On the spontaneous emergence of discrete and compositional signals
Appendix: Compositionality Test Results

Anonymous ACL submission

We here report full results of the compositionality evaluations as described in Section 5.3 of our paper.

	Compositionality by Addition		Composition Network	
	Shared	**Non-shared**	**Shared**	**Non-shared**
Strict				
10 objects	$7.82\% \pm 2.40$	$11.94\% \pm 2.13$	$13.70\% \pm 6.85$	$10.18\% \pm 6.15$
Non-strict				
5 objects	$16.86\% \pm 3.23$	$17.14\% \pm 3.54$	$15.10\% \pm 2.05$	$14.35\% \pm 2.74$
10 objects	$5.82\% \pm 2.37$	$6.46\% \pm 1.79$	$5.00\% \pm 2.62$	$5.92\% \pm 2.12$
15 objects	$3.72\% \pm 1.42$	$4.00\% \pm 1.54$	$1.59\% \pm 1.31$	$2.48\% \pm 1.05$

Table 1: Communicative success using messages 'inferred' by assuming a systemic relation within $\arg\min_i$/$\arg\max_i$ message pairs. The 'compositionality by addition' method assumes that $\text{M}(c, \arg\max_i) = \text{M}(c, \arg\max_j) - \text{M}(c, \arg\min_j) + \text{M}(c, \arg\min_i)$. The 'compositional network' is an MLP trained to predict $\text{M}(c, \arg\max_i)$ from the other three messages. Displayed values are object recovery accuracies averaged for all i.

	Compositionality by Addition		Composition Network	
	Shared	**Non-shared**	**Shared**	**Non-shared**
Strict				
10 objects	0.23 ± 0.04	0.26 ± 0.04	0.10 ± 0.01	0.12 ± 0.01
Non-strict				
5 objects	6.01 ± 1.82	4.75 ± 1.06	1.35 ± 0.20	1.74 ± 0.31
10 objects	3.88 ± 0.91	4.06 ± 0.83	1.53 ± 0.15	1.76 ± 0.15
15 objects	3.73 ± 0.45	4.68 ± 0.73	1.87 ± 0.24	1.98 ± 0.23

Table 2: Average MSE loss of predicted objects using messages generated by the two composition methods described above in Table 1