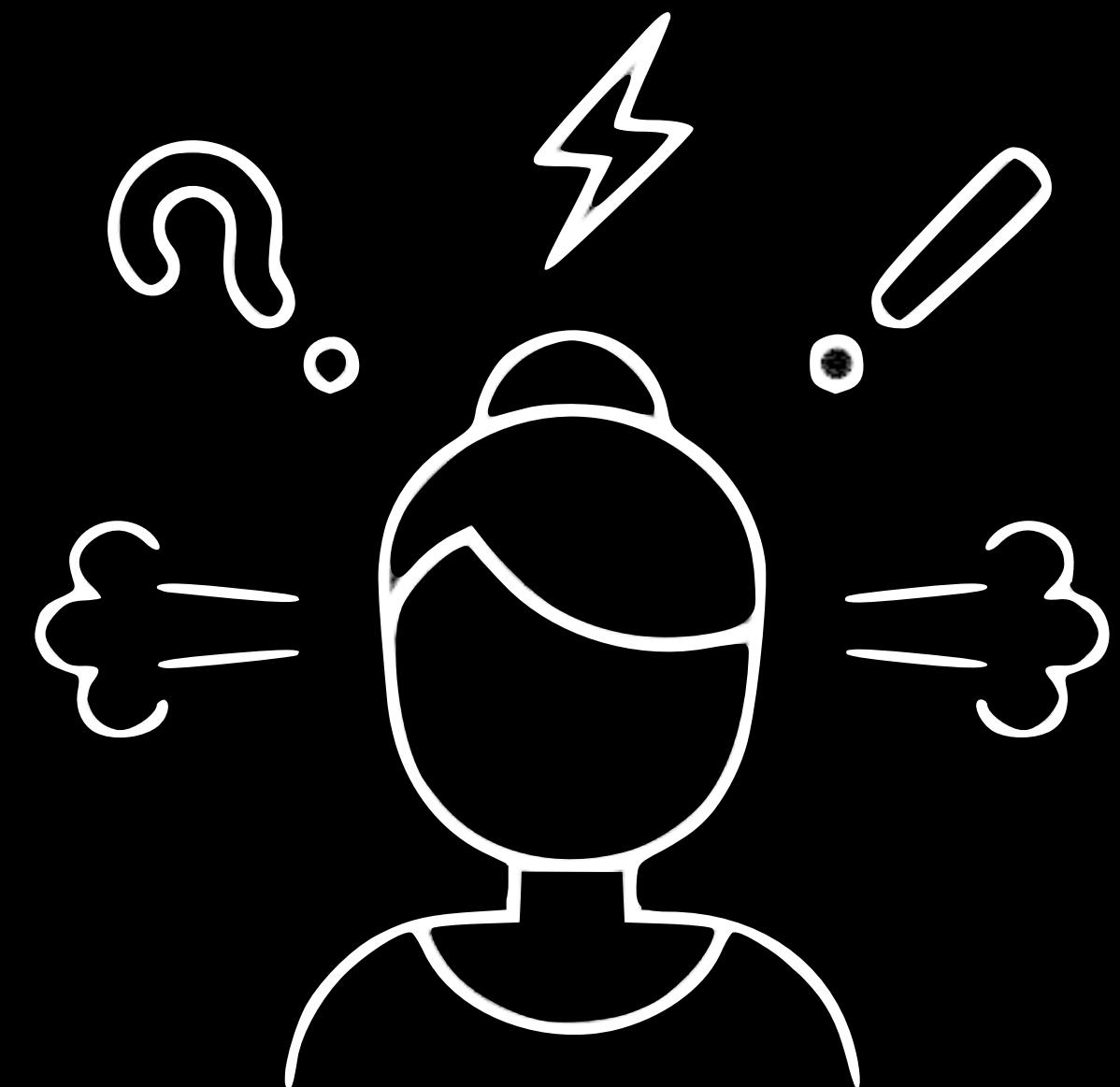
“know” presupposes that the content of its complement is common ground  
rescue strategy: accommodation

(e.g., Heim 1983, van der Sandt 1992)

“know” presupposes that the content of its complement is common ground

## rescue strategy: accommodation

(e.g., Heim 1983, van der Sandt 1992)



accommodation is a rescue strategy but  
with “informative” presuppositions it must  
apply in the majority of examples

(e.g., Delin 1995, Spenader 2003)

# “informative” presuppositions

CC of clause-embedding predicates (*know, discover, realize, regret...*)

Pre-state of change-of-state predicates (*stop, continue, ...*)

Content of temporal clauses (*before, after, ...*)

Existential content of clefts (e.g., *It was Alvin who arrived*)

Possession content of possessive NPs (e.g., *Brenda's parrot*)

Prejacent of *only* (e.g., *Only Cassie danced*)

Prejacent of manner adverb sentences (e.g., *Simone ran quickly*)

...

(e.g., Beaver, Geurts & Denlinger 2021)



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~ Estonia includes hundreds of islands



Nancy asks: “Does Cole know that Julian dances salsa?”

→ Julian dances salsa

1. Nancy knows (and we know) that Julian is Cuban.
2. Nancy knows (and we know) that Julian is German.

(Degen & Tonhauser 2021, *Open Mind*; ms under review)

**desiderata**

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**allow for the principled integration of information from multiple factors**  
(lexical entailments, compositional semantics, prior beliefs, QUDs, ...)

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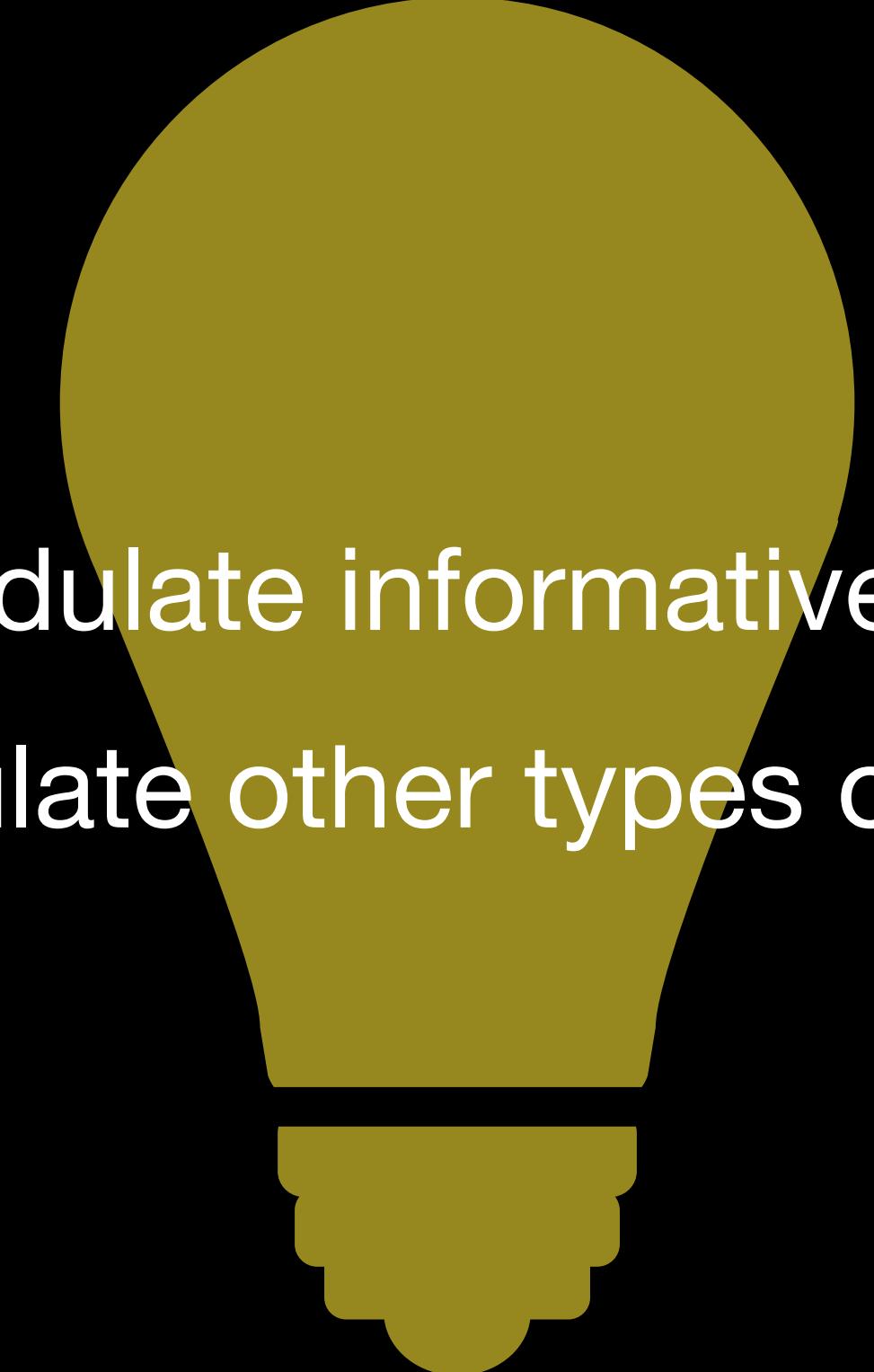
**make empirically testable (i.e., falsifiable) predictions**

**predict probabilistic (not merely categorical) inferences**



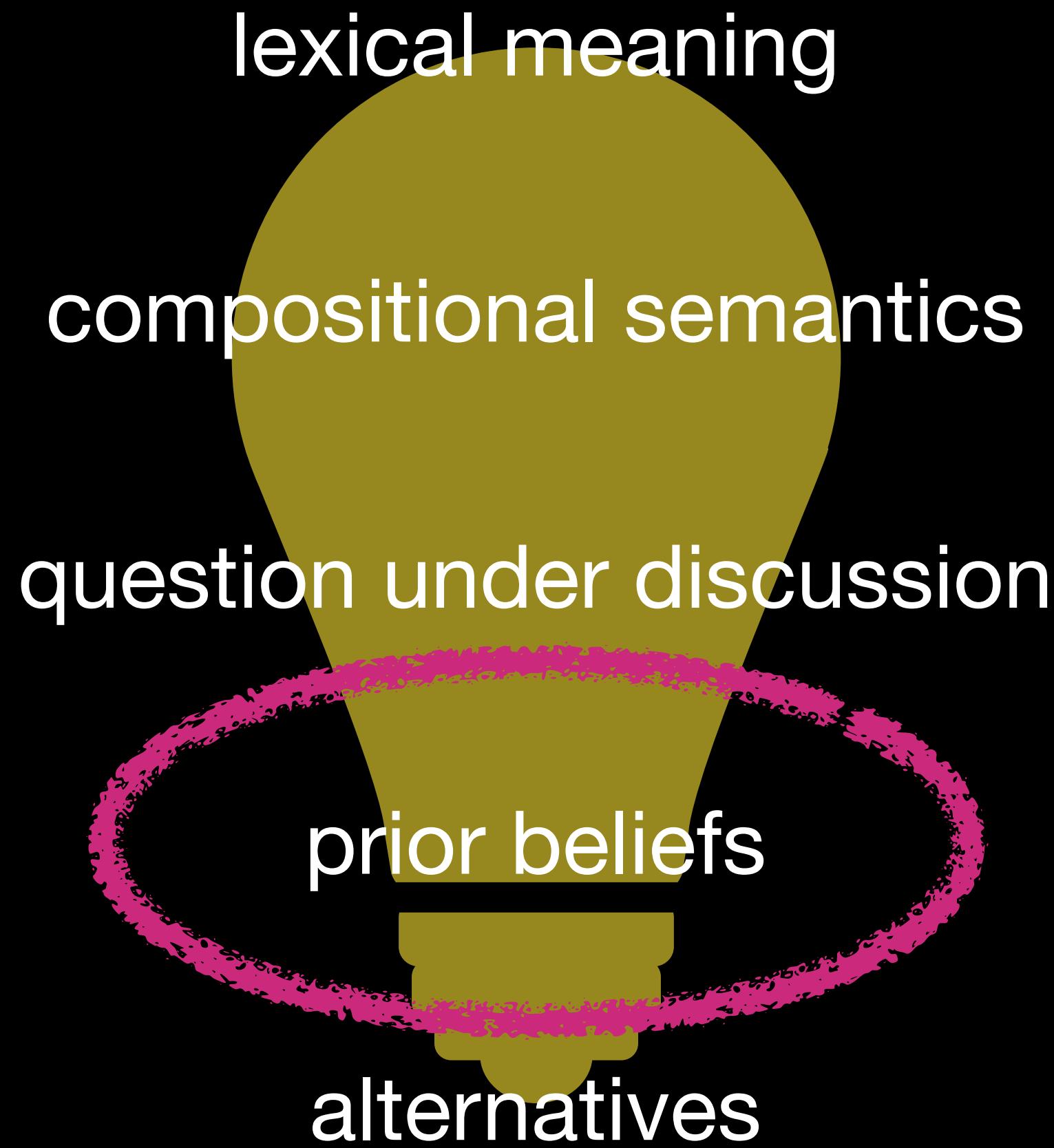
instead of developing analyses tailored to informative presuppositions,  
we **can** and **should** develop more general analyses that make predictions about  
inferences drawn from utterances

informative presuppositions are just one kind of inference



factors that modulate informative presuppositions  
also modulate other types of inferences

# factors that modulate informative presuppositions



(e.g., Abrusán 2011, 2016; Abusch 2002, 2010; Chèmla 2009; Cummins & Rohde 2015; Degen & Tonhauser 2021, 2022, under review; Djärv & Bacovcin 2020; Romoli 2015; Simons et al 2010, 2017)

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## **Rational Speech Act (RSA) modeling framework**

(e.g., Frank & Goodman 2012; Goodman & Frank 2016)

Cole doesn't *think/know* that Charley speaks Spanish.

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→ Charley speaks Spanish

Cole doesn't ***think/know*** that Charley speaks Spanish.



# basic model

$$P_{L_0}(Q(w) \mid u, CG, Q) \propto \sum_{w' \in CG \cap \llbracket u \rrbracket} \delta_{Q(w)=Q(w')} \cdot P(w') \quad \text{literal listener}$$

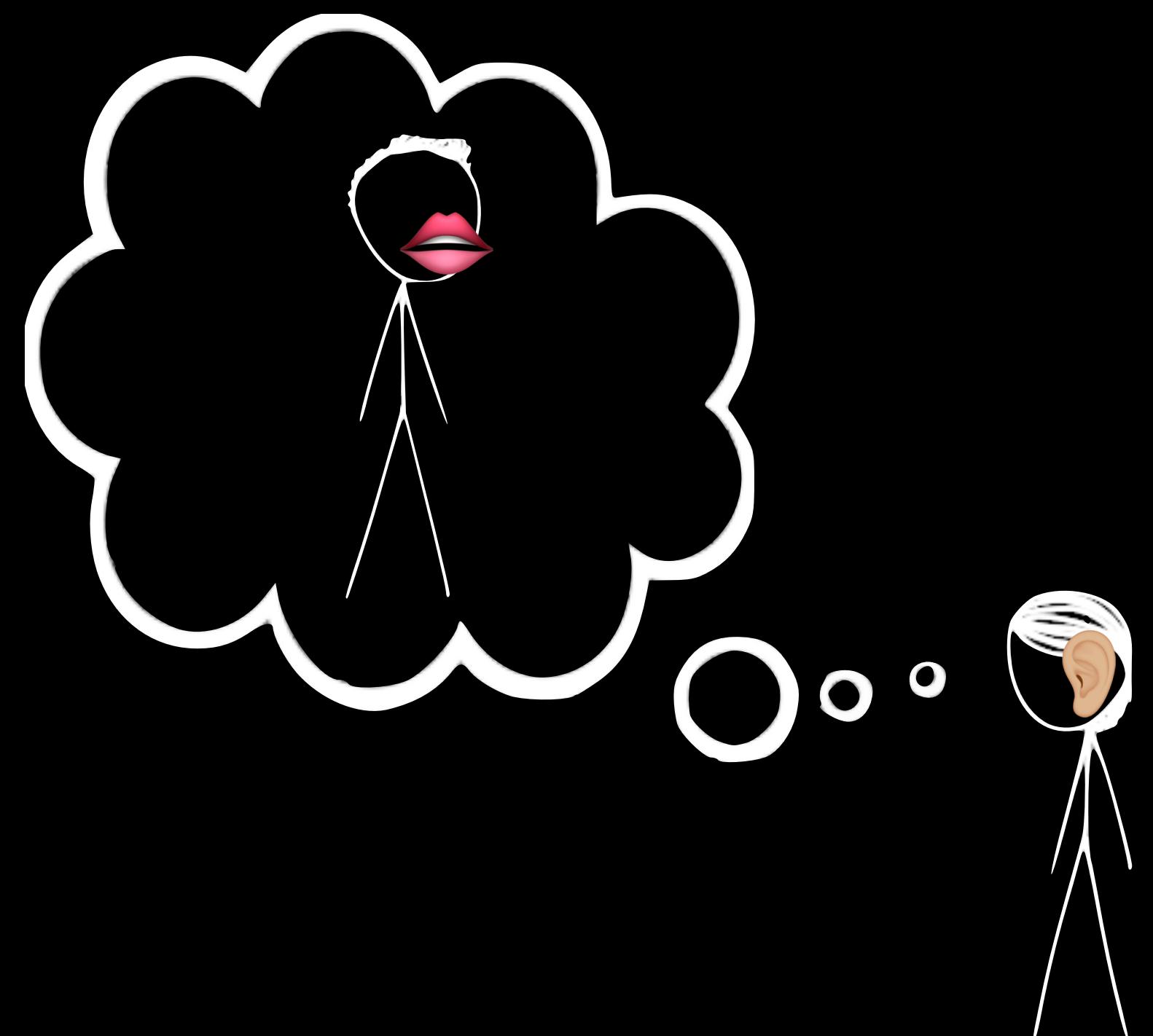
$$P_{S_1}(u \mid w, CG, Q) \propto \exp(\alpha(\log(P_{L_0}(Q(w) \mid u, CG, Q) - C(u)))) \quad \text{pragmatic speaker}$$

$$P_{L_1}(Q(w), CG \mid u, Q) \propto P_{S_1}(u \mid w, CG, Q) \cdot P(w) \cdot P(CG) \quad \text{pragmatic listener}$$

adapted from Qing et al. 2016 (*CogSci*) for *stop*

# basic model intuition

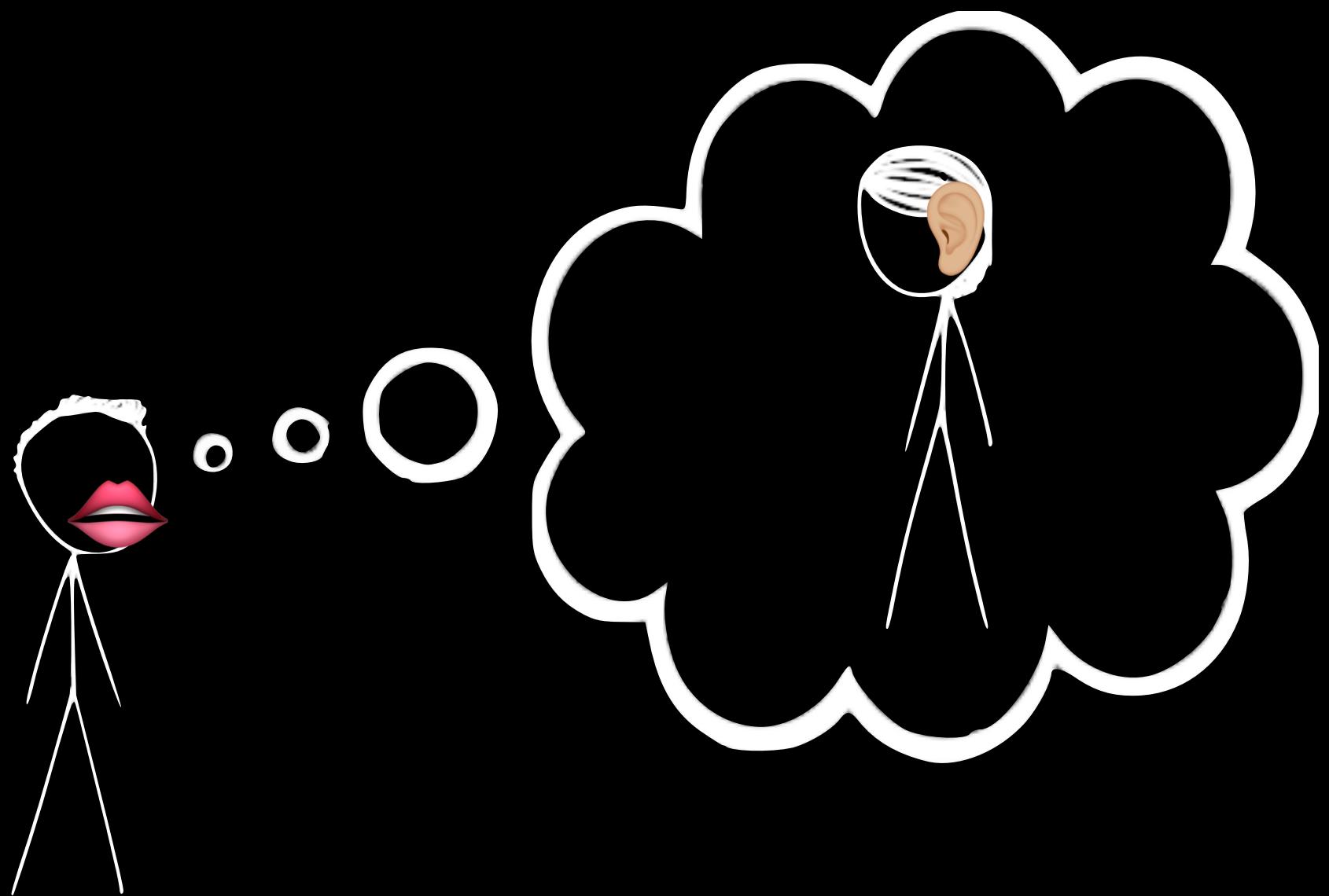
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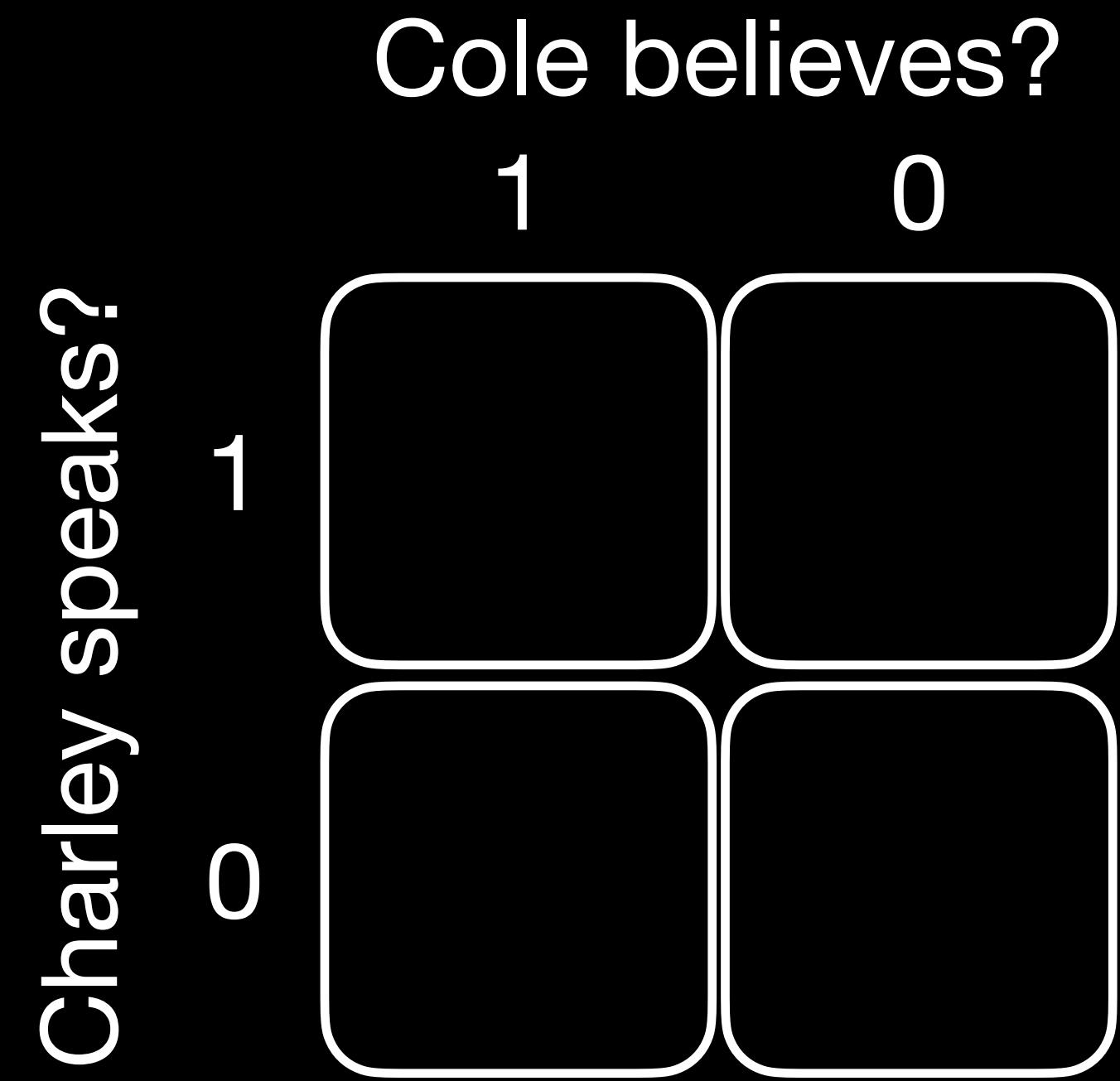
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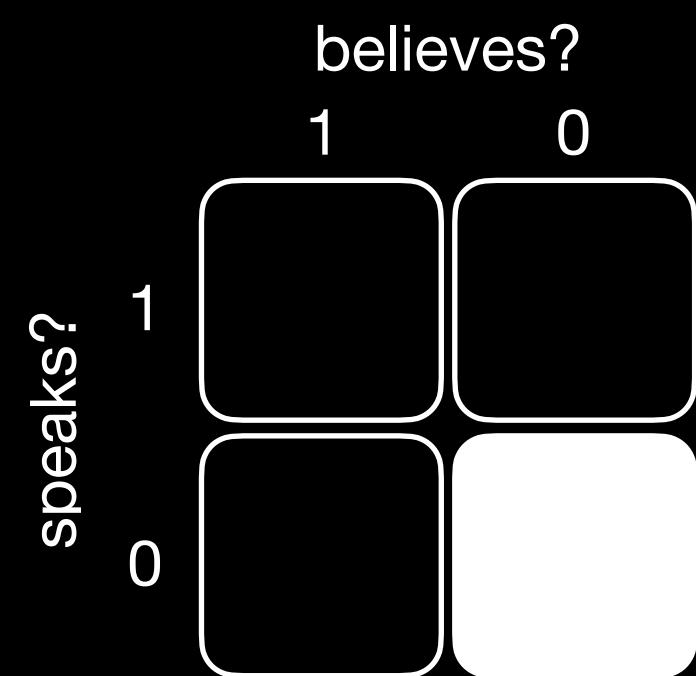
a **know** utterance is **more useful** to a speaker who is already privately **committed to the content of the complement** being true

# basic model worlds



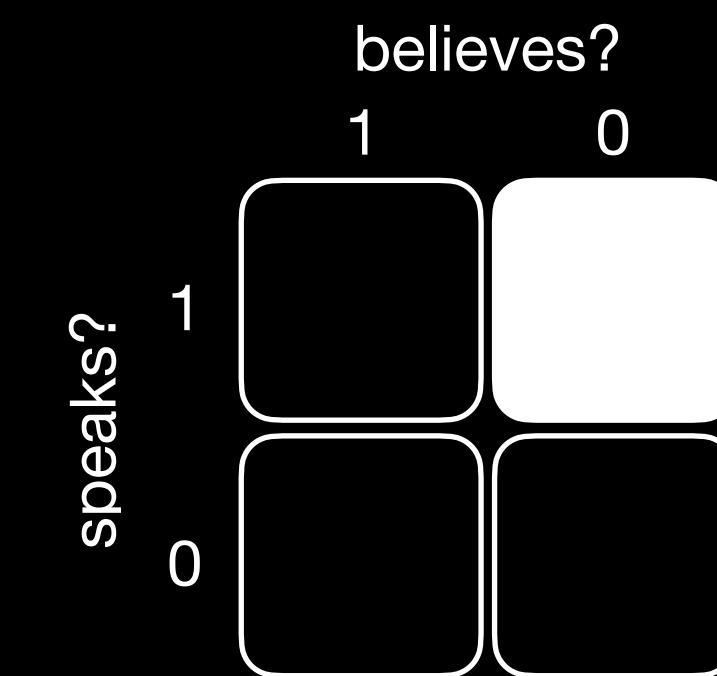
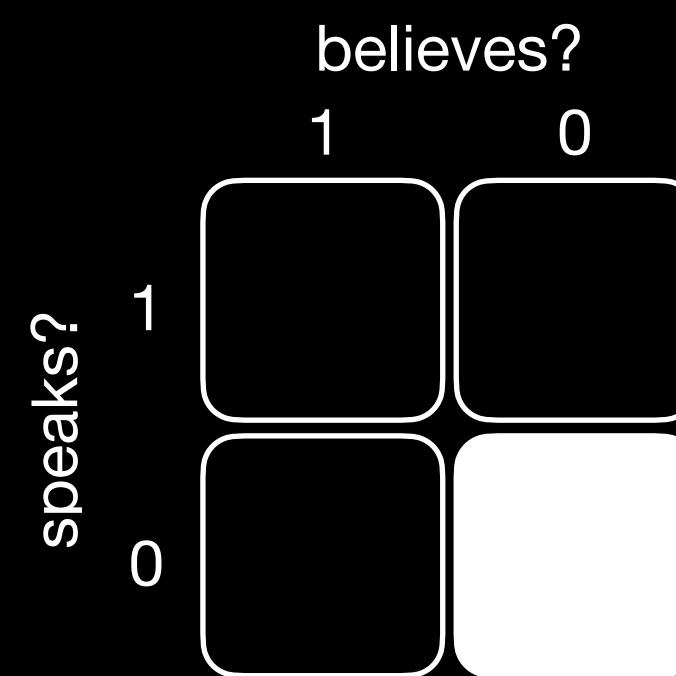
Cole doesn't ***think/know*** that Charley speaks Spanish.

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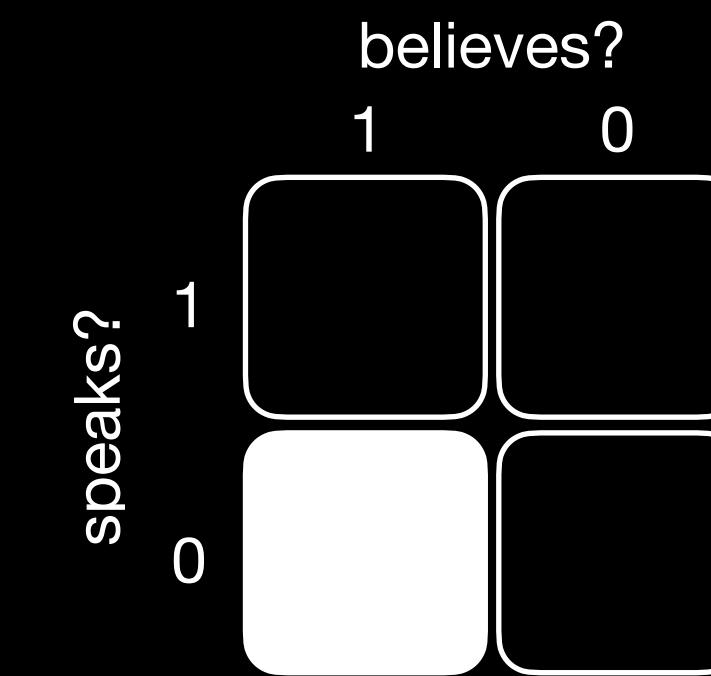
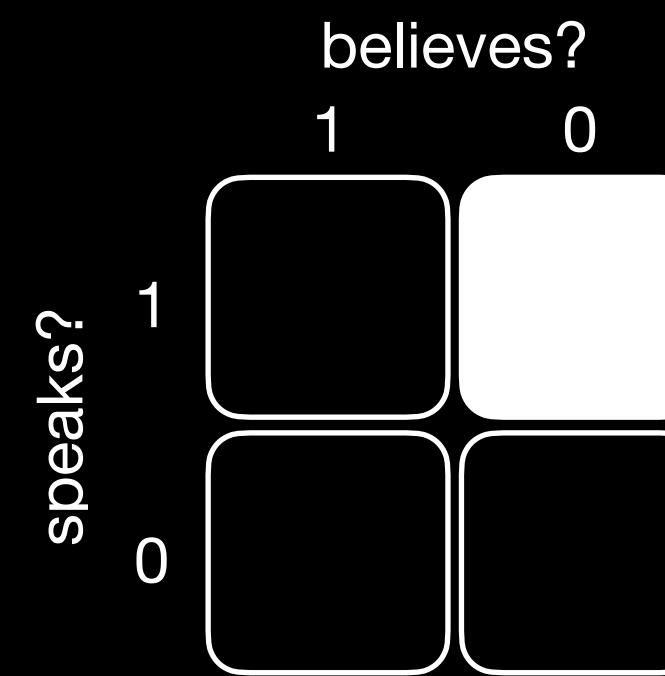
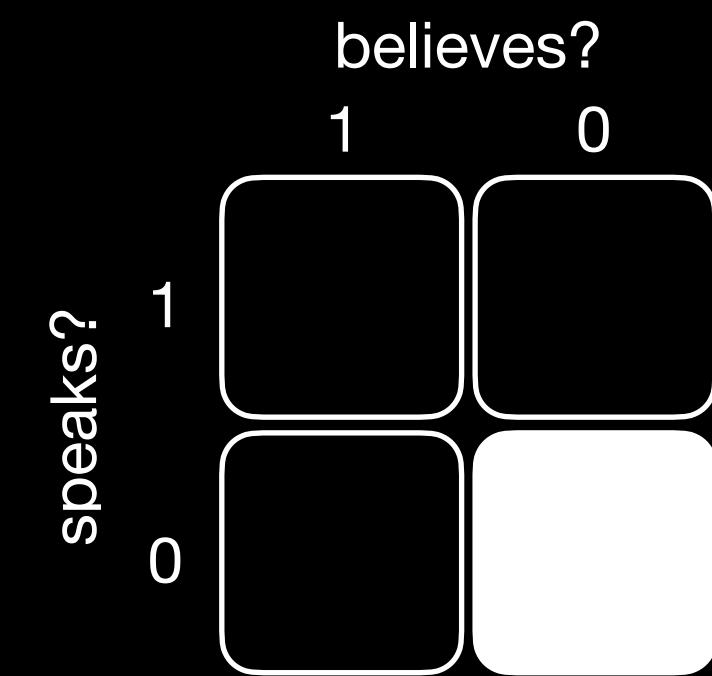
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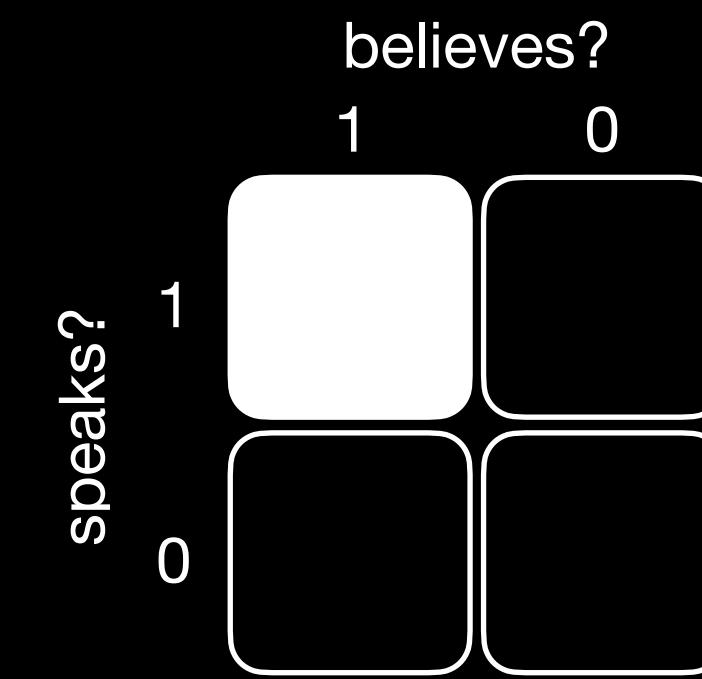
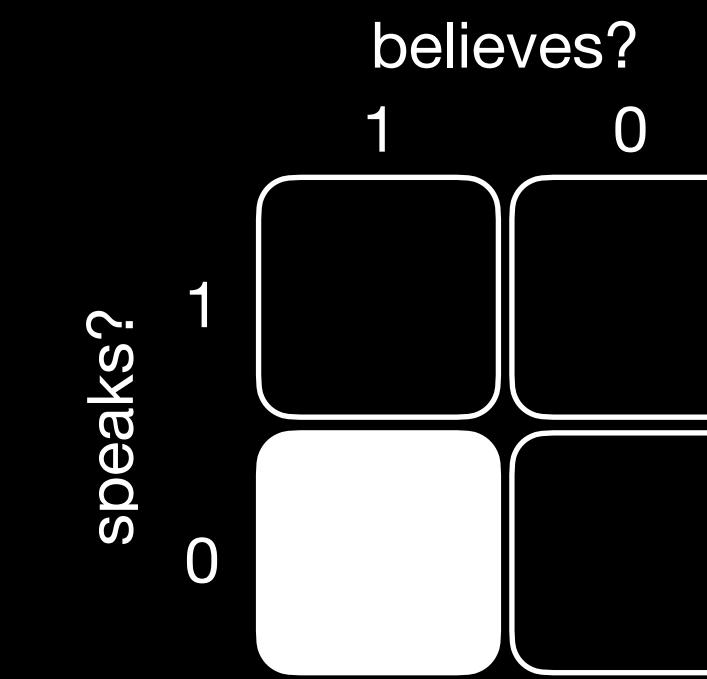
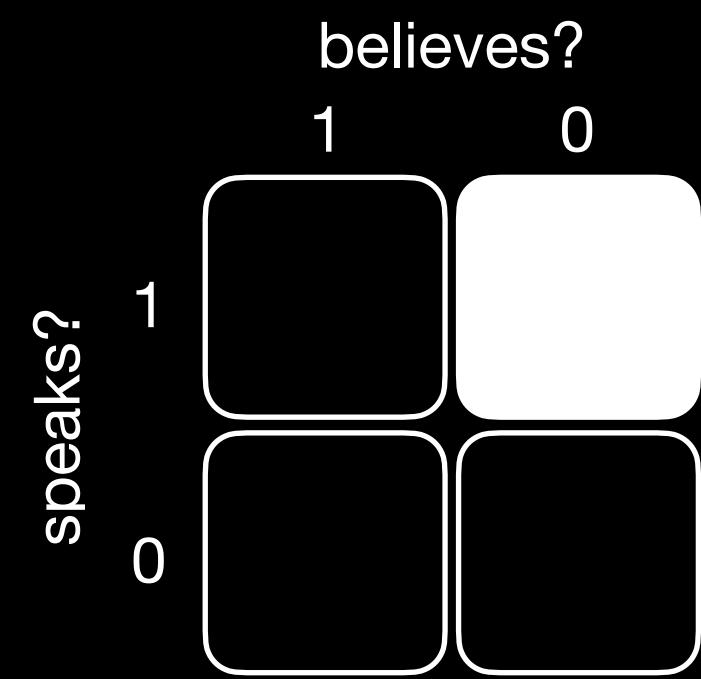
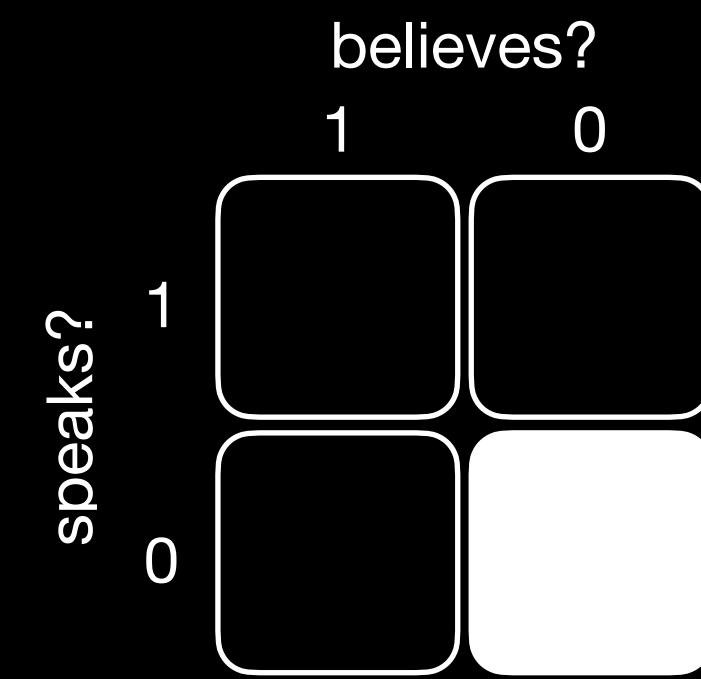
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# prior belief manipulation

believes?		
1	0	
speaks?		
1	<input type="checkbox"/>	<input type="checkbox"/>
0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

believes?		
1	0	
speaks?		
1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0	<input type="checkbox"/>	<input type="checkbox"/>

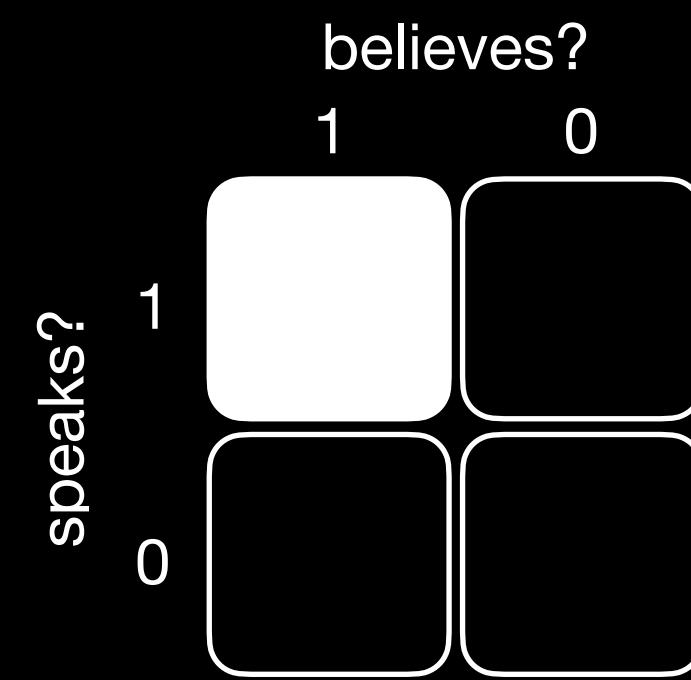
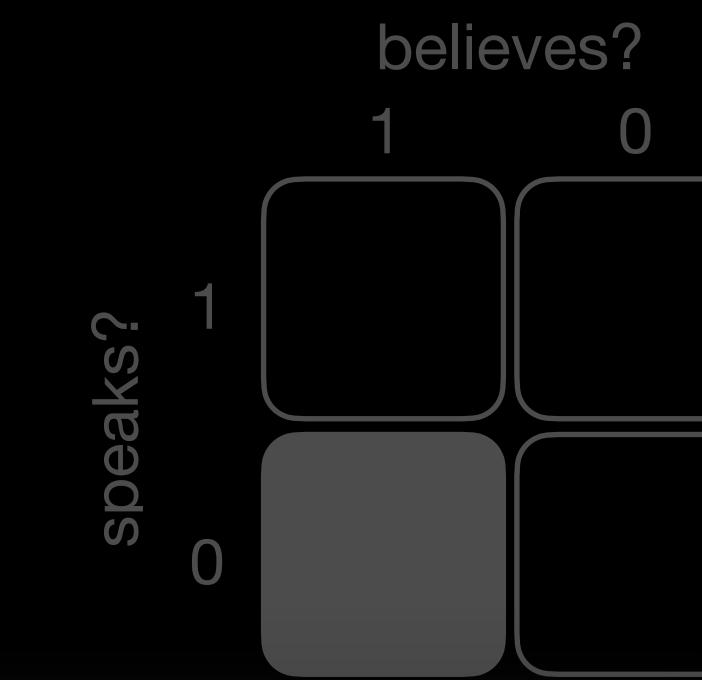
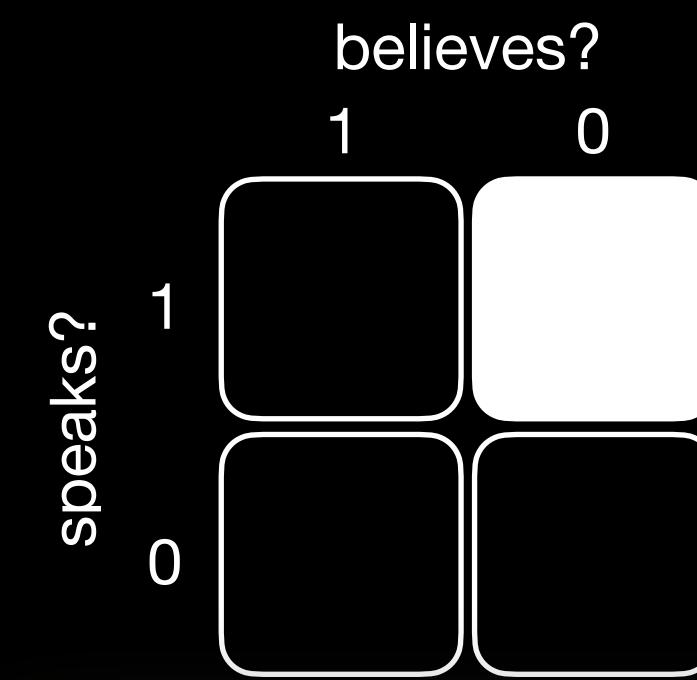
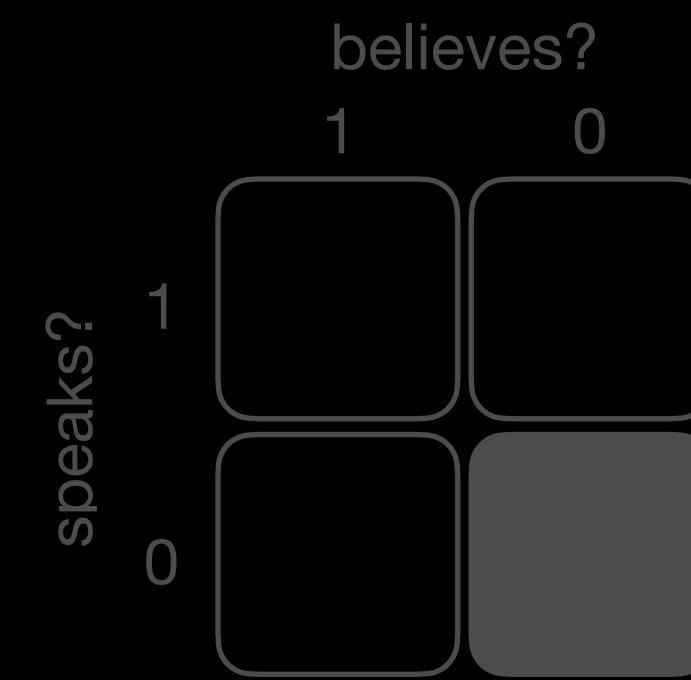
believes?		
1	0	
speaks?		
1	<input type="checkbox"/>	<input type="checkbox"/>
0	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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1	0	
speaks?		
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
0	<input type="checkbox"/>	<input type="checkbox"/>



Charley lives in Mexico

# prior belief manipulation



# prior belief manipulation

believes?		
speaks?	1	0
1	■	■
0	■	■

believes?		
speaks?	1	0
1	■	■
0	■	■

believes?		
speaks?	1	0
1	■	■
0	■	■

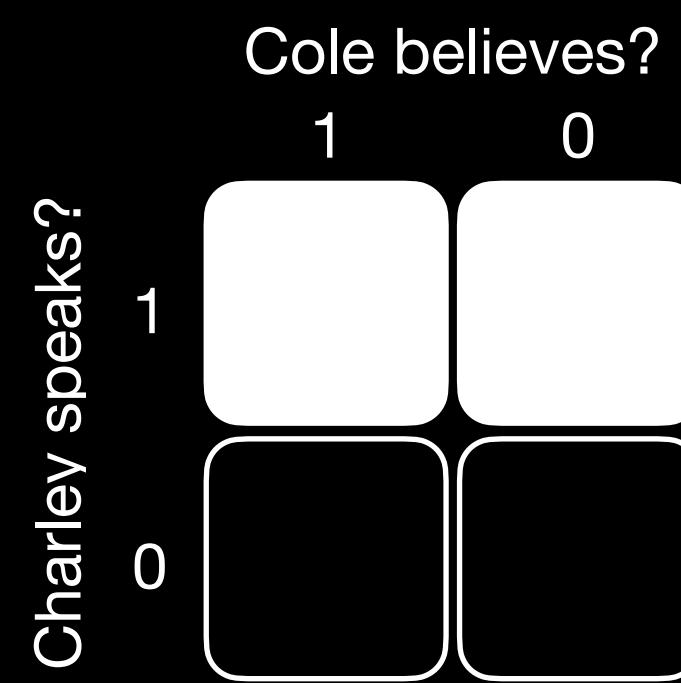
believes?		
speaks?	1	0
1	■	■
0	■	■



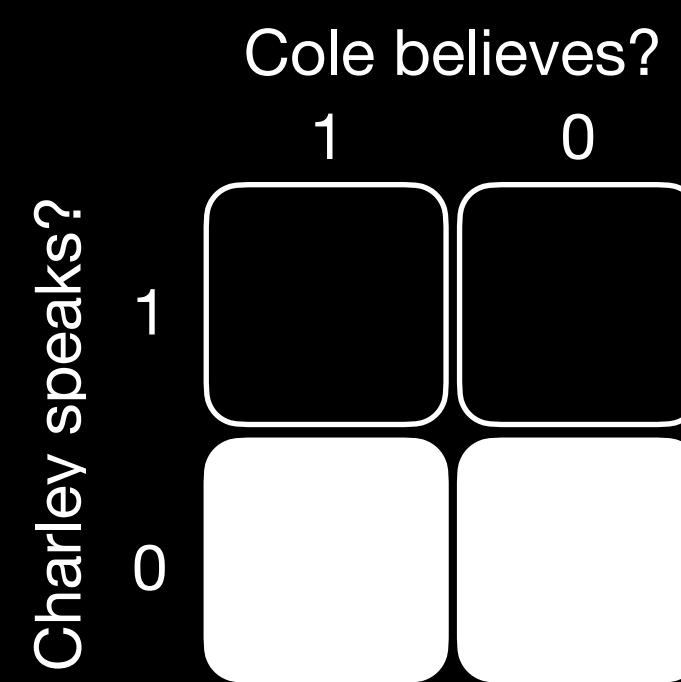
Charley lives in Korea

# basic model utterances and semantics

Charley speaks Spanish.

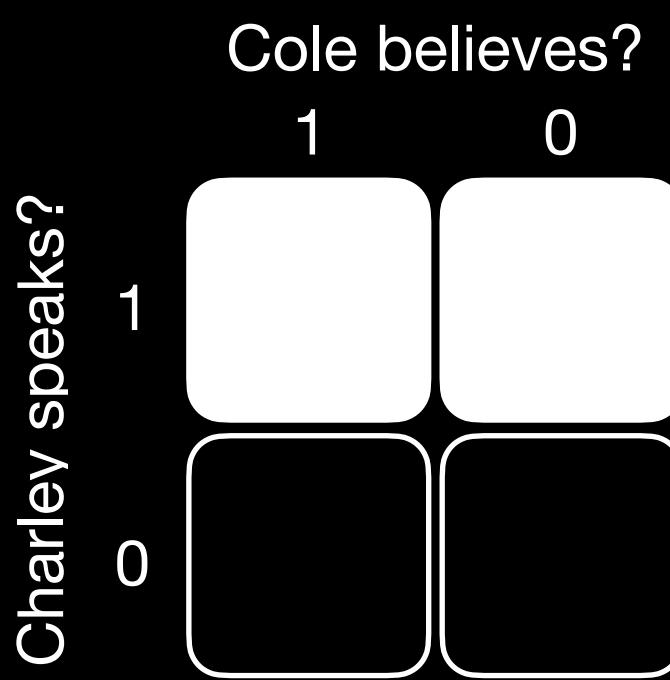


Charley doesn't speak Spanish.

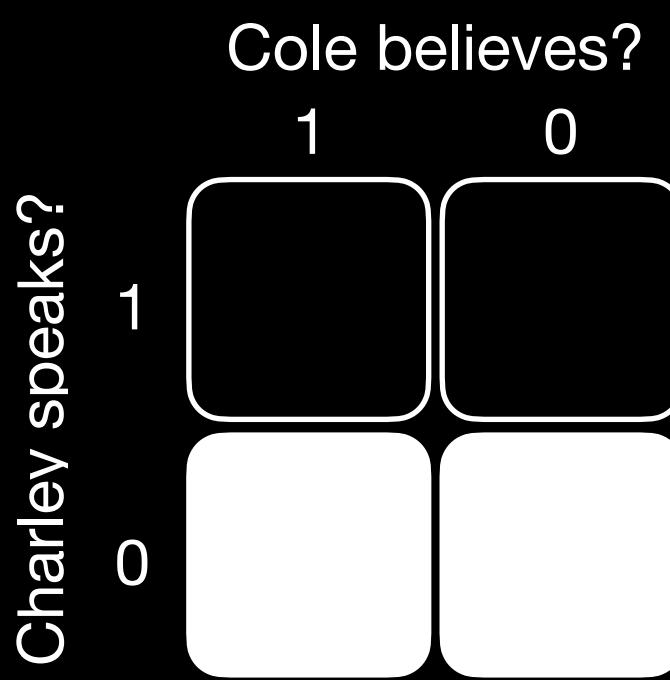


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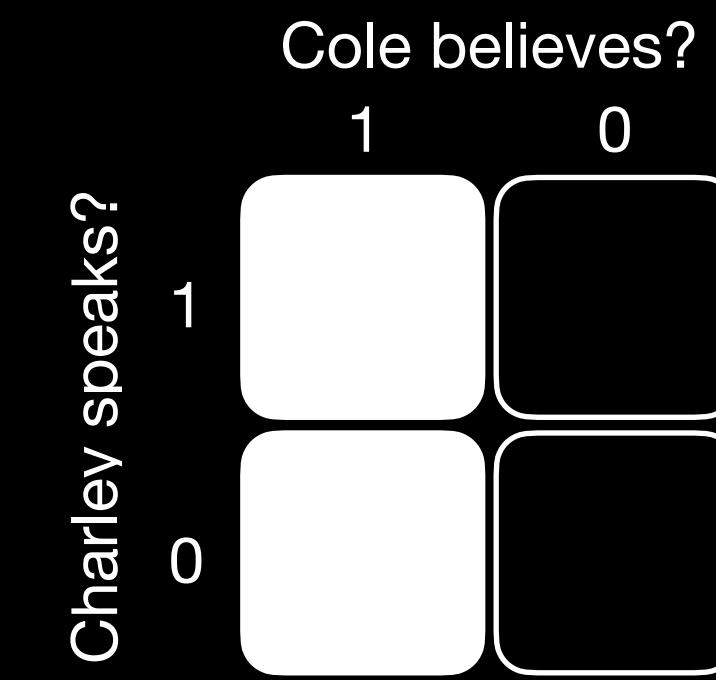
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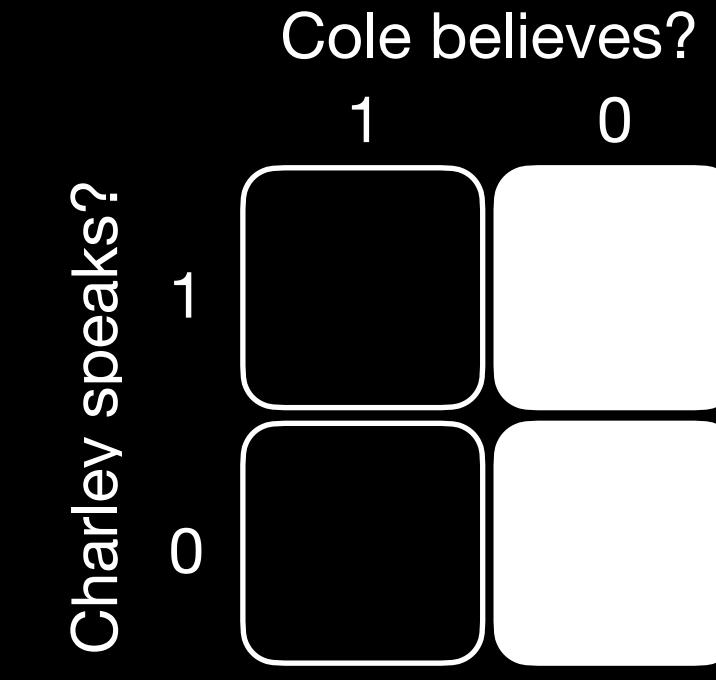
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Cole thinks that  
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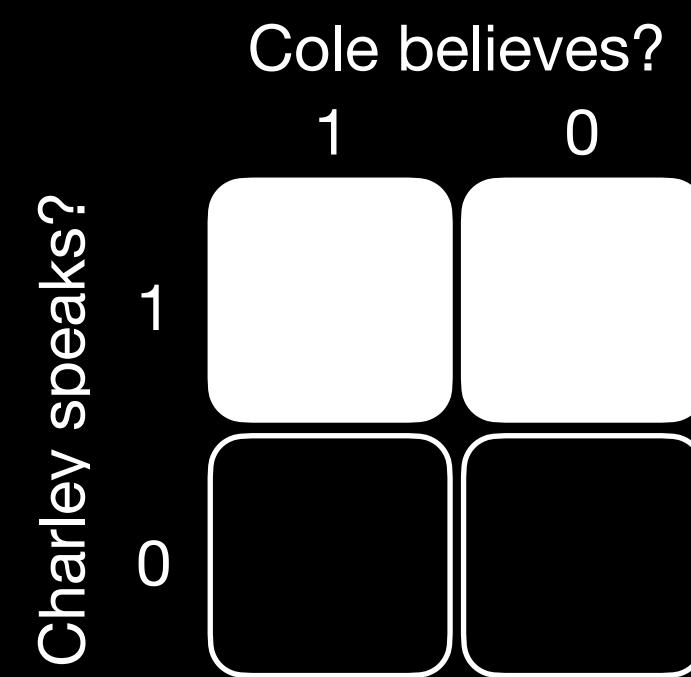


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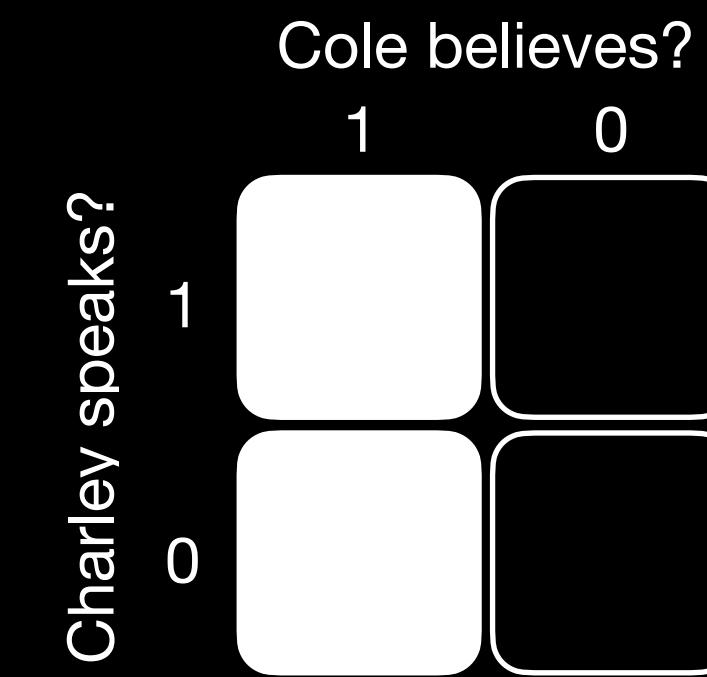


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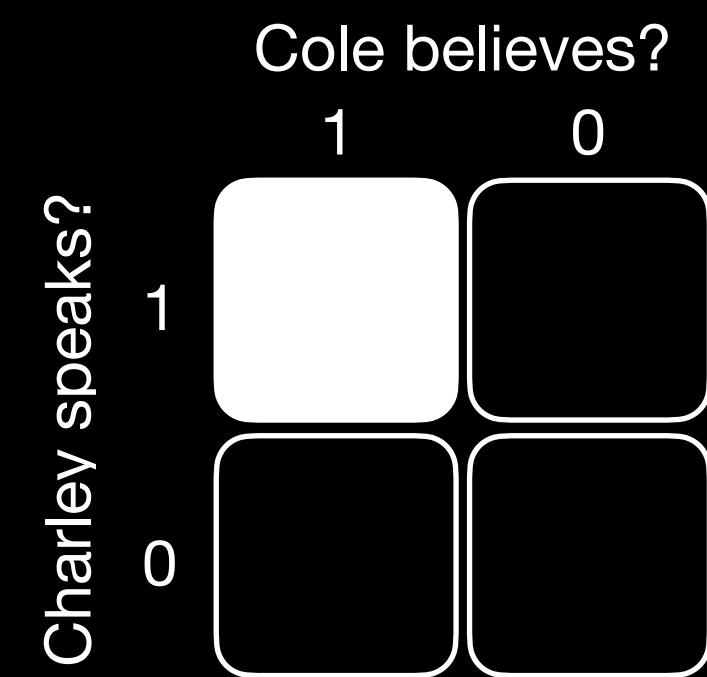
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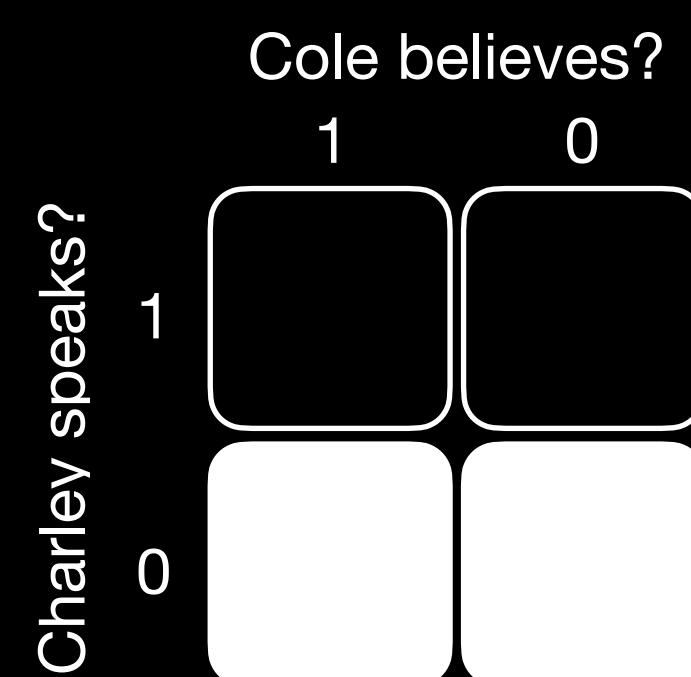
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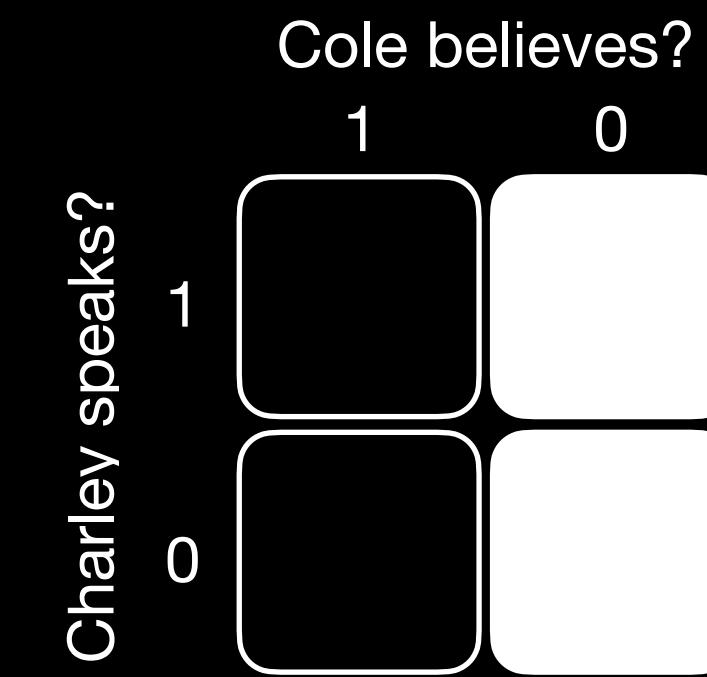
Cole knows that  
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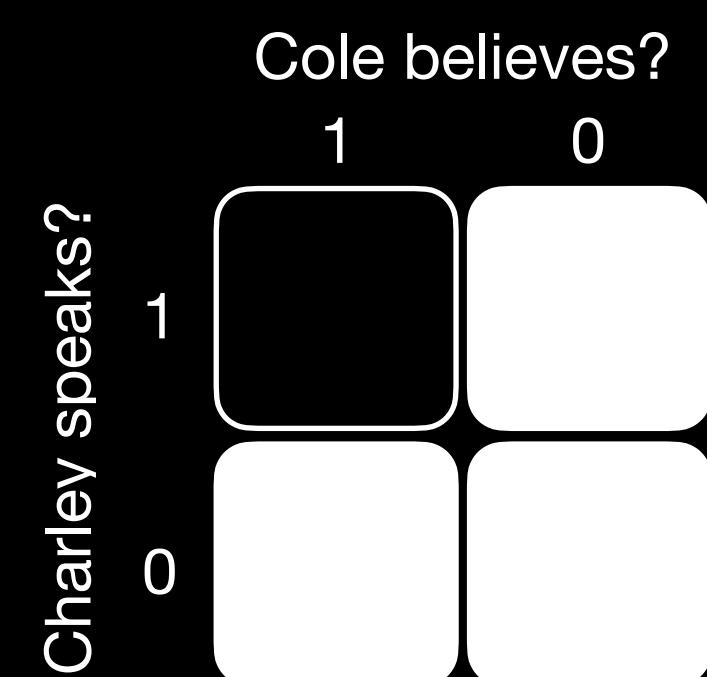
Charley doesn't speak Spanish.



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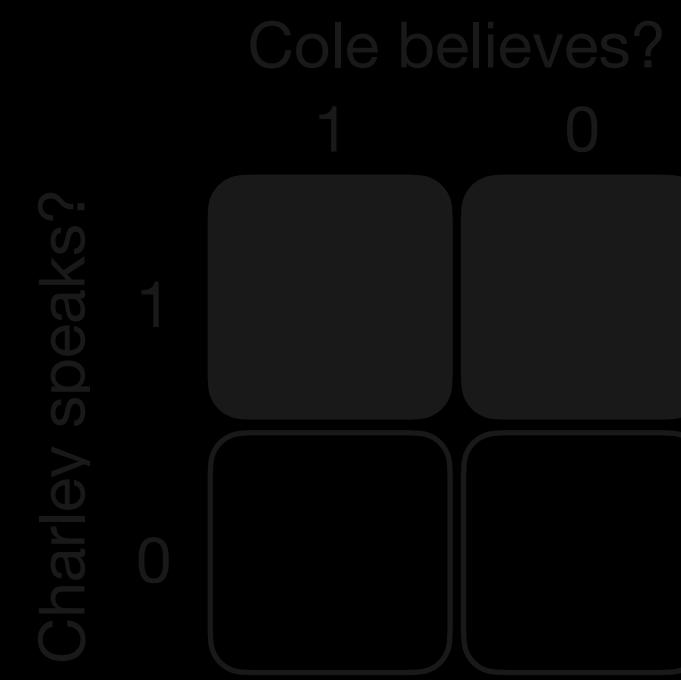


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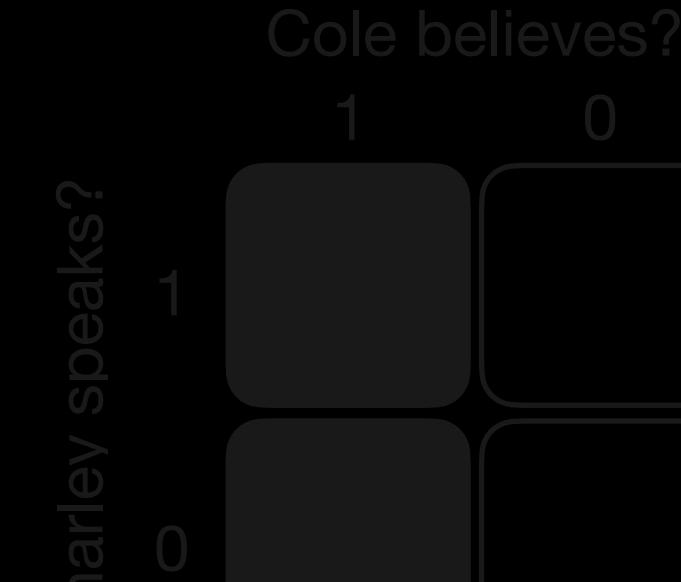


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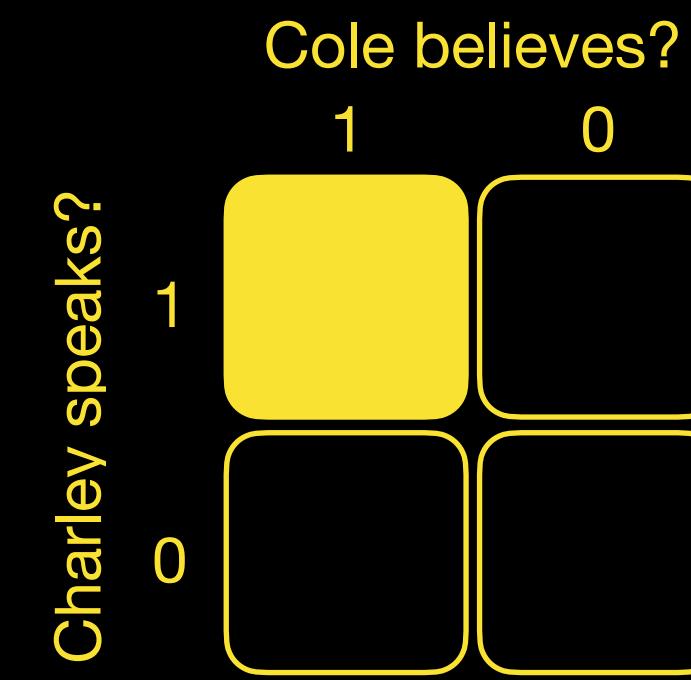
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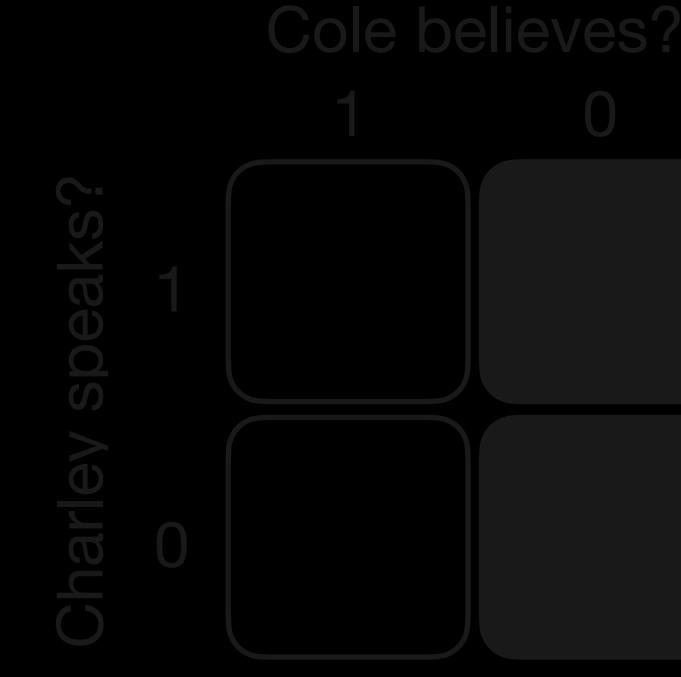
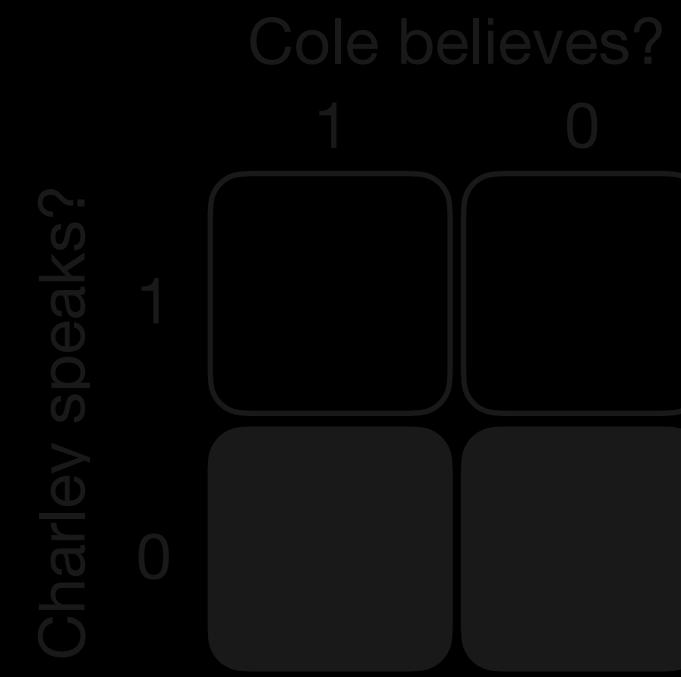


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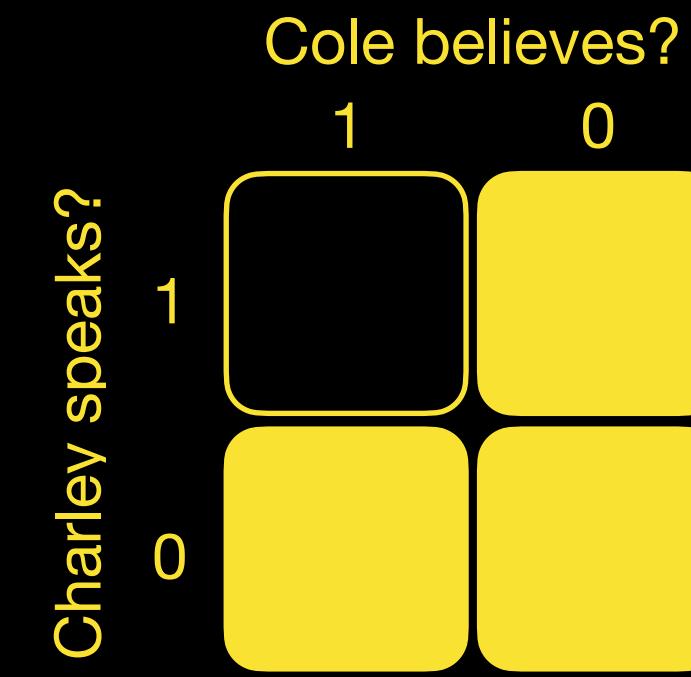


**lexical entailment coded,  
but no presupposition!**

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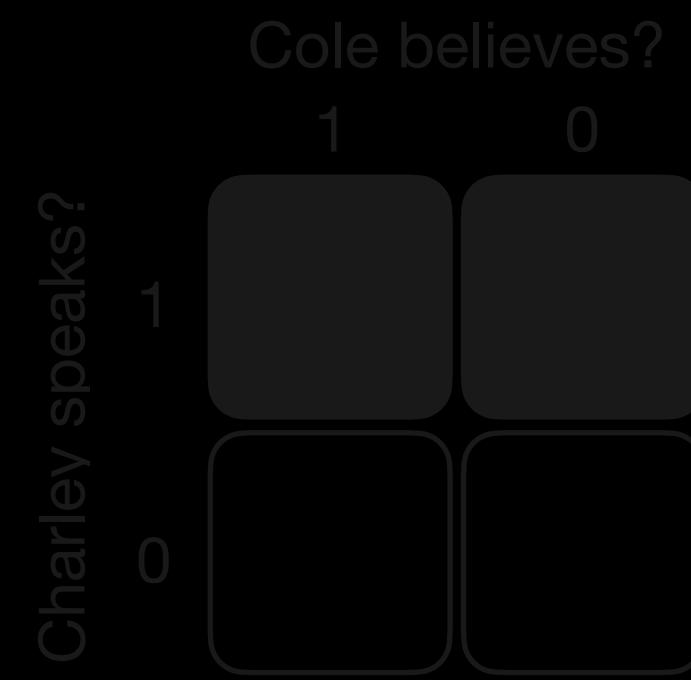


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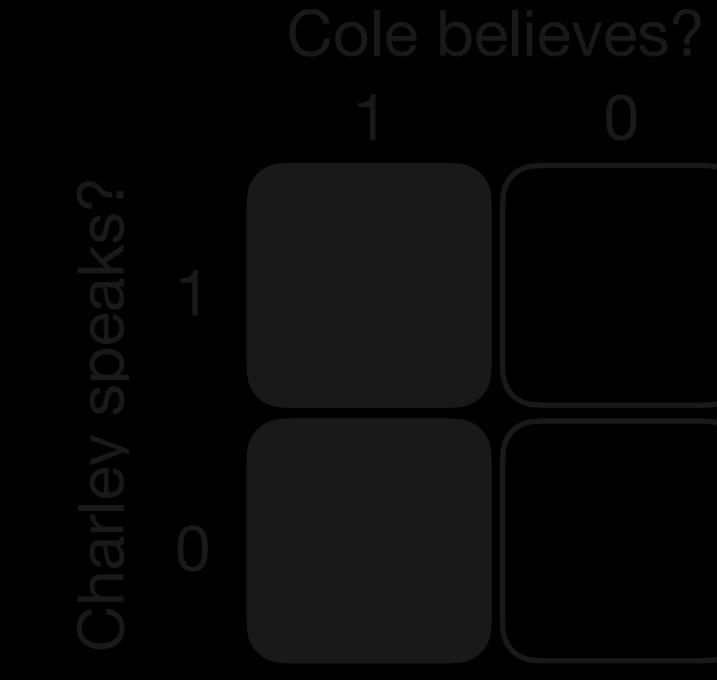


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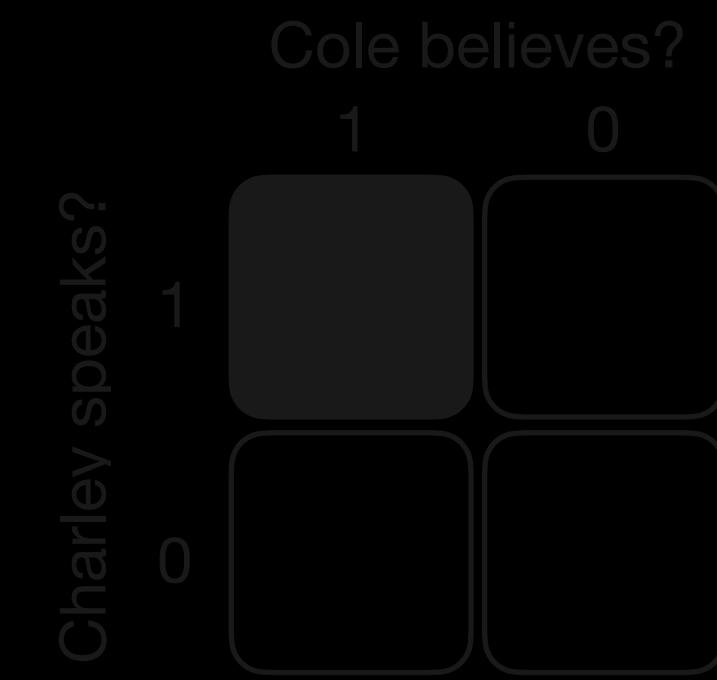
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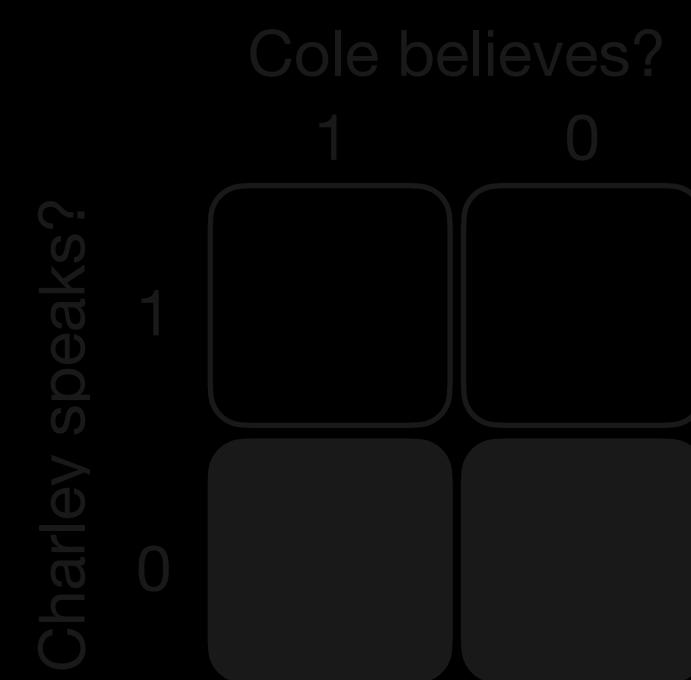
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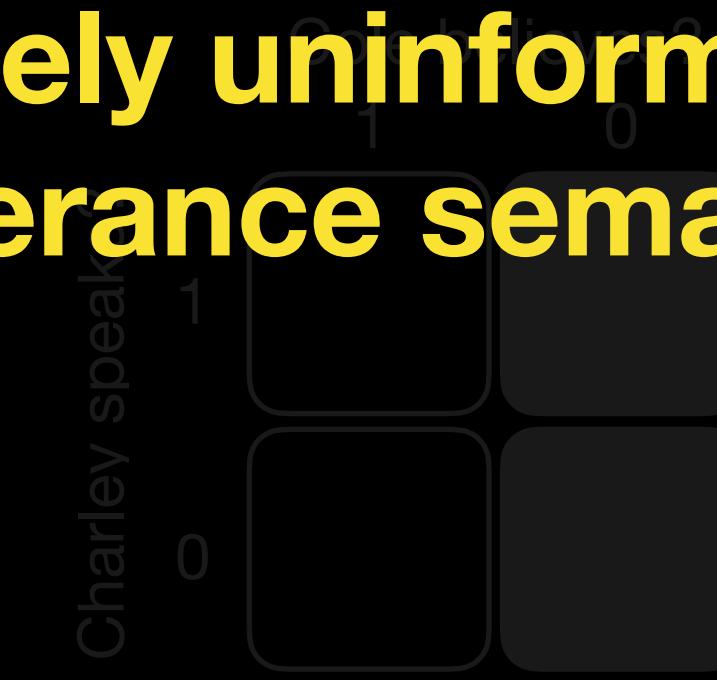
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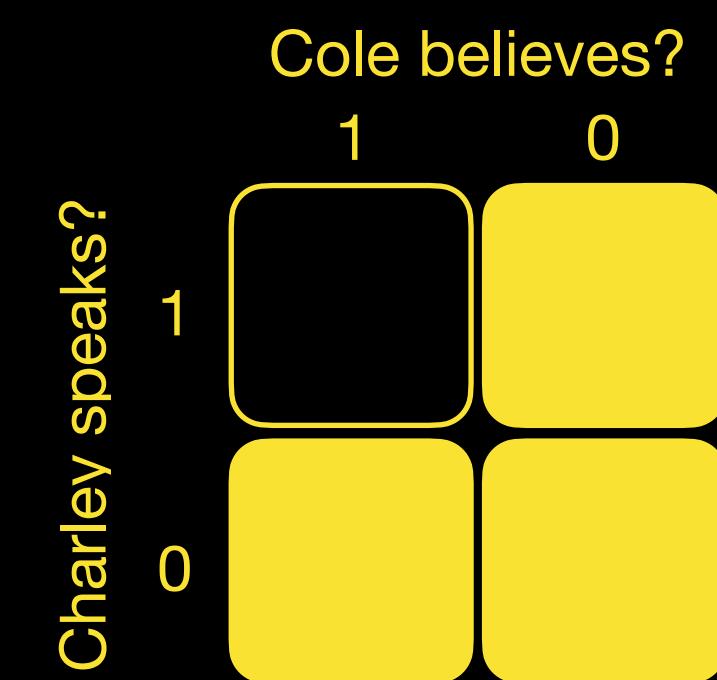
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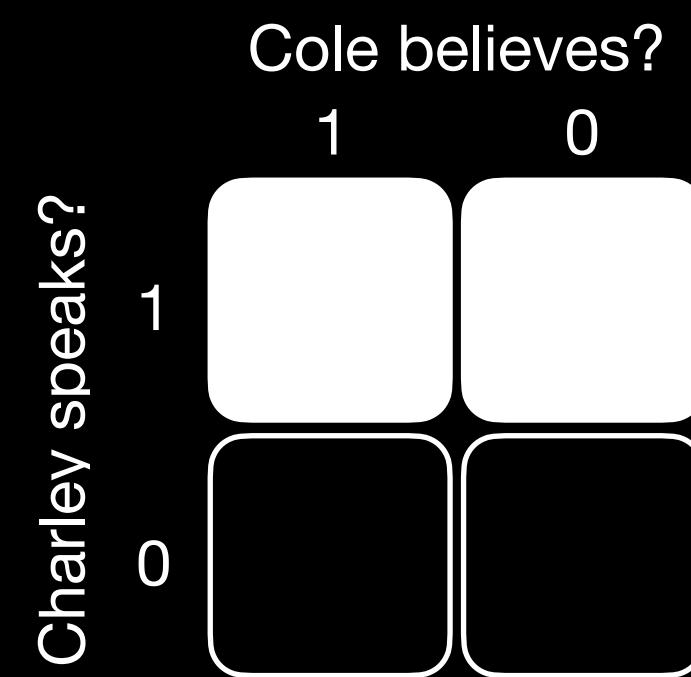
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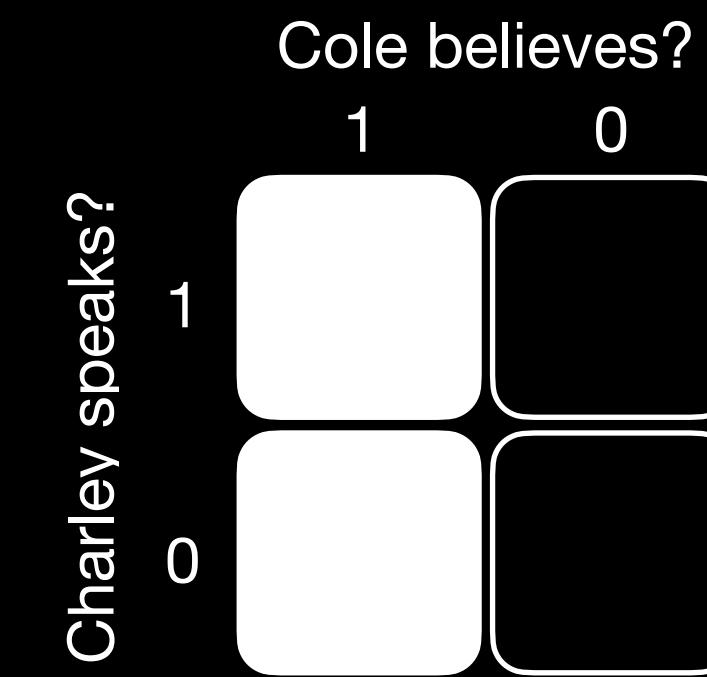
**relatively uninformative  
utterance semantics**

# basic model utterances and semantics

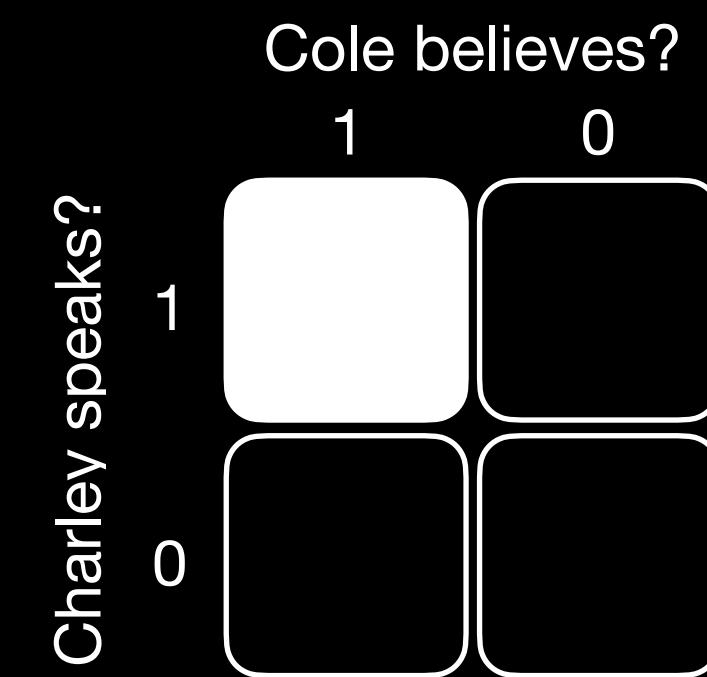
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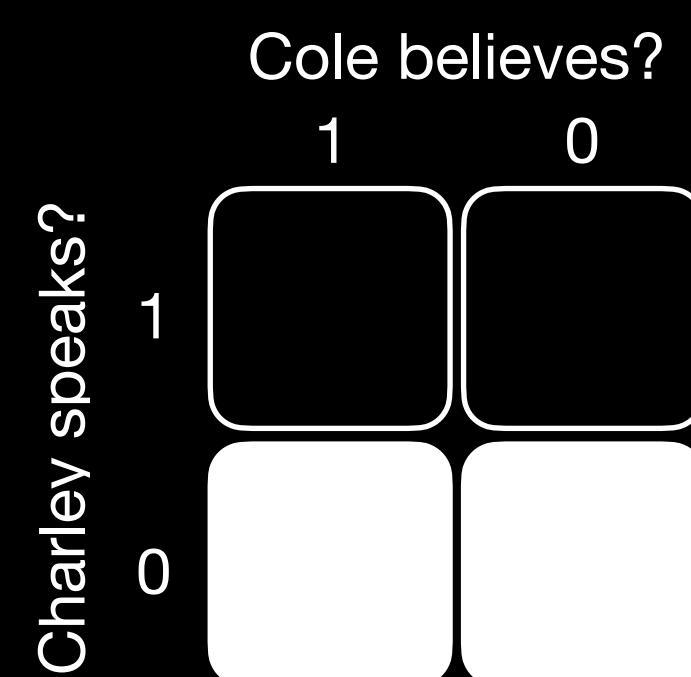
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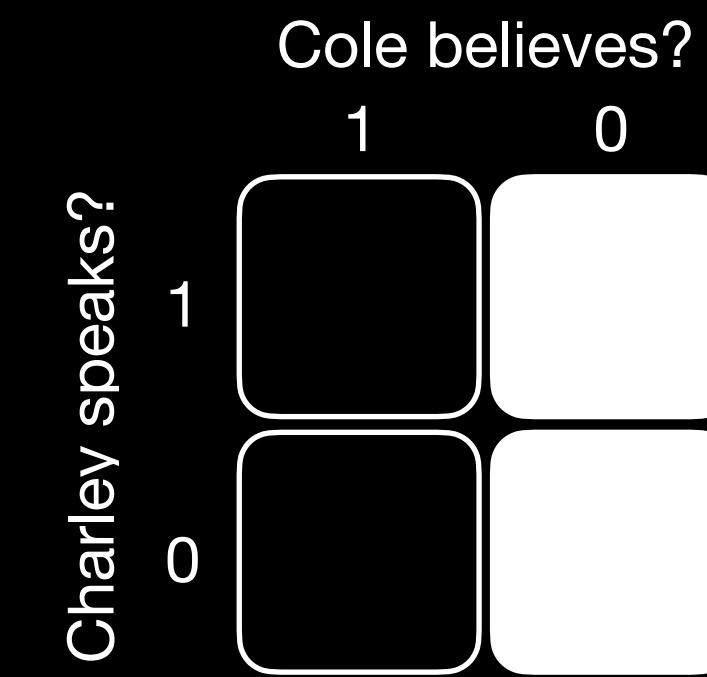
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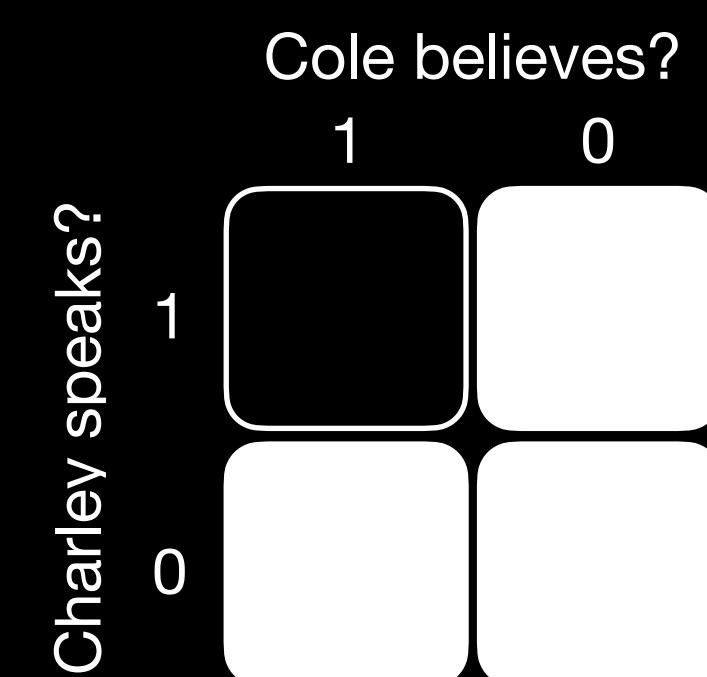
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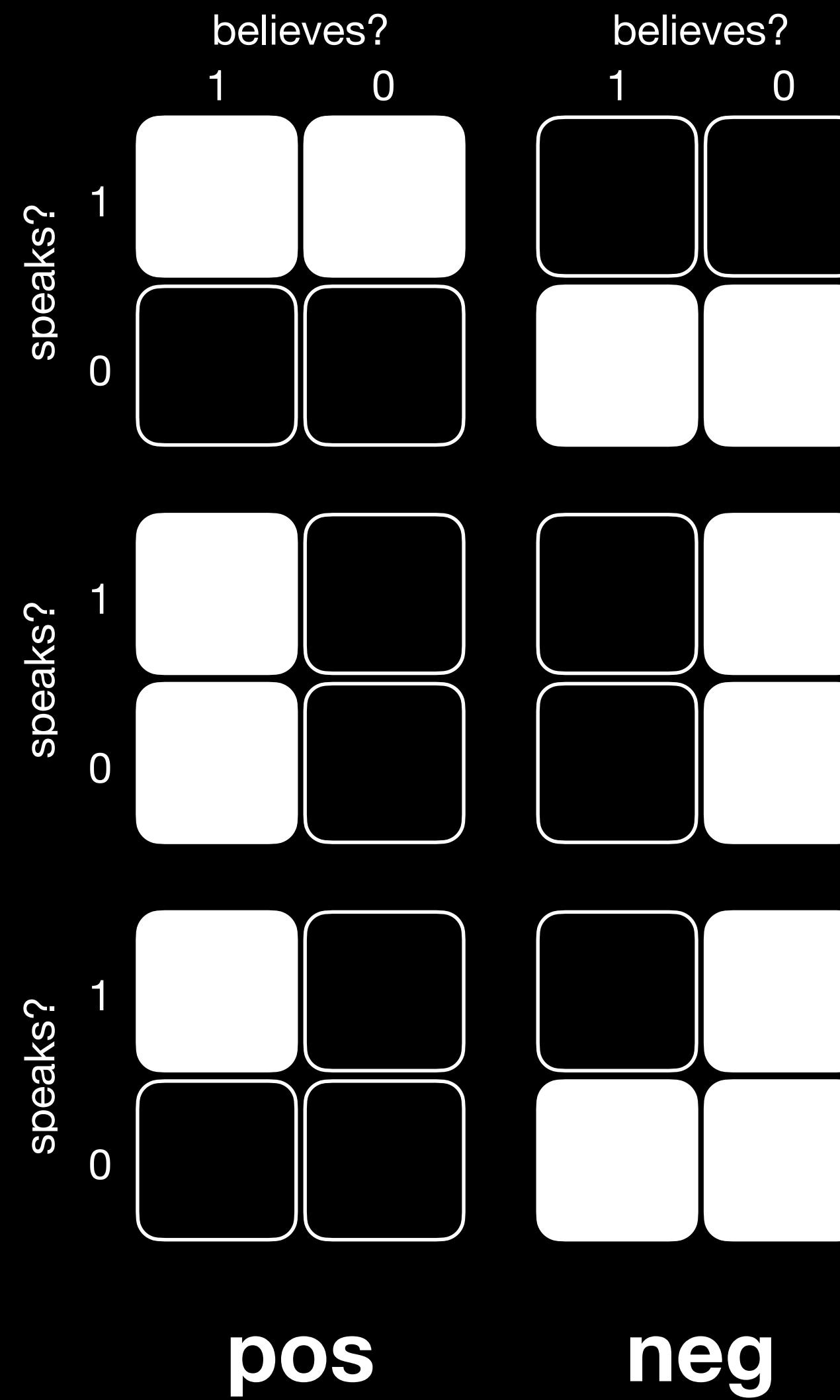


# basic model utterances and semantics

**simple**

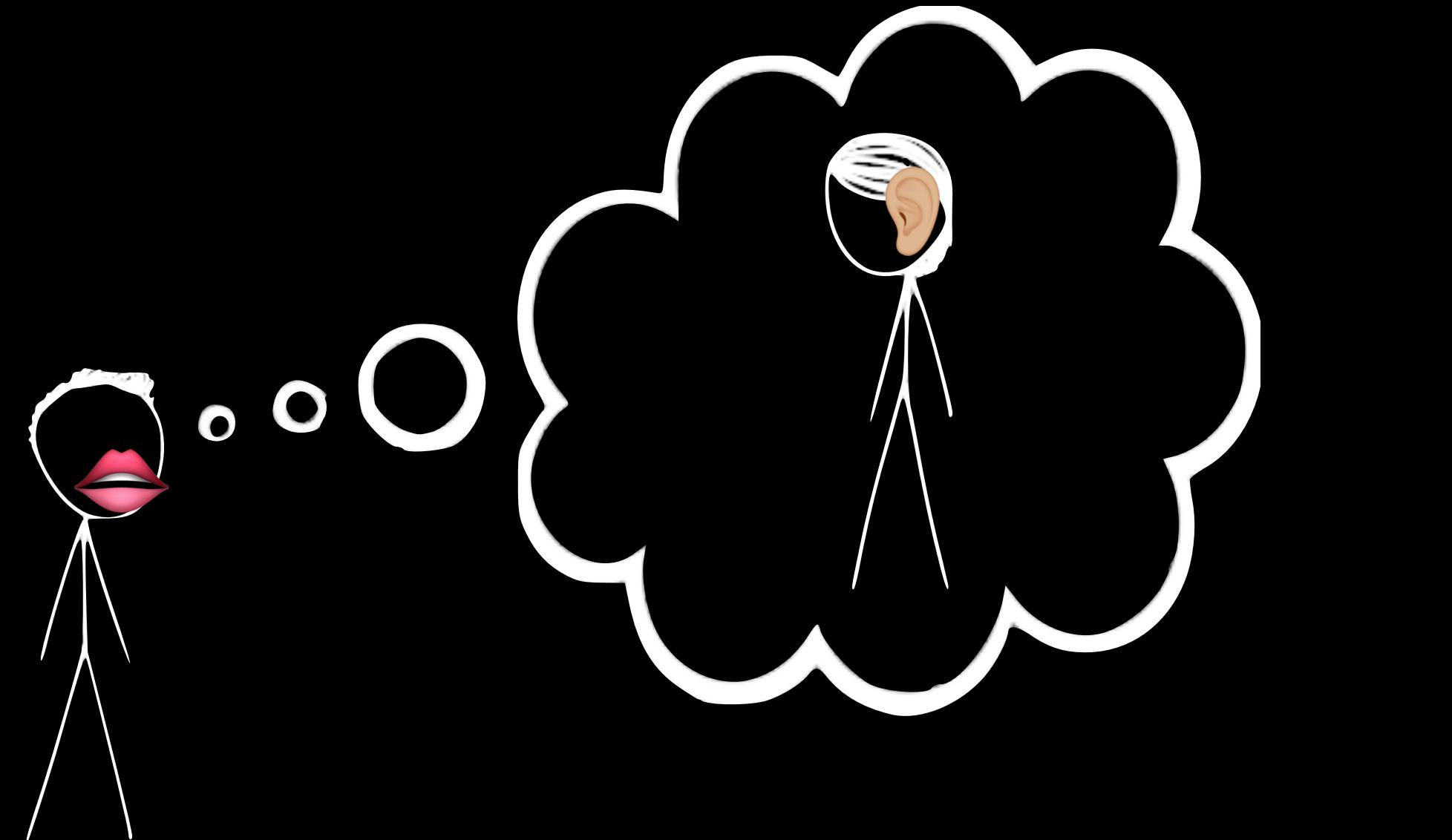
***think***

***know***



# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



**simple**

***think***

***know***

	believes? 1	believes? 0	believes? 1	believes? 0
speaks? 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
speaks? 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
speaks? 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
neg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# speaker behavior

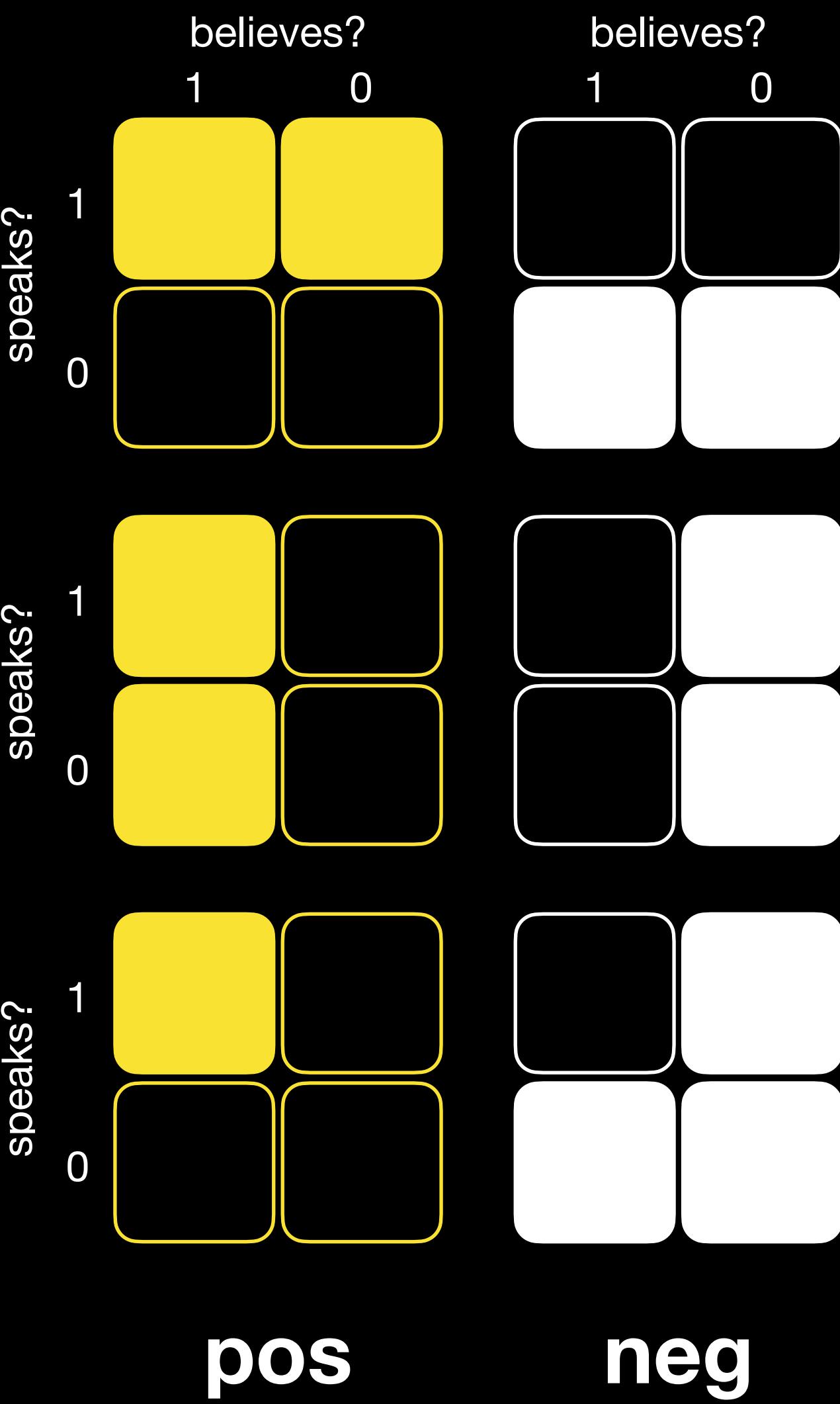
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**simple**

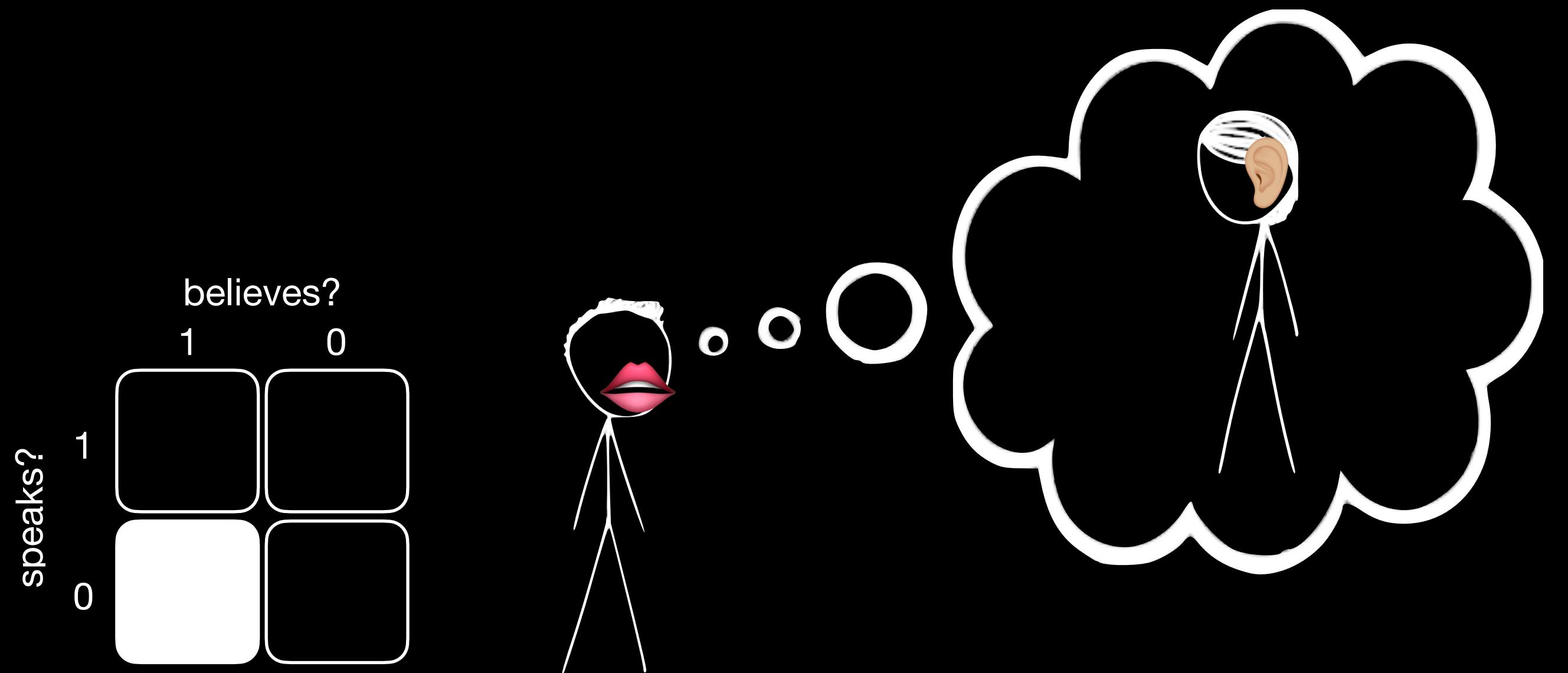
***think***

***know***



# speaker behavior

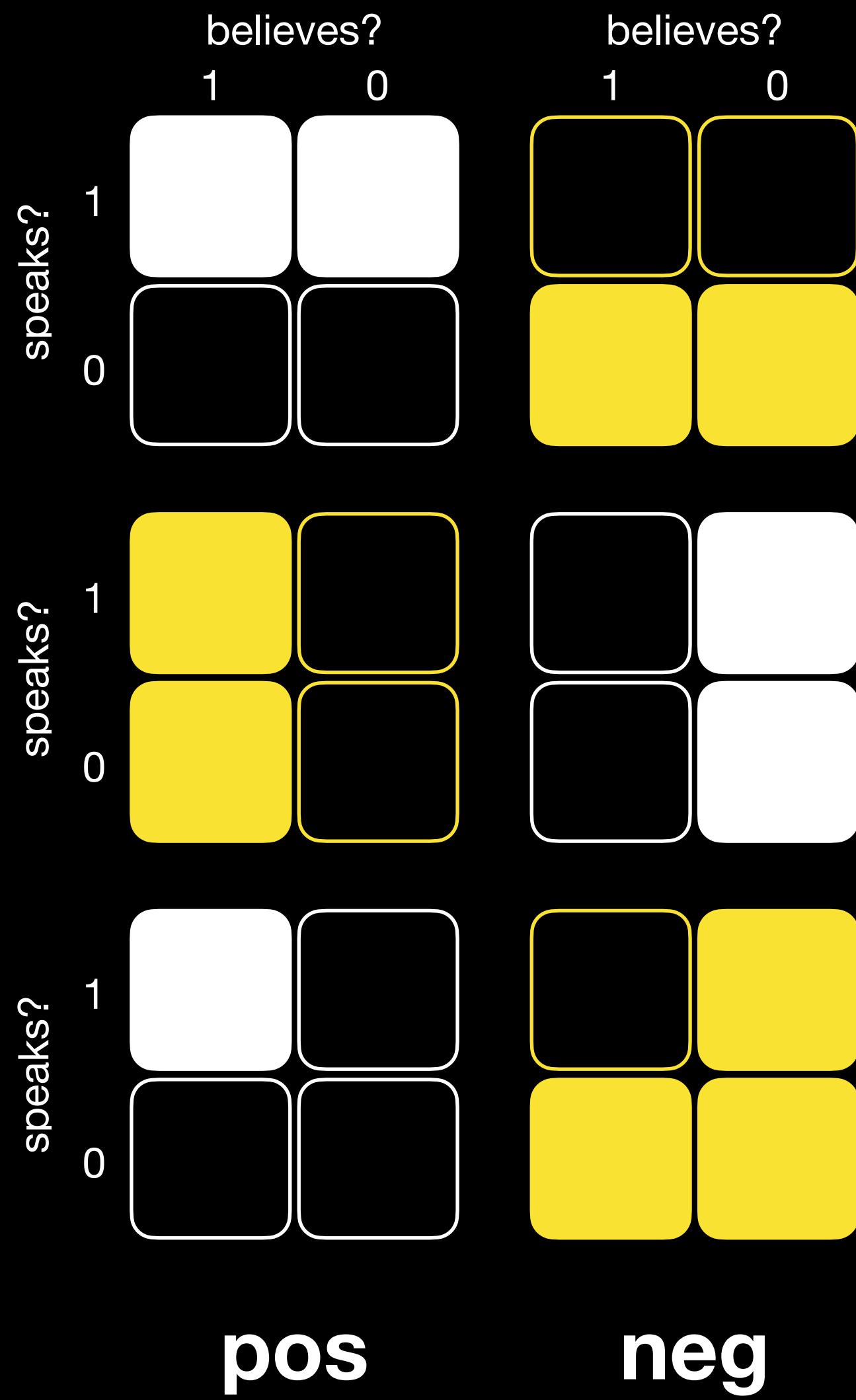
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**simple**

***think***

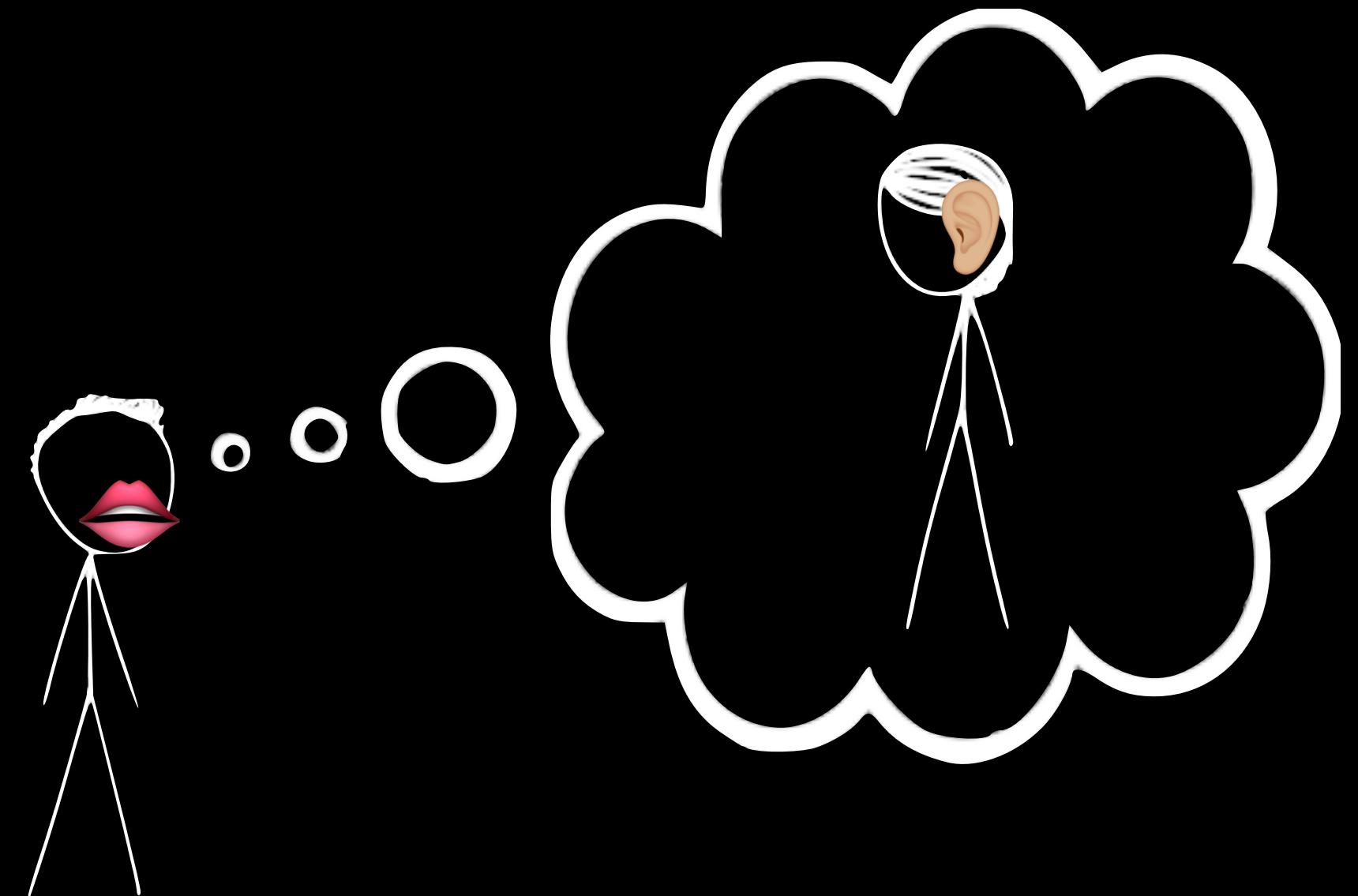
***know***



# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD

speaks?	believes?	1	0
1			
0			



simple

*think*

*know*

believes?	1	0	believes?	1	0
1	<span style="background-color: yellow;"> </span>	<span style="background-color: yellow;"> </span>	1	<span style="background-color: yellow;"> </span>	<span style="background-color: yellow;"> </span>
0	<span style="background-color: black;"> </span>	<span style="background-color: black;"> </span>	0	<span style="background-color: black;"> </span>	<span style="background-color: black;"> </span>

speaks?	1	0	speaks?	1	0
1	<span style="background-color: white;"> </span>	<span style="background-color: black;"> </span>	1	<span style="background-color: black;"> </span>	<span style="background-color: yellow;"> </span>
0	<span style="background-color: white;"> </span>	<span style="background-color: black;"> </span>	0	<span style="background-color: black;"> </span>	<span style="background-color: yellow;"> </span>

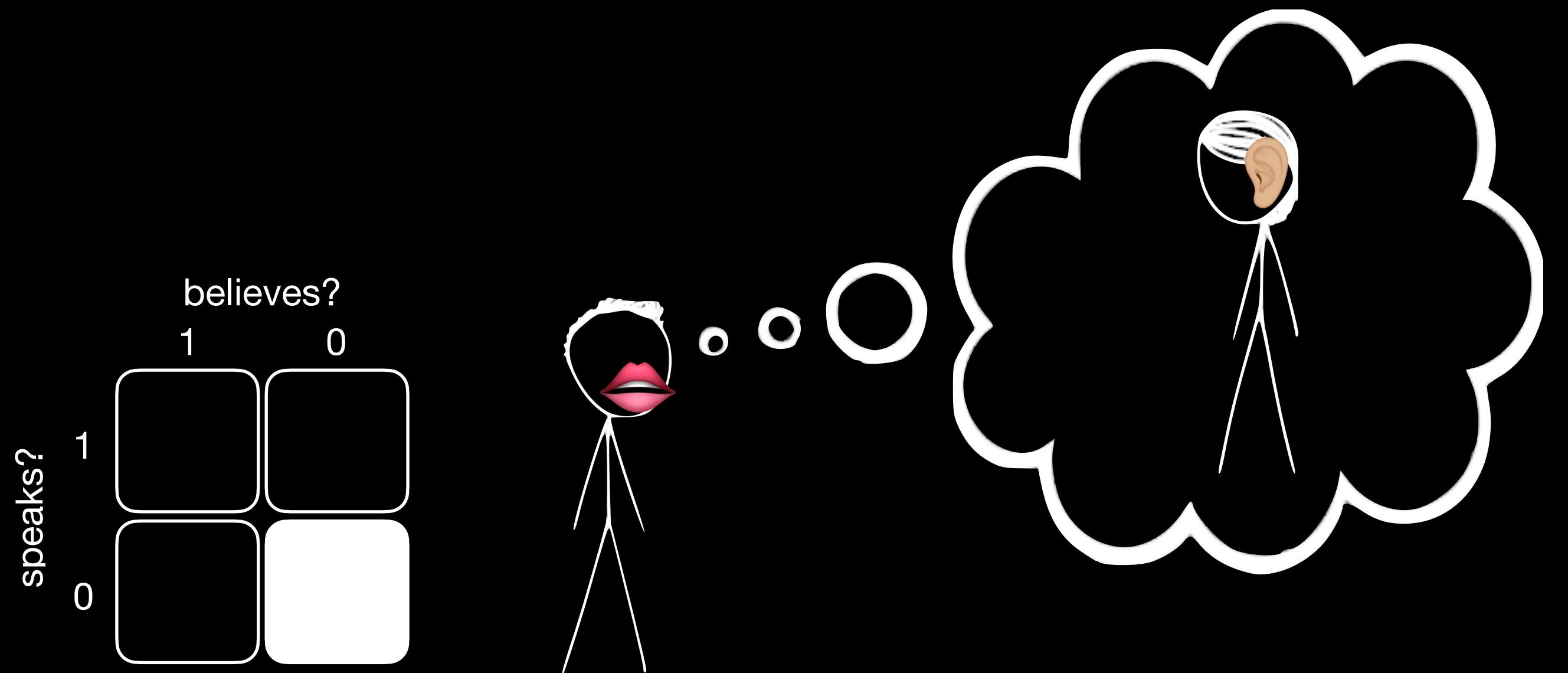
speaks?	1	0	speaks?	1	0
1	<span style="background-color: white;"> </span>	<span style="background-color: black;"> </span>	1	<span style="background-color: black;"> </span>	<span style="background-color: yellow;"> </span>
0	<span style="background-color: yellow;"> </span>	<span style="background-color: yellow;"> </span>	0	<span style="background-color: yellow;"> </span>	<span style="background-color: yellow;"> </span>

pos

neg

# speaker behavior

**speakers choose to produce utterances in proportion to their utility for leading the listener to correctly resolve the QUD**



# simple

# *think*

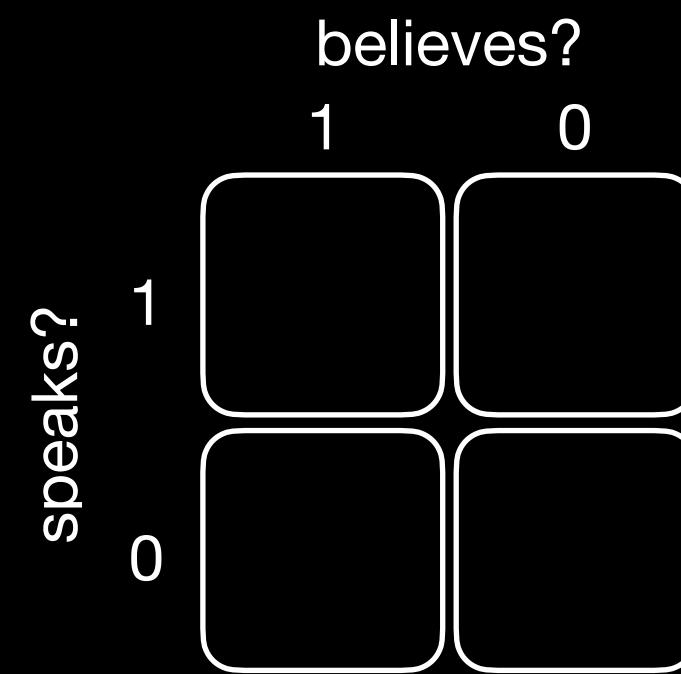
# *know*

The figure consists of six binary classification plots arranged in a 3x2 grid. The columns are labeled "pos" and "neg" at the bottom. The rows are labeled "speaks?" on the left and "believes?" at the top. Each plot has two horizontal axes: one for "speaks?" (0 or 1) and one for "believes?" (0 or 1). The plots are colored: white with black outlines for the "pos" row, yellow with black outlines for the "neg" row, and black with white outlines for the middle row. The "pos" row shows mostly white cells, while the "neg" row shows mostly yellow cells. The middle row shows a mix of white and yellow cells.

	pos	neg
speaks?	1	0
believes?	1	0

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD

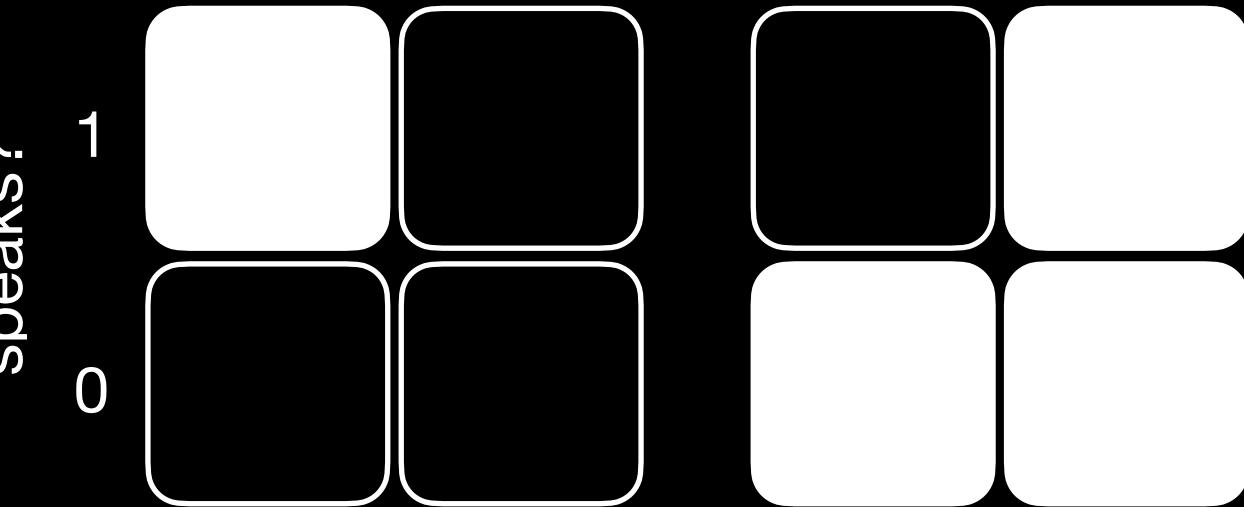
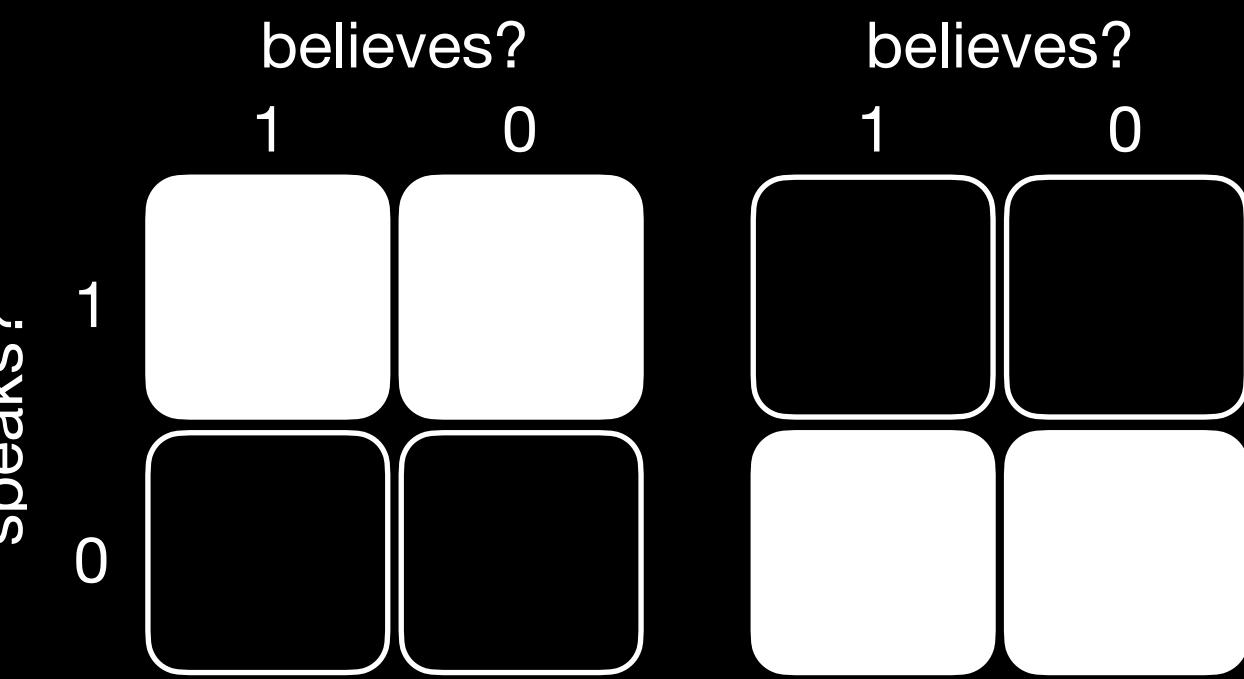


so far, we've considered the QUD  
***what is the state of the world?***

**simple**

**think**

**know**

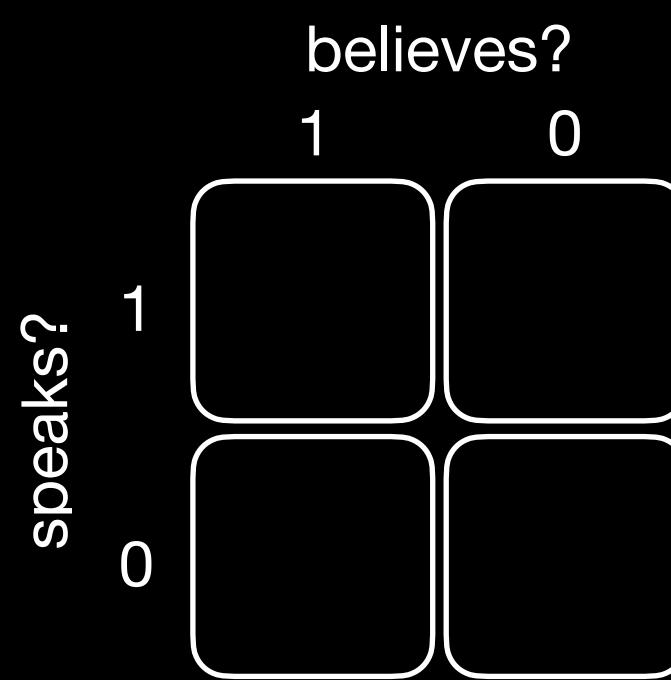


**pos**

**neg**

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



other QUDs:

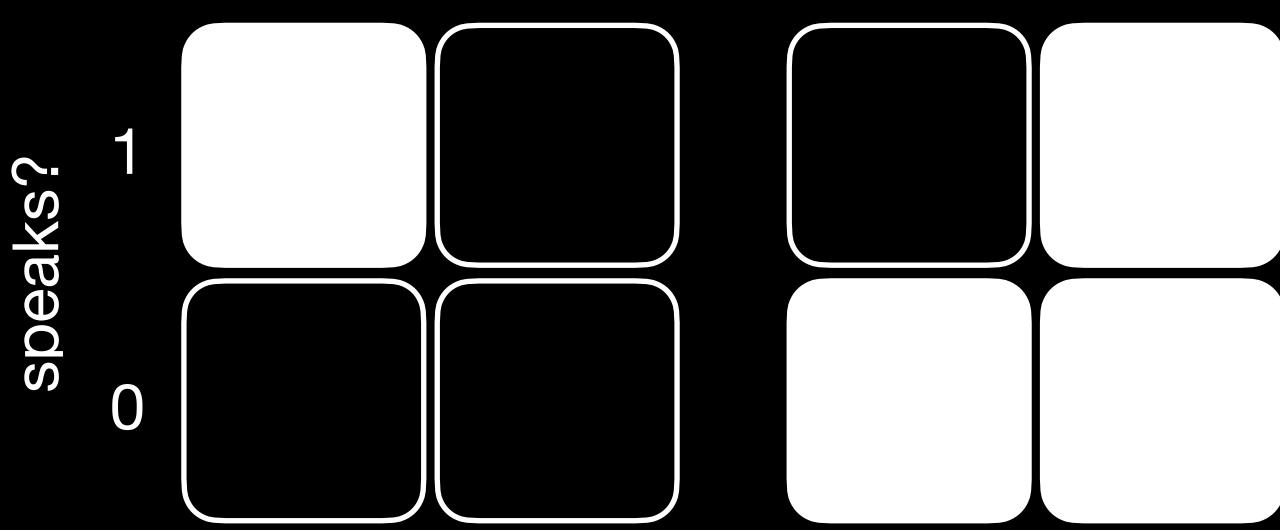
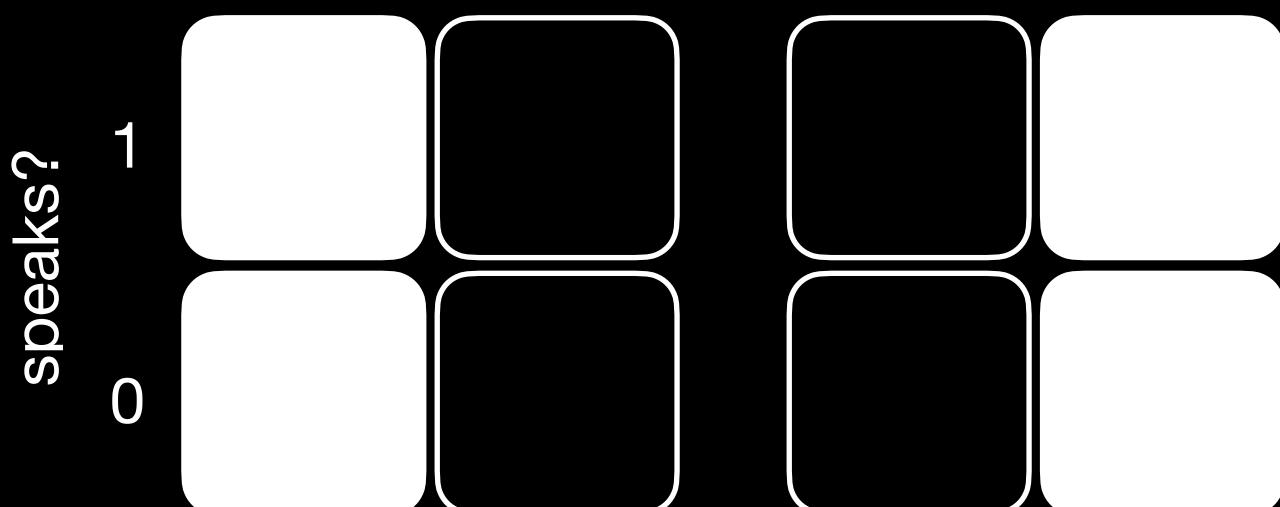
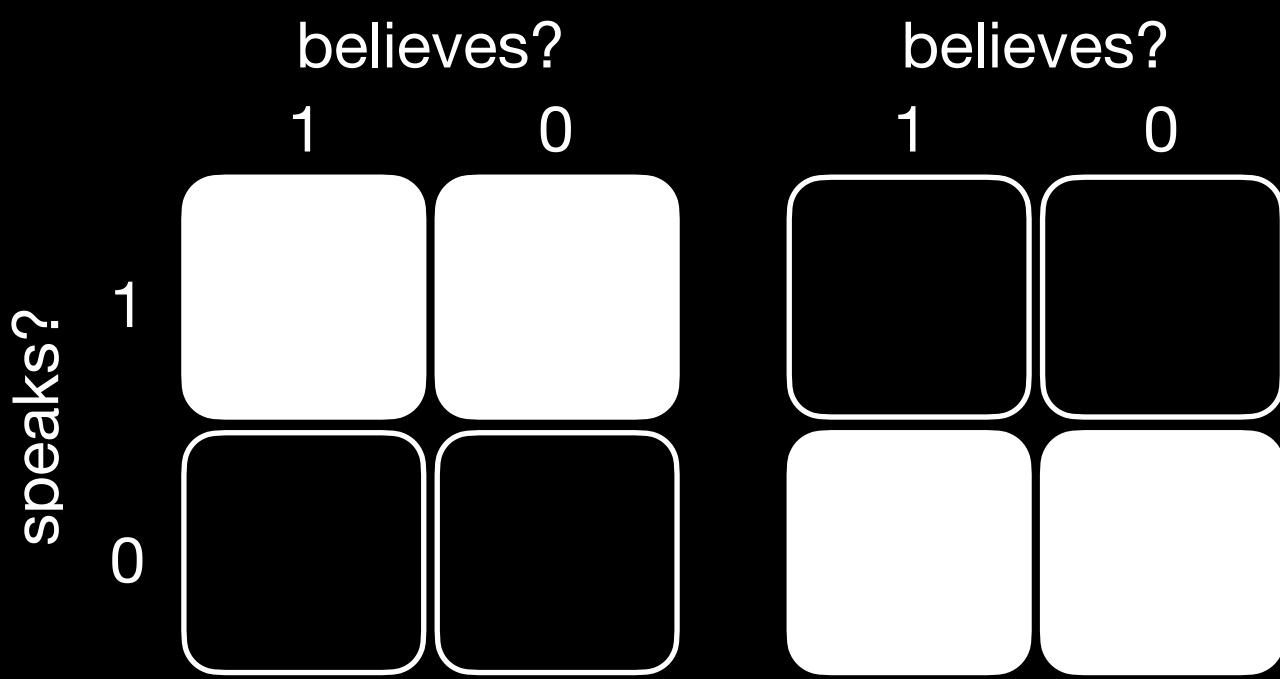
***does Cole believe?***

***does Charley speak Spanish?***

**simple**

***think***

***know***



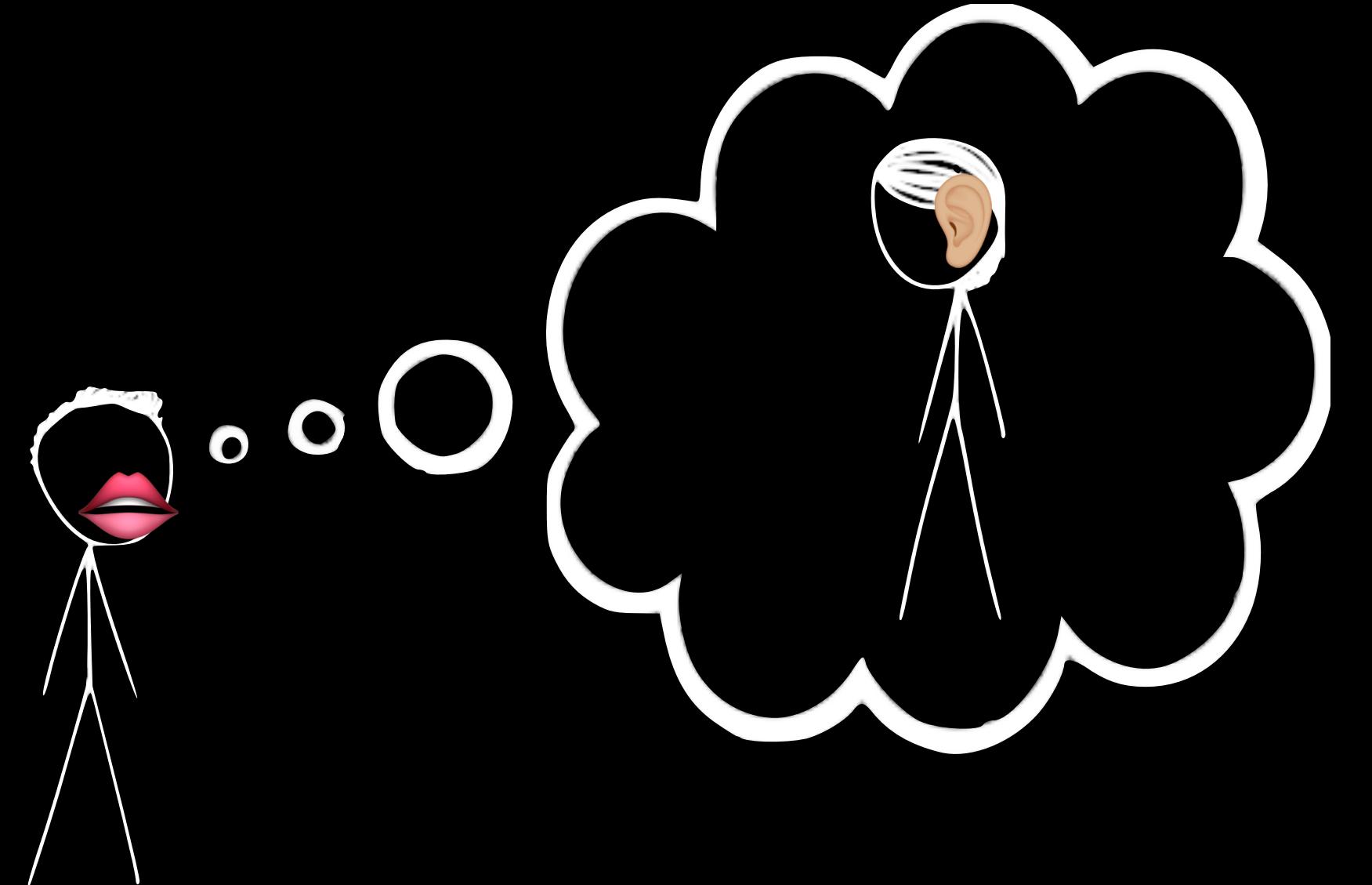
***pos***

***neg***

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD

believes?		
1	0	
speaks?		
1		
0		



simple

*think*

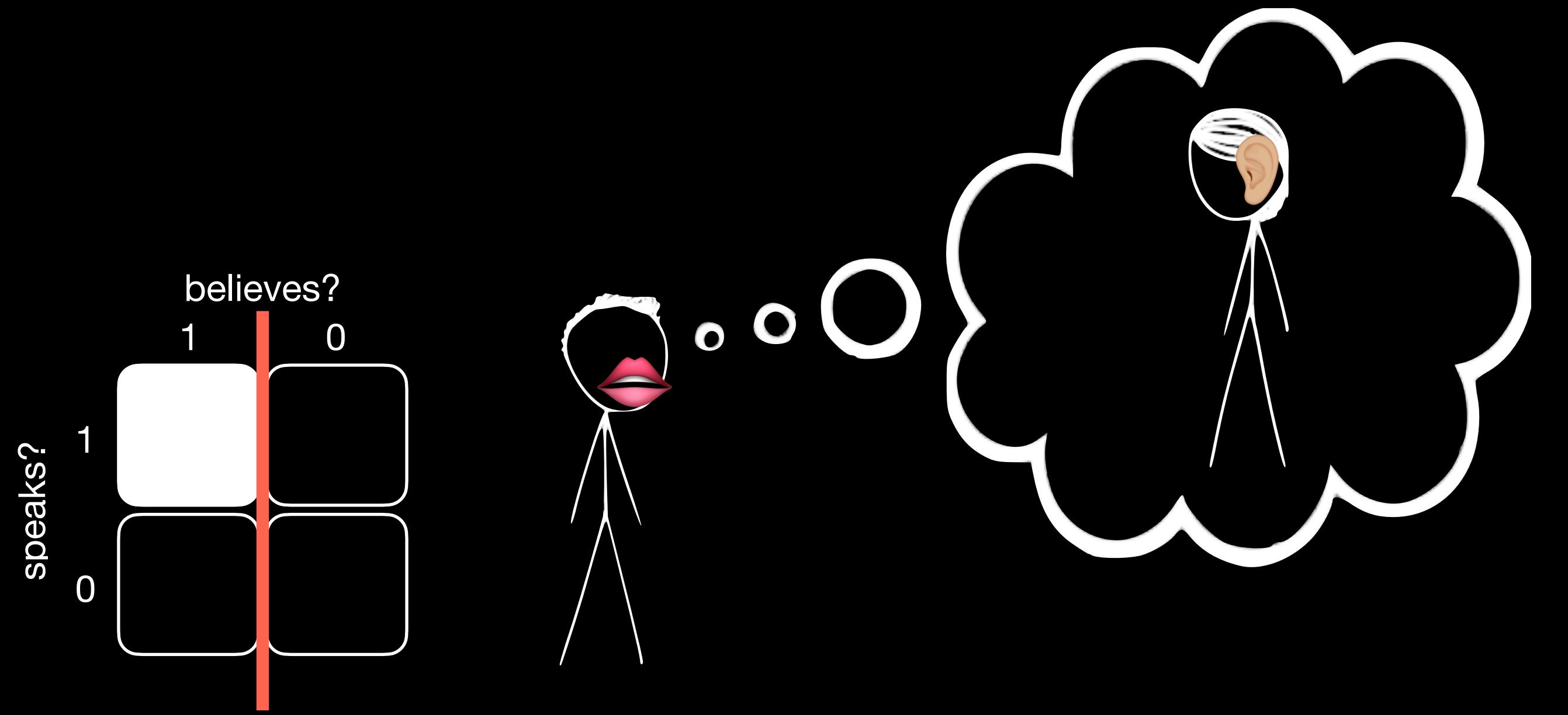
*know*

*does Cole believe?*

believes?		
1	0	
speaks?		
1		
0		
speaks?		
1		
0		
speaks?		
1		
0		
speaks?		
1		
0		
pos		
neg		

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



**simple**

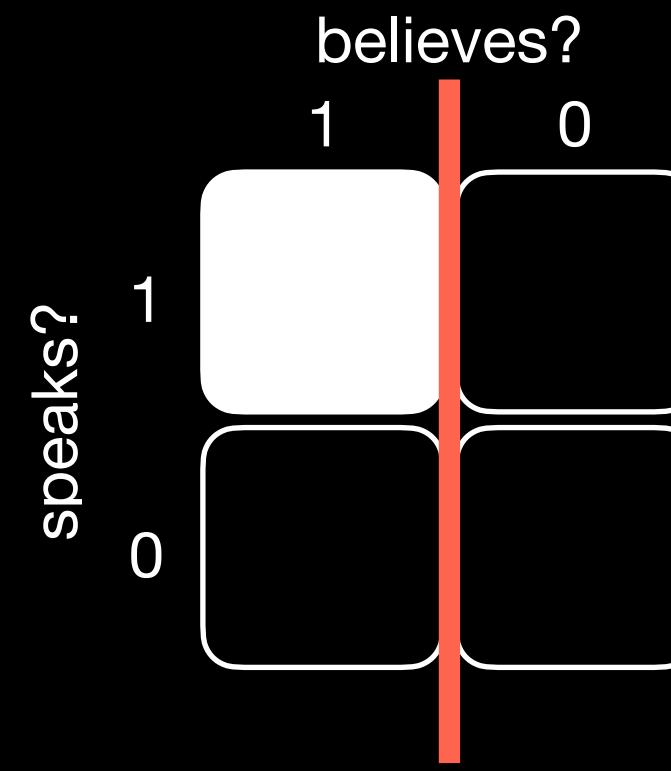
***think***

***know***

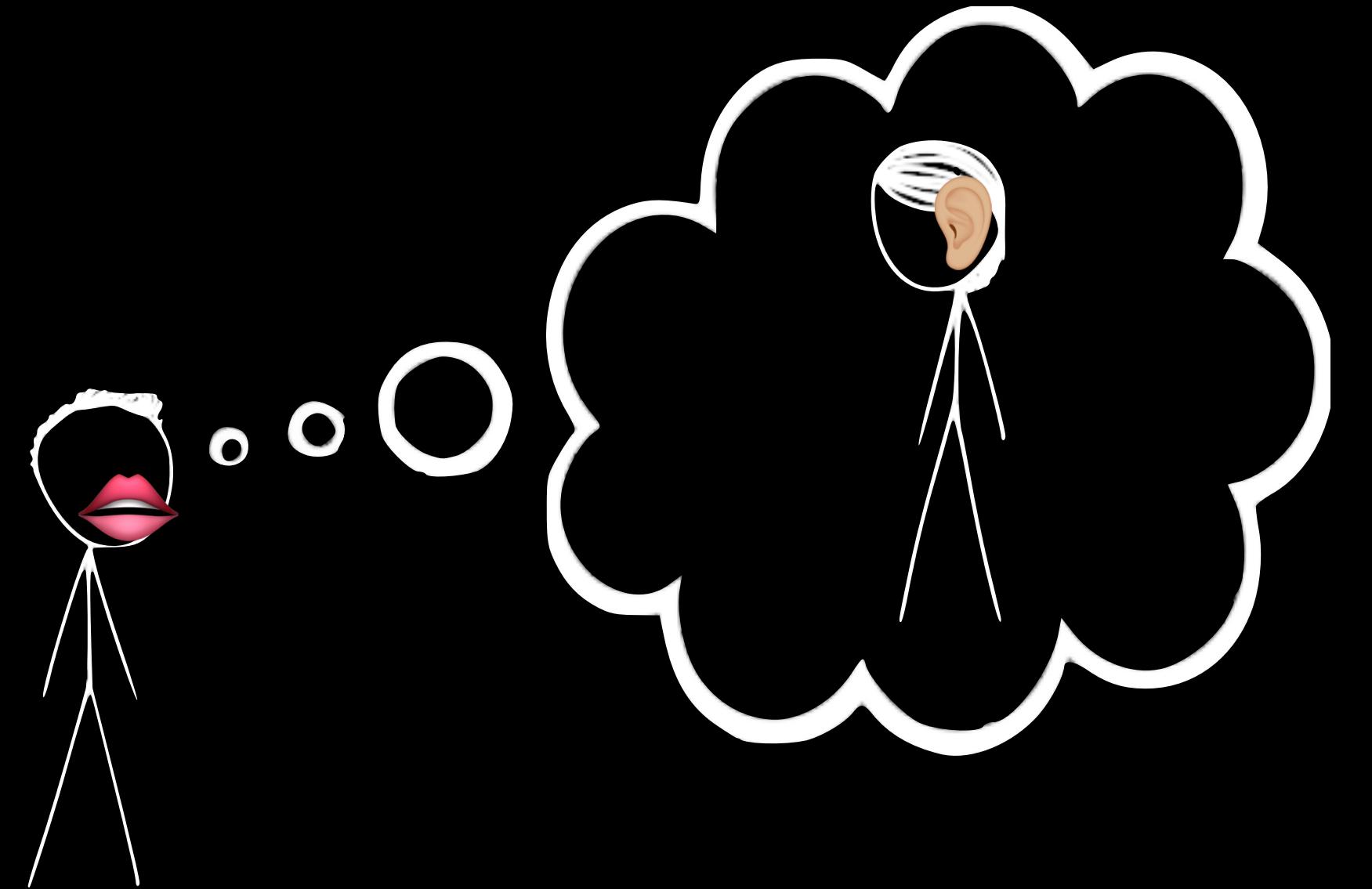
		believes?	believes?								
		1	0								
speaks?	1	<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>				
0	<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					
speaks?	1	<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>				
0	<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					
speaks?	1	<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>				
0	<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					<table border="1"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>					
		pos	neg								

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



*does Cole believe?*



**simple**

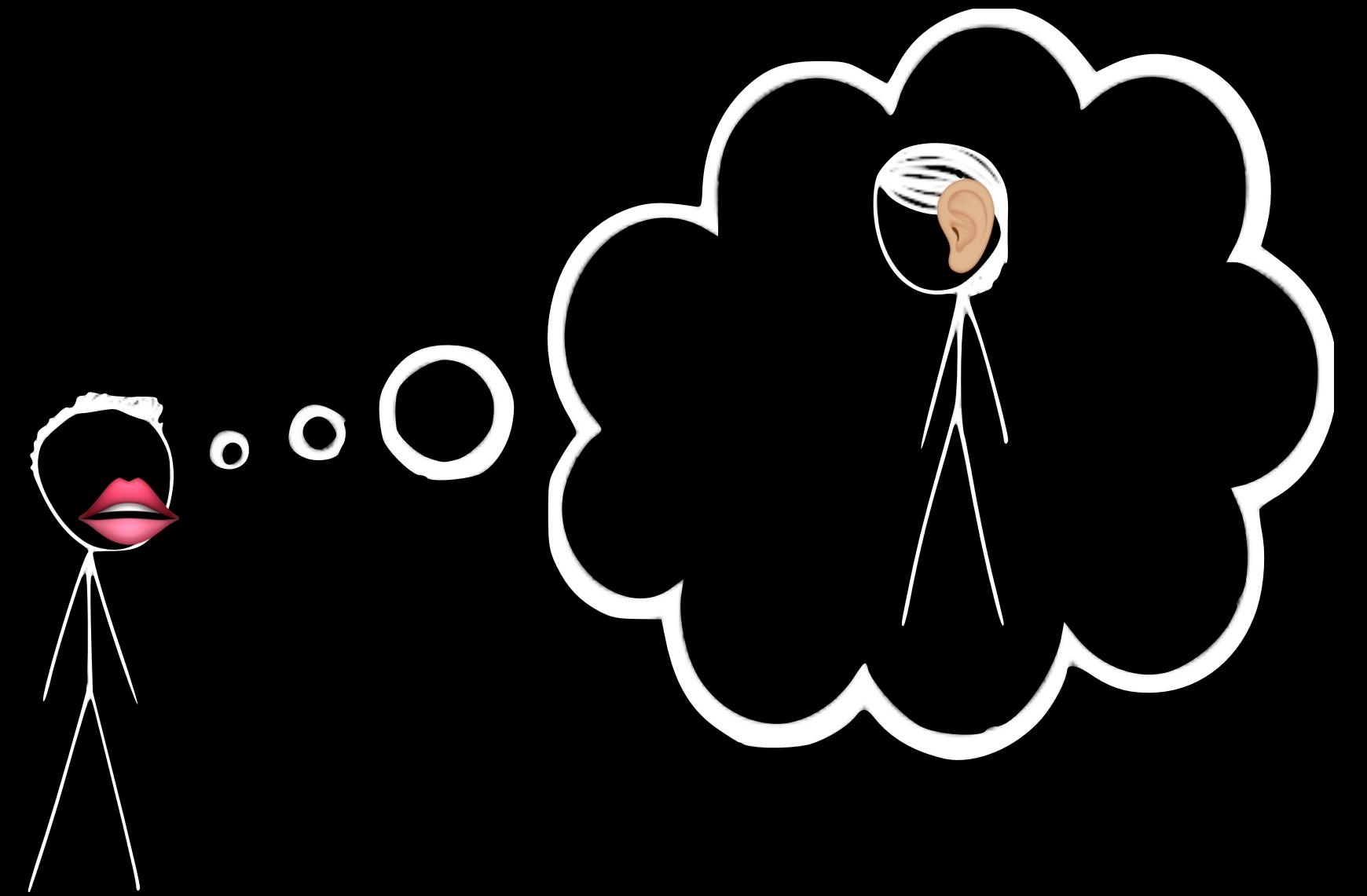
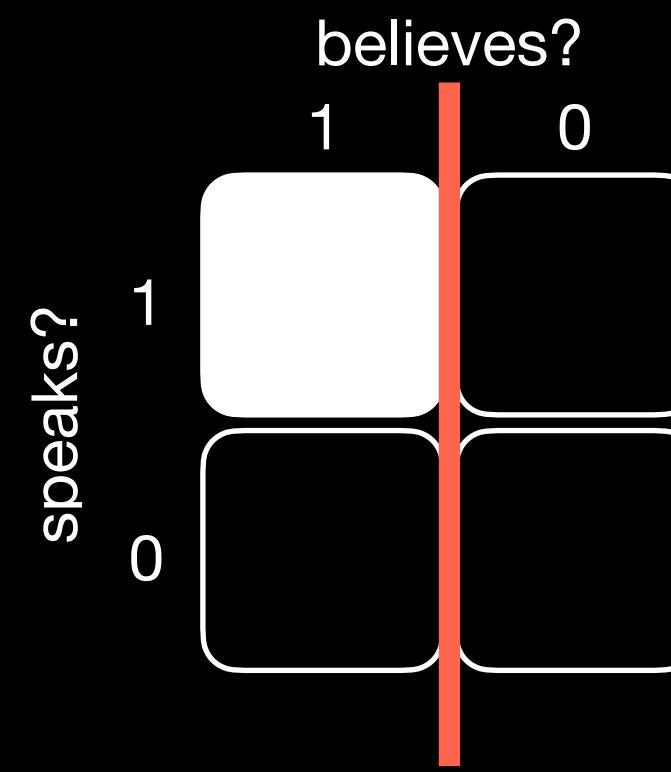
***think***

***know***

pos	neg	pos	neg

# speaker behavior

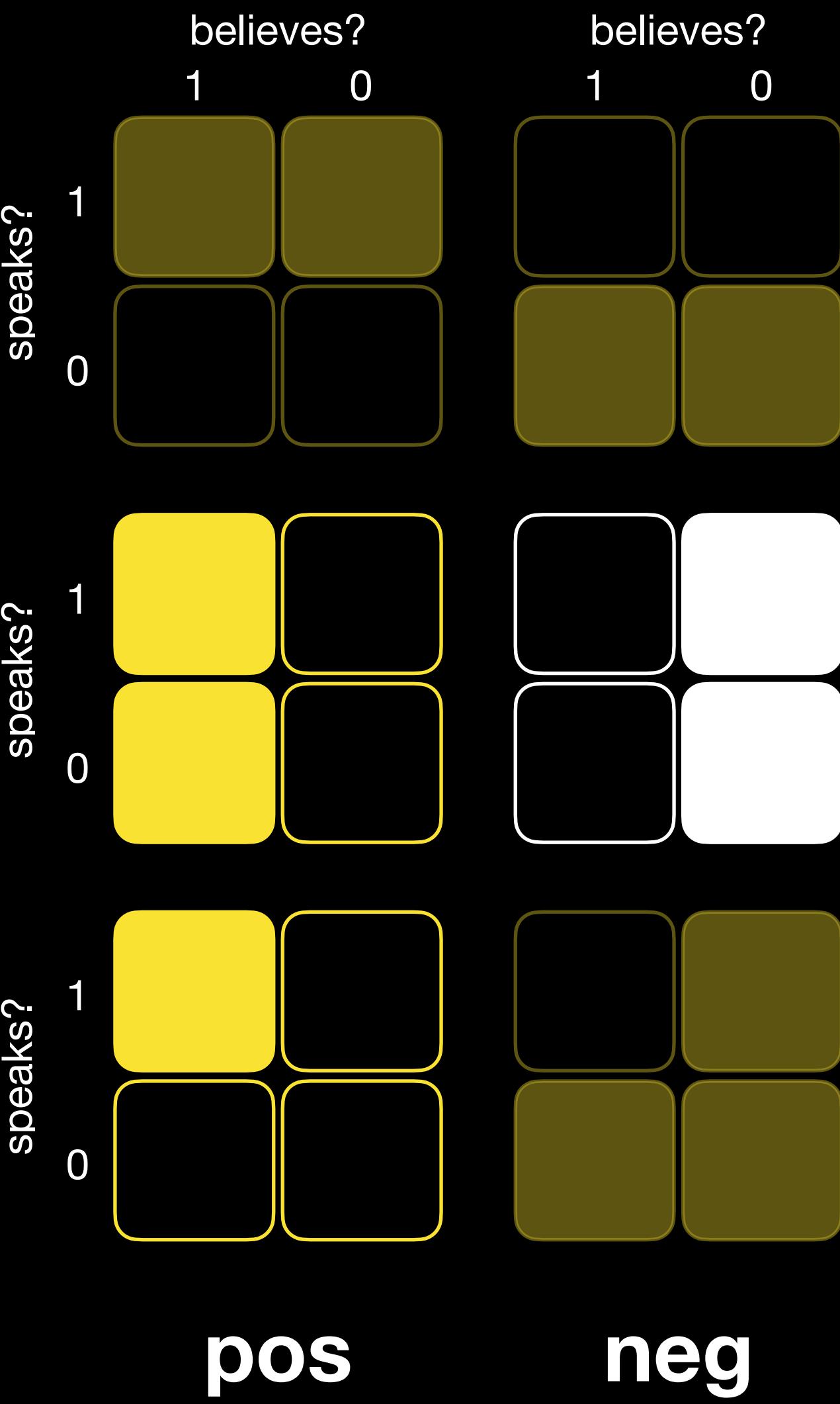
speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



simple

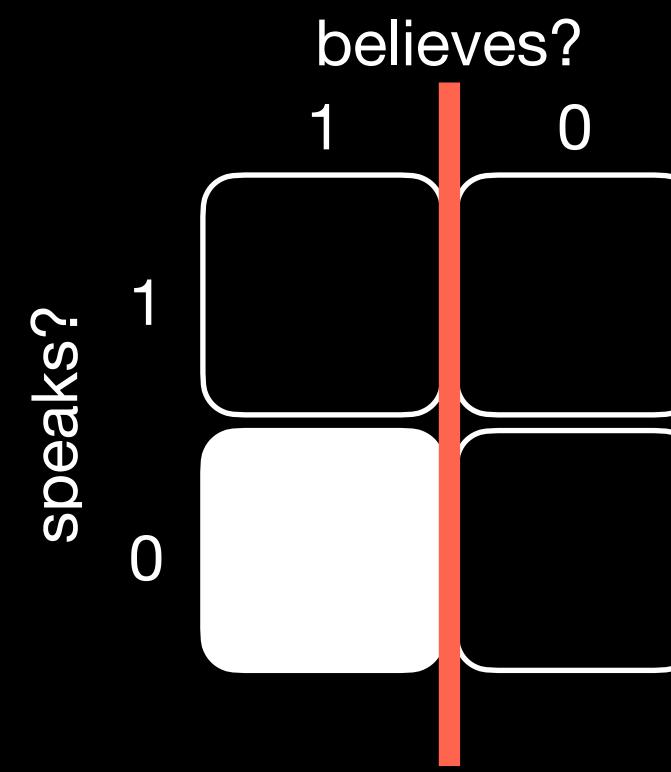
think

know

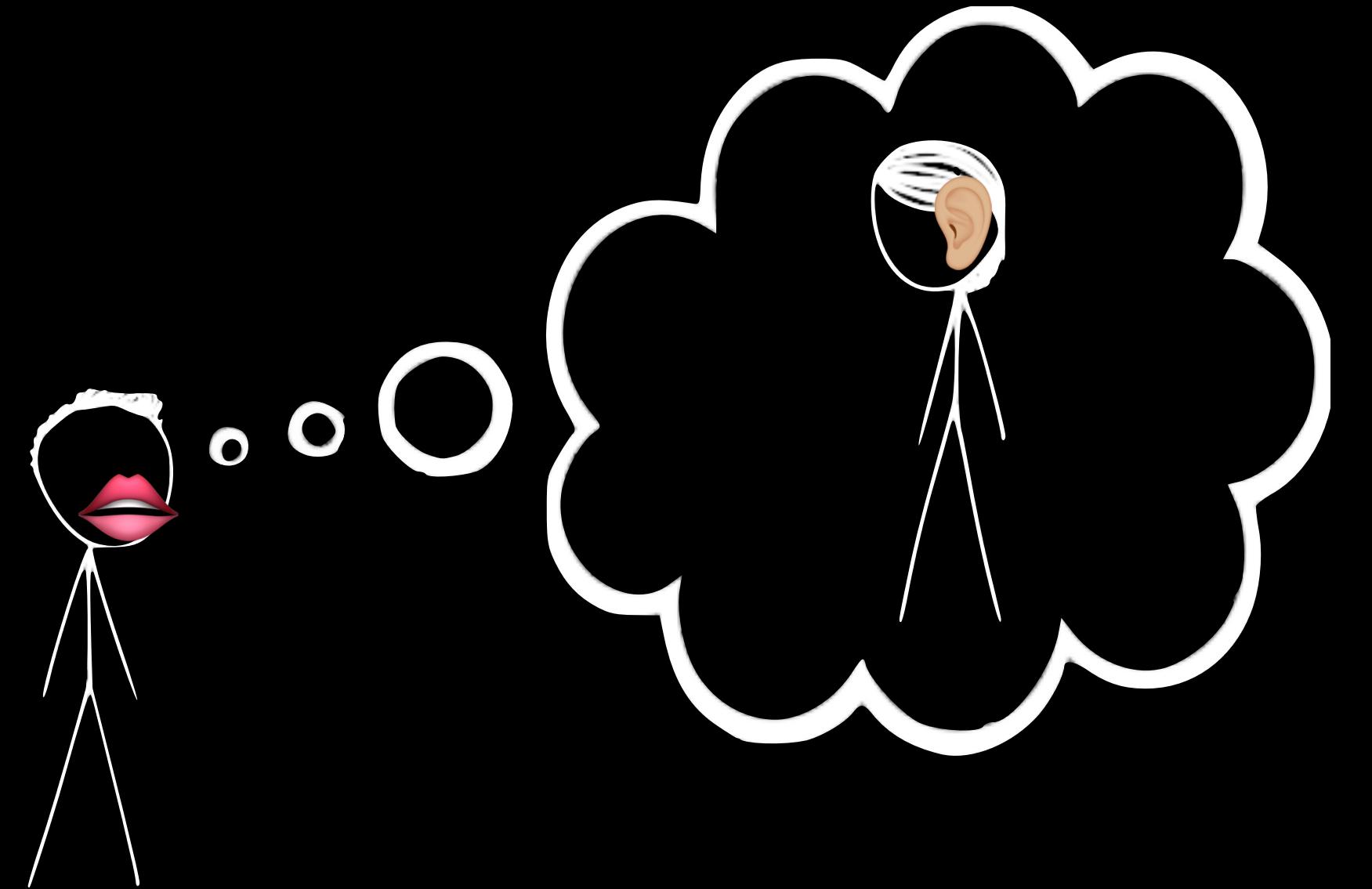


# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



*does Cole believe?*



**simple**

***think***

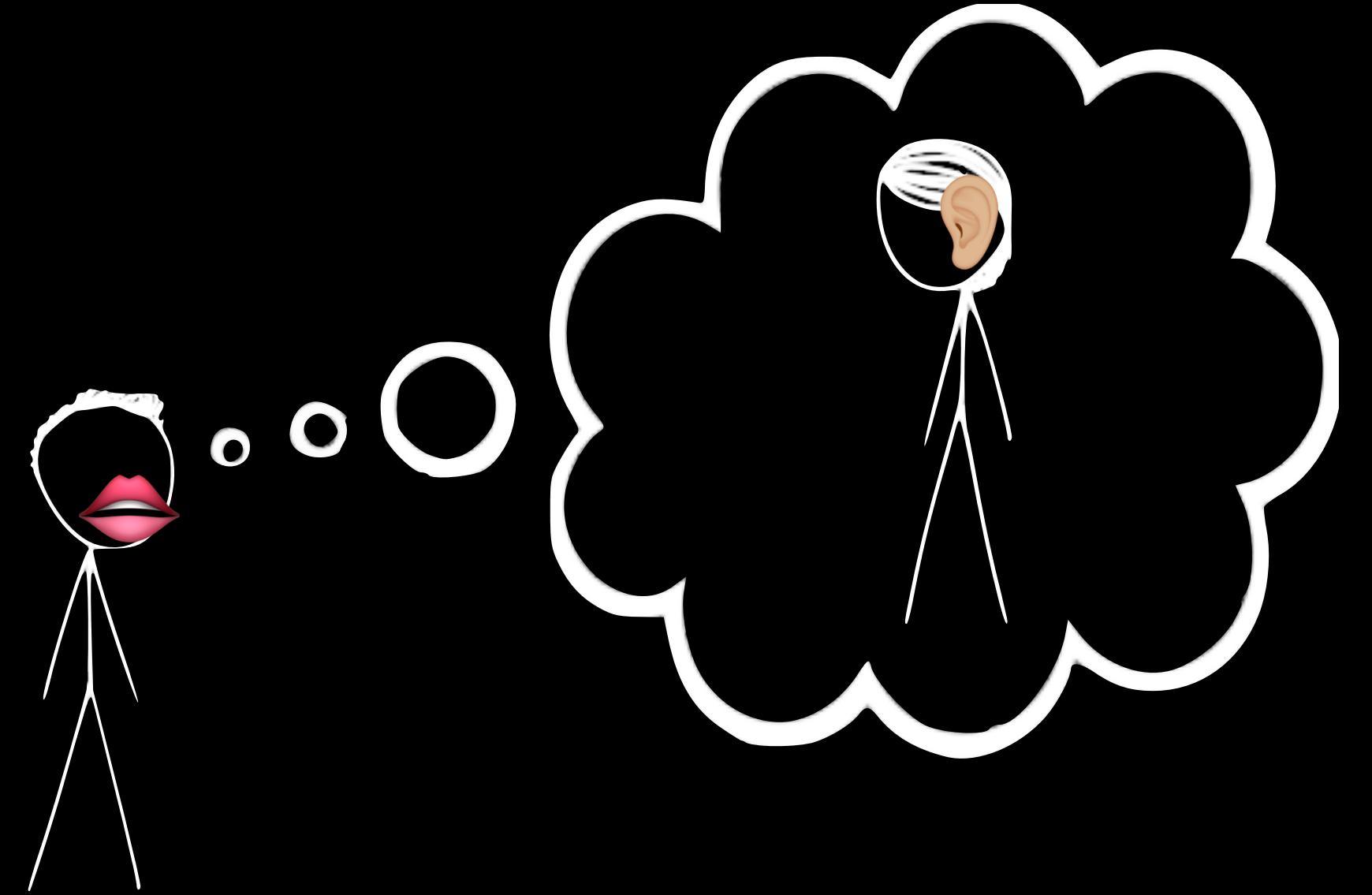
***know***

pos	neg	pos	neg

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD

beliefs?	
1	0
1	speaks?
0	speaks?



simple

*think*

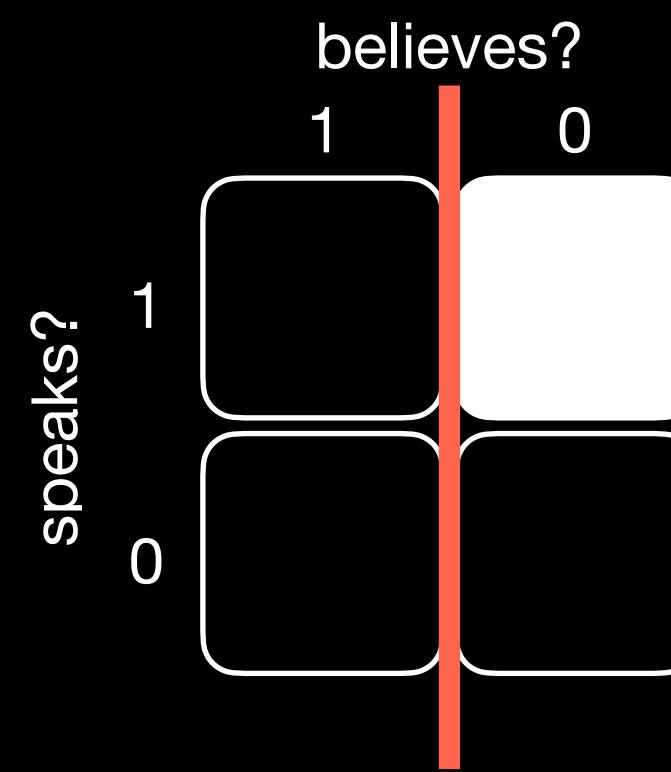
*know*

*does Cole believe?*

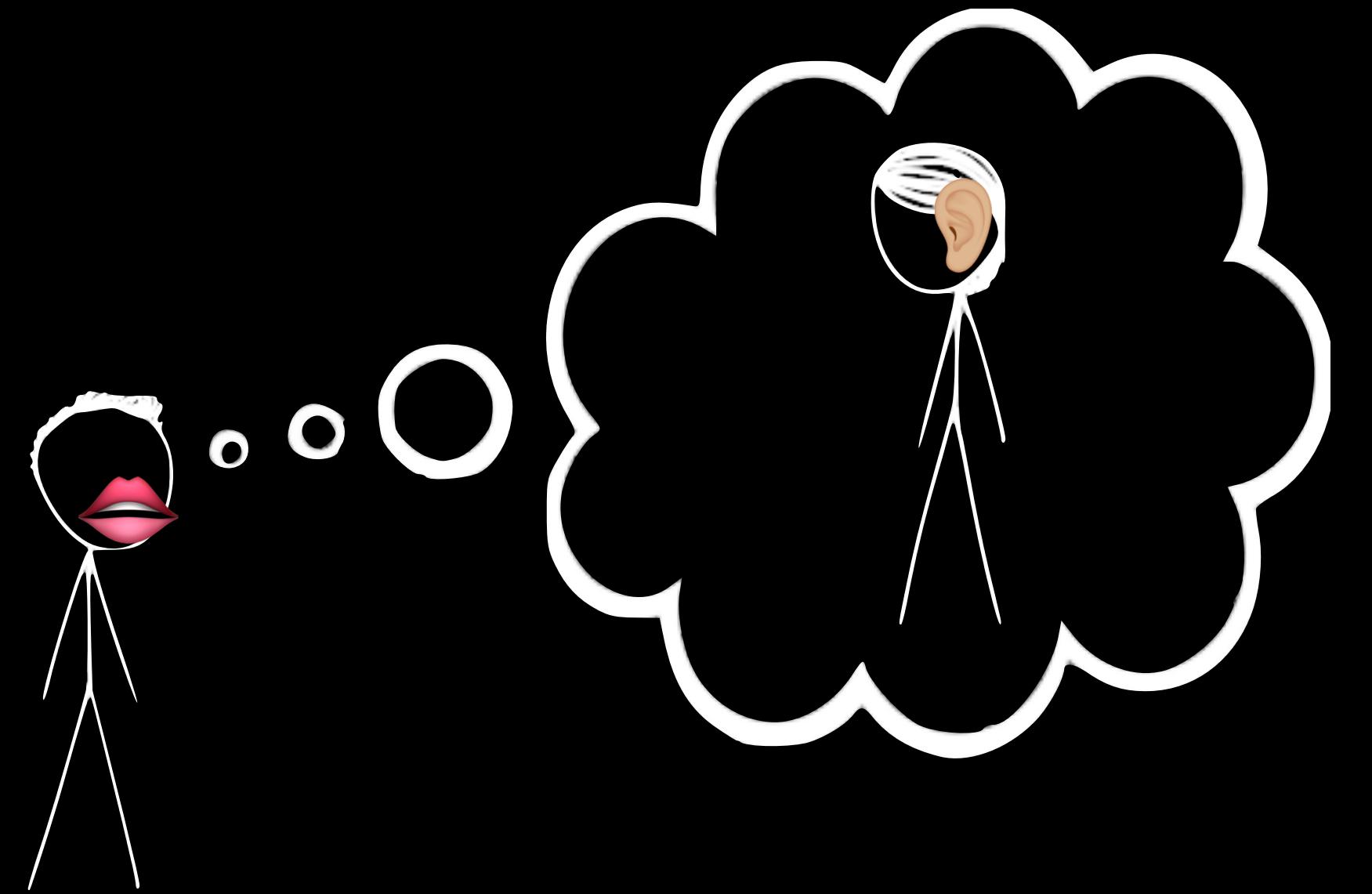
pos	neg	pos	neg
1	0	1	0
speaks?	1	0	1
beliefs?	1	0	1
speaks?	1	0	1
beliefs?	1	0	1
speaks?	1	0	1
beliefs?	1	0	1
speaks?	1	0	1
beliefs?	1	0	1

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



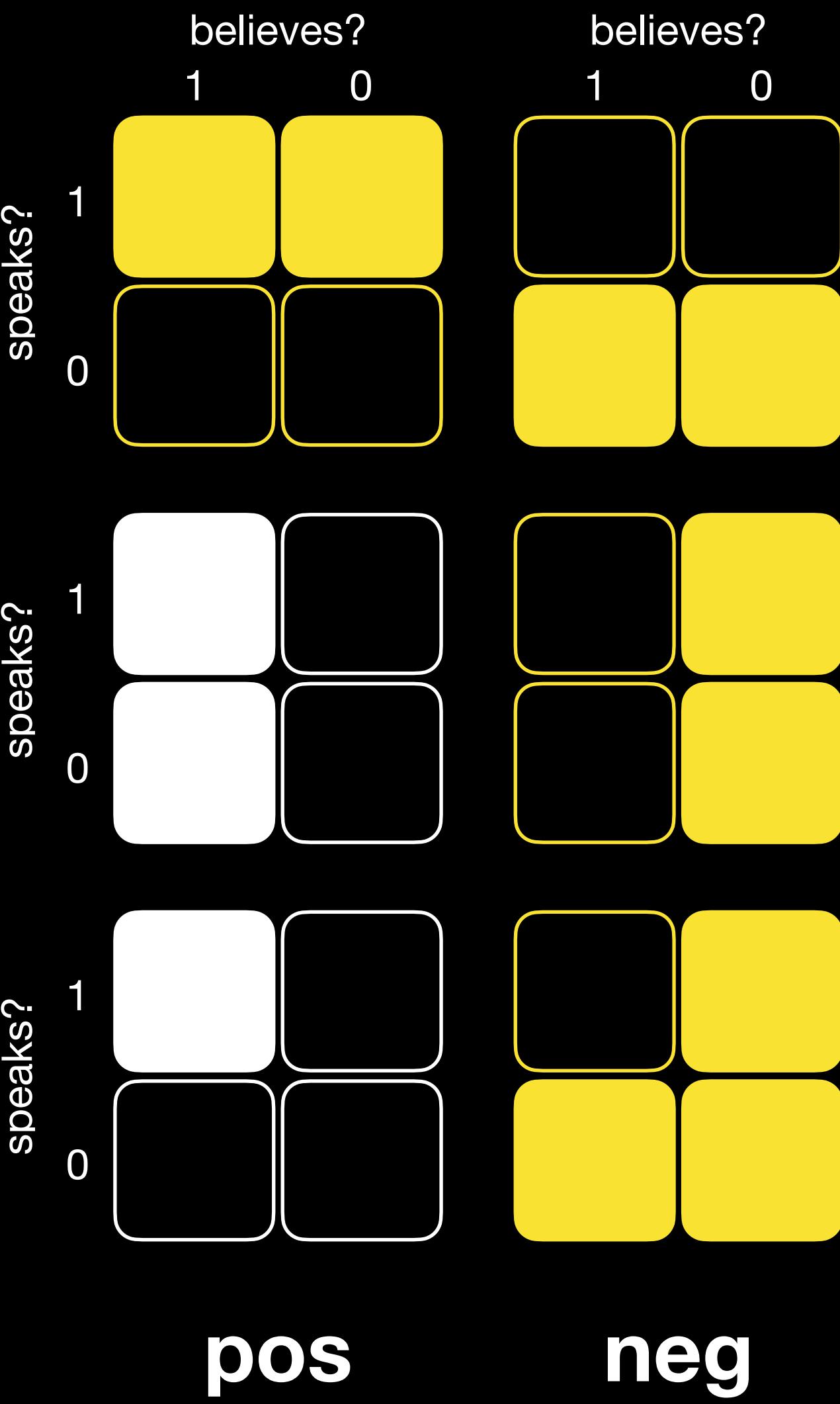
*does Cole believe?*



**simple**

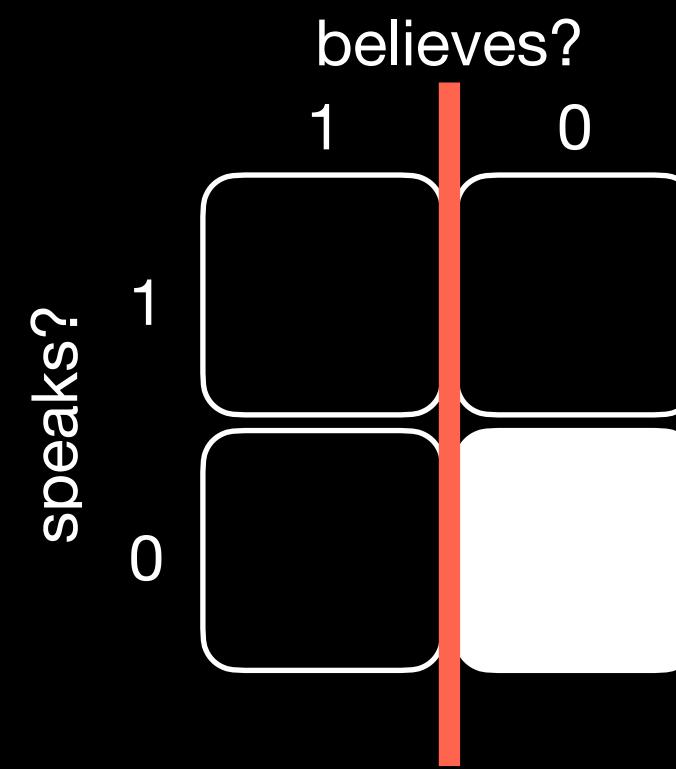
***think***

***know***

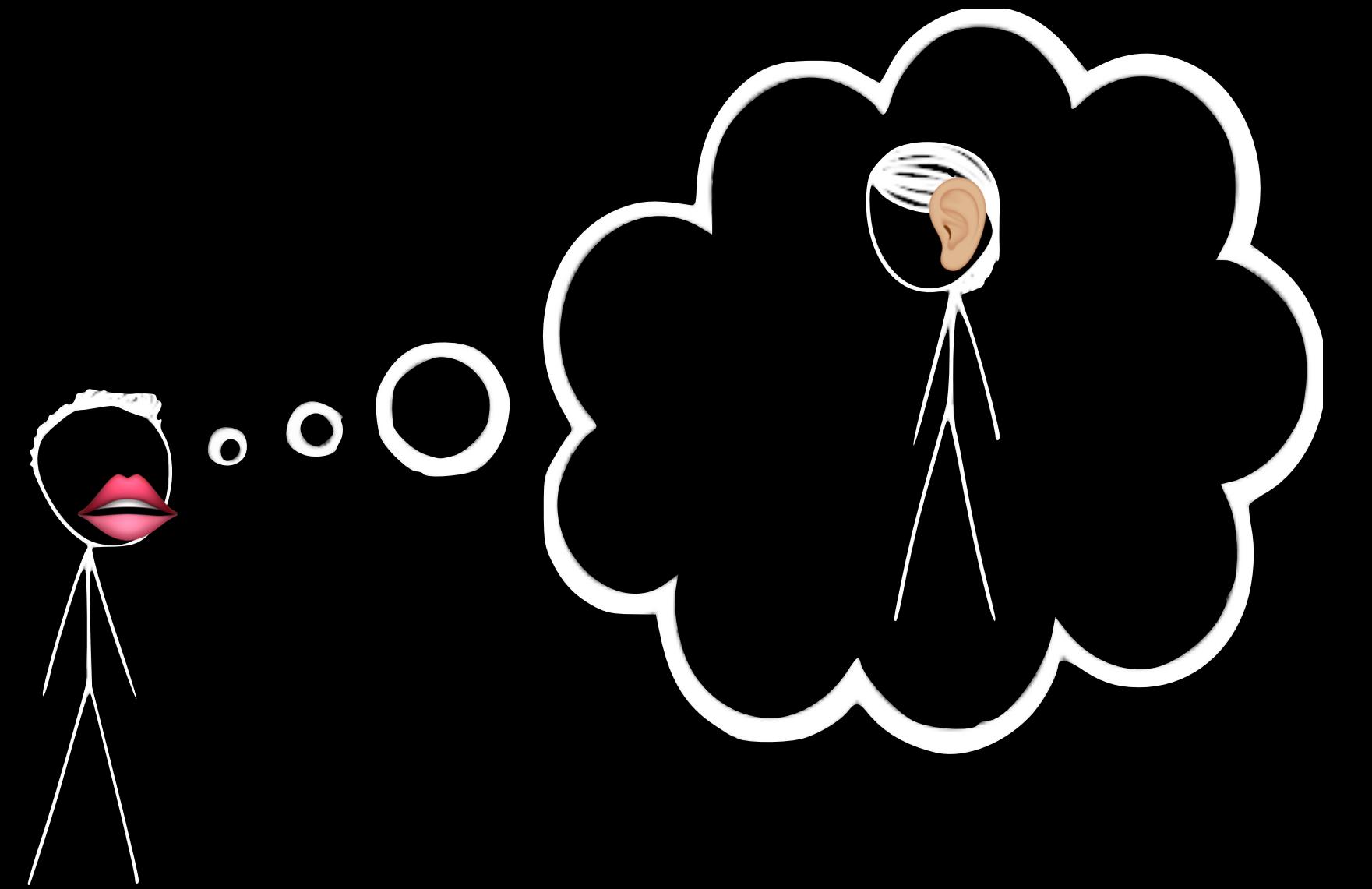


# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



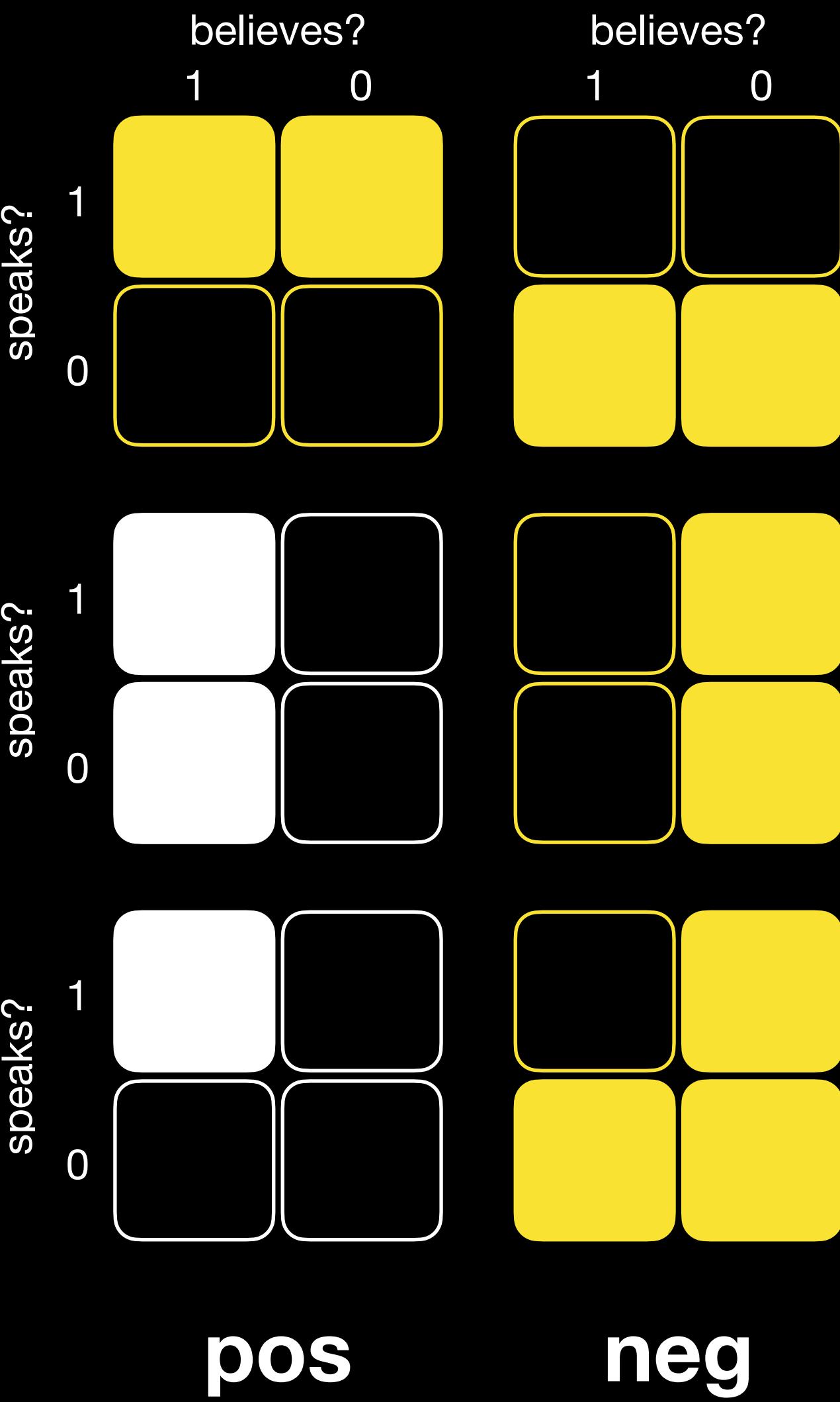
*does Cole believe?*



**simple**

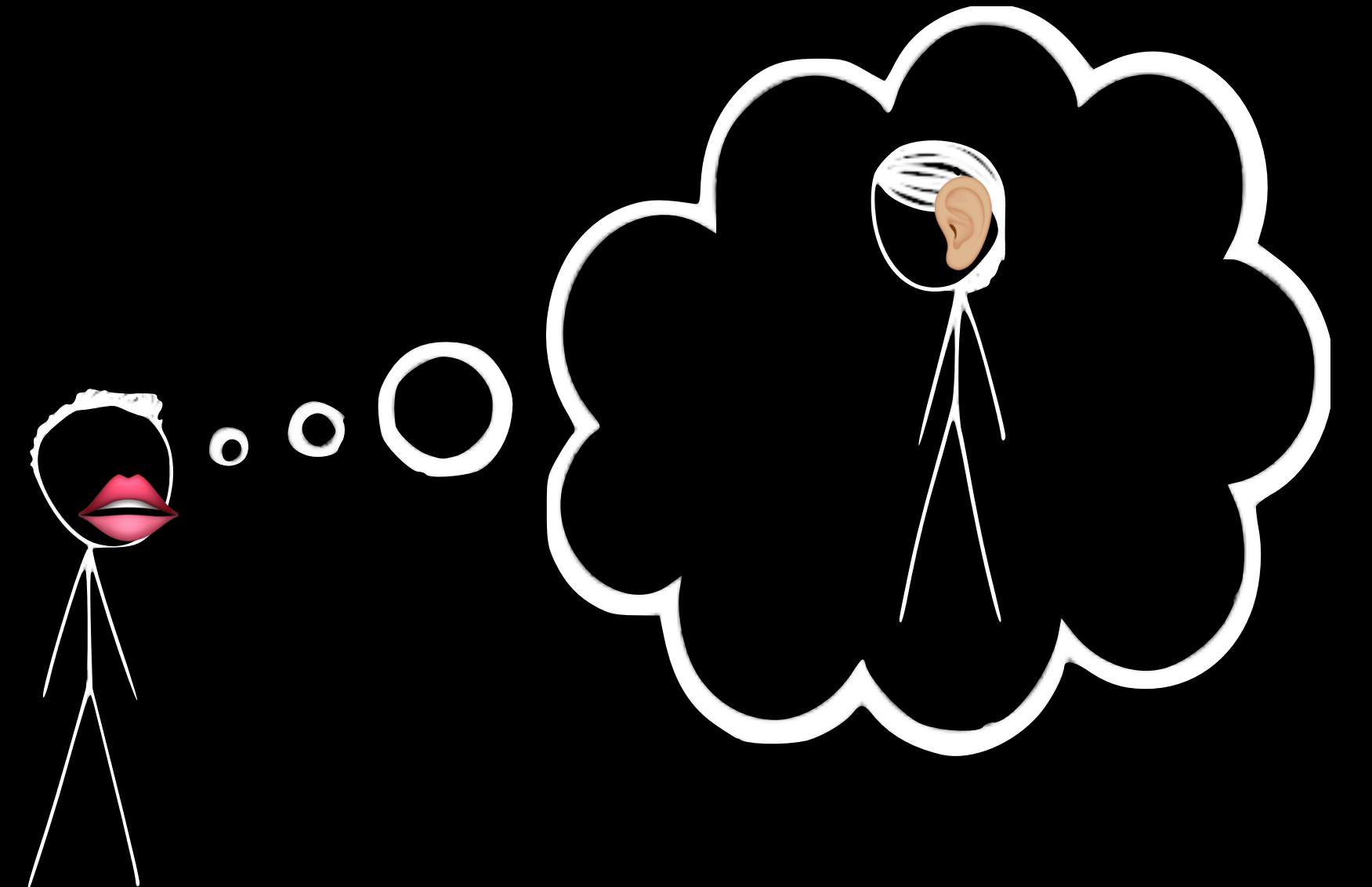
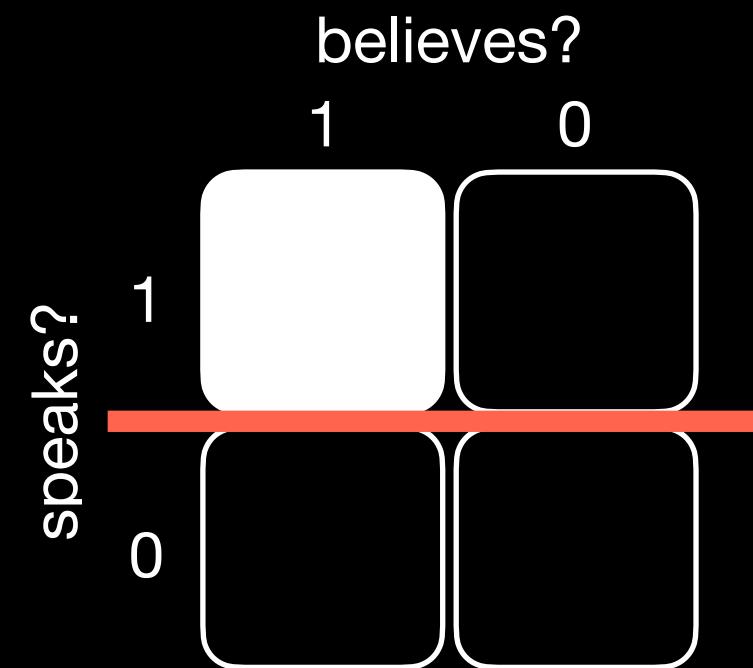
***think***

***know***



# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD

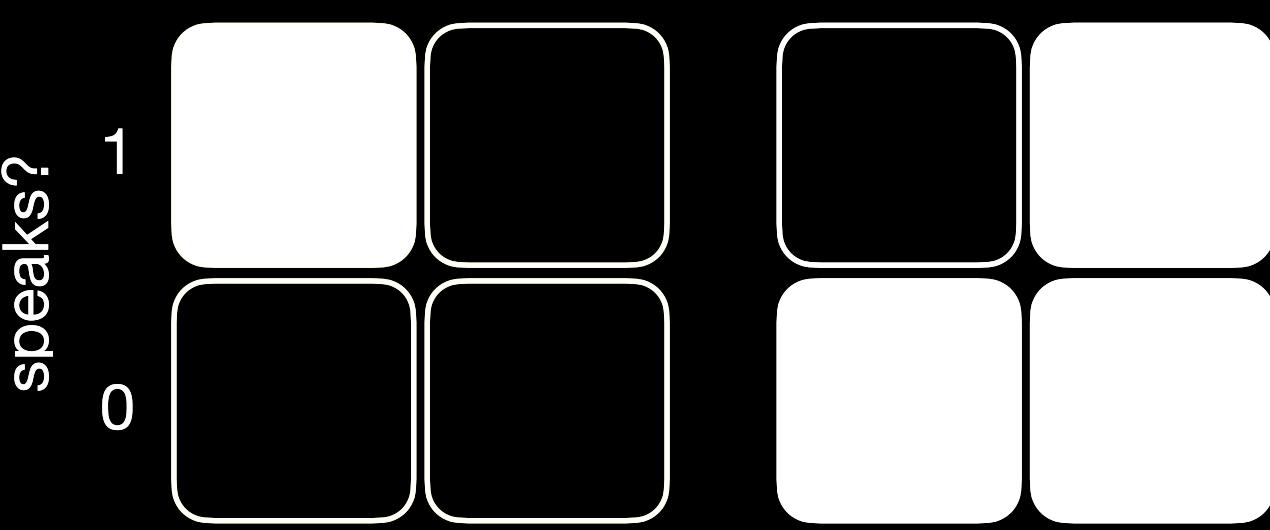
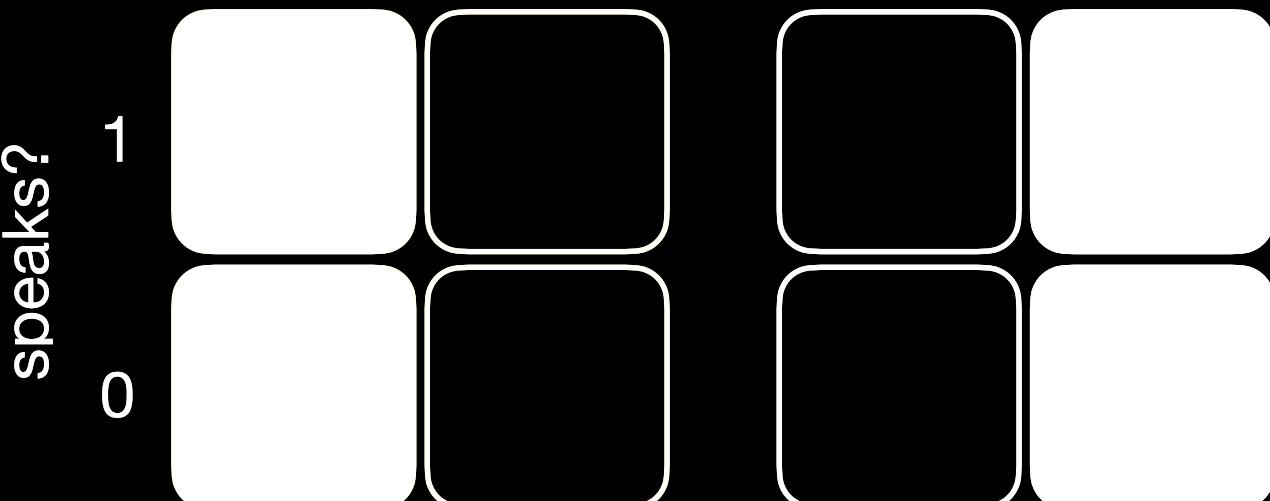
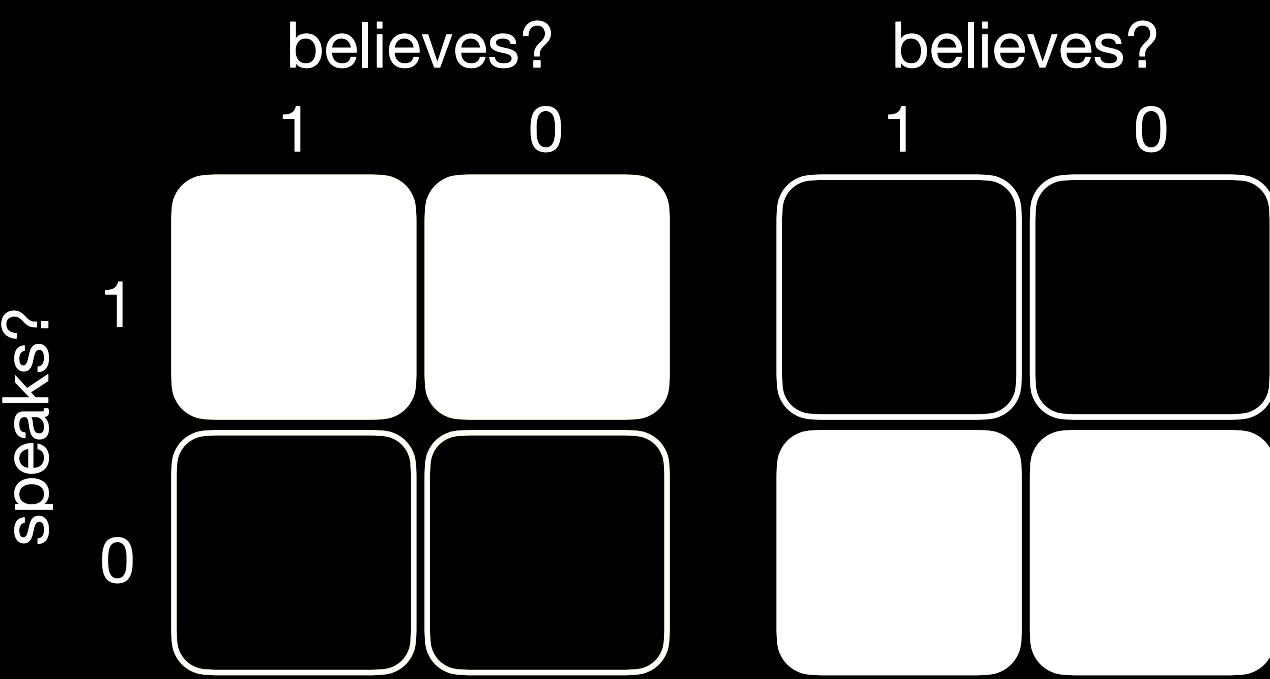


**simple**

***think***

***know***

***does Charley speak Spanish?***

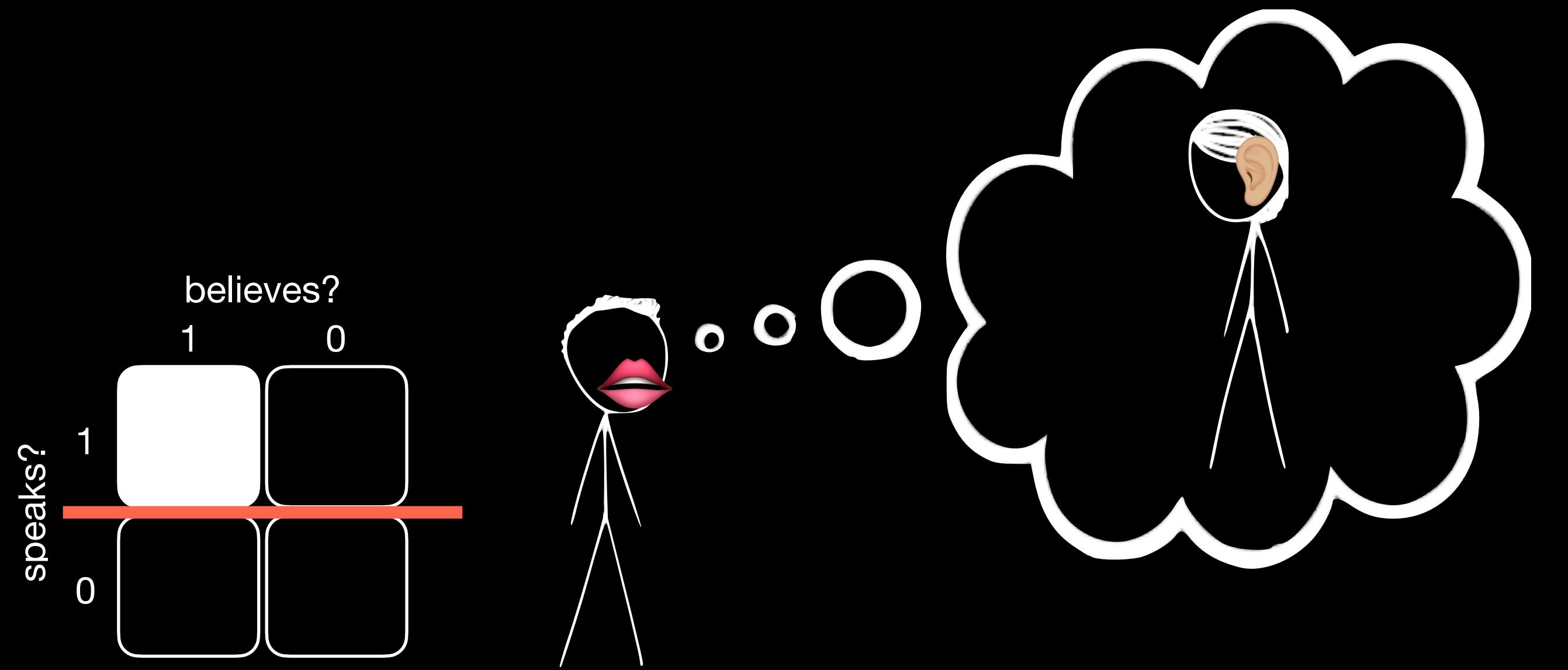


***pos***

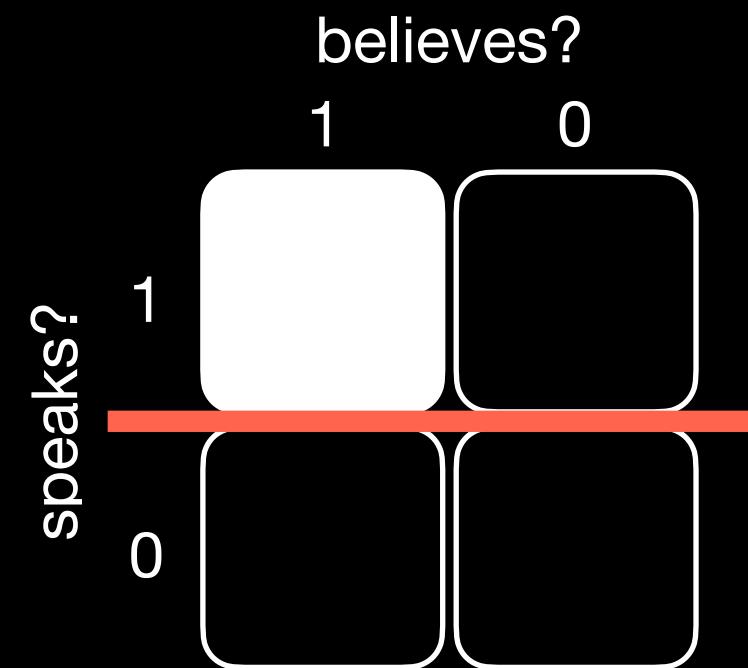
***neg***

# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD



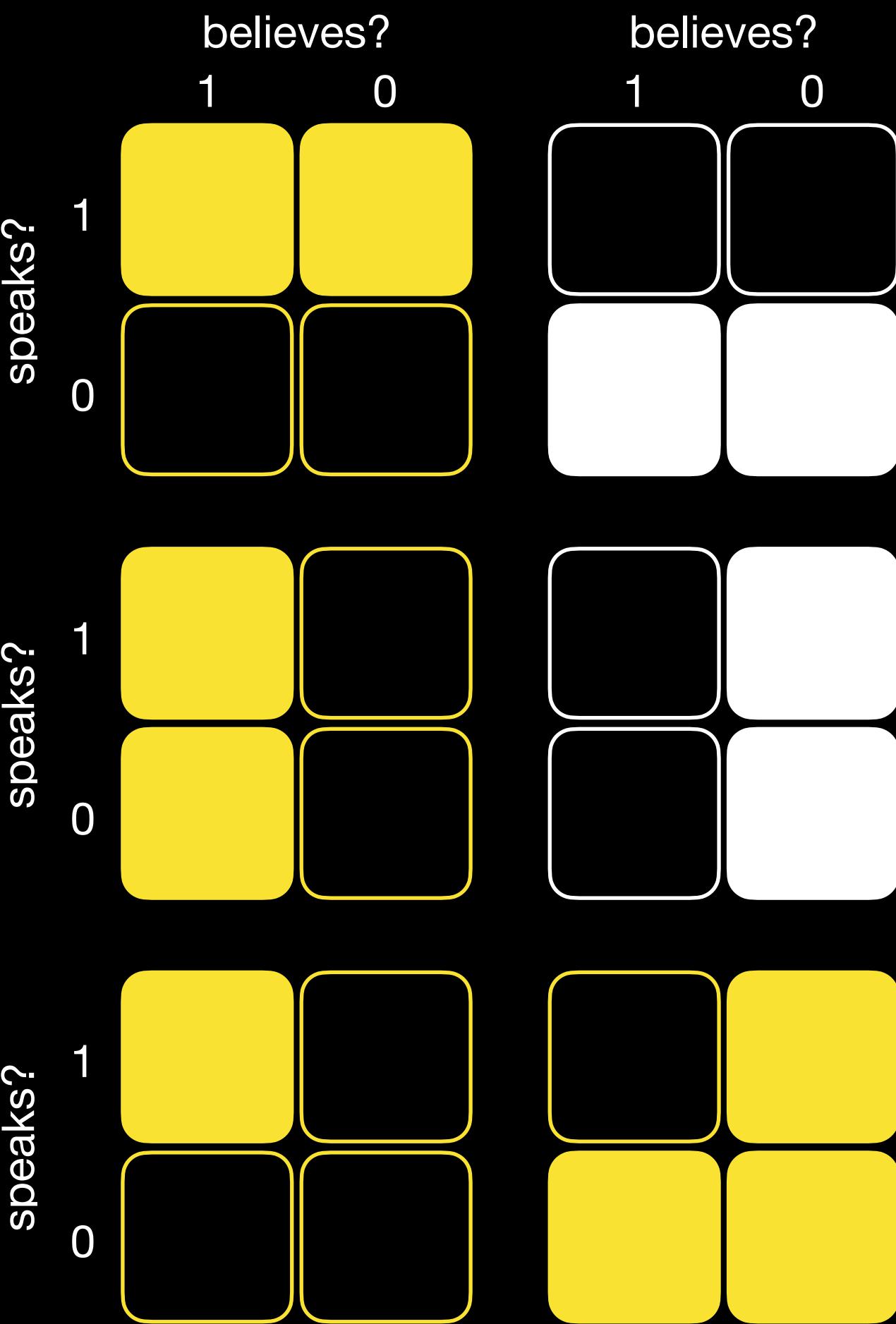
*does Charley speak Spanish?*



**simple**

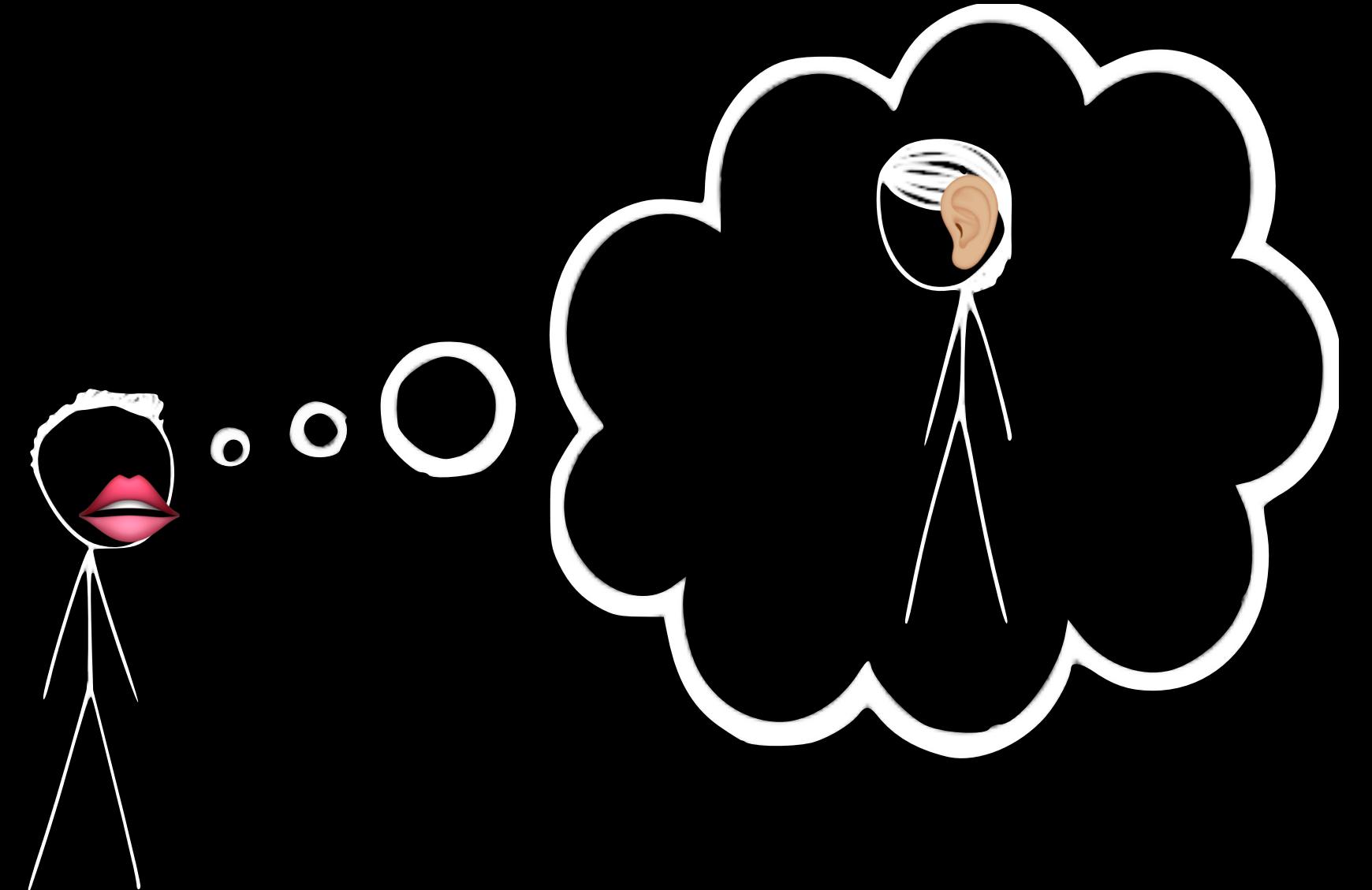
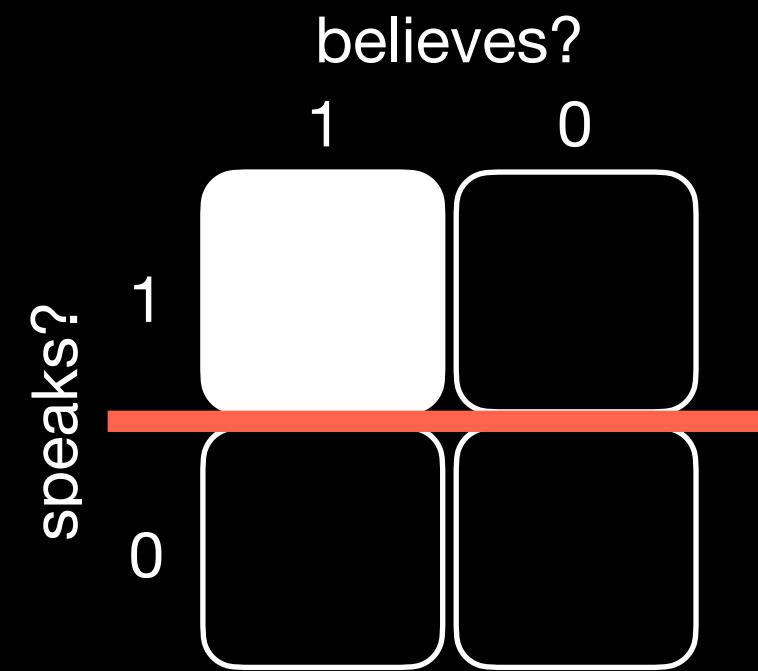
**think**

**know**



# speaker behavior

speakers **choose** to produce **utterances in proportion to their utility** for leading the **listener** to correctly resolve the QUD

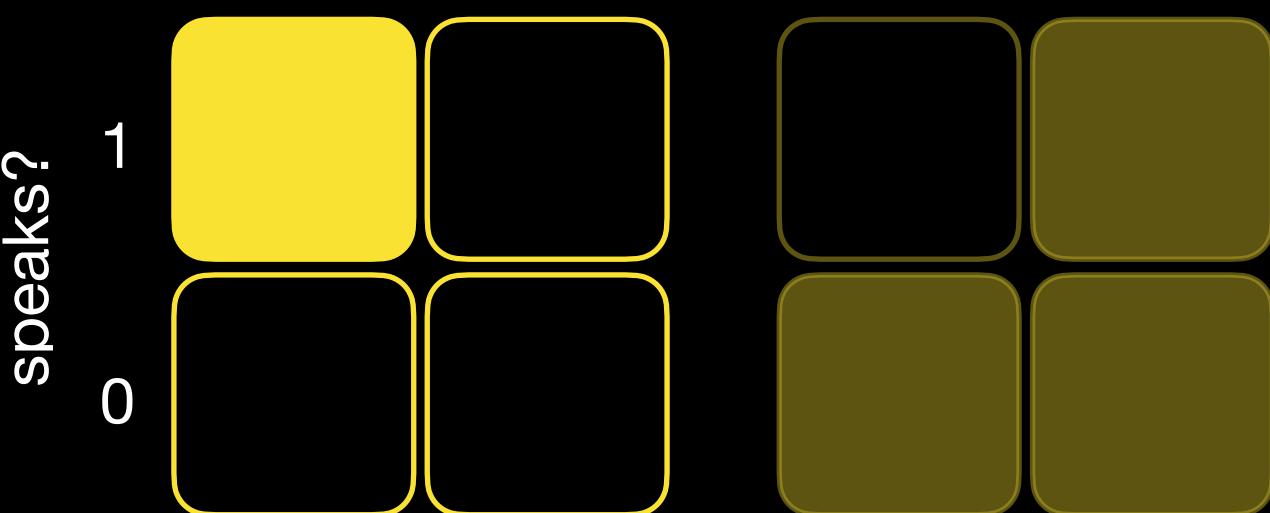
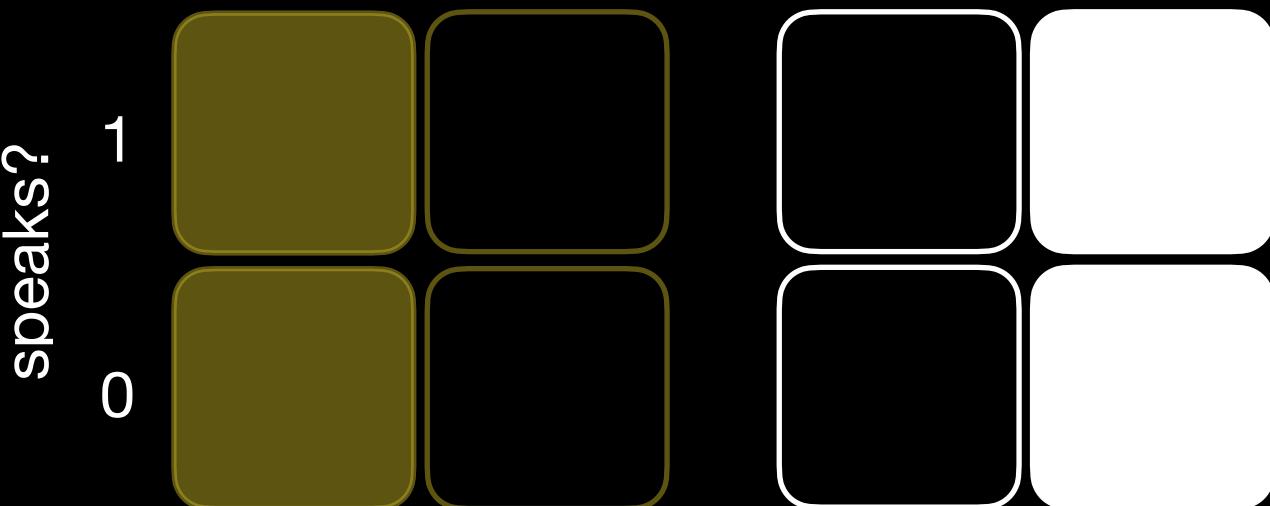
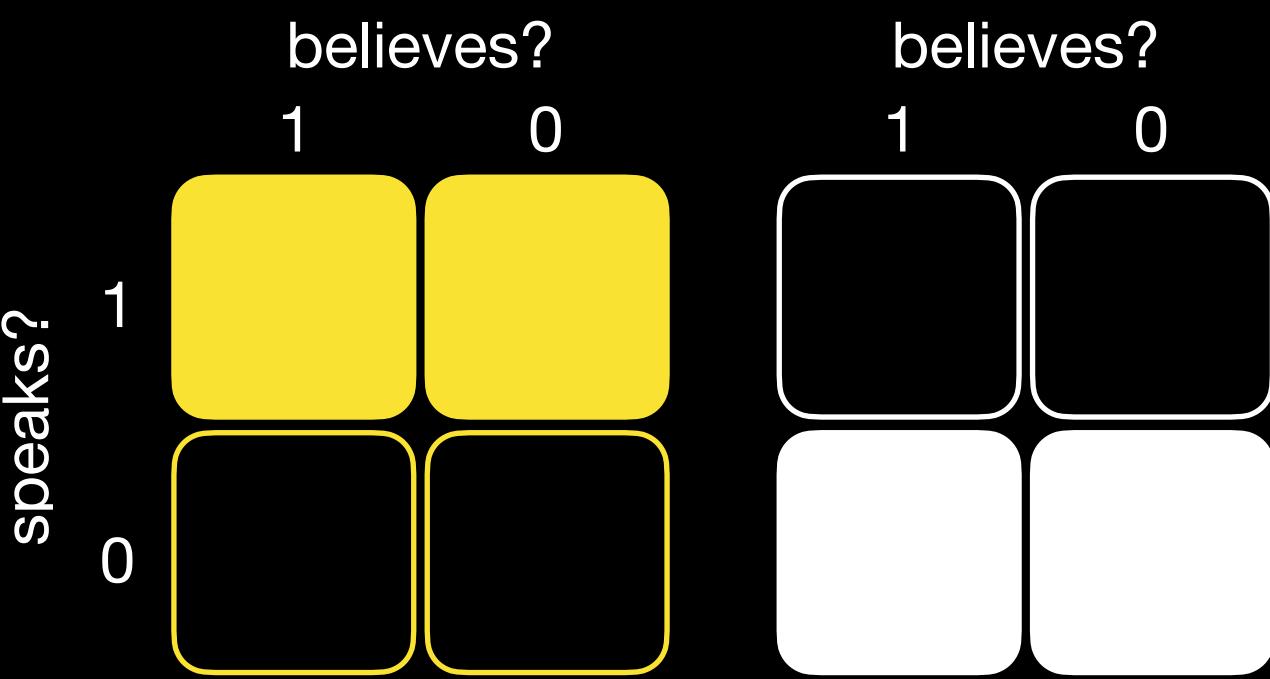


simple

*think*

*know*

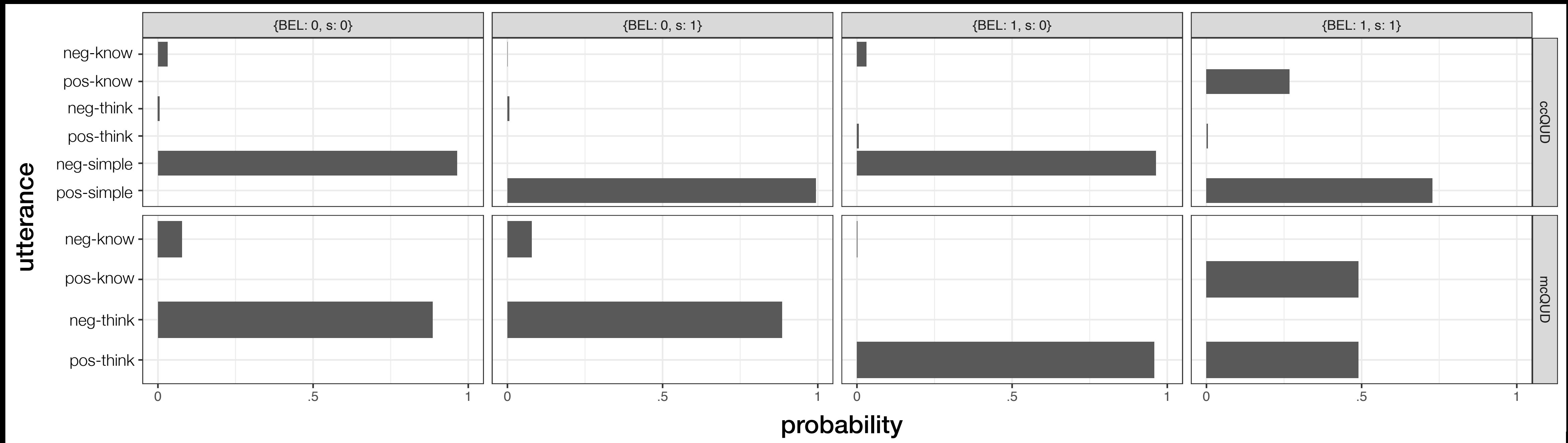
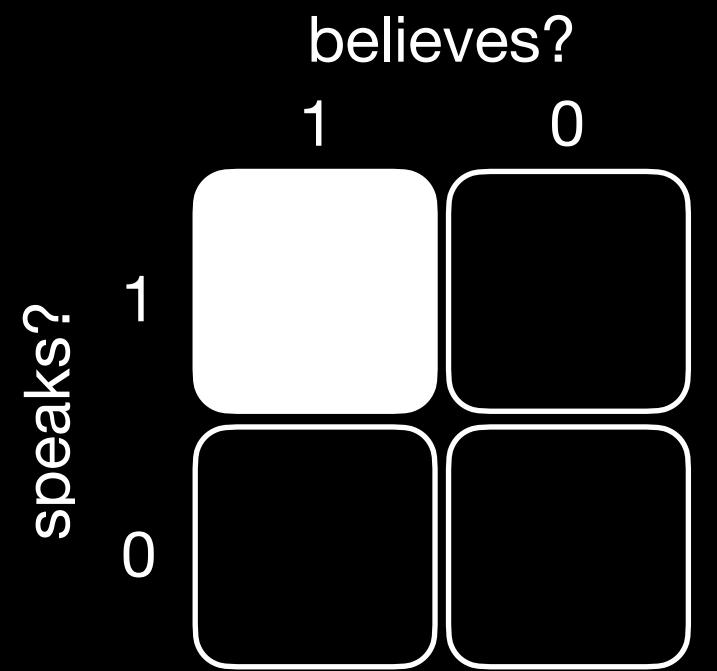
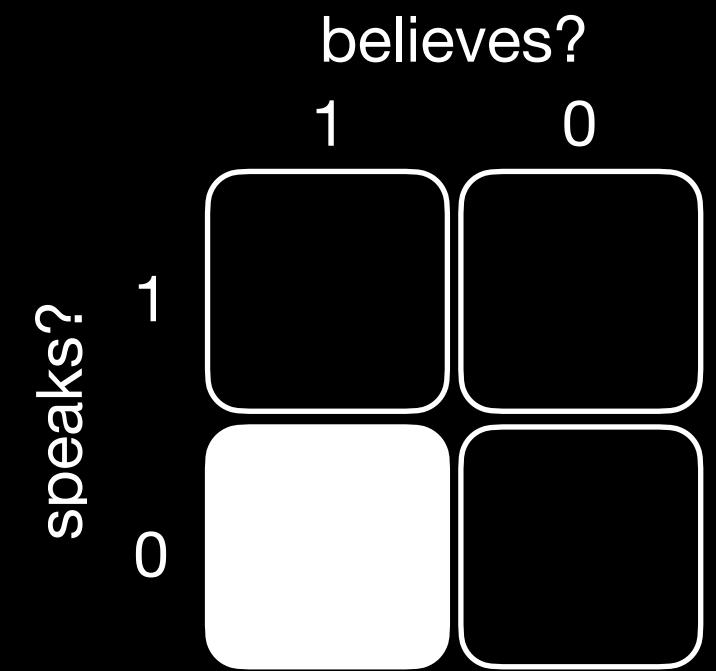
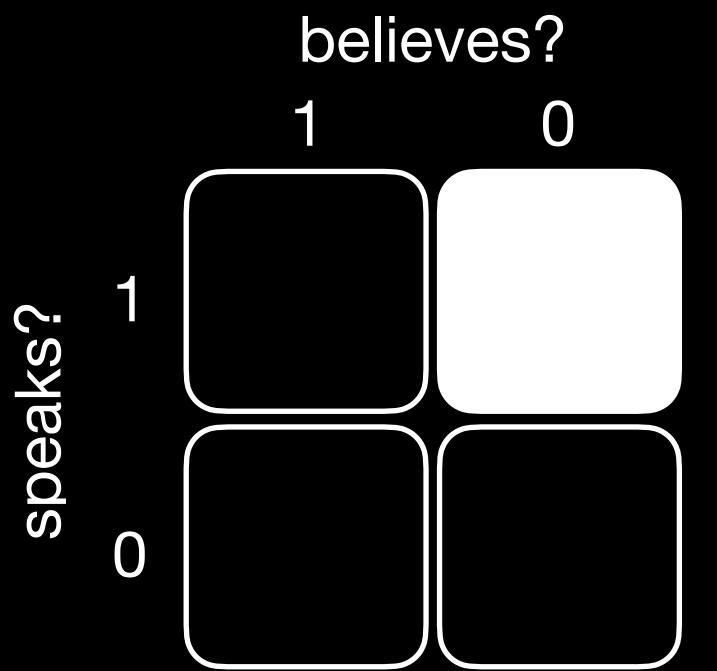
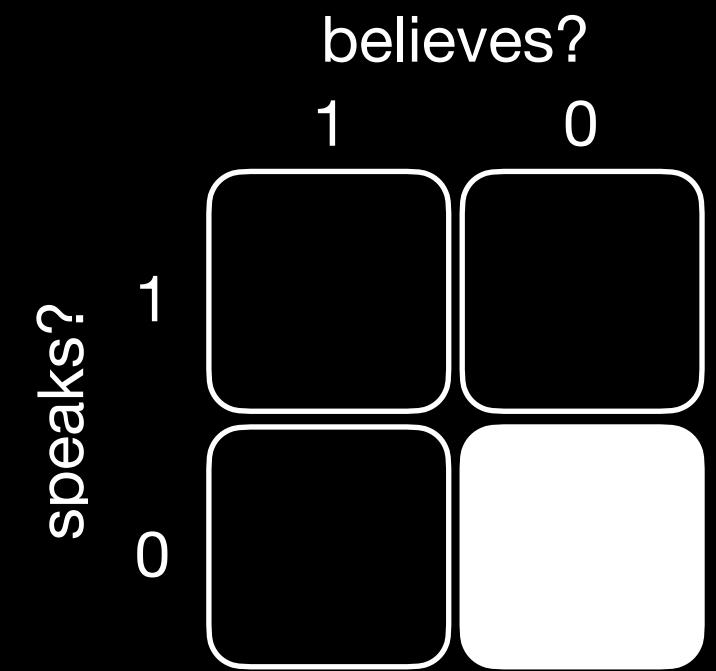
*does Charley speak Spanish?*



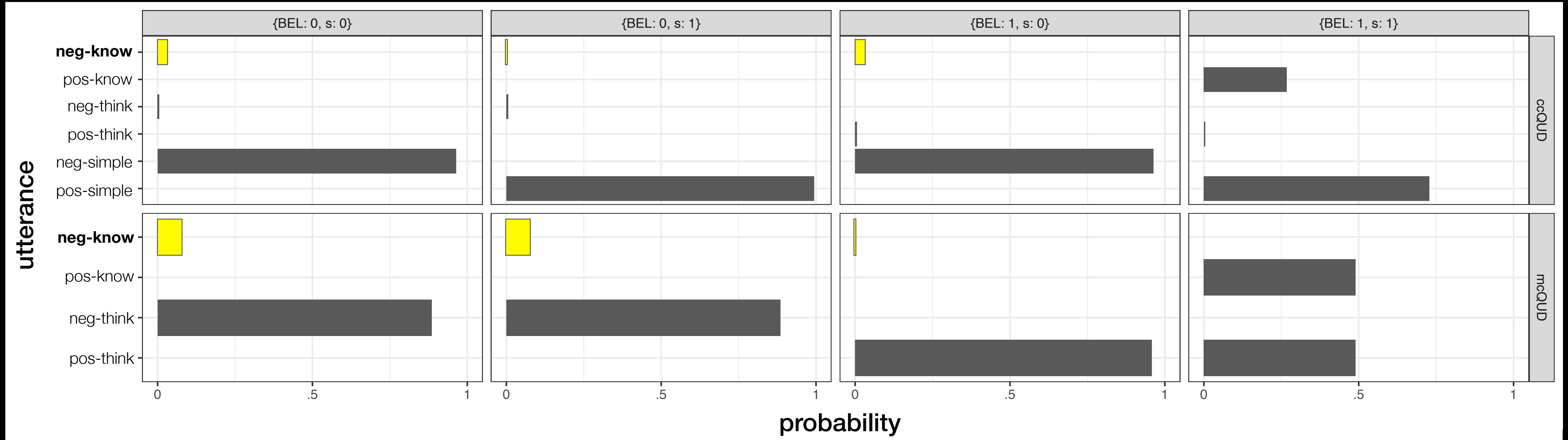
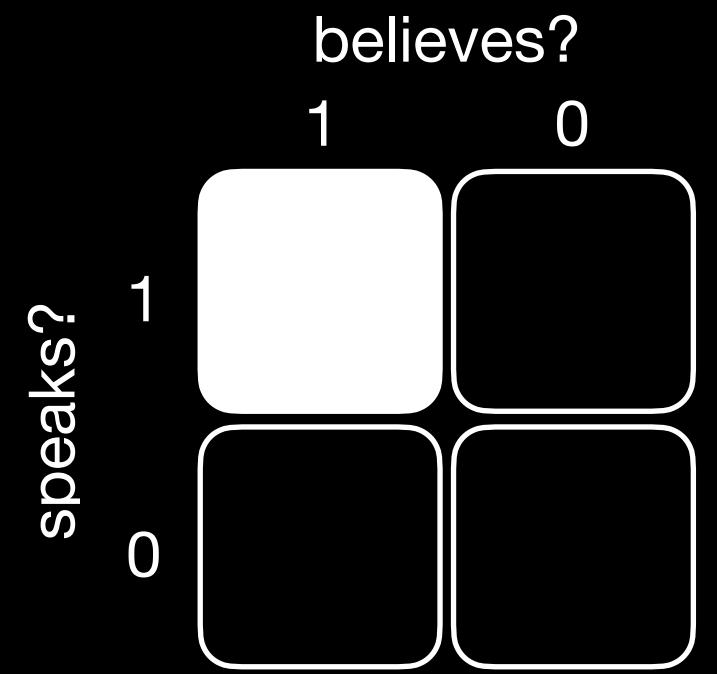
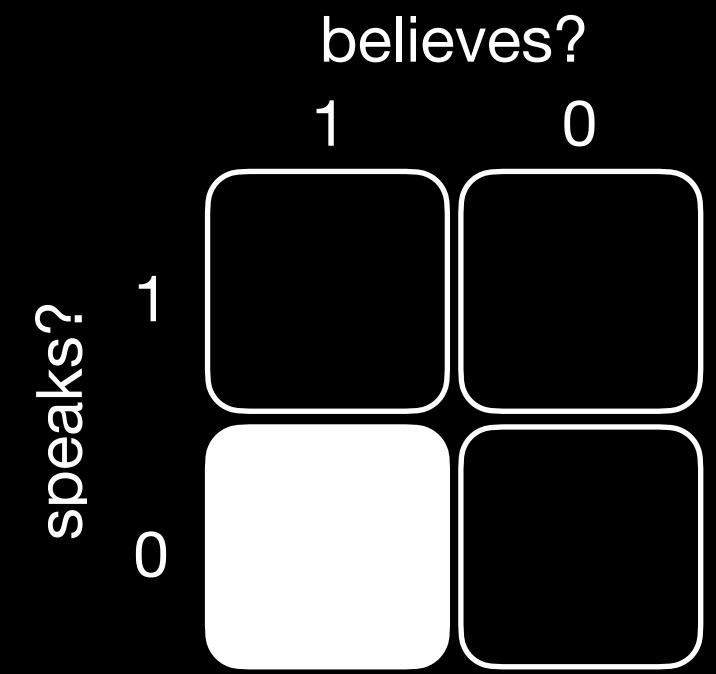
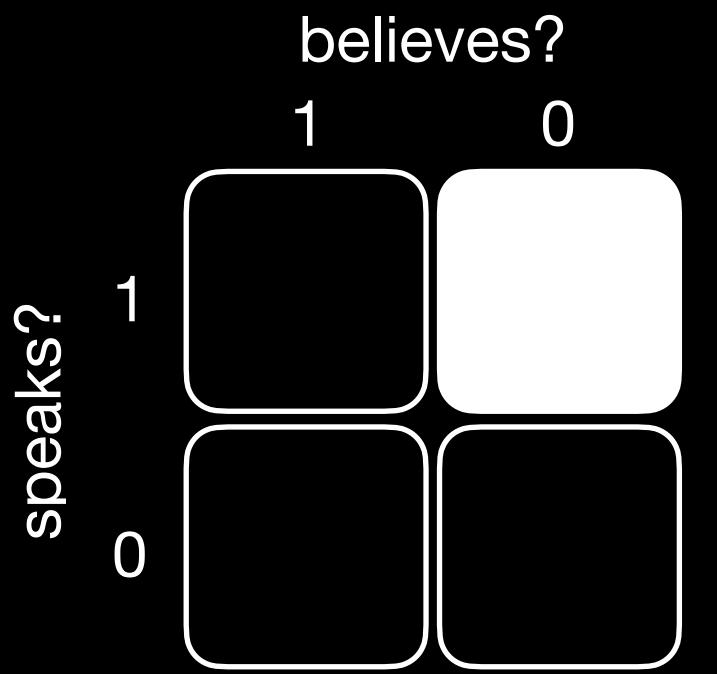
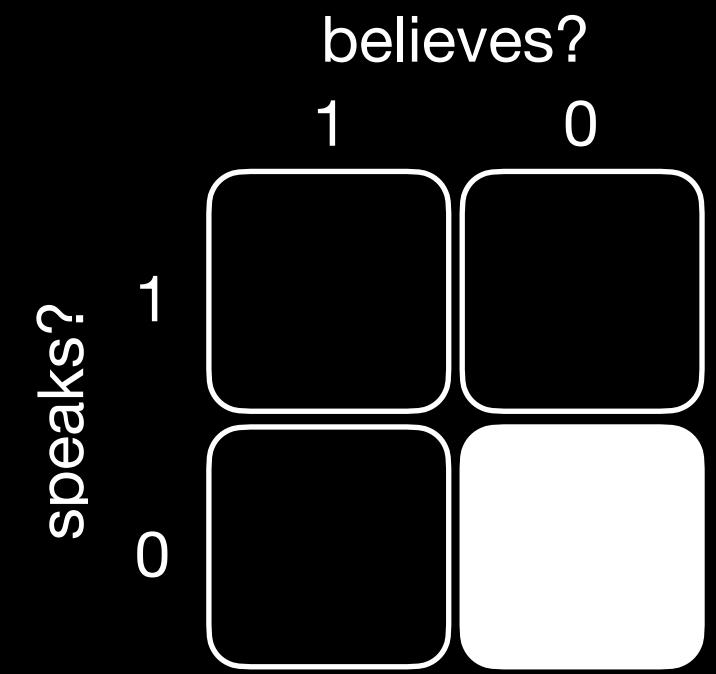
pos

neg

# which utterance does the speaker choose?



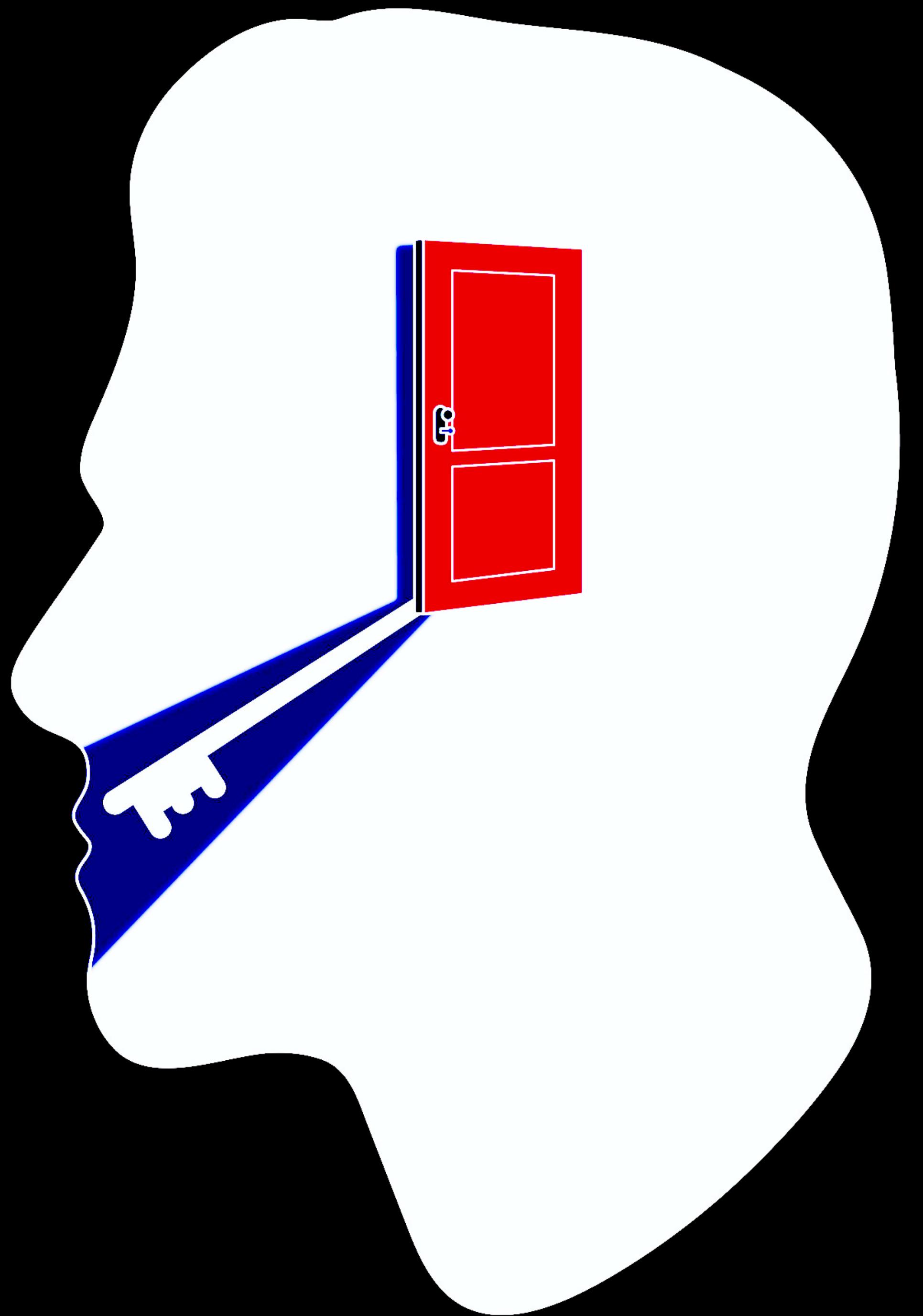
# which utterance does the speaker choose?



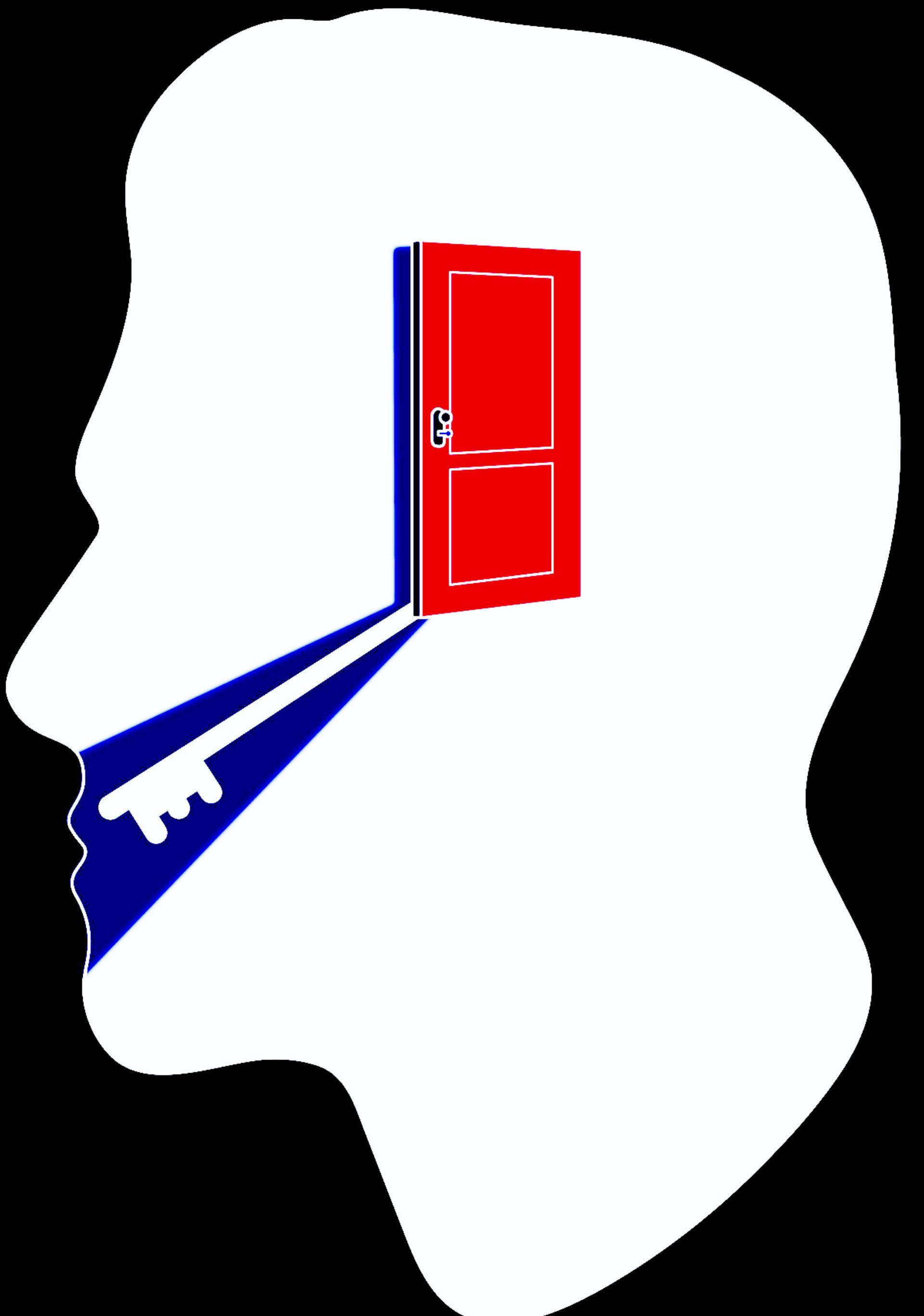
**neg-know** has low utility because it has a weak semantics

One more thing...

private assumptions



the speaker wants to convey  
an answer to the QUD that is  
**consistent with their  
private assumptions**



# private assumptions: what the speaker assumes to be true

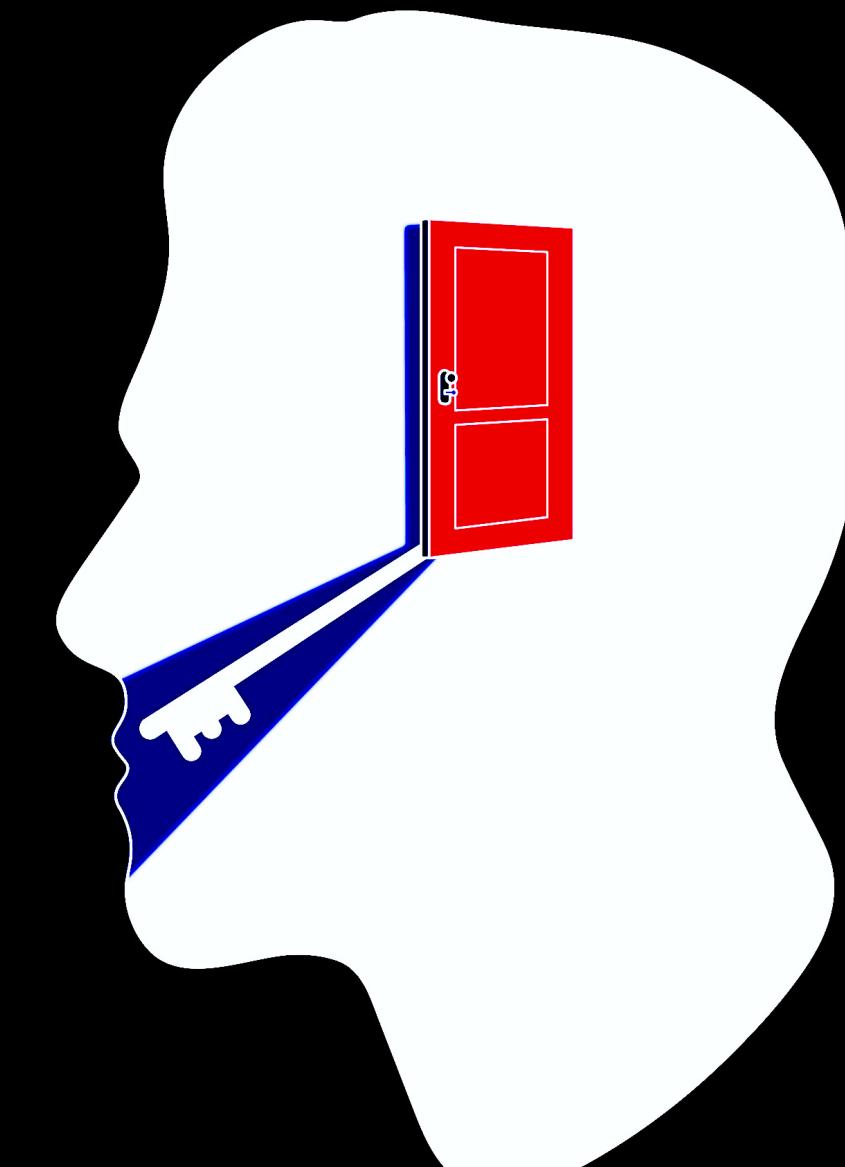
believes?		
1	0	
speaks?		
1	black	black
0	black	white

believes?		
1	0	
speaks?		
1	black	white
0	black	black

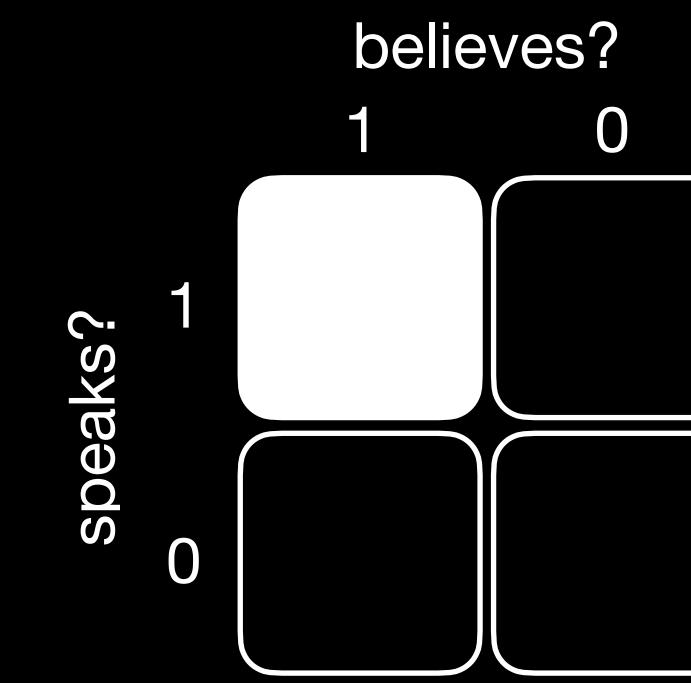
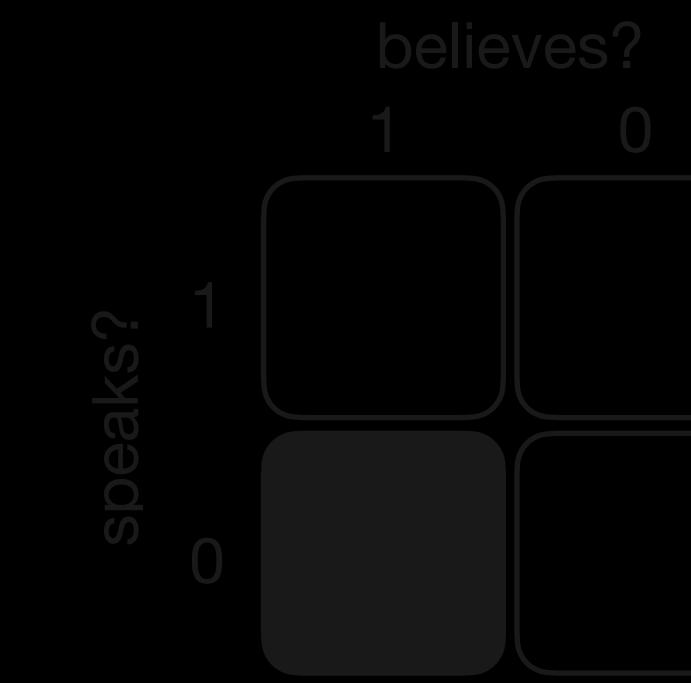
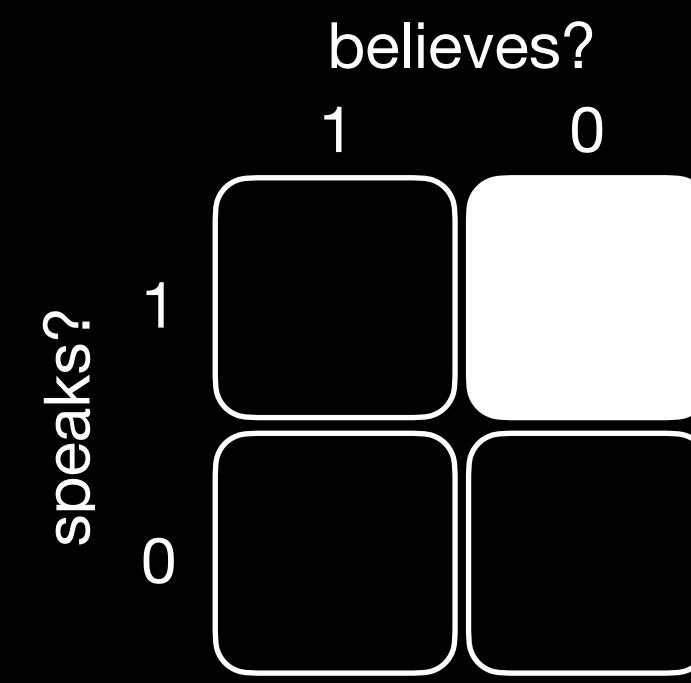
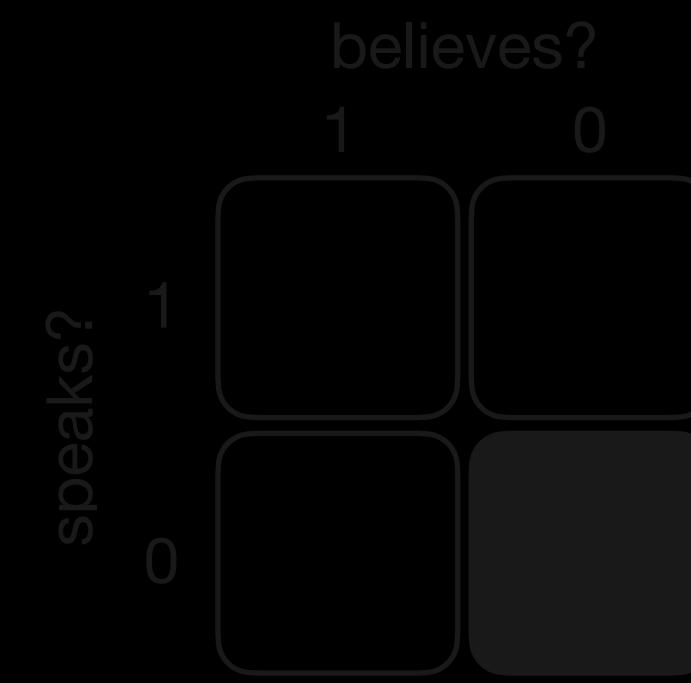
believes?		
1	0	
speaks?		
1	black	black
0	white	black

believes?		
1	0	
speaks?		
1	white	black
0	black	black

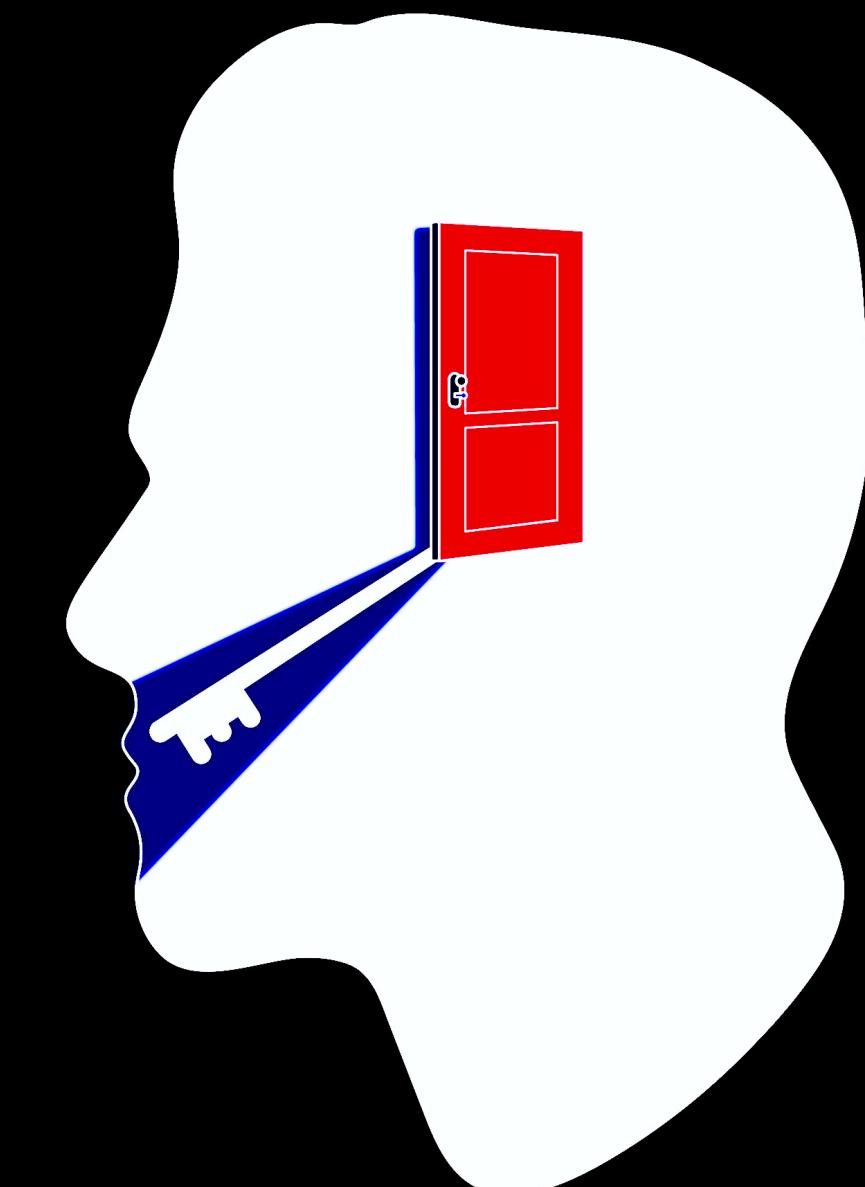
no assumptions;  
all worlds are possible



# private assumptions: what the speaker assumes to be true



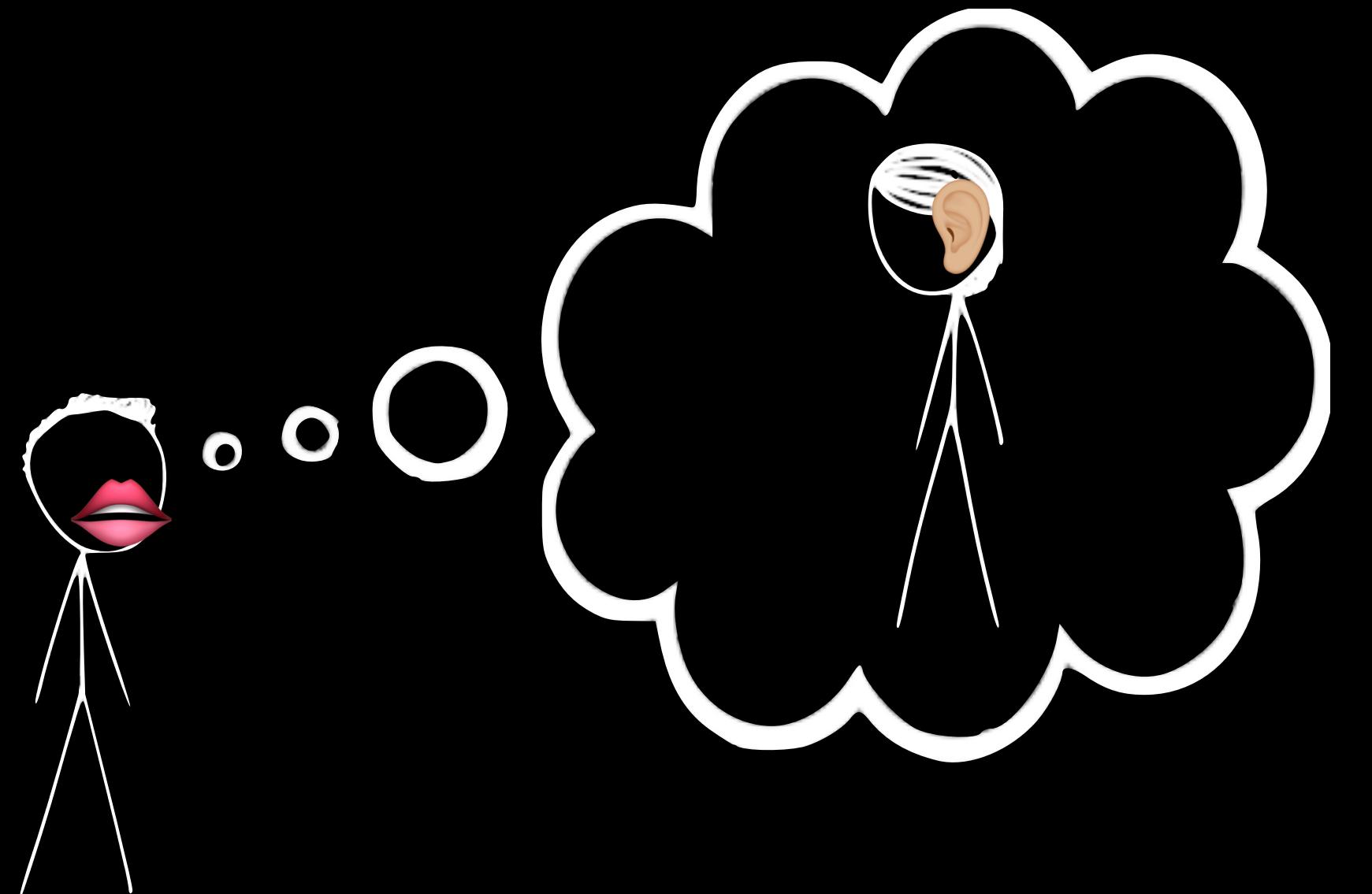
assumption that  
Charley speaks Spanish



# speaker behavior

***neg-know*** not particularly informative

	believes?	speaks?
1		
0		



**simple**

***think***

***know***

	believes?	speaks?	believes?	speaks?
1			1	
0			0	

	believes?	speaks?	believes?	speaks?
1			1	
0			0	

	believes?	speaks?	believes?	speaks?
1			1	
0			0	

	believes?	speaks?	believes?	speaks?
1			1	
0			0	

	believes?	speaks?	believes?	speaks?
1			1	
0			0	

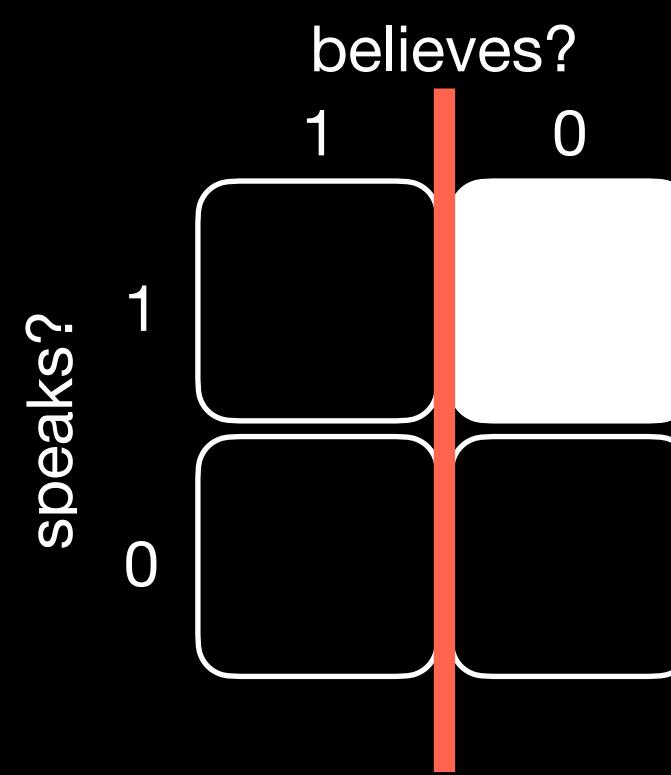
***does Cole believe?***

***pos***

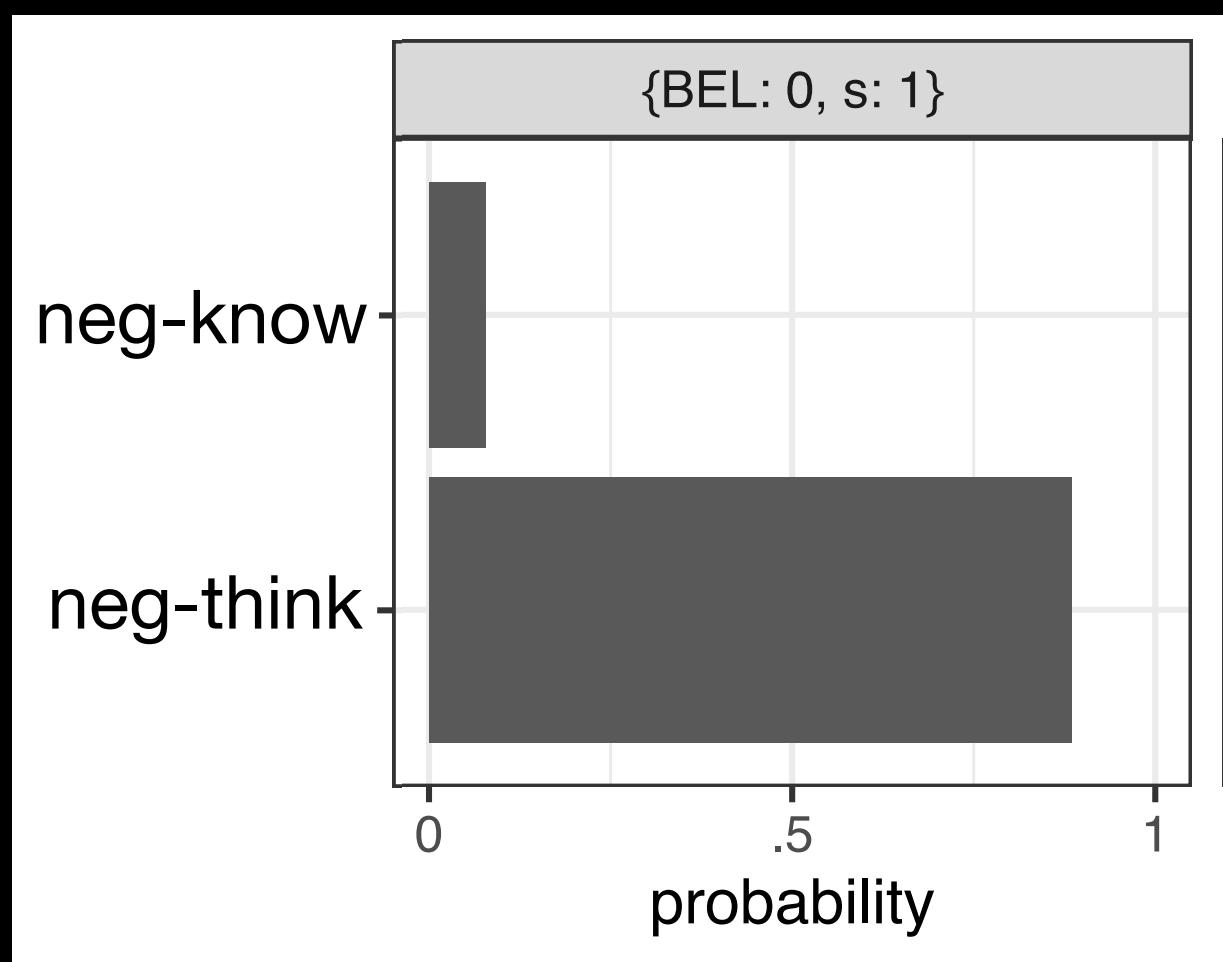
***neg***

# speaker behavior

***neg-know*** not particularly informative



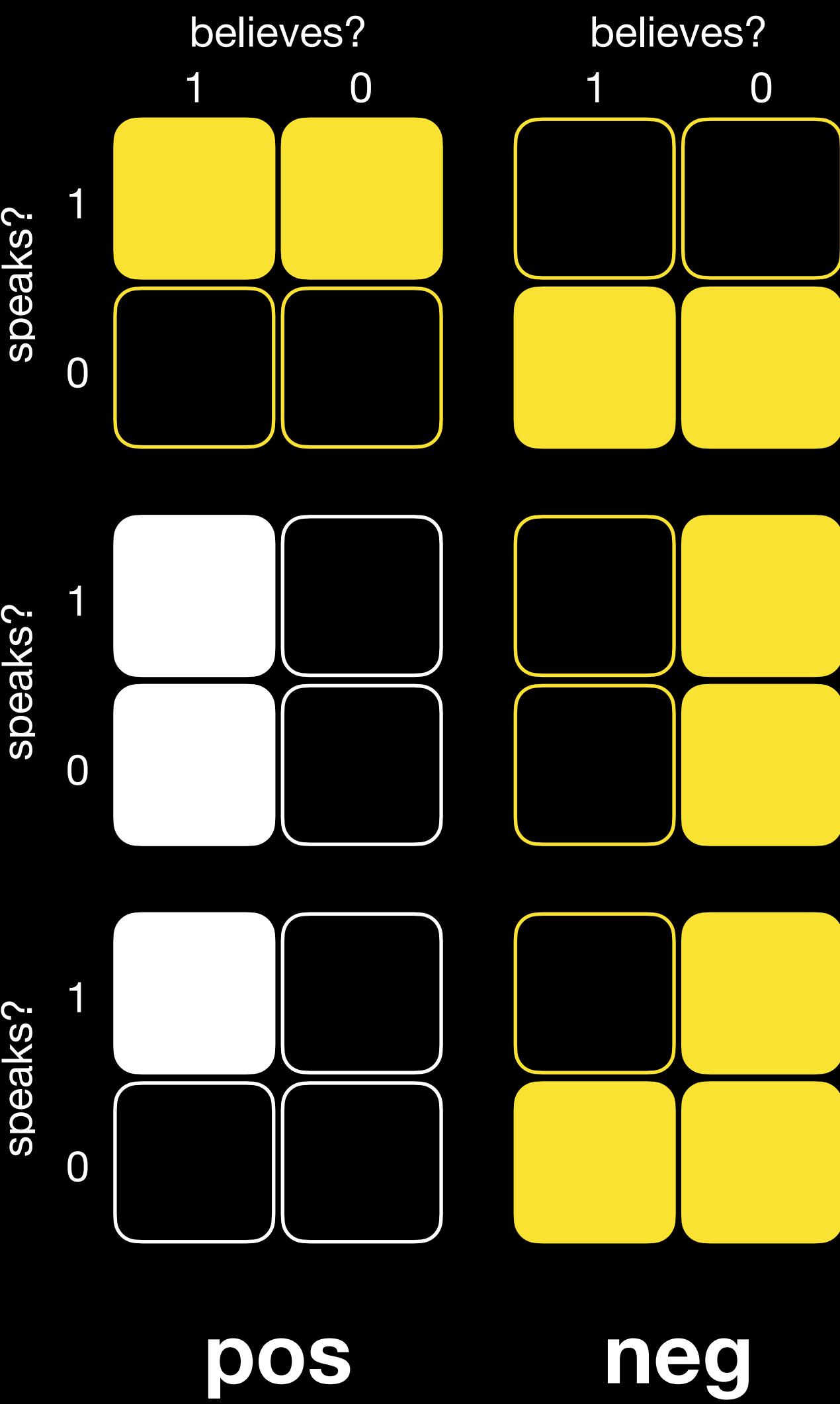
*does Cole believe?*



**simple**

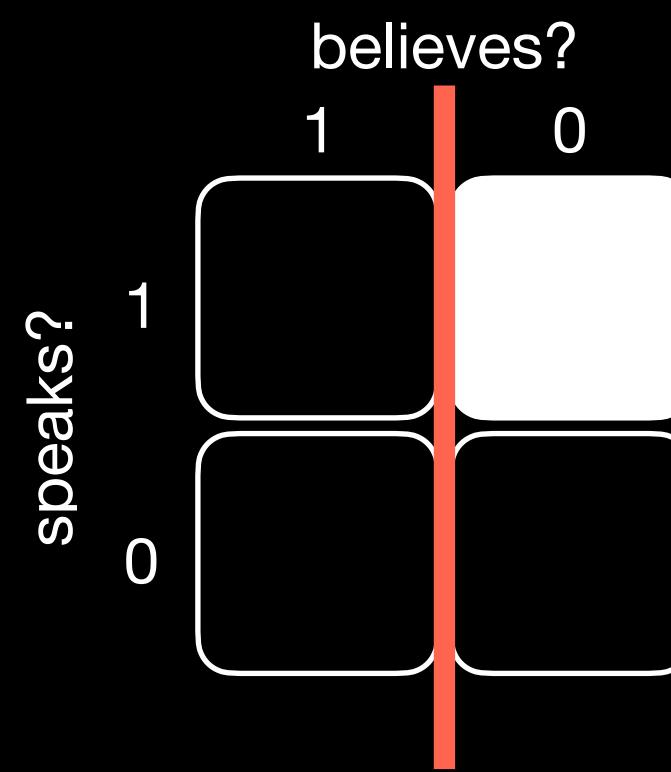
***think***

***know***

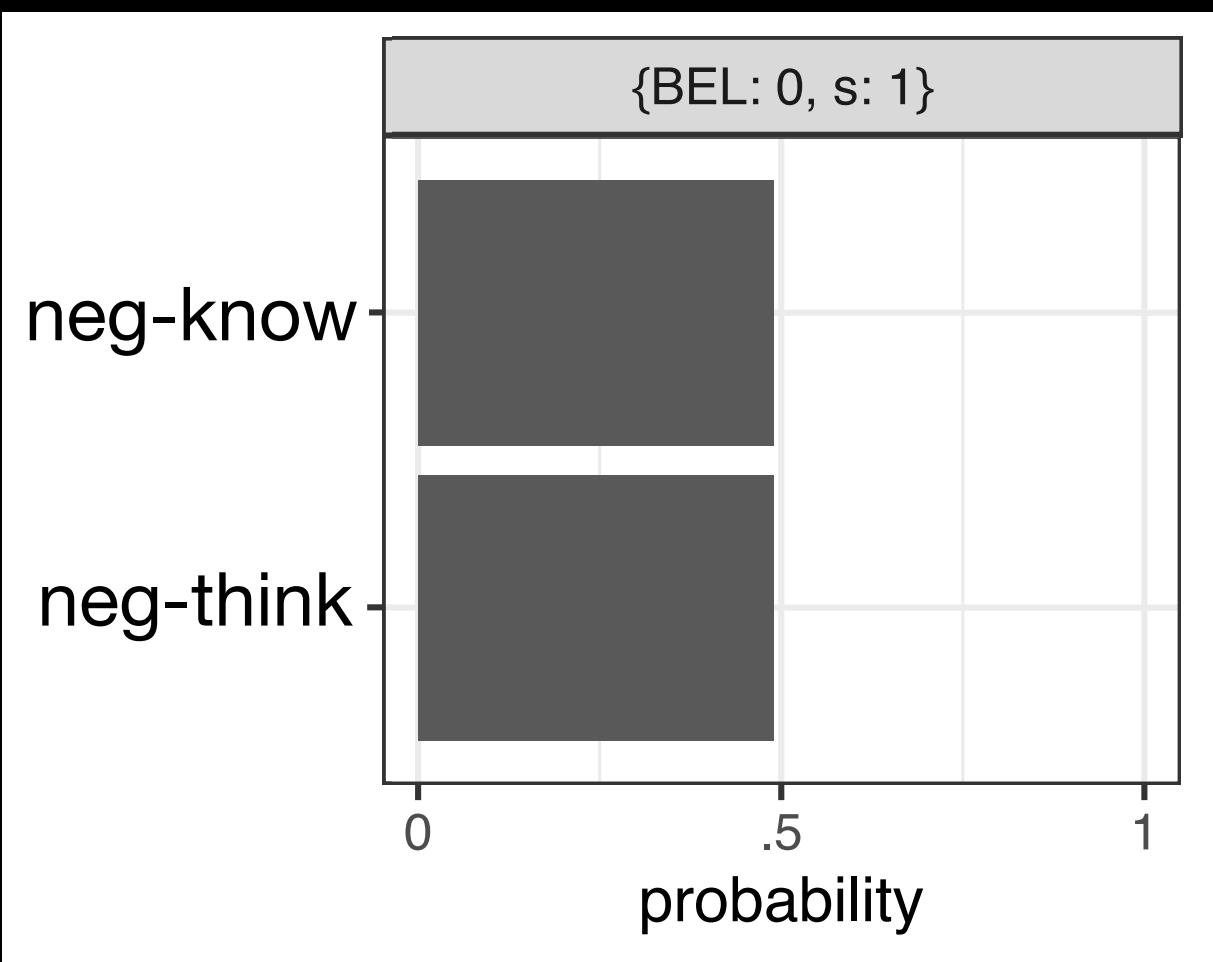


# speaker behavior

***neg-know*** is more informative if the speaker already assumes that Charley speaks Spanish



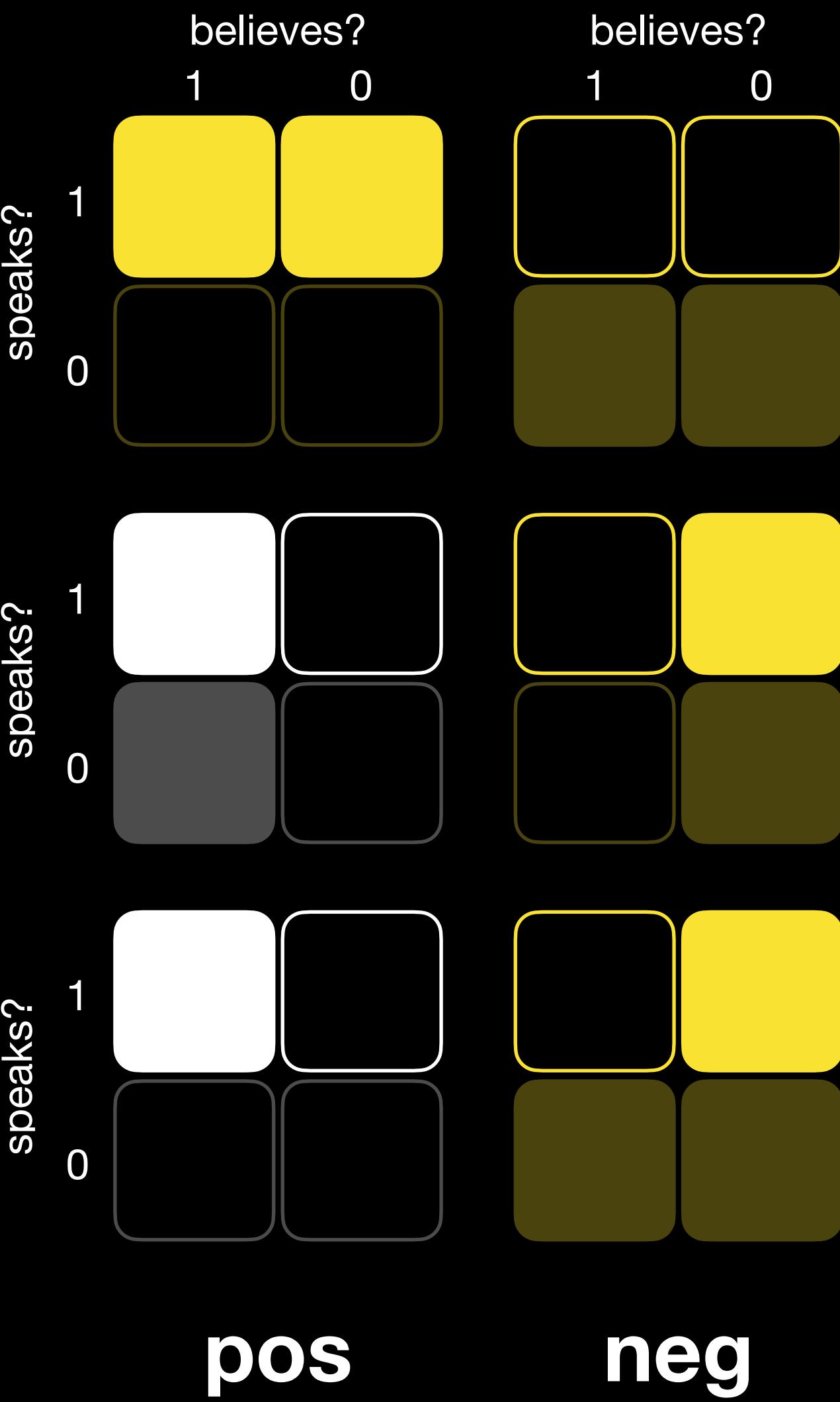
*does Cole believe?*



**simple**

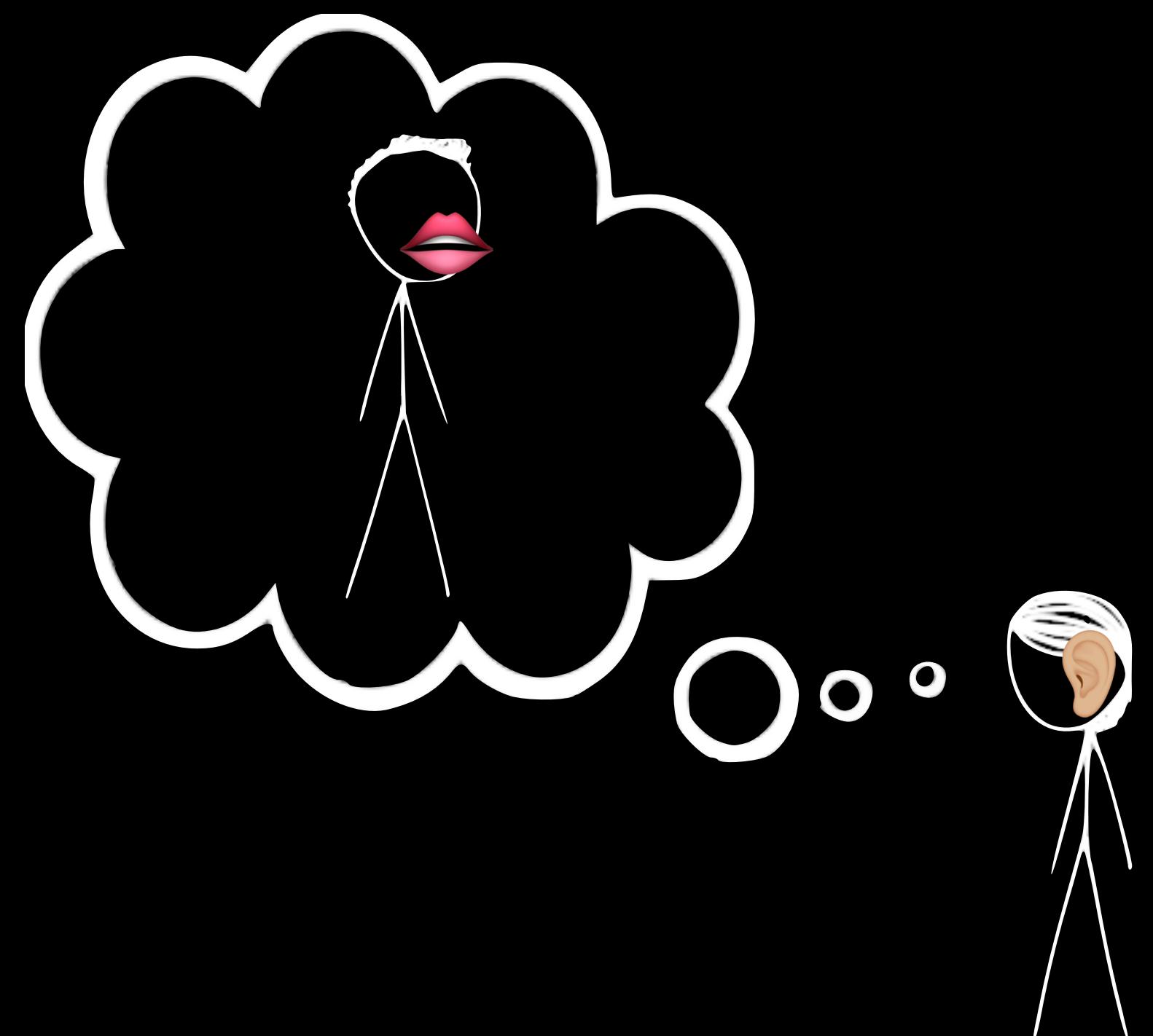
***think***

***know***



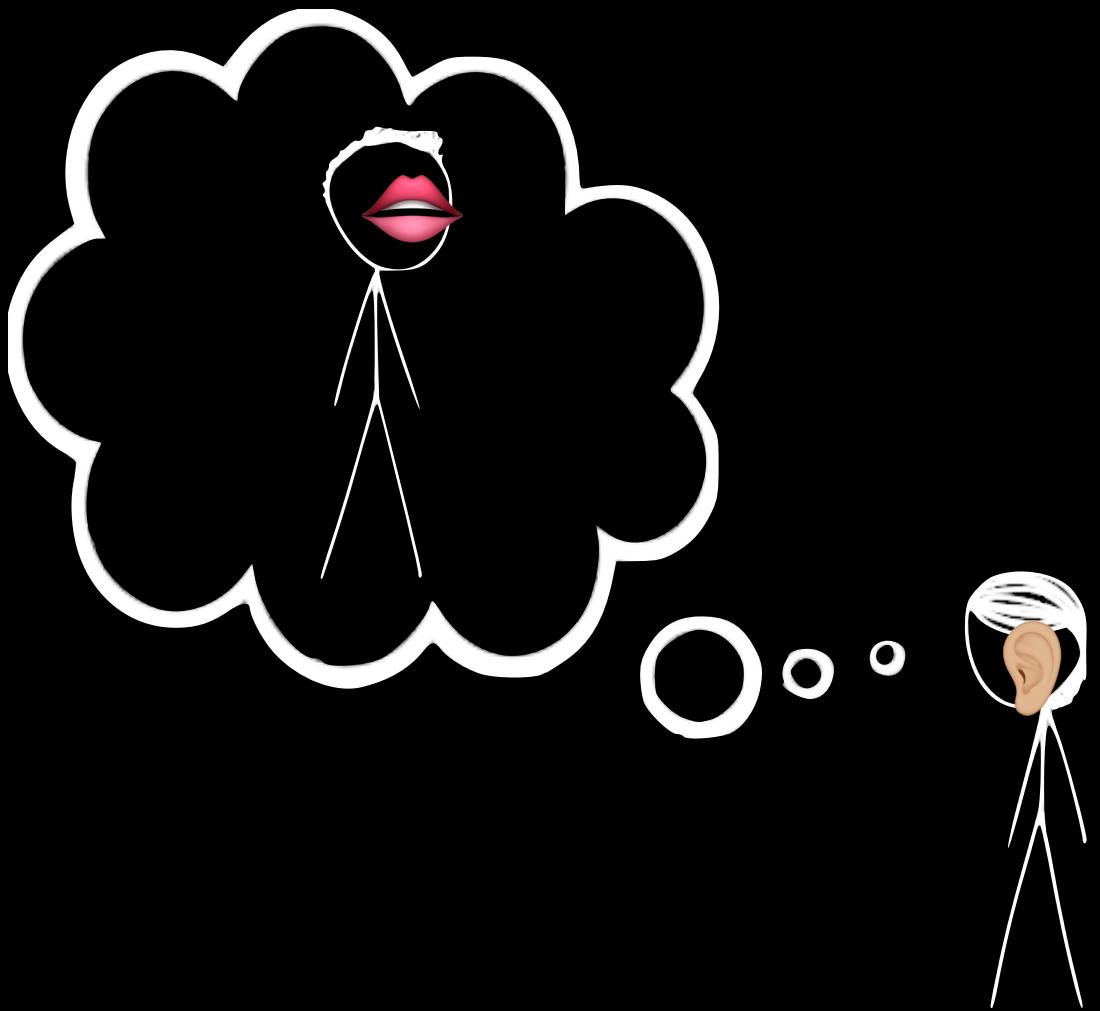
# basic model intuition

listeners interpret utterances by **reasoning about** what would have led  
**a speaker** to produce the utterance in the first place



# basic model intuition

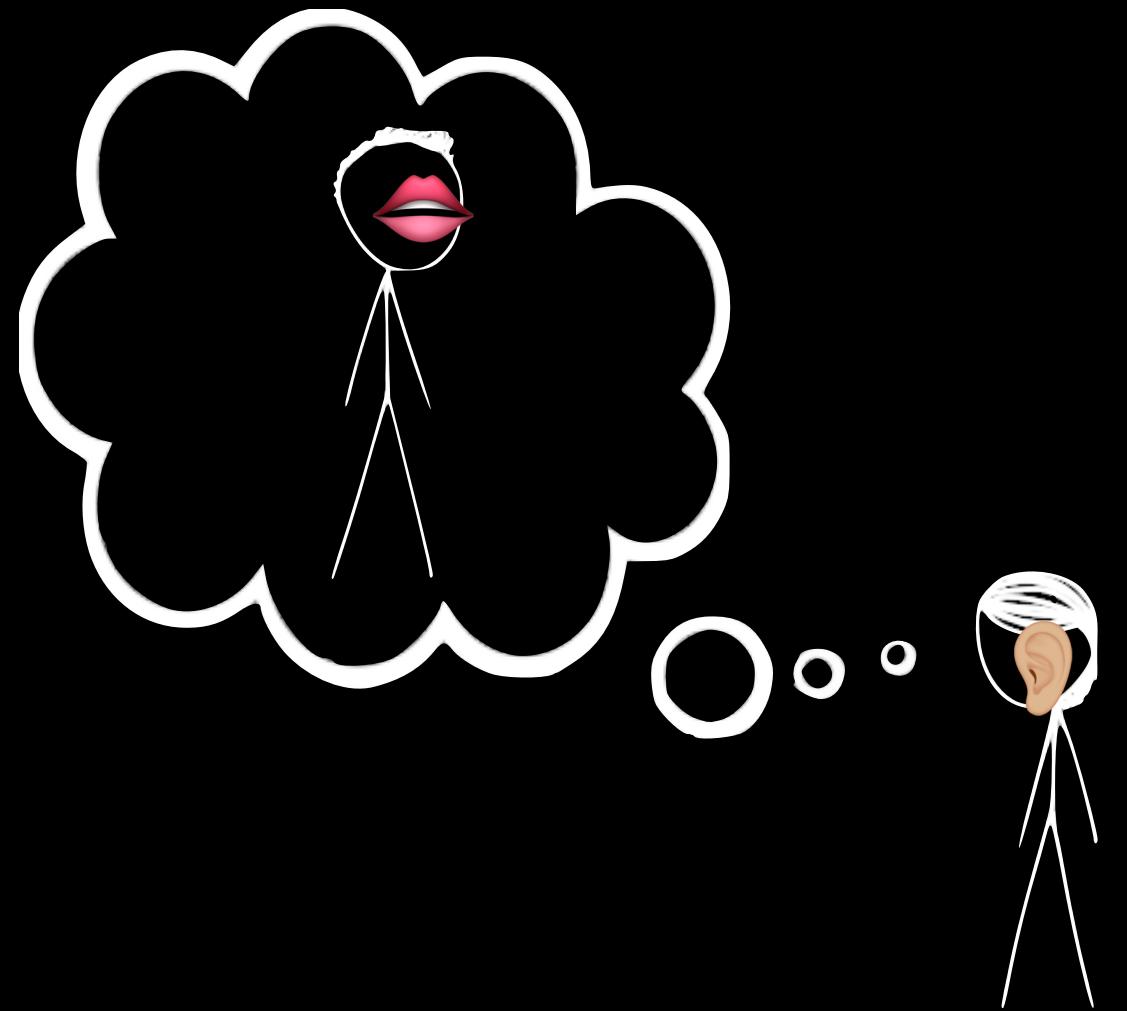
listeners interpret utterances by **reasoning about** what would have led  
**a speaker** to produce the utterance in the first place



when the listener hears “Cole doesn’t know...” they are likely to infer  
that the speaker assumes that Charley speaks Spanish

# basic model intuition

listeners interpret utterances by **reasoning about** what would have led  
**a speaker** to produce the utterance in the first place



**projection!!!**

when the listener hears “Cole doesn’t know...” they are likely to infer  
that the **speaker assumes that Charley speaks Spanish**

Cole doesn't ***think/know*** that Charley speaks Spanish.

→ Charley speaks Spanish

**empirical targets**

***know*** projects more than ***think***

(e.g., Kiparsky & Kiparsky 1970; Degen & Tonhauser 2022)

**prior beliefs** modulate projection

(e.g., Mahler 2020, 2022; Degen & Tonhauser 2021)

**QUDs** modulate projection

(e.g., Abrusán 2011, 2016; Simons et al 2017; Tonhauser et al. 2018, Degen & Tonhauser under review)

Cole doesn't *think/know* that Charley speaks Spanish.

→ Charley speaks Spanish

## testing the empirical targets

**know** projects more than *think*

(e.g., Kiparsky & Kiparsky 2018; Degen & Tonhauser 2022)

**prior beliefs moderate projection**

(e.g., Mahler 2018; Degen & Tonhauser 2022; Degen & Tonhauser 2021)

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(e.g., Abrusán 2011, 2016; Simons et al 2017; Degen & Tonhauser 2018; Degen & Tonhauser under review)

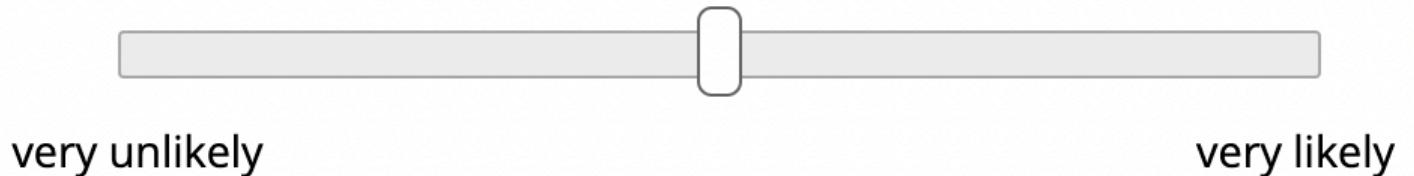
# experiment 1

n=833

Please read this text:

**Sue runs a company that connects language learners with remote teachers who live all over the world. She's trying to figure out how well her assistant, Cole, knows her remote teachers. Sue's business partner tells her what Cole said about Charley, who lives in Korea: "Cole knows that Charley speaks Spanish."**

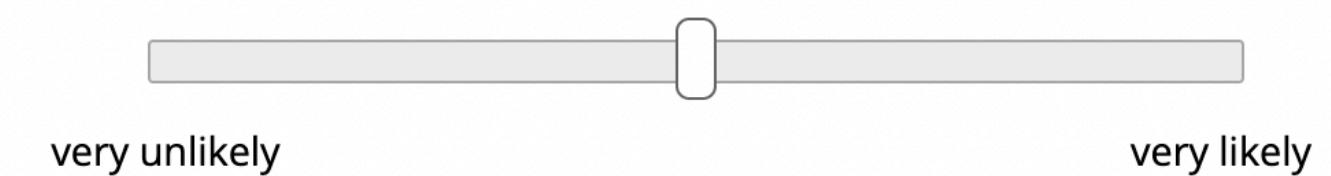
Given what you have read above, how likely is it that Charley speaks Spanish?



Please read this text:

**Sue runs a company that connects language learners with remote teachers who live all over the world. She's putting together a list of the languages spoken by the remote teachers. After consulting her assistant, Cole, who knows the teachers and the languages they speak better than she does, Sue is currently working through the list of teachers to identify who speaks Spanish. When she gets to Charley, who lives in Mexico, Sue says to her business partner: "Cole doesn't think that Charley speaks Spanish."**

Given what you have read above, how likely is it that Charley speaks Spanish?



read a story context, rate the probability of target content

# experiment 1

n=833

Please read this text:

Sue runs a company that connects language learners with remote teachers who live all over the world. She's trying to figure out how well her assistant, Cole, knows her remote teachers. Sue's business partner tells her what Cole said about Charley, who lives in Korea: "Cole knows that Charley speaks Spanish."

Given what you have read above, how likely is it that Charley speaks Spanish?

A horizontal slider scale consisting of a thin grey bar with two small white circles at the ends. The word "very unlikely" is at the left end and "very likely" is at the right end.

Please read this text:

Sue runs a company that connects language learners with remote teachers who live all over the world. She's putting together a list of the languages spoken by the remote teachers. After consulting her assistant, Cole, who knows the teachers and the languages they speak better than she does, Sue is currently working through the list of teachers to identify who speaks Spanish. When she gets to Charley, who lives in Mexico, Sue says to her business partner: "Cole doesn't think that Charley speaks Spanish."

Given what you have read above, how likely is it that Charley speaks Spanish?

A horizontal slider scale consisting of a thin grey bar with two small white circles at the ends. The words "very unlikely" and "very likely" are at the ends of the bar.

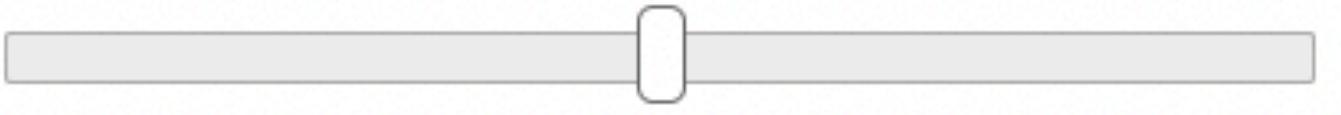
prior manipulation

Sue runs a language school. She's trying to figure out how well her five assistants Kate, Tom, Cole, Tatiana, and Riccardo know her remote teacher Charley. Sue keeps track on this list:

Assistants	Believes that Charley speaks Spanish?
Kate	yes
Tom	no
Cole	
Tatiana	
Riccardo	

Next up, she wants to record in her list whether **COLE** believes that Charley speaks Spanish. Her business partner tells her: "*Cole thinks that Charley speaks Spanish.*"

Given what you have read above, how likely is it that Charley speaks Spanish?



very unlikely

very likely

# experiment 2

n=333

Sue runs a language school. She's currently working through a list of her teachers — Kate, Tom, Charley, Tatiana, and Riccardo — to identify who speaks Spanish. She occasionally consults Cole, who knows some teachers better. Sue keeps track on this list:

Teachers	Speaks Spanish?
Kate	yes
Tom	no
Charley	
Tatiana	
Riccardo	

Next up, she wants to record in the list whether **CHARLEY** speaks Spanish. Sue says to her business partner: "*Cole knows that Charley speaks Spanish.*"

Given what you have read above, how likely is it that Charley speaks Spanish?



very unlikely

very likely

# experiment 2

n=333

Assistants	Believes that Charley speaks Spanish?
Kate	yes
Tom	no
Cole	
Tatiana	
Riccardo	

Next up, she wants to record in her list whether **COLE** believes that Charley speaks Spanish. Her business partner tells her: "*Cole thinks that Charley speaks Spanish.*"

Given what you have read above, how likely is it that Charley speaks Spanish?



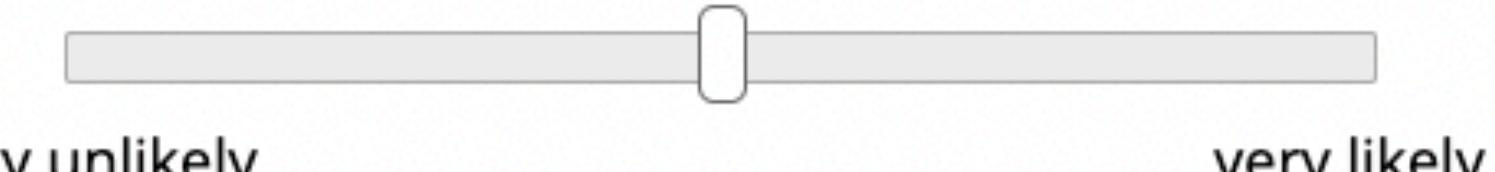
QUD manipulation

Sue runs a language school. She's currently working through a list of her teachers — Kate, Tom, Charley, Tatiana, and Riccardo — to identify who speaks Spanish. She occasionally consults Cole, who knows some teachers better. Sue keeps track on this list:

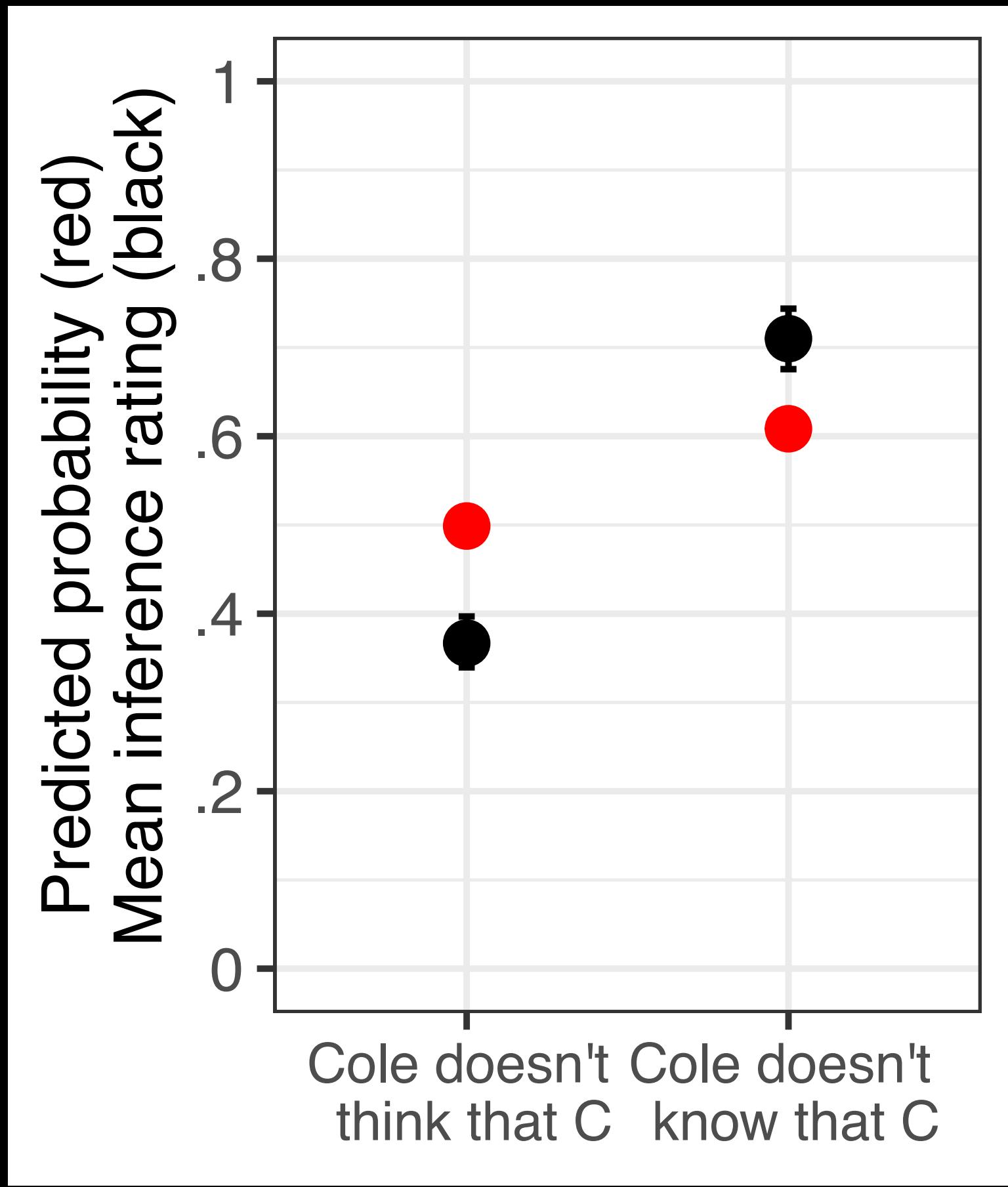
Teachers	Speaks Spanish?
Kate	yes
Tom	no
Charley	
Tatiana	
Riccardo	

Next up, she wants to record in the list whether **CHARLEY** speaks Spanish. Sue says to her business partner: "*Cole knows that Charley speaks Spanish.*"

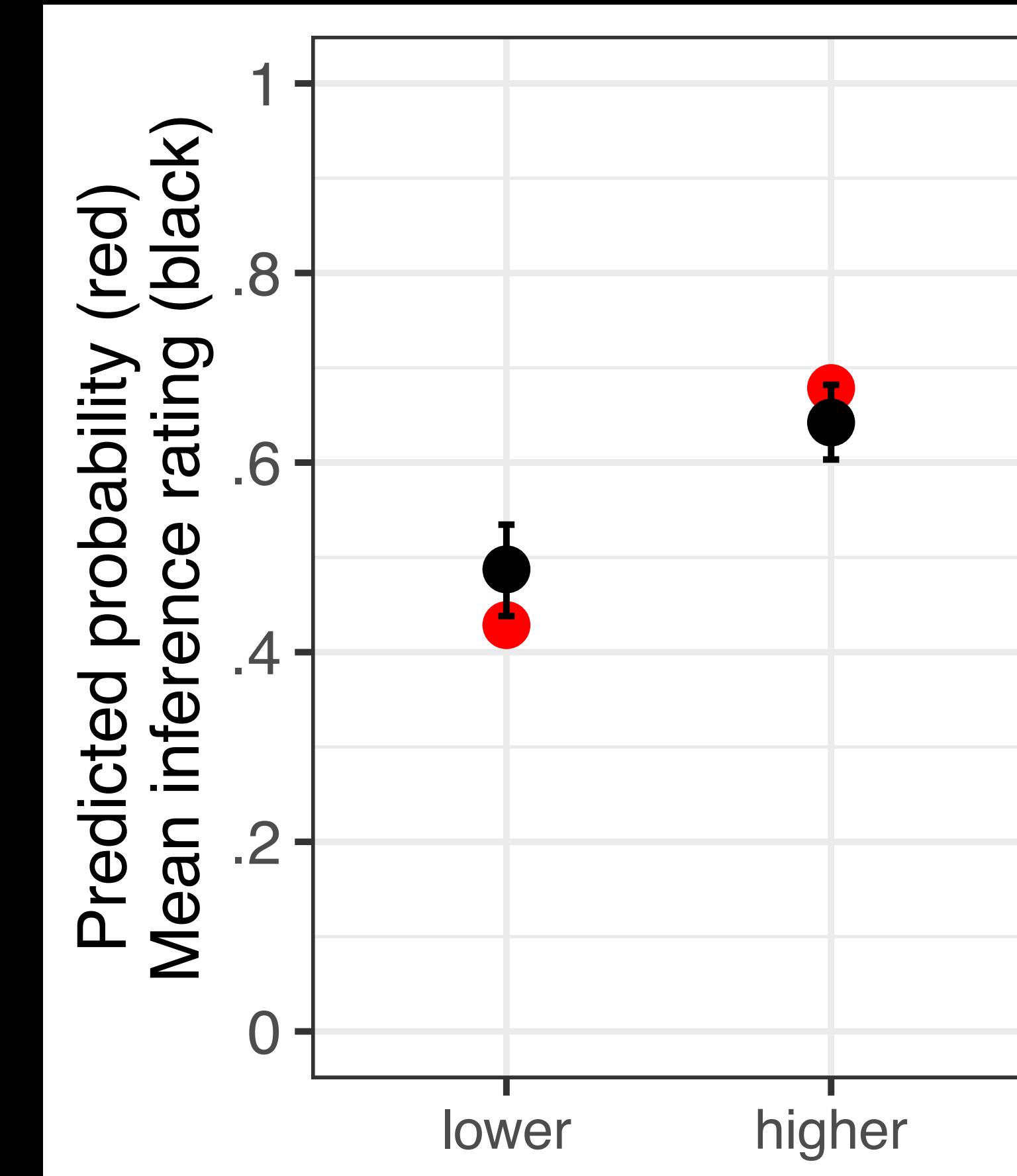
Given what you have read above, how likely is it that Charley speaks Spanish?



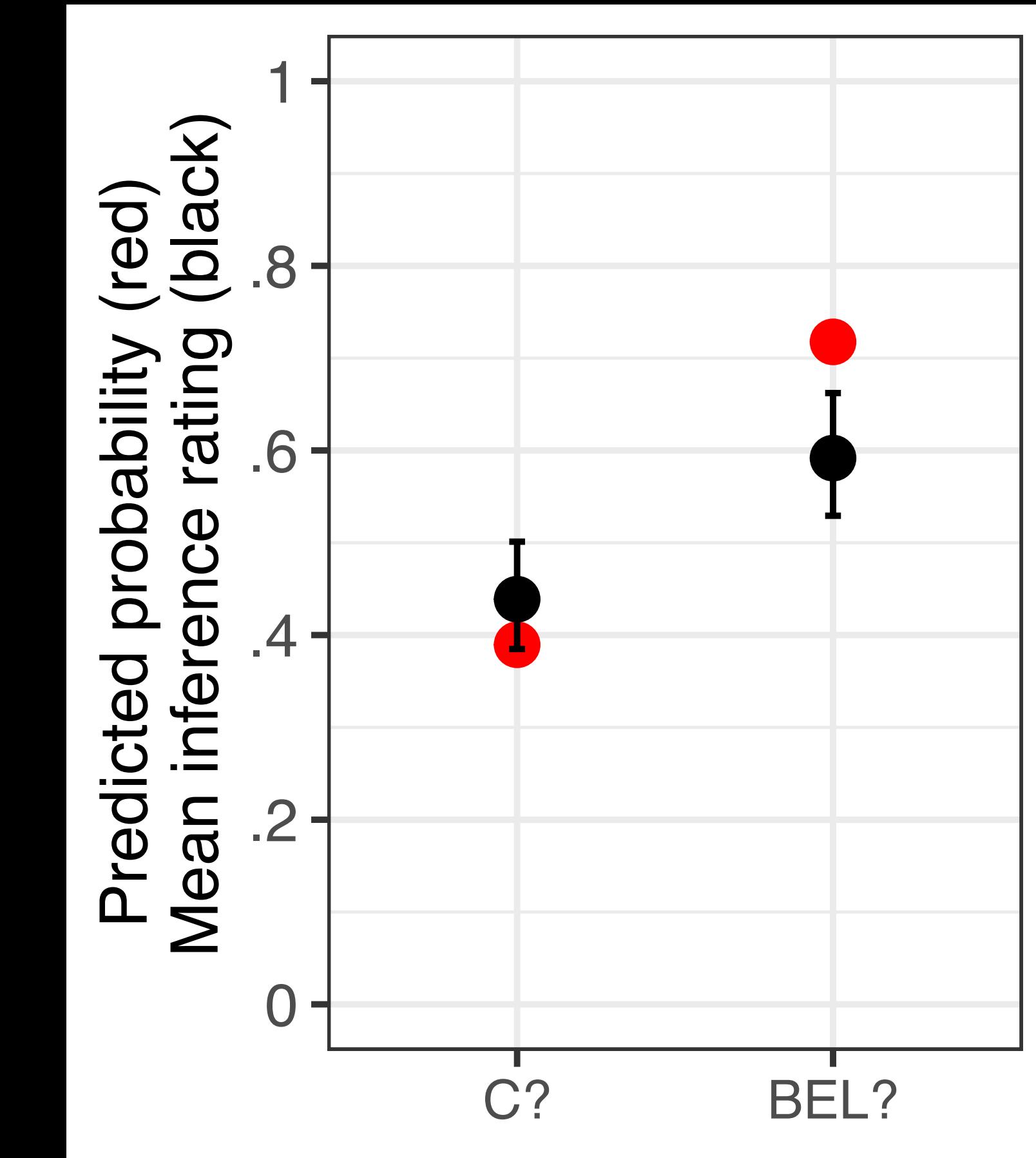
# model predictions and human data



*know* projects  
more than *think*

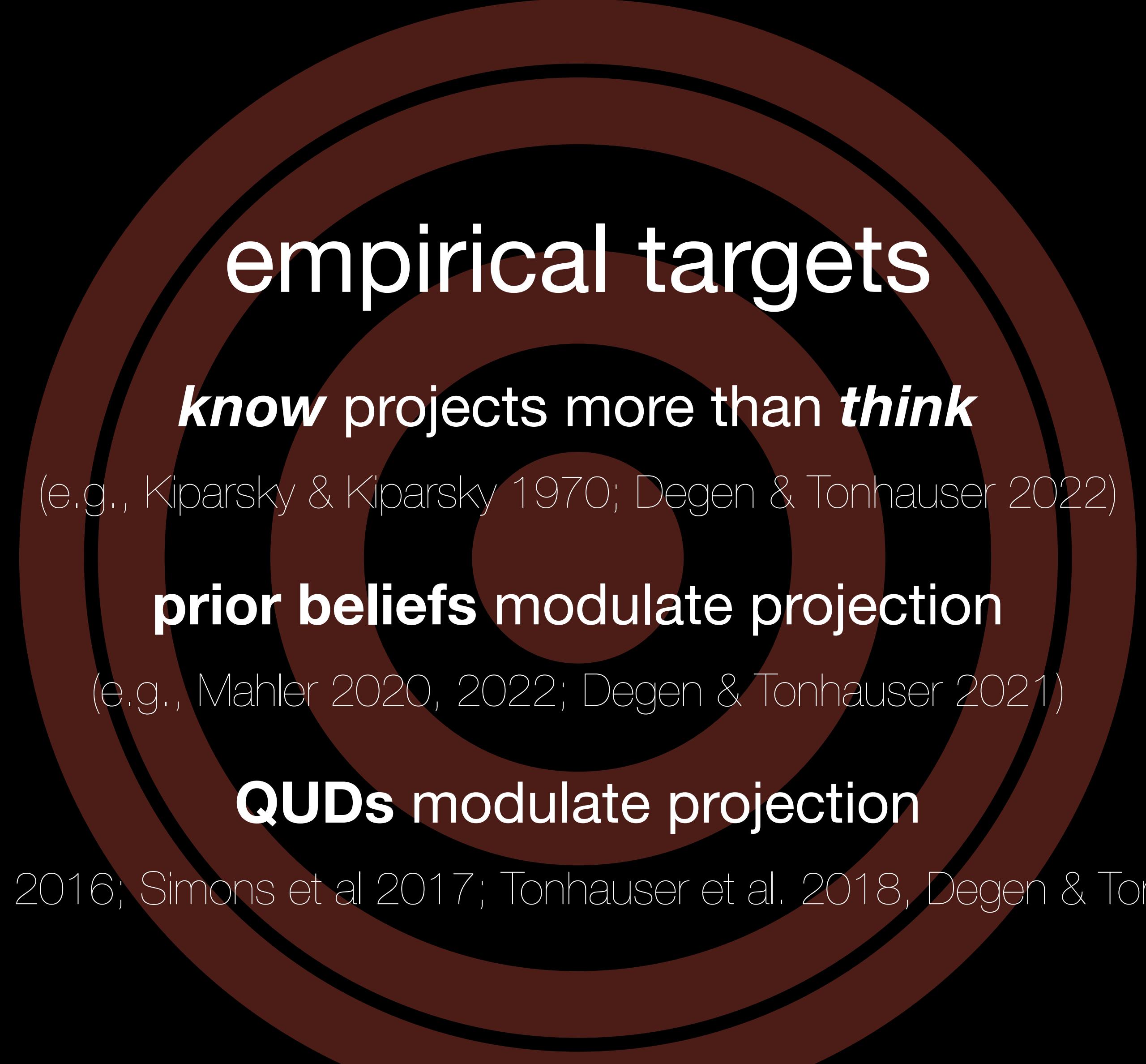


priors beliefs  
modulate projection



QUDs modulate  
projection

Cole doesn't ***think/know*** that Charley speaks Spanish.



**empirical targets**

***know*** projects more than ***think***

(e.g., Kiparsky & Kiparsky 1970; Degen & Tonhauser 2022)

**prior beliefs modulate projection**

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Cole doesn't ***think/know*** that Charley speaks Spanish.

**no prior analysis makes all three predictions**

**empirical targets**

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**prior beliefs modulate projection**

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**QUDs modulate projection**

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Cole doesn't *think/know* that Charley speaks Spanish.

no existing analysis makes all three predictions

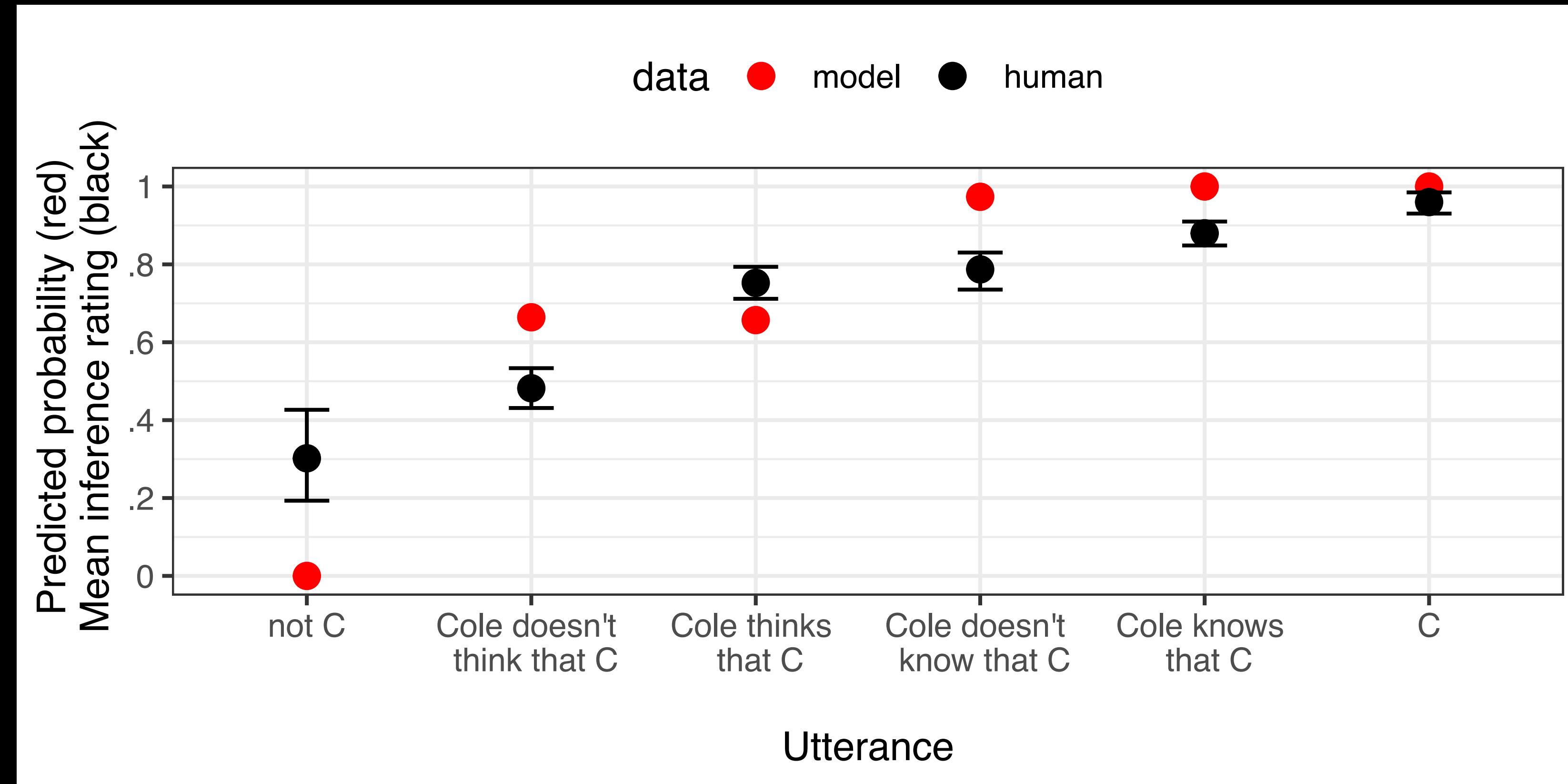
**know** projects  
more than *think*  
**prior beliefs**  
modulate projection  
**QUDs**  
modulate projection



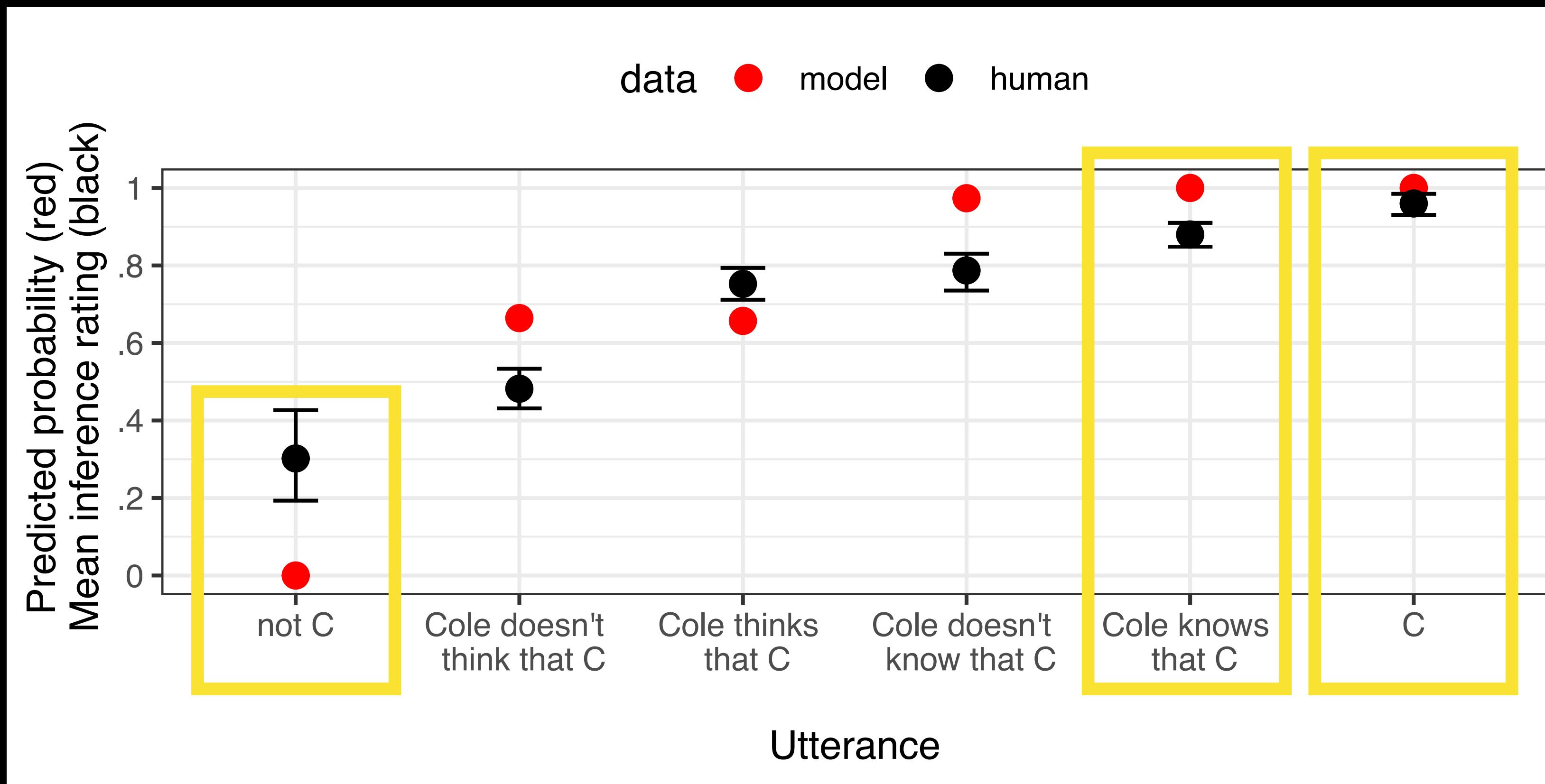


instead of developing analyses tailored to informative presuppositions,  
we **can** and **should** develop more general analyses that make predictions about  
inferences drawn from utterances

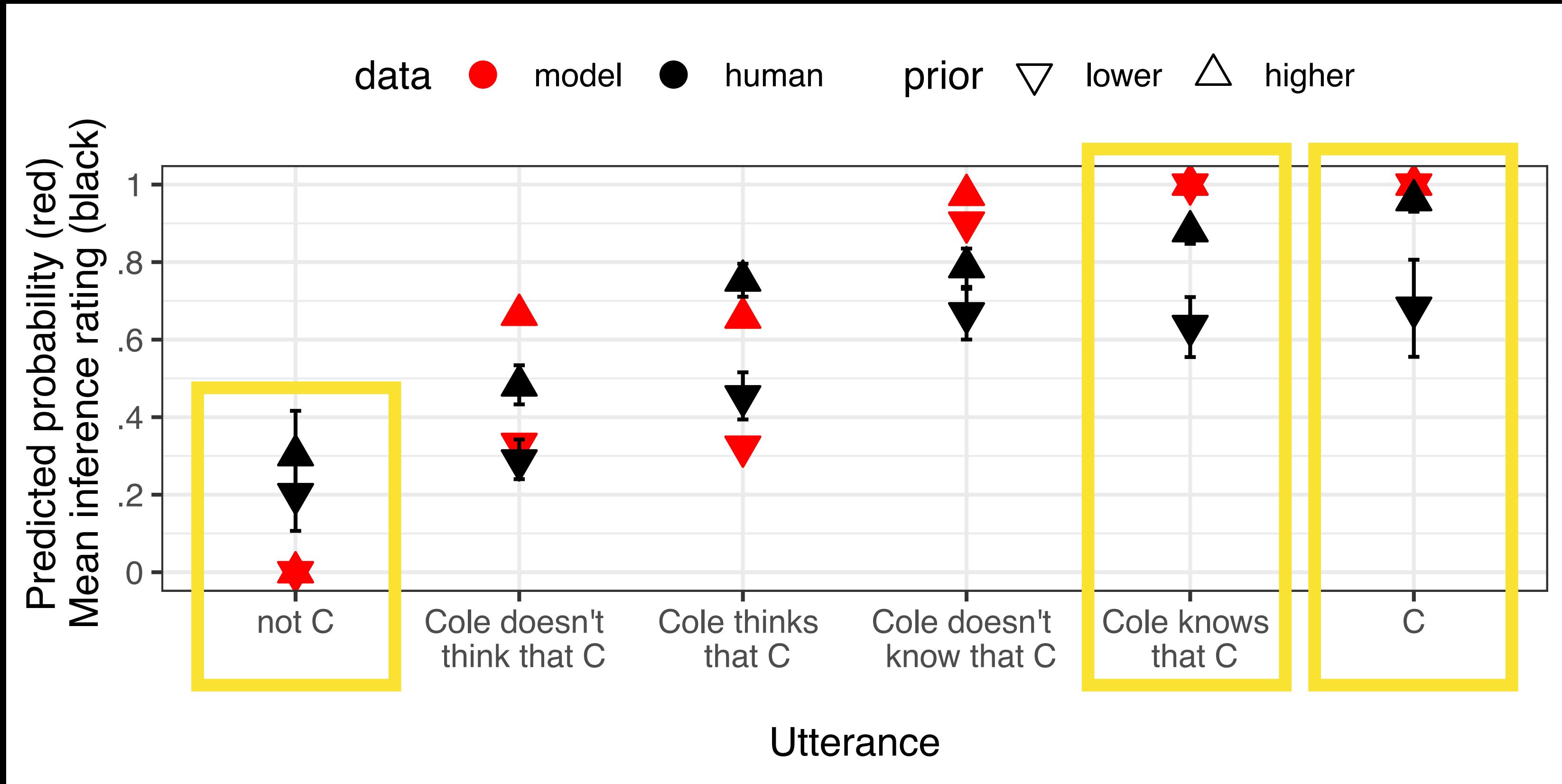
informative presuppositions are just one kind of inference



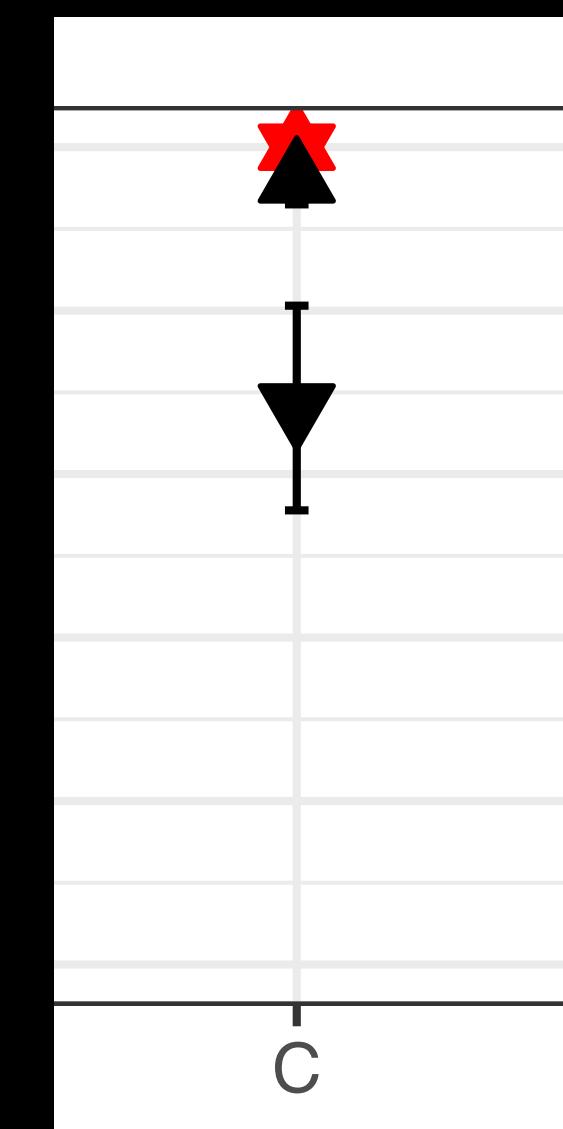
informative presuppositions are just one kind of inference



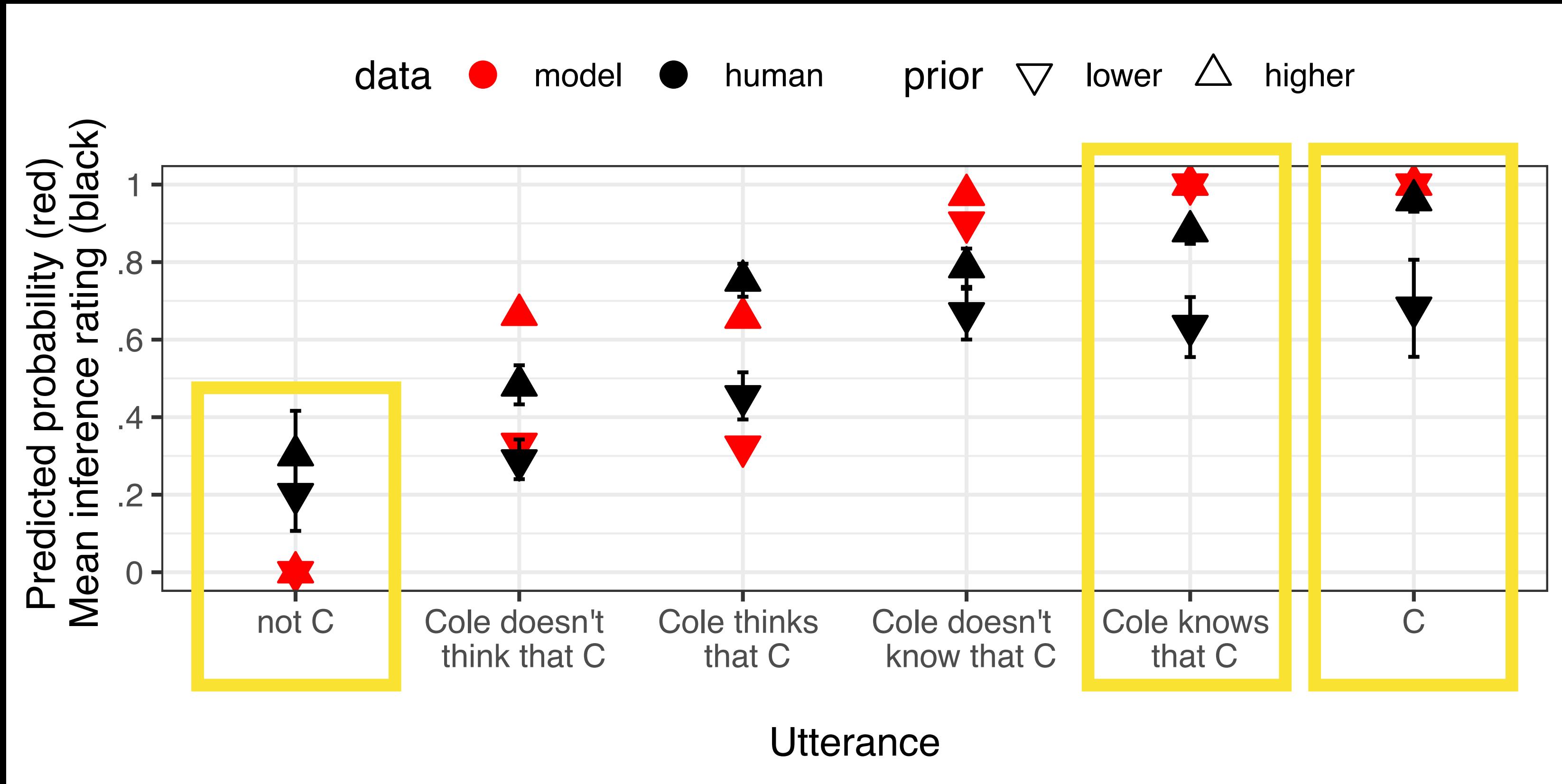
**problem:** too much reliance on literal semantics



problem: no sensitivity to the prior



**problem:** no sensitivity to the prior



problem: no sensitivity to the prior



we need to relax the predictions of the model

**we need to relax the predictions of the model**

option 1  
relax the semantics

**we need to relax the predictions of the model**

option 1  
relax the semantics

option 2  
relax the speaker

**we need to relax the predictions of the model**

option 1  
relax the semantics

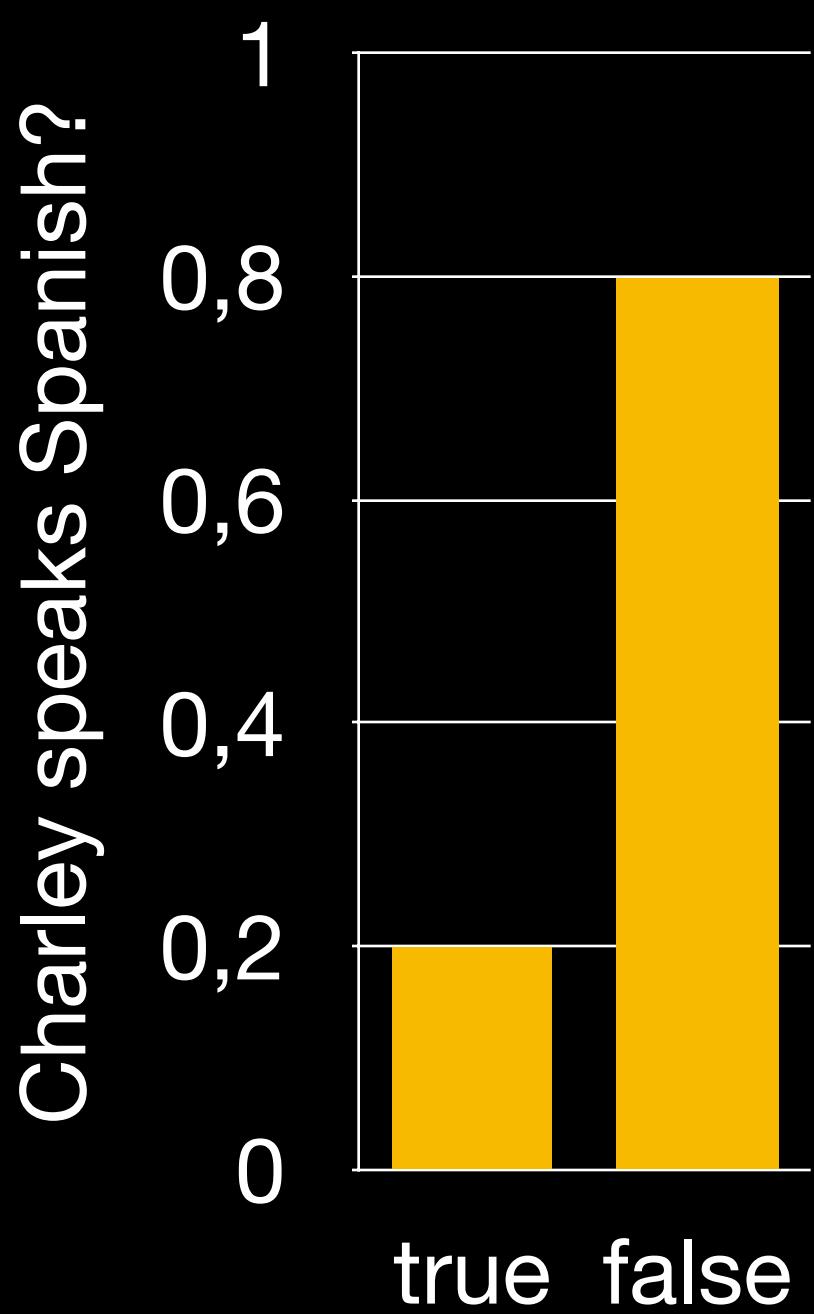
option 2  
relax the speaker

option 3  
relax the listener

relax the listener

**fact:**  
Charley lives in Korea

prior belief

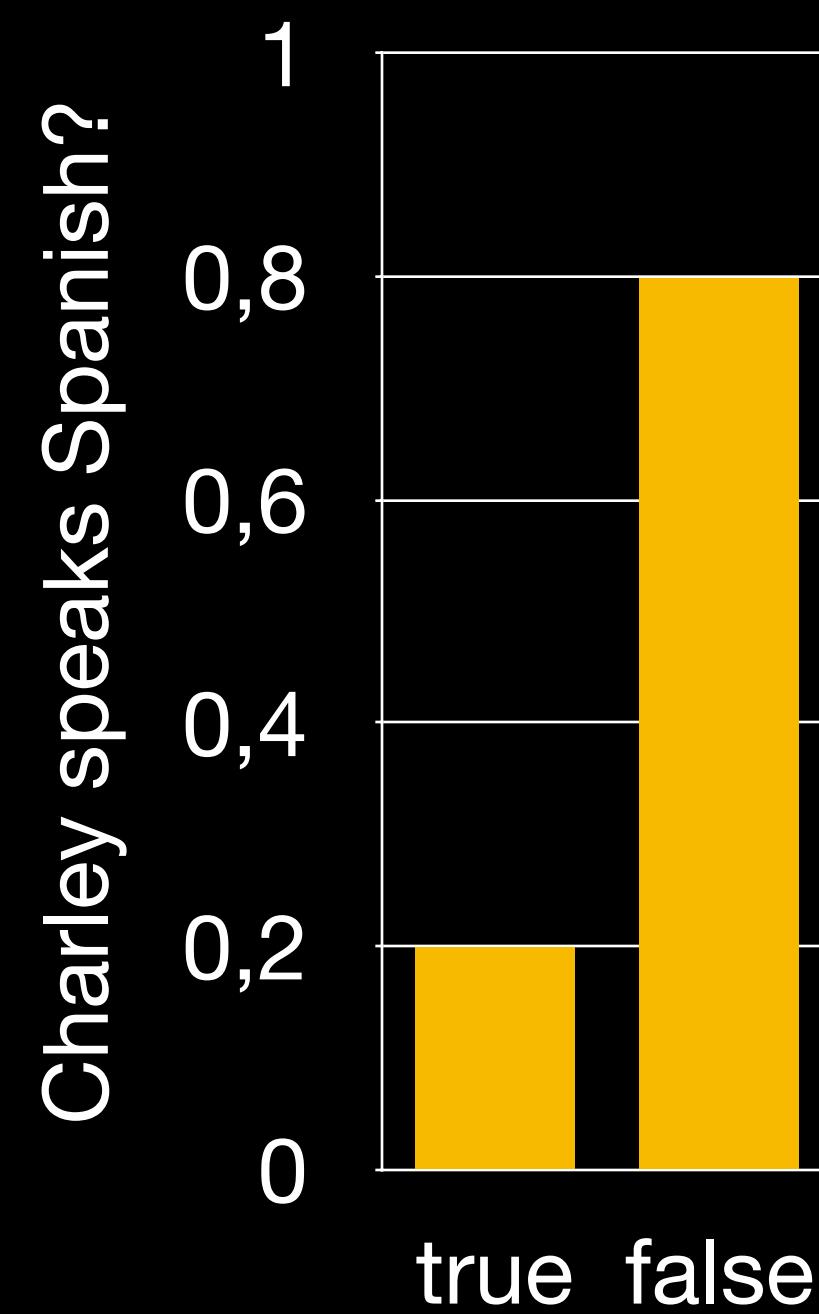


relax the listener

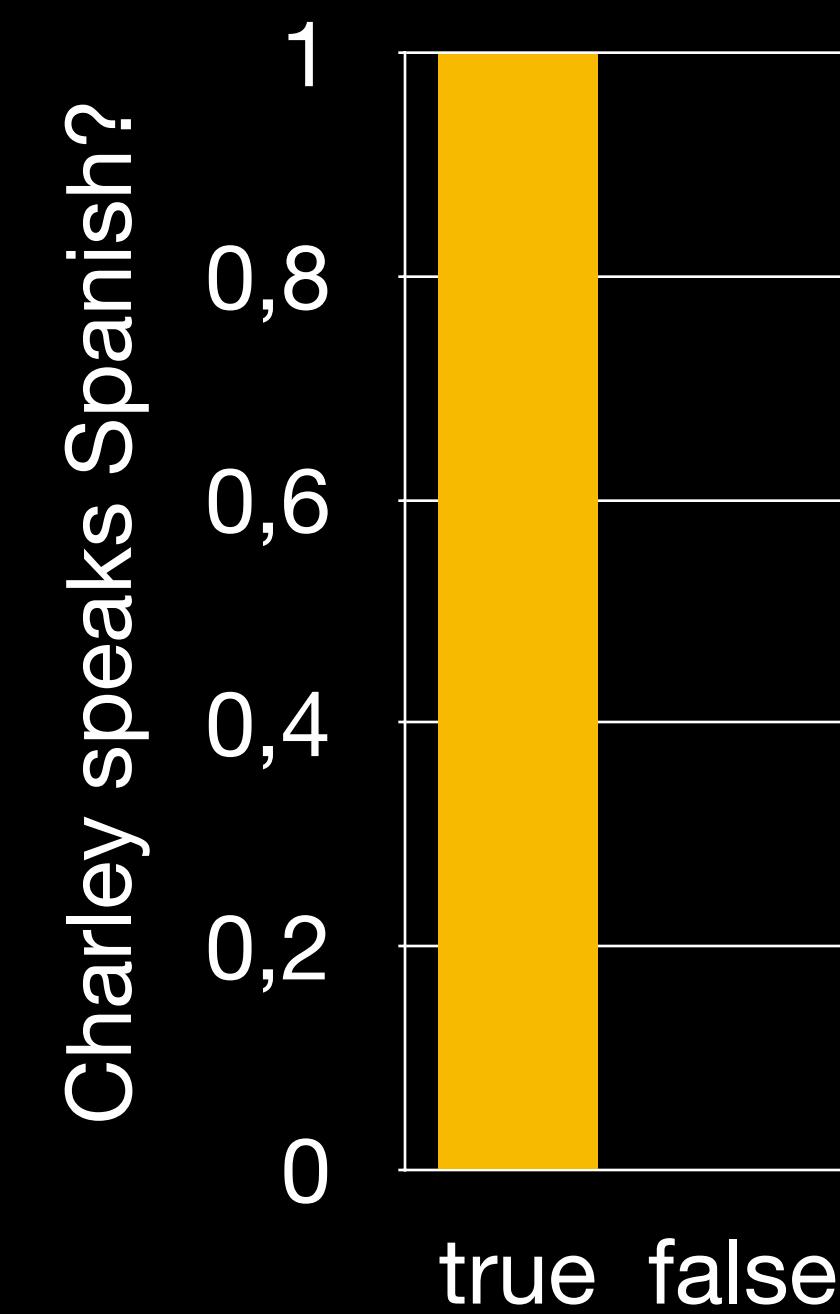
**fact:**  
Charley lives in Korea

**utterance:**  
“Charley speaks Spanish.”

prior belief



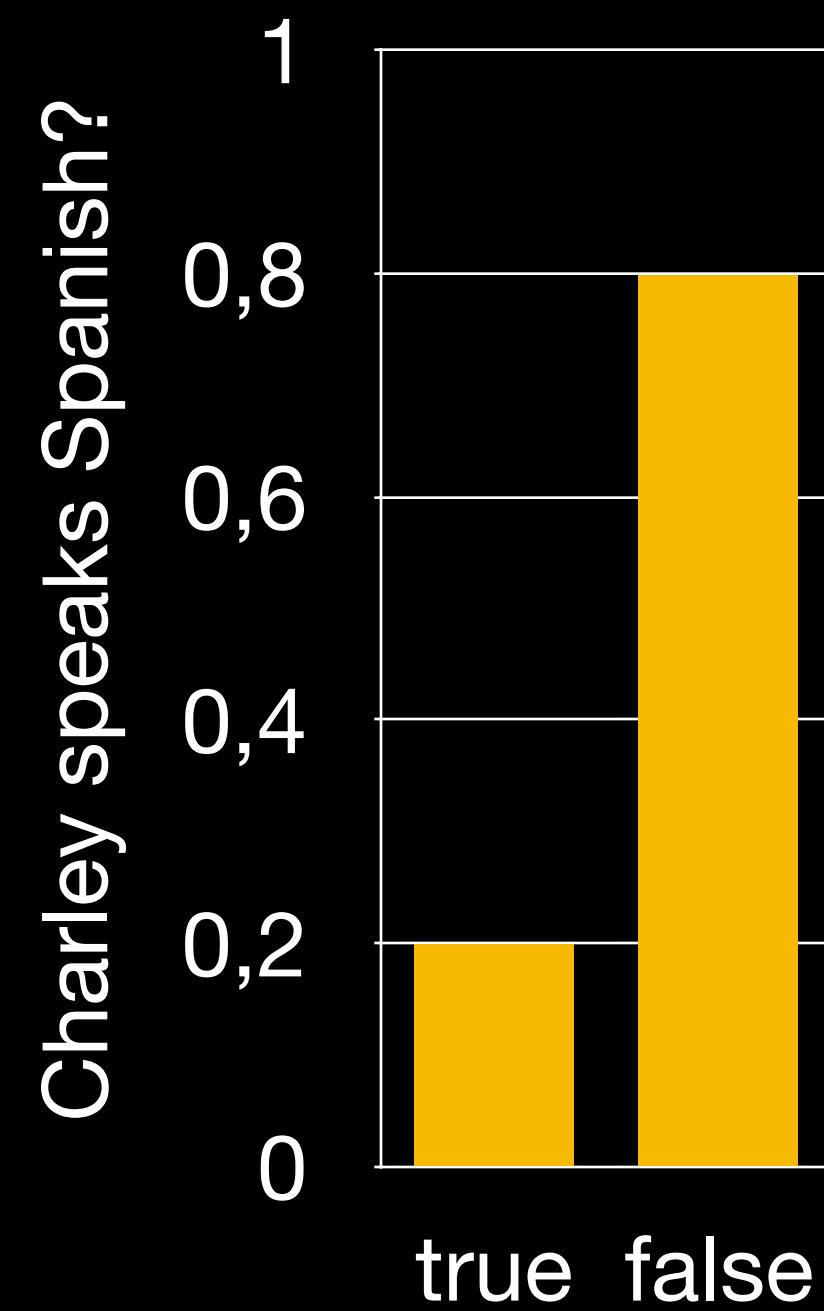
posterior inference



relax the listener

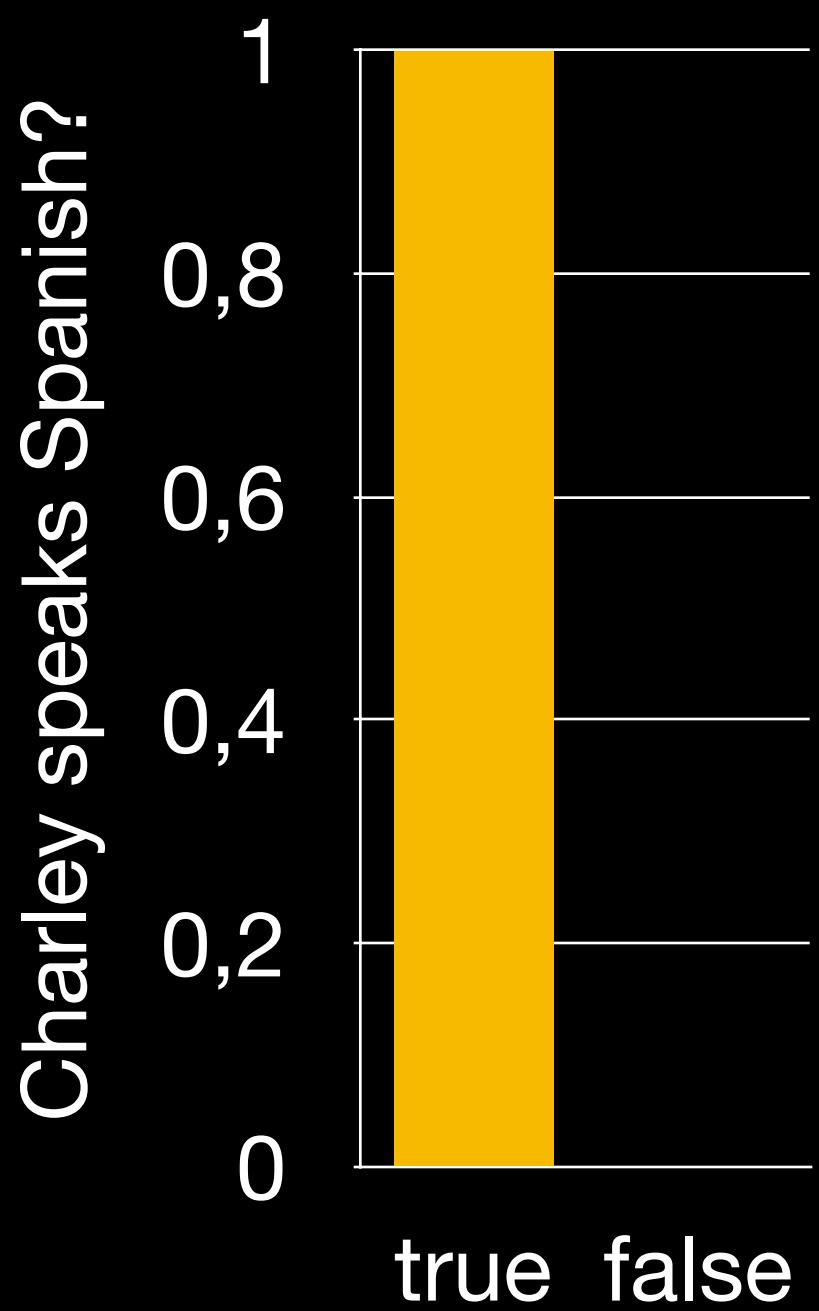
**fact:**  
Charley lives in Korea

prior belief

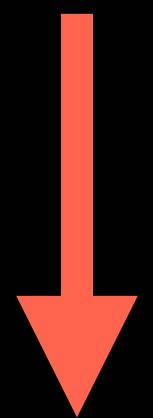


**utterance:**  
“Charley speaks Spanish.”

posterior inference



Kullback-Leibler  
(KL) divergence

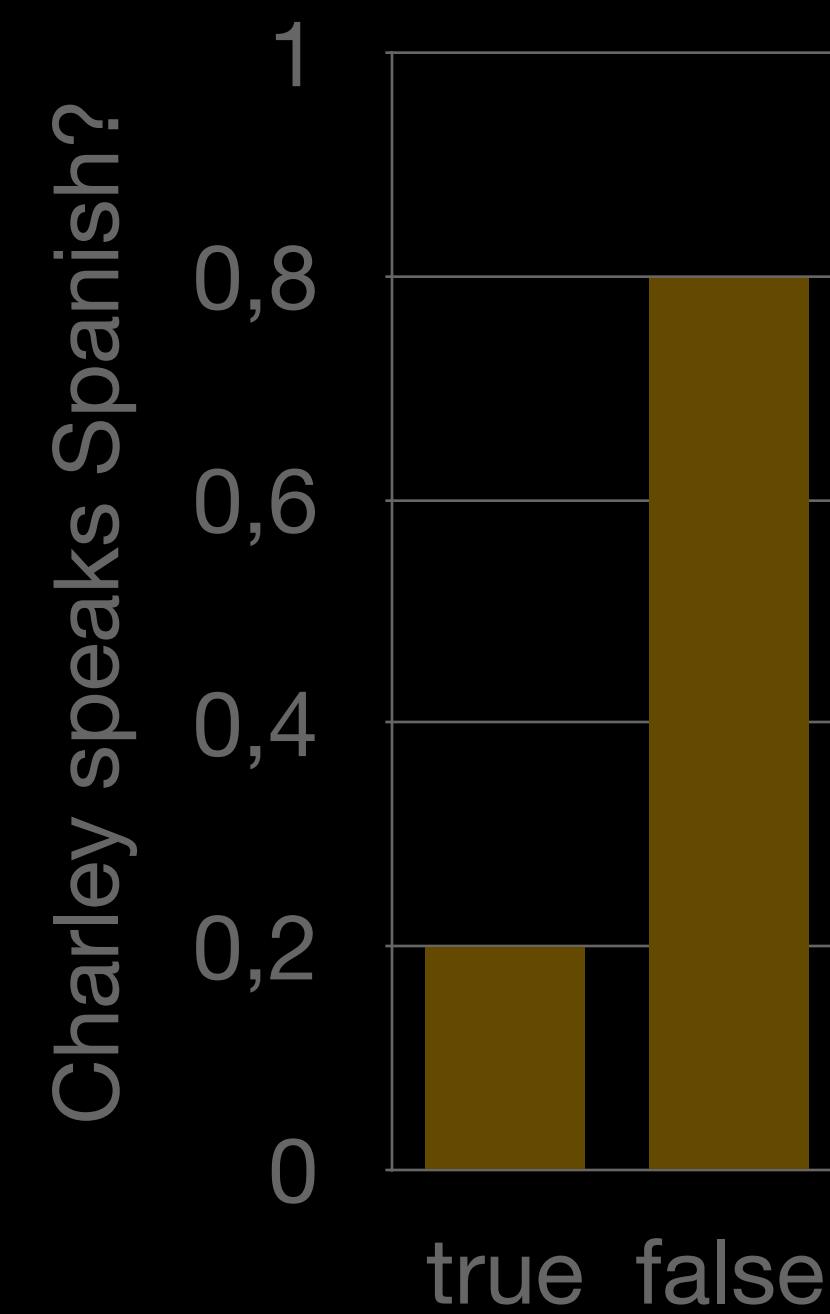


probability with which the listener  
returns a sample from their prior

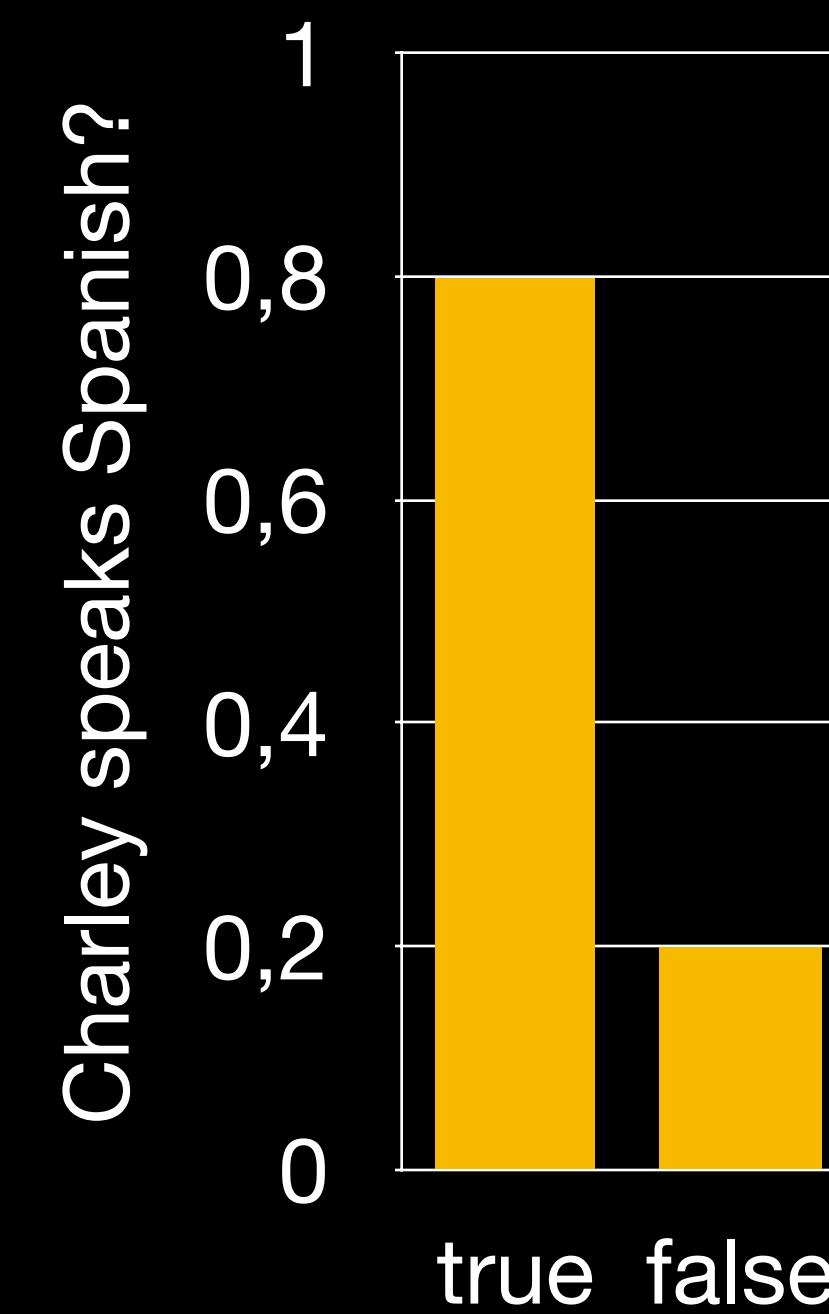
relax the listener

**fact:**  
Charley lives in Korea

prior belief

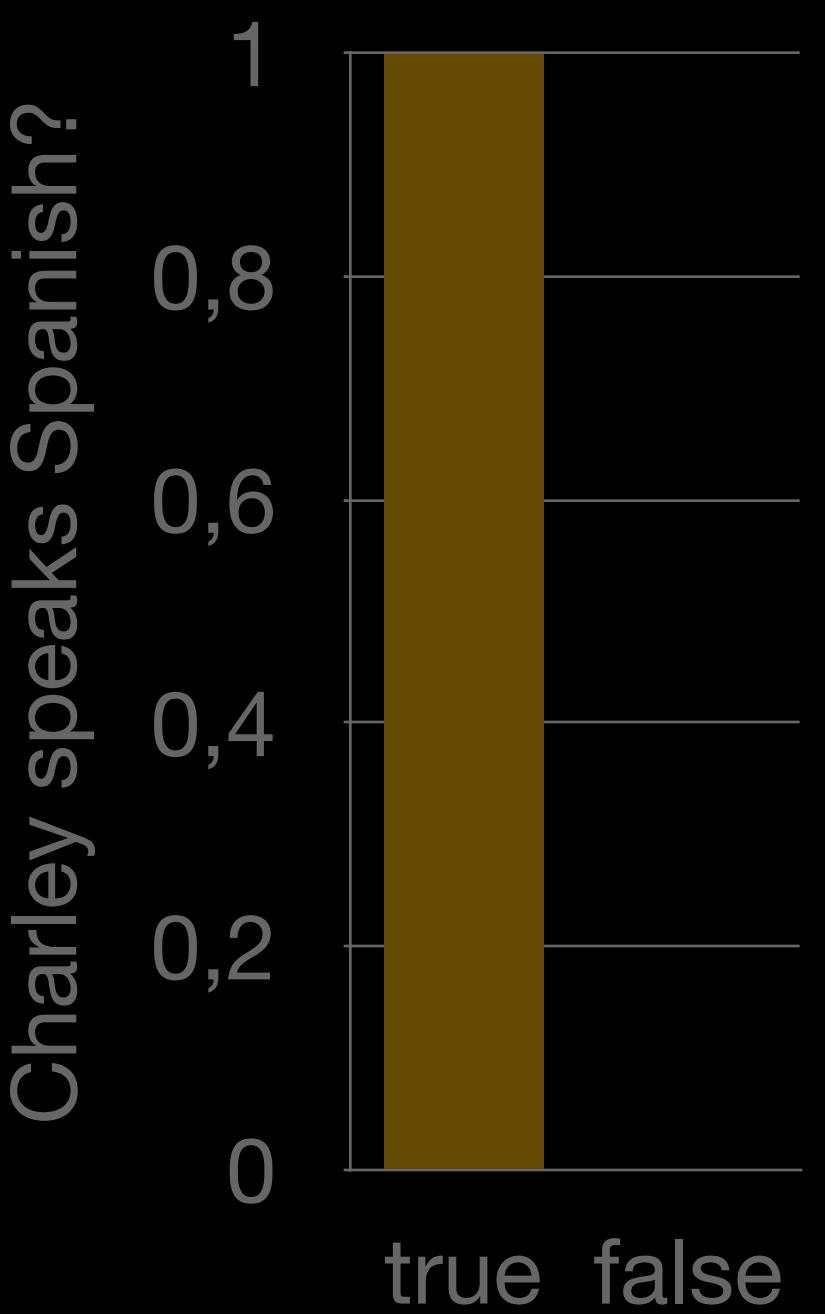


ultimate belief



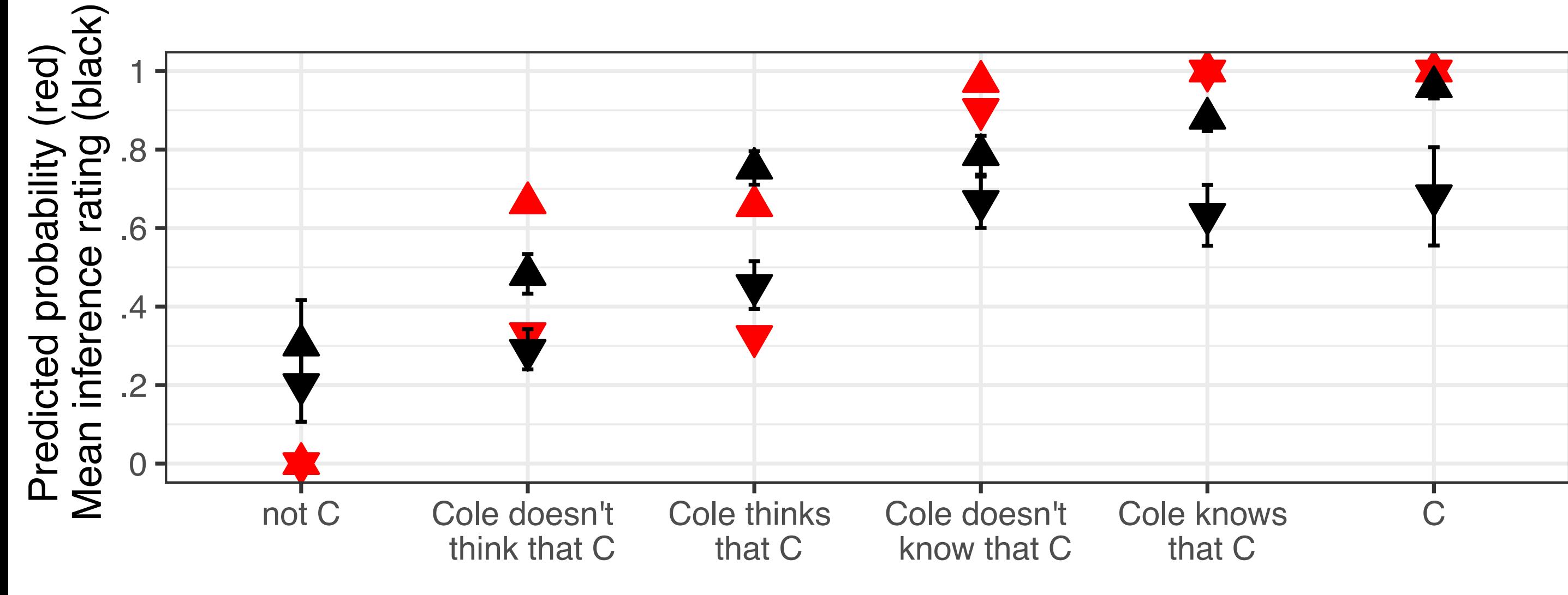
**utterance:**  
“Charley speaks Spanish.”

posterior inference



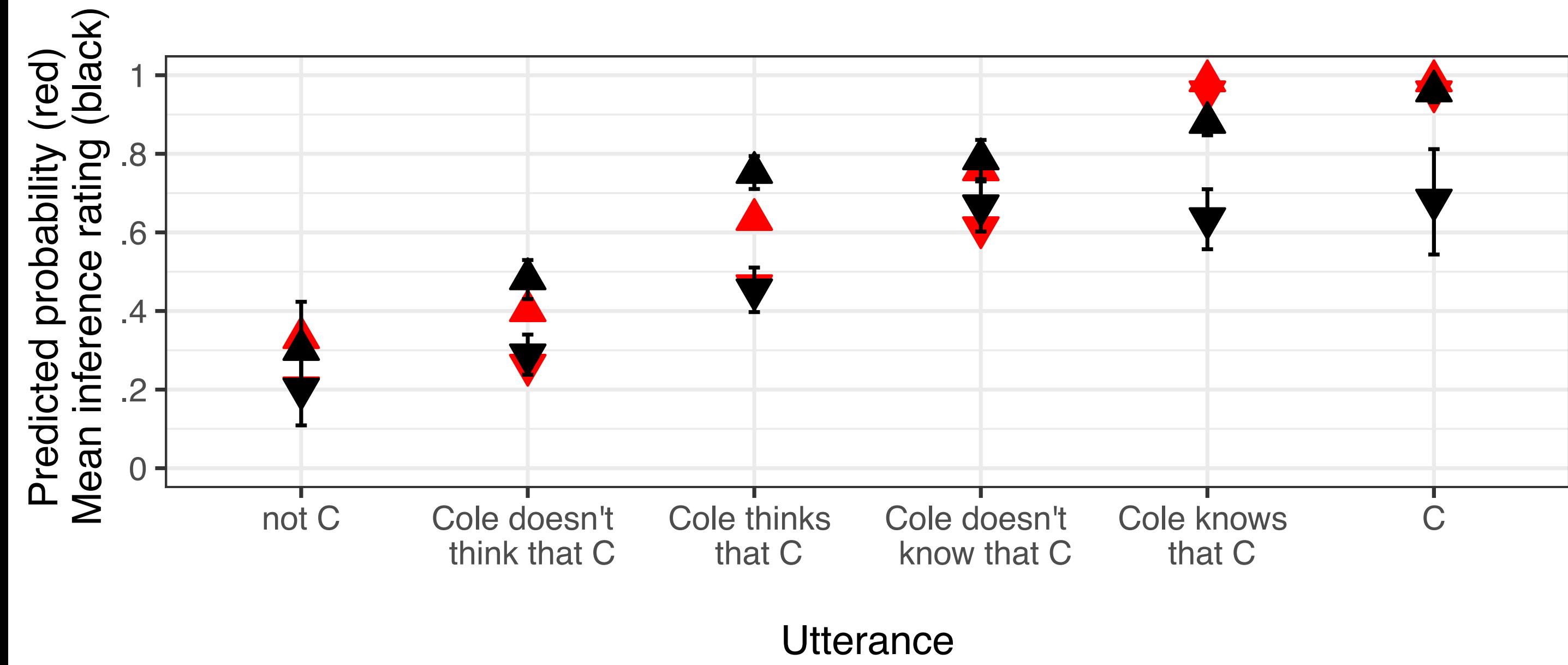
relax the listener

data ● model ● human prior ▽ lower △ higher



before

data ● model ● human prior ▽ lower △ higher



after



“The squirrel doesn't **know** that Estonia includes  
hundreds of islands, small and big.”

→ Estonia includes hundreds of islands

## Projection inferences

- without lexically coded presuppositions
- sensitive to prior beliefs and QUDs

Projection inferences are just one type of inference predicted by the analysis.

Prior beliefs modulate all kinds of inferences, as predicted by our RSA-model.



thank you!