Presentation Abstract

Presentation Title:	Novel word learning selectively sharpens orthographic representations in the VWFA
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Abstract:	Recently, we provided evidence that the Visual Word Form Area (VWFA) contains neurons that are highly selective for individual written real words (RW). However, it is still unclear how learning shapes the neural representation; in particular how new words are incorporated into existing neural representations in the VWFA. We trained subjects to recognize 150 novel pseudowords (PW), and used fMRI rapid adaptation to compare neural selectivity in the VWFA to RW, untrained (UTPW) and trained PW (TPW) before and after training. Each trial consisted of a prime/target pair and subjects (N=12) performed an oddball detection task in the scanner. We examined three conditions: 1) SAME (prime and target were identical), 2) 1L (prime and target differed by one letter) and, 3) DIFF (prime and target shared no letters). We predicted that, before training, VWFA neurons would be broadly tuned for TPW and UTPW, with adaptation for the 1L relative to the DIFF condition, indicating that the two PW in 1L activated overlapping neuronal representations. In contrast, the VWFA would show high selectivity for RW, with full release from adaptation for the 1L condition, indicating that two RW, differing by only one letter, activate disjoint neuronal representations (see Glezer et al., 2009). Crucially, we predicted training would selectively sharpen neural representations of TPW, so that responses to TPW would show the same tight tuning as to RW, while responses to UTPW would continue to be broadly tuned. Prior to training, responses in the VWFA indicated broad tuning to UTPW and TPW with gradual release from adaptation (SAME < 1L < DIFF, at least $p<0.04$), whereas responses to RW indicated tight tuning (SAME < 1L, $p<0.0002$; 1L = DIFF, $p=0.33$), replicating (Glezer et al., 2009). Following training, subjects were highly accurate at discriminating TPW from foils ($d'=3.24$), and responses to TPW resembled those to RW, indicating tight tuning, while the activation to UTPW continued to show broad tuning (1L vs. DIFF: UTPW $p = 0.002$, TPW $p = 0.45$, paired t-test, with a significant word type x session interaction, repeated measures 2x3 ANOVA), suggesting that training resulted in RW-like tuning to TPW in the VWFA. This change in selectivity was specific to the left VWFA; the right VWFA, bilateral FFA, LOC, and posterior VWFA ROI showed no change in tuning to TPW. Additionally, the degree of learning-induced sharpening of tuning in the VWFA correlated with subjects' verbal IQ ($r=0.77$, $p<0.01$). Our results are compatible with the theory that learning novel words selectively increases neuronal selectivity for the learned words in the VWFA, thereby adding these words to the brain's visual dictionary.
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