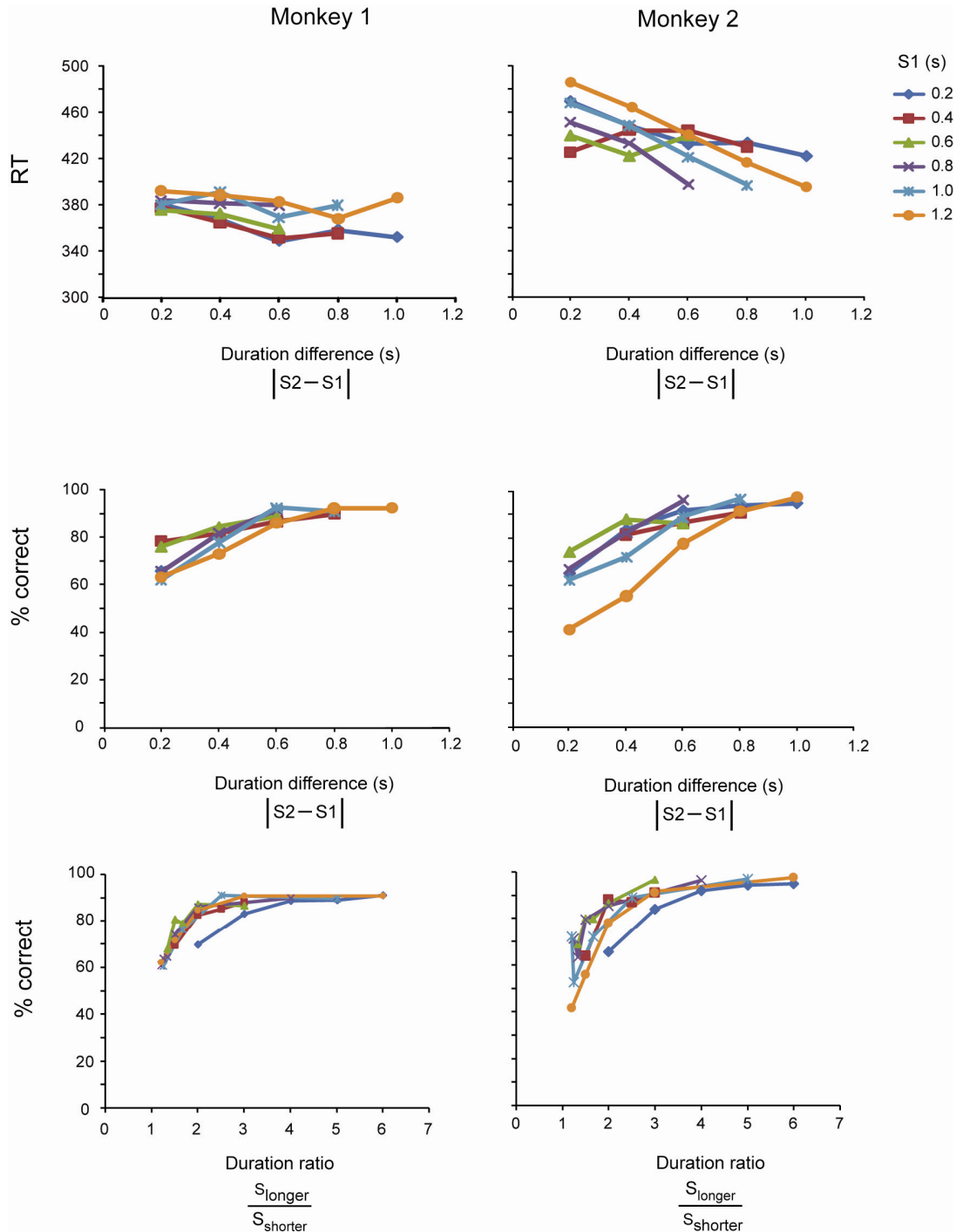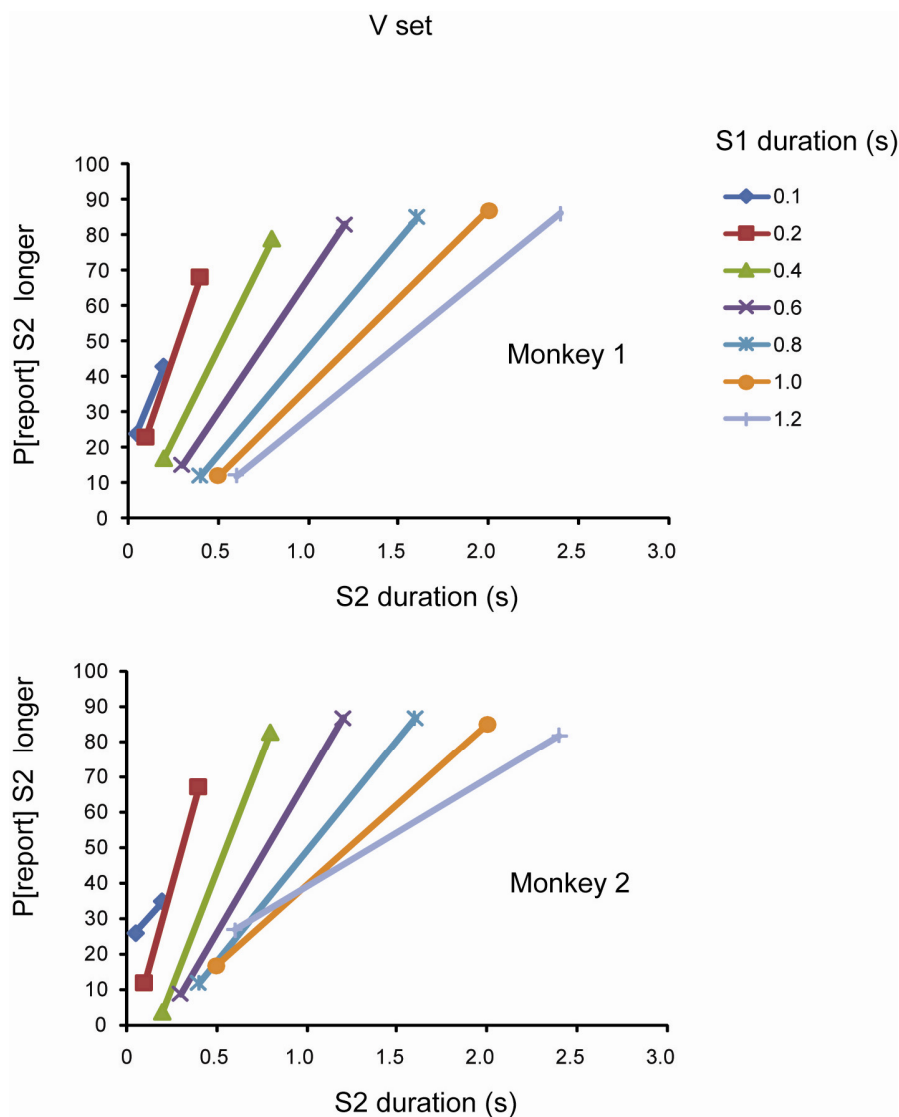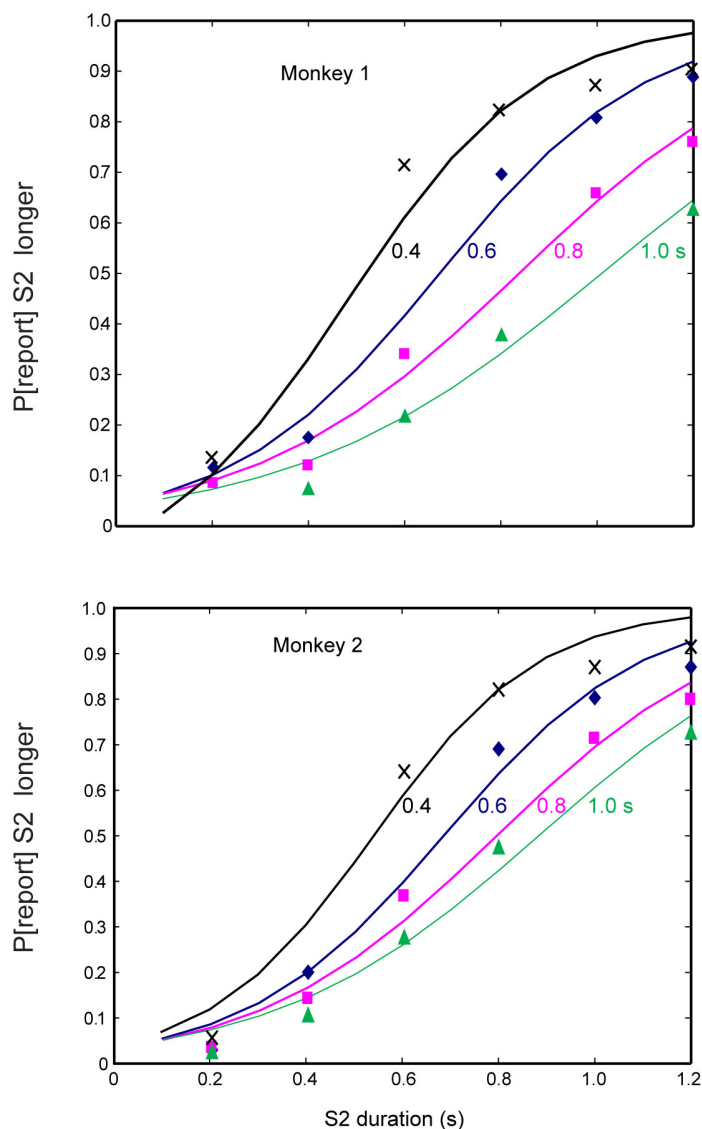## Supplemental figures

Supplemental Figure 1. Reaction times (RT) and percentage correct as a function of the relative duration of the two stimuli. For percent correct, both duration differences (middle row) and ratios (bottom row) are shown. Data from the 'square' set of durations.

Supplemental Figure 2. Performance for the 'V' set of stimulus durations (see Fig. 1C, right). In format of Figure 1D, the plots show the probability that the monkey reported that S2 was longer as a function of the S2 duration.

Supplemental Figure 3. Psychonometric curves, fitted to a pseudo-logistic function. Weber fractions were calculated for an intermediate range of S1 durations. The fit used a logistic function

$$p = [1 + \exp(\mu - t/0.55\sigma)]^{-1};$$

where t is S2 duration and p is the probability of reporting S2 longer. The parameter μ is the point of subjective equality (PSE), which is the value of the duration of S2 corresponding to a 50% chance of reporting that S2 was longer. The parameter σ is the estimate of one standard deviation. We used this model instead of the cumulative normal distribution (CND) because CND is a symmetrical model, whereas Weber's law predicts a positively skewed psychometric function. In general, the Weber fractions remained constant in both monkeys. In monkey 1, the PSEs were 4.8, 6.7, 8.3 and 10.1, respectively, for S2 durations of 0.4, 0.6, 0.8 and 1.0 s. The corresponding Weber fractions were 1.37, 1.77, 1.67 and 1.75. In monkey 2, the PSEs were 5.4, 6.8, 7.9 and 8.8, respectively, for S2 durations of 0.4, 0.6, 0.8 and 1.0 s. The corresponding Weber fractions were 1.75, 1.85, 1.74 and 1.79.
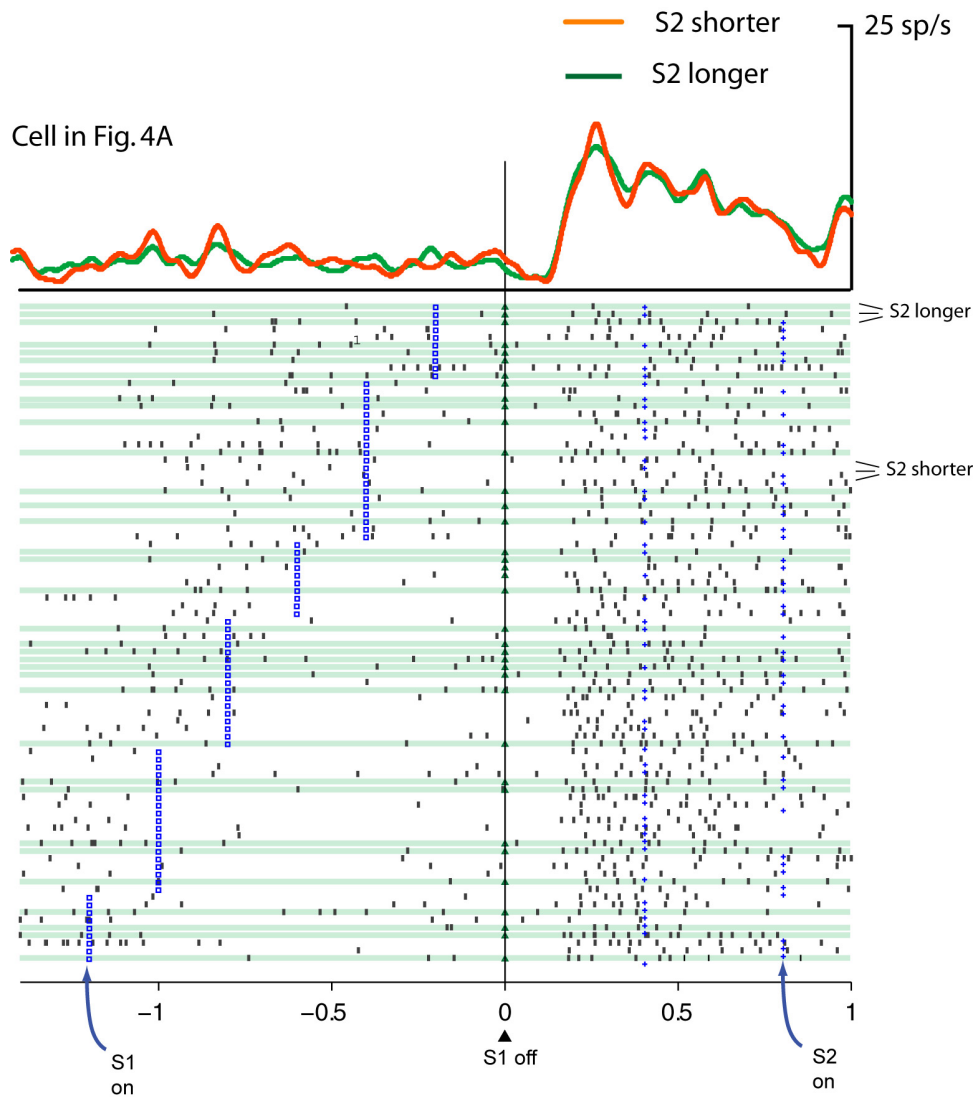
Supplemental Figure 4. For the same cell illustrated in Figure 4A, ruling out prediction effects. The 'V' distribution of stimulus durations was used. This neuron shows a linear relationship between S1 duration and neural activity during the D1 period, in addition to encoding relative duration during the D2 period (see Fig. 4A). The green shaded trials are those with a longer S2, otherwise the trial had a shorter S2. The two spike-density averages above the display refers to trials with S2 either longer (green) or shorter (orange) than S1. Note that there is no difference in activity between these two types of trials in the D1 period.
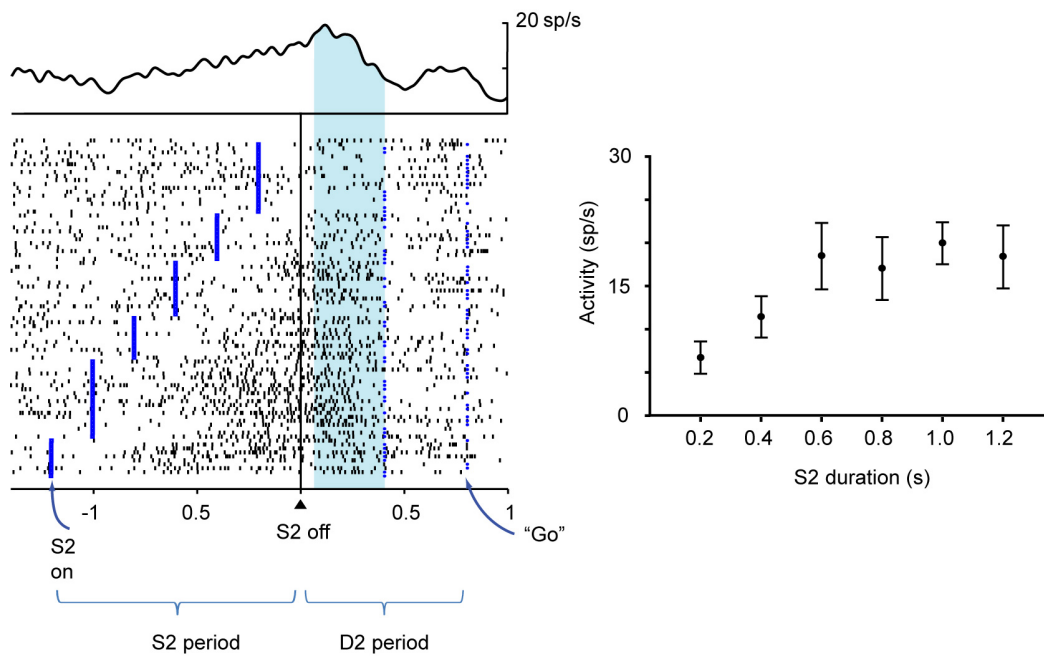
Supplemental Figure 5. Example of a neuron encoding the duration of S2 during the D2 period. Format as in Figure 2, but with activity aligned on S2 offset. Error bars represent standard deviation. Only trials with a D2 period of 400 ms or 800 ms were included.
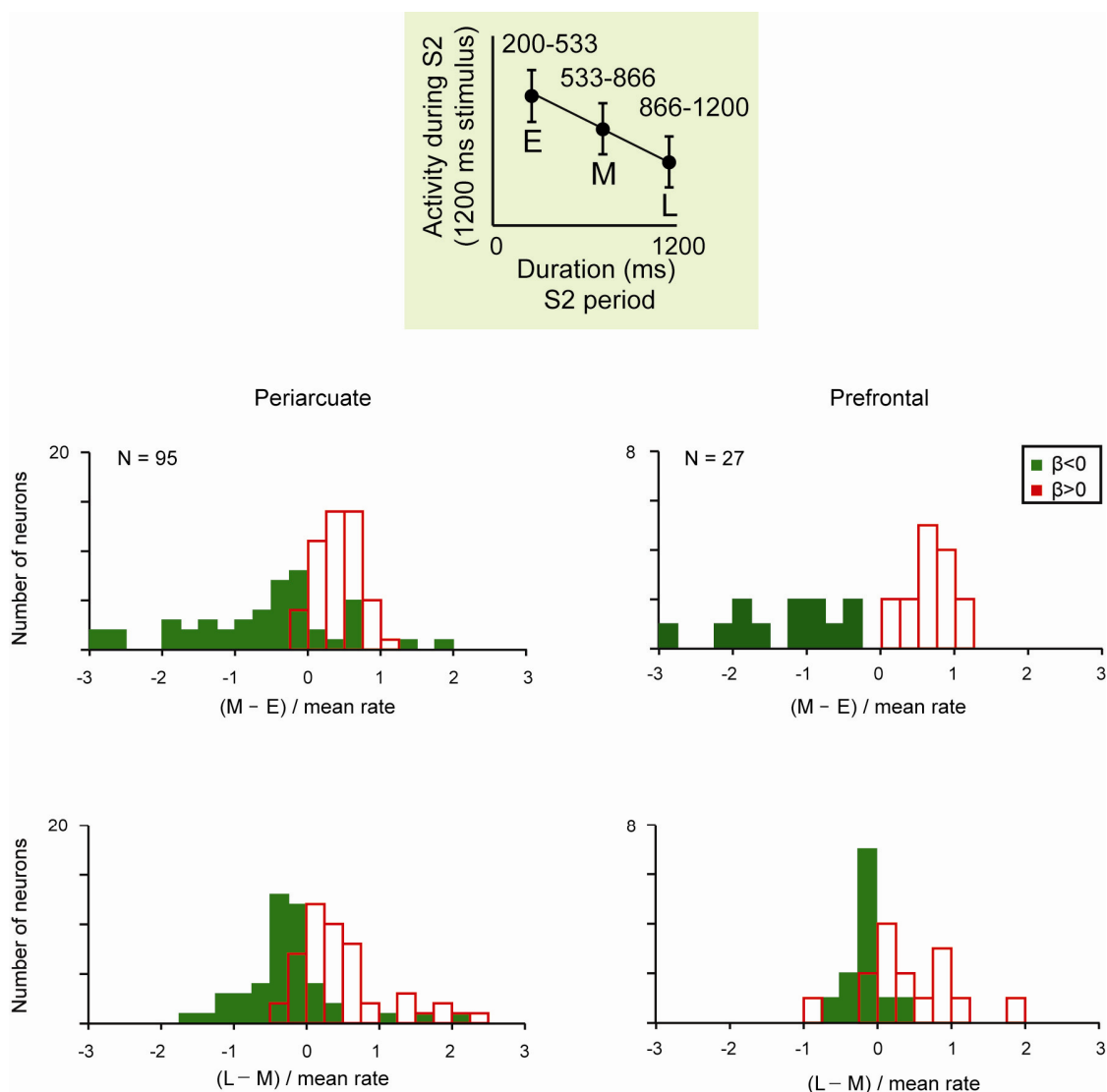
**Supplemental Figure 6**. Relation of activity trends during the S2 period to duration coding during the D2 period. In the format of Figure 3B, but for the S2 period instead of the S1 period. Cells were included if they showed duration-dependent activity during the S2 period (by one-way ANOVA) and were selective for S2 duration during the D2 period (by linear regression analysis). Top: differences between the middle (M) and the early (E) parts of S2 (defined in the inset). Bottom: differences between the late (L) and the middle (M) parts of S2. Both differences are normalized by the mean activity rate. Green bars indicate neurons with a negative correlation between activity and S2 duration during the D2 period ($\beta<0$) and red bars indicate neurons with positive correlations ($\beta>0$). Neurons with positive correlations tended to increase activity during S2, and neurons with negative correlations tended to decrease activity during S2, as was the case during the S1 and D1 periods (Fig. 3B). The 'square' set of durations was used for this analysis.

4-factor multiple regression: D2 period

A
■ Prefrontal (N = 340)
▫ Periarcuate (N = 869)

% neurons

S1 duration · S2 duration · S1–S2 difference · S1 or S2 longer

B

Blue duration · Red duration · Blue–Red difference · Blue or Red longer

8-factor multiple regression: D2 period

C

% neurons

S1 duration · S2 duration · S1–S2 difference · S1 or S2 longer

D

Blue duration · Red duration · Blue–Red difference · Blue or Red longer

Supplemental Figure 7. Results of stepwise, multiple regression analysis. **A, B**. Results of separate 4-factor analyses for activity during the D2 period. **C, D**. Results of a combined 8-factor analysis, corresponding to A and B, showing that the fundamental result remains the same.
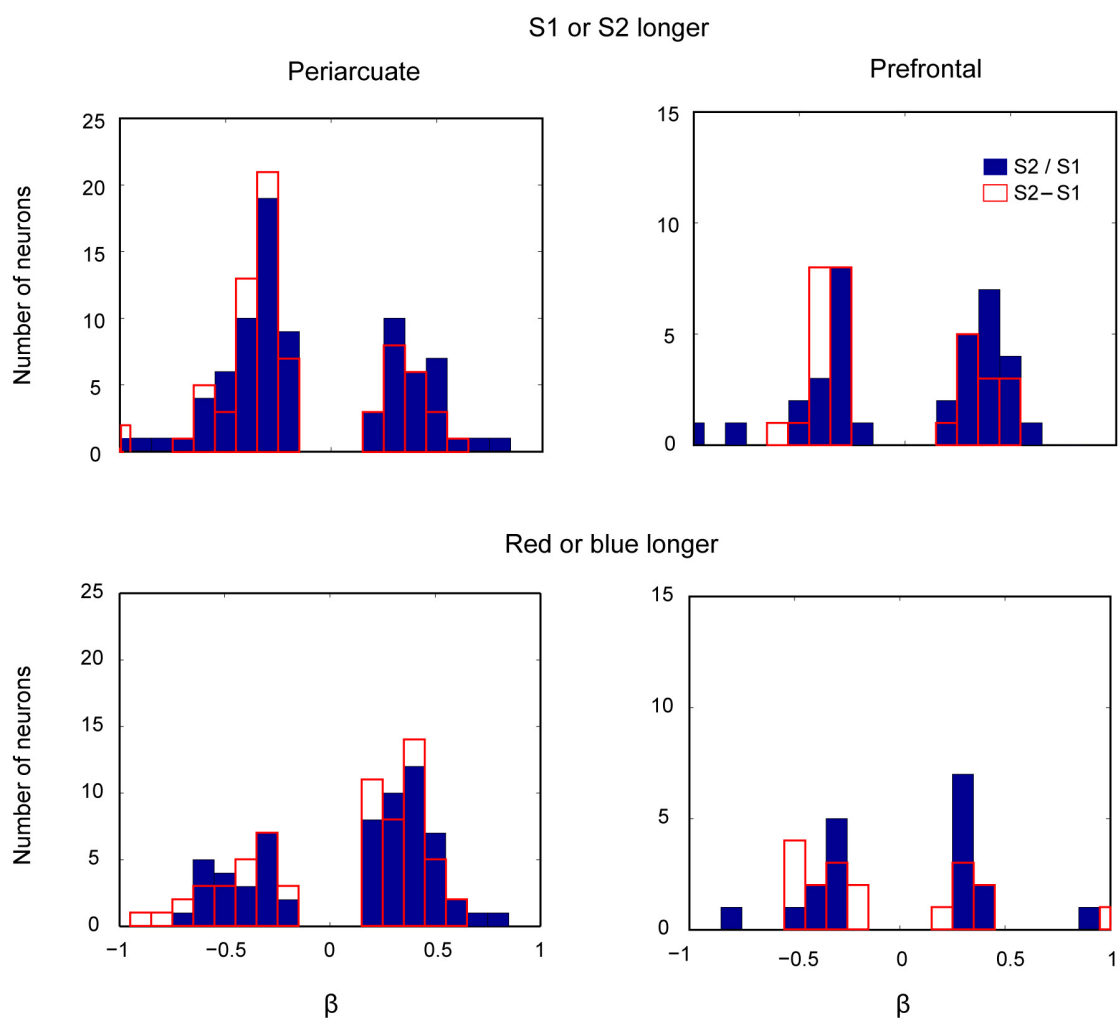
Supplemental Figure 8. Relative-duration effects vary little for differences versus ratios of stimulus duration. β, slope of regression.

A

Prefrontal
N = 340

D2-period activity

Periarcuate
N = 869
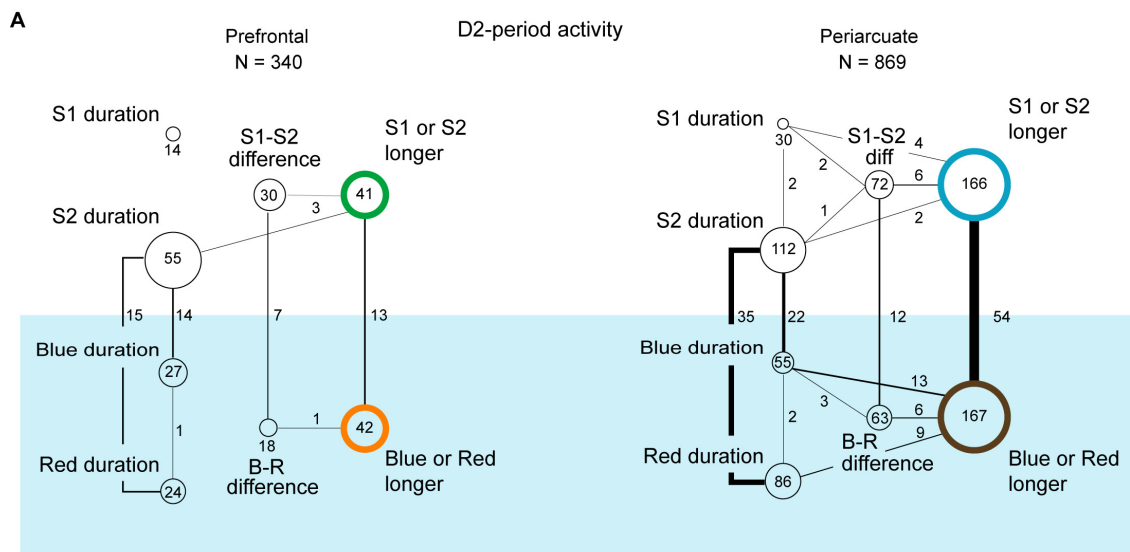
B   Results of stepwise regression for duration coding based on stimulus order ('square' set of durations, see Fig. 1C, left). Numbers (percentages) of cells. Top table: differences; Bottom table: ratios.

Cortical region	N	S1 duration	S2 duration	**S2−S1 difference**	S1 or S2 longer
Prefrontal	340	14 (4%)	55 (16%)	**30 (9%)**	41 (12%)
Periarcuate	869	30 (3%)	112 (13%)	**72 (8%)**	166 (19%)

Cortical regions	N	S1 duration	S2 duration	**S2/S1 ratio**	S2,S1 longer
Prefrontal	340	18 (5%)	52 (15%)	**35 (10%)**	43 (13%)
Periarcuate	869	39 (4%)	106 (12%)	**81 (9%)**	155 (18%)

Results of stepwise regression for duration coding based on stimulus color ('square' set of durations, see Fig. 1C, left). Numbers (percentages) of cells. Top table: differences; Bottom table: ratios.

Cortical regions	N	Blue duration	Red duration	**Blue−Red difference**	Blue or Red longer
Prefrontal	340	27 (8%)	24 (7%)	**18 (5%)**	42 (12%)
Periarcuate	869	55 (6%)	86 (10%)	**63 (7%)**	167 (19%)

Cortical regions	N	Blue duration	Red duration	**Blue/Red ratio**	Blue or Red longer
Prefrontal	340	27 (8%)	24 (7%)	**19 (6%)**	44 (13%)
Periarcuate	869	54 (6%)	91 (10%)	**65 (7%)**	172 (20%)

Supplemental Figure 9. Results of the stepwise-regression analysis. **A**. In the blue shading: the number of cells having significant activity correlations with the duration of the blue stimulus (B), duration of the red stimulus (R), the difference between B and R (B-R), and whether the blue or red stimulus had lasted longer. The diameter of each circle is proportional to the percentage by region, for PFdl (left) and PA (right), with the four colors corresponding to the color code in Figure 6F. The unshaded part of the panel shows equivalent data for four additional factors: S1 duration, S2 duration, the difference between S1 and S2 duration, and whether S1 or S2 had lasted longer. The numerals near each line give the number of cells that showed selectivity for the two factors connected by the line. When no cell showed a given combination, there is no line. Note three findings: (1) more neurons encoded which stimulus was longer than encoded how much longer; (2) the number of cells correlated with S1 duration was not significant during the D2 period (Monte Carlo analysis); and (3) a surprising number of neurons engaged in only one kind of duration coding, with notable exceptions such as the 54 cells in PA that encoded both whether S1 or S2 lasted longer as well as whether the red or blue stimulus lasted longer. **B**. The tables at the bottom compare the results from ratio analysis and difference analysis, using stepwise-regression analysis.

Supplementary Tables

Supplemental Table 1. Neurons showing a significant effect of S1 duration and stimulus color during the D1 period (two-way ANOVA). Numbers (and percentages) of cells.

Cortical region	N	Stimulus set	S1 duration effect	Stimulus color effect	Duration by color interaction
Prefrontal	340	'Square' set	87 (26%)	56 (16%)	21 (6%)
Periarcuate	869	(Fig. 1C, left)	245 (28%)	179 (20%)	96 (11%)
Prefrontal	94	'V' set (Fig.	25 (27%)	16 (17%)	13 (14%)
Periarcuate	417	1C, right)	80 (19%)	54 (13%)	35 (8%)
Prefrontal	434	'Square' & 'V'	112 (26%)	72 (17%)	34 (8%)
Periarcuate	1286	sets, combined	325 (25%)	233 (18%)	131 (10%)

Supplemental Table 2. Neurons showing a significant linear regression between S1 duration and neural activity during the D1 period. Numbers (and percentages) of cells.

Cortical region	N	Stimulus set	linear
Prefrontal	340	'Square' set	81 (24%)
Periarcuate	869	(Fig. 1C, left)	199 (23%)
Prefrontal	94	'V' set (Fig.	23 (24%)
Periarcuate	417	1C, right)	65 (16%)
Prefrontal	434	'Square' & 'V'	104 (24%)
Periarcuate	1286	sets, combined	264 (20%)

Supplemental Table 3. Polynomial contrasts for encoding of S1 duration during the D1 period. Numbers (and percentage) of cells.

Cortical region	N	Stimulus set	ANOVA[a]	linear[b]	quadratic[b]	cubic[b]
Prefrontal	340	'Square' set	87	23 (26%)	29 (33%)	30 (34%)
Periarcuate	869	(Fig. 1C, left)	245	75 (31%)	61 (25%)	78 (32%)
Prefrontal	94	'V' set (Fig.	25	8 (32%)	9 (36%)	5 (20%)
Periarcuate	417	1C, right)	80	21 (26%)	15 (19%)	23 (29%)
Prefrontal	434	'Square' & 'V'	112	31 (28%)	38 (34%)	35 (31%)
Periarcuate	1286	sets, combined	325	96 (30%)	76 (23%)	101 (31%)

[a] from Suppl. Table 1.
[b] % of cells in ANOVA column.

Supplemental Table 4. Mean Pearson's correlation coefficients (± SD) for regressions given in Suppl. Table 3.

Cortical region	Stimulus set	linear	quadratic	cubic
Prefrontal	'Square' set	0.32±0.09	0.35±0.10	0.43±0.12
Periarcuate		0.31±0.09	0.33±0.11	0.39±0.10
Prefrontal	'V' set	0.35±0.08	0.49±0.15	0.39±0.09
Periarcuate		0.31±0.10	0.43±0.11	0.44±0.12

Supplemental Table 5. Neurons showing a significant effect of S2 duration and stimulus color during the D2 period (two-way ANOVA). Numbers (and percentages) of cells.

Cortical region	N	Stimulus set	S2 duration effect	Stimulus color effect	Duration by color interaction
Prefrontal	340	'Square' set	77 (23%)	56 (16%)	55 (16%)
Periarcuate	869	(Fig. 1C, left)	211 (24%)	203 (23%)	194 (22%)
Prefrontal	94	'V' set	12 (13%)	16 (17%)	16 (17%)
Periarcuate	417	(Fig. 1C, right)	56 (13%)	53 (13%)	32 (8%)
Prefrontal	434	'Square' & 'V'	89 (20%)	72 (17%)	71 (16%)
Periarcuate	1286	sets, combined	267 (21%)	256 (20%)	226 (18%)

Supplemental Table 6. Results of two-way ANOVA for relative-duration coding, based on stimulus features (red or blue) and their order (first or second). When neurons were tested with both stimulus sets, the table presents data from the 'square' set of stimulus durations. Numbers (percentages) of cells.

Cortical region	N	Stimulus set	main effect: S1 or S2 longer	main effect: red or blue longer	interactive effects	both main effects
Prefrontal	340	'Square' set	104 (31%)	84 (25%)	64 (19%)	45 (13%)
Periarcuate	869	(Fig. 1C, left)	295 (34%)	278 (32%)	226 (26%)	135 (16%)
Prefrontal	94	'V' set	25 (27%)	17 (18%)	18 (19%)	9 (10%)
Periarcuate	417	(Fig. 1C, right)	88 (21%)	52 (12%)	53 (13%)	19 (5%)
Prefrontal	434		129 (30%)	101 (23%)	82 (19%)	54 (12%)
Periarcuate	1286	Both	383 (30%)	330 (26%)	279 (22%)	154 (12%)