

Is there significant nonfamilial environmental influence on human face recognition?

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For a recent article [1] Wilmer et al. studied correlations between human face recognition (HFR) test scores of monozygotic (MZ) and of dizygotic twins, concluding that HFR ability is highly heritable, but also that “[t]he 0.20 difference between the MZ correlation [0.70] and our highest reliability estimate [0.90] is consistent with a modest but nontrivial nonfamilial environmental contribution” to HFR ability. This latter conclusion was also echoed by a PNAS commentary [2].

That result appears to be an artifact of an unduly high reliability estimate. Most of Wilmer et al.’s reliability estimates are not directly comparable to the MZ correlation, as they are internal consistency measures rather than stability measures, and selecting the “highest” reliability estimate out of several to compare to the MZ correlation is liable to bias upwards the estimate of nonfamilial environmental influence.

The test-retest reliability (TR), as a trait stability measure typically calculated as a correlation coefficient, is the most appropriate reliability estimate to compare to the MZ correlation. Wilmer et al. report a TR of 0.70, identical to the MZ correlation, and so suggesting no nonfamilial environmental contribution to HFR ability.

I quantified this result more rigorously by adding an intraindividual variance component to Wilmer et al.’s ACE model, and fitting the extended model to their correlations.

The intraindividual component should capture random measurement error and other non-phenotypic variance. The model attributes 30% (95% CI: 26–34%) of the variance in the twins’ HFR scores to intraindividual effects, none to shared environment (95% CI: 0–19%), 1% to nonfamilial environment (95% CI: 0–9%), and 69% to additive genetic influences (95% CI: 48–73%). These parameter estimates imply that nonfamilial environmental influences are statistically and practically insignificant.

Given the reports Wilmer et al. cite to “[demonstrate] that face processing is sensitive to environmental input”, the failure to detect nonfamilial environmental influence is bemusing. One possible cause is simple statistical noise; another is TR attenuation due to learning effects. But the first is unlikely because the 95% CI’s upper bound for the nonfamilial environmental effect is only 9%, and the second is doubtful because the variance in HFR test scores did not change from test to retest.

Perhaps more plausible is the possibility of model misspecification; if Wilmer et al.’s fitted model is accurate, my more flexible extension of it should also be accurate, and fitting my model to their correlations implies virtually no nonfamilial environmental influence on HFR.

1. Wilmer JB, et al. (2010) Human face recognition ability is specific and highly heritable. *Proc Natl Acad Sci USA* 107:5238–5241.

2. McKone E, Palermo R (2010) A strong role for nature in face recognition. *Proc Natl Acad Sci USA* 107:4795–4796.

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