

Slowed reacquisition of a previously extinguished response: The effect of partial extinction in human contingency learning

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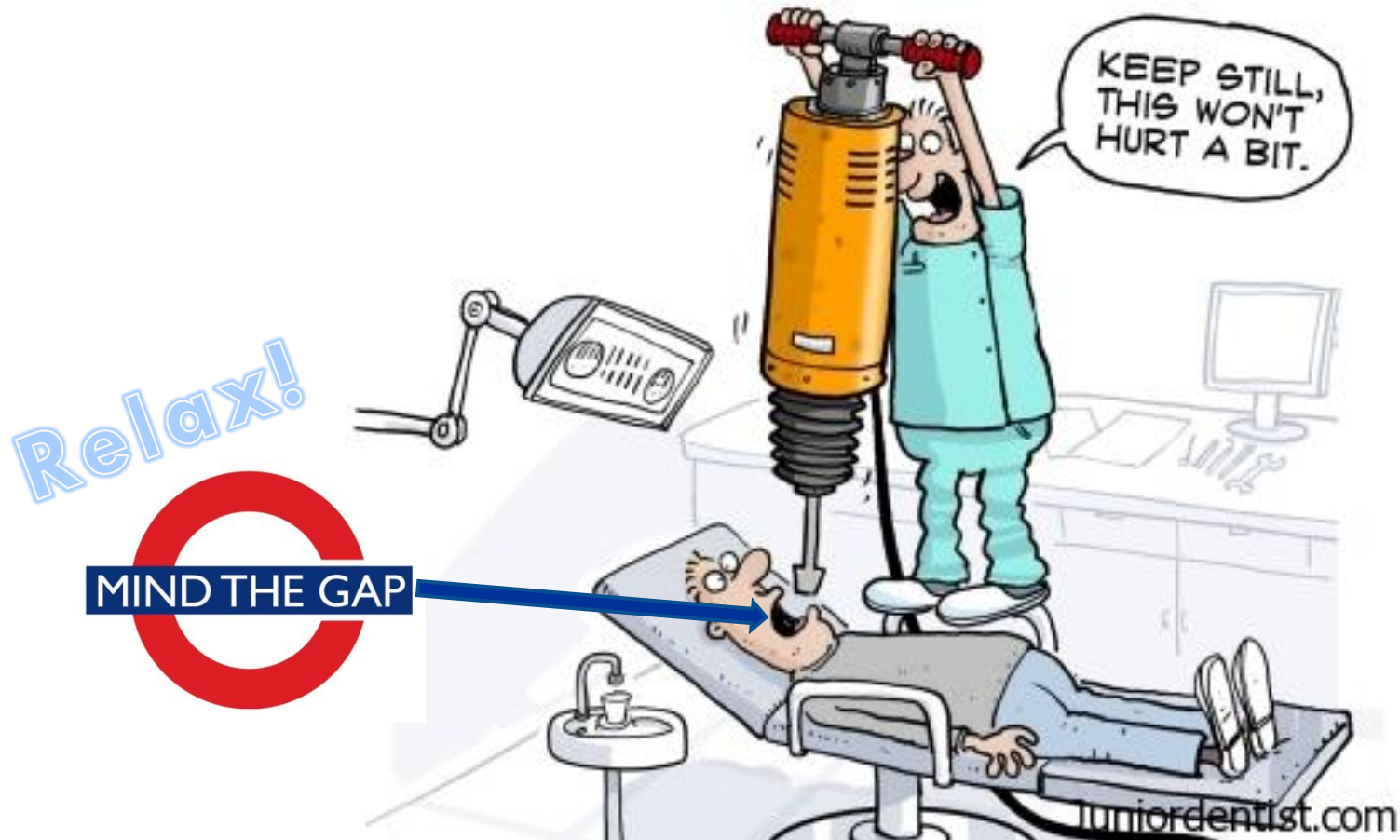


Causal
Cognition
Group



XXVII Congreso de la Sociedad Española de Psicología
Comparada. Sevilla, 9-11 septiembre 2015

Extinction of a fear response



Limitations of extinction



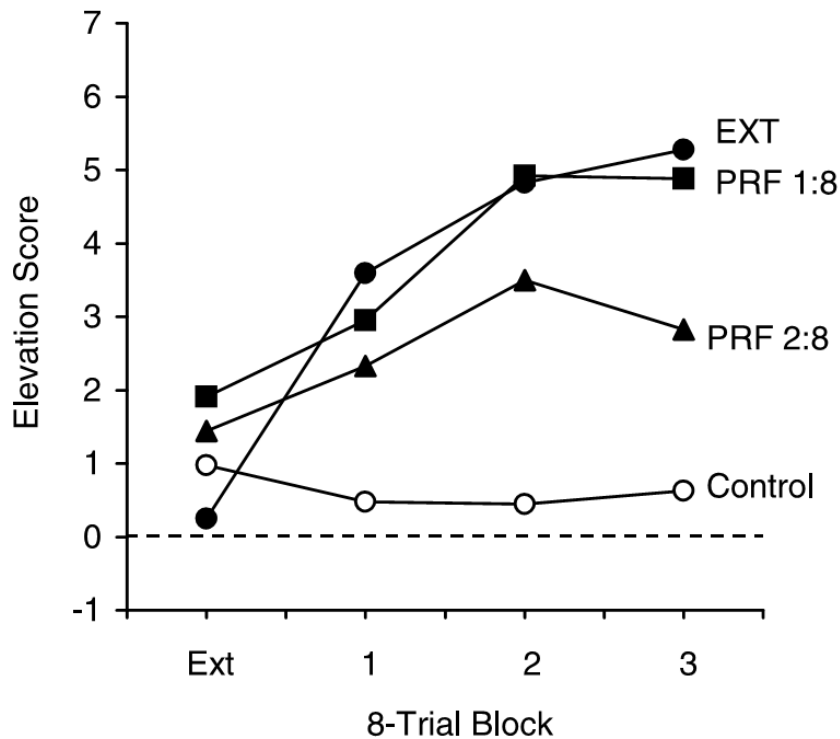
- Relapse phenomena:
 - Renewal, reinstatement, spontaneous recovery, rapid reacquisition...
- How to improve extinction?

Partial extinction slowed later reacquisition

- Bouton et al. (2004, 2007) found:
 - Reacquisition of a previously extinguished response (i.e., either conditioned or operant) slowed down when reinforced trials were included as part of the extinction treatment (i.e., partial extinction)
 - Partial extinction as a way to *mitigate* this form of relapse

Partial extinction slowed later reacquisition

- Bouton et al. (2004)'s results:
 - After conditioning and extinction phases, **reacquisition session in Experiment 1:**



From the extinction phase:

Extinction:

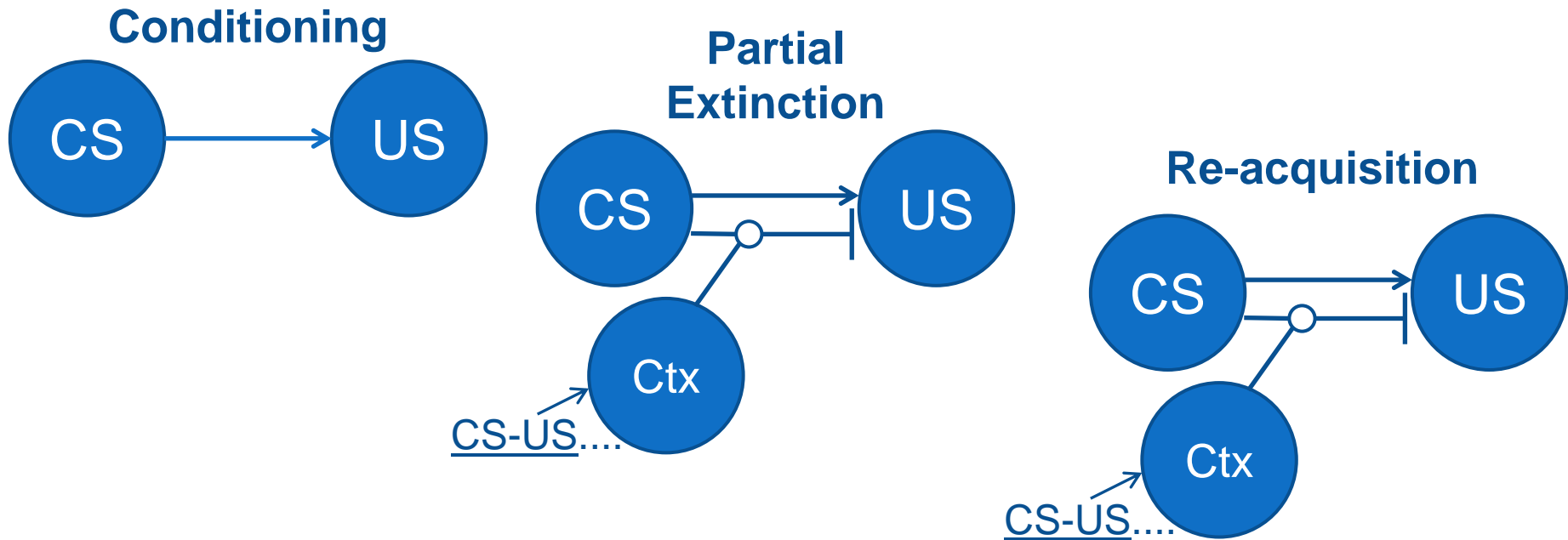
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Partial extinction:

→ CS- CS+ CS- CS- CS- CS- CS+ CS-

Why slowed reacquisition?

- Bouton's explanation:



Objective

- Will an equivalent slow reacquisition effect be found in human contingency learning?
 - In the aversive domain (a mild aversive noise)
 - Focusing on participants' beliefs about the extent to which they think the aversive noise will take place (cognitive component of a fear response)

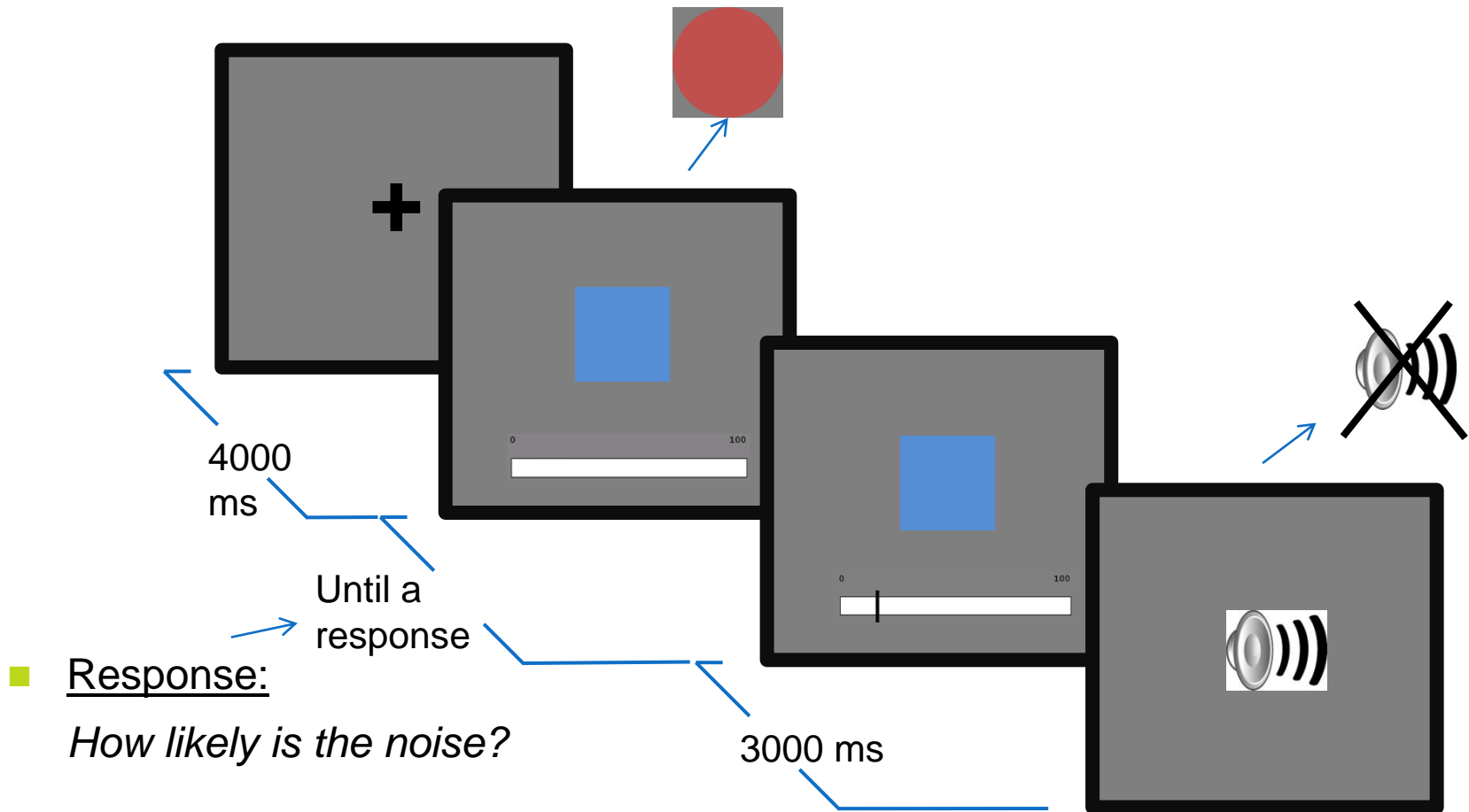
Experiment 1

■ Design:

Group	Acquisition	Extinction	Re-acquisition
Partial Extinction (22,2%)	A (18 +) B (18 -)	A (12 + / 42 -) B (54 -)	A (18 +) B (18 -)
Extinction	A (18 +) B (18 -)	A (54 -) B (54 -)	A (18 +) B (18 -)

- + Refers to a brief (500ms) mildly aversive noise (\cong 85dB)
- Refers to the absence of any stimulus)

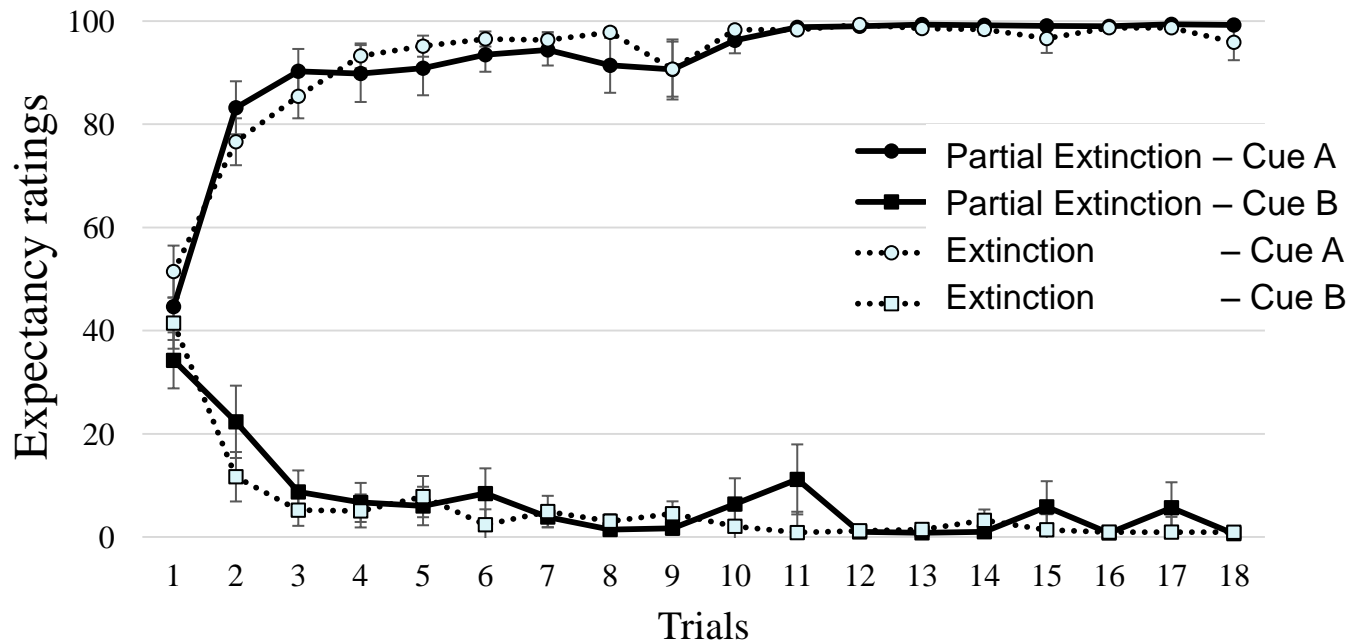
Contingency learning task



Results

n=49

■ Acquisition:

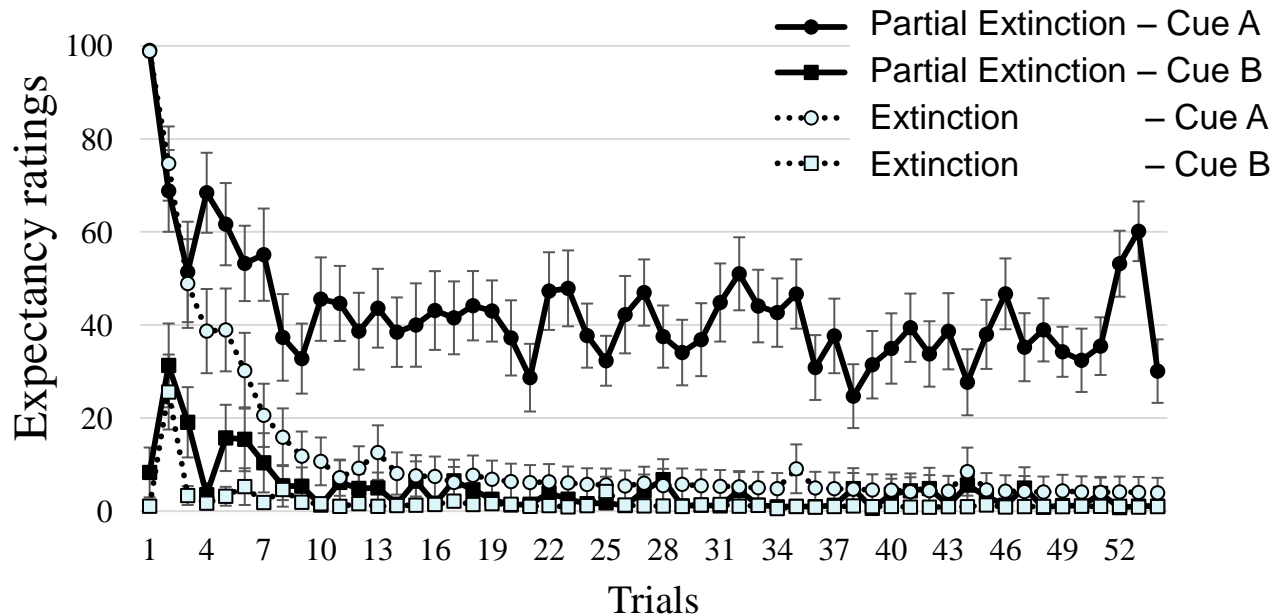


Cue x Trial, $F(5.23, 224.98) = 43.76$, $p < .001$, $\eta^2_p = .504$

Results

n=49

■ Extinction:



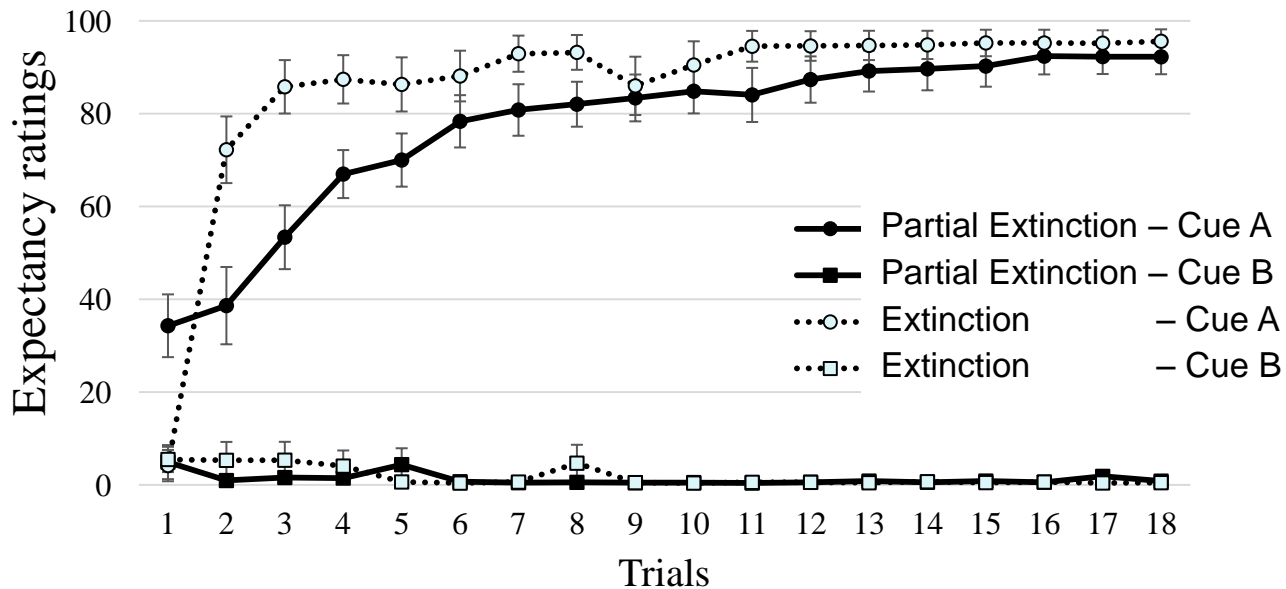
Group x Cue x Trial, $F(9.94, 427.69) = 2.52, p = .005, \eta^2_p = .055$

Within Cue A: Group x Trial, $F(11.86, 581.38) = 2.36, p = .006, \eta^2_p = .046$

Results

n=49

■ Re-acquisition:



Group x Cue x Trial, $F(6, 258.17) = 6.15, p < .001, \eta^2_p = .125$

Within Cue A: Group x Trial, $F(5.34, 229.87) = 8.09, p < .001, \eta^2_p = .158$

Discussion

- Extinction was complete in the Extinction but not in the Partial Extinction group
- Re-acquisition was slower in the Partial Extinction than in the Extinction group

Group	Acquisition	Extinction	Re-acquisition
Partial Extinction (22,2%)	A (18 +) B (18 -)	A (12 + / 42 -) B (54 -)	A (18 +) B (18 -)
Extinction	A (18 +) B (18 -)	A (54 -) B (54 -)	A (18 +) B (18 -)

- Would these re-acquisition results generalize to a more *uncertain* situation?

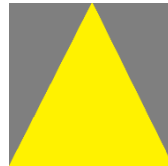
Experiment 2

■ Design:

Group	Acquisition	Extinction	Re-acquisition
Partial Extinction (12,5%)	A (7 + / 1 -) B (8 -) C (1 + / 7 -)	A (3 + / 21 -) B (24 -) C (3 + / 21 -)	A (10 +) B (10 -) C (9 + / 1 -)
Extinction	A (7 + / 1 -) B (8 -) C (1 + / 7 -)	A (24 -) B (8 -) C (3 + / 21 -)	A (10 +) B (10 -) C (9 + / 1 -)

■ Task as in Experiment 1:

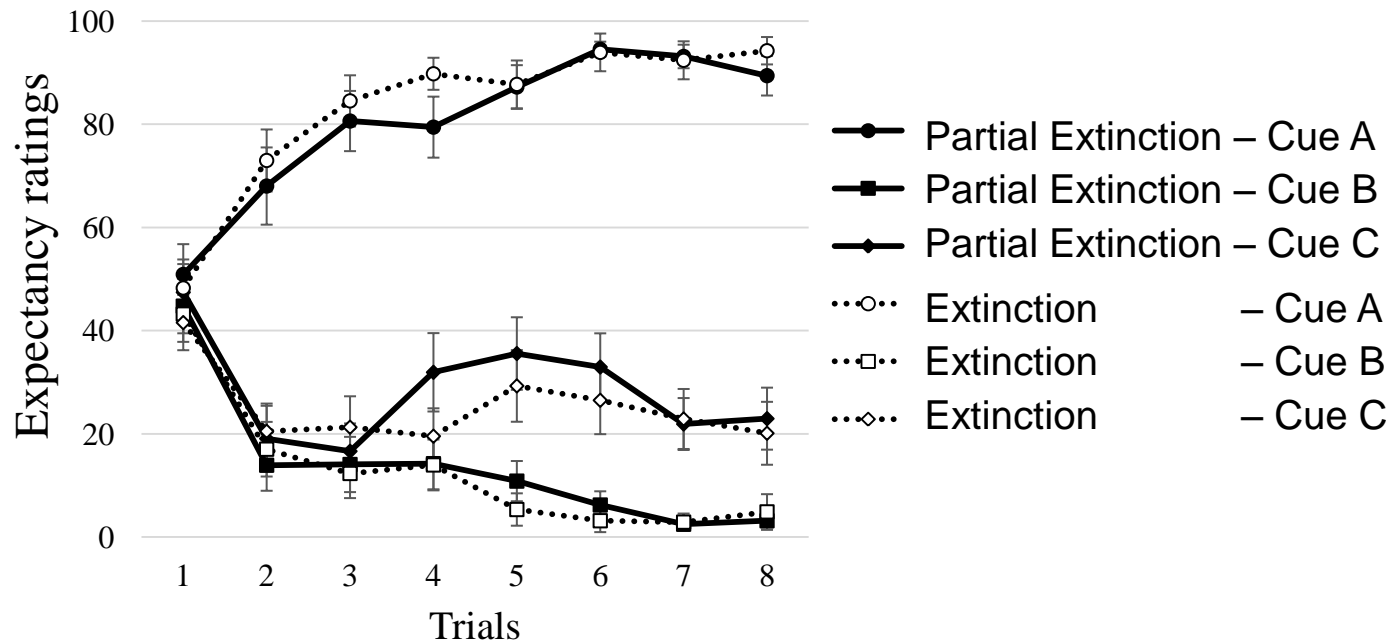
- Cue C was added



Results

n=59

■ Acquisition:

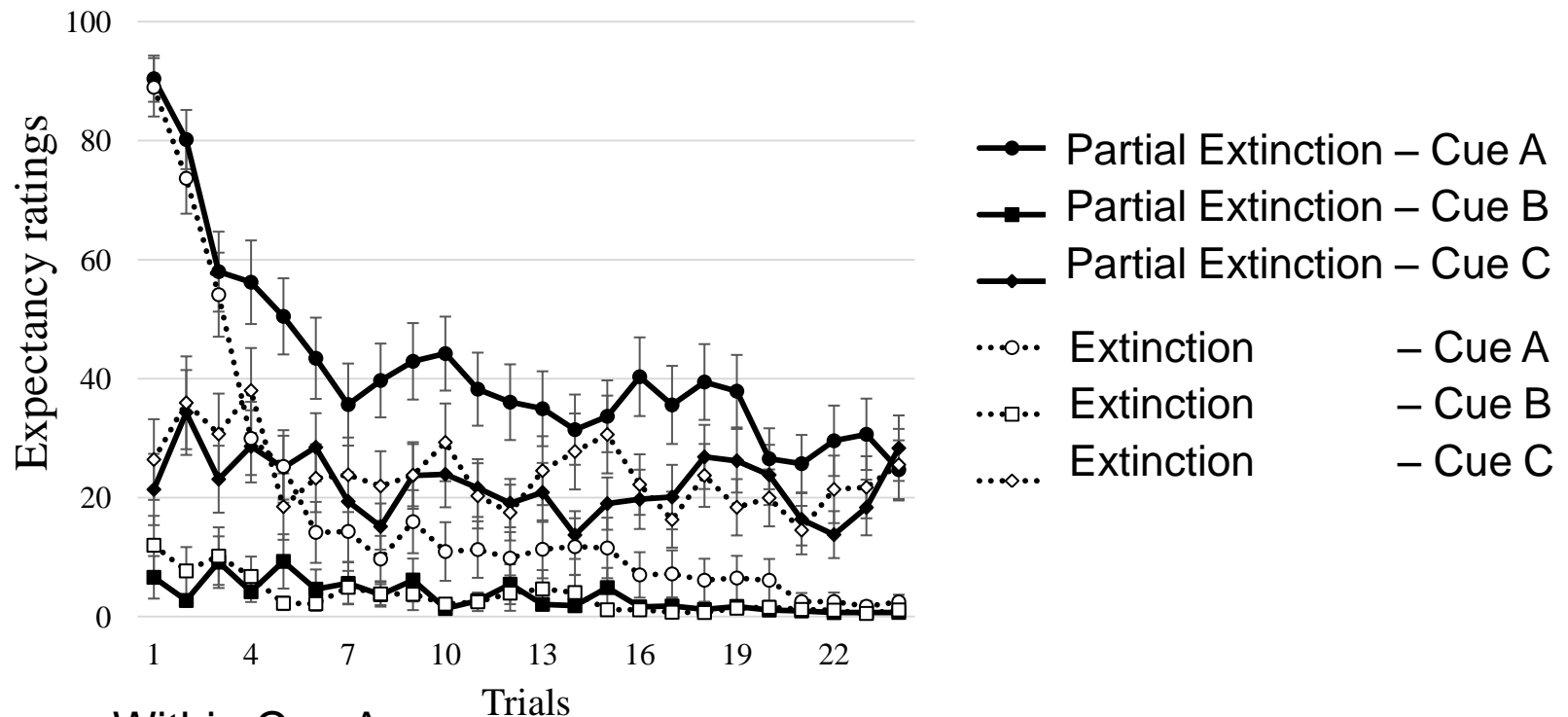


Cue x Trial, $F(7.82, 445.55) = 20.77, p < .001, \eta^2_p = .267$

Results

n=59

■ Extinction:



Within Cue A:

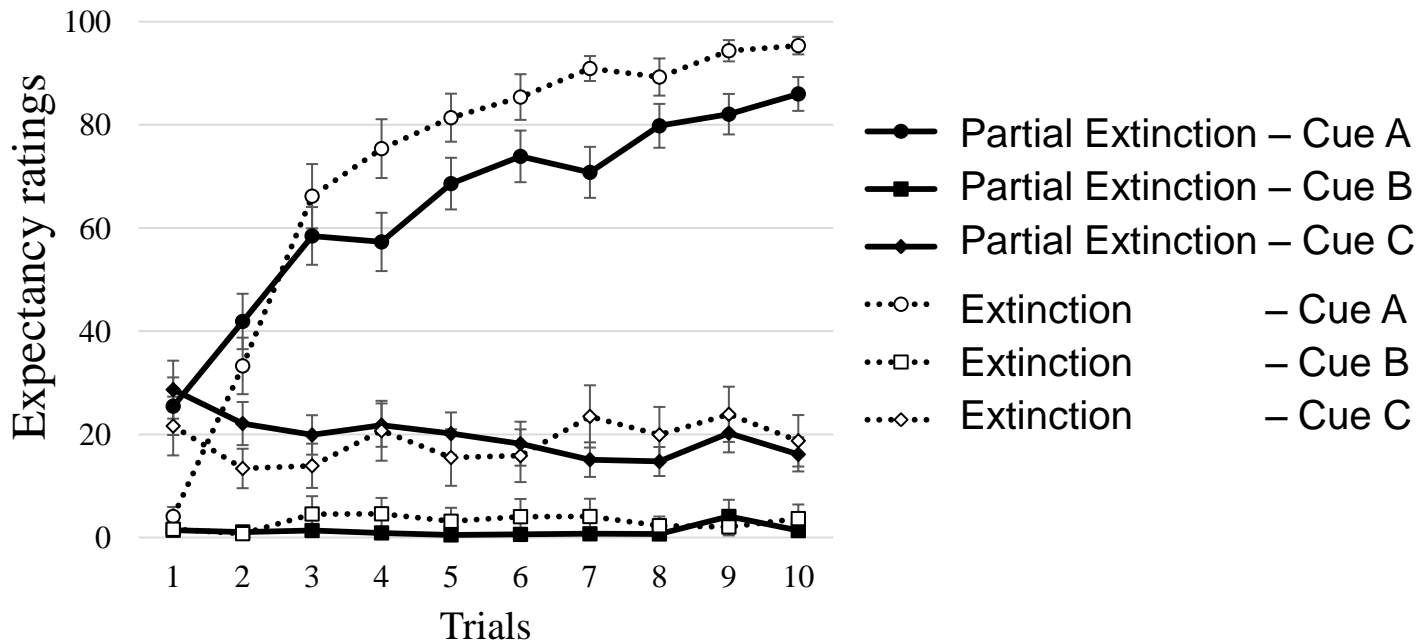
Group, $F(1, 57) = 27.39, p < .001, \eta^2_p = .325$

Group x Trial, $F(11.42, 651.11) = 1.92, p = .033, \eta^2_p = .033$

Results

n=59

■ Re-acquisition:



Group x Cue x Trial, $F(9.59, 546.4) = 2.27, p = .014, \eta^2_p = .038$

Within Cue A: Group x Trial, $F(5.02, 286.33) = 5.47, p < .001, \eta^2_p = .088$

Discussion

- Again, re-acquisition was slower in the Partial Extinction than in the Extinction group
 - And yet, in a more uncertain task; and reducing the number of reinforced trials in the partial extinction group
- As in Experiment 1, extinction was complete in the Extinction but not in the Partial Extinction group
- How to make extinction complete in the Partial Extinction group?

Experiment 3

■ Design:

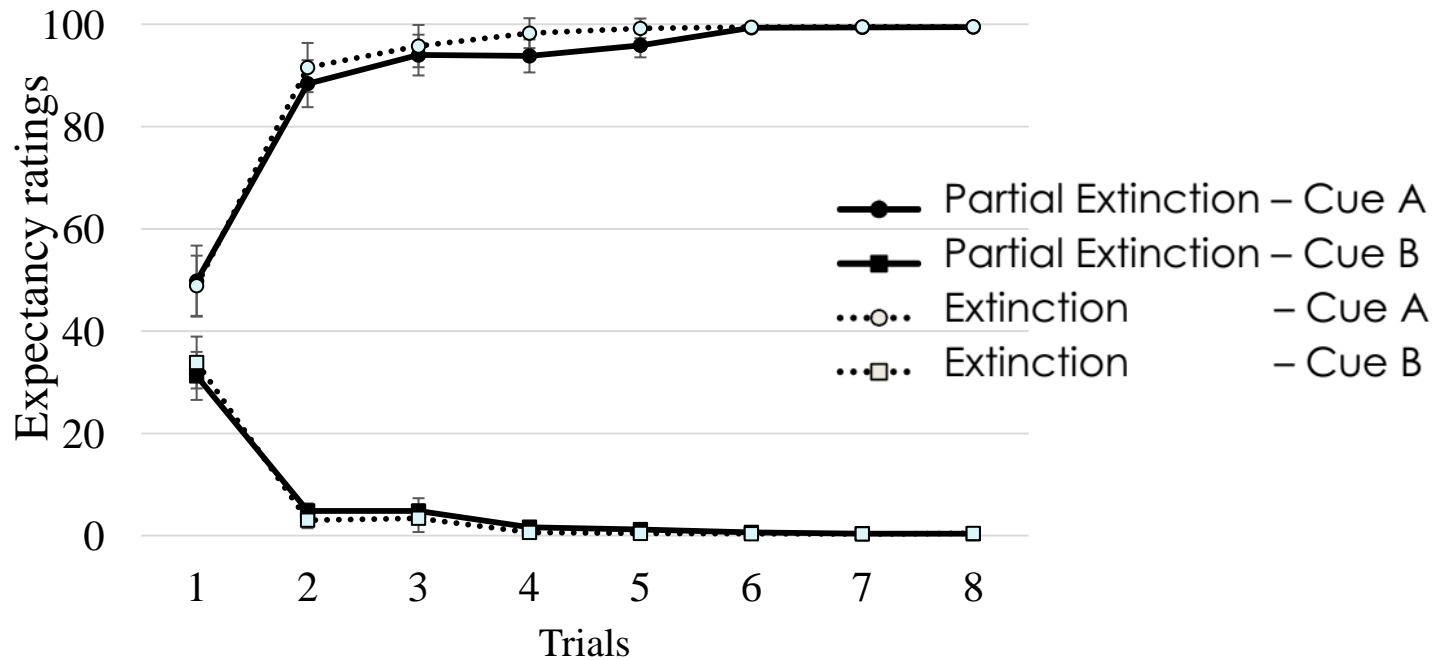
Group	Acquisition	Extinction	Re-acquisition
Partial Extinction	A (8 +) B (10 -)	A (9 + / 47 -) B (54 -)	A (10 +) B (10 -)
Extinction	A (10 +) B (8 -)	A (56 -) B (54 -)	A (10 +) B (10 -)

(9 + / 47 -):	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7
+	5	3	1	0	0	0	0
-	3	5	7	8	8	8	8
% Reinforced	62.5	37.5	12.5	0	0	0	0

Results

n=65

■ Acquisition:

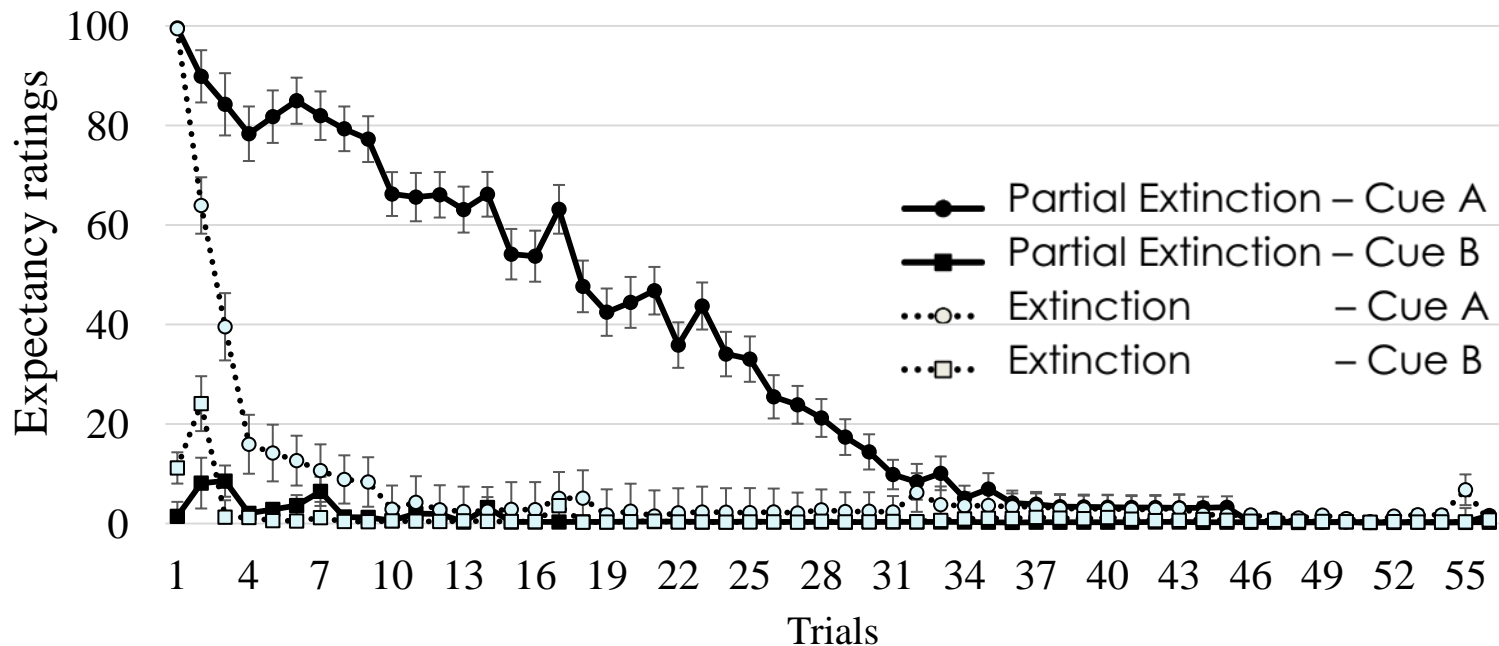


Cue x Trial, $F(2.87, 181.307) = 135.14, p < .001, \eta^2_p = .682$

Results

n=65

■ Extinction:



Within Cue A:

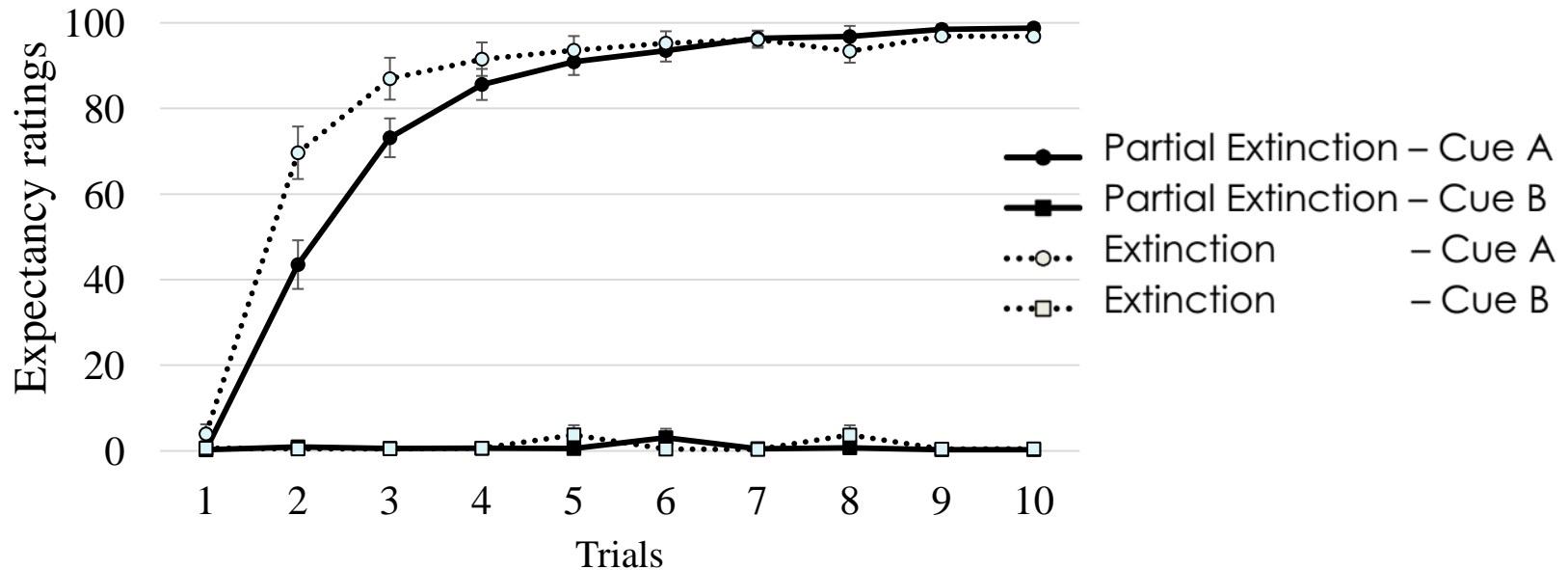
Group, $F(1, 63) = 250.94, p < .001, \eta^2_p = .799$

Group x Trial, $F(11.42, 651.11) = 29.92, p < .001, \eta^2_p = .033$

Results

n=65

■ Re-acquisition:



Group x Cue x Trial, $F(3.83, 243.3) = 5.27, p = .014, \eta^2_p = .038$

Trial 2 and Trial 3: $t(61.15) = 3.12, p = 0.003$ and $t(63) = 2.10, p = 0.04$

Discussion

- Extinction was also complete in the Partial Extinction group
- And still, the partial extinction treatment produced a slower reacquisition compared to a standard Extinction group

Conclusions

- Experiments 1-3 showed that partially reinforced extinction produced a slowed reacquisition effect compared to standard extinction, equivalent to the effect found in animal conditioning
- Experiment 2 showed that the effect could also be obtained in uncertain situations
- Experiment 3 showed that the effect could still be found even when extinction, prior to the re-acquisition phase, was complete in the Partial extinction group

Future directions

- Will the partially extinction effect generalize to more aversive situations or to other fear responses such judgments of fear, skin conductance, or startle responses?
- Will this form of *relapse reduction* generalize to the clinical domain?:
 - Will a scarce exposure to the feared stimulus in exposure-based therapies reduce relapse?

Thanks!



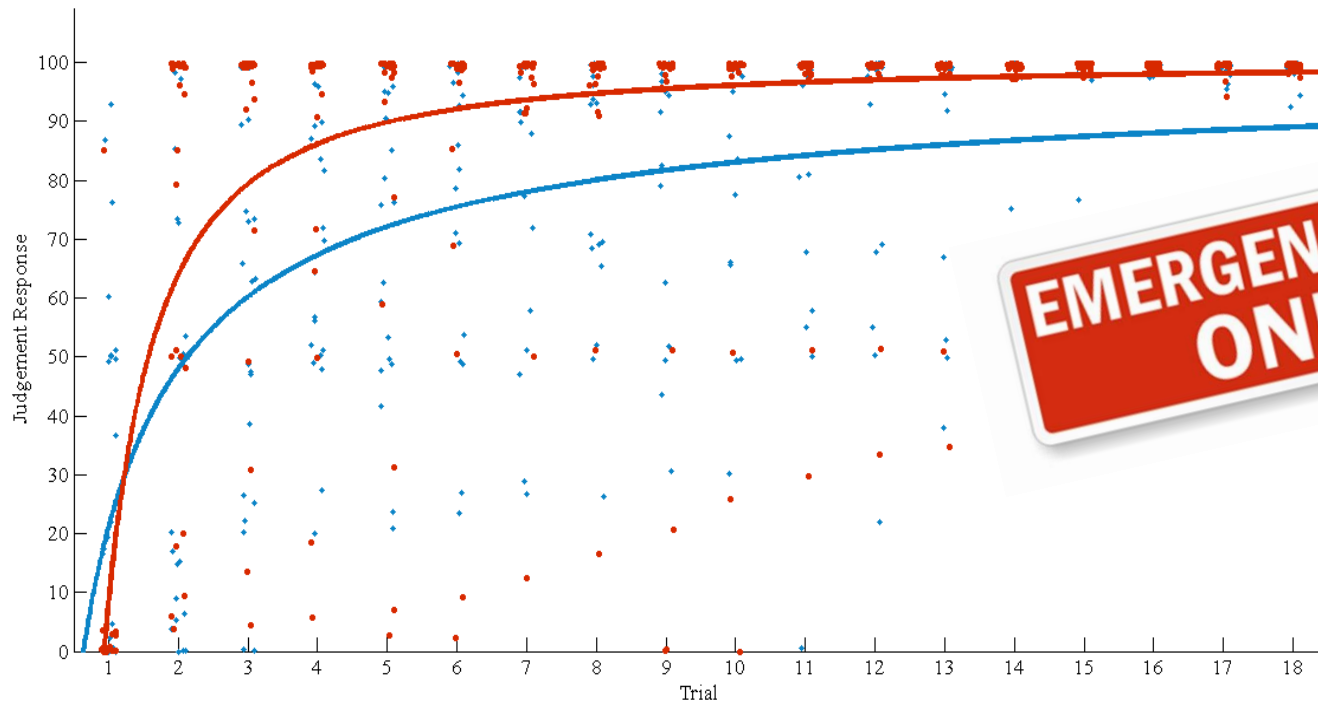
**KEEP
SMILING
BUT
KILL
The Dentist**



Best-fitting curve adjustment

■ Experiment 1 (n=49):

$$y = 100 - \left(\frac{100}{a + x^b} \right)$$



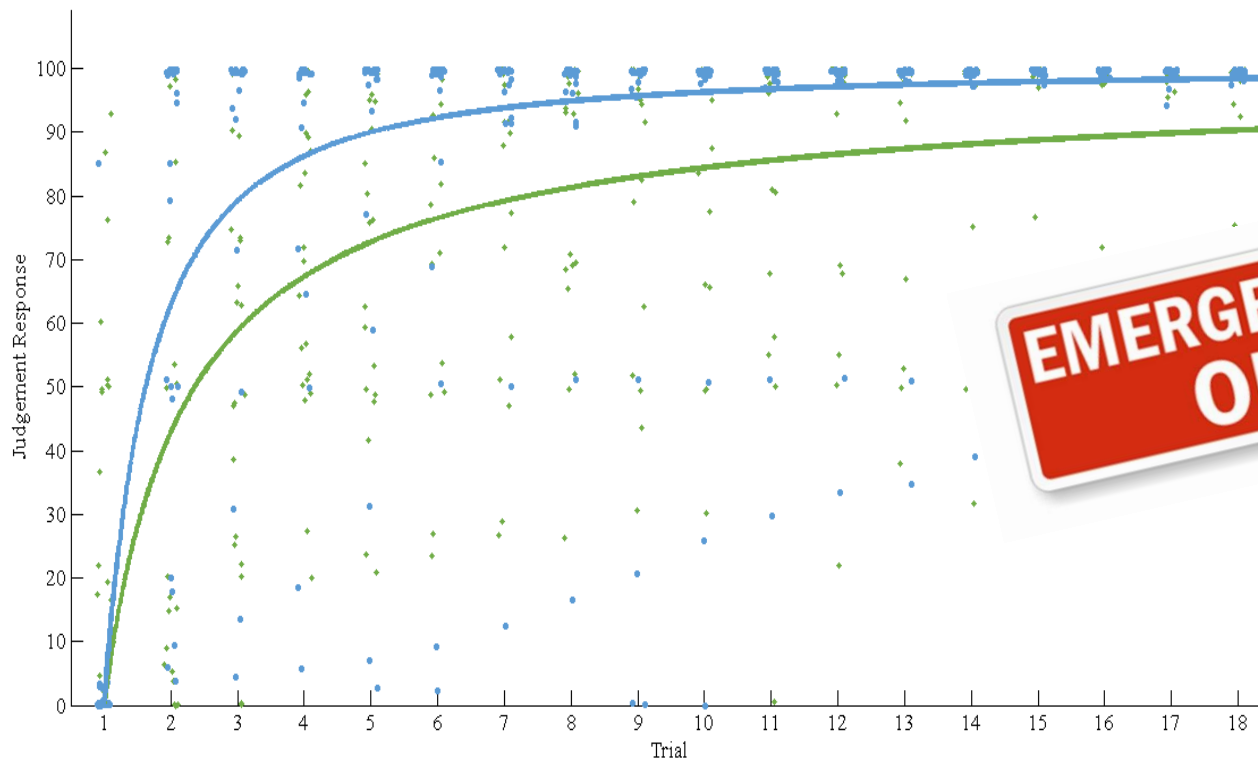
Partial Extinction: $a=0.363$; $b=0.759$

Extinction: $a=0.061$; $b=1.409$

Best-fitting curve adjustment

■ Experiment 2 (n=59):

$$y = 100 - \left(\frac{100}{a + x^b} \right)$$



Partial Extinction:

a=0.291; b=0.668

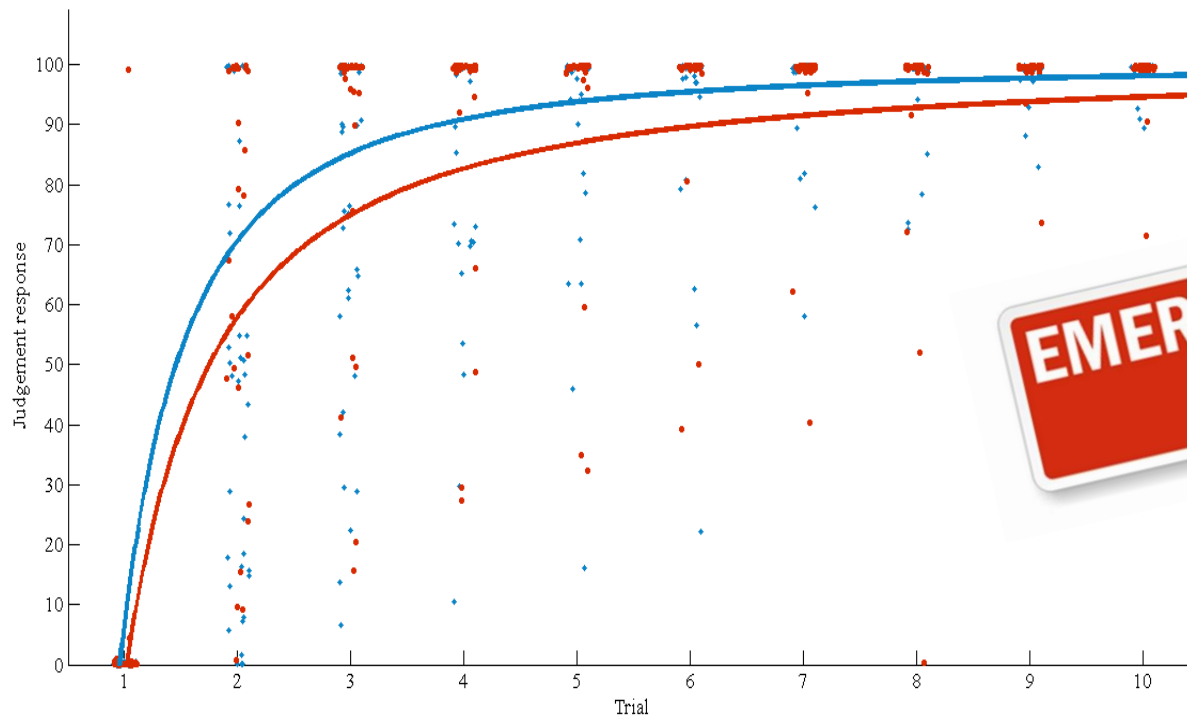
Extinction:

a=0.003; b=0.996

Best-fitting curve adjustment

■ Experiment 3 (n=65):

$$y = 100 - \left(\frac{100}{a + x^b} \right)$$



Partial Extinction:

a=-0.020; b=1.268

Extinction:

a=0.040; b=1.718