

# Negative emotional stimuli enhance vestibular processing

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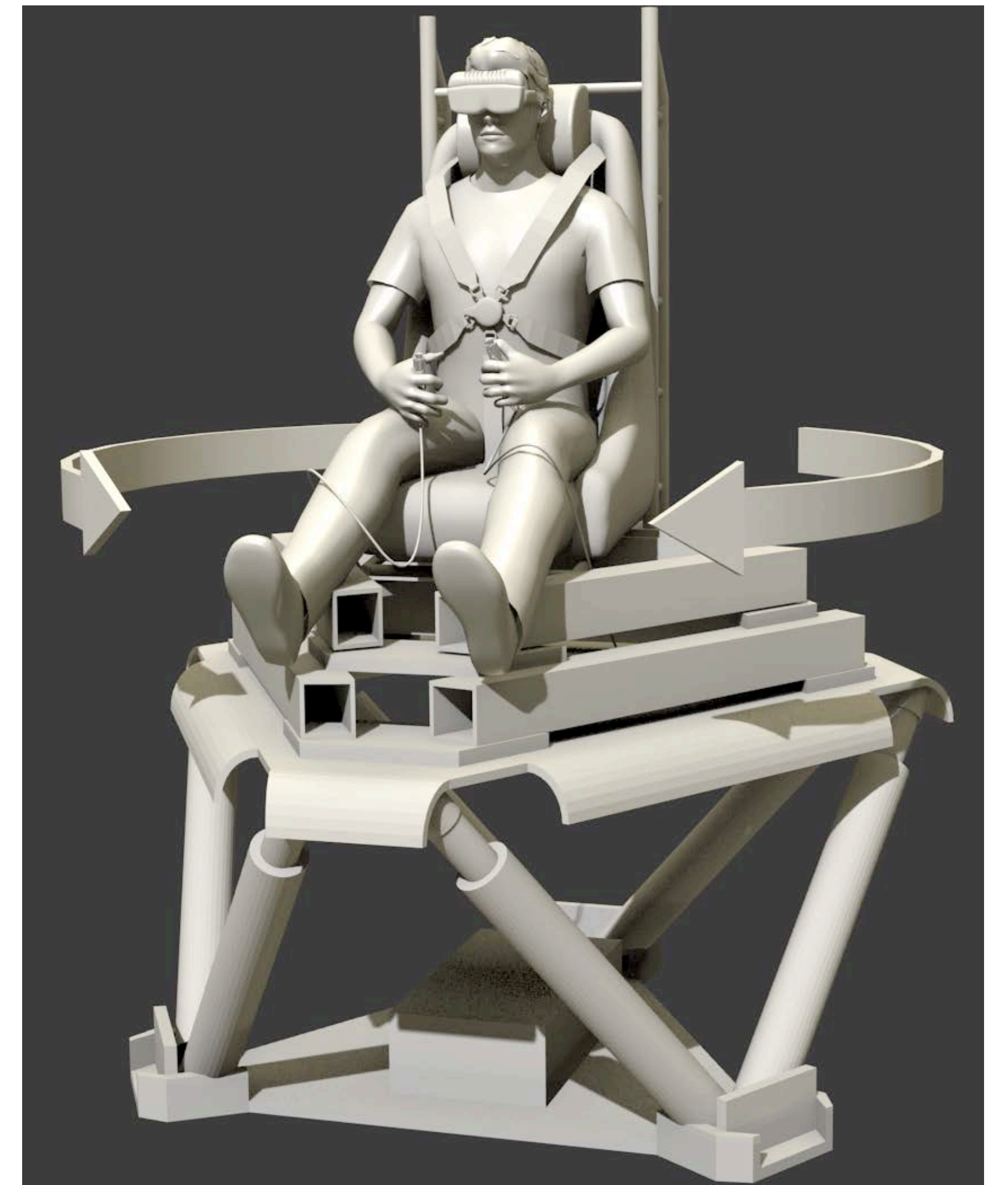


## 1. Introduction

Recent studies have shown that vestibular stimulation can influence affective processes<sup>1,2</sup>. In the present study, we examined whether emotional information can also modulate vestibular perception. Participants performed a vestibular discrimination task on a motion platform while viewing emotional pictures. Processing vestibular information is important in threatening situations, as precise vestibular perception is required for an adaptive motor response. Therefore, we proposed that negative stimuli would improve vestibular discrimination abilities.

## 2. Methods

Participants were seated on a motion platform and exposed to passive yaw rotations (0.5 Hz). Six different picture categories were taken from the IAPS: mutilation, threat, snakes, neutral objects, sports and erotic pictures.



## 3. Analysis

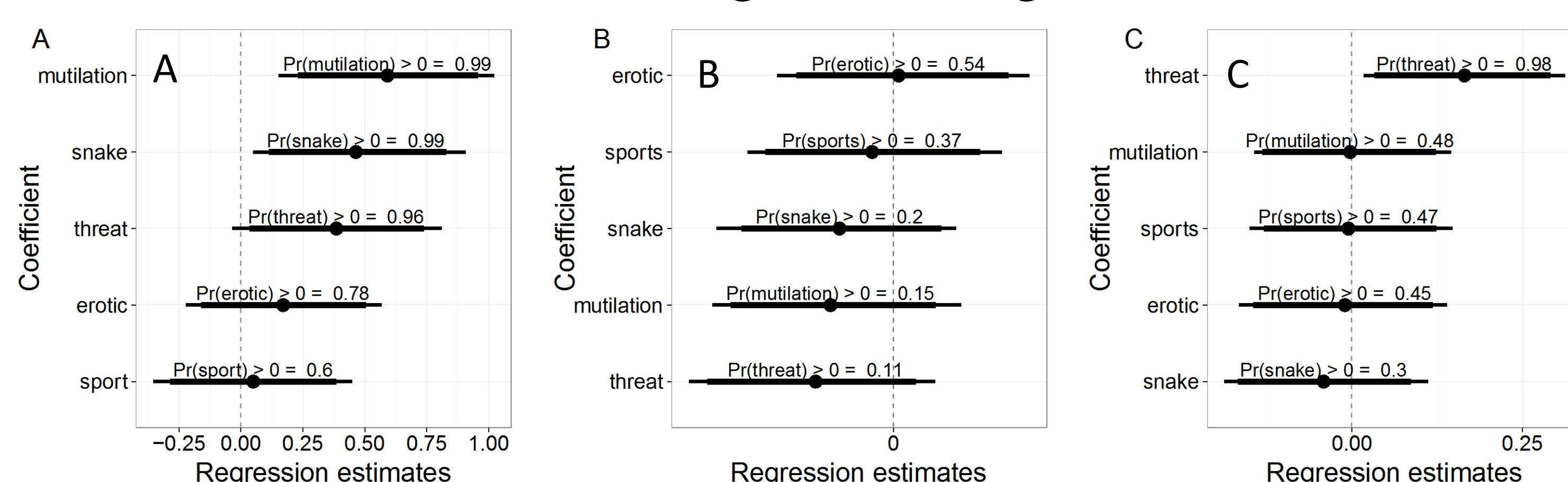
We modelled both accuracy and response time data using mixed-effects hierarchical Bayesian models. For accuracy data, we estimated effects of individual image categories on the probability of giving a correct response. We also computed Bayes factors in order to quantify evidence in favor of our hypothesis that negative images would increase discrimination accuracy.

For response times, we investigated the effect of negative images on  $\mu$  and  $\lambda$  parameters of the Ex-Gaussian distribution<sup>4</sup>. In addition, we computed Bayes factors (BF)<sup>5</sup> in order to determine whether negative images had the effect of shifting the whole RT distribution, or whether there was an effect on the tail behavior of the RT distribution.

## 4. Results

The probability of giving a correct response (A) increased when participants viewed negative pictures. 95% of the marginal posterior densities of the parameters for snake, mutilation and threat images were greater than 0, whilst there was no effect of positive images. A BF of 3.33 revealed strong evidence for a positive effect of negative pictures on accuracy. For RT, we found no effect of stimulus category on the location parameter  $\mu$  (B); A BF of 99 revealed strong evidence in favor of the hypothesis that participants did not slow down when viewing negative images.

Whilst we found an effect of threatening images on  $\lambda$  (C), a BF of 6.93, provided evidence for no effect of negative images on tail behavior.



## 5. Summary

Using hierarchical Bayesian modeling, we were able to show that vestibular discrimination improved when participants viewed emotionally negative pictures (mutilation, threat, snake) when compared to neutral objects.

Furthermore, this increased accuracy was not accompanied by increased or more variable response times. We conclude that emotional information can enhance vestibular sensory processing.

## 6. References

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- 4 Luce, R. D. (1986). *Response Times*. Oxford University Press.
- 5 Kass, R. E., & Raftery, A. E. (1995). Bayes factors. *Journal of the American Statistical Association*, 90(430), 773-795. doi: 10.1080/01621459.1995.10476572