

Supporting Information

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SI Methods

Stimulation Parameters. The stimulation parameters used in the present study were trains of biphasic pulses of 200 μ s, duration of 3s, frequency of 50 Hz, and intensity of 4 mA. These parameters are similar to the parameters of intracortical microstimulation (ICMS) experiments on the human insular cortex (1–4). In particular, note that, unlike in most neurophysiological studies in monkeys, the used frequency in the studies of human insula is typically 50 Hz.

It is well-established that long train stimulation can evoke meaningful behaviors in both subcortical structures (5–7) and the cerebral cortex (8–10). In a recent study, Tolia et al. (11) performed ICMS with biphasic pulses (pulse width = 200 μ s) and currents up to 2 mA delivered at 100 Hz and lasting 4 s on V1 macaque cortex during MRI to assess the spread of cortical activation by analyzing blood oxygenation level-dependent (BOLD) activity. Results showed that current spread around the electrode tip was bigger than expected from previous calculations based on passive spread of current (12–15), most likely because of horizontal projections. Most interestingly, however, the stimulation induced a BOLD response within a hodologically connected network of areas. These data show that parameters very similar to the ones used in the present experiment could be used to probe cortical functions by means of a physiological activation of a cortical network.

To evaluate the validity of spatial localization of the elicited behavior in our study, we assessed the degree of spatial clustering of evoked responses by using cumulative distributions of the Euclidean distances between stimulation sites evoking a given behavior and stimulation sites evoking either the same (distribution within) or different (distribution between) behaviors. The results confirmed the segregation of different behavior elicited by ICMS.

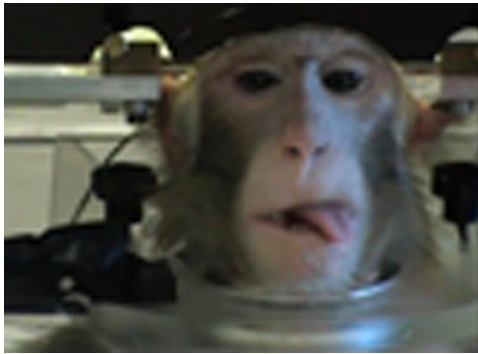
Instantaneous Heart-Rate Frequency Analysis. Electrocardiographic activity was collected with surface electrodes (Medtronic). Electrocardiogram (EKG) signal was amplified (CED 1902; Cambridge

Electronic Design) and sent to a computer by an analog-digital converter (ADC) (Power 1401; Cambridge Electronic Design). EKG data and stimulation signals were monitored online and stored by a computer program (Spike2; Cambridge Electronic Design). Raw signal was filtered and automatically analyzed for QRS complexes. Instantaneous heart rate frequency (HR) was then calculated as the inversed temporal difference between every two consequent QRSs: $HR[t] = 1/(QRS[t] - QRS[t - 1])$. Baseline HR was calculated as the mean HR in a 60-s period immediately preceding the stimulation.

ICMS effect on the HR was assessed within a 10-s period starting at stimulation onset. For this purpose, relative-to-baseline HR profiles consisting of 21 epochs were first calculated by interpolation. For every epoch and behavior outcome, average relative HRs were calculated and confronted against zero with two-tail t tests. Significance level was fixed at $P < 0.05$, and false discovery rate (FDR) corrected for multiple corrections (16). Significance is indicated in HR plots with dots overlaid on the relative HR profiles (black, significant; white, nonsignificant). Peak deviation per outcome and corresponding significance level are reported in the text.

Histological Control. At the end of the experiment, the animal was anesthetized with ketamine hydrochloride (15 mg/kg i.m.) followed by an i.v. lethal injection of sodium thiopental that was perfused through the left cardiac ventricle with saline, 3.5–4% paraformaldehyde, and 5% glycerol in that order. All solutions were prepared in phosphate buffer (0.1 M, pH 7.4). Each brain was then blocked coronally on a stereotaxic apparatus, removed from the skull, photographed, and placed in 10% buffered glycerol for 3 d and 20% buffered glycerol for 4 d. Finally, it was cut when frozen into 60- μ m-thick coronal sections. The sections were stained by using the Nissl method. Outer and inner cortical contours, the locations of the electrolytic lesions, and the electrode tracks were assessed, plotted, digitalized by a computer program, and used for the reconstruction of the penetration sites.

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Movie S3. Ingestive behavior. Effects of ICMS of the ingestive sector of the insular region. Examples of context-dependent licking are presented. Conventions are as in [Movie S1](#).

[Movie S3](#)



Movie S4. Disgust-related behavior. Effects of ICMS of the disgust-related sector of the insular region. Grimace responses and food refusals are presented. Conventions are as in [Movie S1](#).

[Movie S4](#)



Movie S5. Disgust-related behavior. Effects of ICMS of the disgust-related sector of the insular region. Retching responses. Conventions are as in [Movie S1](#).

[Movie S5](#)

