Task specific extraction of horizontal information in faces

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Context

Previous studies have revealed that horizontal information is crucial for face processing (Dakin & Watt, 2009; Goffaux & Dakin, 2010; Pachai, Sekuler & Bennett, 2013). Interestingly, inverting a face in the picture plane disrupts the processing of horizontal information (Goffaux & Dakin, 2010; Goffaux & Greenwood, 2016; Pachai et al., 2013). Furthermore, some face processing areas (e.g. the Fusiform Face Area) seem to express a horizontal selectivity for faces (Goffaux et al., 2016).

Some studies have also linked face processing abilities, for example face identification (Pachai, et al., 2013) or facial expressions recognition (Duncan et al., 2017) with the utilization of horizontal information. Better face identification and facial expression recognition are both linked with a stronger horizontal information tuning.

Here, we intended to verify if the ability to extract horizontal information generalizes from one task to the other at the individual level.

Method

In this experiment

- Participants had to complete 600 trials for both a face identification and a race categorization tasks.
- Spatial orientation utilization of 28 participants was measured with the Orientation bubbles method (Duncan et al., 2017).

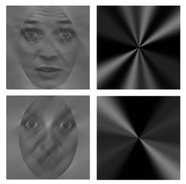


Figure 2 – Example of stimuli filtered with Orientation bubbles (Duncan et al. 2017)

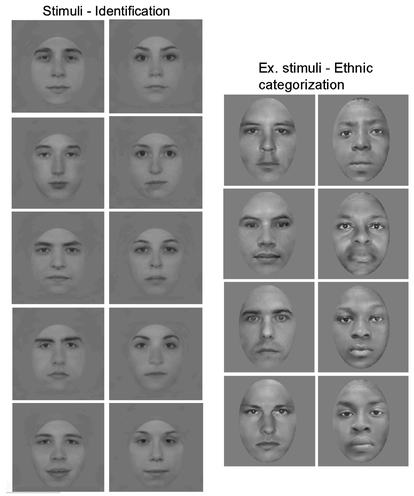
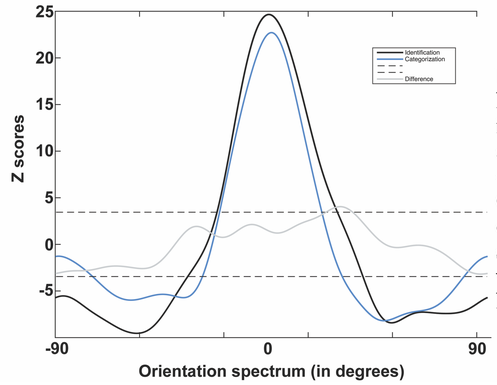


Figure 1 – Example of stimuli used in both tasks

Results

Orientation tunings were obtained by conducting what amounts to a multiple regression analysis on the orientation filters and accuracies across trials. Statistical thresholds were found with the Pixel test from the Stat4Ci toolbox (Chauvin et al., 2005). A group classification vector (CV) was created by first summing individually z-scored CVs across subjects, and then dividing the outcome by √n, where n is the sample size.

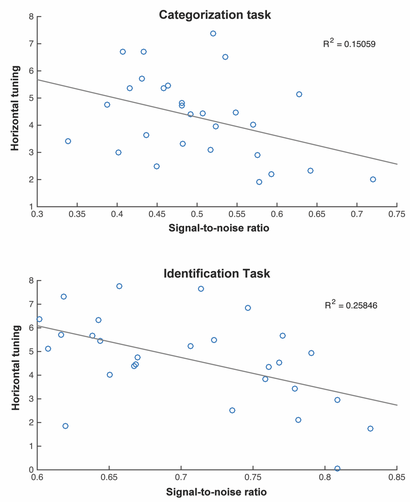
Orientation tuning at group level for both tasks



Horizontal information is highly diagnostic for both face identification (Zmax = 24.8) and race categorization (Zmax = 22.9), all *p*s<.05 and Group CVs of both task were highly correlated, r= .96, *p*<.001, showing high similarity in visual strategies at the group level.

Figure 3 – Orientation tuning at group level for both ethnic categorization (blue) and identification tasks (black). The difference in the horizontal tuning at the group level between both tasks is shown in grey.

Correlation between the performance and horizontal tuning

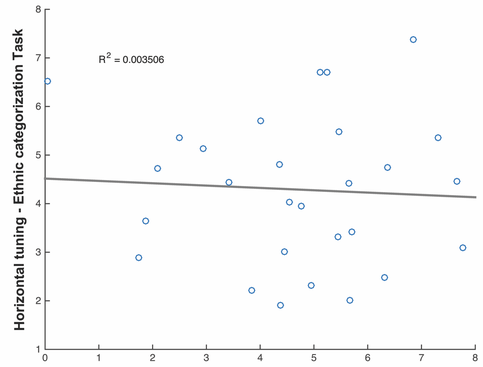


Ethnic categorization task:
• $R^2 = 0.151$, $p < 0.05$

Face identification task:
• $R^2 = 0.258$, $p < 0.01$

Figure 4 – Correlation between the signal-to-noise ratio and horizontal tuning in the ethnic categorization task (top) and the face identification task (bottom).

Correlation between horizontal tuning in both tasks at the individual level



At the individual level, the horizontal tuni ng in one task does not predict the horizontal tuning in another task (R^2= 0.0035, p = 0.765)

Figure 5 – Correlation between horizontal tuning in both categorization and identification tasks at the individual level

Discussion and Conclusion

Our results thus show that, although horizontal information is diagnostic for both tasks, individual differences in the extraction of this information appears to be task dependant.

For future research, it would be interesting to look at the correlation at the individual level of the horizontal tuning on two tasks in which the eyes are an important feature (i.e. gender categorization and face identification).

References

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