



# Bistable Perception Modulated by Conditioned Fear for Invisible Stimuli

\*Ji-Eun Kim, Seung-A Lee & Chai-Youn Kim  
Department of Psychology, Korea University

ANS 2012

Contact Information  
blessedpond@gmail.com  
Anam-dong, Seongbuk-Gu  
Seoul, 136-701, Korea

## Background

Previously, we showed that perceptual awareness during bistable perception is affected by fear conditioning [1]. Specifically, a visual interpretation associated with an aversive electrical stimulation (CS+) predominated over another visual interpretation not associated with stimulation (CS-) for observers who showed their heart rate modulation during conditioning. Moreover, that change in bistable perception after the fear conditioning was positively correlated with participants' state anxiety score.

## Question

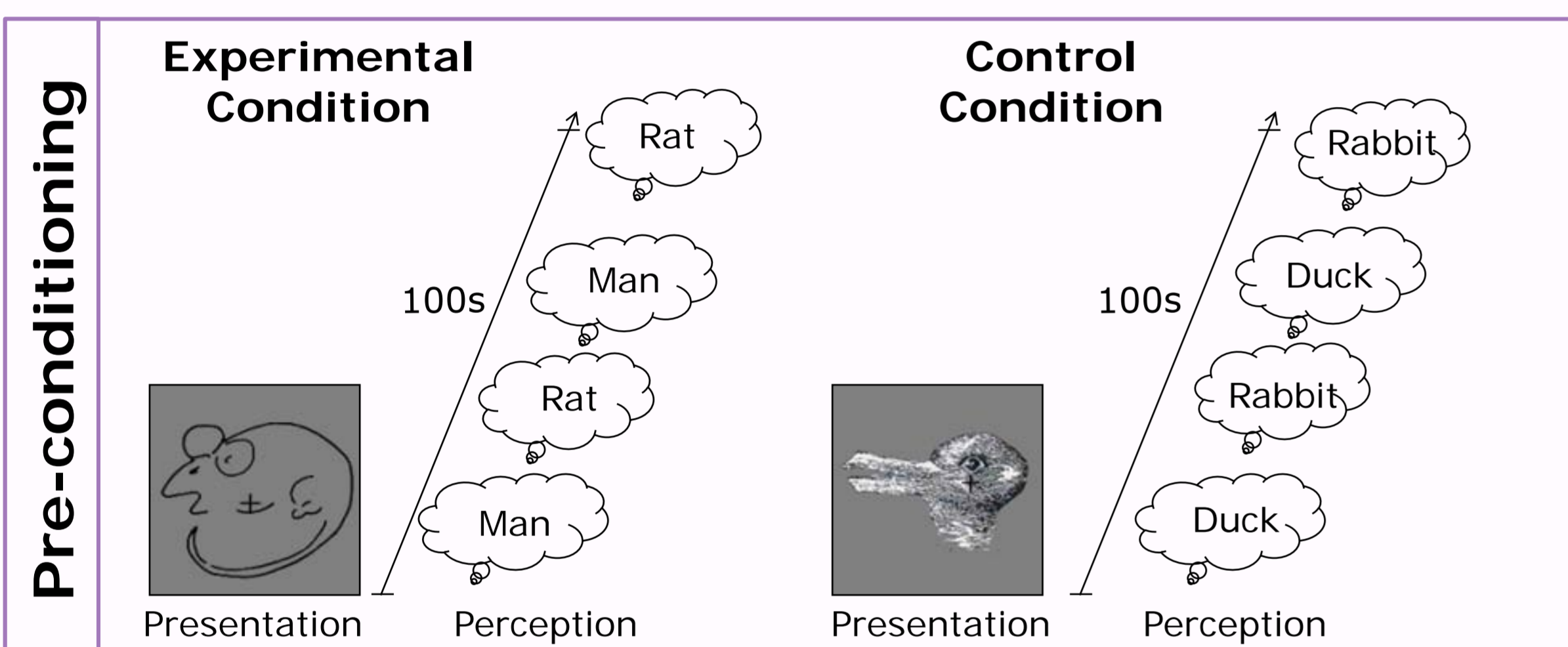
We investigated whether changes in bistable perception can be influenced by invisibly conditioned fear using continuous flash suppression (CFS) method [2].

## Conclusion

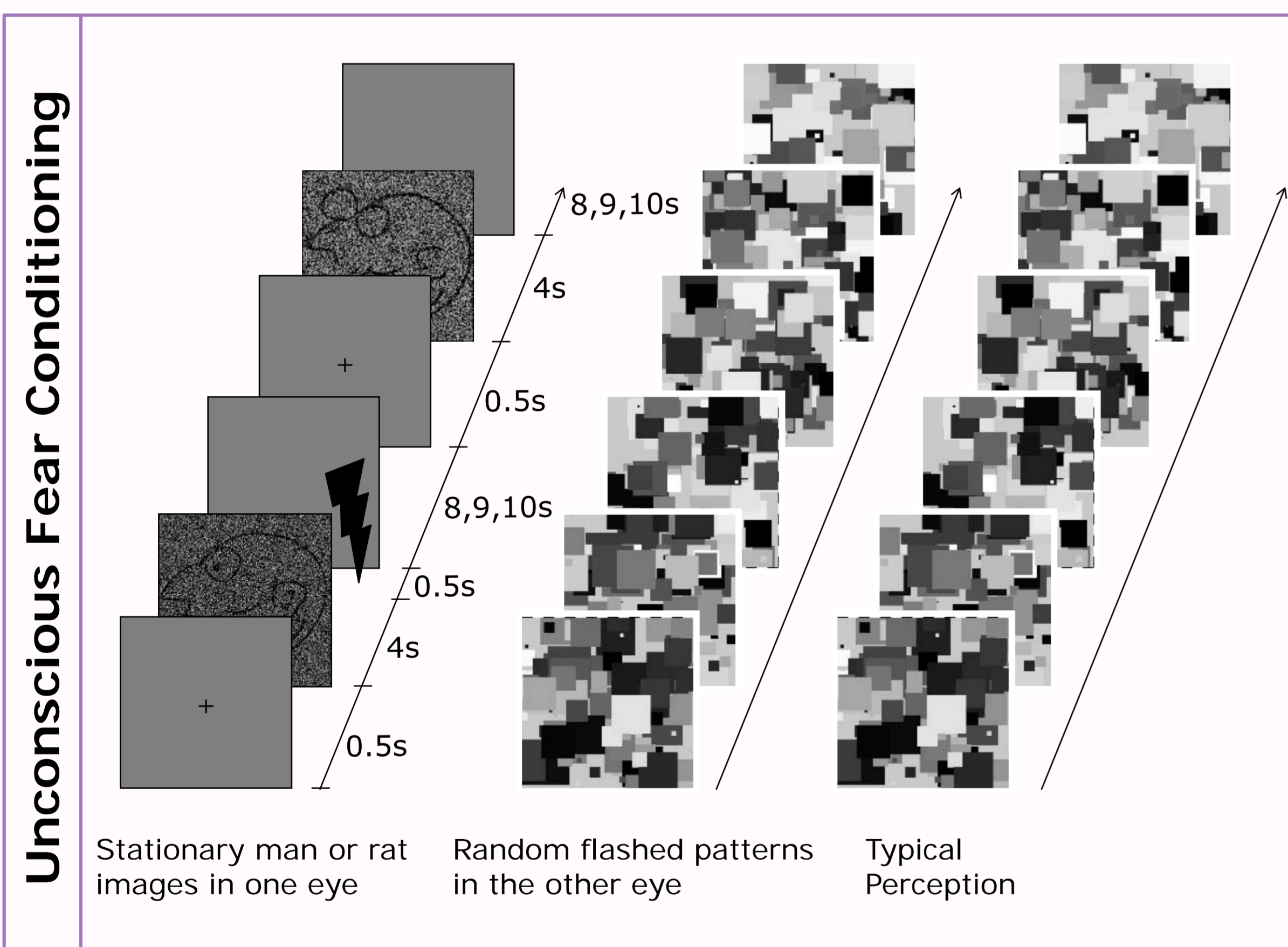
For observers who showed fear conditioning effect (indexed by large difference of heart rate in response to unpaired CS+ and CS-) as well as high anxiety scores, visual awareness during bistable perception is modulated by invisibly conditioned fear.

## Methods

Observers: 45 young observers (23 female, 22 male).  
Design: - Pre-Conditioning Bistability  
- Unconscious Fear Conditioning  
- Post-Conditioning Bistability

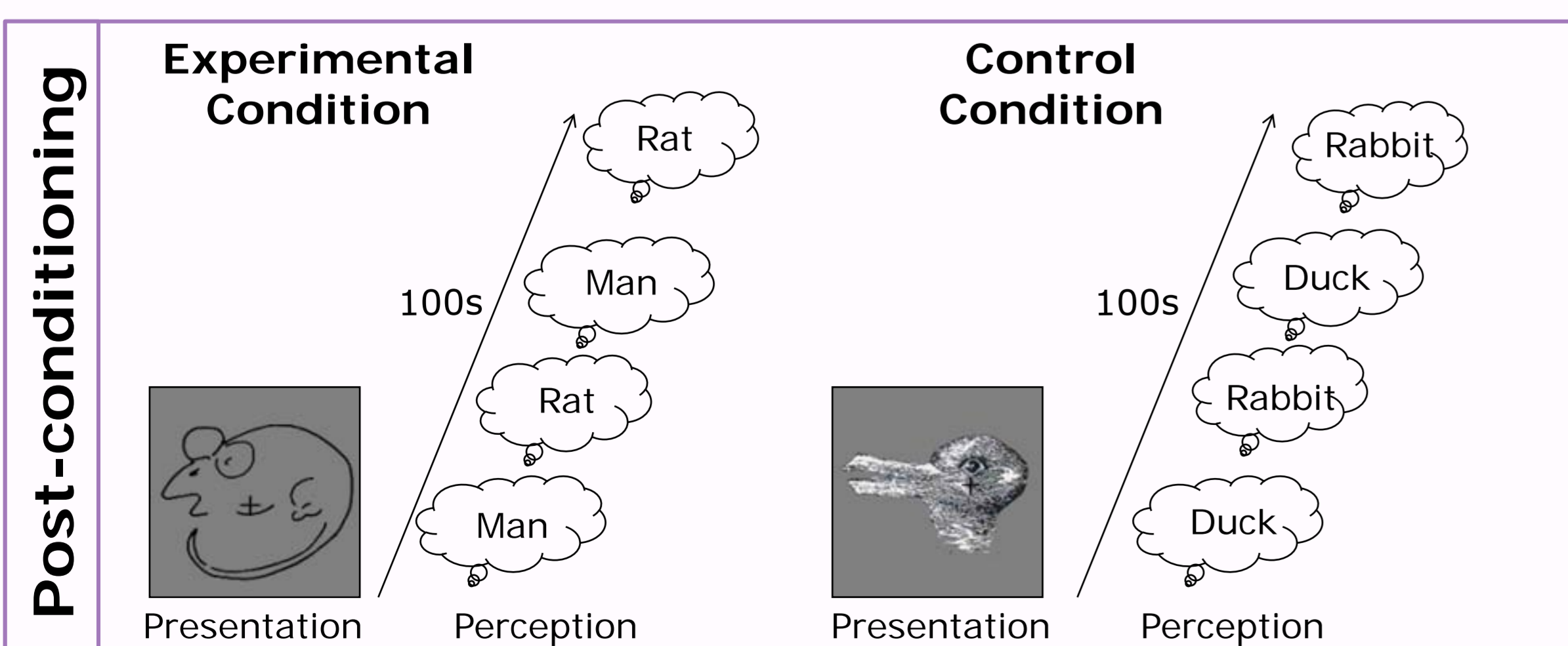


- **Stimuli** :  
Man/Rat (Experimental)  
Duck/Rabbit (Control)  
ambiguous figures  
- **Trial Duration** :  
100sec  
- **Trial Number** :  
6 of each figure \* 2 = 12  
- **Response** : pressing one of two buttons continuously during perception.



- **Stimuli**  
one eye: Man/Rat unambiguous figures (20% gaussian noised)  
the other eye: gray random flashed patterns (10Hz)  
- **Trial Number** : 36  
Paired CS+: 12  
Unpaired CS+: 12  
CS-: 12 (50% CS-US contingency)  
- **Response** :  
2-AFC discrimination task:  
Man or Rat?  
In case of seeing flashed patterns: pressing any key of man or rat.  
=> The averaged correct rate of all the observers was 0.61 (no significant difference from chance level)

- CS : Man or Rat figure  
US : Electrical shock



- Same as in pre-conditioning bistability test.

## Results

### 1. Grouping Participants

**Median Difference of Heart Rate :**  
Median (|HR<sub>unpaired CS+</sub> - HR<sub>CS-</sub>|)  
= 0.90 (BPM)

**Conditioned Group :**

|HR<sub>unpaired CS+</sub> - HR<sub>CS-</sub>| > Median Diff.

**Unconditioned Group :**

|HR<sub>unpaired CS+</sub> - HR<sub>CS-</sub>| < Median Diff.

### 2. Changes in Bistable Perception after Unconscious Fear Conditioning

**[Total Dominance]**

The sum of incidences of exclusive perception.

**[Mean Dominance]**  
Mean duration of incidences of exclusive perception.

**[Frequency]**

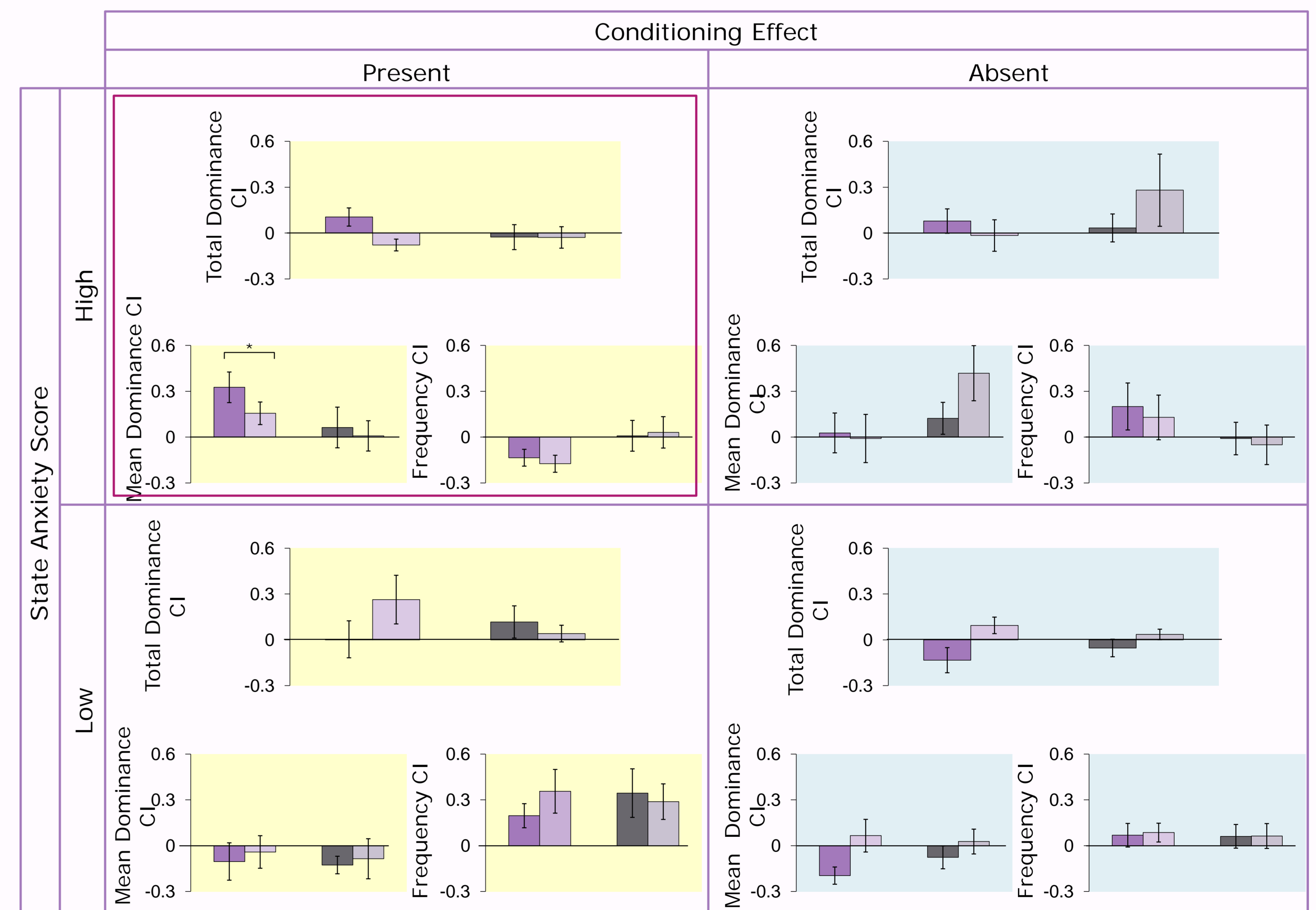
The number of alternations.

**[Change Index (CI)]**

$$= \frac{\text{Post} - \text{Pre}}{\text{Pre}}$$

**[Bar Graph Legend]**

CS+ (purple), CS- (light purple) (Experimental)  
Duck (dark gray), Rabbit (light gray) (Control)



- In the conditioned group with high anxiety score (top), Mean Dominance for CS+ increased more than that for CS- after unconscious fear conditioning ( $p < 0.05$ ). The difference between Total Dominance for CS+ and that for CS- was marginally significant ( $p = 0.08$ ).

- In the conditioned group with low anxiety score (bottom), conditioned modulation of bistable perception was not found.

- Overall, duck/rabbit (control) stimulus elicited no changes in bistable perception after unconscious fear conditioning for man or rat.

- In the unconditioned group, regardless of state-anxiety score, conditioned modulation of bistable perception was not found.

## Acknowledgement

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education, Science and Technology (2011-0027274)

## Reference

[1] Kim, Lee, Kang & Kim (2010), *VSS*. [2] Tsuchiya & Koch (2005), *Nature Neuroscience*.