Supplementary material for:

Building integrated representations through interleaved learning

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Supplementary Table 1 - Parameters for TCM simulations

parameter	*description*	*value*
γ_{fc}	the parameter that controls the learning rate for the feature-to-context matrix	0.1
γ_h	the proportion of t^{IN}given by h associated with the input item	0.9
β_{enc}	the rate of context drift during encoding produced by each t^{IN}	0.7
$\beta_{distractor}$	the rate of context drift produced by each distractor	0.99
γ_{cf}	the rate of update for the context-to-feature matrix	0.5

Supplementary Table 2 - Parameters for REMERGE simulations

parameter	*description*	*value*
w	the weight of bidirectional connections	1.52
τ	the temperature parameter for the logistic function and the hedged softmax function	0.4
C	the constant term for the hedged softmax function	1
λ	the proportion of the net input to a unit given by that on the previous timestep	0.2

Supplementary Table 3 - Layer parameters for C-HORSE, as modified from Schapiro et al. (2017)

Layer	**Parameter**	**Schapiro et al. (2017)**	**Current Model**
pCA1	Layer	Does not exist	Added
	# Units	Does not exist	50
	Inhibition	Does not exist	FFFB (Gi = 3)
dCA1	Layer	Does not exist	Added
	# Units	Does not exist	50
	Inhibition	Does not exist	FFFB (Gi = 2.2)
CA1	Layer	Exists	Removed
	# Units	100	-
	Inhibition	kWTA Avg Inhib 0.25 pct/0.7 pt	-
DG	Inhibition	kWTA Avg Inhib 0.01 pct/0.9 pt	FFFB Gi = 24
CA3	Inhibition	kWTA Avg Inhib 0.06 pct/0.7 pt	FFFB Gi = 4.5
EC_in and EC_out	# Units	8/15/9	18
	Inhibition	kWTA Inhib k = 2/0.5 pt	FFFB Gi = 2.0

Supplementary Table 4 - Projection parameters for C-HORSE, as modified from Schapiro et al. (2017)

Projection	Parameter	Schapiro et al. (2017)	Current Model
Input -> EC_in	Weight range	0.25-0.75	0.8
EC_in -> DG	Learning rate	0.2	0.4
EC_in -> CA3	Learning rate	0.2	0.4
CA3 -> CA3	Learning rate	0.2	0.4
	WtScale.Rel	1	2
CA3 -> pCA1/CA1	Connectivity	100%	0.25
EC_in -> dCA1/CA1	WtScale.Abs	3	1
	Learning rate	0.02	0.04
dCA1/CA1 -> EC_out[a]	Learning rate	0.02	0.04
pCA1/CA1 -> EC_out[a]	Learning rate	0.02	0.04
EC_out -> dCA1/CA1	Learning rate	0.02	0.04
EC_out -> pCA1/CA1	Learning rate	0.02	0.04
EC_out -> EC_in	Weight range	0.49 - 0.51	0.7
	WtScale.Abs	2	1
	WtScale.Rel	0.5	1

a See Supplementary Table 5 for changes in Absolute Weight Scaling.

Supplementary Table 5 – Weight scale parameters for C-HORSE, as modified from Schapiro et al. (2017)

Train									
Schapiro et al. (2017)[a]					**Current Model[b]**				
Projection	**Q1**	**Q2**	**Q3**	**Q4**	**Projection**	**Q1**	**Q2**	**Q3**	**Q4**
Ecin -> CA1	1	0	0	1	Ecin -> dCA1	1	0	0	2
CA3 -> CA1	0	1	1	0	CA3 -> pCA1	0	1	1	1
CA1 -> Ecout	4	4	4	4	dCA1 -> Ecout	1	0	0	1
					pCA1 -> Ecout	0	1	1	1

Test									
Schapiro et al. (2017)[a]					**Current Model[b]**				
Projection	**Q1**	**Q2**	**Q3**	**Q4**	**Projection**	**Q1**	**Q2**	**Q3**	**Q4**
Ecin -> CA1	1	0	0	1	Ecin -> dCA1	1	1	1	1
CA3 -> CA1	0	1	1	0	CA3 -> pCA1	1	1	1	1
CA1 -> Ecout	4	4	4	4	dCA1 -> Ecout[c]	(4)1	(4)1	(4)1	(4)1
					pCA1 -> Ecout[c]	1(4)	1(4)	1(4)	1(4)

a No. of cycles per quarter - Q1: 40, Q2: 20, Q3: 20, Q4: 20.

b No. of cycles per quarter - Q1: 25, Q2: 25, Q3: 25, Q4: 25.

c Symmetric upregulation of Absolute Weight Scale Values (1 vs 4)

Supplementary Figures

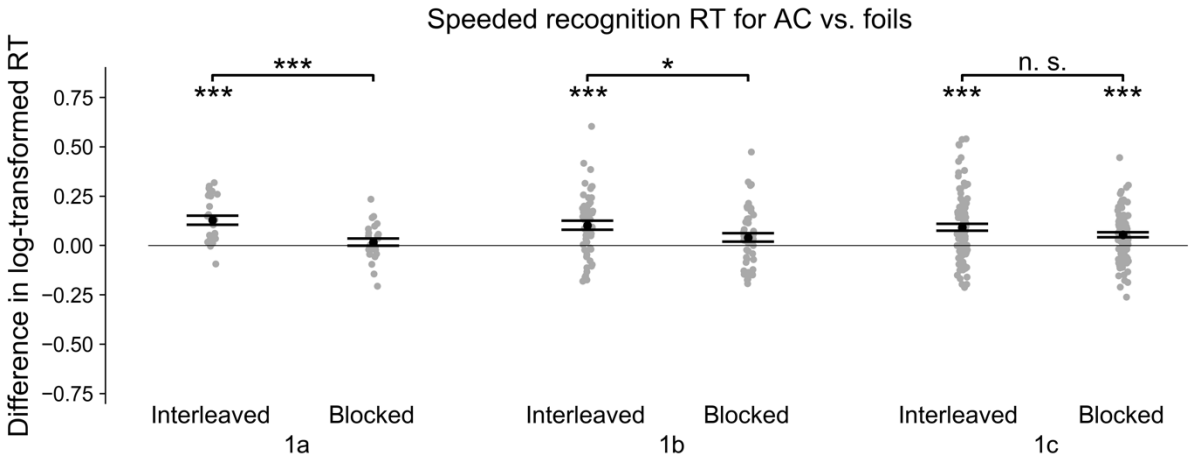

Figure S1. RTs for ACs — foils during speeded recognition in Exps 1a-c. *p<0.05; **p<0.01; ***p<0.001.

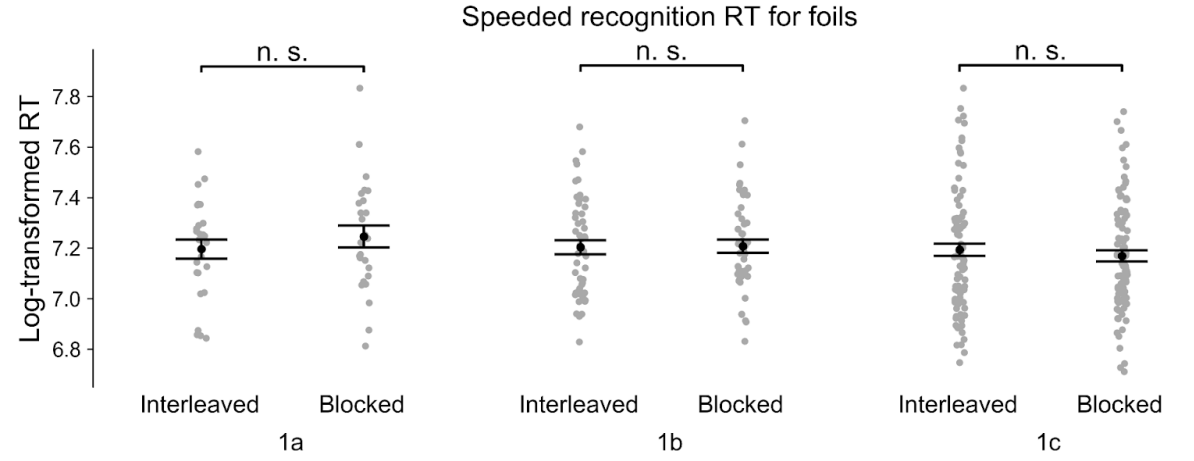

Figure S2. RTs for foil trials during speeded recognition in Exps 1a-c.

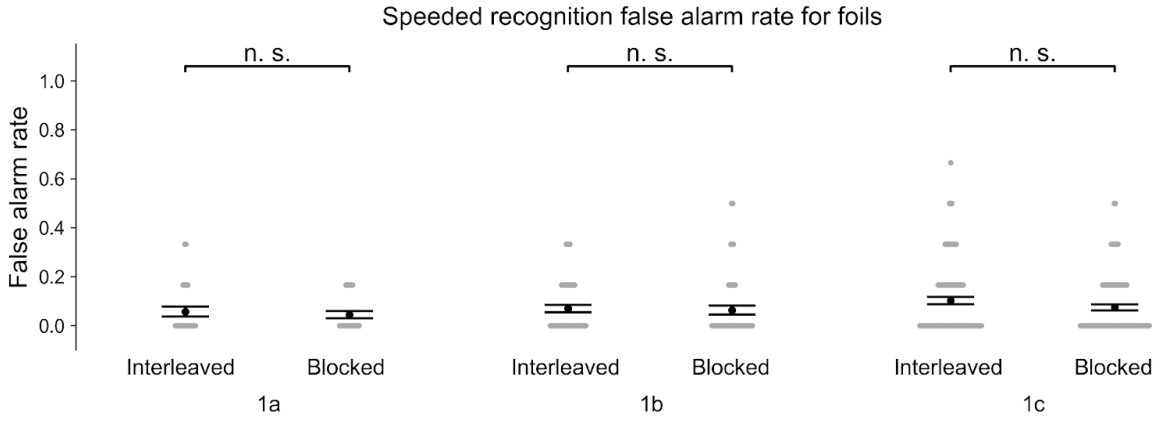

Figure S3. False alarm rates for foil trials during speeded recognition in Exps 1a-c.

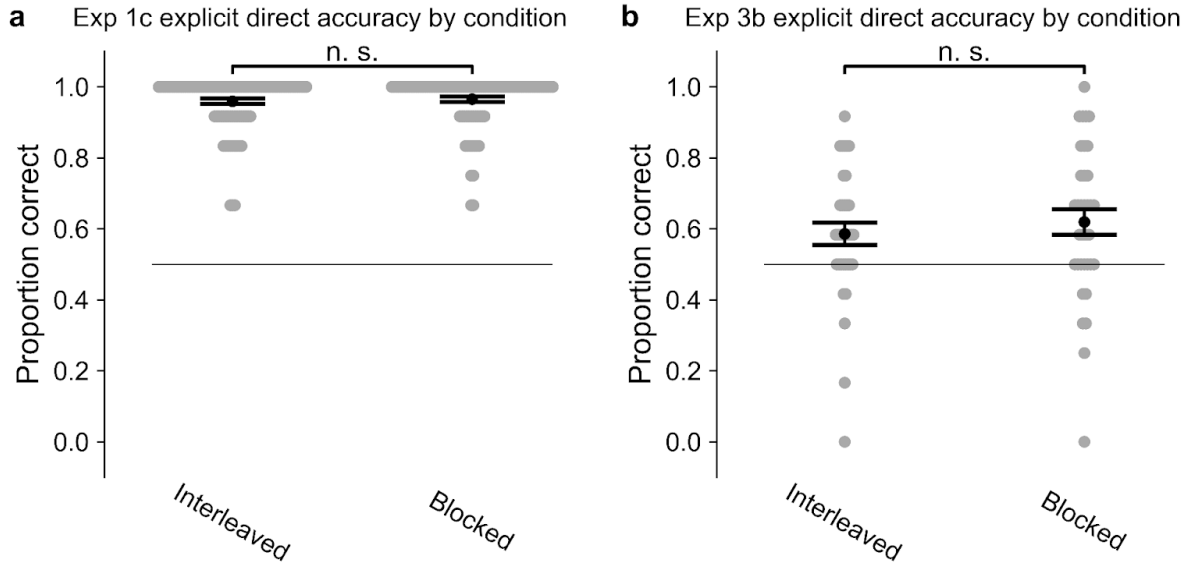

Figure S4. Accuracy for explicit direct trials in Exps 1c and 3b.

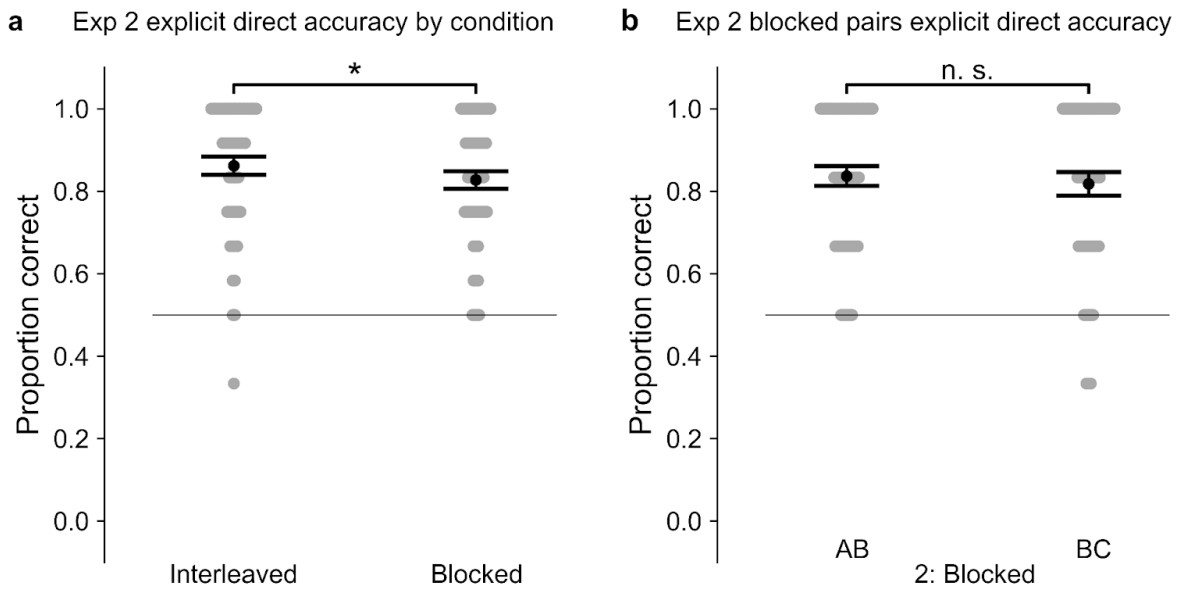

Figure S5. Accuracy for explicit direct trials in Exp 2.

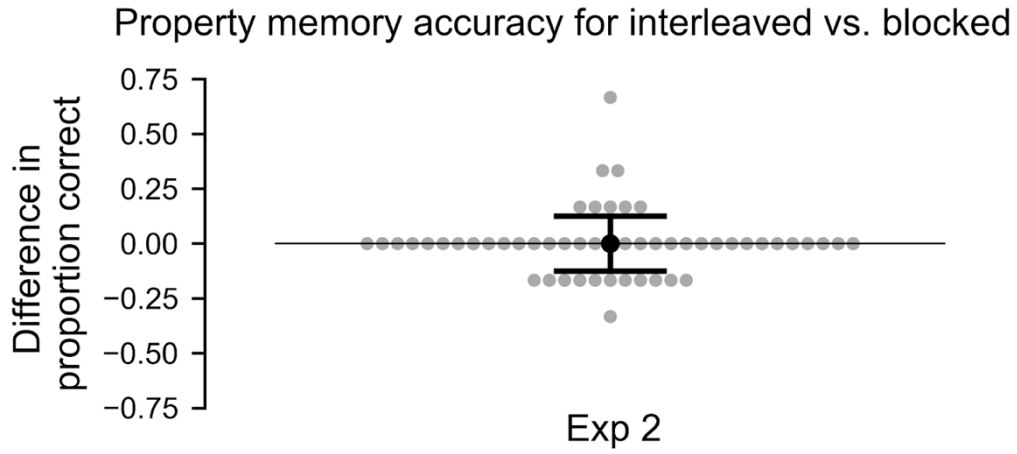

Figure S6. Property memory accuracy for interleaved vs. blocked trials in Exp 2.

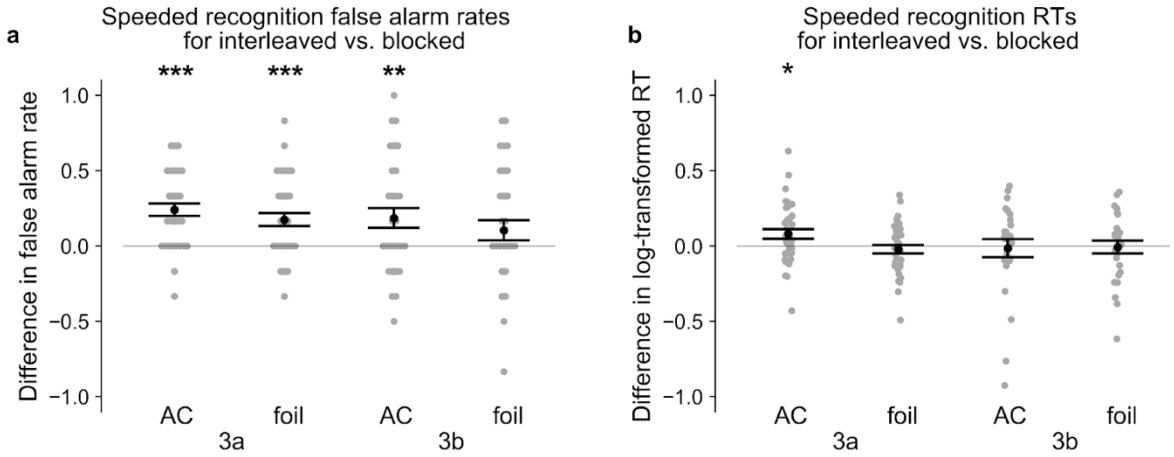

Figure S7. (a) False alarm rates for interleaved — blocked AC and foil trials during speeded recognition in Exps 3a-b. (b) RTs for interleaved — blocked AC and foil trials during speeded recognition in Exps 3a-b.

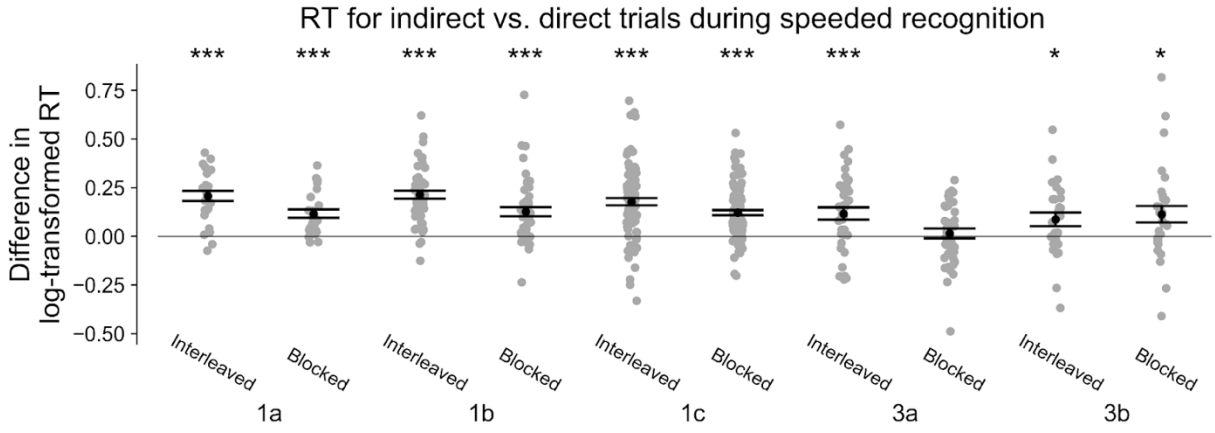

Figure S8. RTs for indirect — direct trials during speeded recognition in Exps 1a-c and 3a-b.

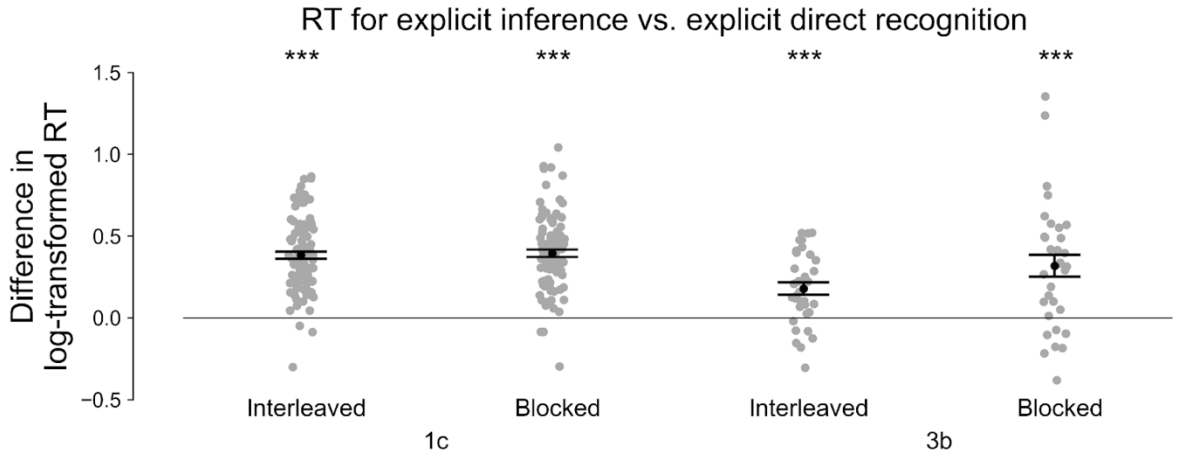

Figure S9. RTs for explicit inference — explicit direct recognition trials by condition in Exps 1c and 3b.

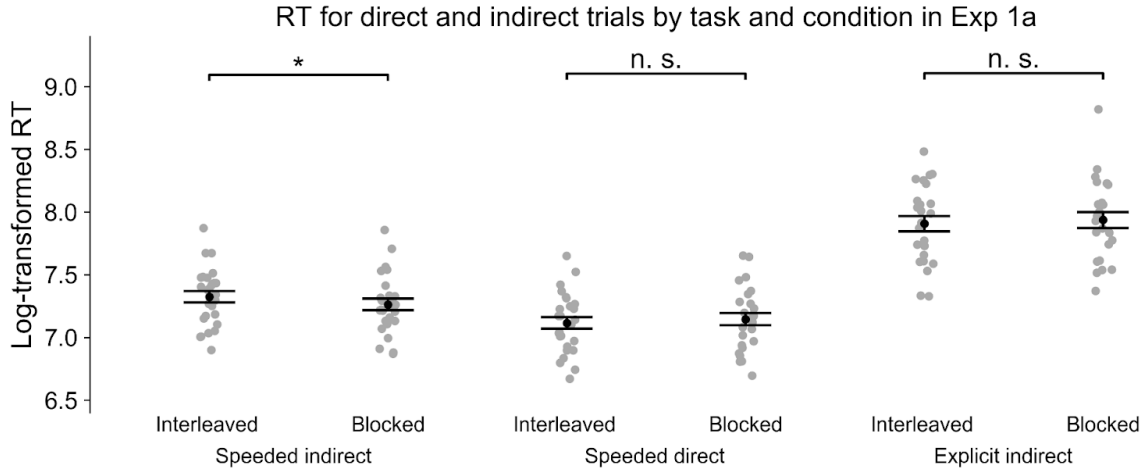

Figure S10. RTs for direct and indirect trials by task and condition in Exp 1a.

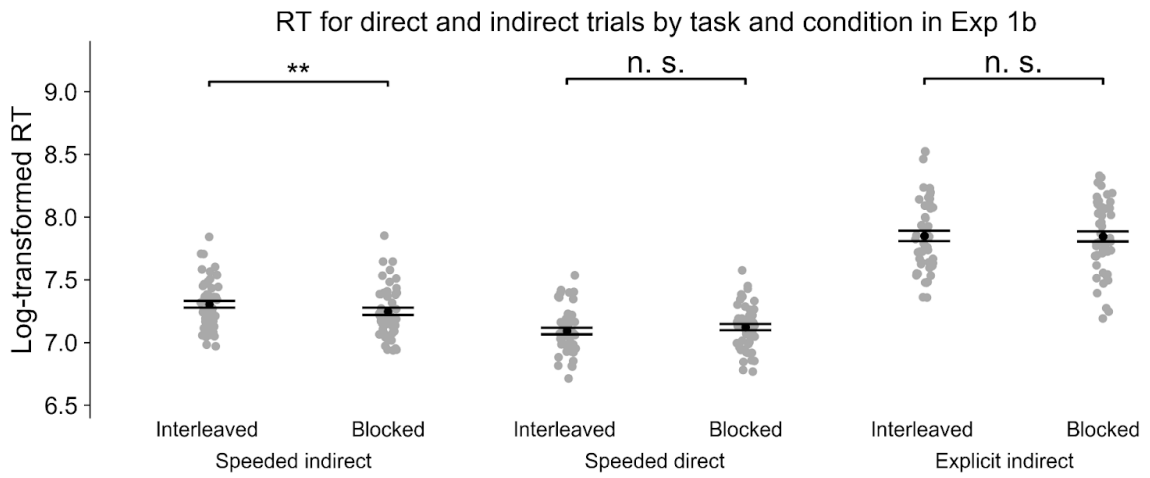

Figure S11. RTs for direct and indirect trials by task and condition in Exp 1b.

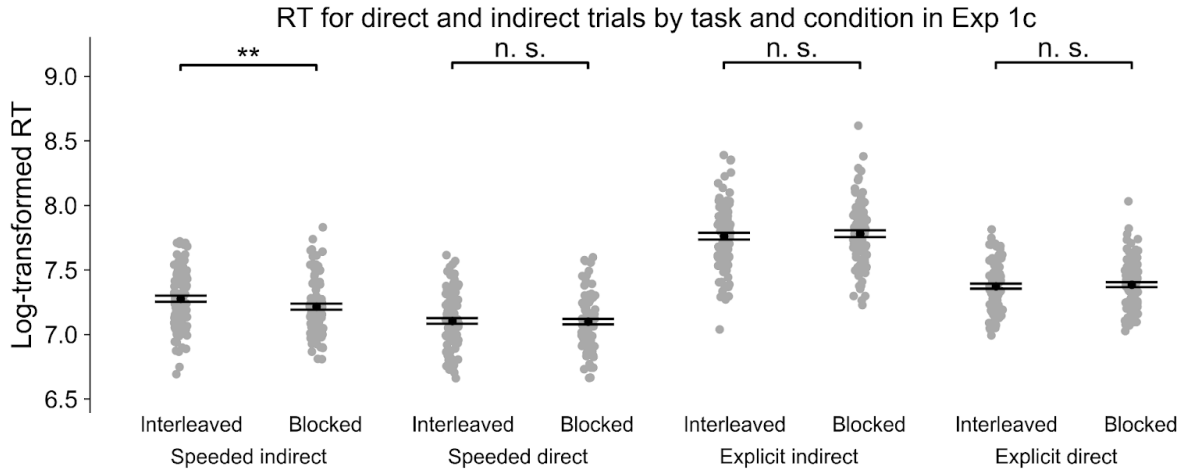

Figure S12. RTs for direct and indirect trials by task and condition in Exp 1c.

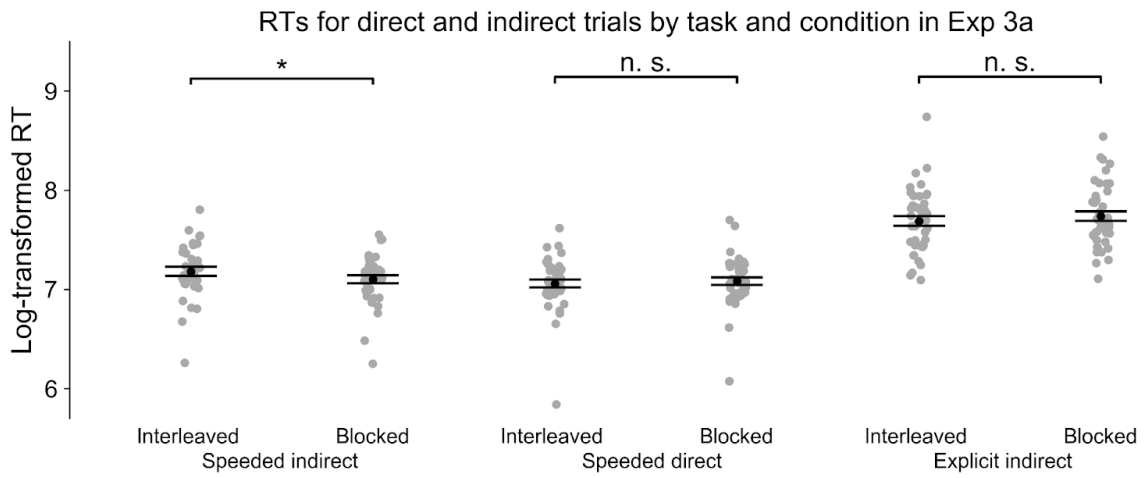

Figure S13. RTs for direct and indirect trials by task and condition in Exp 3a.

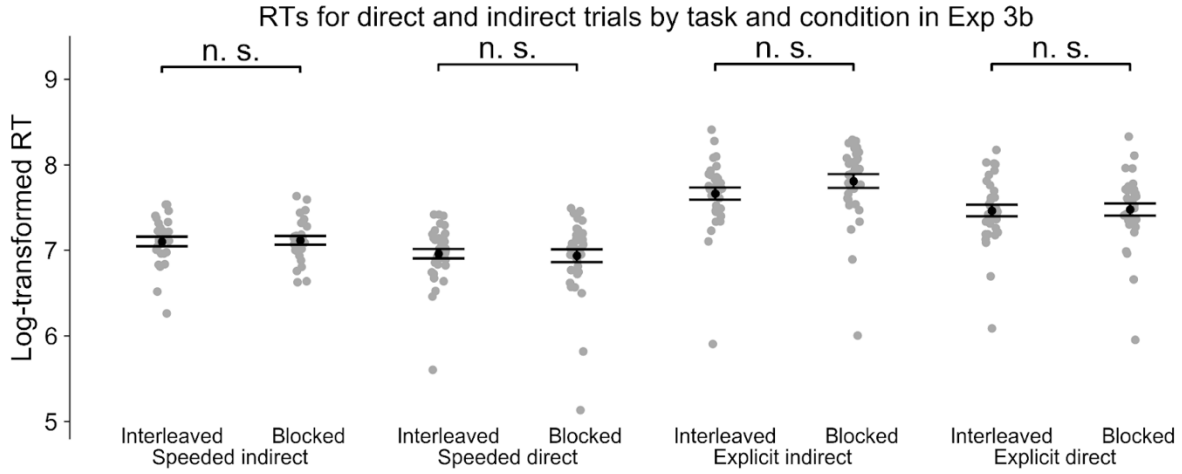

Figure S14. RTs for direct and indirect trials by task and condition in Exp 3b.

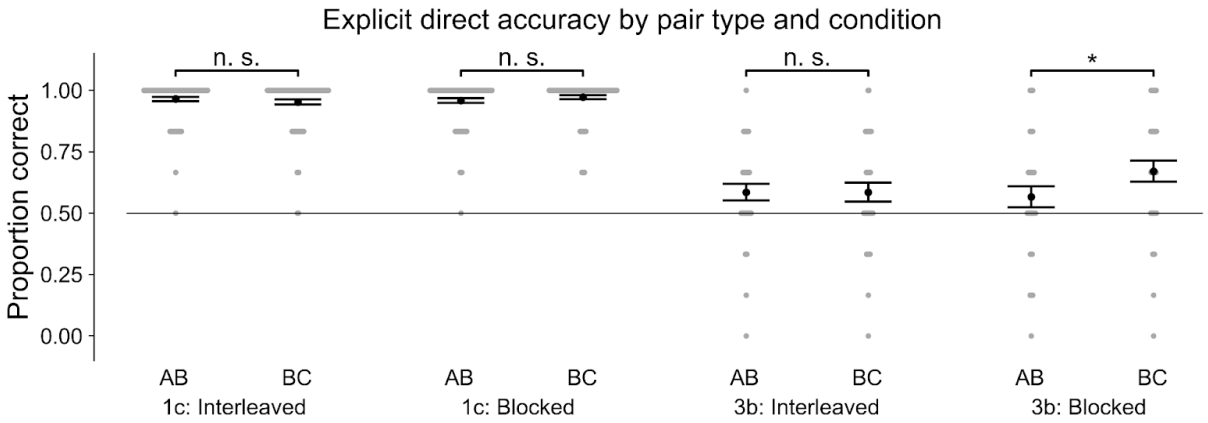

Figure S15. Accuracy for explicit direct trials in Exps 1c and 3b.

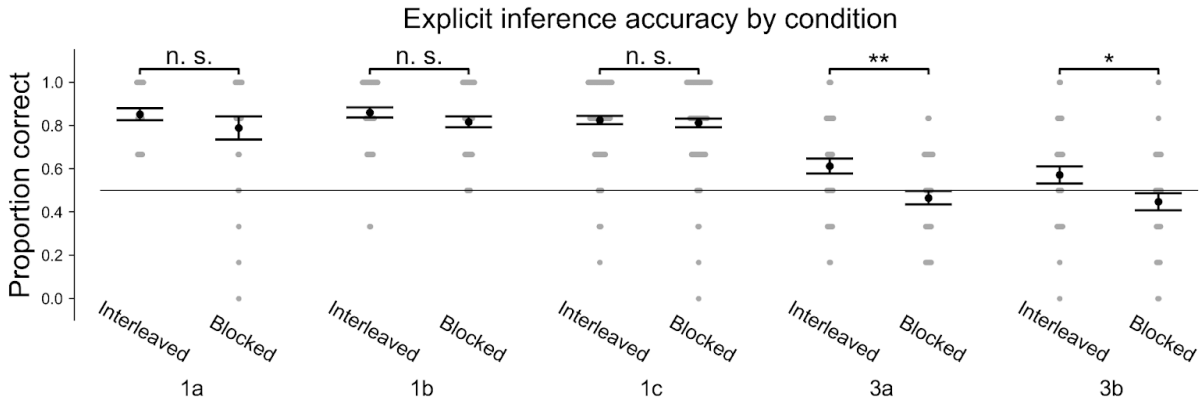

Figure S16. Accuracy for explicit inference trials by condition in Exps 1a-c and 3a-b.

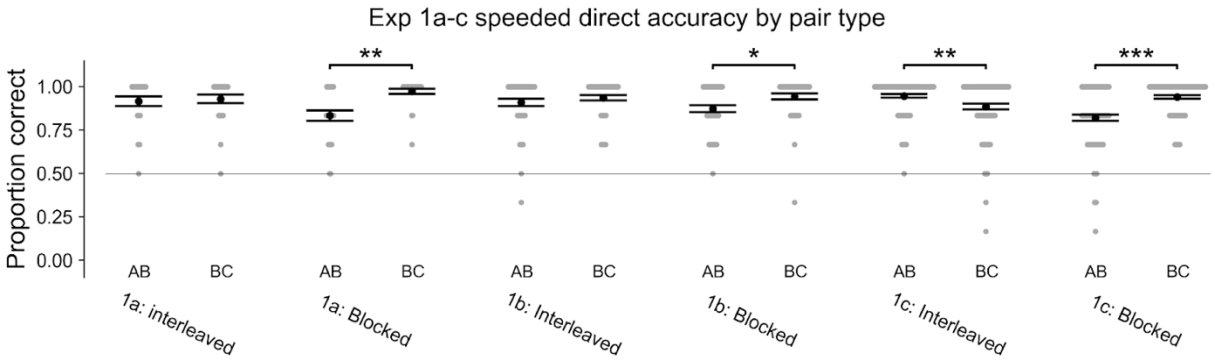

Figure S17. Accuracy for speeded direct trials by pair type in Exps 1a-c.

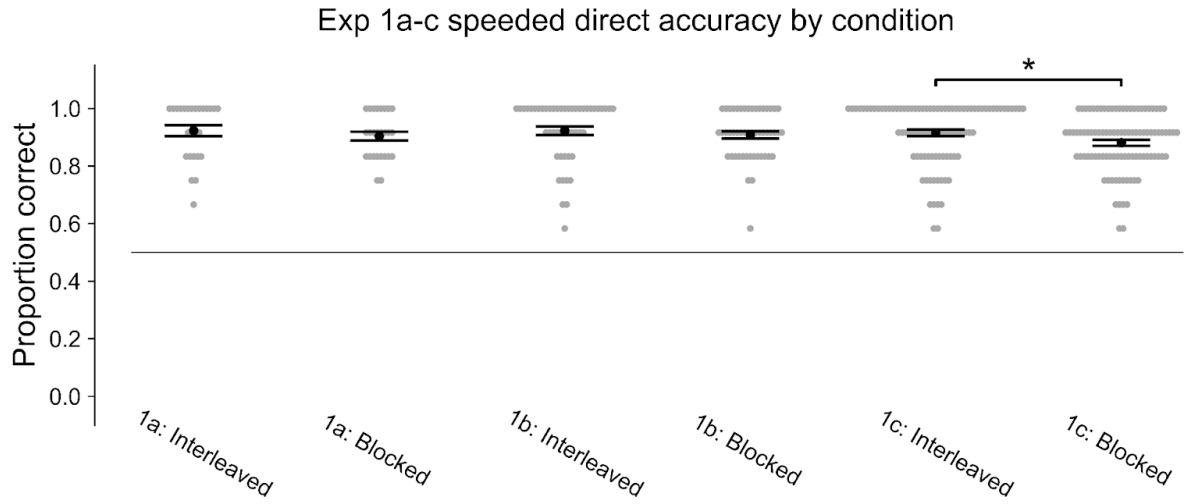

Figure S18. Accuracy for speeded direct trials by condition in Exps 1a-c.

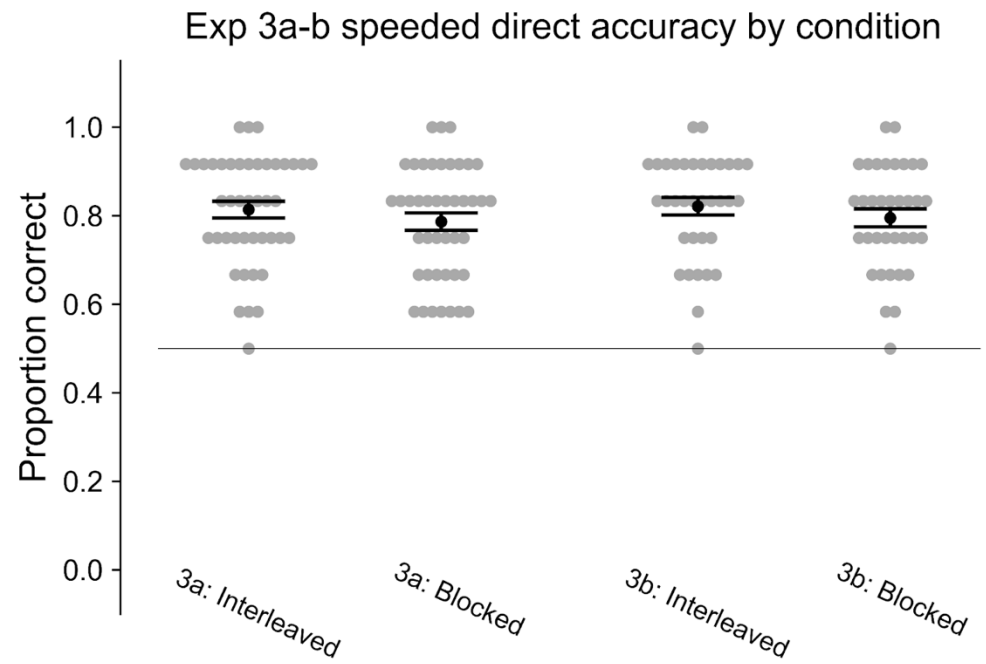

Figure S19. Accuracy for speeded direct trials by condition in Exps 3a-b.

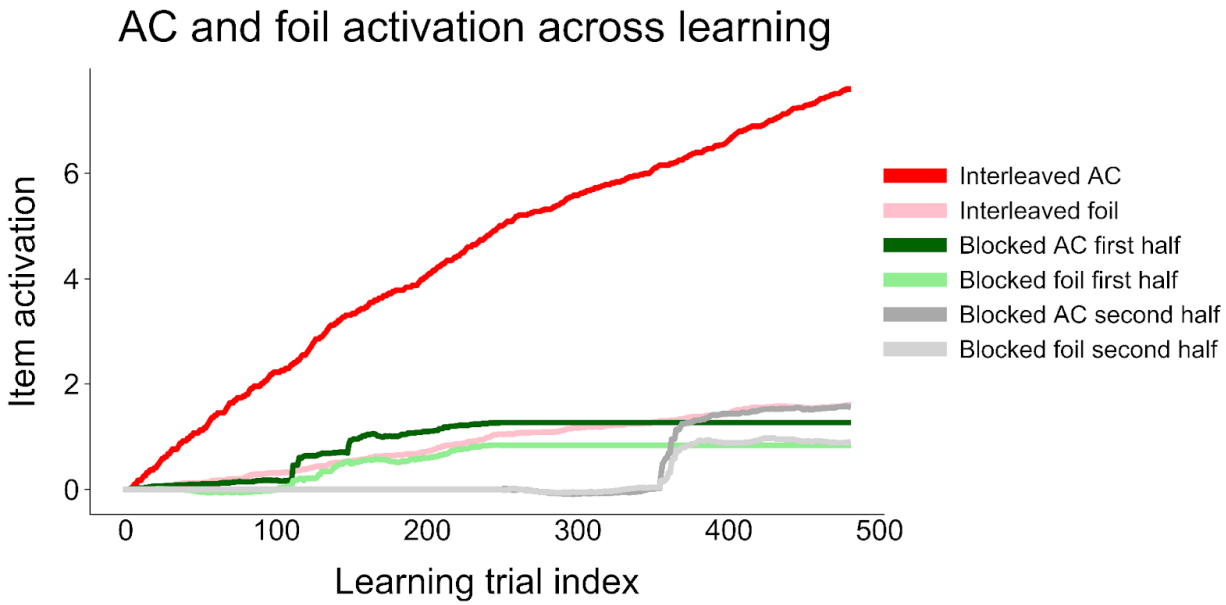

Figure S20. Activation of ACs and foils in TCM when related pairs are blocked in the first half of learning, blocked in the second half of learning, or interleaved throughout learning.