# The effect of experience and instructions on learned attentional biases

*Pedro L. Cobos, Miguel A. Vadillo*
*David Luque & Mike E. Le Pelley*

MINISTERIO DE CIENCIA E INNOVACIÓN

JUNTA DE ANDALUCIA

F.E.D.E.R.

UNIVERSIDAD DE MÁLAGA

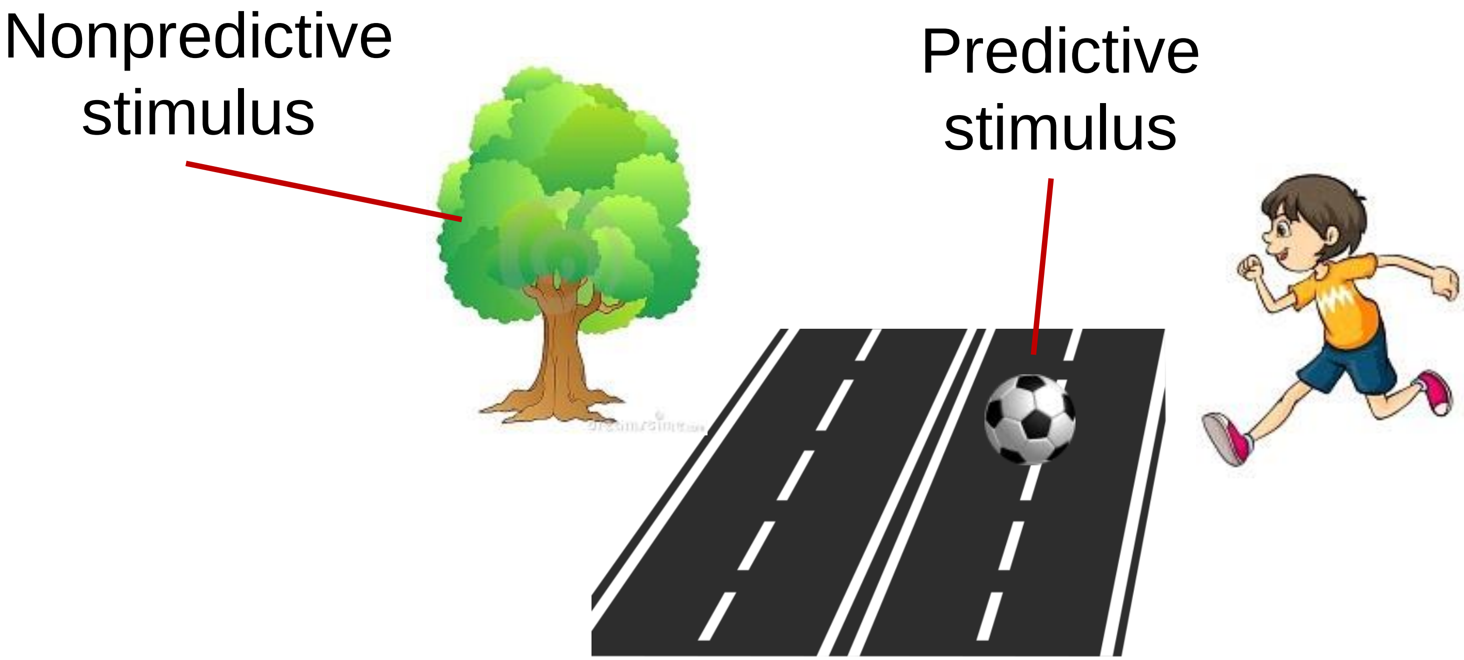
ibima Instituto de Investigación Biomédica de Málaga

Causal Cognition Group

SOCIEDAD ESPAÑOLA PSICOLOGÍA COMPARADA

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

# The relationship between predictive learning and attentional capture




We learn from experience which stimuli are predictive of relevant outcomes and which are nonpredictive

# The relationship between predictive learning and attentional capture

Selective attention prioritizes predictive over nonpredictive stimuli

We learn more about attended stimuli than about nonattended stimuli

# Our main concern

What mechanism underlies the effect of learned predictiveness on attentional capture?

| Top-down mechanism<br>Mitchell et al. (2012) | Bottom-up mechanism<br>Le Pelley et al. (2013) |
|---|---|
| Voluntary control of attention | Automatic control of attention |
| Based on reasoning processes | Triggered by stimulus properties |
| Can be flexibly altered | Rather inflexible |

## Evidence based on the effect of verbal instructions

Mitchell et al. (2012): The effect of learned predictiveness can be reversed through verbal instructions

| Instructions provided between learning phases 1 and 2 | |
|---|---|
| **Continuity group** | **Change group** |
| Those stimuli that were predictive during Phase 1 will *continue to be predictive* during Phase 2 | Those stimuli that were predictive during Phase 1 will *be nonpredictive* during Phase 2 |

# Evidence based on the effect of verbal instructions

Mitchell et al. (2012)

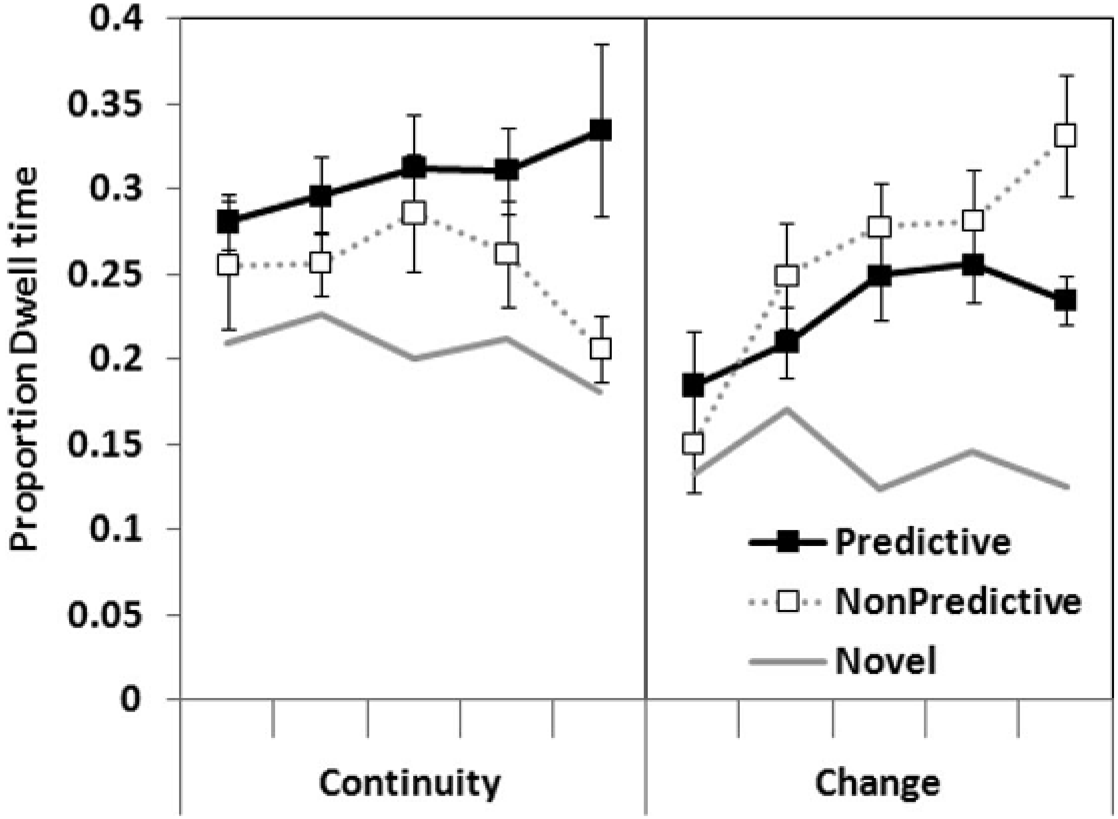



*Figure 7.* Mean proportion dwell-time values from Phase 2 of Experiment 2 for both the continuity (left panel) and the change (right panel) groups. Error bars are standard error of the mean.

# Evidence based on the effect of verbal instructions

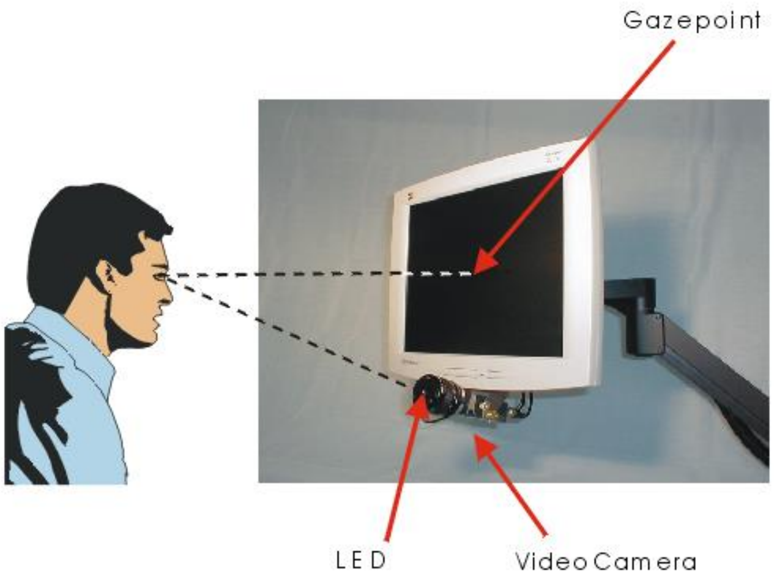
Mitchell et al. (2012) concluded that:

The effect of learned predictiveness on attentional capture is better explained by a top-down mechanism of selective attention.

Bottom-up processes play no role in the effect of learned predictiveness on attentional capture.

# A possible limitation of Mitchell et al.'s (2012) study

The amount of time spent looking at each stimulus may be insensitive to bottom-up processes of attentional capture.




Limited to overt attention.

Insensitive to fast, covert attentional shifts.

# The aim of our study

To test the effect of instructions and learned predictiveness on attentional capture by using an attentional measure more sensitive to fast, covert attentional shifts.

Attentional capture was measured by using a dot probe task embedded within training trials.

# Method

## Design

| **Learning phase 1** | | | | |
|---|---|---|---|---|
| *A*C-1<br>*A*D-1<br>*B*C-2<br>*B*D-2 | | | | |

*Note*: Italic letters stand for stimuli that were predictive during Phase 1; bold letters stand for stimuli instructed as relevant.

# Method

## Design

| Learning phase 1 | Instructions | | | |
|---|---|---|---|---|
| *A*C-1<br>*A*D-1<br>*B*C-2<br>*B*D-2 | From now on, the only relevant figures to predict the correct category will be A, D, F, and G | | | |

*Note*: Italic letters stand for stimuli that were predictive during Phase 1; bold letters stand for stimuli instructed as relevant.

# Method

## Design

| Learning phase 1 | Instructions | Learning phase 2 | | |
|---|---|---|---|---|
| *A*C-1<br>*A*D-1<br>*B*C-2<br>*B*D-2 | From now on, the only relevant figures to predict the correct category will be A, D, F, and G | Old stimuli<br>***A***C-3<br>*B***D**-4 | | |
| | | New stimuli<br>E**F**-3<br>**G**H-4 | | |
| | | Fillers<br>IJ-3<br>KL-4 | | |

*Note*: Italic letters stand for stimuli that were predictive during Phase 1; bold letters stand for stimuli instructed as relevant.

# Method

## Design

| Learning phase 1 | Instructions | Learning phase 2 | Judgements | |
|---|---|---|---|---|
| *AC*-1<br>*AD*-1<br>*BC*-2<br>*BD*-2 | From now on, the only relevant figures to predict the correct category will be A, D, F, and G | Old stimuli<br>***A***C-3<br>*B***D**-4<br><br>New stimuli<br>E**F**-3<br>**G**H-4<br><br>Fillers<br>IJ-3<br>KL-4 | Rate the extent to which you think that the following figure predicts category 3 (or 4):<br>***A***? *B*? C? **D**?<br>E? **F**? **G**? H? | |

*Note*: Italic letters stand for stimuli that were predictive during Phase 1; bold letters stand for stimuli instructed as relevant.

# Method

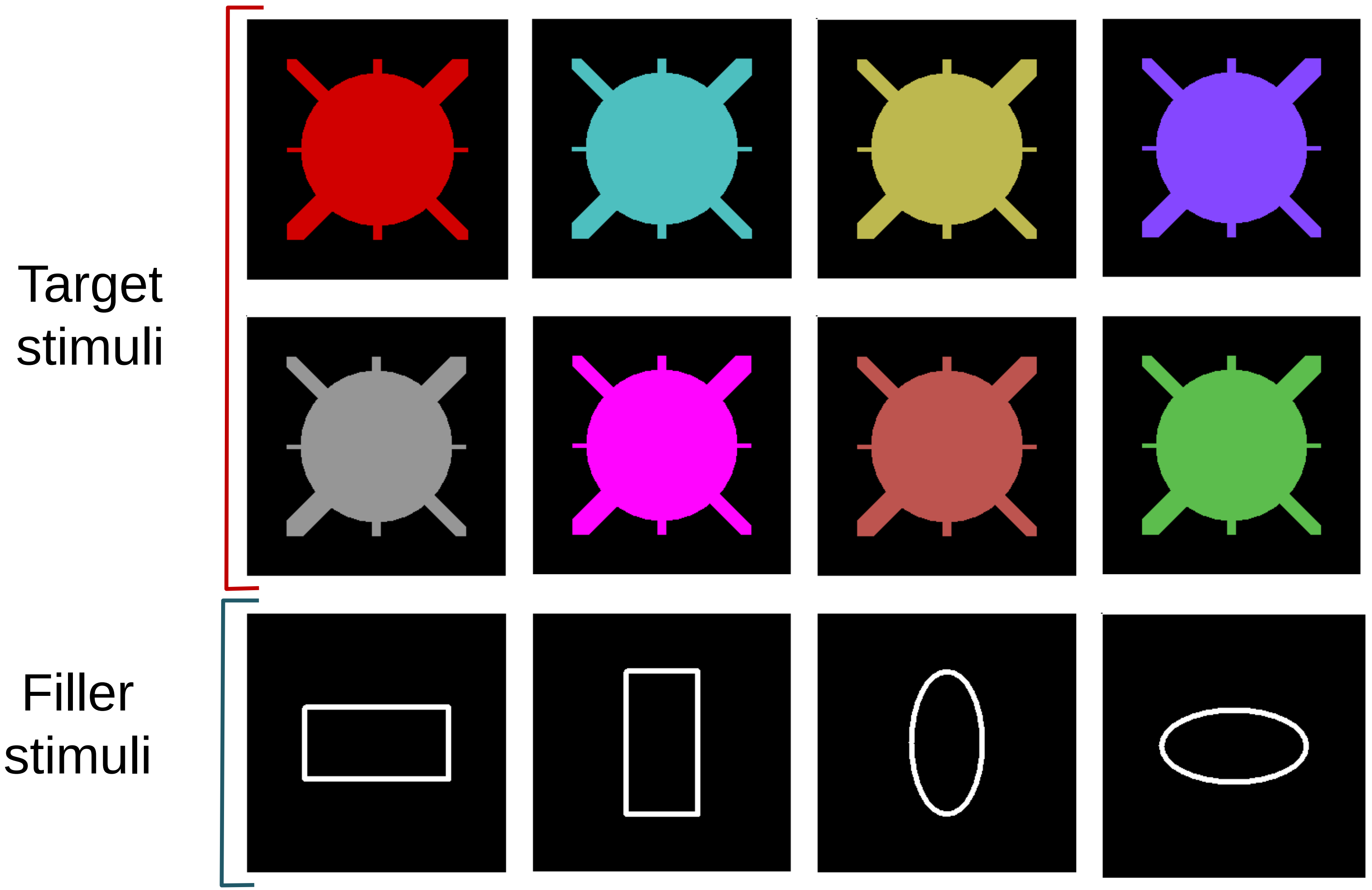
## Design

| Learning phase 1 | Instructions | Learning phase 2 | Judgements | Memory test |
|---|---|---|---|---|
| *AC*-1<br>*AD*-1<br>*BC*-2<br>*BD*-2 | From now on, the only relevant figures to predict the correct category will be A, D, F, and G | Old stimuli<br>***A***C-3<br>*B***D**-4<br><br>New stimuli<br>E**F**-3<br>**G**H-4<br><br>Fillers<br>IJ-3<br>KL-4 | Rate the extent to which you think that the following figure predicts category 3 (or 4):<br>***A***? *B*? C? **D**?<br>E? **F**? **G**? H? | Rate the extent to which you think that the following figure was instructed as relevant:<br>***A***? *B*? C? **D**?<br>E? **F**? **G**? H?<br>I? J? K? L? |

*Note*: Italic letters stand for stimuli that were predictive during Phase 1; bold letters stand for stimuli instructed as relevant.

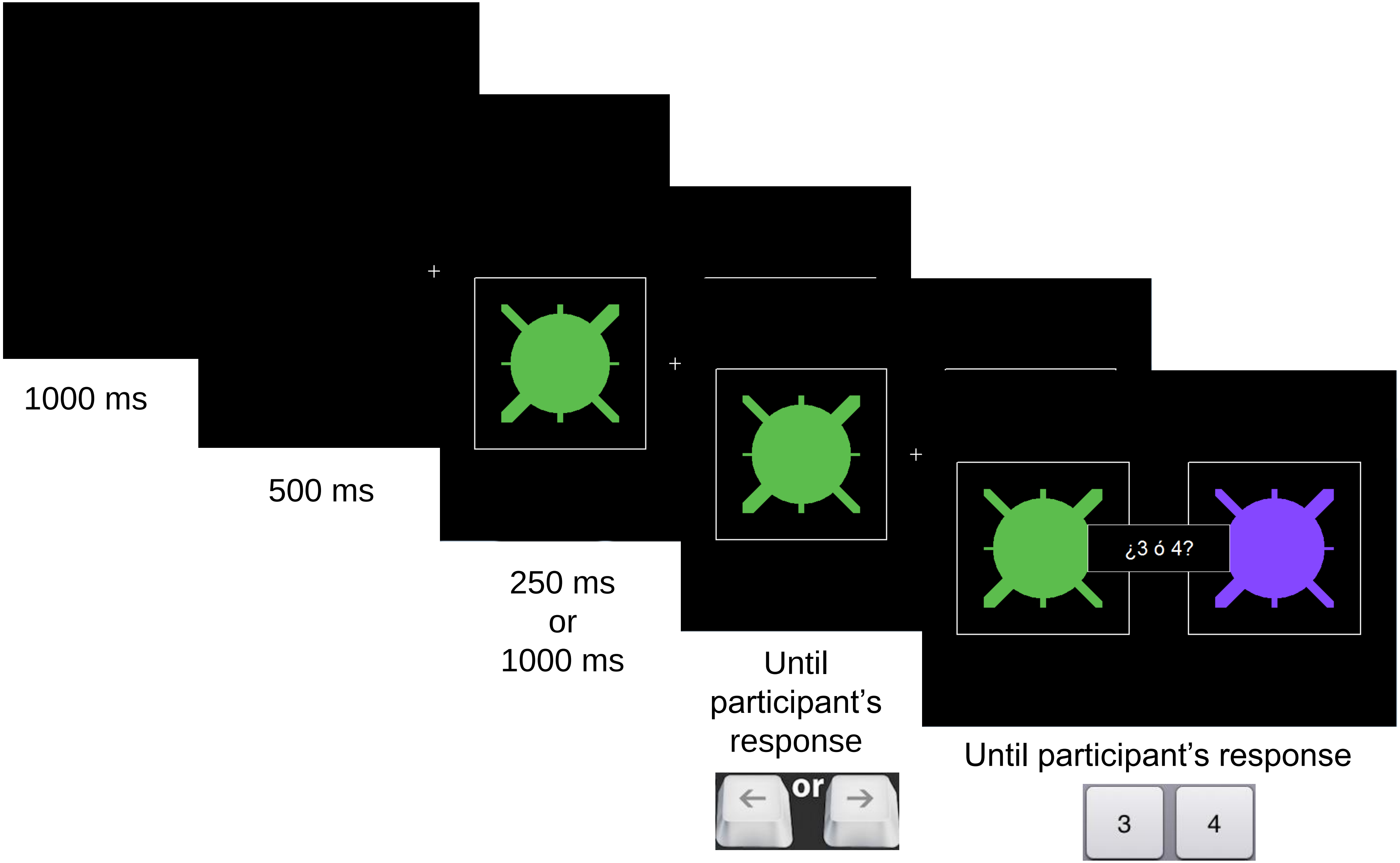
# Method

## Stimuli



# Method

## Procedure

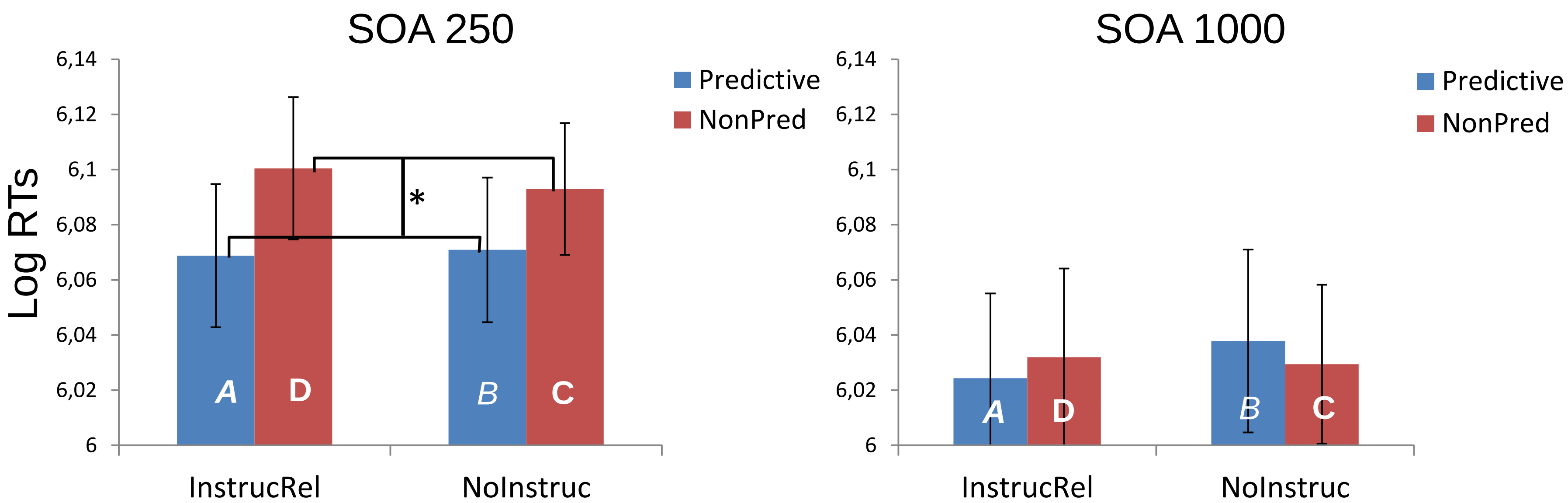


# Results

## Learning phase 2: RTs in the dot probe task (old stimuli)

N = 122

### Compounds in learning phase 2: AC BD




Predictiveness x SOA: $F(1, 120) = 3.37$, $p = .069$

**SOA 250**

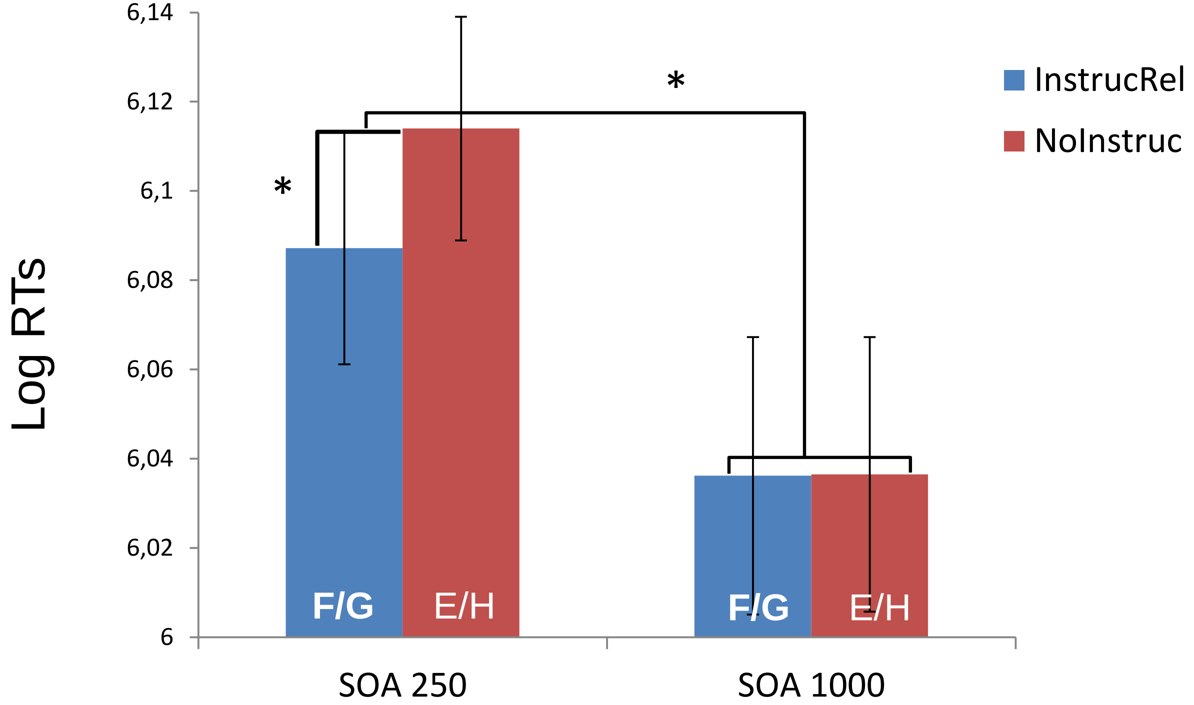
Predictiveness: $F(1, 62) = 6.6$, $p = .013$

# Results

## Learning phase 2: RTs in the dot probe task (new stimuli)

### Compounds in learning phase 2: EF GH

N = 122




Instructed relevance x SOA: F(1, 120) = 2.59, p = .110

SOA: F(1, 120) = 2.76, p = .022

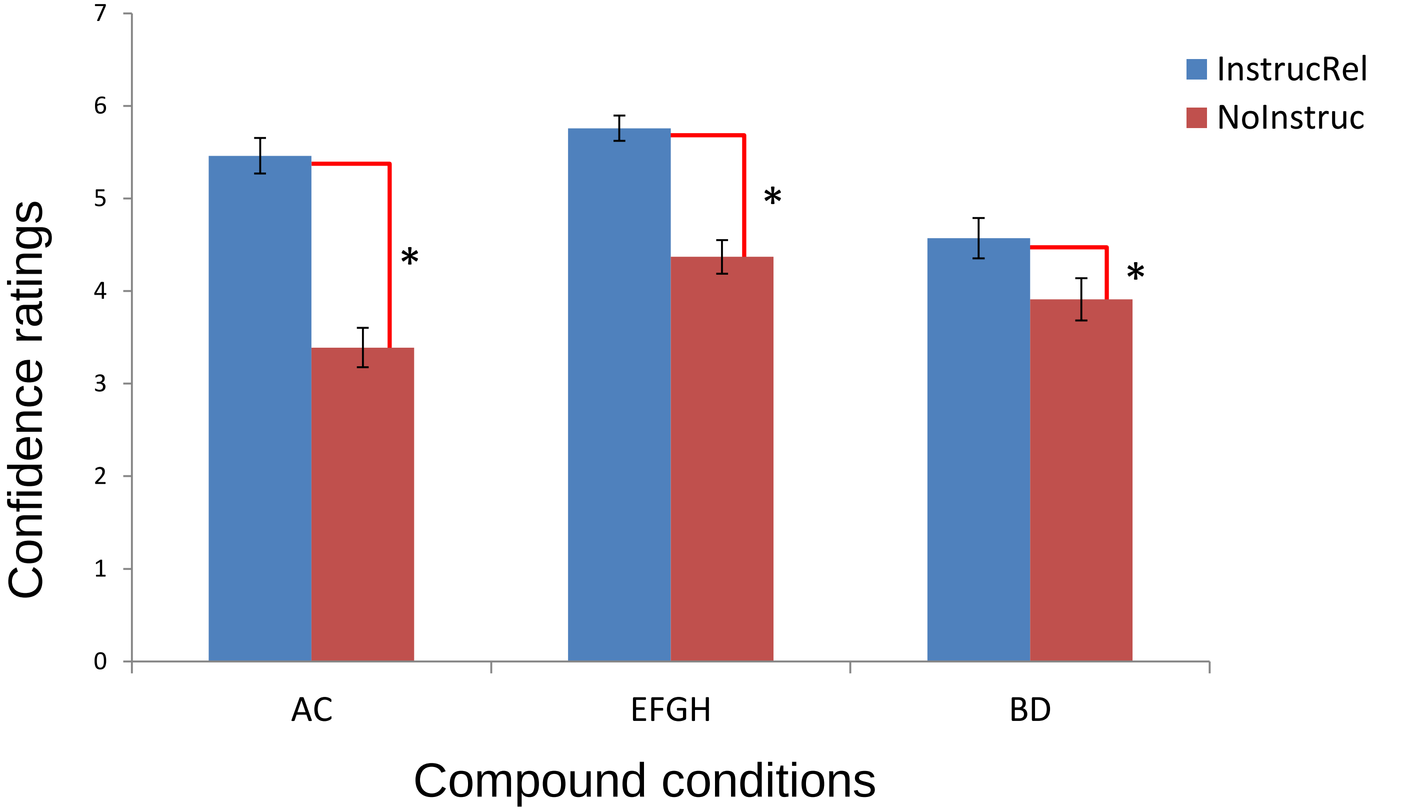
**SOA 250**

Instructed relevance: F(1, 62) = 5.43, p = .023

# Results

## Memory of instructions

N = 122




Instructed relevance: F(1, 121) = 65.59, p < .001
Compound: F(2, 242) = 11, p < .001
Instructed relevance x Compound: F(2, 242) = 8.41, p < .001

# Discussion

Learned predictiveness produced a covert attentional bias towards predictive stimuli a very few milliseconds after the onset of stimuli. This effect vanished quickly.

- The results from the dot probe revealed an attentional bias only when an SOA of 250 ms was used.

Instructions could not revert or even modulate the effect of learned predictiveness.

- But an attentional bias due to instructions was found for new stimuli that did not form part of any previous learning experience, which is consistent with previous demonstrations of top-down influences on rapid attentional capture (see Nordfang, Dyrholm, & Bundesen, 2012, JEP:G).

Our results suggest that the learned predictiveness effect on attentional capture is (to great extent) produced by bottom-up processes out of participants' volitional control.

Thank you