McGurk effect

A common measure of multisensory integration is the McGurk effect, an illusion in which incongruent auditory and visual speech are integrated to produce an entirely different percept. Published studies report that participants who differ in age, gender, culture, native language, or traits related to neurological or psychiatric disorders also differ in their susceptibility to the McGurk effect. These group-level differences are used as evidence for fundamental alterations in sensory processing between populations. Using empirical data and statistical simulations tested under a range of conditions, we show that published estimates of group differences in the McGurk effect are inflated when only statistically significant ($p < 0.05$) results are published. With a sample size typical of published studies, a group difference of 10% would be reported as 31%. As a consequence of this inflation, follow-up studies often fail to replicate published reports of large between-group differences. Inaccurate estimates of effect sizes and replication failures are especially problematic in studies of clinical populations involving expensive and time-consuming interventions, such as training paradigms to improve sensory processing. Reducing effect size inflation and increasing replicability requires increasing the number of participants by an order of magnitude compared with current practice [1)].

Chinese and American cultures differ in the prevalence of direct facial gaze and in the auditory structure of their languages, raising the possibility of cultural- and language-related group differences in the McGurk effect. There is no consensus in the literature about the existence of these group differences, with some studies reporting less McGurk effect in native Mandarin Chinese speakers than in English speakers and others reporting no difference. However, these studies sampled small numbers of participants tested with a small number of stimuli. Therefore, we collected data on the McGurk effect from large samples of Mandarin-speaking individuals from China and English-speaking individuals from the USA (total n = 307) viewing nine different stimuli. Averaged across participants and stimuli, we found similar frequencies of the McGurk effect between Chinese and American participants (48 vs. 44 %). In both groups, we observed a large range of frequencies both across participants (range from 0 to 100 %) and stimuli (15 to 83 %) with the main effect of culture and language accounting for only 0.3 % of the variance in the data. High individual variability in perception of the McGurk effect necessitates the use of large sample sizes to accurately estimate group differences [2)].

In 2015 Mallick et al. measured McGurk perception using 12 different McGurk stimuli in a sample of 165 English-speaking adults, 40 of whom were retested following a one-year interval. We observed dramatic differences both in how frequently different individuals perceived the illusion (from 0 % to 100 %) and in how frequently the illusion was perceived across different stimuli (17 % to 58 %). For individual stimuli, the distributions of response frequencies deviated strongly from normality, with 77 % of participants almost never or almost always perceiving the effect (≤10 % or ≥90 %). This deviation suggests that the mean response frequency, the most commonly reported measure of the McGurk effect, is a poor measure of individual participants' responses, and that the assumptions made by parametric statistical tests are invalid. Despite the substantial variability across individuals and stimuli, there was little change in the frequency of the effect between initial testing and a one-year retest (mean change in frequency = 2 %; test-retest correlation, r = 0.91). In a second experiment, we replicated our findings of high variability using eight new McGurk stimuli and tested

the effects of open-choice versus forced-choice responding. Forced-choice responding resulted in an estimated 18 % greater frequency of the McGurk effect but similar levels of interindividual variability. Our results highlight the importance of examining individual differences in McGurk perception instead of relying on summary statistics averaged across a population. However, individual variability in the McGurk effect does not preclude its use as a stable measure of audiovisual integration [3].

1)
Magnotti JF, Beauchamp MS. Published estimates of group differences in multisensory integration are inflated. PLoS One. 2018 Sep 19;13(9):e0202908. doi: 10.1371/journal.pone.0202908. eCollection 2018. PubMed PMID: 30231054.
2)
Magnotti JF, Basu Mallick D, Feng G, Zhou B, Zhou W, Beauchamp MS. Similar frequency of the McGurk effect in large samples of native Mandarin Chinese and American English speakers. Exp Brain Res. 2015 Sep;233(9):2581-6. doi: 10.1007/s00221-015-4324-7. Epub 2015 Jun 4. Erratum in: Exp Brain Res. 2016 May;234(5):1333. PubMed PMID: 26041554; PubMed Central PMCID: PMC4536079.
3)
Mallick DB, Magnotti JF, Beauchamp MS. Variability and stability in the McGurk effect: contributions of participants, stimuli, time, and response type. Psychon Bull Rev. 2015 Oct;22(5):1299-307. doi: 10.3758/s13423-015-0817-4. PubMed PMID: 25802068; PubMed Central PMCID: PMC4580505.