

Supplementary Table : Statistical Analysis

Figure	Test groups	Test performed	P values	Additional Statistical Reporting
1a	Lick rate across reward, neutral and aversive contexts (n=12 mice, 24 sessions)	Two-way ANOVA with Sidak's post hoc	p<0.0001 for reinforced and probe trials; adjusted **p=0.08, ***p=0.0008, ****p<0.0001	F (2, 138) = 116.9
1g	CA1 feature-selective and conjunctive representation during retrieval (n=3 mice, 9 sessions)	Two tailed Wilcoxon matched-pairs signed rank test	p=0.0039	W = 45
2d	Comparison between CA1 context neuron suppression by AC vs LEC inhibition (n= 4 mice, 7 sessions AC; n= 3 mice, 6 sessions LEC)	Two -tailed Student's t-Test	p = 0.001	t=4.423, df=11
2d	Comparison between CA1 context inhibition vs chance inhibition by AC inhibition (n= 4 mice, 7 sessions)	Two tailed Wilcoxon match paired signed rank Test; chance AC 33.4±0.02%	p=0.015	W= -28
2d	Comparison between CA1 context neurons inhibition vs chance inhibition by LEC inhibition (n=3 mice, 6 sessions)	Two tailed Wilcoxon match paired signed rank Test; chance = 32.9±0.04%	p>0.99	W=1
2g	Comparison between % inhibition of CA1 Context vs Non- context neurons by LEC inhibition (n=3 mice, 6 sessions) for AVOT, AOT and OT features	Two-way ANOVA with Sidak's post hoc	p=0.37	F (1, 30) = 2.801
2g	Comparison between % inhibition of CA1 Context vs Non- context neurons by AC inhibition (n=4 mice, 7 sessions) for AVOT, AOT and OT. Features	Two-way ANOVA with Sidak's post hoc	Inhibition p<0.0001; adjusted p for AVOT (p=0.006), AOT (p=0.001), OT (p=0.002)	F (1, 36) = 38.92
2h	Discrimination index of Light Off and Light On trials in LEC-stGtACR2 cohort	Two-way ANOVA with Sidak's post hoc	Inhibition p = 0.82	F (1, 16) = 0.8219
2h	Discrimination index of Light Off and Light On trials in LEC-mCherry cohort	Two-way ANOVA with Sidak's post hoc	Inhibition p = 0.37	F (1, 13) = 0.1601
2i	Discrimination index of Light Off and Light On trials in AC-stGtACR2 cohort	Two-way ANOVA with Sidak's post hoc	Inhibition p<0.0001; adjusted *p=0.04; **p=0.006; ****p<0.0001	F (1, 17) = 43.79

2i	Discrimination index of Light Off and Light On trials in AC-mCherry cohort	Two-way ANOVA with Sidak's post hoc	p = 0.92		F (1, 20) = 0.008323
3c	Comparison between AC feature-selective and conjunctive representation during retrieval (n=3 mice, 9 sessions)	Two tailed Wilcoxon matched-pairs signed rank test	p=0.002		W=-64.00
3d	Comparison between feature vs conjunctive representations between AC and CA1	Two-way ANOVA with Sidak's post hoc	Feature ***p=0.005, ****p<0.0001	Conjunctive	Feature t=4.7, DF=16. Conjunctive: t= 12.0 DF=16.00;
3h	Net generalised feature ensemble response to same vs opposite context in AC	Multiple paired t-test; two sided	*q=0.027		df=10; t ratio = 2.571
	Net generalised feature ensemble response to same vs opposite context in CA1	Multiple paired t-test; two sided	****q<0.0001		df = 8; t ratio = 17.30
3k	Discrimination index in TRAP'ed feature coding neurons cohort across R1 vs R6	Two-way ANOVA with Sidak's post hoc	Inhibition p<0.0001		F (1, 50) = 30.04
	Discrimination index in TRAP'ed feature coding neurons cohort across R6 vs R7	Two-way ANOVA with Sidak's post hoc	Inhibition p<0.0001; adjusted *p=0.035, **p=0.0033, ***p<0.0001		F (1, 50) = 52.61
3k	Discrimination index in TRAP'ed habituation neurons cohort across R6 vs R7	Two-way ANOVA with Sidak's post hoc	Inhibition p = 0.71		F (1, 20) = 0.1402
4c	Comparison of distribution of time onset of AC and CA1 context ensembles during training (m1)	Two tailed Kolmogorov–Smirnov test	p<0.0001		
	Comparison of distribution of time onset of AC feature and CA1 context ensembles during retrieval (m1)	Two tailed Kolmogorov–Smirnov test	p=0.001		
4d	AC Feature - CA1 Context ensemble net dF/F correlations between neutral and aversive feature trials (n=3 mice, 5 sessions with 3 features each)	Kruskal-Wallis One-Way ANOVA with Dunn's post hoc	CA1 Neutral - AC Neutral vs CA1 Neutral - AC aversive : p=0.03 CA1 Aversive - AC Aversive vs CA1 Neutral - AC neutral : p=0.001		

CA1 Neutral - AC Neutral vs CA1 Aversive -
AC aversive : p=0.04

CA1 Neutral - AC Aversive vs CA1 Aversive
- AC aversive : p=0.04

CA1 Neutral - AC Neutral vs CA1 Neutral -
AC aversive : p<0.0001

4e Long-range neurons correlated with AC (n=3 mice,
5 sessions) Two sided paired Student's t-test p=0.009 t=4.665, df=4

4e Long-range neurons correlated with CA1 (n=3
mice, 5 sessions) Paired Student's t-test, two-tailed p=0.055 t=2.678, df=4

EXTENDED DATA FIGURES

Figure	Test groups	Test performed	P values	Additional Statistical Reporting
Extended Data Fig 1a	Latency to first lick across reward, neutral and aversive contexts (n=12 mice, 24 sessions)	Two-way ANOVA with Sidak's post hoc	p<0.0001 for reinforced and probe trials; adjusted *p=0.029; ***p=0.001; ****p<0.0001	F (1.779, 71.16) = 51.84
Extended Data Fig 1b	Lick rate across contexts for full cue trials in retrieval session (n=21 mice, 18 sessions)	Two-way ANOVA with Sidak's post hoc	p<0.0001; adjusted ***p<0.005	F (1.538, 26.14) = 16.94
Extended Data Fig 1c	Discrimination index (normalised lick rate difference b/w reward and aversive context) in mCherry vs stGtACR2 in CA1 cohorts (n=6 mice each)	Two-way ANOVA with Sidak's post hoc	p=0.015 for probe trials; p=0.52 for reinforced trials	F (1, 20) = 8.091
Extended Data Fig 1d	Lick rate across reward, neutral and aversive contexts with mice bearing GRIN implants (n=16 mice)	Two-way ANOVA with Sidak's post hoc	p<0.0001; adjusted **p<0.01, ***p<0.001, ****p<0.0001	F (2, 30) = 46.20
Extended Data Fig 1e	Discrimination index across reinforced and probe trials (for data in 1d; n=16 mice)	Two-way ANOVA with Sidak's post hoc	p=0.01 for probe trials T1-T3	
Extended Data Fig 3h	Comparison of fraction of neurons that are feature selective vs conjunctive in CA1 (n=3 mice)	Two tailed paired t-test	p=0.024	t=6.336, df=2

Extended Data Fig 6a	Mean event rate of CA1 neurons across Control (n=4) , LEC-stGtACR2 (n=3) and AC-stGtACR2 (n=4) cohort (event/sec)	Ordinary one-way ANOVA with Tukey's multiple comparison	p=0.2562	F (2, 8) = 1.622
Extended Data Fig 6b	Average time between consecutive onsets for CA1 neurons across Control (n=4) , LEC-stGtACR2 (n=3) and AC-stGtACR2 (n=4) cohort (in s)	Ordinary one-way ANOVA with Tukey's multiple comparison	p=0.9249	F (2, 8) = 0.07880
Extended Data Fig 6c	Mean onset activity of CA1 neurons (as fraction, Methods) across Control (n=4) , LEC-stGtACR2 (n=3) and AC-stGtACR2 (n=4) cohort	Ordinary one-way ANOVA with Tukey's multiple comparison	p=0.0008	F (2, 8) = 20.13
Extended Data Fig 6d	Fraction of context selective neurons across Control (n=4 mice, 9 sessions) , LEC-stGtACR2 (n=3 mice, 6 sessions) and AC-stGtACR2 (n=4 mice, 7 sessions) cohort	Ordinary one-way ANOVA with Tukey's multiple comparison	p=0.9456	F (2, 19) = 0.05606
Extended Data Fig 6e	Mean initial ensemble activity (mean onset times) of CA1 context ensembles in AC and LEC st-GtACR2 cohorts during light Off trials	Two-way ANOVA with Sidak's post hoc	p=0.2632	F (1, 33) = 1.296
Extended Data Fig 6f	Mean ensemble activity of CA1 non-context ensembles in AC and LEC st-GtACR cohorts during light Off trials	Two-way ANOVA with Sidak's post hoc	p=0.6905	F (1, 33) = 0.1613
Extended Data Fig 6g	Mean CA1 context ensemble activity in LEC GtACR2 cohort between Light off and Light on trials (n=3 mice, 6 sessions)	Two-way ANOVA with Sidak's post hoc	p<0.0001; adjusted ***p<0.005; ****p<0.001	F (15, 15) = 10.78
Extended Data Fig 6g	Mean CA1 context ensemble activity in AC stGtACR2 cohort between Light off and Light on trials (n=4 mice, 7 sessions)	Two-way ANOVA with Sidak's post hoc	p<0.0001; adjusted ***p<0.005; ****p<0.001	F (1, 18) = 84.53
Extended Data Fig 6h	Mean CA1 non-context ensemble activity in LEC GtACR cohort between Light off and Light on trials (n=3 mice, 6 sessions)	Two-way ANOVA with Sidak's post hoc	p<0.0001; adjusted ***p<0.005;	F (1, 15) = 82.37

Extended Data Fig 6h	Mean CA1 non-context ensemble activity in AC stGtACR2 cohort between Light off and Light on trials (n=4 mice, 7 sessions)	Two-way ANOVA with Sidak's post hoc	P=0.0078; AVOT (p=0.61); AOT(p=0.31); OT(p=0.07)	F (1, 18) = 8.961
Extended Data Fig 6i	Comparison of percent of CA1 context neurons inhibited (n=3 mice LEC stGtACR2, 4 mice AC stGtACR2)	Two tailed unpaired t-test	p= 0.0324	t=2.937, df=5
Extended Data Fig 6j	Comparison between percent inhibition of CA1 context vs non- context neurons by LEC inhibition (n=3 mice)	Two-way ANOVA with Sidak's post hoc	P=0.2107	F (1, 12) = 1.749
Extended Data Fig 6j	Comparison between percent inhibition of CA1 context vs non- context neurons by AC inhibition (n=4 mice)	Two-way ANOVA with Sidak's post hoc	P<0.0001; adjusted *p<0.05, **p<0.01	F (1, 18) = 36.39
Extended Data Fig 6k	percent dF/F change in CA1 context vs non-context neurons on LEC inhibition (n=3 mice, 6 sessions)	Two-way ANOVA with Sidak's post hoc	P=0.0356	F (1, 30) = 4.845
Extended Data Fig 6k	percent dF/F change in CA1 context vs non-context neurons on AC inhibition (n=4 mice, 7 sessions)	Two-way ANOVA with Sidak's post hoc	P<0.0001; adjusted *p<0.05, **p<0.01	F (1, 36) = 33.52
Extended Data Fig 7e	Comparison of % cells in CA1 that receive inputs from AC or LEC that overlay with cFos (n=4 mice, 8 slices total)	Two tailed Welch's t-test	p=0.0024	t=4.117, df=9.298
Extended Data Fig 8l	Comparison of fraction of neurons that are feature selective vs conjunctive in AC (n=7 mice)	Two tailed Wilcoxon matched-pairs signed rank test	p=0.0156	W=28
Extended Data Fig 8n	Decoding accuracy of AC neurons during training across CA1 mcherry vs CA1 stGtACR2 cohort (n=3 mice)	Two tailed Mann Whitney U Test	p= 0.0081	U= 868
Extended Data Fig 8o	% of AC feature responsive neurons during retrieval across CA1 mcherry vs CA1 stGtACR2 cohort (n=3 mice)	Two tailed Mann Whitney U Test	p = 0.1000	U=0

Extended Data Fig 9c	Net dF/F response of feature responsive ensembles for same context vs opposite contexts for AC (n=7 mice) and CA1 (n=3 mice)	Two-way ANOVA with Sidak's post hoc	*p=0.02 (AC); ****p=0.0002 (CA1)	t=2.849 DF= 16.00 (AC); t=5.035; DF= 16.00 (CA1)
Extended Data Fig 9e	Comparison of inter-context (context separation) vs intra-context (feature separation) in n-dimensional space between AC and CA1	Two tailed Student's t-test	p=0.0031	t=3.385, df=19
Extended Data Fig 10c	Lick rate of mice in modified behavior setup across neutral vs aversive feature trials (n=3 mice)	Two tailed paired t-test	p=0.023	t=6.443, df=2
Extended Data Fig 10f	Comparison of distribution of time onset of AC and CA1 context ensembles during training (m2)	Two tailed Kolmogorov–Smirnov test	p=0.015	
Extended Data Fig 10f	Comparison of distribution of time onset of AC feature and CA1 context ensembles during retrieval (m2)	Two tailed Kolmogorov–Smirnov test	p=0.002	
Extended Data Fig 10f	Comparison of distribution of time onset of AC and CA1 context ensembles during training (m3)	Two tailed Kolmogorov–Smirnov test	p=0.001	
Extended Data Fig 10f	Comparison of distribution of time onset of AC feature and CA1 context ensembles during retrieval (m3)	Two tailed Kolmogorov–Smirnov test	p<0.0001	
Extended Data Fig 10f	Mean onset time from CDF of ensemble onsets across training and retrieval session between AC and CA1	Two-way ANOVA with Sidak's multiple comparison	p=0.01 (Training); p<0.0001 (Retrieval)	t=3.823; df=8 (Training); t=7.65; df=8 (Retrieval)