



**HAL**  
open science

## Learning effects in peripheral vision

Jad Laaboudi, Anne Hillairet de Boisferon, Adrien Paire, Céline Paeye

► **To cite this version:**

Jad Laaboudi, Anne Hillairet de Boisferon, Adrien Paire, Céline Paeye. Learning effects in peripheral vision. GDR Vision, Oct 2021, Lille, France. hal-03830221

**HAL Id: hal-03830221**

**<https://hal.science/hal-03830221>**

Submitted on 26 Oct 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Introduction

Fast perceptual learning is frequently observed in visual tasks when stimuli are presented in foveal vision, but such improvement in the perception of basic features of peripheral objects is less clear [1]. Previous studies mentioned large interindividual differences in peripheral perceptual learning [2], that could also depend on the nature and number of perceptual dimensions relevant to the task, external noise, familiarity, and task complexity [3].

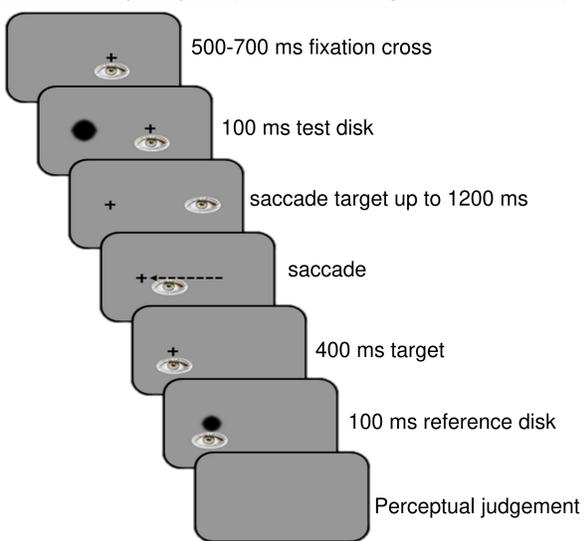
**In this study we evaluated fast improvement of visual discrimination in peripheral vision.** Three experiments were conducted to assess the perception of size (Expt. 1), feature orientation (Expt. 2) and temporality (Expt. 3) of simple stimuli within a single 1h-session.

## Methods

### General procedure : yes-no tasks

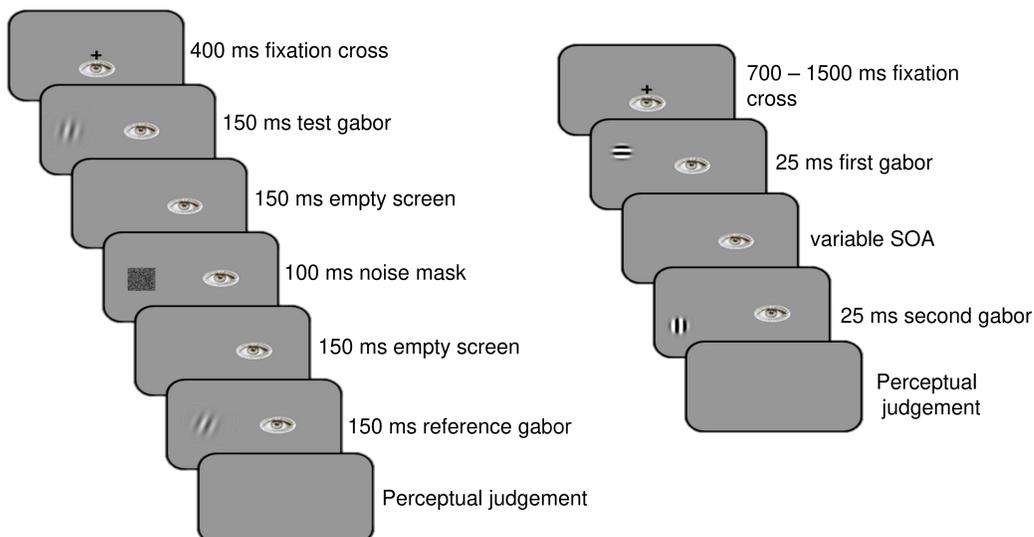
- 1) Practice (64 trials).
  - 2) Psychophysical measurements were made using two or three different procedures: Constant Stimuli (CS, ~182 trials), Quest+ [4] (Q+, ~64 trials) and Staircase (~100 trials, in Expt. 2 and 3).
- The order of the procedures was counterbalanced across participants in each experiment (this factor had no effect).
  - Factor : "block", that corresponds to the trials for the first, second (and third) implemented procedures, independently of the method used.
  - VD: PSEs (or PSSs) and JNDs.

### Experiment 1 : size perception (N=19, cf. Pressigout et al., 2019 [5])



### Experiment 2 : feature orientation perception (N=23)

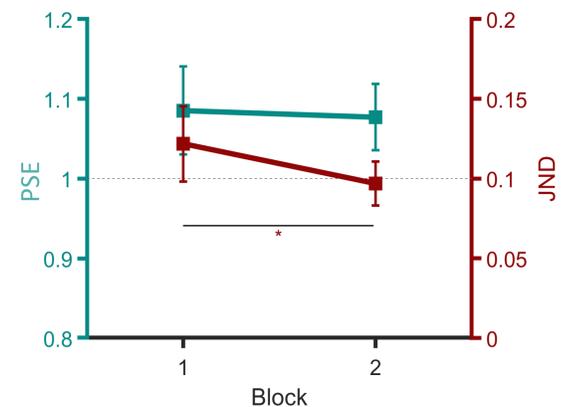
### Experiment 3 : temporality perception (TOJ task, N=24)



## Results

### Experiment 1 : Size

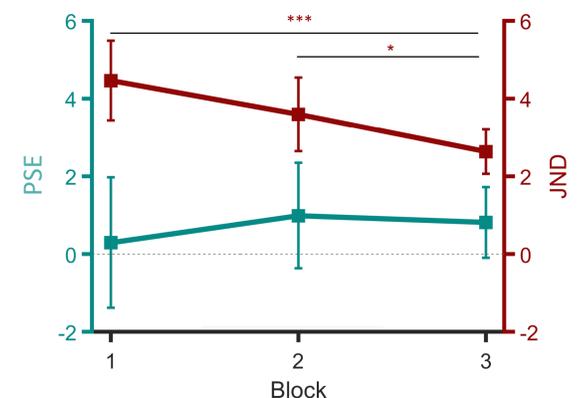
PSE:  $t(18) = 0.37, p = .72,$   
Cohen's  $d = .08$   
JND:  $t(18) = 2.48, p = .023$   
Cohen's  $d = .54$



While PSE values did not differ, JNDs significantly decreased between the two blocks (i.e., sensitivity increased). These results are consistent with those of Pressigout et al. [5], who used the same task but introduced 400 exposure trials between two measurements.

### Experiment 2 : Orientation

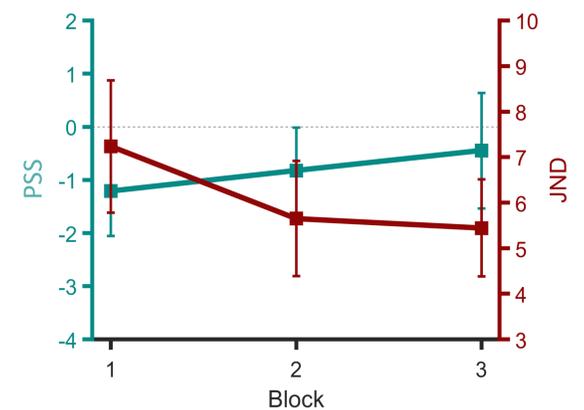
PSE:  $F(2,40) = 0.62, p = .54,$   
JND:  $F(2,40) = 13.6, p < .001,$   
marginal  $R^2 = .16$



The enhancement of oblique orientation discrimination is in line with Schoups et al.'s findings [6].

### Experiment 3 : TOJ

PSS:  $F(2,42) = 1.22, p = .30,$   
JND:  $F(2,42) = 3.85, p < .029,$   
marginal  $R^2 = .09$



While JNDs decreased in this experiment as well, the disappearance of a response bias in the third block (PSS~0) suggests that performance increased thanks to the learning of the procedure rather than with perceptual learning.

## Conclusion

Our findings confirm that the peripheral perception of basic spatial features is susceptible to learning with practice. This contradicts Westheimer's [1] conclusions about the difficulty to enhance such perception. (For the TOJ task however, because of the increase in PSS and conflicting results in the literature [7], we question the perceptual nature of the performance improvement.) In Experiments 1 and 2, perceptual learning occurred within less than one hour of training [8].

## References

- 1 Westheimer, G. (2001). Is peripheral visual acuity susceptible to perceptual learning in the adult?. *Vision Research*, 41, 47-52.
- 2 Beard, B. L., Levi, D. M., & Reich, L. N. (1994). Perceptual Learning in Parafoveal Vision. *Vision Research*, 35(12), 1679-1690.
- 3 Fine, I., & Jacobs, R. A. (2002). Comparing perceptual learning across tasks: A review. *Journal of vision*, 2(2), 5-5.
- 4 Watson, A. B. (2017). QUEST+: A general multidimensional Bayesian adaptive psychometric method. *Journal of Vision*, 17(3), 10-10.
- 5 Pressigout, A., Paeye, C., & Doré-Mazars, K. (2020). Saccadic adaptation shapes perceived size: Common codes for action and perception. *Attention, Perception & Psychophysics*, 82, 3676-3685.
- 6 Schoups, A. A., Vogels, R., & Orban, G. A. (1995). Human perceptual learning in identifying the oblique orientation: retinotopy, orientation specificity and monocularity. *Journal of Physiology*, 483(3), 797-810.
- 7 Arstila V, Georgescu AL, Pesonen H, Lunn D, Noreika V, et al. (2020) Event timing in human vision: Modulating factors and independent functions. *PLOS ONE*, 15(8).
- 8 Fahle, M., Edelman, S., Poggio, T. (1995) Fast Perceptual Learning in Hyperacuity. *Vision Research*, 35(21), 3003-3013.