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The Man who Mistook his wife for a Surgical Mask

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I shouldn't know you again if we did meet," Humpty Dumpty replied in a discontented tone, giving her one of his fingers to shake: "you're so exactly like other people."

Lewis Carroll, "Through the looking-glass and what Alice found there" (1872)

In 1985, neurologist and author, Oliver Sacks wrote a book, "The Man who Mistook his Wife for a Hat". This is a real story about Dr. P, a musician and painter with severe visual agnosia who was unable to identify facial expressions or recognize himself in the mirror, a condition known as prosopagnosia or face blindness. In addition, Dr. P could not name objects or place them in categories. For example, he could not describe the shape of an orange but could identify it by smell or taste. To educate the public about prosopagnosia, Oliver Sacks, who himself suffered from this neurodevelopmental defect of the fusiform gyrus, lectured and wrote extensively.

Face recognition is essential for the social functioning of human beings who often need to identify familiar faces in large crowds of people. One of my patients with prosopagnosia once said: "it is embarrassing when people tell you, that you looked them in the eyes and did not say a word". Another middle-aged gentleman stated: "doctor I don't have a problem recognizing you in your office, but if I see you on the street, I probably could not recall your face".

Developmental prosopagnosia (DP) is a lifelong face recognition defect which remains unchanged throughout the years, although many patients adapt, learning to identify people by their mannerisms or voice. On the other hand, acquired prosopagnosia (AP) occurs after head trauma, tumors, or strokes that involve the face processing area of the brain. Interestingly, sporadic cases of prosopagnosia were encountered after COVID-19, suggesting that the virus can access the fusiform cortex (1).

The unintended consequences of surgical masks

"We speak with the left hemisphere", exclaimed Paul Broca in 1865 after locating the motoric word center in the left frontal lobe. However, it took another eight decades, until 1947, when Joachim Brodamer identified the face recognition are of the brain and coined the term prosopagnosia. This happened after one of Brodamer patients sustained a stroke and became unable to recognize family members (2). After seeing other similar cases and performing autopsies, Brodamer discovered a small area in the right visual association cortex that responded to faces more than to other stimuli, making him to proudly state: "we recognize faces with the right hemisphere" (3).

The COVID-19 pandemic brought with it unique challenges, including mouth and nose-covering masks, rendering facial recognition more difficult (4). Indeed, several studies have found that surgical

face masks significantly impair facial identification to the extent that prosopagnosia patients, aware of their deficits, learn to avoid people (5-8). In this regard, a novel neuroimaging study of brain activity has corelated the pre-COVID fusiform gyrus resting state with the development of social anxiety, emphasizing that prosopagnosia patients are prone to this disorder (9).

Other research, focusing on face regions conveying social cues, found that some areas are more informative than others. For example, the nose and mouth provide more clues on approachability and trustworthiness compared to the hair, ears, or chin (10). Mask wearing may disrupt the estimation of other peoples' intentions, thrust, or friendliness, leading to more reserved and guarded attitudes toward peers. Indeed, the term "pandemic paranoia" has been coined to illustrate the heightened level of human mistrust and suspicion during the COVID-19 pandemic (11-12).

Masks and development

Faces are vital for the psychosocial development of infants who can recognize some facial features as early as birth (13). At two months and a half, babies respond to smiling mother's face by smiling back thus, establishing an early nonverbal interaction that builds trust and significance (14). By six months, infants can recognize many individual faces, including those of other races however, in the absence of exposure, this plasticity appears to be lost by the age of 12 (15-16).

Indeed, neuroimaging studies found that children with less out-group experience activate the fusiform gyrus differently in response to own vs. other races (5). Interestingly, a novel study revealed that treatment with propranolol can diminish the negative racial bias, indicating that noradrenergic pathways likely drive the fusiform gyrus function (17).

This may be significant for child development as lockdowns and isolation during the COVID-19 pandemic likely diminished the inter- racial contact, possibly increasing the out-group bias.

The pathophysiology of face recognition

In the 1970s, Charlie Gross had identified neurons in the inferior temporal cortex of macaques that responded selectively to faces (18). In human infants, the "face cells", which fire in response to people previously seen, have been identified, indicating that the fusiform gyrus requires "experience" to fully develop (19).

In 2005, during brain surgery for intractable seizure, a surgeon found that single neurons can react to the faces of specific people. These, so called "grandmother cells", a term coined by Jerome Lettvin, have been called different names by various groups, including Jennifer Aniston, Luke Skywalker, or the Tower of Pisa neurons (20-21). Individual neuronal cells responding to particular faces may explain hallucinatory palinopsia, a hallucination of face identity, generated by intracerebral stimulation of the right lateral fusiform gyrus (22). Palinopsia differs from Capgras Syndrome, a delusional misidentification disorder, in which faces are recognized but do not generate a sense of emotional familiarity, prompting the patient to think of close family members as impostors (24). In contrast, hyperfamiliarity for faces (HFF) is a syndrome in which unfamiliar people appear familiar, prompting the patient to treat complete strangers as close friends (25).

Novel studies have found that visual mental imagery engages the left, rather than the right fusiform gyrus, suggesting that imagination dwells in the left hemisphere (26). This is significant as antisocial tendencies and psychotic hallucinations are lateralized in the left hemisphere, linking imagery with the subjective perception of reality (27-28).

Interestingly, actively hallucinating patients with schizophrenia have showed less right fusiform gyrus activity compared to controls, probably emphasizing a right hemisphere compensatory mechanism (29).

Taken together, face recognition disorders, a pathology at the interface between psychiatry and neurology, highlights the importance of insight as a differentiating factor between agnosia and psychosis. Indeed, as individuals with prosopagnosia are aware of their deficit, patients with schizophrenia lack this awareness (30).

Conclusions

The monumental efforts to lower the transmissibility of COVID-19 has led to several unintended consequences, one of which is the daily use of surgical masks which impair recognition by partially occluding the face. Individuals with prosopagnosia and children who require experience to train their "face cells" are more affected by masks than others. For this reason, face recognition pathology, including out-group bias, may be one of the COVID-19 sequelae that "children of the pandemic" will need to cope with later in life.

References

1. Marie-Luise Kieseler, Brad Duchaine; Persisting Prosopagnosia due to COVID-19. Journal of Vision 2021;21(9):2408. doi: https://doi.org/10.1167/jov.21.9.2408.

2. Wegrzyn M, Garlichs A, Heß RWK, Woermann FG, Labudda K. The hidden identity of faces: a case of lifelong prosopagnosia. BMC Psychol. 2019 Jan 22;7(1):4. doi: 10.1186/s40359-019-0278-z

3. De Renzi E, Perani D, Carlesimo GA, Silveri MC, Fazio F. Prosopagnosia can be associated with damage confined to the right hemisphere--an MRI and PET study and a review of the literature. Neuropsychologia. 1994 Aug;32(8):893-902. doi: 10.1016/0028-3932(94)90041-8.

4. Tabish SA. COVID-19 pandemic: Emerging perspectives and future trends. J Public Health Res. 2020 Jun 4;9(1):1786. doi: 10.4081/jphr.2020.1786.

5. Carragher DJ, Hancock PJB. Surgical face masks impair human face matching performance for familiar and unfamiliar faces. Cogn Res Princ Implic. 2020 Nov 19;5(1):59. doi: 10.1186/s41235-020-00258-x.

6. Freud E, Di Giammarino D, Camilleri C. Mask-wearing selectivity alters observers' face perception. Cogn Res Princ Implic. 2022 Nov 16;7(1):97. doi: 10.1186/s41235-022-00444-z.

7. Tsantani M, Gray KLH, Cook R. New evidence of impaired expression recognition in developmental prosopagnosia. Cortex. 2022 Sep;154:15-26. doi: 10.1016/j.cortex.2022.05.008.

8. Carbon CC. Wearing Face Masks Strongly Confuses Counterparts in Reading Emotions. Front Psychol. 2020 Sep 25;11:566886. doi: 10.3389/fpsyg.2020.566886.

9. Gong Q, Li Q, Zhang X, et al. Pre-COVID resting-state brain activity in the fusiform gyrus prospectively predicts social anxiety alterations during the pandemic. Research Square; 2022. DOI: 10.21203/rs.3.rs-2177845/v1.

10. Stanbouly D, Chuang SK. What are the Psychosocial Consequences of Chronic Mask-Wearing in the COVID-19 Pandemic? J Oral Maxillofac Surg. 2021 Sep;79(9):1815-1816. doi: 10.1016/j.joms.2021.04.014.

11. Ellett L, Schlier B, Kingston JL, Zhu C, So SH, Lincoln TM, Morris EMJ, Gaudiano BA. Pandemic paranoia in the general population: international prevalence and sociodemographic profile. Psychol Med. 2022 Sep 6:1-8. doi: 10.1017/S0033291722002975.

12. Lyons M, Bootes E, Brewer G, Stratton K, Centifanti L. "COVID-19 spreads round the planet, and so do paranoid thoughts". A qualitative investigation into personal experiences of psychosis during the COVID-19 pandemic. Curr Psychol. 2021 Oct 12:1-10. doi: 10.1007/s12144-021-02369-0.

13. Pascalis O, de Haan M, Nelson CA. Is face processing species- specific during the first year of life? Science. 2002 May 17;296(5571):1321-3. doi: 10.1126/science.1070223.

14. Ellinwood, E.H. Perception of faces: Disorders in organic and psychopathological states. Psych Quar 43, 622–646 (1969). https://doi.org/10.1007/BF01564275

15. Żochowska A, Jakuszyk P, Nowicka MM, Nowicka A. Are covered faces eye-catching for us? The impact of masks on attentional processing of self and other faces during the COVID-19 pandemic. Cortex. 2022 Apr;149:173-187. doi: 10.1016/j.cortex.2022.01.015.

16. McKone E, Wan L, Pidcock M, Crookes K, Reynolds K, Dawel A, Kidd E, Fiorentini C. A critical period for faces: Other-race face recognition is improved by childhood but not adult social contact. Sci Rep. 2019 Sep 6;9(1):12820. doi: 10.1038/s41598-019-49202- 0. PMID: 31492907

17. Farmer H, Hewstone M, Spiegler O, Morse H, Saifullah A, Pan X, Fell B, Charlesford J, Terbeck S. Positive intergroup contact modulates fusiform gyrus activity to black and white faces. Sci Rep. 2020 Feb 14;10(1):2700. doi: 10.1038/s41598-020-59633-9.

18. Terbeck S, Kahane G, McTavish S, McCutcheon R, Hewstone M, Savulescu J, Chesterman LP, Cowen PJ, Norbury R. β- Adrenoceptor blockade modulates fusiform gyrus activity to black versus white faces. Psychopharmacology (Berl). 2015 Aug;232(16):2951-8. doi: 10.1007/s00213-015-3929-7.

19. Taubert J, Wardle SG, Ungerleider LG. What does a "face cell" want?'. Prog Neurobiol. 2020 Dec;195:101880. doi: 10.1016/j.pneurobio.2020.101880.

20. Mash C, Bornstein MH, Arterberry ME. Brain dynamics in young infants' recognition of faces: EEG oscillatory activity in response to mother and stranger. Neuroreport. 2013 May 8;24(7):359-63. doi: 10.1097/WNR.0b013e32835f6828

21. Gross CG. Genealogy of the "grandmother cell". Neuroscientist. 2002 Oct;8(5):512-8. doi: 10.1177/107385802237175.

22. Quiroga RQ. Concept cells: the building blocks of declarative memory functions. Nat Rev Neurosci. 2012 Jul 4;13(8):587-97. doi: 10.1038/nrn3251.

23. Gersztenkorn D, Lee AG. Palinopsia revamped: a systematic review of the literature. Surv Ophthalmol. 2015 Jan-Feb;60(1):1- 35. doi: 10.1016/j.survophthal.2014.06.003.

24. Barrelle A, Luauté JP. Capgras Syndrome and Other Delusional Misidentification Syndromes. Front Neurol Neurosci. 2018;42:35-43. doi: 10.1159/000475680.

25. Devinsky O, Davachi L, Santchi C, Quinn BT, Staresina BP, Thesen T. Hyperfamiliarity for faces. Neurology. 2010 Mar 23;74(12):970-4. doi: 10.1212/WNL.0b013e3181d5dc22.

26. Spagna A, Hajhajate D, Liu J, Bartolomeo P. Visual mental imagery engages the left fusiform gyrus, but not the early visual cortex: A meta-analysis of neuroimaging evidence. Neurosci Biobehav Rev. 2021 Mar;122:201-217. doi: 10.1016/j.neubiorev.2020.12.029.

27. Hugdahl K, Løberg EM, Jørgensen HA, Lundervold A, Lund A, Green MF, Rund B. Left hemisphere lateralisation of auditory hallucinations in schizophrenia: a dichotic listening study. Cogn Neuropsychiatry. 2008 Mar;13(2):166-79. doi: 10.1080/13546800801906808.

28. Hecht D. Cerebral lateralization of pro- and anti-social tendencies. Exp Neurobiol. 2014 Mar;23(1):1-27. doi: 10.5607/en.2014.23.1.1. Epub 2014 Mar 27. PMID: 24737936; PMCID: PMC3984952.

29. Katharina Kunzelmann, Matthias Grieder, Claudia van Swam, Philipp Homan, Stephanie Winkelbeiner, Daniela Hubl, Thomas Dierks. Am I hallucinating or is my fusiform cortex activated? Functional activation differences in schizophrenia patients with and without hallucinations, The European Journal of Psychiatry, Volume 33, Issue 1, 2019, Pages 1-7, https://doi.org/10.1016/j.ejpsy.2018.06.002.

30. Harrington A, Oepen G, Spitzer M. Disordered recognition and perception of human faces in acute schizophrenia and experimental psychosis. Compr Psychiatry. 1989 Sep- Oct;30(5):376-84. doi: 10.1016/0010-440x(89)90003