Fig. 1b

ANOVA, Tukey-Kramer *post hoc* tests

Comparison	d.f.	*F*-statistic	*P*-value	*P*-value
$zf_{ZF} - lf_{LF}$				0.99
$zf_{ZF} - zf_{BF}$				0.16
$zf_{BF} - bf_{BF}$	(4, 56)	3.30	0.017	0.92
$bf_{BF} - lf_{BF}$				0.080
$lf_{BF} - lf_{LF}$				0.95
$zf_{BF} - lf_{BF}$				0.065

Fig. 1c

Nested ANOVAs: syllable copy similarity ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
$zf_{ZF} - lf_{LF}$	(1, 35)	6.30	0.016
$zf_{BF} - lf_{BF}$	(1, 19)	4.64	0.043
$zf_{ZF} - zf_{BF}$	(1, 34)	60.06	1.4×10^{-8}
$zf_{BF} - bf_{BF}$	(1, 12)	10.60	0.0073
$bf_{BF} - lf_{BF}$	(1, 11)	1.54	0.24
$lf_{BF} - lf_{LF}$	(1, 20)	1.18	0.29

Fig. 2d

Repeated-measures ANOVAs: diff. in spike rate (ZF – LF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 145)	164.43	1.2×10^{-25}
	lf_{LF}	(1, 165)	25.64	1.1×10^{-6}
sup.	zf_{ZF}	(1, 176)	63.1	2.3×10^{-13}
	lf_{LF}	(1, 51)	1.45	0.23
deep	zf_{ZF}	(1, 278)	112.05	3.2×10^{-22}
	lf_{LF}	(1, 234)	10.63	0.0013
sec.	zf_{ZF}	(1, 214)	13.58	2.9×10^{-4}
	lf_{LF}	(1, 196)	46.91	9.4×10^{-11}

Nested ANOVAs: selectivity ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - lf_{LF}$	(1, 4)	21.58	0.0094
sup.	$zf_{ZF} - lf_{LF}$	(1, 3)	24.15	0.0010
deep	$zf_{ZF} - lf_{LF}$	(1, 4)	18.82	0.012
sec.	$zf_{ZF} - lf_{LF}$	(1, 4)	59.13	9.0×10^{-4}

Repeated-measures ANOVAs: diff. in spike rate (ZF − BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 146)	15.45	1.3×10^{-4}
	zf_{BF}	(1, 70)	8.68	0.0044
sup.	zf_{ZF}	(1, 178)	25.01	1.4×10^{-6}
	zf_{BF}	(1, 77)	2.76	0.10
deep	zf_{ZF}	(1, 267)	116.45	9.1×10^{-23}
	zf_{BF}	(1, 133)	9.17	0.0030
sec.	zf_{ZF}	(1, 194)	18.50	2.7×10^{-5}
	zf_{BF}	(1, 247)	0.21	0.64

Nested ANOVAs: selectivity ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - zf_{BF}$	(1, 4)	1.19	0.32
sup.	$zf_{ZF} - zf_{BF}$	(1, 4)	0.02	0.89
deep	$zf_{ZF} - zf_{BF}$	(1, 4)	10.24	0.016
sec.	$zf_{ZF} - zf_{BF}$	(1, 4)	4.80	0.065

Two-sided, paired *t*-tests: number of segments ($zf_{ZF} > zf_{BF}$ vs. $zf_{BF} > zf_{ZF}$)

Comparison		d.f.	*t*-statistic	*P*-value
deep	ZF	4	3.45	0.026
	BF	4	-3.94	0.017

Fig. 3c

Repeated-measures ANOVAs: diff. in spike rate (LF − BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	lf_{LF}	(1, 161)	16.03	9.5×10^{-5}
	lf_{BF}	(1, 130)	45.90	3.9×10^{-10}
sup.	lf_{LF}	(1, 46)	0.03	0.85
	lf_{BF}	(1, 20)	1.85	0.19
deep	lf_{LF}	(1, 221)	15.85	9.3×10^{-5}
	lf_{BF}	(1, 72)	2.18	0.14
sec.	lf_{LF}	(1, 205)	32.35	4.4×10^{-8}
	lf_{BF}	(1, 187)	3.88	0.050

Nested ANOVAs: selectivity ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$lf_{LF} - lf_{BF}$	(1, 4)	2.69	0.17
sup.	$lf_{LF} - lf_{BF}$	(1, 3)	5.38	0.023
deep	$lf_{LF} - lf_{BF}$	(1, 4)	9.17	0.027
sec.	$lf_{LF} - lf_{BF}$	(1, 4)	9.51	0.036

Fig. 3d

Two-sided, paired *t*-tests: number of segments ($lf_{LF} > lf_{BF}$ vs. $lf_{BF} > lf_{LF}$)

Comparison		d.f.	*t*-statistic	*P*-value
deep	LF	4	17.10	6.9×10^{-5}
	BF	4	-1.12	0.32

Fig. 4d

Pearson correlations: one-sided *P*-values from randomized permutations

	Comparison	d.f.	*t*-statistic	*r*	*P*-value
int.	$zf_{ZF} - lf_{LF}$	108	-1.45	-0.14	0.93
	$zf_{BF} - lf_{BF}$	108	8.62	0.64	<0.001
	$zf_{ZF} - zf_{BF}$	108	3.52	0.32	0.001
	$lf_{LF} - lf_{BF}$	108	6.34	0.52	<0.001
deep	$zf_{ZF} - lf_{LF}$	108	5.84	0.49	<0.001
	$zf_{BF} - lf_{BF}$	108	25.22	0.92	<0.001
	$zf_{ZF} - zf_{BF}$	108	14.54	0.81	<0.001
	$lf_{LF} - lf_{BF}$	108	9.03	0.66	<0.001

Fig. 4e

Repeated-measures ANOVAs: diff. in spike rate (In − Out) ~ bird identity

	Comparison	d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 164)	0.03	0.86
	zf_{BF}	(1, 86)	12.14	7.8×10^{-4}
	lf_{LF}	(1, 189)	3.31	0.070
	lf_{BF}	(1, 159)	0.04	0.84
deep	zf_{ZF}	(1, 293)	96.86	6.3×10^{-20}
	zf_{BF}	(1, 183)	9.05	0.0030
	lf_{LF}	(1, 252)	92.98	6.3×10^{-19}
	lf_{BF}	(1, 108)	22.08	7.7×10^{-6}

Fig. 5d, *top*

ANOVA: SMFs evoking different pPSTHs ~ **bird group** + stimulus species

	Comparison	d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - lf_{LF}$	(1, 1)	72.69	7.0×10^{-16}

Nested ANOVAs: spike rate ~ **bird group** + bird identity(group)

	Comparison	d.f.	*F*-statistic	*P*-value
	1.8 cyc/kHz	(1, 4)	0.00	1.00
	1.6	(1, 4)	0.22	0.66
	1.4	(1, 4)	0.25	0.64
	1.2	(1, 4)	0.16	0.71
	1.0	(1, 4)	0.08	0.79
int.	0.8	(1, 4)	0.21	0.67
	0.6	(1, 4)	3.54	0.13
	0.4	(1, 4)	3.52	0.13
	0.2	(1, 4)	0.03	0.87
	0	(1, 4)	2.59	0.18

Fig. 5d, *bottom*

ANOVA: SMFs evoking different pPSTHs ~ **bird group** + stimulus species

	Comparison	d.f.	*F*-statistic	*P*-value
deep	$zf_{ZF} - lf_{LF}$	(1, 1)	41.24	5.6×10^{-10}

Nested ANOVAs: spike rate ~ **bird group** + bird identity(group)

	Comparison	d.f.	*F*-statistic	*P*-value
	1.8 cyc/kHz	(1, 4)	46.08	9.7×10^{-5}
	1.6	(1, 4)	31.12	5.1×10^{-4}
	1.4	(1, 4)	21.10	0.0042
	1.2	(1, 4)	12.33	0.0097
	1.0	(1, 4)	0.11	0.75
deep	0.8	(1, 4)	33.33	7.5×10^{-4}
	0.6	(1, 4)	54.94	2.6×10^{-4}
	0.4	(1, 4)	17.13	0.0084
	0.2	(1, 4)	3.10	0.11
	0	(1, 4)	4.27	0.078

Fig. 5e, *top*

ANOVA: SMFs evoking different pPSTHs ~ **bird group** + stimulus species

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - zf_{BF}$	(1, 1)	12.07	6.9×10^{-4}

Nested ANOVAs: spike rate ~ **bird group** + bird identity(group)

Comparison		d.f.	*t*-statistic	*P*-value
	1.8 cyc/kHz	(1, 4)	5.81	0.047
	1.6	(1, 4)	5.18	0.067
	1.4	(1, 4)	1.71	0.25
	1.2	(1, 4)	0.15	0.71
	1.0	(1, 4)	0.08	0.79
int.	0.8	(1, 4)	0.13	0.74
	0.6	(1, 4)	0.07	0.80
	0.4	(1, 4)	0.36	0.58
	0.2	(1, 4)	0.60	0.48
	0	(1, 4)	1.38	0.30

Fig. 5e, *bottom*

ANOVA: SMFs evoking different pPSTHs ~ **bird group** + stimulus species

Comparison		d.f.	*F*-statistic	*P*-value
deep	$zf_{ZF} - zf_{BF}$	(1, 1)	21.75	7.7×10^{-6}

Nested ANOVAs: spike rate ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
	1.8 cyc/kHz	(1, 4)	3.74	0.11
	1.6	(1, 4)	2.32	0.18
	1.4	(1, 4)	0.28	0.62
	1.2	(1, 4)	0.99	0.36
	1.0	(1, 4)	1.53	0.27
deep	0.8	(1, 4)	13.09	0.012
	0.6	(1, 4)	18.90	0.0012
	0.4	(1, 4)	0.03	0.88
	0.2	(1, 4)	0.29	0.61
	0	(1, 4)	6.44	0.039

<u>Fig. 5f, *top*</u>

ANOVA: SMFs evoking different pPSTHs ~ **bird group** + stimulus species

	Comparison	d.f.	*F*-statistic	*P*-value
int.	$lf_{LF} - lf_{BF}$	(1, 1)	7.90	0.0054

Nested ANOVAs: spike rate ~ **bird group** + bird identity(group)

	Comparison	d.f.	*F*-statistic	*P*-value
	1.8 cyc/kHz	(1, 4)	0.82	0.42
	1.6	(1, 4)	1.09	0.35
	1.4	(1, 4)	1.52	0.28
	1.2	(1, 4)	1.14	0.34
	1.0	(1, 4)	0.39	0.57
int.	0.8	(1, 4)	0.12	0.74
	0.6	(1, 4)	0.16	0.71
	0.4	(1, 4)	1.45	0.29
	0.2	(1, 4)	0.64	0.47
	0	(1, 4)	0.25	0.64

<u>Fig. 5f, *bottom*</u>

ANOVA: SMFs evoking different pPSTHs ~ **bird group** + stimulus species

	Comparison	d.f.	*F*-statistic	*P*-value
deep	$lf_{LF} - lf_{BF}$	(1, 1)	10.70	0.0013

Nested ANOVAs: spike rate ~ **bird group** + bird identity(group)

	Comparison	d.f.	*F*-statistic	*P*-value
	1.8 cyc/kHz	(1, 4)	5.95	0.059
	1.6	(1, 4)	5.88	0.056
	1.4	(1, 4)	5.06	0.071
	1.2	(1, 4)	4.32	0.080
	1.0	(1, 4)	1.69	0.23
deep	0.8	(1, 4)	2.78	0.15
	0.6	(1, 4)	7.80	0.040
	0.4	(1, 4)	11.27	0.018
	0.2	(1, 4)	3.81	0.081
	0	(1, 4)	2.59	0.14

<u>Fig. 6a</u>

Pearson correlations: two-sided *P*-values from randomized permutations

Comparison	d.f.	*t*-statistic	*r*	*P*-value
zf$_{ZF}$: ZF – LF	108	-6.69	-0.54	<0.001
lf$_{LF}$: ZF – LF	108	-1.18	-0.11	0.27
ZF: zf$_{ZF}$ – lf$_{LF}$	108	14.86	0.82	<0.001
LF: zf$_{ZF}$ – lf$_{LF}$	108	16.74	0.85	<0.001

<u>Fig. 6b</u>

Pearson correlations: two-sided *P*-values from randomized permutations

Comparison	d.f.	*t*-statistic	*r*	*P*-value
zf$_{ZF}$: ZF – BF	108	-10.12	-0.70	<0.001
zf$_{BF}$: ZF – BF	108	-4.27	-0.38	<0.001
ZF: zf$_{ZF}$ – zf$_{BF}$	108	24.90	0.92	<0.001
BF: zf$_{ZF}$ – zf$_{BF}$	108	3.86	0.35	<0.001

<u>Fig. 6c</u>

Pearson correlations: two-sided *P*-values from randomized permutations

Comparison	d.f.	*t*-statistic	*r*	*P*-value
lf$_{LF}$: LF – BF	108	-3.67	-0.33	<0.001
lf$_{BF}$: LF – BF	108	-0.18	-0.02	0.86
LF: lf$_{LF}$ – lf$_{BF}$	108	12.59	0.77	<0.001
BF: lf$_{LF}$ – lf$_{BF}$	108	5.07	0.44	<0.001

<u>Fig. S1d, *top*</u>

Nested ANOVAs: syllable pitch ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
ZF – zf$_{ZF}$	(1, 28)	0.42	0.52
zf$_{ZF}$ – zf$_{BF}$	(1, 34)	41.59	3.9×10^{-7}
zf$_{BF}$ – BF	(1, 14)	2.00	0.18
BF – lf$_{BF}$	(1, 13)	0.06	0.81
lf$_{BF}$ – lf$_{LF}$	(1, 20)	23.72	5.8×10^{-5}
lf$_{LF}$ – LF	(1, 16)	0.07	0.79

<u>Fig. S1d, *bottom*</u>

Regression: pupil syllable pitch ~ **tutor syllable pitch (X$_1$)** + tutor identity (X$_2$)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
ZF – zf$_{ZF}$	125	15.02	0.80	9.2×10^{-30}
BF – zf$_{BF}$	92	18.96	0.89	1.6×10^{-33}
BF – lf$_{BF}$	66	20.50	0.93	2.5×10^{-30}
LF – lf$_{LF}$	46	40.69	0.99	1.0×10^{-37}

<u>Fig. S1e, *top*</u>

Nested ANOVAs: syllable mean freq. ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
ZF – zf$_{ZF}$	(1, 28)	0.14	0.71
zf$_{ZF}$ – zf$_{BF}$	(1, 34)	0.23	0.64
zf$_{BF}$ – BF	(1, 14)	6.42	0.024
BF – lf$_{BF}$	(1, 13)	8.48	0.012
lf$_{BF}$ – lf$_{LF}$	(1, 20)	2.63	0.12
lf$_{LF}$ – LF	(1, 16)	0.64	0.43

<u>Fig. S1e, *bottom*</u>

Regression: pupil syllable mean freq. ~ **tutor syllable mean freq. (X$_1$)** + tutor identity (X$_2$)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
ZF – zf$_{ZF}$	125	15.47	0.81	8.0×10^{-31}
BF – zf$_{BF}$	92	8.29	0.65	9.2×10^{-13}
BF – lf$_{BF}$	66	4.05	0.45	1.4×10^{-4}
LF – lf$_{LF}$	46	19.30	0.94	1.1×10^{-23}

<u>Fig. S1f, *top*</u>

Nested ANOVAs: syllable FM ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
ZF – zf$_{ZF}$	(1, 28)	0.17	0.68
zf$_{ZF}$ – zf$_{BF}$	(1, 34)	2.02	0.17
zf$_{BF}$ – BF	(1, 14)	10.00	0.010
BF – lf$_{BF}$	(1, 13)	13.08	0.0035
lf$_{BF}$ – lf$_{LF}$	(1, 20)	10.82	0.0029
lf$_{LF}$ – LF	(1, 16)	0.09	0.77

<u>Fig. S1f, *bottom*</u>

Regression: pupil syllable FM ~ **tutor syllable FM (X$_1$)** + tutor identity (X$_2$)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
ZF – zf$_{ZF}$	125	30.82	0.94	3.0×10^{-60}
BF – zf$_{BF}$	92	14.04	0.83	1.3×10^{-24}
BF – lf$_{BF}$	66	10.51	0.79	1.0×10^{-15}
LF – lf$_{LF}$	46	14.35	0.90	1.3×10^{-18}

<u>Fig. S1g, *top*</u>

Nested ANOVAs: syllable entropy ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
ZF – zf$_{ZF}$	(1, 28)	1.26	0.27
zf$_{ZF}$ – zf$_{BF}$	(1, 34)	4.72	0.038
zf$_{BF}$ – BF	(1, 14)	0.64	0.44
BF – lf$_{BF}$	(1, 13)	16.16	0.0016
lf$_{BF}$ – lf$_{LF}$	(1, 20)	27.62	2.0×10^{-5}
lf$_{LF}$ – LF	(1, 16)	3.89	0.060

<u>Fig. S1g, *bottom*</u>

Regression: pupil syllable entropy ~ **tutor syllable entropy (X$_1$)** + tutor identity (X$_2$)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
ZF – zf$_{ZF}$	125	15.48	0.81	7.5×10^{-31}
BF – zf$_{BF}$	92	12.41	0.79	2.4×10^{-21}
BF – lf$_{BF}$	66	6.97	0.65	1.8×10^{-9}
LF – lf$_{LF}$	46	10.47	0.84	9.4×10^{-14}

Fig. S4a

See Figs. 2d, 3a, 3c.

Fig. S5a-c

Regression: selectivity (non-tutor syl. types) ~ **selectivity (all types) (X_1)** + bird identity (X_2)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
zf_{ZF} (ZF − LF)	822	208.74	0.99	$<4.2 \times 10^{-288}$
lf_{LF} (ZF − LF)	653	233.08	0.99	$<4.2 \times 10^{-288}$
zf_{ZF} (ZF − BF)	794	162.22	0.99	$<4.2 \times 10^{-288}$
zf_{BF} (ZF − BF)	543	134.89	0.99	$<4.2 \times 10^{-288}$
lf_{LF} (LF − BF)	640	190.81	0.99	$<4.2 \times 10^{-288}$
lf_{BF} (LF − BF)	417	96.92	0.98	4.2×10^{-288}

Fig. S5d

Repeated-measures ANOVAs: selectivity (all − non-tutor) ~ bird identity

Comparison	d.f.	*F*-statistic	*P*-value
zf_{ZF}: ZF − LF	(1, 823)	128.69	8.2×10^{-28}
lf_{LF}: ZF − LF	(1, 654)	110.64	5.2×10^{-24}
zf_{ZF}: ZF − BF	(1, 795)	99.27	4.1×10^{-22}
zf_{BF}: ZF − BF	(1, 544)	53.90	7.7×10^{-13}
lf_{LF}: LF − BF	(1, 641)	98.32	1.2×10^{-21}
lf_{LF}: LF − BF	(1, 418)	18.83	1.8×10^{-5}

Fig. S6a

Repeated-measures ANOVAs: diff. in reliability (ZF – LF) ~ bird identity

	Comparison	d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 151)	383.76	2.6×10^{-43}
	lf_{LF}	(1, 173)	291.90	5.6×10^{-39}
sup.	zf_{ZF}	(1, 186)	399.21	3.6×10^{-48}
	lf_{LF}	(1, 53)	206.00	6.7×10^{-20}
deep	zf_{ZF}	(1, 293)	591.06	3.1×10^{-72}
	lf_{LF}	(1, 241)	242.35	2.7×10^{-38}
sec.	zf_{ZF}	(1, 221)	274.76	1.2×10^{-40}
	lf_{LF}	(1, 209)	130.94	7.4×10^{-24}

Nested ANOVAs: reliability ~ **bird group** + bird identity(group)

	Comparison	d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - lf_{LF}$	(1, 4)	10.55	0.030
sup.	$zf_{ZF} - lf_{LF}$	(1, 3)	4.62	0.056
deep	$zf_{ZF} - lf_{LF}$	(1, 4)	6.17	0.058
sec.	$zf_{ZF} - lf_{LF}$	(1, 4)	2.58	0.17

Fig. S6b

Repeated-measures ANOVAs: diff. in reliability (ZF – BF) ~ bird identity

	Comparison	d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 151)	924.04	3.1×10^{-66}
	zf_{BF}	(1, 72)	500.57	3.8×10^{-34}
sup.	zf_{ZF}	(1, 186)	1590.81	4.4×10^{-93}
	zf_{BF}	(1, 82)	83.39	3.9×10^{-14}
deep	zf_{ZF}	(1, 293)	2179.92	9.7×10^{-138}
	zf_{BF}	(1, 145)	435.88	1.5×10^{-45}
sec.	zf_{ZF}	(1, 221)	1978.28	3.1×10^{-112}
	zf_{BF}	(1, 265)	420.05	1.4×10^{-56}

Nested ANOVAs: reliability ~ **bird group** + bird identity(group)

	Comparison	d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - zf_{BF}$	(1, 4)	0.25	0.63
sup.	$zf_{ZF} - zf_{BF}$	(1, 4)	0.20	0.66
deep	$zf_{ZF} - zf_{BF}$	(1, 4)	1.47	0.27
sec.	$zf_{ZF} - zf_{BF}$	(1, 4)	1.29	0.29

Fig. S6c

Repeated-measures ANOVAs: diff. in reliability (LF − BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	lf_{LF}	(1, 173)	143.60	1.8×10^{-24}
	lf_{BF}	(1, 148)	104.42	7.0×10^{-19}
sup.	lf_{LF}	(1, 53)	117.16	4.9×10^{-15}
	lf_{BF}	(1, 24)	13.93	0.0010
deep	lf_{LF}	(1, 241)	380.06	1.9×10^{-51}
	lf_{BF}	(1, 87)	51.69	2.1×10^{-10}
sec.	lf_{LF}	(1, 209)	277.12	3.6×10^{-40}
	lf_{BF}	(1, 211)	275.62	3.8×10^{-40}

Nested ANOVAs: reliability ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$lf_{LF} - lf_{BF}$	(1, 4)	0.16	0.71
sup.	$lf_{LF} - lf_{BF}$	(1, 3)	0.44	0.51
deep	$lf_{LF} - lf_{BF}$	(1, 4)	12.29	0.0085
sec.	$lf_{LF} - lf_{BF}$	(1, 4)	0.30	0.61

Fig. S7a

Repeated-measures ANOVAs: diff. in precision (ZF − LF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 147)	0.23	0.64
	lf_{LF}	(1, 154)	0.00	0.99
sup.	zf_{ZF}	(1, 173)	0.02	0.88
	lf_{LF}	(1, 47)	0.15	0.70
deep	zf_{ZF}	(1, 265)	0.04	0.85
	lf_{LF}	(1, 200)	3.23	0.074
sec.	zf_{ZF}	(1, 191)	0.55	0.46
	lf_{LF}	(1, 128)	2.25	0.14

Nested ANOVAs: precision ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - lf_{LF}$	(1, 4)	0.32	0.60
sup.	$zf_{ZF} - lf_{LF}$	(1, 3)	1.14	0.30
deep	$zf_{ZF} - lf_{LF}$	(1, 4)	11.22	0.0045
sec.	$zf_{ZF} - lf_{LF}$	(1, 4)	2.09	0.21

Fig. S7b

Repeated-measures ANOVAs: diff. in precision (ZF − BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 146)	18.35	3.3×10^{-5}
	zf_{BF}	(1, 66)	2.93	0.092
sup.	zf_{ZF}	(1, 177)	1.74	0.19
	zf_{BF}	(1, 76)	0.13	0.72
deep	zf_{ZF}	(1, 266)	9.27	0.0026
	zf_{BF}	(1, 129)	5.55	0.020
sec.	zf_{ZF}	(1, 188)	24.97	1.3×10^{-6}
	zf_{BF}	(1, 225)	8.01	0.0051

Nested ANOVAs: precision ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - zf_{BF}$	(1, 4)	0.74	0.42
sup.	$zf_{ZF} - zf_{BF}$	(1, 4)	0.05	0.83
deep	$zf_{ZF} - zf_{BF}$	(1, 4)	2.76	0.11
sec.	$zf_{ZF} - zf_{BF}$	(1, 4)	0.43	0.52

<u>Fig. S7c</u>

Repeated-measures ANOVAs: diff. in precision (LF − BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	lf_{LF}	(1, 162)	5.23	0.024
	lf_{BF}	(1, 134)	3.58	0.061
sup.	lf_{LF}	(1, 48)	6.71	0.013
	lf_{BF}	(1, 20)	0.93	0.35
deep	lf_{LF}	(1, 213)	0.15	0.69
	lf_{BF}	(1, 69)	3.84	0.054
sec.	lf_{LF}	(1, 184)	0.60	0.44
	lf_{BF}	(1, 178)	4.66	0.032

Nested ANOVAs: precision ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$lf_{LF} - lf_{BF}$	(1, 4)	1.20	0.33
sup.	$lf_{LF} - lf_{BF}$	(1, 3)	0.02	0.89
deep	$lf_{LF} - lf_{BF}$	(1, 4)	0.75	0.42
sec.	$lf_{LF} - lf_{BF}$	(1, 4)	1.42	0.29

Fig. S8a

Repeated-measures ANOVAs: diff in. discrimination (ZF – LF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 110)	31.76	1.4×10^{-7}
	lf_{LF}	(1, 96)	4.87	0.030
sup.	zf_{ZF}	(1, 108)	10.21	0.0018
	lf_{LF}	(1, 31)	0.81	0.38
deep	zf_{ZF}	(1, 183)	26.06	8.3×10^{-7}
	lf_{LF}	(1, 121)	0.11	0.75
sec.	zf_{ZF}	(1, 137)	11.40	9.5×10^{-4}
	lf_{LF}	(1, 35)	16.56	2.6×10^{-4}

Nested ANOVAs: discrimination ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - lf_{LF}$	(1, 3)	0.61	0.49
sup.	$zf_{ZF} - lf_{LF}$	(1, 3)	1.70	0.27
deep	$zf_{ZF} - lf_{LF}$	(1, 3)	22.50	0.016
sec.	$zf_{ZF} - lf_{LF}$	(1, 3)	6.88	0.066

Fig. S8b

Repeated-measures ANOVAs: diff. in discrimination (ZF – BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	zf_{ZF}	(1, 123)	0.19	0.66
	zf_{BF}	(1, 36)	0.49	0.49
sup.	zf_{ZF}	(1, 114)	1.43	0.23
	zf_{BF}	(1, 47)	0.17	0.68
deep	zf_{ZF}	(1, 199)	15.92	9.3×10^{-5}
	zf_{BF}	(1, 89)	0.10	0.75
sec.	zf_{ZF}	(1, 124)	7.81	0.0060
	zf_{BF}	(1, 157)	0.010	0.93

Nested ANOVAs: discrimination ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$zf_{ZF} - zf_{BF}$	(1, 3)	0.21	0.66
sup.	$zf_{ZF} - zf_{BF}$	(1, 3)	0	0.98
deep	$zf_{ZF} - zf_{BF}$	(1, 3)	21.10	4.8×10^{-4}
sec.	$zf_{ZF} - zf_{BF}$	(1, 3)	2.08	0.19

Repeated-measures ANOVAs: diff. in discrimination (LF − BF) ~ bird identity

Comparison		d.f.	*F*-statistic	*P*-value
int.	lf_{LF}	(1, 132)	7.06	0.0089
	lf_{BF}	(1, 92)	18.09	5.1×10^{-5}
sup.	lf_{LF}	(1, 38)	0.050	0.83
	lf_{BF}	(1, 12)	4.15	0.064
deep	lf_{LF}	(1, 150)	0	0.99
	lf_{BF}	(1, 39)	12.38	0.0011
sec.	lf_{LF}	(1, 117)	6.71	0.011
	lf_{BF}	(1, 119)	5.87	0.017

Nested ANOVAs: discrimination ~ **bird group** + bird identity(group)

Comparison		d.f.	*F*-statistic	*P*-value
int.	$lf_{LF} - lf_{BF}$	(1, 4)	0.80	0.42
sup.	$lf_{LF} - lf_{BF}$	(1, 3)	4.33	0.066
deep	$lf_{LF} - lf_{BF}$	(1, 4)	6.49	0.037
sec.	$lf_{LF} - lf_{BF}$	(1, 4)	5.42	0.075

Fig. S8d

Regression: diff. in discrimination (ZF − LF) ~ **selectivity (X_1)** + bird identity (X_2)

Comparison		d.f.	*t*-statistic	partial *r*	*P*-value
zf$_{ZF}$	int.	109	2.74	0.25	0.0071
	sup.	107	4.89	0.43	3.6×10^{-6}
	deep	182	4.52	0.32	1.1×10^{-5}
	sec.	136	9.33	0.62	2.6×10^{-16}
lf$_{LF}$	int.	94	8.90	0.68	4.2×10^{-14}
	sup.	30	1.21	0.22	0.24
	deep	119	7.67	0.58	5.1×10^{-12}
	sec.	35	2.80	0.43	0.0082

Fig. S8e

Regression: diff. in discrimination (ZF − BF) ~ **selectivity (X_1)** + bird identity (X_2)

Comparison		d.f.	*t*-statistic	partial *r*	*P*-value
zf$_{ZF}$	int.	122	3.49	0.30	6.8×10^{-4}
	sup.	113	2.53	0.23	0.013
	deep	198	6.93	0.44	5.8×10^{-11}
	sec.	123	6.32	0.50	4.3×10^{-9}
zf$_{BF}$	int.	35	1.60	0.26	0.12
	sup.	45	4.27	0.54	1.0×10^{-4}
	deep	87	4.88	0.46	4.8×10^{-6}
	sec.	156	6.37	0.45	2.0×10^{-9}

Fig. S8f

Regression: diff. in discrimination (LF − BF) ~ **selectivity (X_1)** + bird identity (X_2)

Comparison		d.f.	*t*-statistic	partial *r*	*P*-value
lf$_{LF}$	int.	131	7.21	0.53	3.9×10^{-11}
	sup.	37	3.88	0.54	4.2×10^{-4}
	deep	149	6.98	0.50	8.9×10^{-11}
	sec.	116	8.66	0.63	3.2×10^{-14}
lf$_{BF}$	int.	91	7.36	0.61	7.8×10^{-11}
	sup.	11	0.79	0.23	0.44
	deep	38	2.19	0.33	0.035
	sec.	118	6.20	0.50	8.5×10^{-9}

Fig. S9a

Two-sided, paired *t*-tests: number of segments ($zf_{ZF} > zf_{BF}$ vs. $zf_{BF} > zf_{ZF}$)

Comparison		d.f.	*t*-statistic	*P*-value
int.	ZF	4	1.49	0.21
	BF	4	-1.29	0.27

Fig. S9b

Two-sided, paired *t*-tests: number of segments ($lf_{LF} > lf_{BF}$ vs. $lf_{BF} > lf_{LF}$)

Comparison		d.f.	*t*-statistic	*P*-value
int.	LF	4	5.93	0.0040
	BF	4	-1.38	0.24

Fig. S10a

Two-sided, paired *t*-tests: number of segments ($zf_{ZF} > zf_{BF}$ vs. $zf_{BF} > zf_{ZF}$)

Comparison		d.f.	*t*-statistic	*P*-value
sup.	ZF	4	0.88	0.43
	BF	4	-2.27	0.086

Fig. S10b

Two-sided, paired *t*-tests: number of segments ($lf_{LF} > lf_{BF}$ vs. $lf_{BF} > lf_{LF}$)

Comparison		d.f.	*t*-statistic	*P*-value
sup.	LF	4	2.95	0.042
	BF	4	-1.75	0.16

Fig. S11a

Two-sided, paired *t*-tests: number of segments ($zf_{ZF} > zf_{BF}$ vs. $zf_{BF} > zf_{ZF}$)

Comparison		d.f.	*t*-statistic	*P*-value
sec.	ZF	4	1.19	0.30
	BF	4	-3.64	0.022

Fig. S11b

Two-sided, paired *t*-tests: number of segments ($lf_{LF} > lf_{BF}$ vs. $lf_{BF} > lf_{LF}$)

Comparison		d.f.	*t*-statistic	*P*-value
sec.	LF	4	3.38	0.028
	BF	4	-3.29	0.030

Fig. S12c

1-way ANOVA, Tukey-Kramer *post hoc* tests

Comparison		d.f.	*F*-statistic	*P*-value	*P*-value
int.	$zf_{ZF} - zf_{BF}$	(2,129)	36.09	3.6×10^{-13}	0.26
	$zf_{ZF} - \times$				9.6×10^{-10}
	$zf_{BF} - \times$				1.3×10^{-9}
sup.	$zf_{ZF} - zf_{BF}$	(2,129)	20.06	2.6×10^{-8}	7.6×10^{-4}
	$zf_{ZF} - \times$				1.8×10^{-9}
	$zf_{BF} - \times$				0.022
deep	$zf_{ZF} - zf_{BF}$	(2,129)	13.82	3.6×10^{-6}	0.79
	$zf_{ZF} - \times$				3.8×10^{-6}
	$zf_{BF} - \times$				8.3×10^{-5}
sec.	$zf_{ZF} - zf_{BF}$	(2,129)	9.65	1.2×10^{-4}	0.047
	$zf_{ZF} - \times$				3.4×10^{-5}
	$zf_{BF} - \times$				0.11

1-way ANOVA, Tukey-Kramer *post hoc* tests

Comparison		d.f.	*F*-statistic	*P*-value	*P*-value
int.	$lf_{LF} - lf_{BF}$	(2,114)	21.89	9.0×10^{-9}	1
	$lf_{LF} - \times$				2.1×10^{-7}
	$lf_{BF} - \times$				3.0×10^{-7}
sup.	$lf_{LF} - lf_{BF}$	(2,114)	49.63	3.1×10^{-16}	0.48
	$lf_{LF} - \times$				9.6×10^{-10}
	$lf_{BF} - \times$				9.6×10^{-10}
deep	$lf_{LF} - lf_{BF}$	(2,114)	26.77	3.0×10^{-10}	1
	$lf_{LF} - \times$				1.4×10^{-8}
	$lf_{BF} - \times$				1.7×10^{-8}
sec.	$lf_{LF} - lf_{BF}$	(2,114)	13.55	5.3×10^{-6}	0.88
	$lf_{LF} - \times$				1.3×10^{-4}
	$lf_{BF} - \times$				1.9×10^{-5}

*Only data from the deep region are plotted in Fig. S10

Fig. S13c

Nested ANOVAs: best frequency ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
$zf_{ZF} - lf_{LF}$	(1, 4)	0.58	0.49
$zf_{ZF} - zf_{BF}$	(1, 4)	0.28	0.62
$lf_{LF} - lf_{BF}$	(1, 4)	1.55	0.28

Regression: spike rate selectivity ~ **best frequency (X$_1$)** + bird identity (X$_2$)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
zf_{ZF}: ZF − LF	774	0.01	0.00	0.99
lf_{LF}: ZF − LF	593	0.13	0.01	0.90
zf_{ZF}: ZF − BF	747	2.09	0.08	0.04
zf_{BF}: ZF − BF	519	0.39	0.02	0.70
lf_{LF}: LF − BF	585	1.06	0.04	0.29
lf_{BF}: LF − BF	365	-0.48	-0.02	0.63

Fig. S13d

Nested ANOVAs: bandwidth ~ **bird group** + bird identity(group)

Comparison	d.f.	*F*-statistic	*P*-value
$zf_{ZF} - lf_{LF}$	(1, 4)	4.11	0.11
$zf_{ZF} - zf_{BF}$	(1, 4)	0.01	0.94
$lf_{LF} - lf_{BF}$	(1, 4)	0.73	0.44

Regression: spike rate selectivity ~ **bandwidth (X$_1$)** + bird identity (X$_2$)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
zf_{ZF}: ZF − LF	774	5.89	0.21	5.7×10^{-9}
lf_{LF}: ZF − LF	593	2.19	0.09	0.029
zf_{ZF}: ZF − BF	747	1.24	0.05	0.22
zf_{BF}: ZF − BF	519	-1.13	-0.05	0.26
lf_{LF}: LF − BF	585	-4.94	-0.20	1.0×10^{-6}
lf_{BF}: LF − BF	365	-4.49	-0.23	9.7×10^{-6}

Fig. S14d

Regression: spike rate selectivity ~ **song-tuning overlap (X_1)** + bird identity (X_2)

Comparison	d.f.	*t*-statistic	partial *r*	*P*-value
zf$_{ZF}$: ZF − LF	731	12.91	0.43	1.7×10^{-34}
lf$_{LF}$: ZF − LF	503	12.77	0.49	1.5×10^{-32}
zf$_{ZF}$: ZF − BF	731	13.30	0.44	2.6×10^{-36}
zf$_{BF}$: ZF − BF	493	19.46	0.66	5.1×10^{-63}
lf$_{LF}$: LF − BF	503	12.91	0.50	3.9×10^{-33}
lf$_{BF}$: LF − BF	361	7.92	0.38	3.1×10^{-14}