



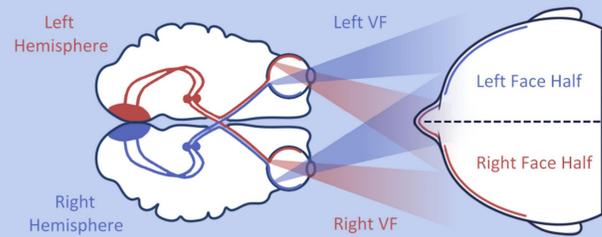
THE INTEGRATION OF INFORMATION FROM THE LEFT AND RIGHT HALVES OF THE FACE

Bartholomew P. A. Quinn, David M. Watson, Kira N. Noad, A. Mike Burton, & Timothy J. Andrews



BACKGROUND

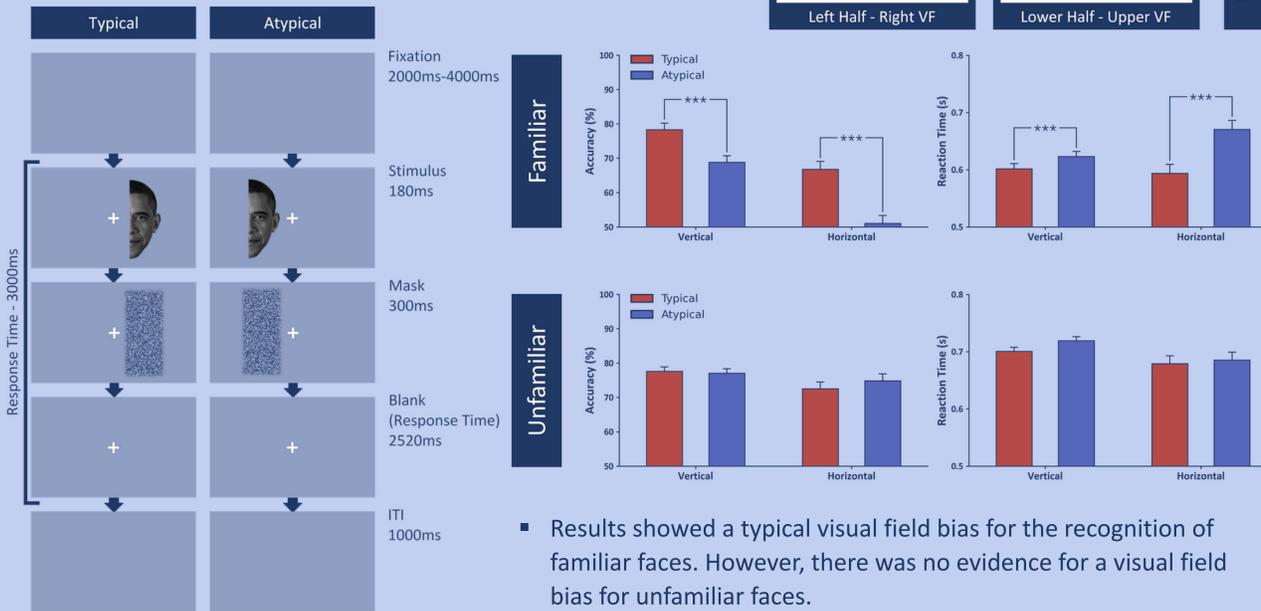
- Faces are typically fixated at the horizontal midpoint, slightly below the eyes^[1].
- This results in different parts of the face projecting to anatomically distinct regions of the visual cortex. For example, the left side of the face projects to the right hemisphere and the right side of the face projects to the left hemisphere^[2].



- Despite this segregation of information, faces are perceived holistically^[3]. This suggests that information is integrated during processing.
- Here, we explore the following questions:
 - Is there a visual field bias in face recognition?
 - Are the left and right sides of the face integrated holistically?
 - What is the role of interhemispheric connectivity in combining information about faces?

EXP 1: FACE HALVES IN TYPICAL VISUAL FIELDS

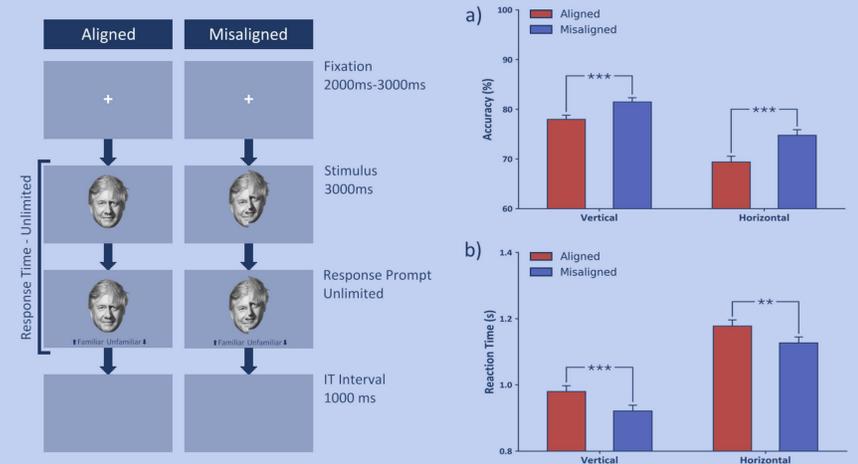
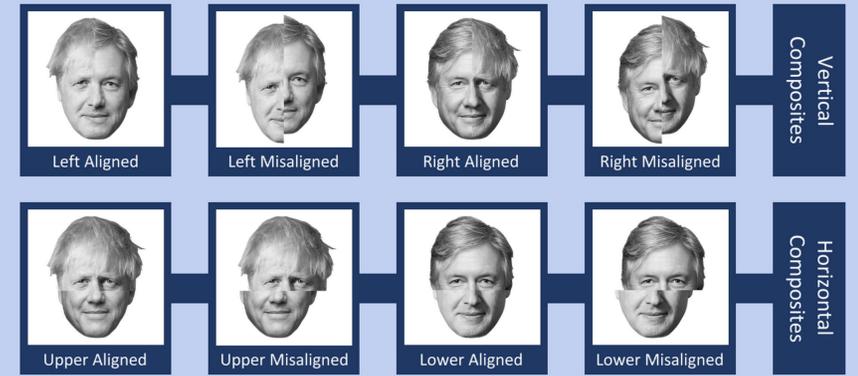
- Previous studies have shown that face halves presented in a typical visual field location (e.g., right half in right visual field) have a detection advantage over face halves presented in an atypical visual field location (e.g., right half in left visual field)^[4,5].
- Here we asked whether a similar visual field bias exists for the recognition of familiar and unfamiliar faces.



- Results showed a typical visual field bias for the recognition of familiar faces. However, there was no evidence for a visual field bias for unfamiliar faces.

EXP 2: A COMPOSITE EFFECT FOR VERTICALLY DIVIDED FACES

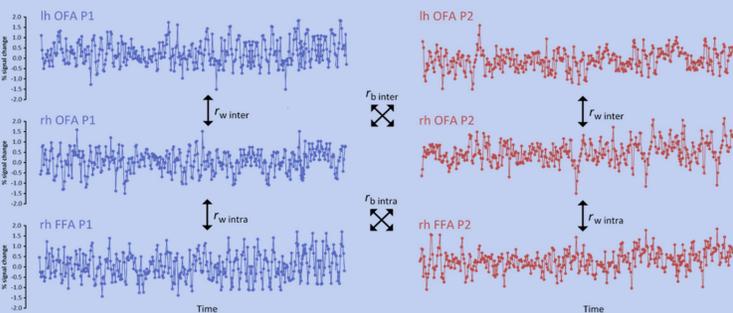
- The *composite face effect* (CFE) is a phenomenon in which a target face half is more difficult to recognise when aligned with a different face half, than when the two halves are misaligned^[6,7].
- Although well-established for *horizontal* composites (made of upper and lower face halves), it is unclear whether a similar effect exists for *vertical* composites (made up of left and right halves).



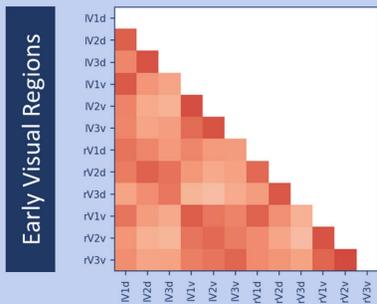
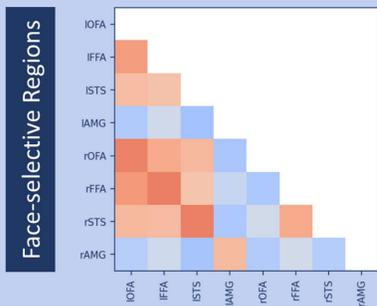
- Our results showed a CFE for vertical composites, with a) lower accuracy and b) slower reaction times for aligned compared to misaligned faces, comparable in size to that of the traditional horizontal CFE.
- Our findings suggest that left and right face halves are integrated holistically.

EXP 3: INTERHEMISPHERIC CONNECTIVITY IN FACE PERCEPTION

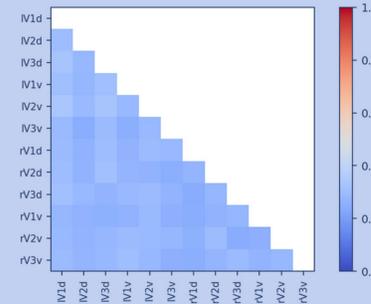
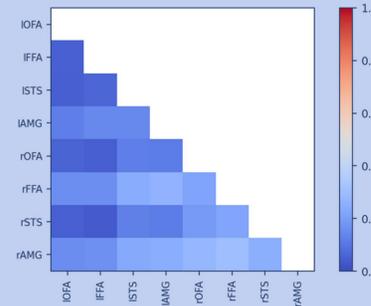
- Neurological models of face perception have focused on *intra*hemispheric connections (within hemispheres) between face selective regions of the human brain^[8] but have largely ignored the potential relevance of *inter*hemispheric connections (between hemispheres).
- Here we compared the relative strength of interhemispheric and intrahemispheric functional connectivity.
- We also questioned if patterns of interhemispheric connectivity were idiosyncratic.
- Inter- and intra-hemispheric functional connectivity were compared within- and between-subjects by calculating the magnitude of correlations between regional time-courses of BOLD activity during natural viewing.



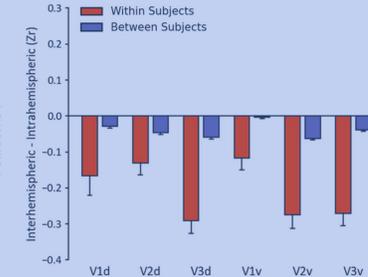
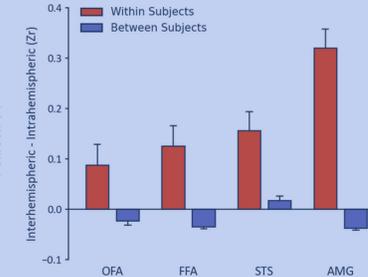
Within-Subjects Connectivity



Between-subjects Connectivity



Inter-Intra Idiosyncrasy



- Our results provided evidence of significantly greater inter-hemispheric than intra-hemispheric functional connectivity across face regions. A similar bias was not evident in early visual areas.
- The idiosyncrasy of these connections suggest that they reflect individual differences in perceptual ability.

GENERAL CONCLUSIONS

- There was a visual field bias in the recognition of faces, which was shown by the increased recognition of face halves when they were presented in the typical visual field.
- Despite that the left and right halves of the face project to anatomically different regions of the visual brain, the presence of composite face effect for vertically divided faces shows that they are integrated holistically.
- The neural processes underlying the holistic processing of faces may be evident in the high inter-hemispheric connectivity between corresponding face regions.

[1] Peterson, M. F., & Eckstein, M. P. (2012). Looking just below the eyes is optimal across face recognition tasks. *Proceedings of the National Academy of Sciences*, 109(48), E3314-E3323. [2] Hsiao, J. H. W., Shieh, D. X., & Cottrell, G. W. (2008). Convergence of the visual field split: Hemispheric modeling of face and object recognition. *Journal of Cognitive Neuroscience*, 20(12), 2298-2307. [3] Richler, J. J., & Gauthier, I. (2014). A meta-analysis and review of holistic face processing. *Psychological Bulletin*, 140(5), 1231. [4] Chan, A. W., Kravitz, D. J., Truong, S., Altschul, J., & Baker, C. I. (2010). Cortical representations of bodies and faces are strongest in commonly experienced configurations. *Nature Neuroscience*, 13(4), 417-418. [5] de Haas, B., Schwarzkopf, D. S., Alvarez, J., Lawson, R. P., Henriksson, L., Kriegeskorte, N., & Rees, G. (2016). Perception and processing of faces in the human brain is tuned to typical feature locations. *Journal of Neuroscience*, 36(36), 9289-9302. [6] Young, A. W., Hellawell, D., & Hay, D. C. (1987). Configurational information in face perception. *Perception*, 16(6), 747-759. [7] Murphy, J., Gray, K. L., & Cook, R. (2017). The composite face illusion. *Psychonomic Bulletin & Review*, 24, 245-261. [8] Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2000). The distributed human neural system for face perception. *Trends in cognitive sciences*, 4(6), 223-233.