

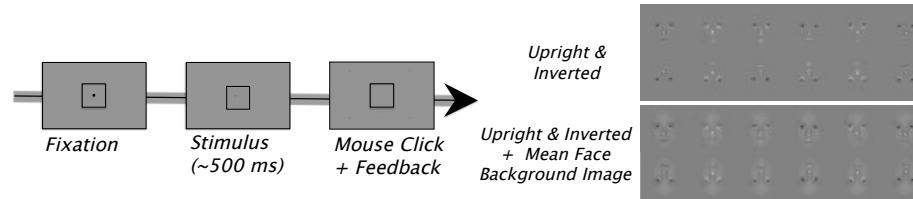
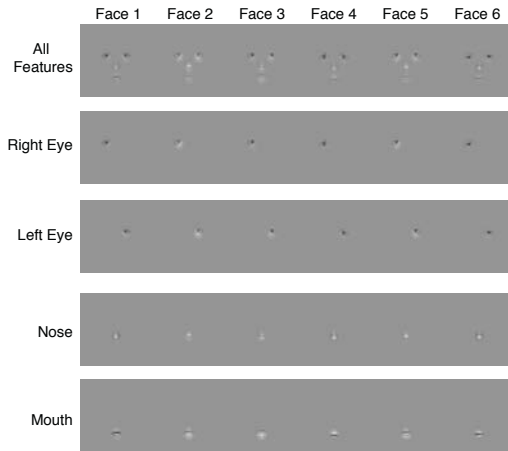
# OPTIMAL FEATURE INTEGRATION FOR UPRIGHT BUT NOT INVERTED FACES

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How efficiently do we combine information across features when recognizing a face?



## Results

○ There was a significant main effect of face orientation but no main effect of background and no orientation x background interaction

○ Mean integration index for upright faces was not significantly different from 1 (optimal integration); mean integration index for inverted faces was significantly less than 1 (sub-optimal integration)

## Conclusions

○ Upright facial feature integration is optimal -- a result that is inconsistent with a strong version of 'holistic' face processing, in which the relationships amongst features allow observers to perform better than would be predicted by their performance with the isolated features

○ Inverted facial feature integration is sub-optimal, suggesting the 'face inversion effect'<sup>3</sup> is due to relatively inefficient feature integration rather than a disruption of holistic processing

### Summation-at-threshold<sup>1,2</sup> method:

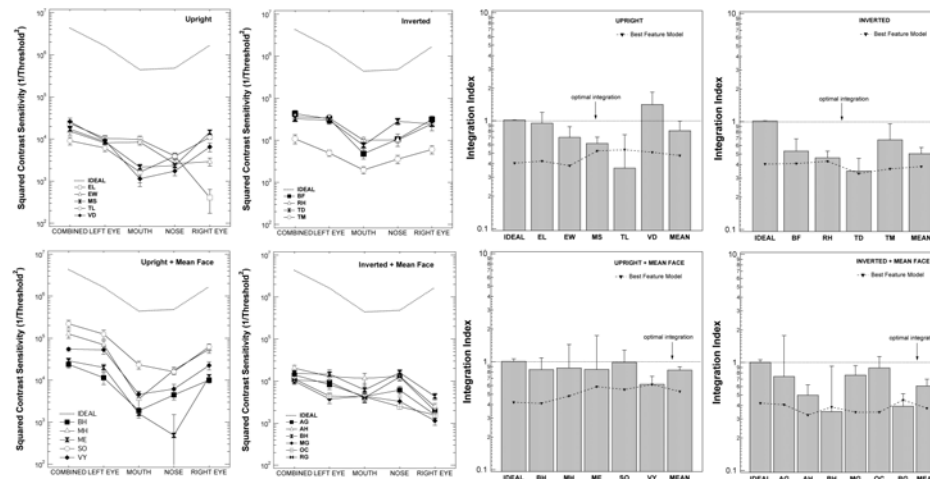
- Measure contrast sensitivity\* (*S*) for each individual set of features (i.e., noses, mouths, left eyes, right eyes)
- Measure *S* for all features combined
- Compute *Integration Index*:

$$S^2_{\text{all features}}$$

$$S^2_{\text{left eye}} + S^2_{\text{right eye}} + S^2_{\text{mouth}} + S^2_{\text{nose}}$$

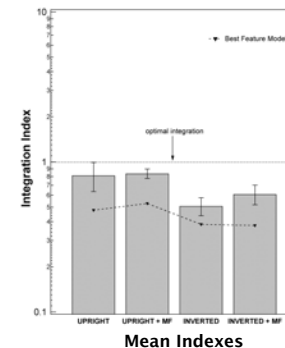
- Index < 1: sub-optimal integration
- Index = 1: optimal integration
- Index > 1: super-optimal integration

\*contrast sensitivity *S* is equal to 1/threshold, where threshold is the nominal contrast level (i.e. the contrast of the intact face from which the part is extracted) necessary to produce 50% correct performance in the 1-of-6 identification task (chance performance is ~17% correct).



### Model Observers

- Ideal observer (index = 1)
- 'Best feature' model prediction for each observer (only uses the single feature with the highest sensitivity when recognizing the combination)



### References

- <sup>1</sup>Nandy, A. S., & Tjan, B. S. (2008). Efficient integration across spatial frequencies for letter identification in foveal and peripheral vision. *Journal of Vision*, 8(13), 3 1-20.
- <sup>2</sup>Graham, N., Robson, J. G., & Nachmias, J. (1978). Grating summation in fovea and periphery. *Vision Research*, 18, 815-825.
- <sup>3</sup>Valentine, T. (1988). Upside-down faces: a review of the effect of inversion upon face recognition. *Br J Psychol*, 79 ( Pt 4), 471-491.