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reconstruction of the cortical surface and compared to the location of ECS *hand* responses. The localization of the electrodes was determined using a combination of cortical surface reconstructions based on pre-operative structural MRI scans and post-operative CT (computed tomography) scans, as described in [4-5]. Additionally, in order to provide a comparison and assess the degree of overlap between eye and hand representations on M1, the ECS results were compared with ECoG activity elicited during a hand motor task performed by the same patients. For that, ECoG data acquired during the hand motor task was filtered to remove 50 Hz noise. Channels with extremely poor-quality signal were excluded from the analysis. Signed R^2 values for the active versus rest condition in the high-frequency range 60-130 Hz were plotted on the cortical surface reconstructions. The high-frequency band (HFB) was chosen as a target for the analysis due to it being part of the control signal of the UNP participant [1] as well as for its known relevance for cortical activation [6-7].

High-Density ECoG

Data from one patient (E1, female, 31 years old) temporarily implanted with subdural ECoG grids for removal of the focus of epilepsy was used. The subject was also implanted with a high-density (HD) ECoG grid over the sensorimotor cortex (PMT Corporation, MN, USA; 4 mm inter-electrode spacing, sampled at 2000 Hz). We defined an ROI for the M1 hand region based on anatomical landmarks. E1 performed one eye movement and one finger movement localizer task with 15 s blocks of rest and active conditions (10 trials in total). In the active condition of the eye localizer the subject was asked to follow a red circle moving along the edges of a square with her eyes. The target circle could start in any of the corners of the square and move in either clock- or counter-clockwise direction. The active trials of the finger localizer consisted of continuous finger tapping movements. Data were processed in similar way as described in the previous section.

fMRI

Ten healthy (F1-10), right-handed volunteers participated in the study (6 female, mean age 26.9 ± 10.7). The fMRI scanning was carried out using a 7 Tesla Philips Achieva MRI system (Philips Healthcare, Best, Netherlands). Participants performed an eye-movement task while fMRI data was acquired using an Echo Planar Imaging (EPI) sequence. The fMRI task employed a different paradigm than the ECoG tasks, in that an event-related design was used instead of a block design. The participants were instructed to fixate on a target at the center of the screen. Once every 10.5 s, the target moved upwards, downwards, to the left or to the right (32 trials in total). When this happened, the subject had to execute a saccade to fixate on the target at the new position. Additionally, the subjects performed a hand localizer task, from which movement of all fingers (against rest) was used to look for overlap between hand and eye activation. fMRI data was preprocessed using standard protocol and co-registered to the T1-weighted anatomical scan of the participant. FreeSurfer (https://surfer.nmr.mgh.harvard.edu/) was then used to create a surface reconstruction based on the anatomical images. First level statistics were carried out using SPM12. A custom procedure called CGRID was employed to visualize the results and facilitate between-subject comparisons [8]. CGRID transforms the flattened surface reconstructions of the SMC into a grid of 84 x 28 tiles with standardized x- and y-coordinates. In this grid an ROI corresponding to the M1 hand area which consisted of 210 tiles.

RESULTS

ECS and ECoG

Eye responses to stimulation of M1 were present in some subjects. Of the 34 clinical ECS records available for analysis, 10 contained reports of eye-related motor or sensory responses. Of these, only 3 reports described eye-related responses in the proximity of the region of interest (Figure 1). One individual had eye responses close to M1 but with no overlap with hand movement. Two individuals had eye-responsive electrodes exactly on M1 and partly overlapping with electrodes that elicited hand movement during stimulation. One of these subjects (S3) also showed overlapping with electrodes that showed significant HFB power changes during the finger tapping localizer task.

High-Density ECoG

For subject E1, multiple electrodes on M1 responded to the eye task with high and significant signed R^2 values (Figure 2). Many of these electrodes were located on M1, even partly overlapping with electrodes that showed increases in HFB activity in response to a hand movement task. A total of 7/42 electrodes in the M1 ROI with signed R^2 values > 0.25 ($p < 0.05$) in response to the eye task also had HFB increases in response to the hand task with at least $R^2 > 0.25$ ($p < 0.05$).

fMRI

Movement of the fingers elicited clear and recognizable patterns of activity in the contralateral SMC, with the majority of activity increases in M1 being observed in the hand area, located relatively high on M1 (Figure 3). While the responses to eye movements were variable, in most subjects increases in activity were observed in either the hand region or very near it. Furthermore, in some subjects, such as F1, F3 and F7, more than 20% overlap between the eye and hand activation was present, measured as the number of tiles with both eye and hand activity out of all active tiles. Even in the case of F2, F5 and F6, who had little or no actual overlap, distinct regions of eye and hand activation in the ROI were present in close proximity to each other. On average, out of the total active tiles in the ROIs of all participants, 12% had overlap, while 25% were exclusively eye-responsive (Figure 4).