

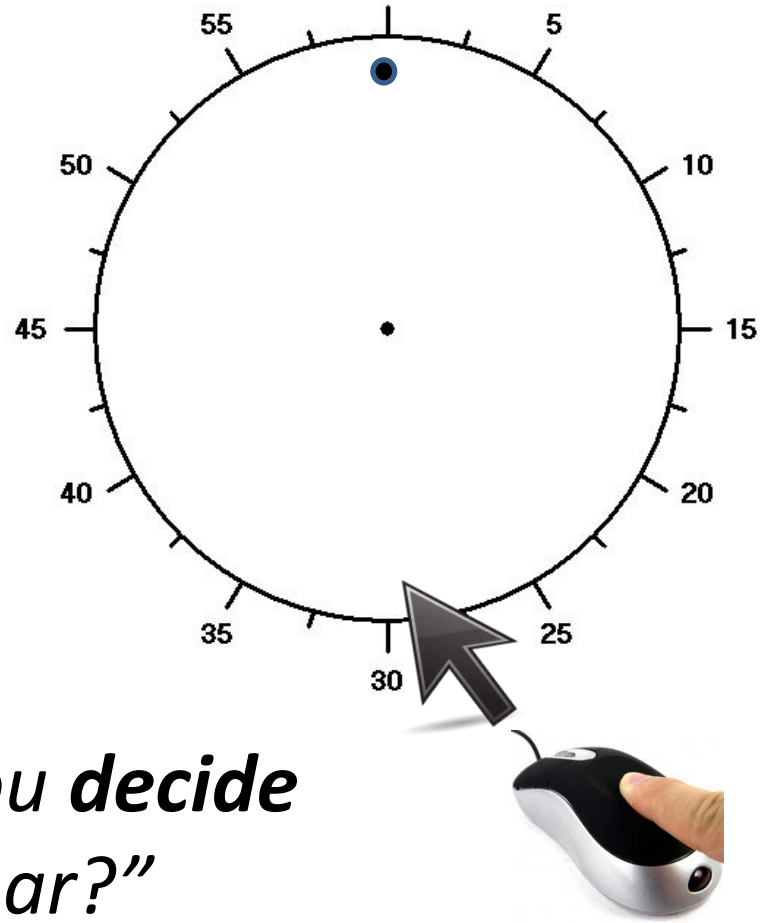
Increasing the action-effect interval and changing the assessment questions in the clock binding paradigm

Helena Matute, Pablo Garaizar & Carmelo P. Cubillas

Deusto University, Bilbao, Spain



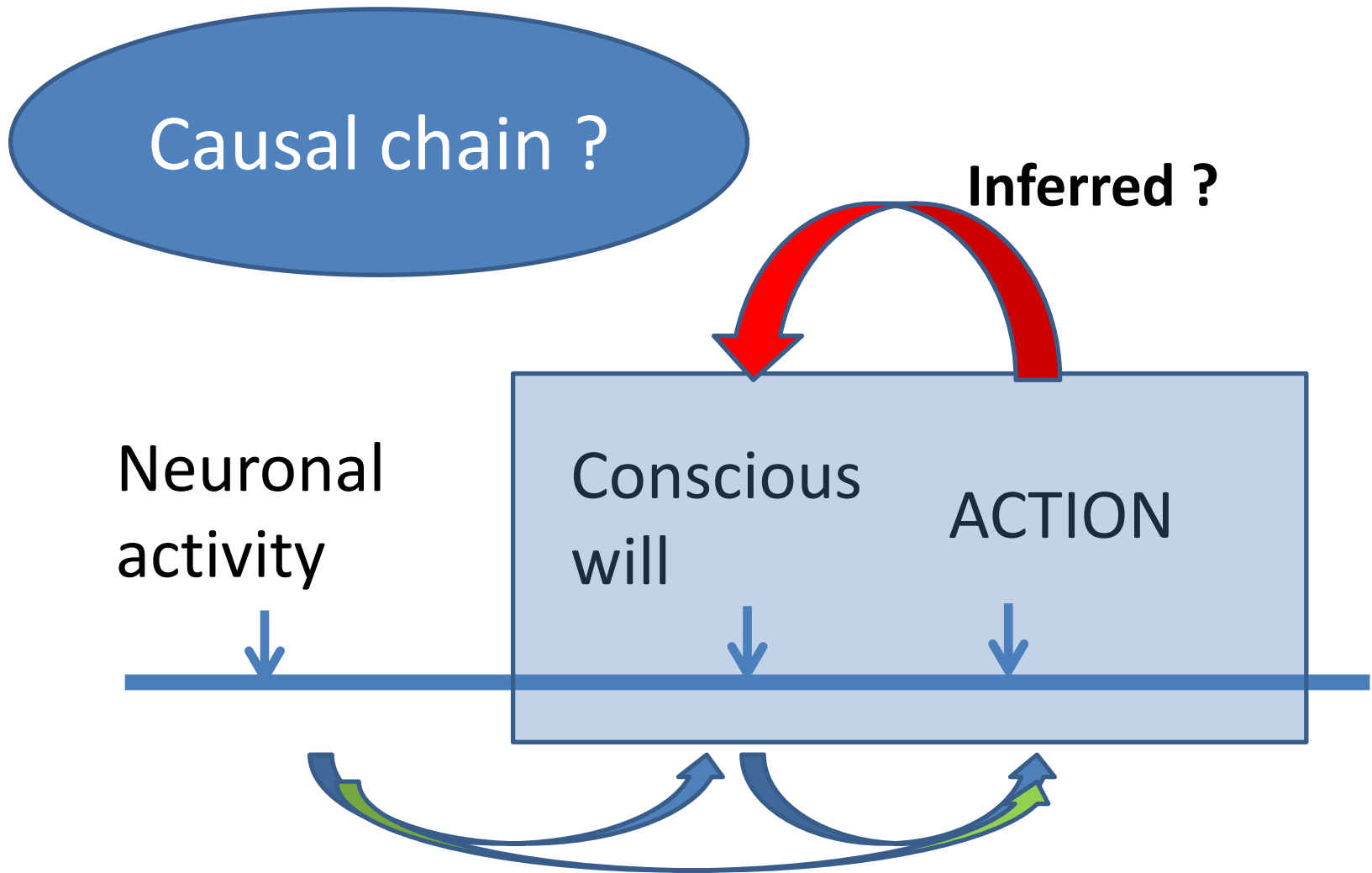
Libet's clock paradigm



*“When did you **decide** to press the bar?”*



Sequence for self-initiated action



Banks & Isham (2009)

Beep feedback at
5, 20, 40, 60 ms
AFTER the action

People **believe they decided to act** sooner or later as a function of beep delay with respect to the action:
THEY INFER TIME OF DECISION TO RESPOND



**Conscious
will**

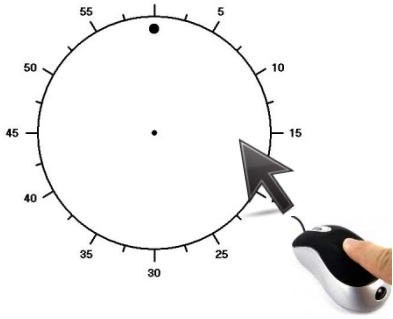


ACTION



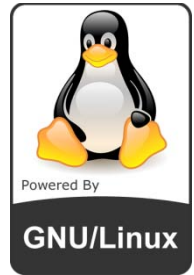
**BEEP
FEEDBACK**





Potential problems

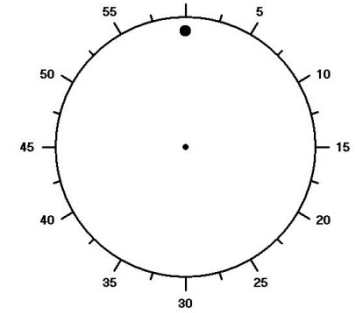
- Intervals too short (5, 20, 40, 60, ms)
 - People not accurate with mouse
 - current software & hardware
 - (e.g., LCD vs CRT monitors)
- Only 8 subjects



Microsoft
Windows



Experiment 1



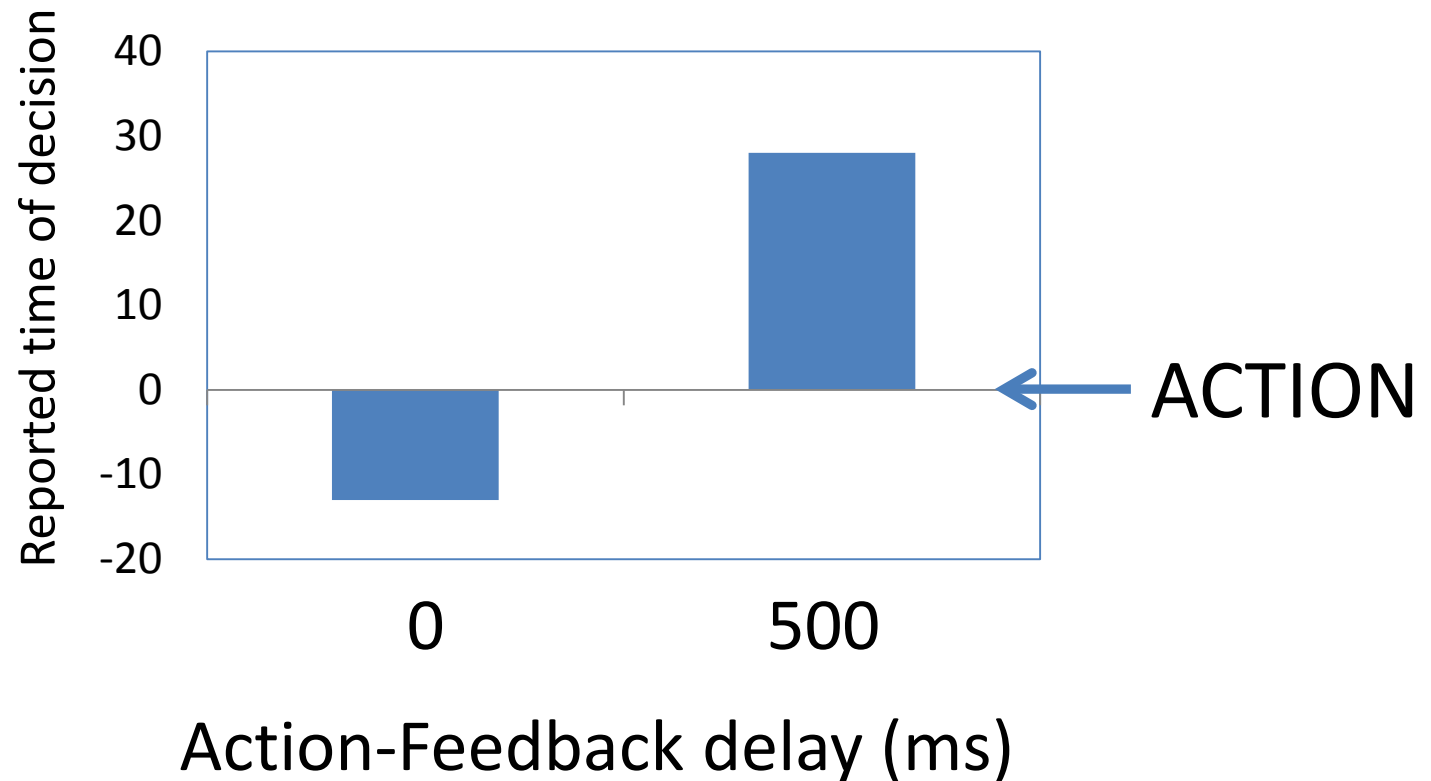
Longer Action-Beep intervals

N = 50

- BEEP delays: 0 vs. 500 ms
- 80 trials, random order:
 - 40 trials: R → **0ms** → Beep
 - 40 trials: R → **500ms** → Beep
- Question: *When did you **DECIDE** to press?*

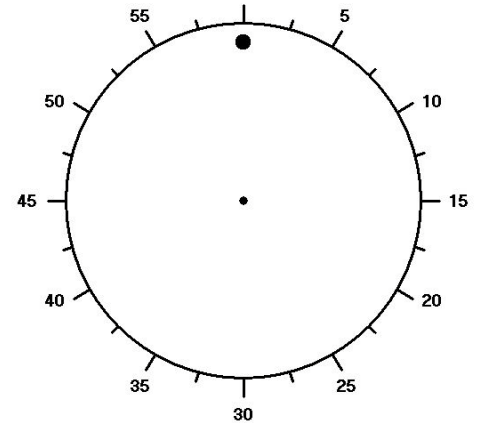
EXPERIMENT 1 – RESULTS

Reported time of decision
is a function of action-feedback delay



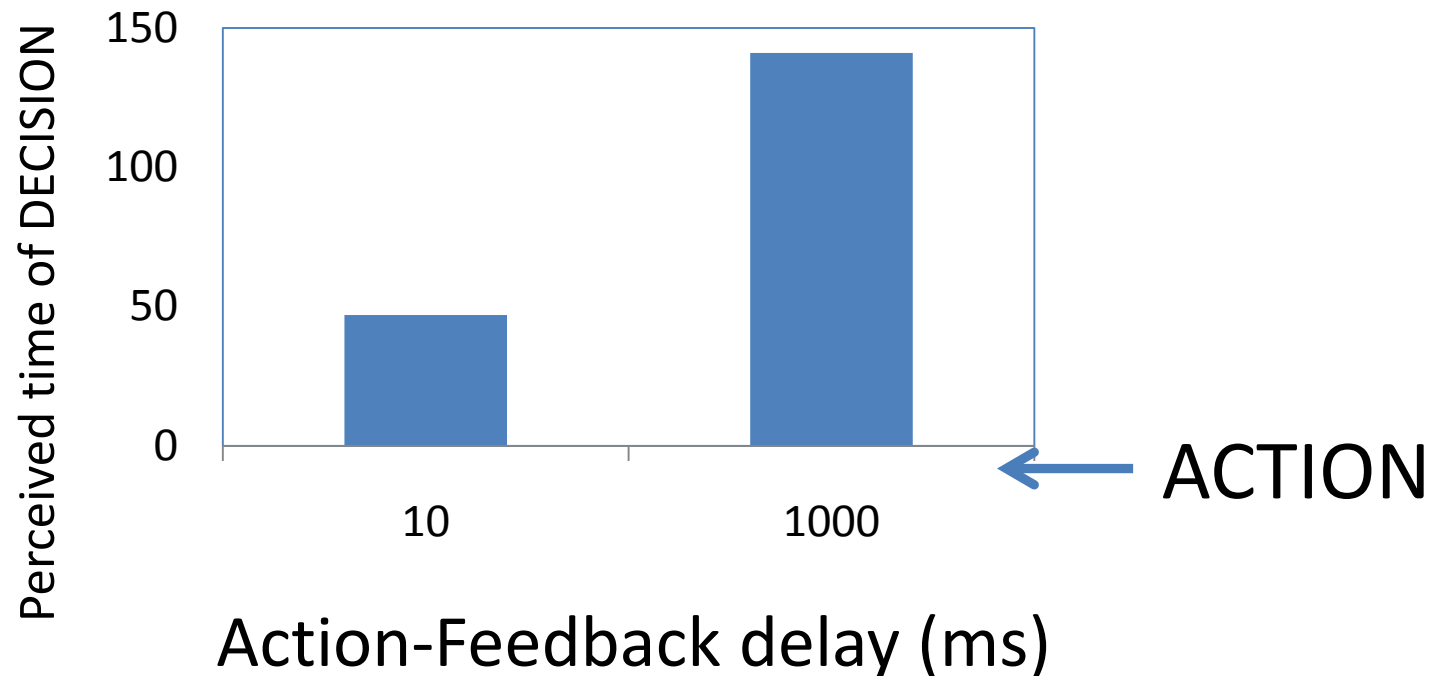
Experiment 2

- $N = 44$
- **BEEP delays: 10 vs. 1000 ms**
- Question: *When did you DECIDE TO PRESS?*



Experiment 2 - Results

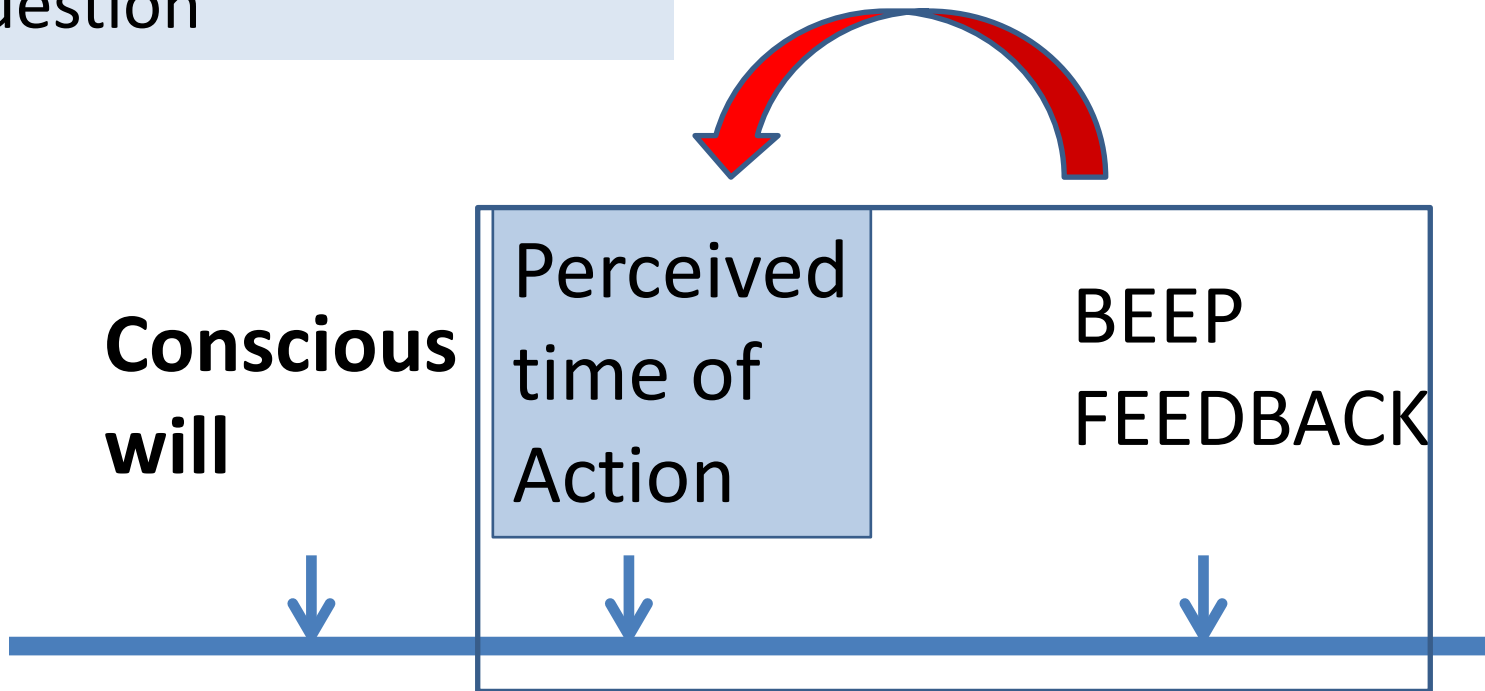
Reported time of decision
is a function of action-feedback delay



Action-Effect Binding

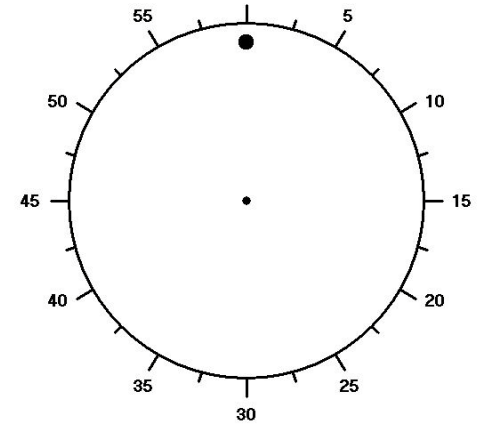
Potential
misunderstanding of
question

Inferred ?



Experiment 3: Identical to Exp 1 except...

- BEEP delays: 0 vs. 500 ms
- 80 trials, random order:
 - 40 trials: R → 0ms → Beep
 - 40 trials: R → 500ms → Beep
- **Question: *When did you PRESS?***
- N = 60

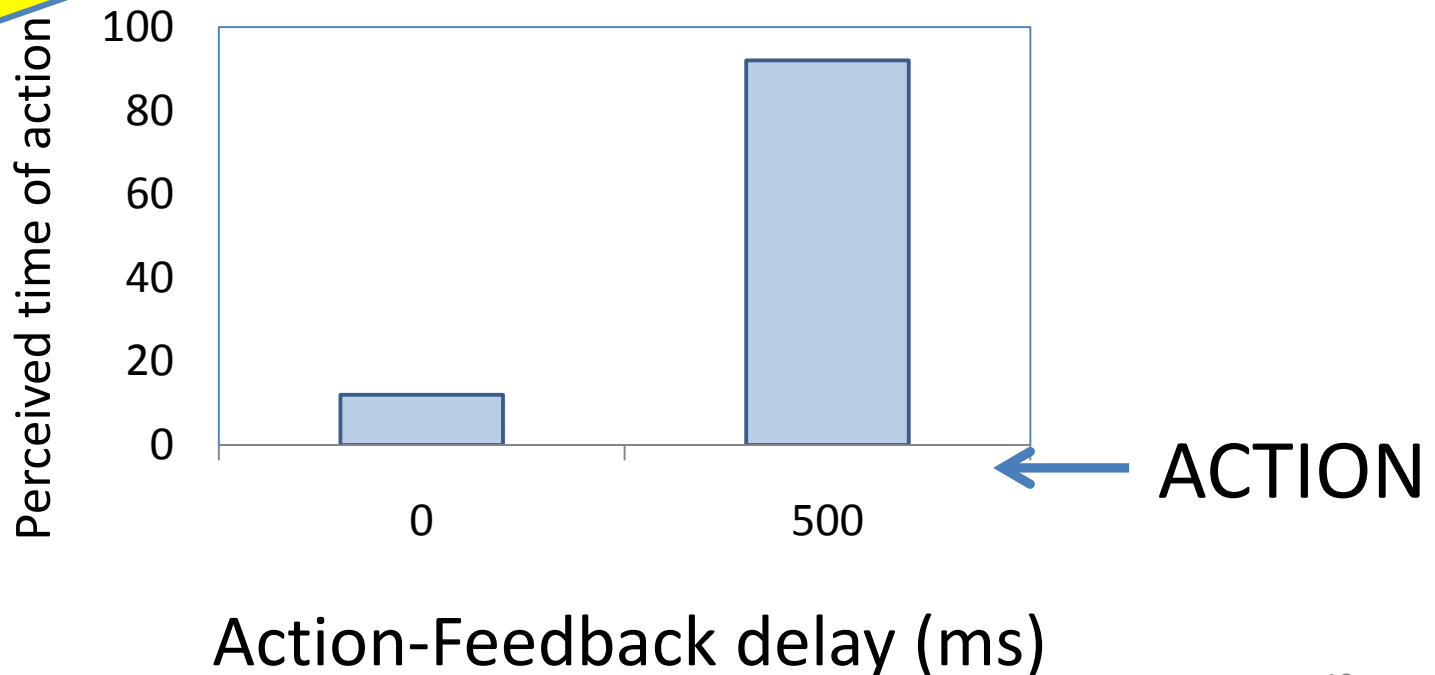


Experiment 3 - Results

Reported time of ACTION

is also a function of action-feedback delay

Action-Effect
BINDING

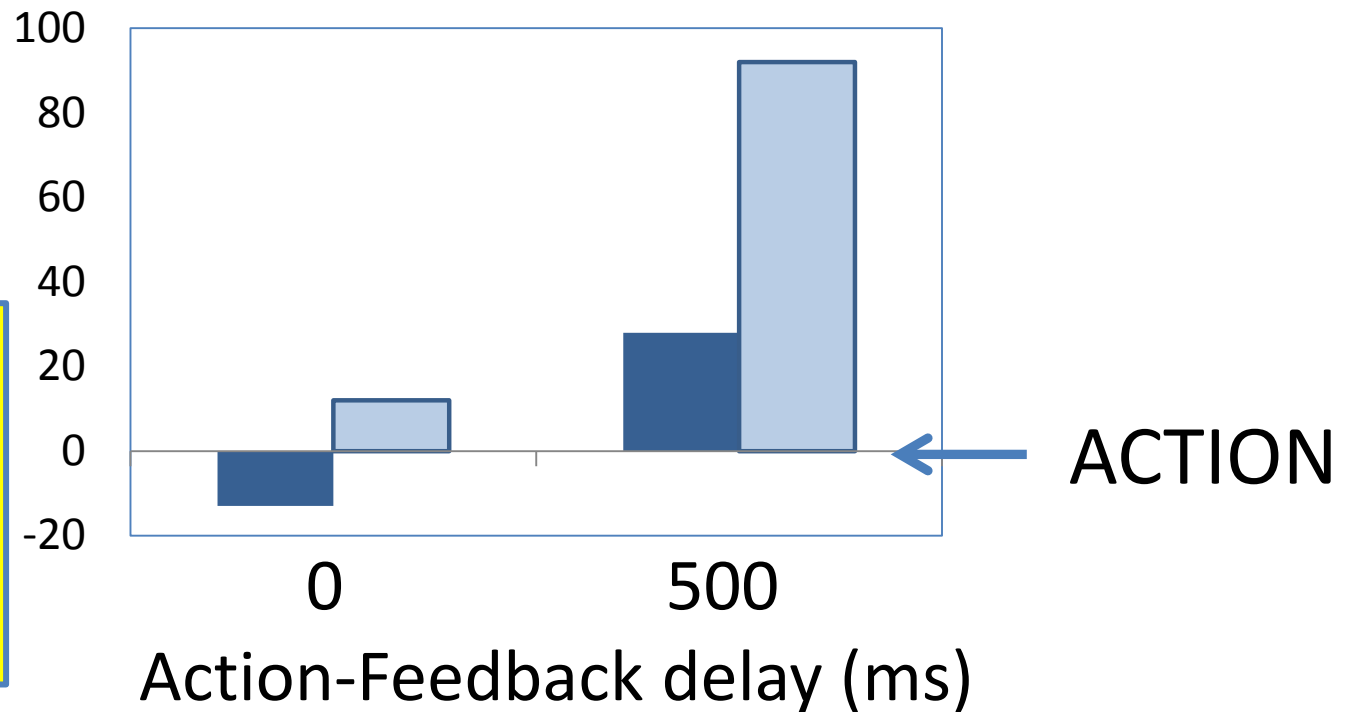


Experiment 1 & 3 - Compared

Reported time of **DECISSION** ■
Reported time of **ACTION** ■

People distinguish the two questions

The effect is shown with both questions



Discussion (I)

- People can perfectly discriminate between the two questions: Time to act & time of decision
- When asked about the time they (a) acted or (b) decided to act, they infer the response from feedback
- Results also show ACTION-EFFECT Binding
 - This binding does NOT change the conclusion that conscious will is inferred from feedback

Discussion (II)

- ROBUST methodology
- It allows for very long (1000 ms) delays between ACTION and FEEDBACK,
 - This makes it more reliable when used in today's computerized laboratories.
- NEXT: web studies





THANKS FOR YOUR ATTENTION!

Helena Matute, Pablo Garaizar & Carmelo P. Cubillas