IAP P7/33
Mechanisms of conscious and unconscious learning

Work Package 2
Mechanisms of conditioning and causal learning
Partners: KU Leuven (Beckers), UGent (De Houwer), ULB (Peigneux, Cleeremans, Kolinsky)

Elisa Maes – master in biomedical sciences (Antwerp)

rule learning and inference making in rats (WP2)

promotor: Tom Beckers (KU Leuven)
co-promotors: Jan De Houwer (U Gent), Rudi D'Hooge (KU Leuven)

will be paid on IAP funds for 8 months

Perine Coppens – master in psychology (VUB)

causal learning in children (WP2)

promotor: Tom Beckers (KU Leuven)
co-promotors: Jan De Houwer (U Gent), Teresa McCormack (Queen's University Belfast)

will be paid fully on IAP funds (4 years)

Yannick Boddez – doctor in psychology (KU Leuven)

conditioning in the absence of awareness (WP2, in collaboration with Philippe Peigneux, ULB)
learning through instructions (WP3, in collaboration with Jan De Houwer, U Gent)

will be paid on IAP funds for 2,4 years

WP2: mechanisms of conditioning and causal learning

mental processes that underlie learning

learning: changes in the behavior of an organism that are the result of regularities in the environment of that organism

mental processes:

can they be non-associative? e.g., propositional, inferential

can they be non-cognitive?

WP2: mechanisms of conditioning and causal learning

involvement of “complex cognition” in seemingly low-level phenomena of animal conditioning and in young children’s causal learning (WP2a & WP2b)

possibility for learning and conditioning to occur in the complete absence of awareness (WP2c)

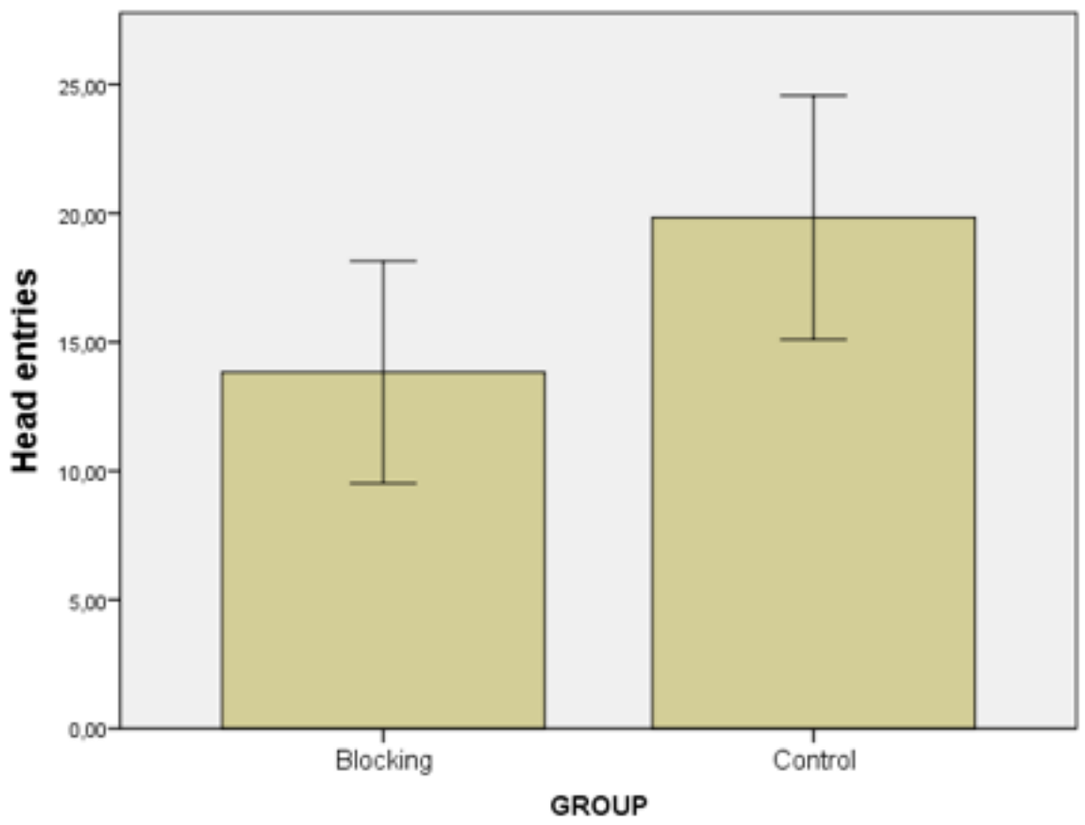
(seemingly) rule-governed behaviour in rats

- blocking and inference
- rule-based generalization

symbol learning in rats

- symmetry in matching-to-sample learning
- controlling actions by their consequences

	Phase 1	Phase 2	Test
Blocking	A+	AX+	X?
Control	B+	AX+	X?



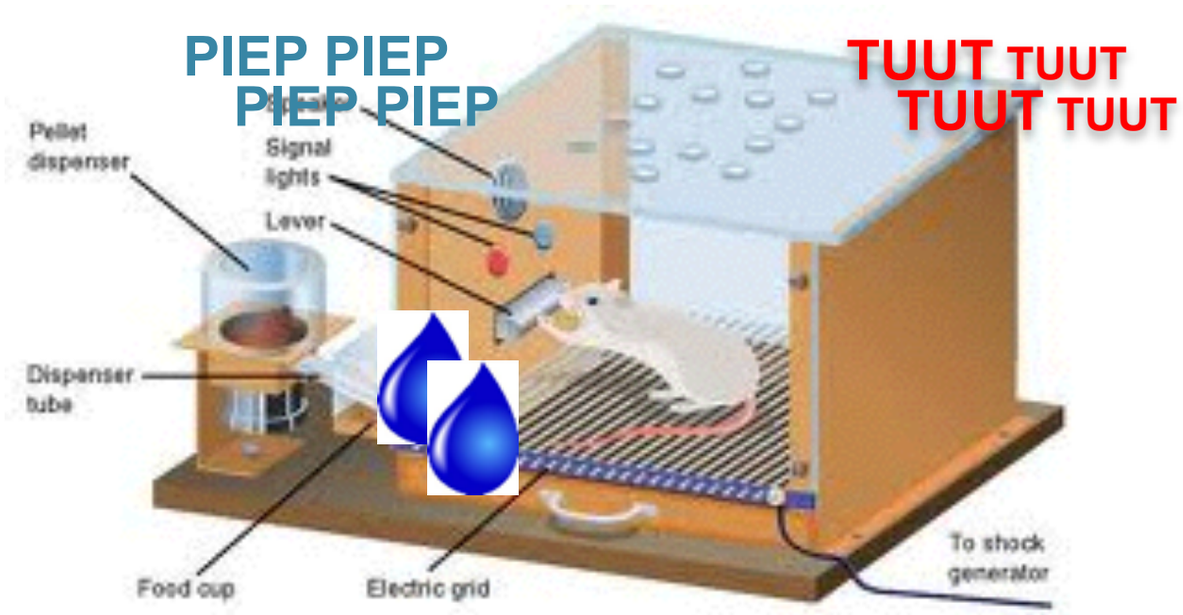
	Phase 1			Phase 2	Phase 3	Test
Blocking	C+	D+	CD+	A+	AX+	X?
Control	C+	D+	CD+	B+	AX+	X?

—> blocking is reduced

	Phase 1	Phase 2	Phase 3	Test
Blocking	C+ D+ CD+	A+	AX+	X?
Control	C+ D+ CD+	B+	AX+	X?

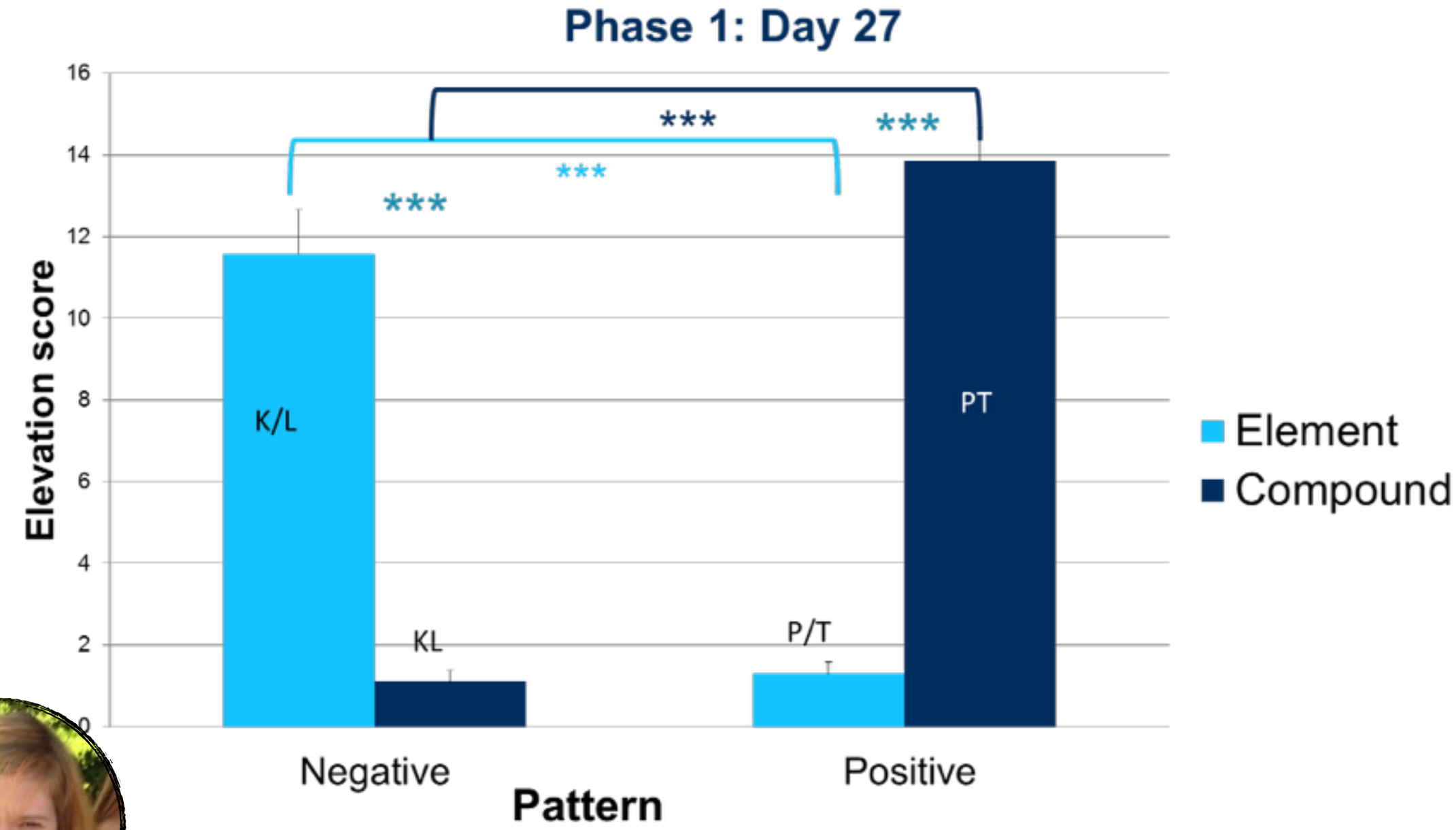
—> blocking is reduced?

patterning and generalisation

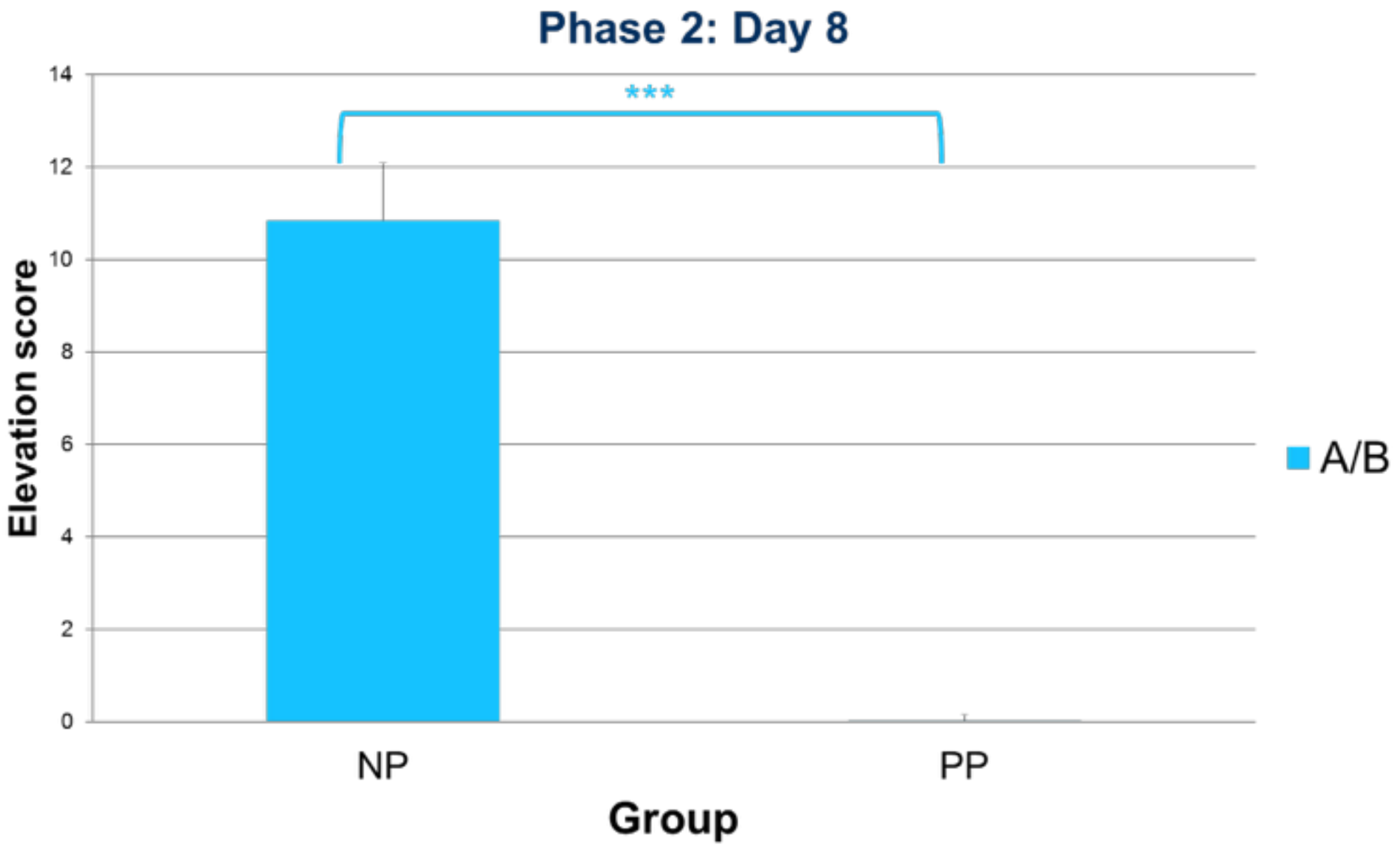


Phase 1

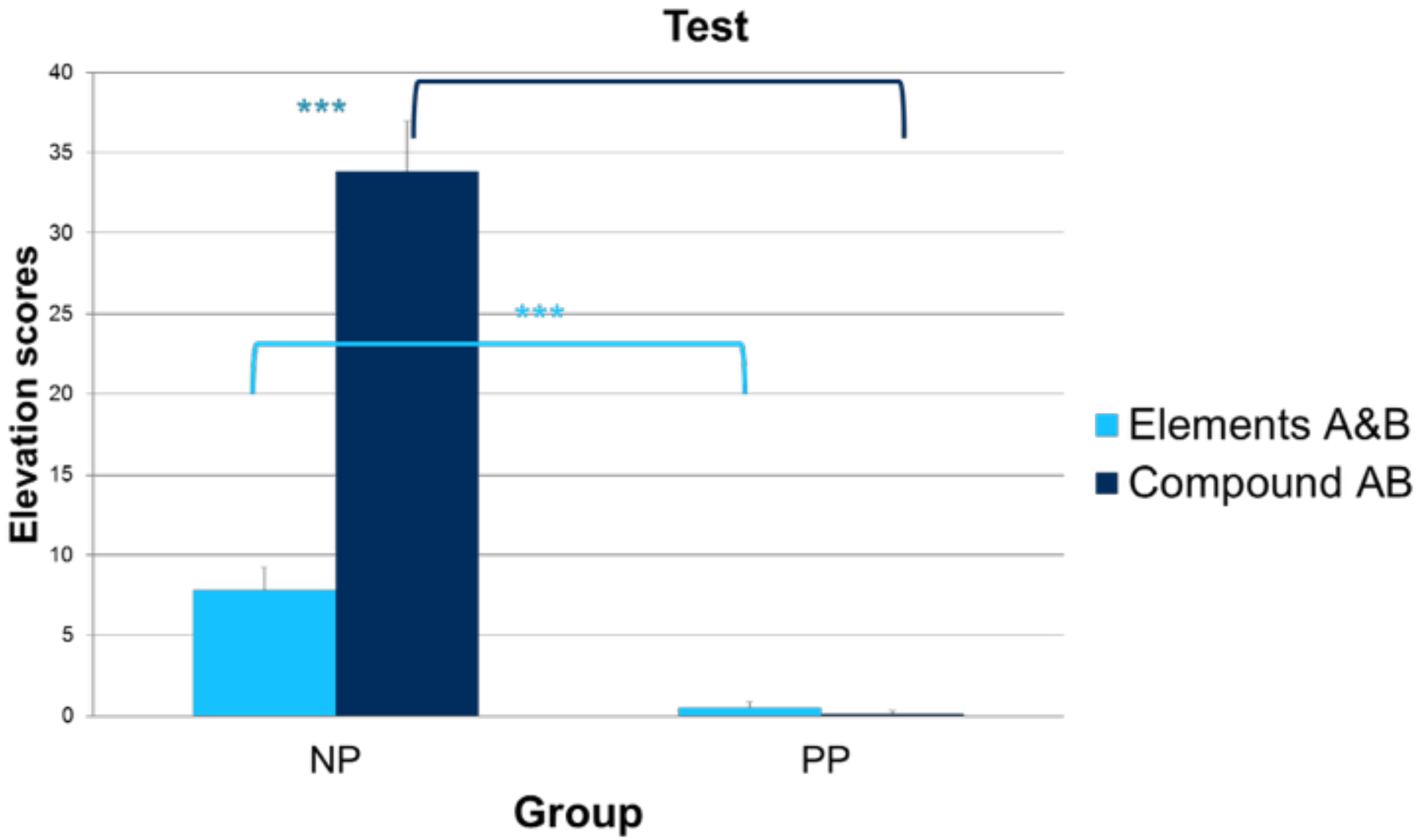
K+/ L+/ KL-/ P-/ T-/ PT+



Group	Phase 2
NP	*K+/ L+/ KL-/ P-/ T-/ PT+/ A+/ B+*
PP	*K+/ L+/ KL-/ P-/ T-/ PT+/ A-/ B-*



Group	Phase 3
NP	***K+/ L+/ KL-/ P-/ T-/ PT+/ A+/ B+*** ***AB //*** *AB/ A / B*
PP	***K+/ L+/ KL-/ P-/ T-/ PT+/ A-/ B-*** ***AB //*** *AB/ A / B*



(seemingly) rule-governed behaviour in rats

- blocking and inference
- rule-based generalization

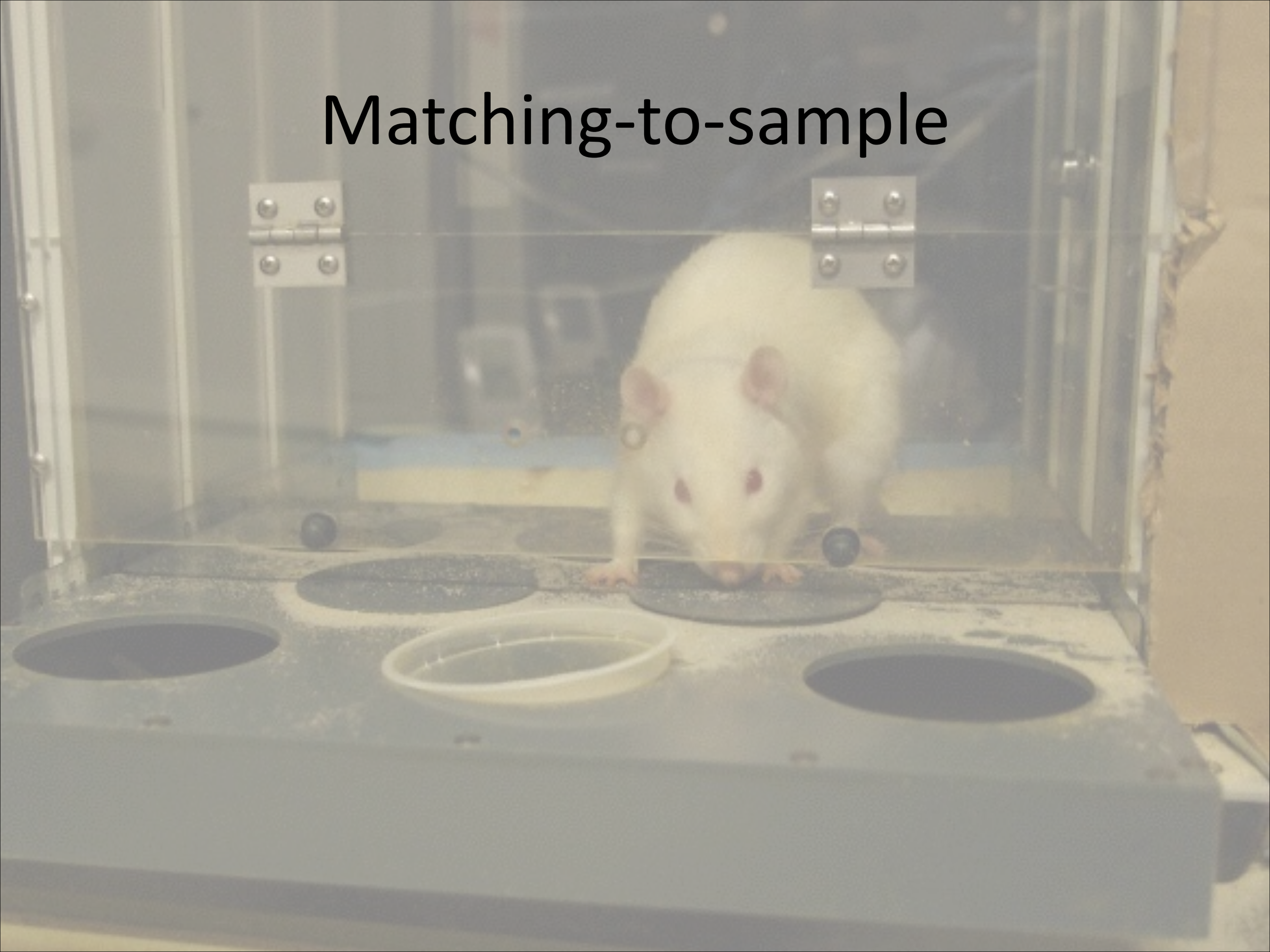
symbol learning in rats

- symmetry in matching-to-sample learning
- controlling actions by their consequences

symmetry as a hallmark of arbitrary stimulus equivalence (and a basic feature of language)

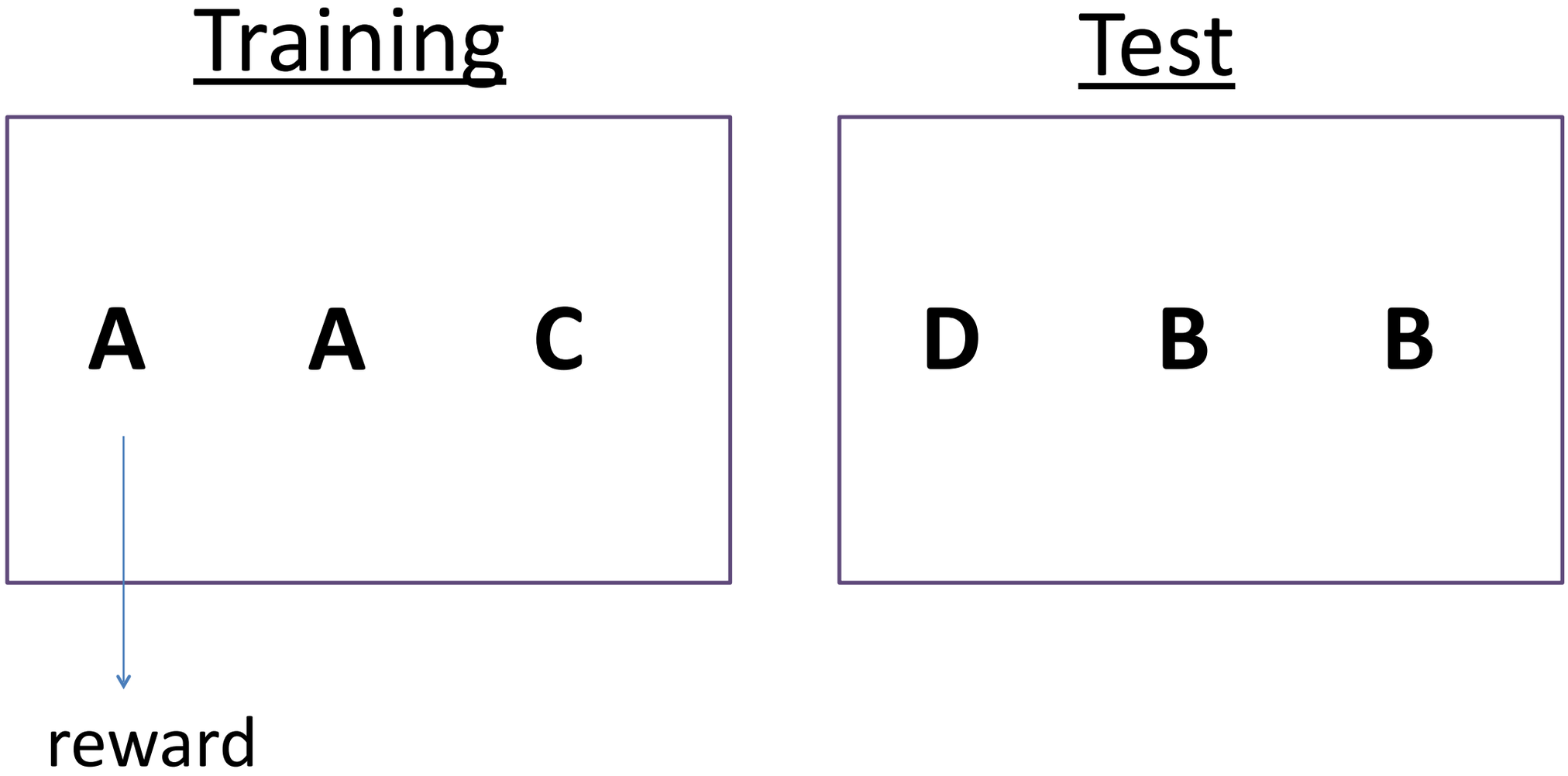

Ceci n'est pas une pipe.

Matching-to-sample



Matching-to-sample

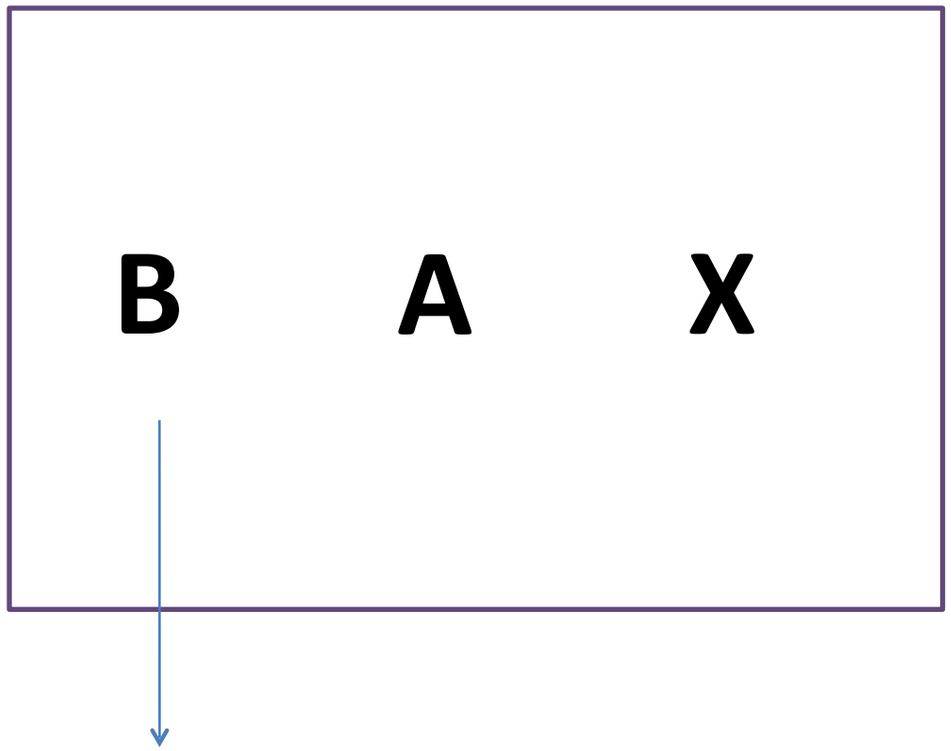
Reflexivity → Identity matching-to-sample



Matching-to-sample

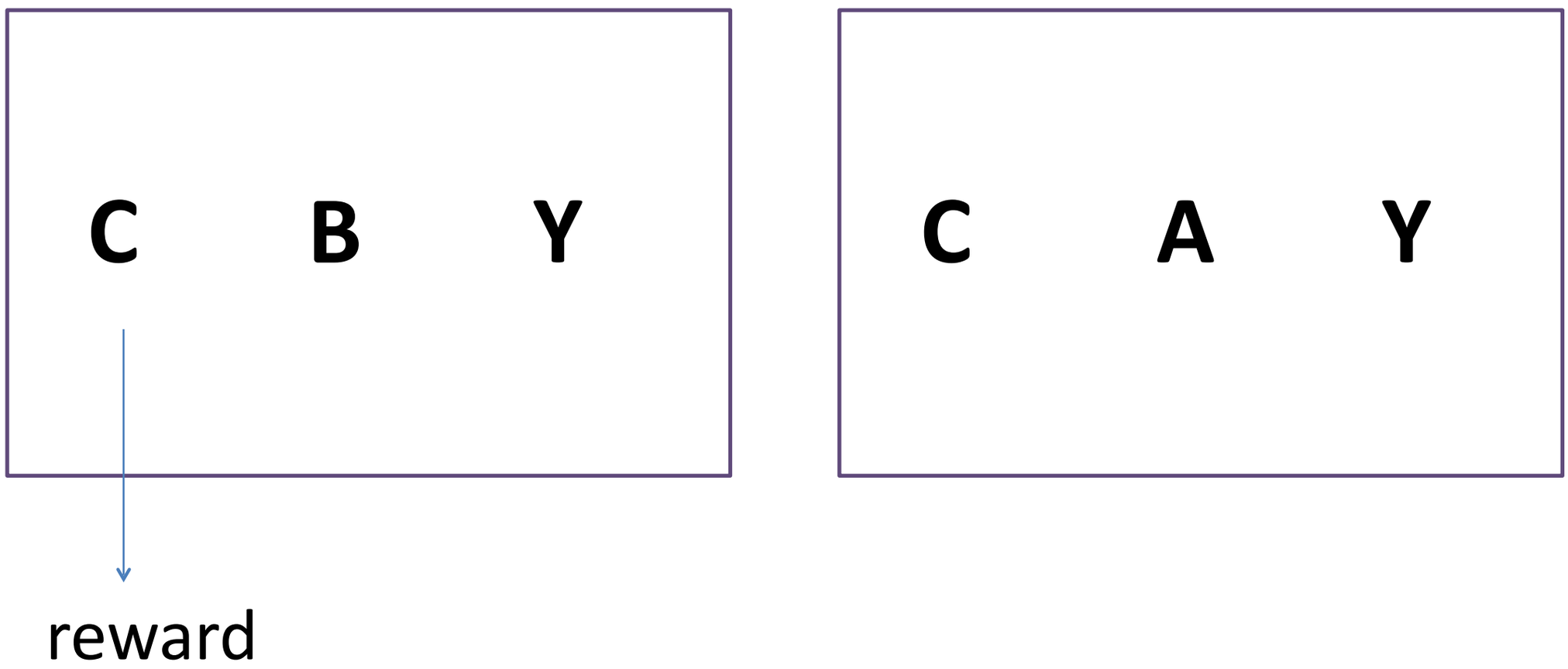
Transitivity → successive matching-to-sample

Training 1



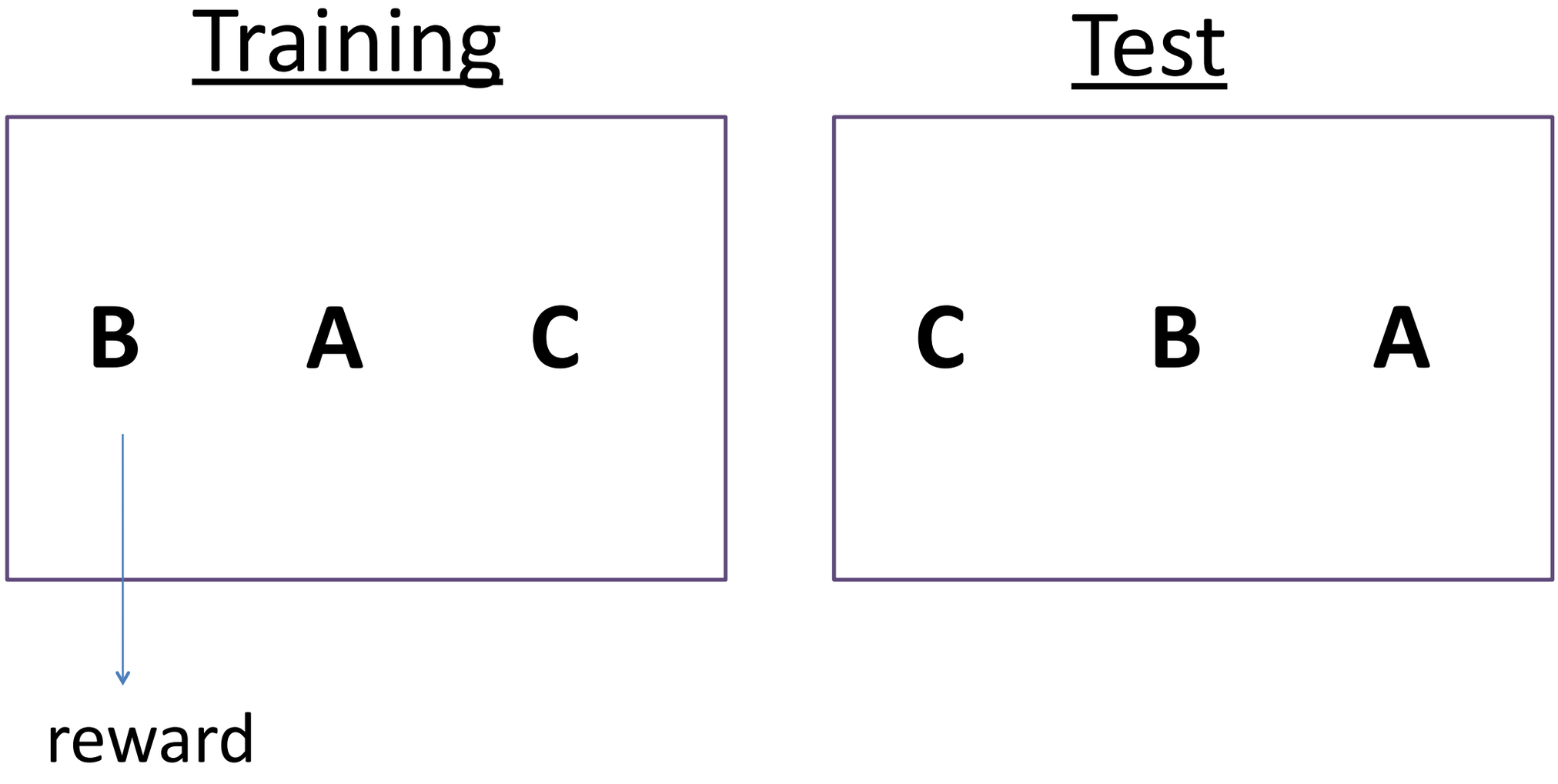
Matching-to-sample

Transitivity → successive matching-to-sample



Matching-to-sample

- Symmetry → Arbitrary matching-to-sample



→ **Very difficult to find in animals**

MTS: Training

Training features in animals		Language training in humans
Location control	*Multiple locations*	√
Temporal control	Multi-exemplars	√
	Identity training	√
Select control	Multiple distractors	√
	Different distractors	√

→ Animals do not learn symmetry through learning in nature

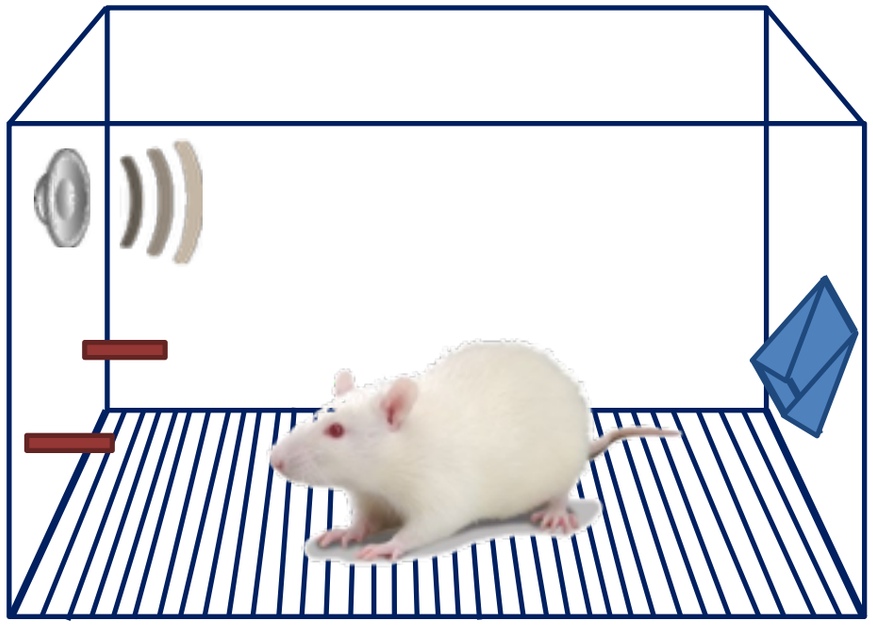
→ Can they learn symmetry when they are given training with the same characteristics as language training in humans?

Pavlovian-Instrumental Transfer (PIT)

alternative procedure to investigate the symmetrical (bi-directional) use of „associations” in animals

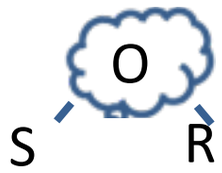
PIT procedure

1. Classical Conditioning
   - A1 →O1
   - B1 →O2
2. Operant Conditioning
   - R1 →O1 →R1 →O1
   - R2 →O2 →R2 →O2
3. Test
   - A1: R1 > R2
   - B1: R2 > R1



Explanation

Specific outcome representations



Does this imply backward associations?

No

PIT-like procedure

Operant Conditioning:

R1 → A1 → O

R2 → A2 → O

Test :

A1: R1 ≷ R2 ?

A2: R2 ≷ R1 ?

Training

A1 → R1

A2 → R2

Operant Conditioning 2:

R1 → B1 → O

R2 → B2 → O

Test 2:

B1: R1 > R2 ?

B2: R2 > R1 ?

Training 2

OC 3

Test3

If it is a capacity that need to be trained,
we expect that multi-exemplars are needed

causal learning in children

does blocking in young children reflect a failure to acquire an association between the blocked cue and the outcome?

Pavlovian-Instrumental Transfer again

A - O1	R1 - O1	A: R1 > R2
B - O2	R2 - O2	B: R1 < R2

Pavlovian-Instrumental Transfer again

A - O1 B - O2	A - / B - /	R1 - O1 R2 - O2	A: R1 > R2 B: R1 < R2

Pavlovian-Instrumental Transfer again

A - O1 B - O2	A - / B - /	R1 - O1 R2 - O2	A: R1 > R2 B: R1 < R2

PIT can reveal associations that are behaviorally silent

Pavlovian-Instrumental Transfer again

A - O1	AX - O1	R1 - O1	X: R1 > R2
B - O2	BY - O2	R2 - O2	Y: R1 < R2

PIT can reveal associations that are behaviorally silent

Pavlovian-Instrumental Transfer again

C - O1	AX - O1	R1 - O1	X: R1 > R2
D - O2	BY - O2	R2 - O2	Y: R1 < R2

PIT can reveal associations that are behaviorally silent

learning in the absence of awareness

can we learn to associate stimuli under conditions of limited or no awareness?