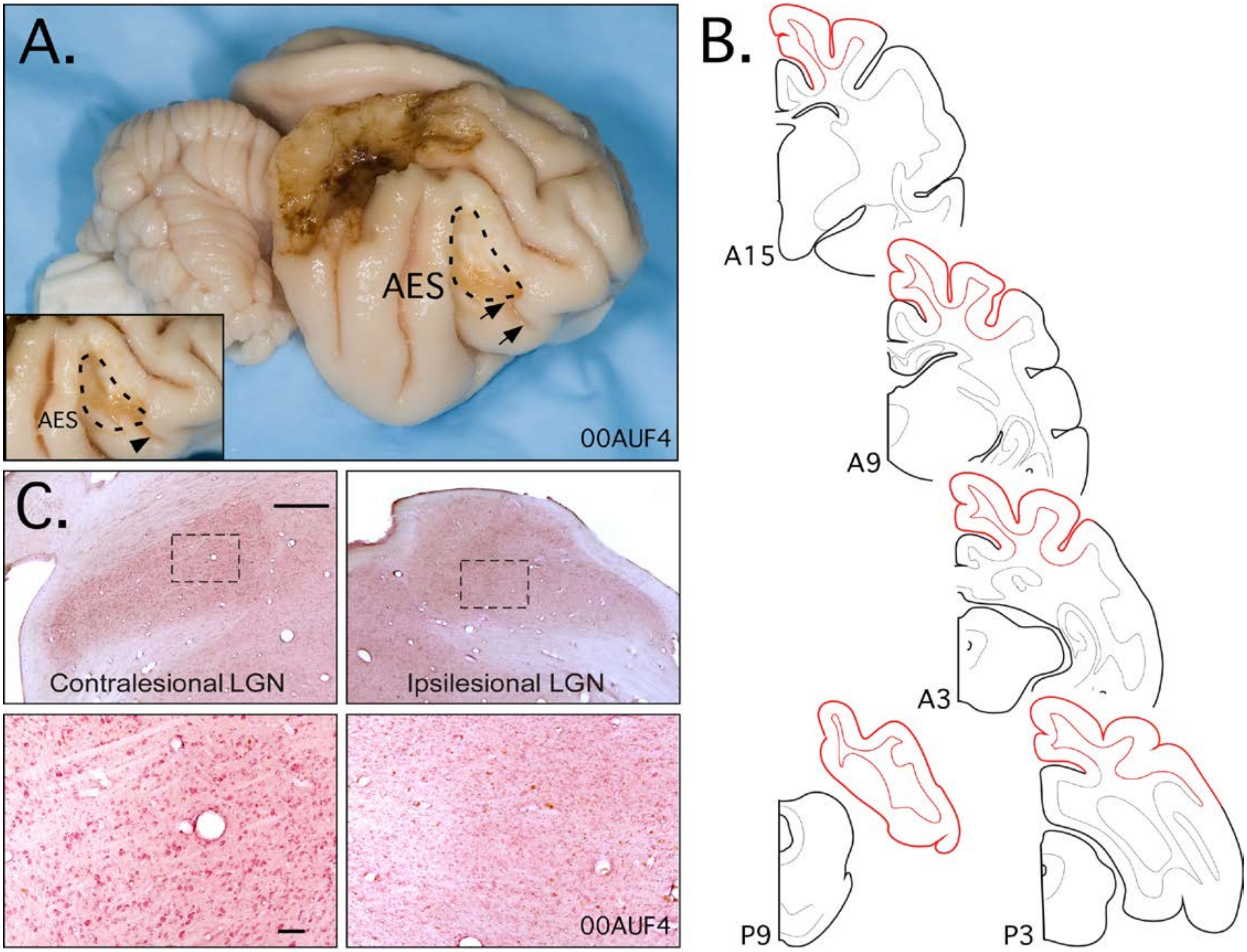
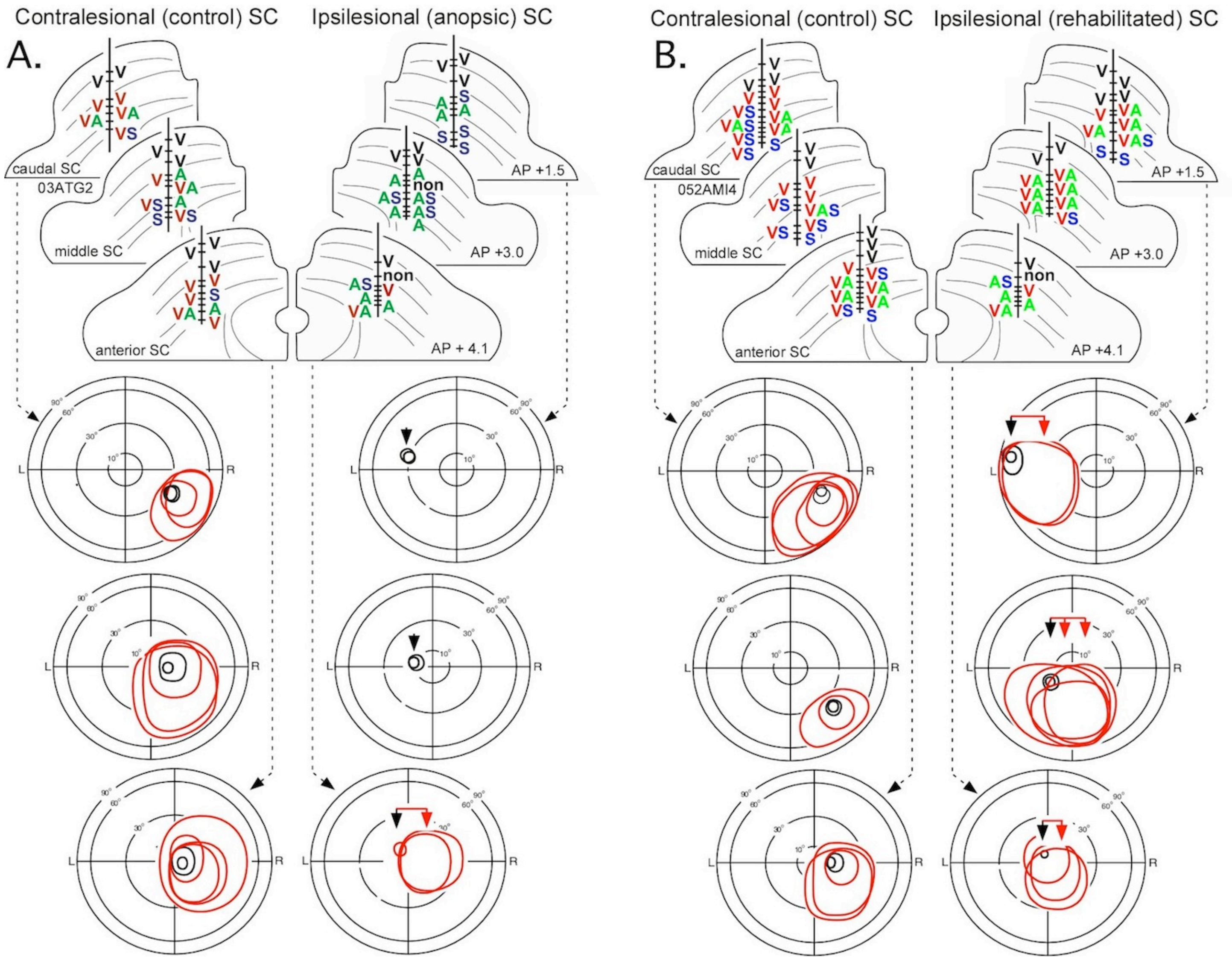
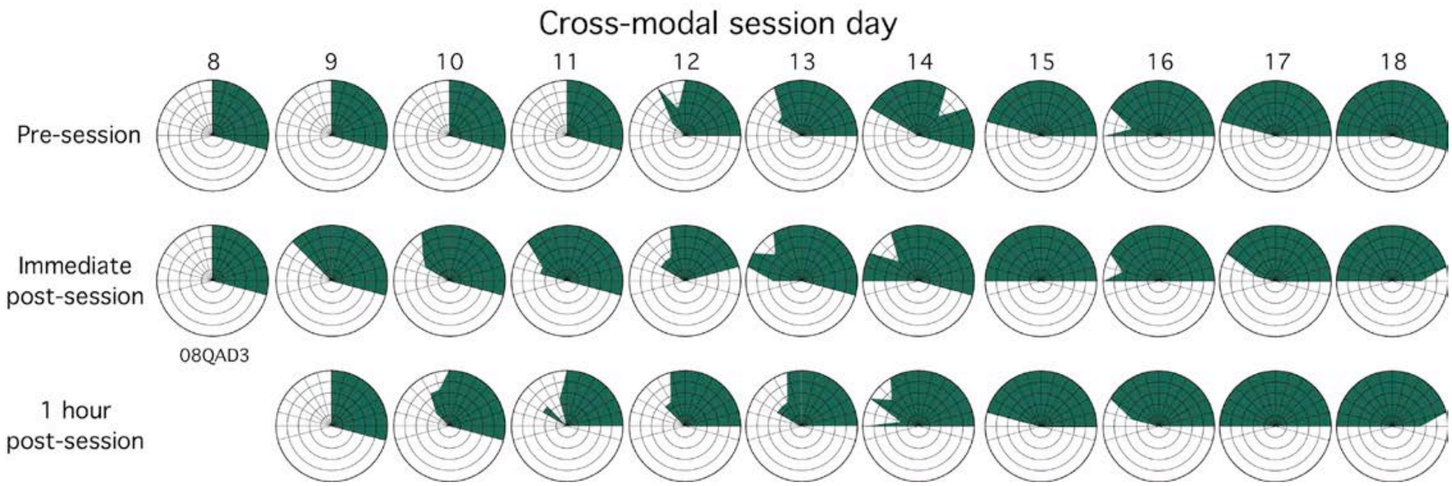


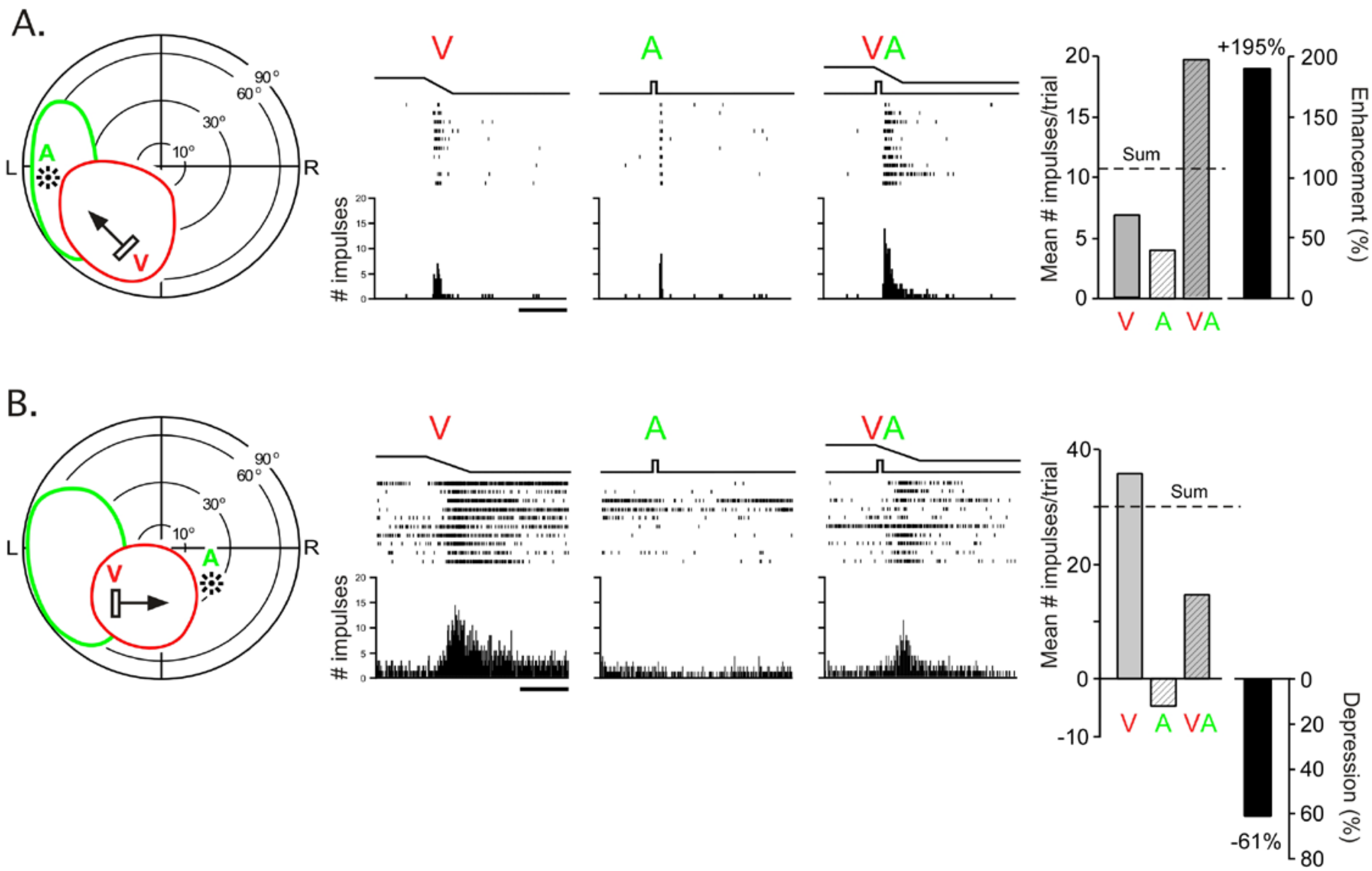
Supplementary Fig. 1: *Post mortem* cortical anatomy and thalamic histology. A. The extent of the original visual cortex lesion and subsequent AES lesion in animal 00AUF4 are shown. Because the remaining cortex shifts medially to fill the aspiration defect, the actual extend of the lesion is minimized. The lesion produced an enduring (2 ½ months) contralesional hemianopia that was subsequently ameliorated by cross-modal training. Removal of the caudal aspect of the ipsilesional AES (inset lower left), which contain its visual and auditory representations, reinstated the visual hemianopia. Polar plots of this animal's behavioral history are shown in Fig. 2C. B. Five coronal sections throughout the rostro-caudal extent of the lesion are shown, with approximate anterior-posterior (A, P) coordinates. Red lines represent the extirpated neural tissue. C. The cortical lesion produced profound retrograde degeneration in the ipsilesional LGN, resulting in a neuropil that was virtually devoid of cell bodies (right, lower) compared to the contralateral LGN (left, lower). This suggests that the visuomotor capabilities in rehabilitated animals were not due to spared components of the geniculo-cortical systems. Scale bars = 1 mm (upper); 100µm (lower)



Supplementary Fig. 2: Sensory activity in the SC of a hemianopic animal with and without cross-modal auditory-visual training. A. The hemianopia was accompanied by markedly attenuated visual activity in the ipsilesional deep SC, whereas auditory and somatosensory activity was retained. Reconstruction of electrode penetrations (vertical black lines) and recording sites are shown at three anterior-posterior levels (left, upper) of the contralesional (left) and ipsilesional (right) SC. The corresponding visual receptive fields of superficial (black ovoids) and deep (red ovoids) SC neurons are depicted below (left, lower). The ipsilesional deep SC displayed a marked loss of visual neurons (red V) in its multisensory layers despite the presence of visual activity in the superficial layers (black V). Note the presence of auditory (green A) and somatosensory (blue S) neurons. Also note that visual activity was retained in the anterior SC where central visual space is represented. Here, deep visual SC RF centers were displaced nasally from those in the overlying superficial layers in the ipsilesional SC (left, lower) (indicated by red vs black arrows). B. The re-instatement of visual orientation by cross-modal auditory-visual training was correlated with the re-emergence of visual activity in the ipsilesional deep SC. All conventions as in A. Note that the electrode penetrations at more caudal levels that were previously devoid of deep visual activity now contained visually-responsive neurons. Note, however, that the deep visual SC RF centers were displaced from those in the overlying superficial layers.\



Supplementary Fig. 3: Spatiotemporal dynamics of visual orientation competencies observed during the recovery process. Shown are polar plots of visual orientation capabilities prior to, immediately following and 1hr after daily rehabilitative session (days 8-18). Note that early in the rehabilitative training period visual orientation was first observed immediately after termination of the training session on day 9, but it was not present 1 hour later. By training day 11, however, capabilities seen on the previous day were retained on the morning of the following day. With continued training, permanently reinstated orientation competencies emerged in a central to-peripheral progression. Conventions are as in previous figures.



Supplementary Fig. 4: Normal multisensory processing was evident after cross-modal auditory-visual training and the amelioration of hemianopia. A. Response enhancement. A moving bar of light (arrow) and a broad-band noise burst (speaker icon) within the RFs of deep ipsilesional SC neuron both elicited responses. When the two stimuli were combined, however, the evoked responses exceeded the largest unisensory response (=195%), and even exceeded their summed response (indicated by the dotted line in the summary graphs at the right). Such multisensory enhancement is characteristic of normal SC neurons when integrating weakly effective spatiotemporal cross-modal stimuli. B. Response depression. When the cross-modal stimuli were spatially disparate, the response was less than that to the most effective component stimulus. Such multisensory depression is characteristic of normal SC neurons when integrating spatially discordant cross-modal stimuli. Scale bars = 1 sec (upper & lower)