Supplementary Information:

A shared inhibitory circuit for both exogenous and endogenous control of stimulus selection

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Supplementary Figure 1. Imc connectivity and effect of Imc blockade on stimulus-driven competitive inhibition in the OTid.

(a) Schematic showing the inputs to an Imc neuron from the optic tectum (black neurite) and the output projections of the Imc neuron (red neurites) back to the optic tectum.

(b) Unit-by-unit analysis of response suppression. Shown is the statistical significance of maximum response-suppression across the three conditions. Black fill indicates significant suppression by the competitor at the 0.05 level, white fill indicates an absence of significant suppression. For each unit, and in each condition, the significance of suppression was determined by comparing the responses to the RF

(d1) Distance between OT-Imc RFs (deg), (d2) Distance in elevation (deg), (d3) Distance in azimuth (deg)

Average values of parameters:
- RF stimulus loom speed (deg/s) 4.4 ± 2.4
- Competitor loom speed (deg/s) 7.2 ± 4.7.2
- Spike count window: start (ms) 50.0 ± 0.100
- Spike count window: end (ms) 300.0 ± 250.300
stimulus measured without and with the competitor (in each case, responses were measured repeatedly between 10 and 15 times). Comparison was performed using t-tests or ranksum tests (depending on whether the distributions being compared were both normal, or not); tests for each unit were followed by Holm-Bonferroni correction for multiple comparisons.

(c) Responses to the RF stimulus alone were not significantly affected by Imc blockade. (c1) Plot of responses to the RF stimulus alone across the three conditions for all the units tested. Gray line connects data from one unit. Although there was no significant effect of Imc blockade on responses to the RF stimulus alone in the majority of units, there was a weak, but not significant trend of progressively decreasing responses to single stimuli, from baseline to blockade to recovery, for some units. This gradual reduction is consistent with response adaptation due to repeated presentation of stimuli (10-15 times for each condition) at the same location. The inter-stimulus-interval used in these experiments was between 2.5 and 3.5 seconds, chosen based on previous work so as to minimize adaptation \(^{13}\). (c2) Unit-by-unit analysis of responses to the RF stimulus alone: comparison of responses in the baseline vs. Imc blockade, and the Imc blockade vs. recovery conditions. Conventions as in (b). For each unit, significance was determined using t-tests or ranksum tests across pairs of conditions (depending on whether the distributions being compared were both normal, or not). Tests were followed by Holm-Bonferroni corrections for multiple comparisons.

(d) (d1) A map of the receptive field (RF) centers of OTid units, and of the corresponding, inactivated Imc units, recorded in the experiments described in Figure 2. The competitor stimuli were presented at the centers of the inactivated RFs. The spatial spread of points shows that the effects hold true across the OTid/Imc space maps. (d2) Plot of azimuthal and elevational distances between the OTid RF and Imc RF for all the tested units. (d3) Tables showing average values of key parameters in the experimental protocol, computed across the tested population. Data shown as x±y represent mean ±s.e.m; data shown as x \[y,z\] represent median, along with the 95% confidence interval of the median.
Supplementary Figure 2. Space-specificity, modality independence, and competitor-strength independence of the effect of Imc blockade on stimulus-driven competitive inhibition in the OTid.

(a-b) Spatial specificity. (a1) A map of the receptive field centers of OTid units, and of the corresponding, inactivated Imc units. In addition, the locations of the visual competitors are also shown. Note that in this experiment, competitors were presented outside the Imc RFs. These data refer to the experiments described in Figure 3a. (a2) Tables showing average values of key parameters in the experimental protocol, computed across the tested population. (b) Unit-by-unit analysis of response suppression. Conventions and statistical analyses as in Supplementary Figure 1b.

(c-d) Sensory modality independence. (c1) A map of the receptive field centers of OTid units, and of the corresponding, inactivated Imc units, recorded in the experiments described in Figure 3b. The auditory competitor stimuli were presented at the centers of the Imc RFs. (c2) Tables showing average values of key parameters in the experimental protocol, computed across the tested population. (d) Unit-by-unit analysis of response suppression. Conventions and statistical analyses as in Supplementary Figure 1b.
(e-f) Competitor strength-independence. (e1) A map of the receptive field centers of OTid units, and of the corresponding, inactivated Imc units, recorded in the experiments described in Figure 4. (e2) Tables showing average values of key parameters in the experimental protocol, computed across the tested population. (f) Unit-by-unit analysis of response correlation (left panel) and suppression (right panel). Conventions and statistical analyses as in Supplementary Figure 1b.

Supplementary Figure 3. Imc blockade and endogenous inhibition in the OTid.

(a-c). Schematic of the electrode configuration (duplicated from Fig. 5a-c).

(d-f). Rasters of spike responses of an OTid unit to the RF stimulus alone (top panels; in black), or to the RF stimulus paired with non-aligned AGF microstimulation (bottom panels). Also shown are the rasters in response to AGF microstimulation delivered alone (middle panels). The rows in the rasters highlighted with darker colors correspond to the spatial location of -11°, the only stimulus location for which responses were suppressed by AGF microstimulation.
(g) A map of the receptive field centers of OTid units, of the corresponding, inactivated Imc units, and of the microstimulation sites in the AGF; data from experiments in Figure 5. (g2) Tables showing average values of key parameters in the experimental protocol, computed across the tested population.

(h) Unit-by-unit analysis of response suppression. Conventions and statistical analyses as in Supplementary Figure 1b.

Supplementary Figure 4. Space-specificity and modality independence of the effect of Imc blockade on endogenous inhibition in the OTid.

(a-b) Spatial specificity. (a1) A map of the receptive field centers of OTid units, of the corresponding, inactivated Imc units, and of the microstimulation sites in the AGF; data from experiments in Figure 6a. (a2) Tables showing average values of key parameters in the experimental protocol, computed across the tested population. (b) Unit-by-unit analysis of response suppression. Conventions and statistical analyses as in Supplementary Figure 1b.

(c-d) Auditory competitor. (c1) A map of the receptive field centers of OTid units, of the corresponding, inactivated Imc units, and of the microstimulation sites in the AGF; data from experiments in Figure 6b. (c2) Tables showing average values of key parameters in the experimental protocol, computed across the tested population. (d) Unit-by-unit analysis of response suppression. Conventions and statistical analyses as in Supplementary Figure 1b.