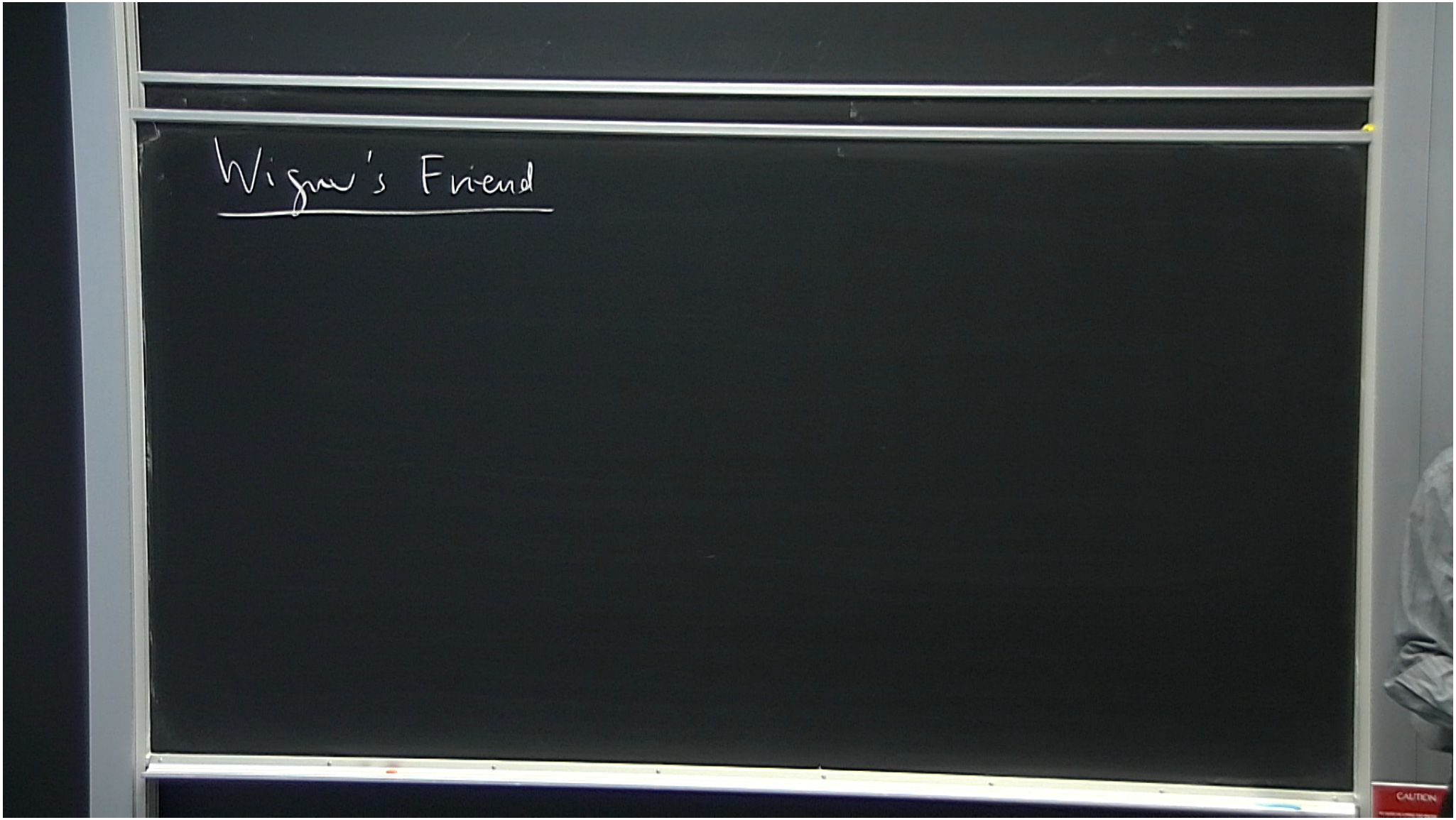
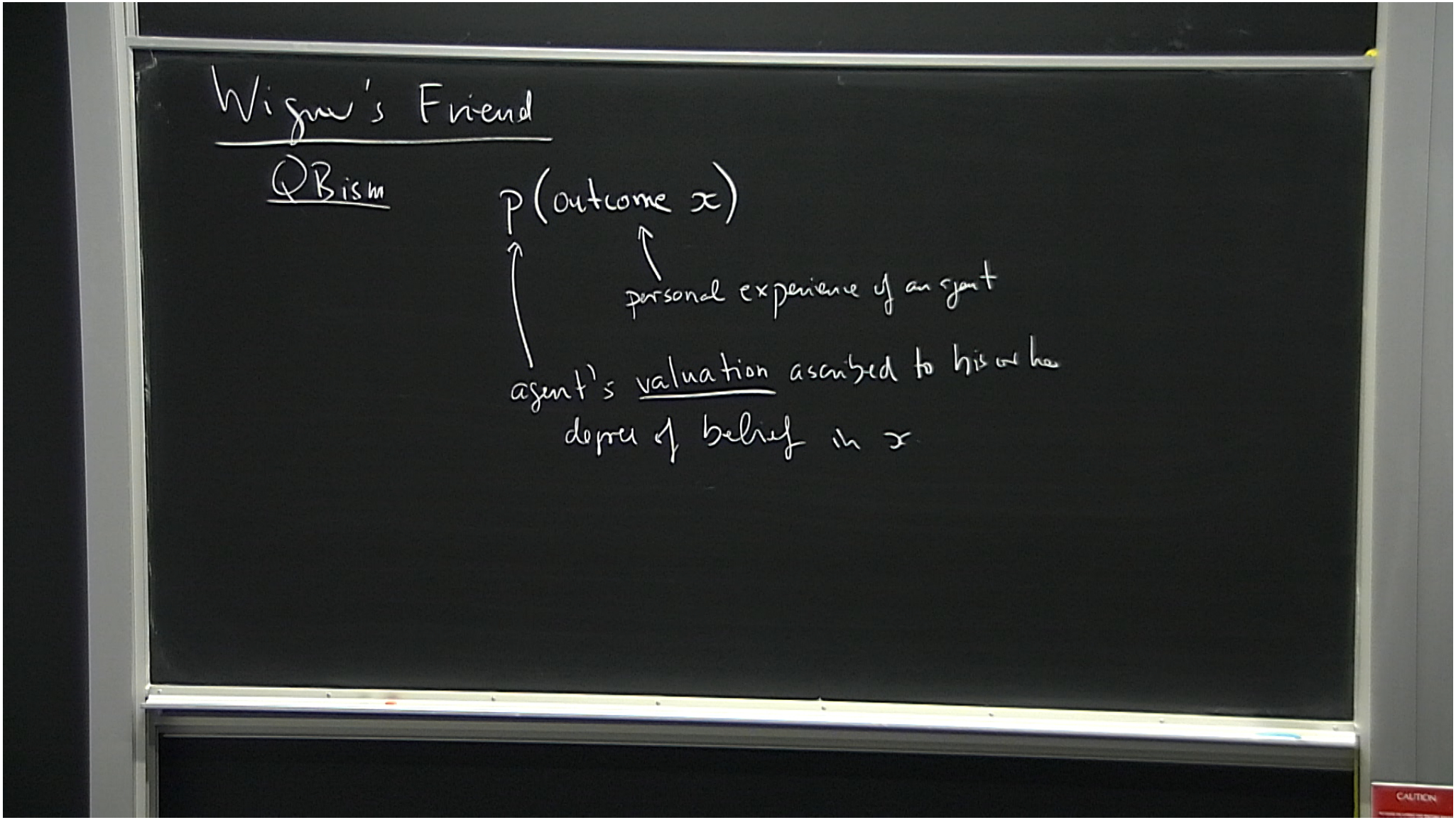
Title: QBism and Wigner's friend

Date: Apr 05, 2018 04:00 PM

URL: http://pirsa.org/18040088

Abstract:


Wigner's Friend
CAUTION


Wigner's Friend
QBism
p(outcome x)
personal experience of an agent
agent's valuation ascribed to his or her
degree of belief in x

Wigner's Friend

QBism

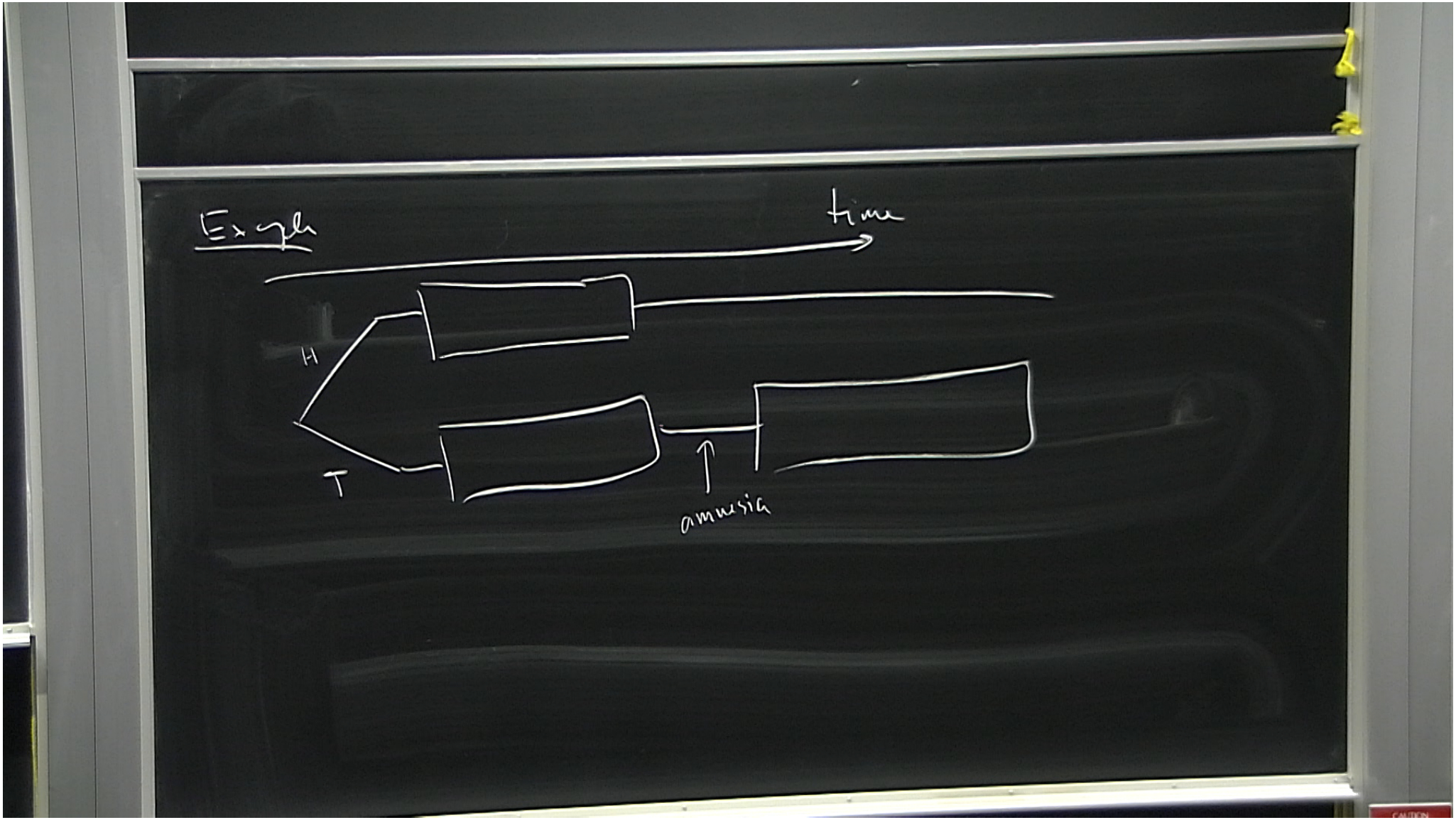
p(outcome x)

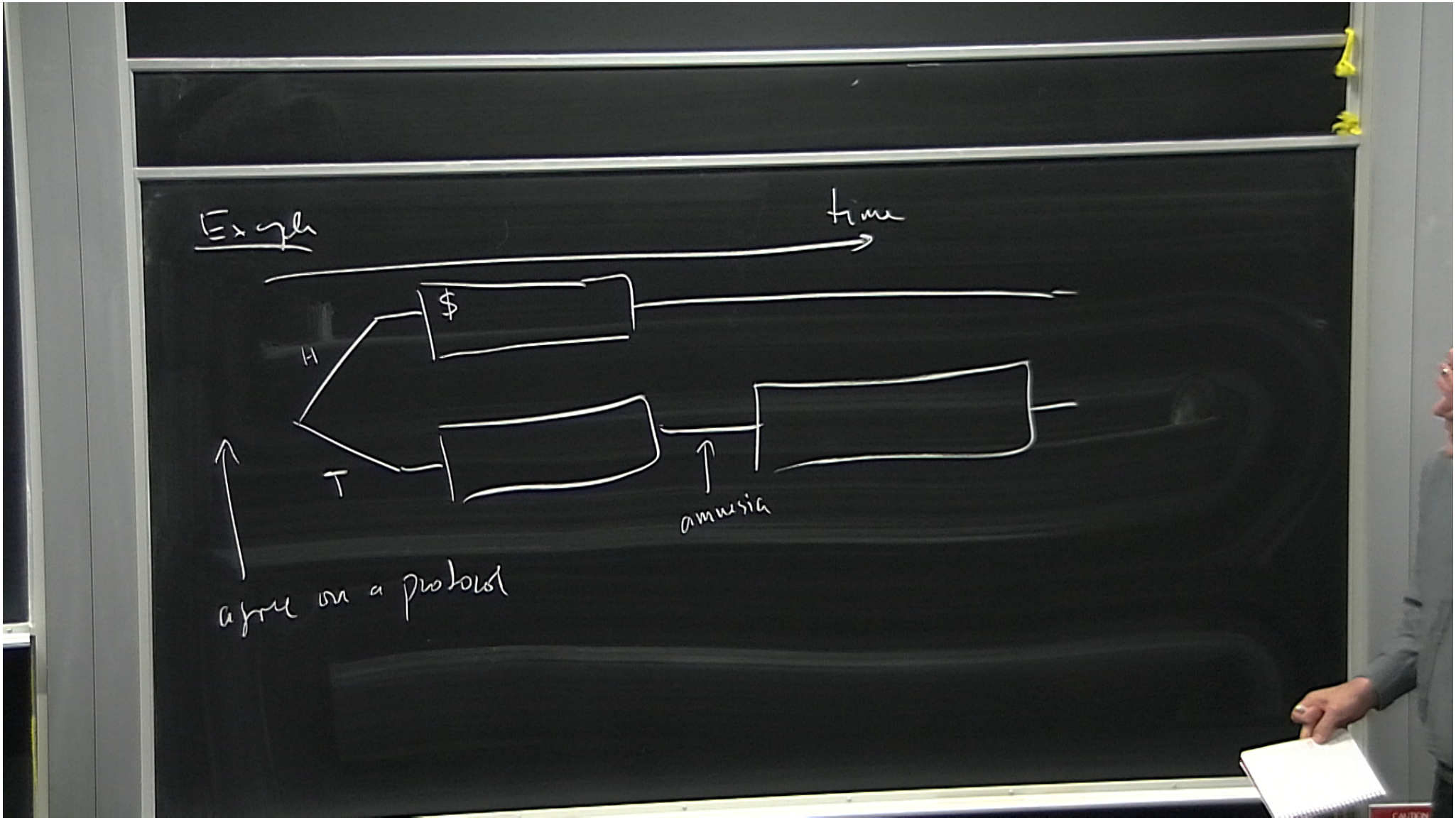
↑ personal experience of an agent

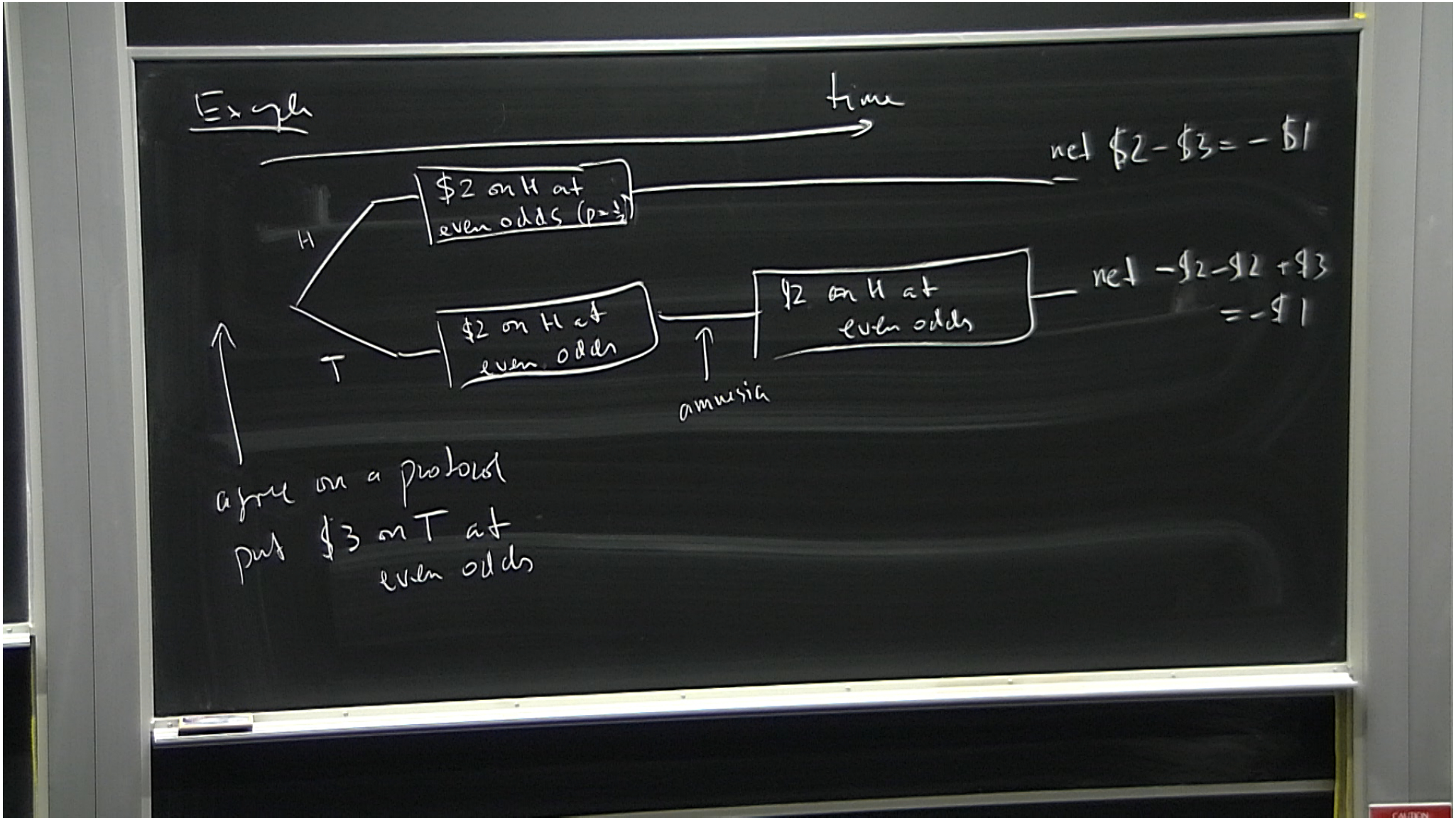
↑ agent's valuation ascribed to his or her degree of belief in x

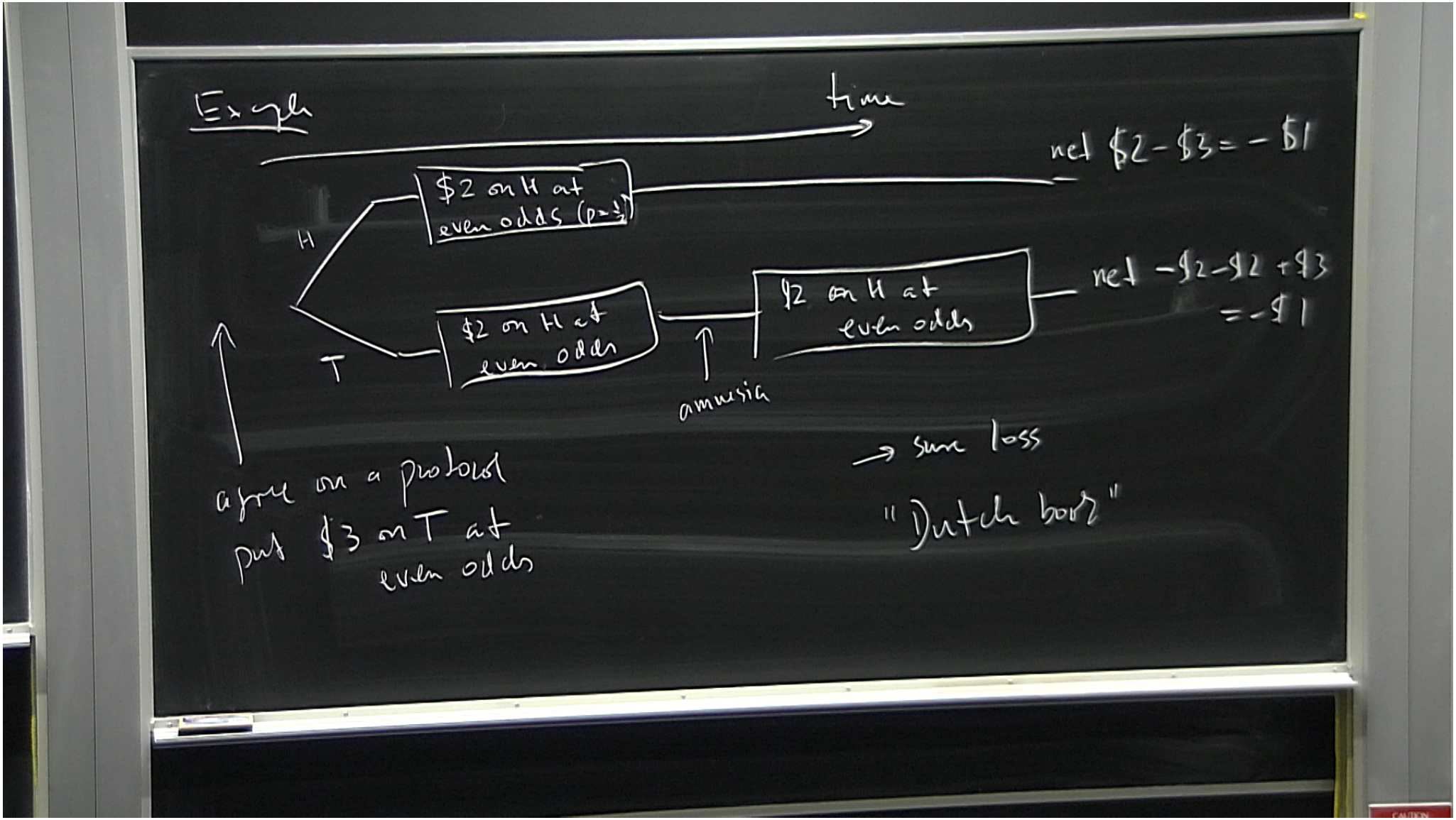
"how should I act?"

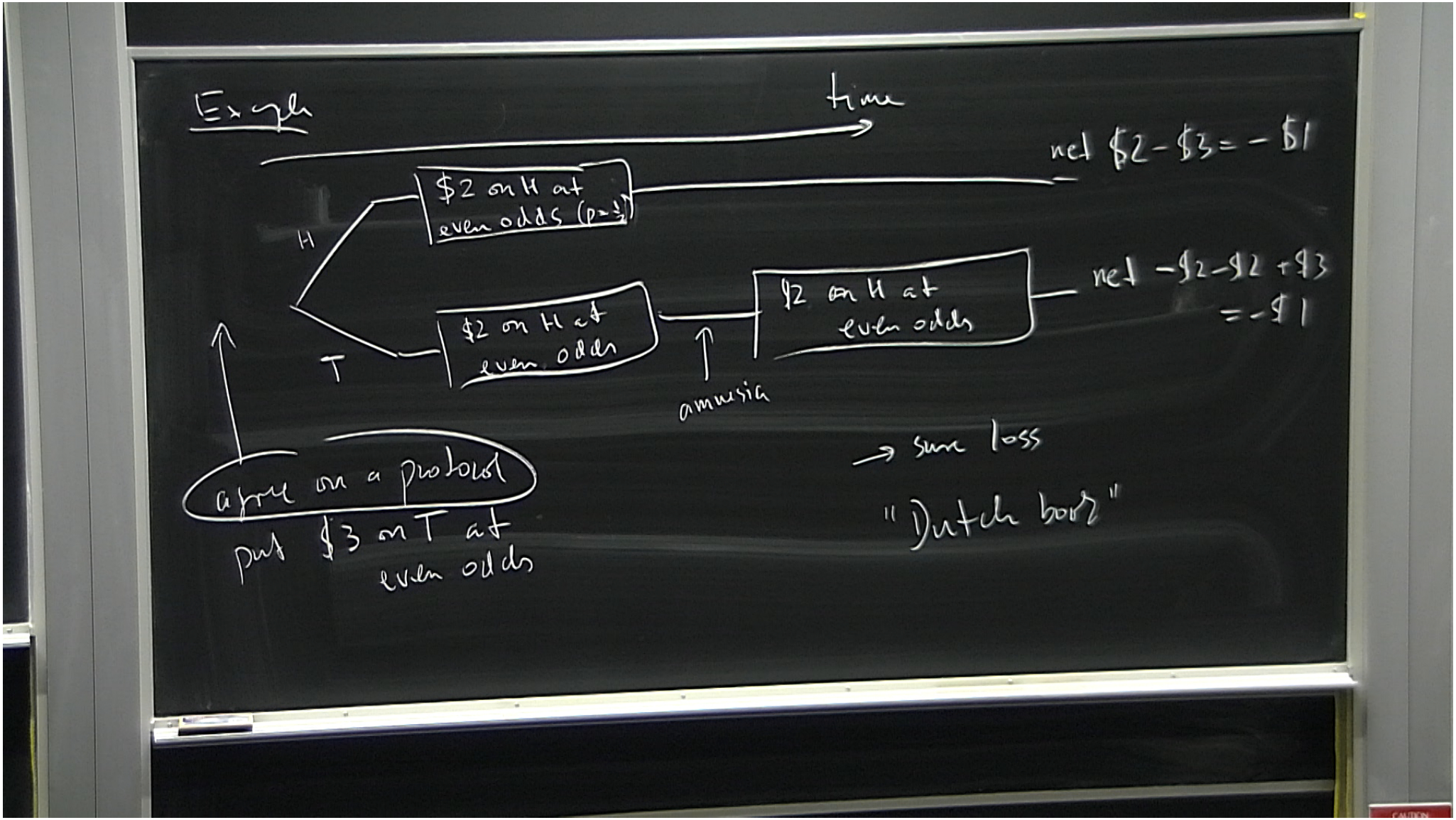
"doxastic" rather than "epistemic"

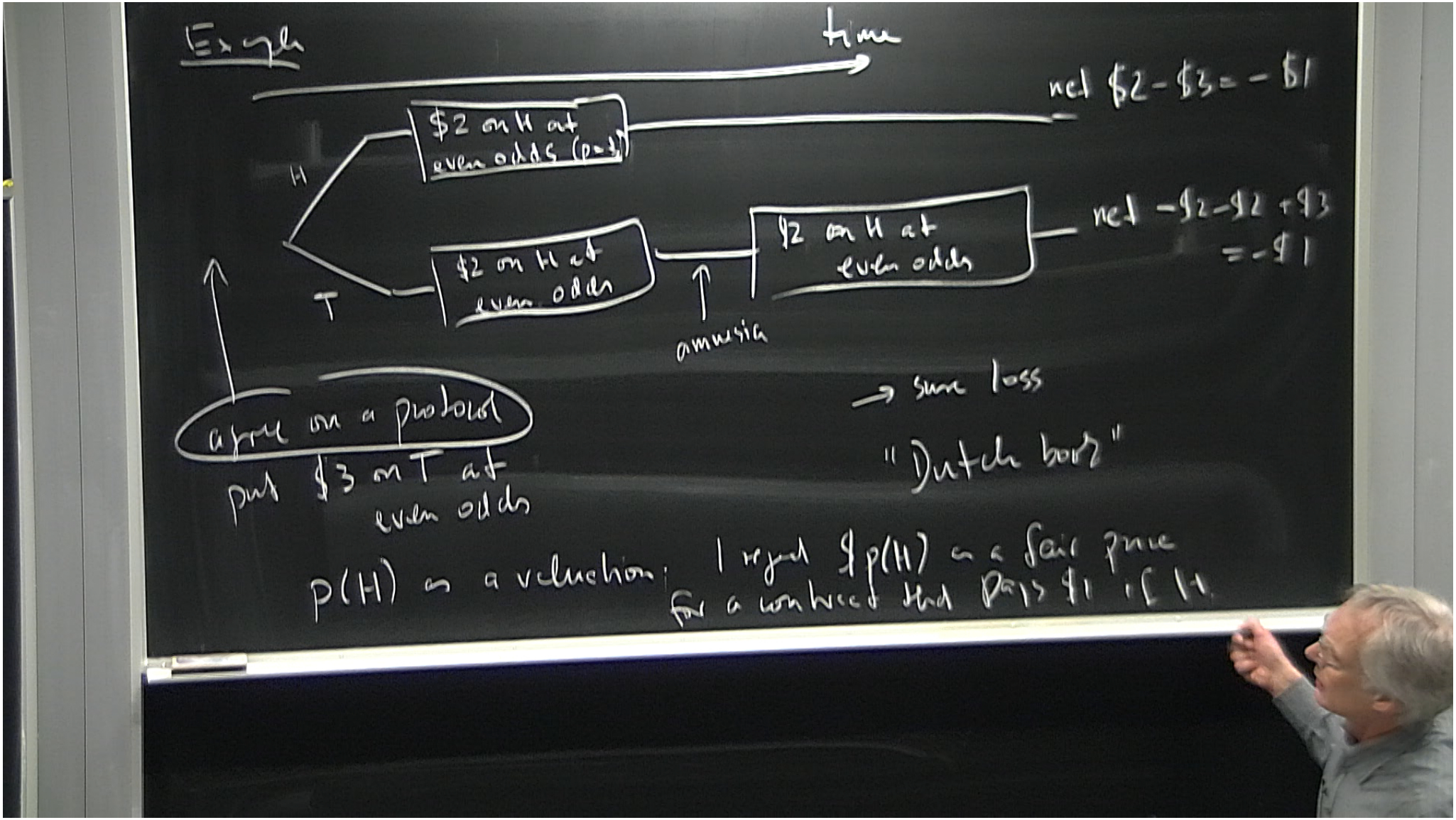

Exch
time
H
T
amnesia


Eagle
time
$
H
T
amnesia
agree on a protocol


Example
time
net $2 - $3 = - $1
$2 on H at even odds (p=½)
H
$2 on H at even odds
T
$2 on H at even odds
net -$2 -$2 +$3 = -$1
amnesia
agree on a protocol
put $3 on T at even odds


Example
time
net $2 - $3 = - $1
H
$2 on H at even odds (p=½)
T
$2 on H at even odds
$2 on H at even odds
net -$2 -$2 +$3 = -$1
amnesia
agree on a protocol
put $3 on T at even odds
→ sure loss
"Dutch book"


Example
time
net $2 - $3 = - $1
$2 on H at even odds (p=½)
H
T
$2 on H at even odds
$2 on H at even odds
net -$2 -$2 +$3 = -$1
amnesia
agree on a protocol
put $3 on T at even odds
→ sure loss
"Dutch book"


Example
time
net $2 - $3 = - $1
$2 on H at even odds (p=1/2)
H
T
$2 on H at even odds
$2 on H at even odds
net -$2 -$2 +$3 = -$1
amnesia
agree on a protocol
pay $3 on T at even odds
→ sure loss
"Dutch book"
p(H) as a reduction: I regard $p(H) as a fair price for a contract that pays $1 if H.

P(H) as a reduction: I regard $p(H) as a fair price for a contract that pays $1 if H.

Example 3 coins are tossed

I assign P(at least 2H) = $\frac{1}{2}$

P(at least 2T) = $\frac{1}{3}$

Inconsistent!

P(H) as a reduction: I regard $p(H) as a fair price for a contract that pays $1 if H.

Example 3 coins are tossed

I assign p(at least 2H) = $\frac{1}{2}$ Inconsistent!

p(at least 2T) = $\frac{1}{3}$

Theory provides not probabilities but only relations between them.

The Born rule

$$q_j = \mathrm{tr}(\rho E_j)$$

$\{P_i\}$ $\{\Gamma_{jk}\}$ (w.r.t. a suitable reference measurement)

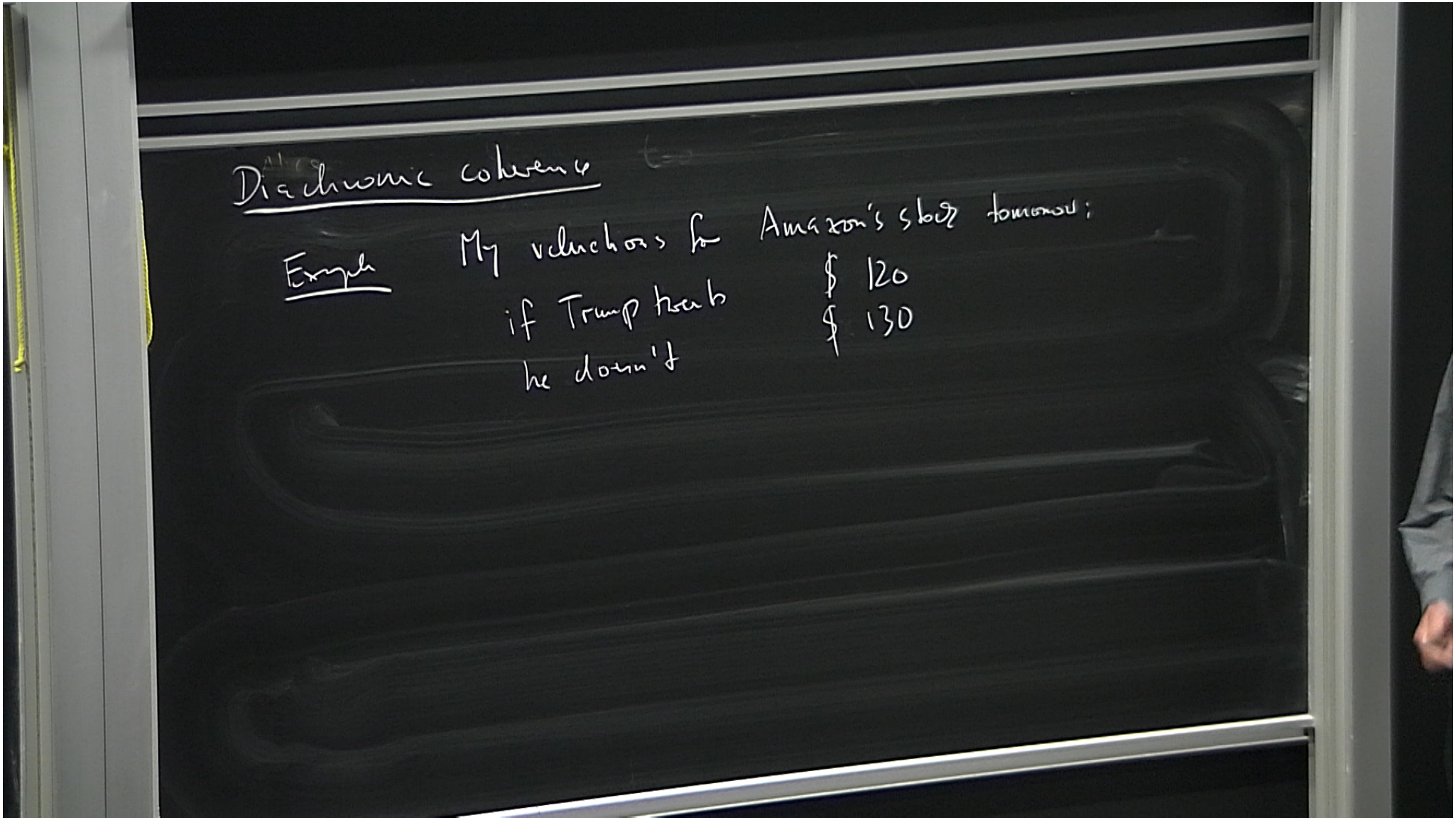
The Born rule

$$q_j = \mathrm{tr}(\rho E_j)$$

$\{p_i\}$ $\{\Gamma_{j|i}\}$ (w.r.t. a suitable reference measurement)

Addition to probability theory

Additional constraints.

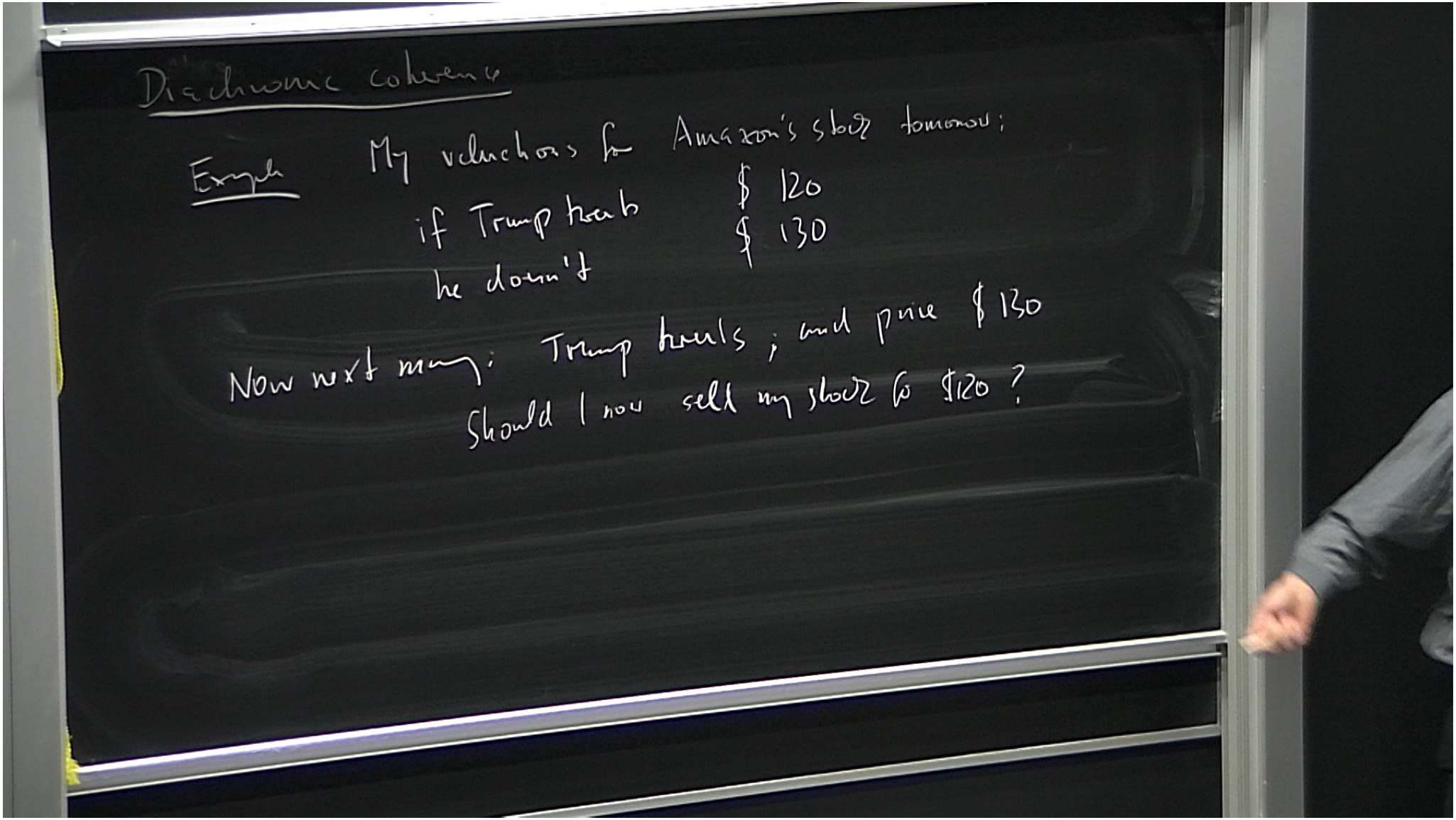

Diachronic coherence
Exmple My valuations for Amazon's stock tomorrow:
if Trump tweets $ 120
he doesn't $ 130

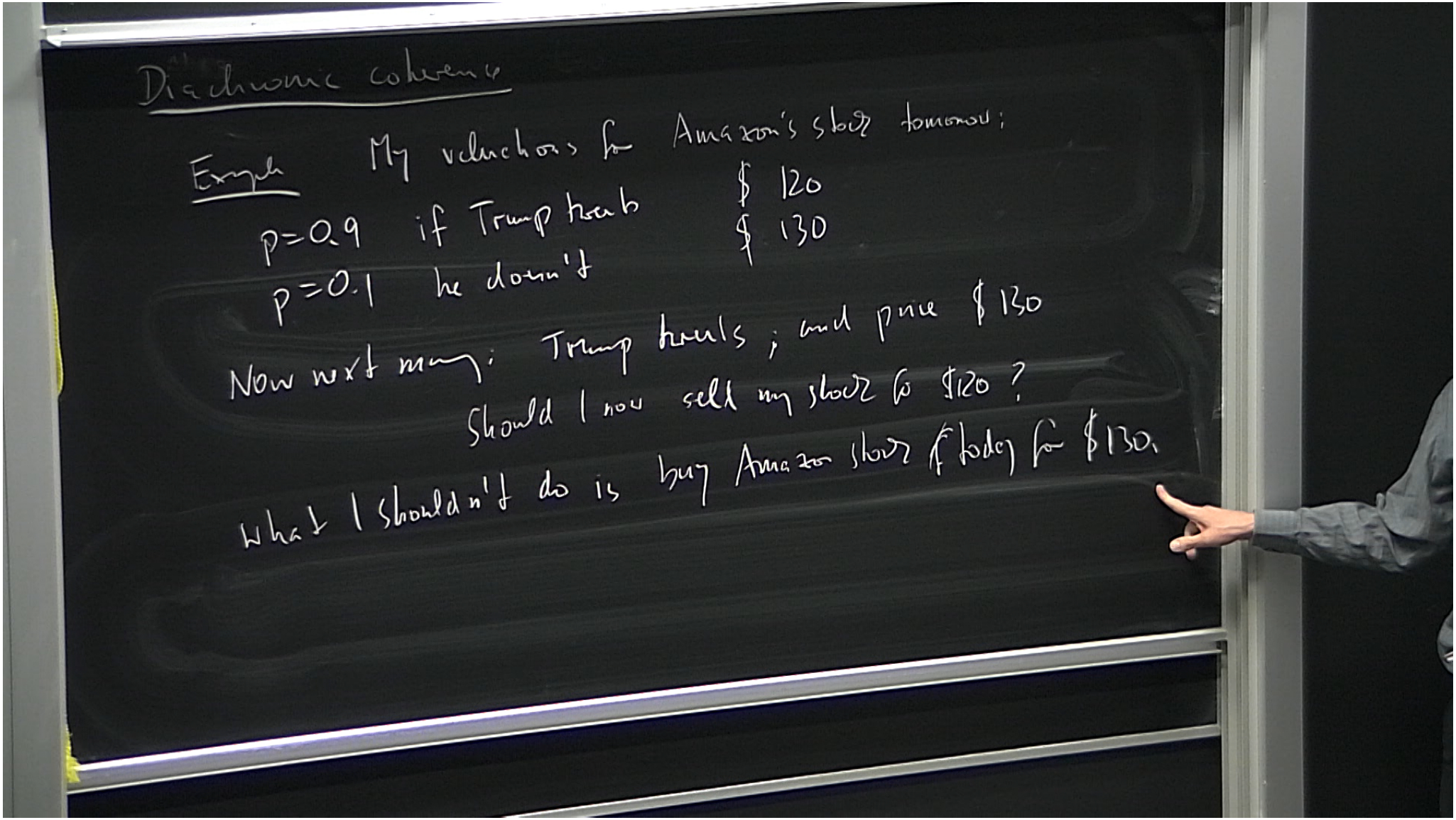
Diachronic coherence

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Now next morning: Trump tweets; and price $ 130


Diachronic coherence
Example My valuations for Amazon's stock tomorrow:
if Trump tweets $120
he doesn't $130
Now next morning: Trump tweets; and price $130
Should I now sell my stock for $120?


Diachronic coherence
Exmple My valuations for Amazon's stock tomorrow:
p=0.9 if Trump travels $120
p=0.1 he doesn't $130
Now next morning: Trump travels; and price $130
Should I now sell my stock for $120?
What I shouldn't do is buy Amazon stock today for $130.

Diachronic coherence

Example My valuations for Amazon's stock tomorrow:

$p=0.9$ if Trump travels $120

$p=0.1$ he doesn't $130

Now next morning: Trump travels; and price $130

Should I now sell my stock for $120?

What I shouldn't do is buy Amazon stock today for $130.

would be inconsistent and violate diachronic coherence

Diachronic coherence

Example My valuations for Amazon's stock tomorrow:

$p = 0.9$ if Trump tweets \$120

$p = 0.1$ he doesn't \$130

Now next morning: Trump tweets; and price \$130

Should I now refuse to buy stock for \$130?

What I shouldn't do is buy Amazon stock today for \$130.

would be inconsistent and violate diachronic coherence

Diachronic coherence

Exmple My valuations for Amazon's stock tomorrow:

$p=0.9$ if Trump tweets $ 120

$p=0.1$ he doesn't $ 130

Now next morning: Trump tweets, and price $130

Should I now refuse to buy stock for $130?

What I shouldn't do is buy Amazon stock today for $130.

would be inconsistent and violate diachronic coherence

The reflection principle $P_{now}\left(H \mid P_{tomorrow}(H)=q\right) = q$.

would be inconsistent and violate diachronic coherence

The reflection principle $P_{now}(H \mid P_{tomorrow}(H) = q) = q$.

$P_{now}(\text{accident}) = 10^{-2}$

I know (now) that $P_{2am}(\text{accident}) = 10^{-6}$

Violates reflection: the insurance I buy now for $100

would be inconsistent and violate diachronic coherence

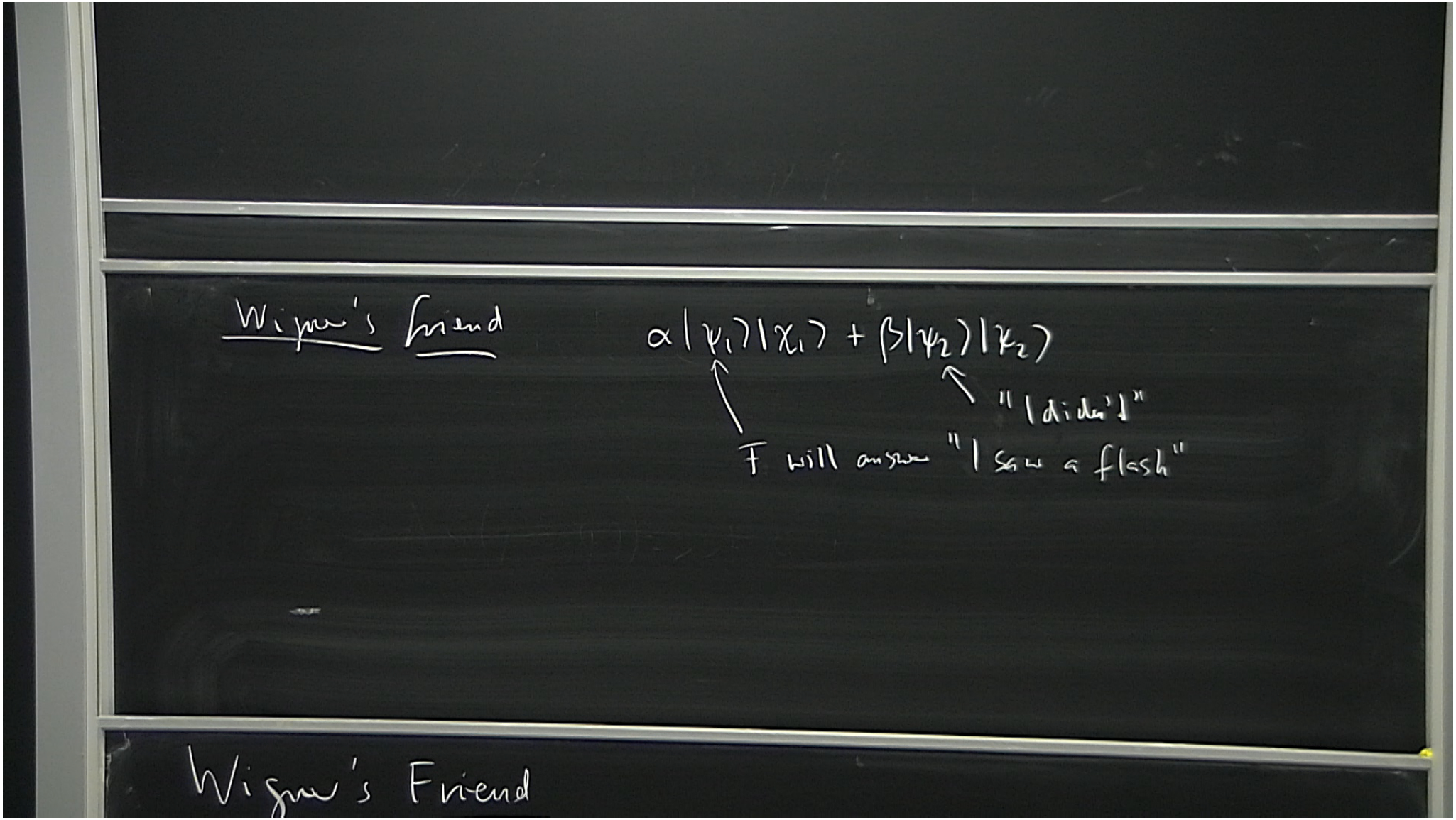
The reflection principle $P_{now}(H \mid P_{tomorrow}(H) = q) = q$.

$P_{now}(\text{accident}) = 10^{-2}$

I know (now) that $P_{2am}(\text{accident}) = 10^{-6}$

Violates reflection: the insurance I buy now for $100 will be worth it to me at 2 am.

Hand keys to a friend.


Wigner's friend
$\alpha|\psi_1\rangle|\chi_1\rangle + \beta|\psi_2\rangle|\chi_2\rangle$
"I didn't"
F will answer "I saw a flash"
Wigner's Friend

Wigner's friend

$\alpha|\psi_1\rangle|\chi_1\rangle + \beta|\psi_2\rangle|\chi_2\rangle$ (*)

$|\psi_1\rangle$: $\bar{F}$ will answer "I saw a flash"

$|\psi_2\rangle$: "I didn't"

If we accept $\bar{F}$ did (or did not) see a flash,

the correct state is a mixture of $|\psi_1\rangle|\chi_1\rangle$ and $|\psi_2\rangle|\chi_2\rangle$ (**)

Wigner's Friend

Wigner's friend

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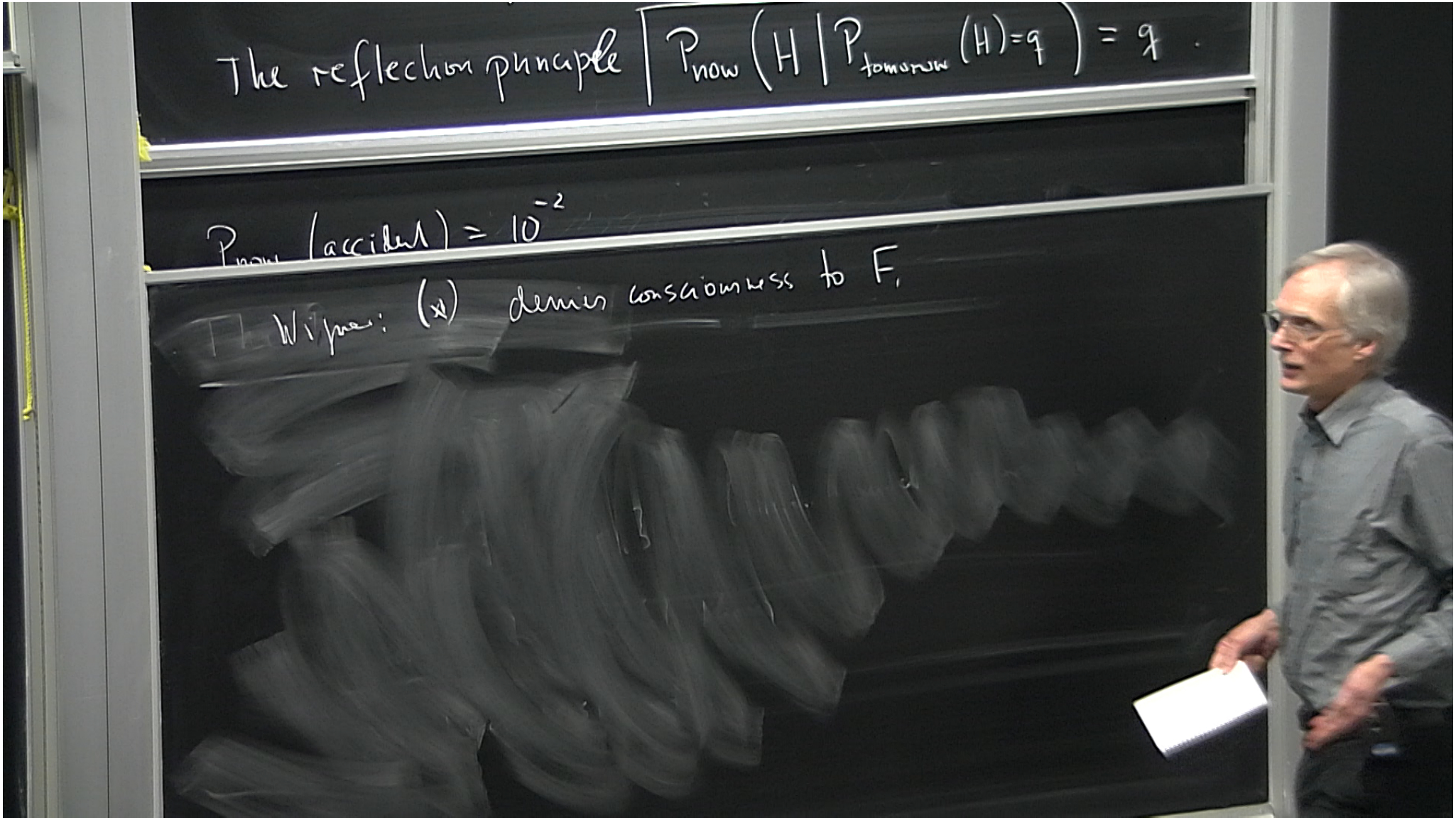
$|\psi_2\rangle$: "I didn't"

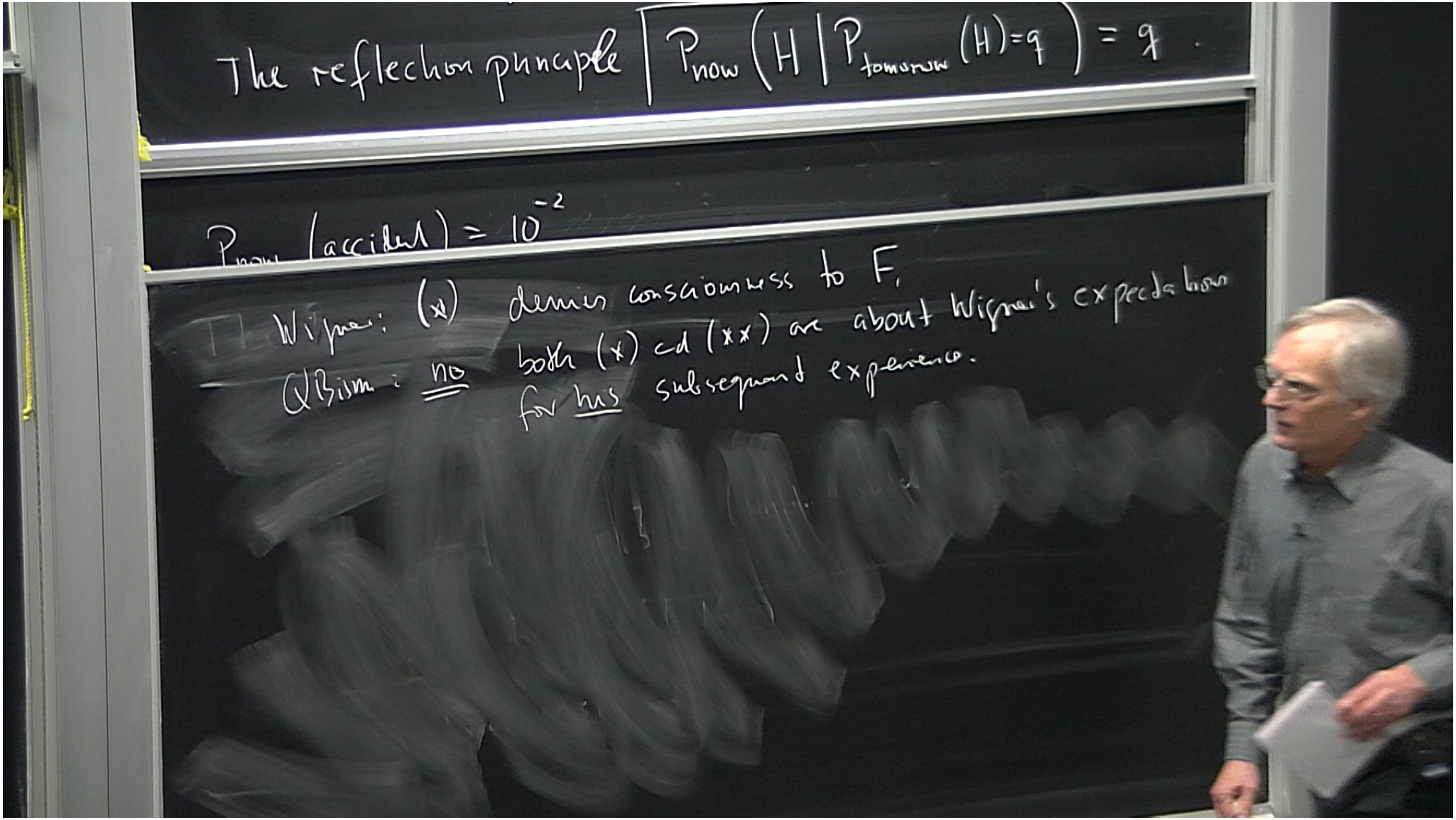
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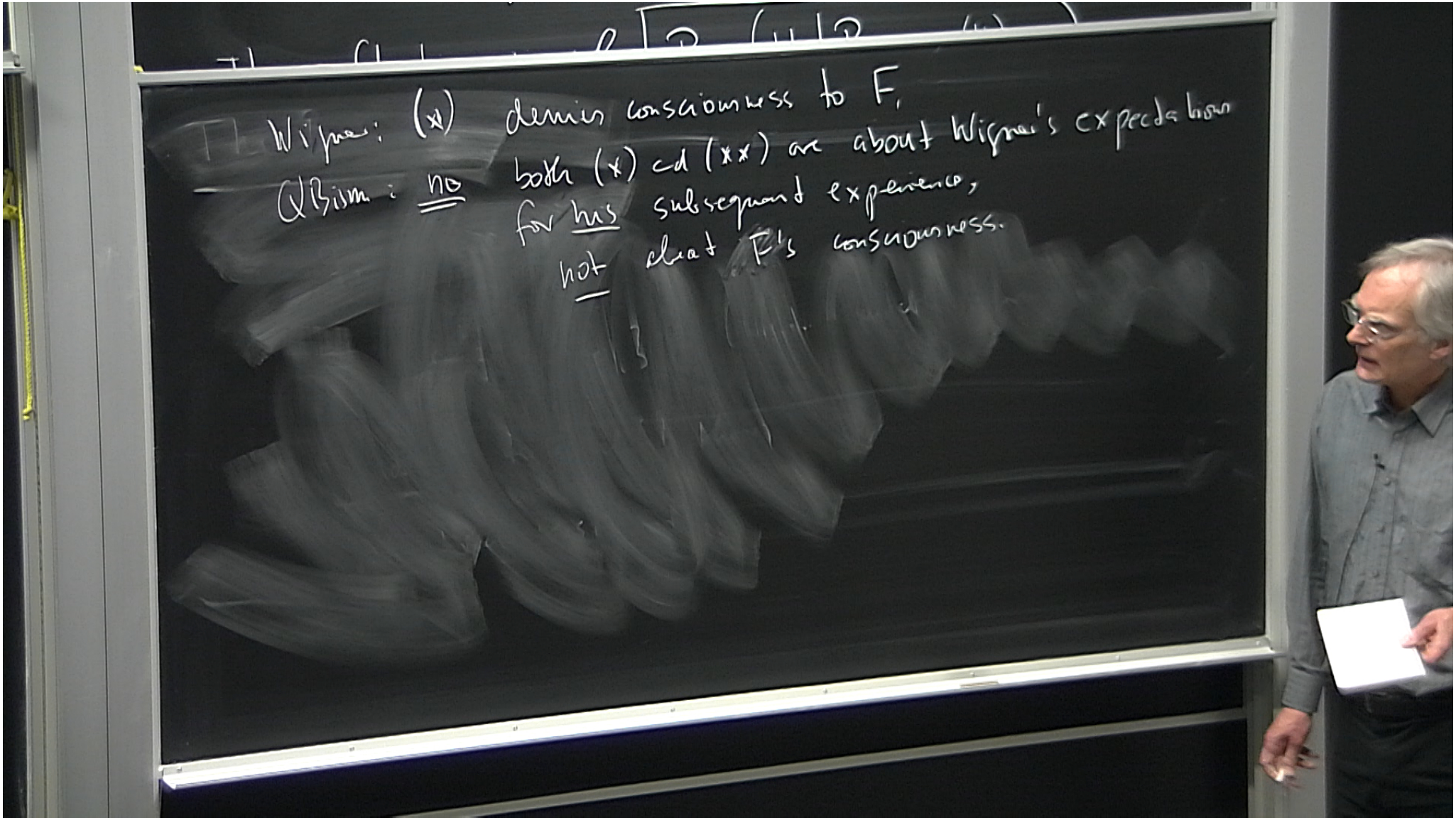
the correct state is a mixture of $|\psi_1\rangle|\chi_1\rangle$ and $|\psi_2\rangle|\chi_2\rangle$ (**)

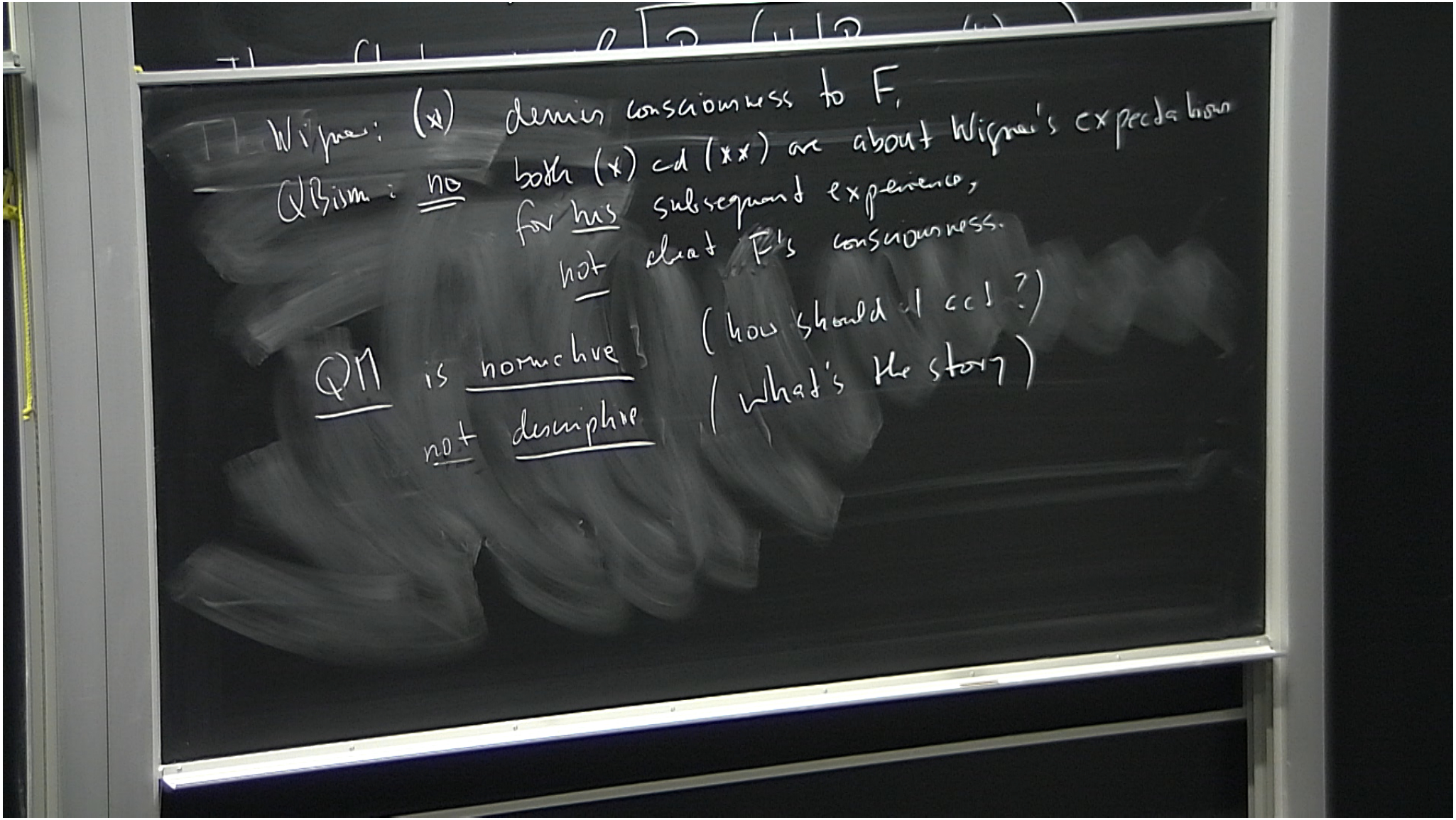
inconsistency

Wigner's Friend

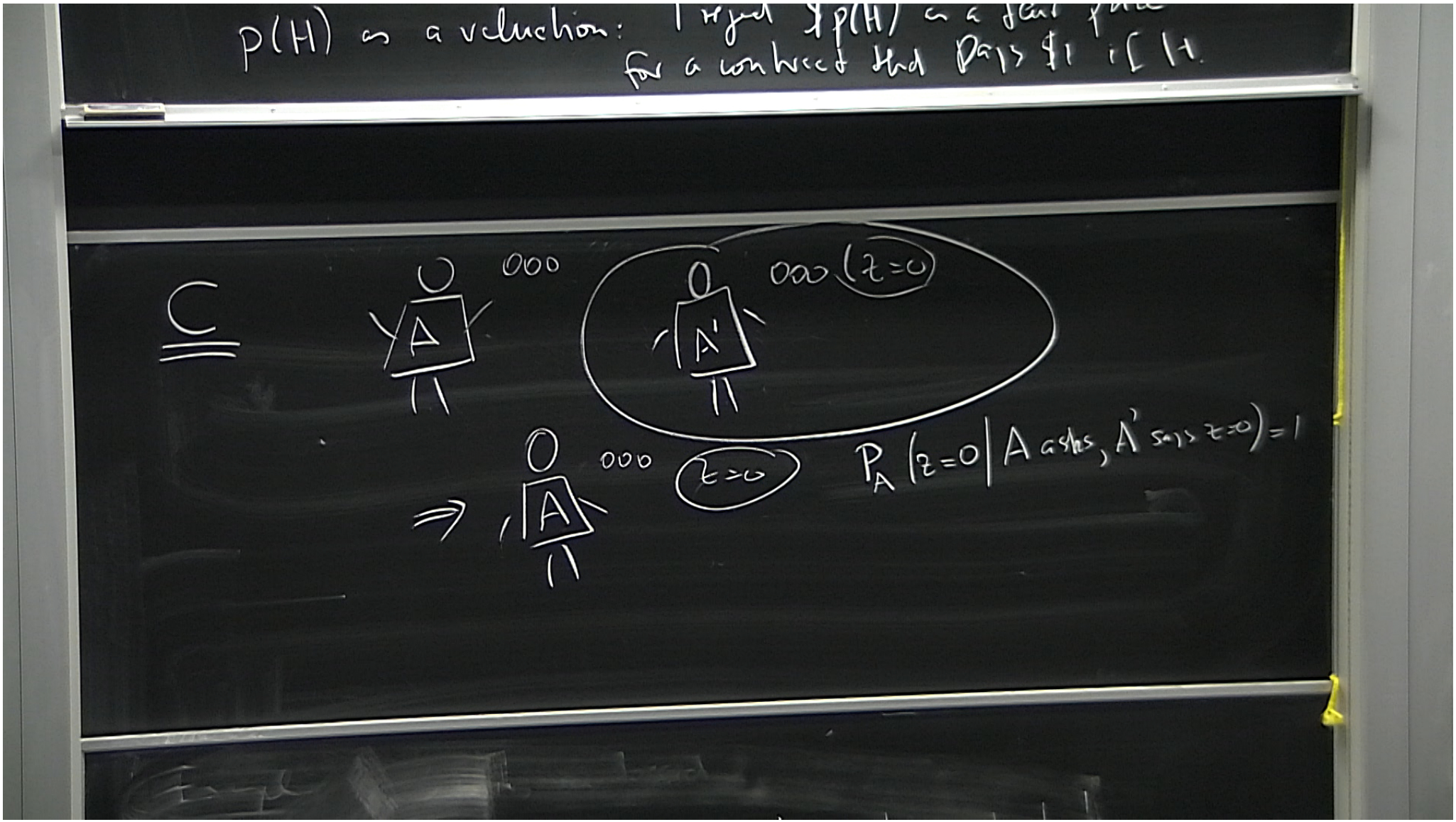

The reflection principle
$P_{now}(H \mid P_{tomorrow}(H) = q) = q$.
$P_{now}(\text{accident}) = 10^{-2}$
Wigner: (x) denies consciousness to F.


The reflection principle
$P_{now}(H \mid P_{tomorrow}(H) = q) = q$.
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Wigner: (*) denies consciousness to F.
QBism: no both (*) and (**) are about Wigner's expectations for his subsequent experience.

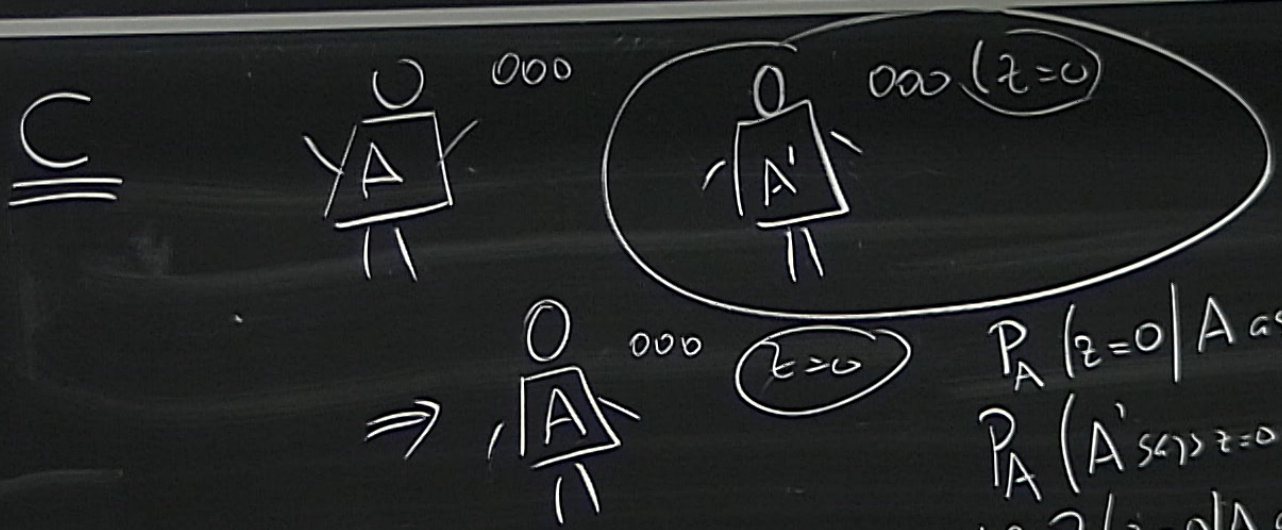

Wigner: (*) denies consciousness to F,
QBism: no both (*) and (**) are about Wigner's expectations
for his subsequent experience,
not about F's consciousness.


Wigner: (*) denies consciousness to F,
QBism: no both (*) and (**) are about Wigner's expectations
for his subsequent experience,
not about F's consciousness.
QM is normative (how should I act?)
not descriptive (what's the story)

P(H) as a reduction: Input $ p(H) as a fair coin
for a construct that says $1 if H.



P(H) as a reduction: Input $ p(H) as a fair coin
for a construct that pays $1 if H.



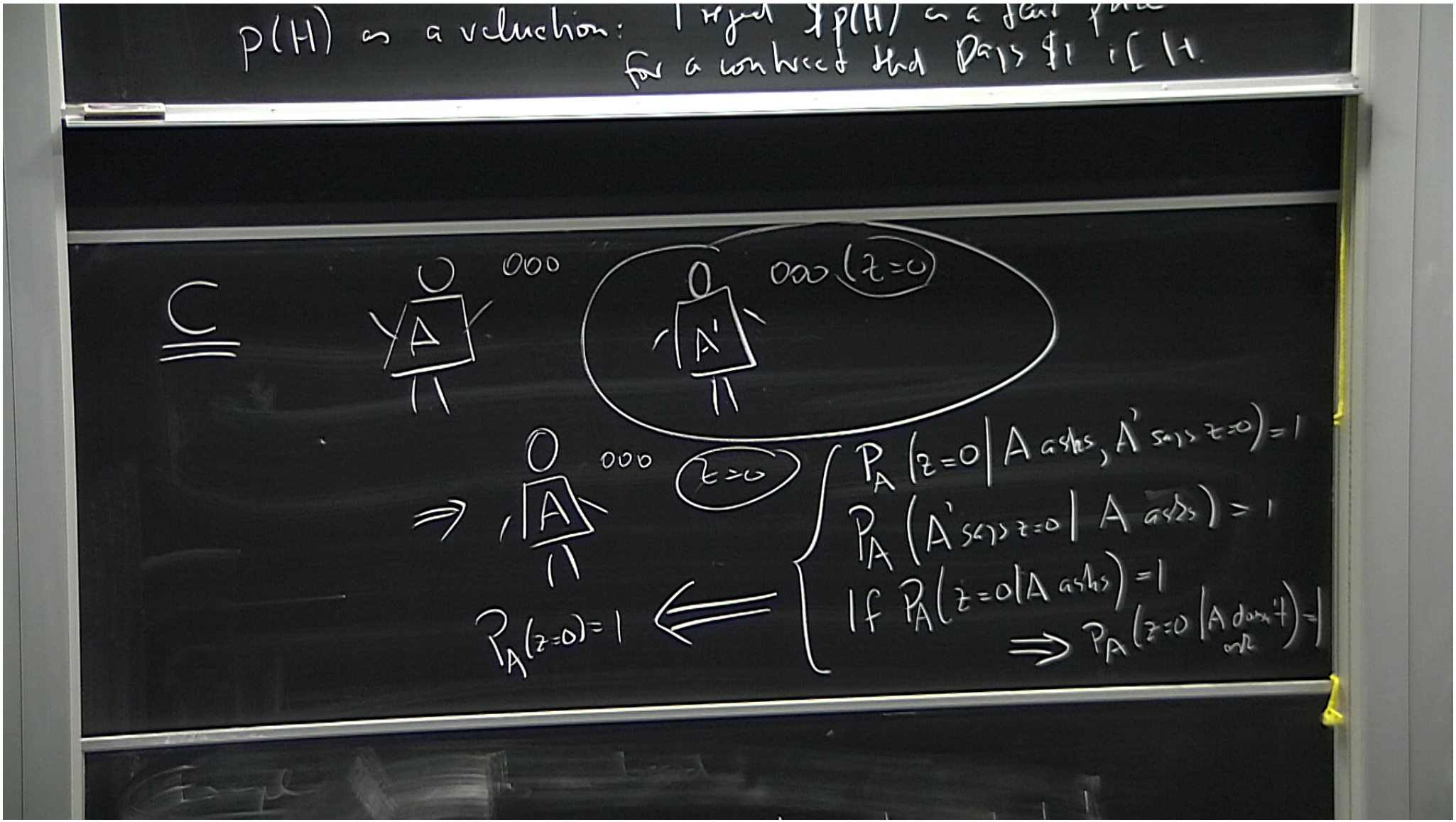
$P_A(z=0 \mid A \text{ asks}, A' \text{ says } z=0) = 1$

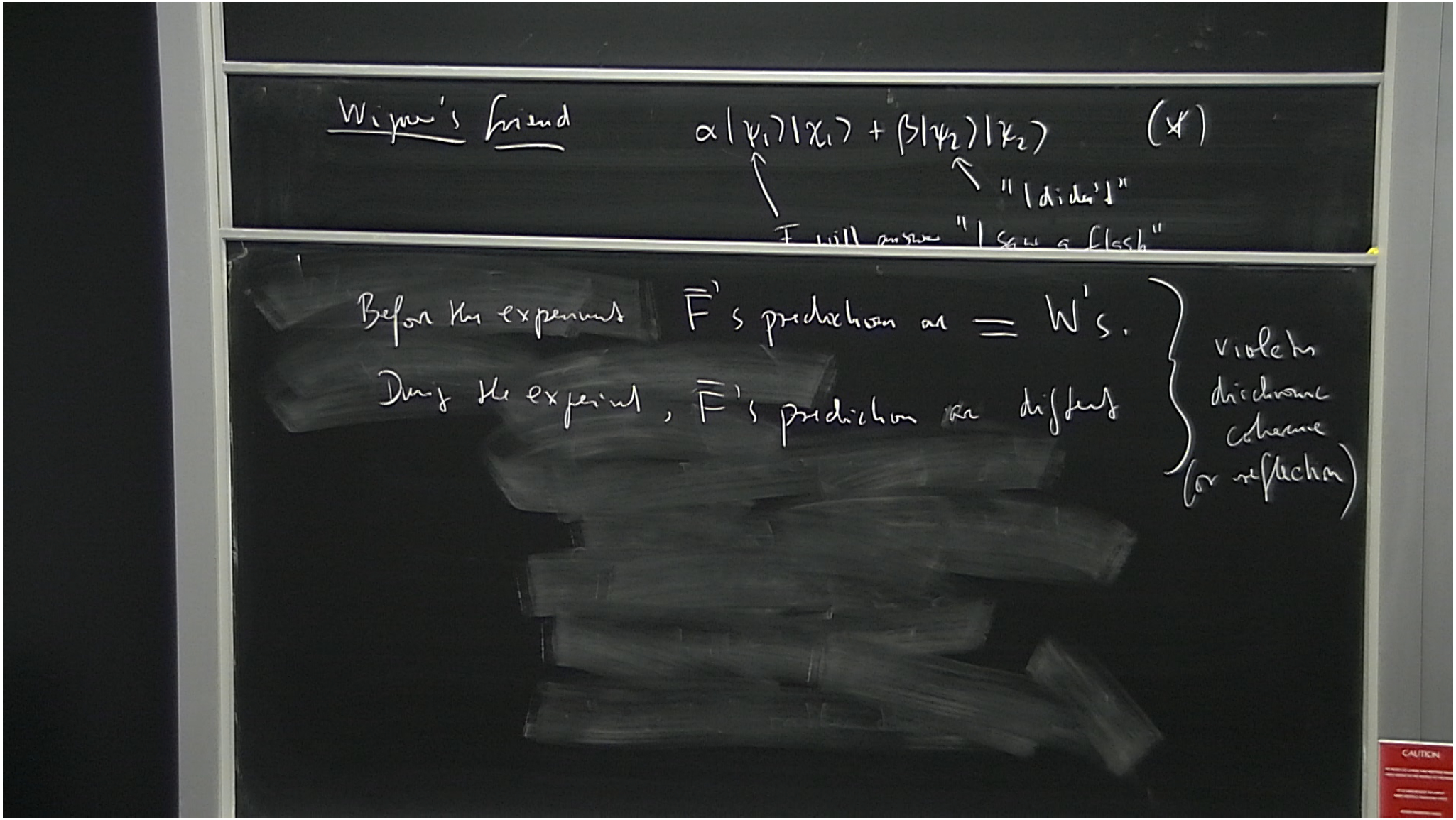
$P_A(A' \text{ says } z=0 \mid A \text{ asks}) = 1$

If $P_A(z=0 \mid A \text{ asks}) = 1$

$\Rightarrow P_A(z=0 \mid A \text{ doesn't only ask})$

P(H) as a reduction: Input 1^n, $p(H)$ as a [illegible] for a constant that says 1 if H.




Wigner's friend
$\alpha|\psi_1\rangle|\chi_1\rangle + \beta|\psi_2\rangle|\chi_2\rangle$ (*)
"I dided"
F will answer "I saw a flash"
Before the experiment F's predictions are = W's.
During the experiment, F's predictions are different
Violates
decoherence
(or reflection)