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Supplemental Information

Transformation of Perception from Sensory to Motor Cortex

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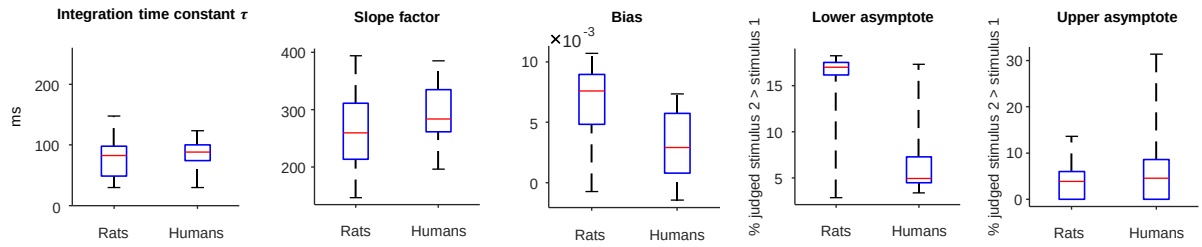

Figure S1. Distributions of values of *SEWP* model parameters for all humans and rats, related to Figure 3.

The box plots show the mean (red), the 25th and 75th percentiles (blue rectangle) and the 99% confidence interval (whiskers). From left to right: Integration time constant, τ, slope factor of psychometric curve, bias of psychometric curve, measured as distance of the inflection point from the value of NSD = 0, lower asymptote, upper asymptote.

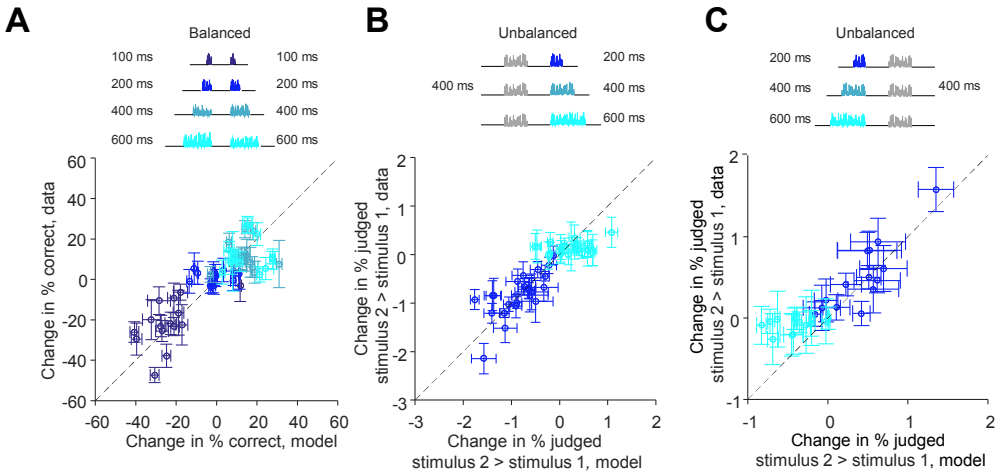

Figure S2. Further investigation of the accuracy of the *SEWP* model in predicting experimental data, related to Figure 3.

(A) Change in percent of correct trials observed in the data and predicted by the model for all rat and human subjects in the balanced condition. Each point represents one duration ($T1 = T2$). Error bars indicate the standard deviation of the mean over 200 test sets. Closeness of points to the diagonal line attests to the accuracy of the model. (B) Change in percent of trials judged stimulus 2 $>$ stimulus 1 observed in the data and predicted by the model for all rat and human subjects in the unbalanced condition. $T1/T2$ = 400/200 ms (blue) and 400/600 ms conditions (cyan) trials are computed with respect to their values in $T1/T2$ = 400/400 ms. Data and model output for $T1/T2$ = 400/400 ms is 0 by definition and not illustrated. (C) Same as (B) but for unbalanced condition where $T1/T2$ = 200/400 ms (blue) and 600/400 ms conditions (cyan). Data and model output for $T1/T2$ = 400/400 ms is 0 by definition and not illustrated.

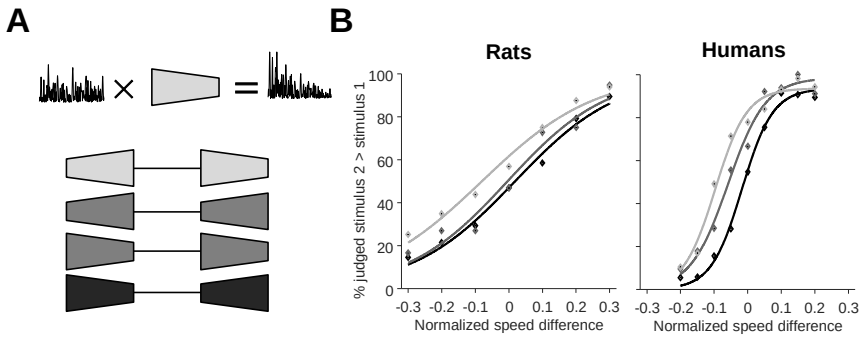

Figure S3. Experiments in rats and humans to test which type of temporal integration is at play – primacy or recency, related to Figure 3.

(A) We introduced ramped stimuli, where the sequence of sp_t values that form the vibration was multiplied by an envelope that gradually and linearly rose or else fell along the course of the presentation; overall *sp* was unaltered by the multiplication. In control experiments with human subjects, direction of the ramp could not be systematically detected (64% accuracy; chance = 50%), indicating that such gradual slopes could not induce any purposeful change in strategy. Sequence of sp_t was multiplied by a linear envelope (shading) that gradually increased or decreased stimulus amplitude. For the purpose of illustration, the slope of the ramp is shown as much steeper than the actual slope (8% change per 100 ms). Ramped stimulus pairs were delivered in 4 combinations. For a given value of *sp*, an upward-ramped vibration should be felt as lower in intensity if primacy is at play but higher if recency is at play. A downward-ramped vibration should be felt as higher in intensity if primacy is at play but lower if recency is at play. Thus, the primacy model posits that for an up/down sequence (light gray), stimulus 2 should be overestimated; for a down-up sequence, stimulus 1 should be overestimated (black). The up-up and down-down sequences (dark gray) should lead to equivalent effects on both stimuli of the pair. The middle two ramp pairs (dark gray) lead to the same predicted perceptual effect and their results are combined in the next plot. (B) Results from 4 rats (left) and 5 humans (right). The shading of the curve corresponds to the ramp condition in (A).

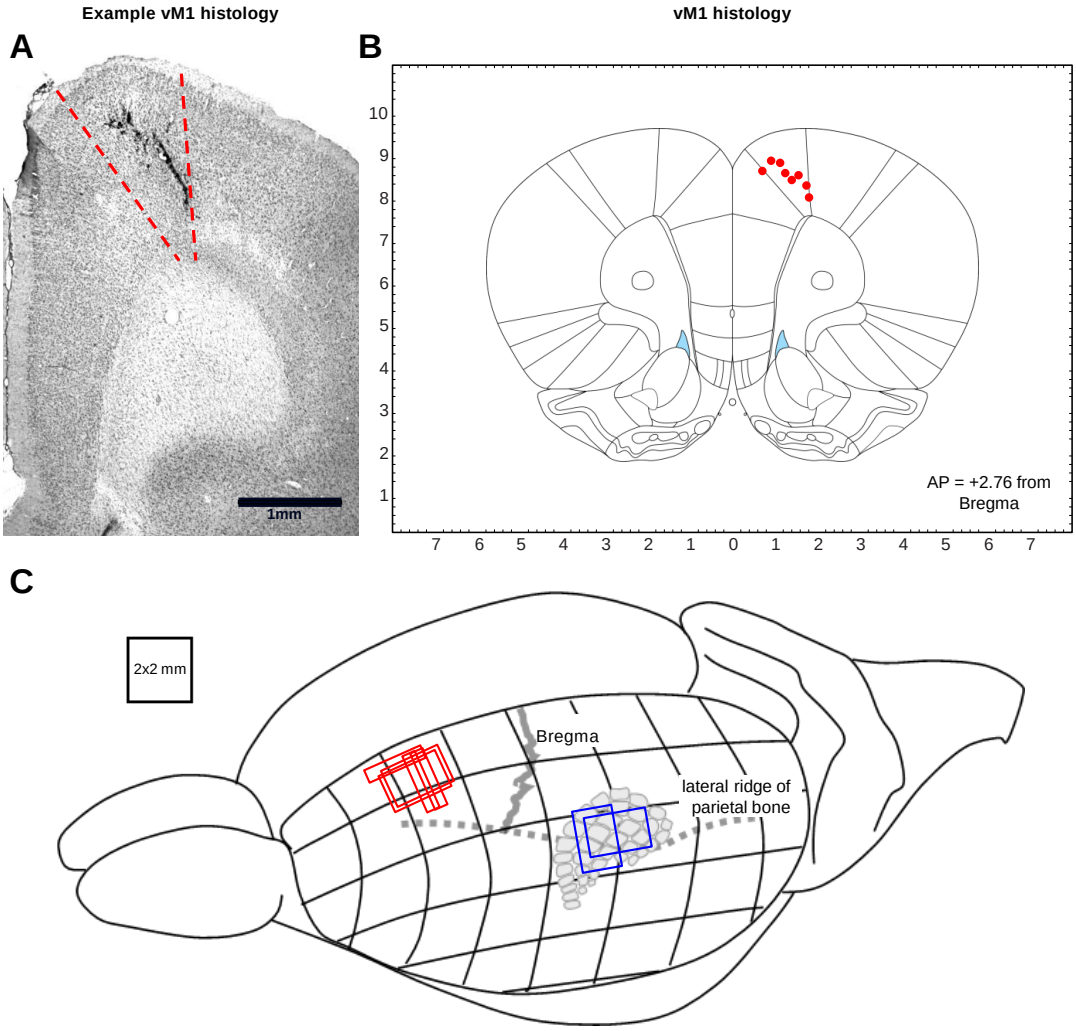

Figure S4. Cortical regions examined, related to STAR Methods on Electrode implantation and data acquisition.

(A) Example of an electrode tracks (dark tissue) in a histologically processed section after the conclusion of the experiment. Dashed red lines indicate the border of vM1. (B) All vM1 recording sites projected into the coordinates of Paxinos and Watson 2006 [S1]. (C) Positions projected onto standard brain of microarrays implanted in 5 rats in vM1 (red rectangles) and 2 rats in vS1 (blue rectangles).

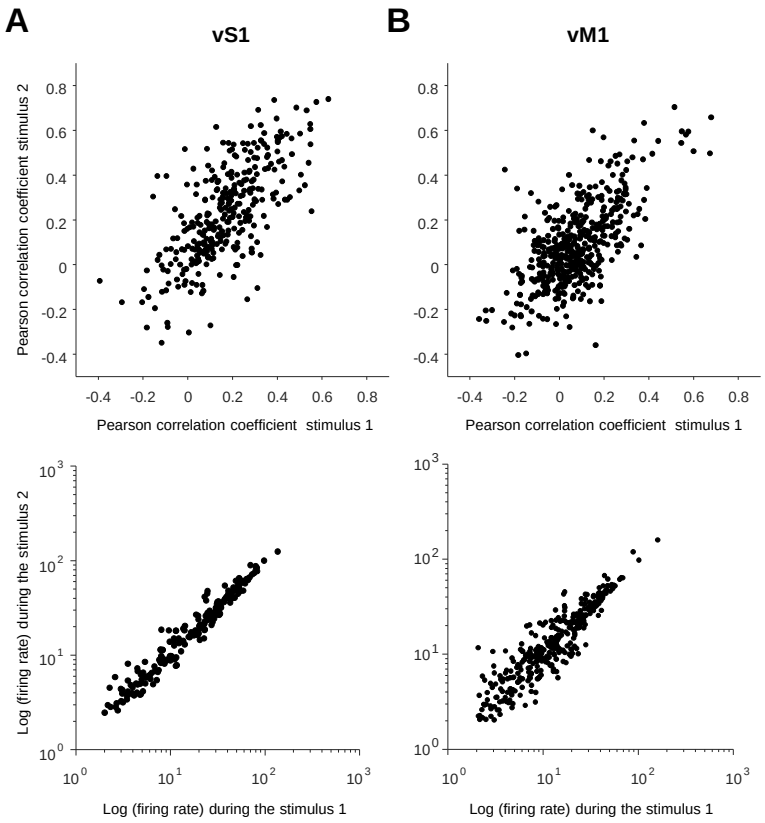

Figure S5. Consistency of coding of stimulus 1 and stimulus 2 in vS1 and vM1, related to Figure 4.

(A) Upper panel: Pearson correlation coefficient between *sp* and mean firing rate for stimulus 1 versus stimulus 2 in vS1. Each dot shows an individual vS1 single- or multiunit. Lower panel: mean firing rate, in log scale, in response to stimulus 1 versus stimulus 2. (B) the same as (A) but for vM1 single units.

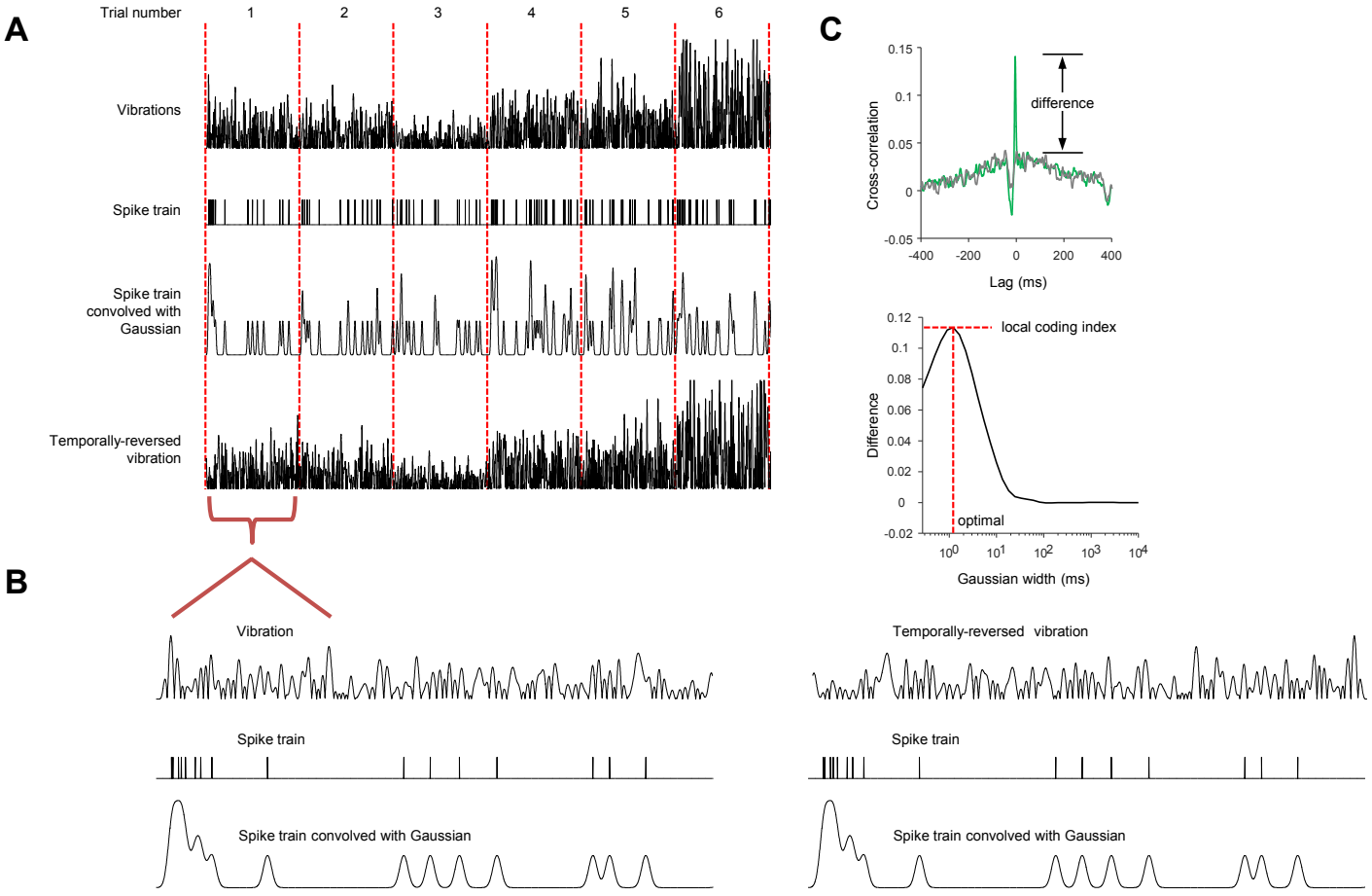

Figure S6. Method for measuring cross-correlation, related to Figure 5.

(A) Upper plot: the stimuli of many trials were concatenated. A chain of 6 vibrations is illustrated. Below, the spike trains recorded simultaneously with each vibration are kept in temporal register. The spike trains are convolved with a Gaussian waveform to convert the point process spike train into a continuous function. Lowest plot: each individual vibration is temporally-reversed and then concatenated. (B) Left: magnified view of one vibration, spike train, and Gaussian-convolved spike train. Right: the same vibration is now temporally-reversed. The spike train and Gaussian-convolved spike train are maintained in the forward direction, so that stimulus/response temporal contingencies are disordered but firing rate is conserved. (C) Upper plot: by computing the correlation between the vibration and the Gaussian-convolved spike train, a cross-correlogram (green trace) emerges. The delay is varied in order to produce the maximum peak of cross-correlation. Likewise, the width of the Gaussian kernel is varied in order to maximize the peak. Then the cross-correlogram with the temporally-reversed vibration is computed (gray trace) to yield a forward/reversed difference. A statistically significant difference is the criterion for neuronal “local coding”. Lower plot: the forward/reversed difference varies according to the width of the Gaussian kernel. The width yielding the largest difference indicates the time scale of local coding.

Supplemental References

S1. Paxinos, G. and Watson, C. (2013). The Rat Brain in Stereotaxic Coordinates: Hard Cover Edition (Elsevier Science). URL https://books.google.it/books?id=FuqGAwAAQBAJ.