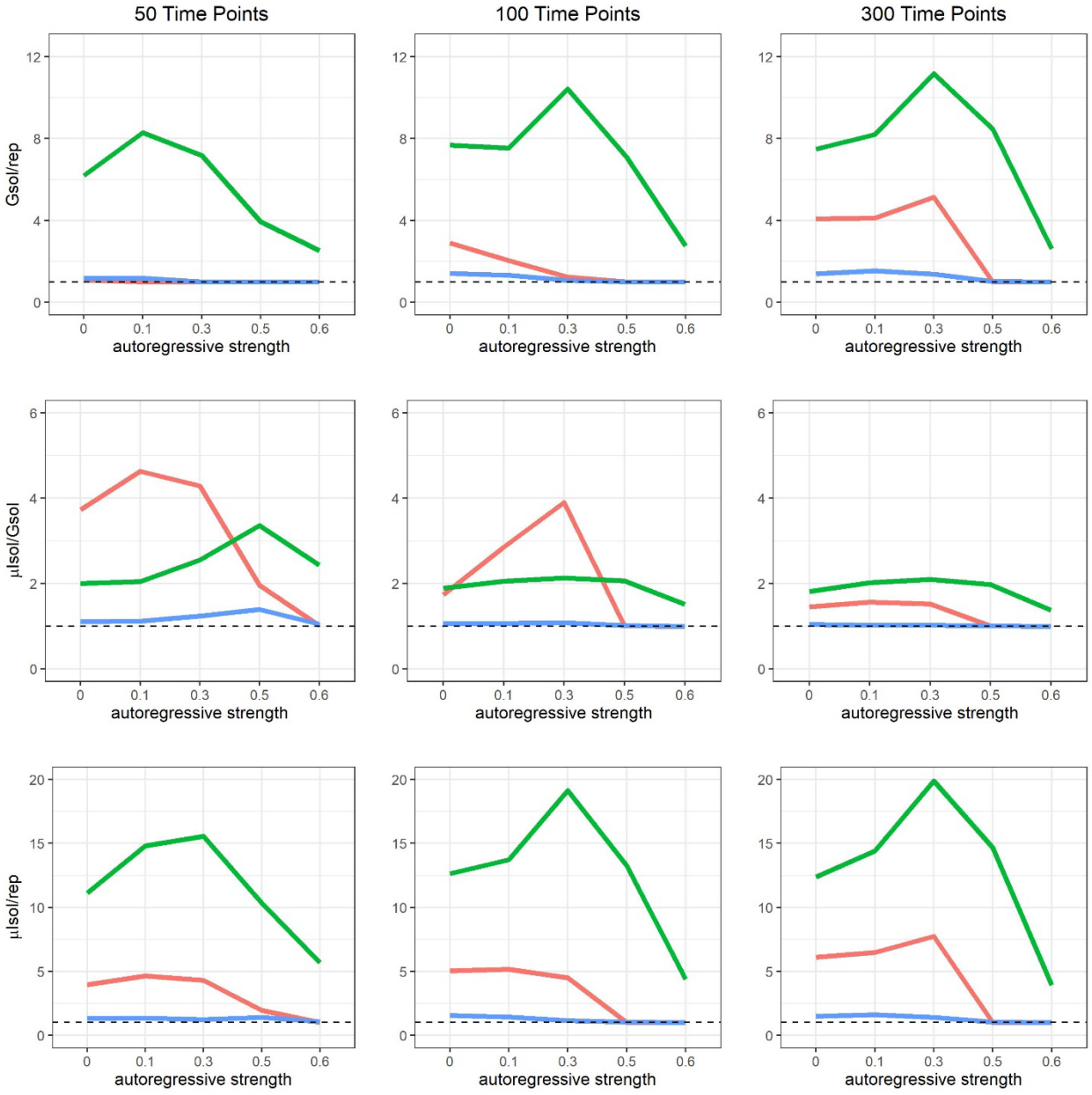
Levels of Multiple Solutions by Simulation Condition

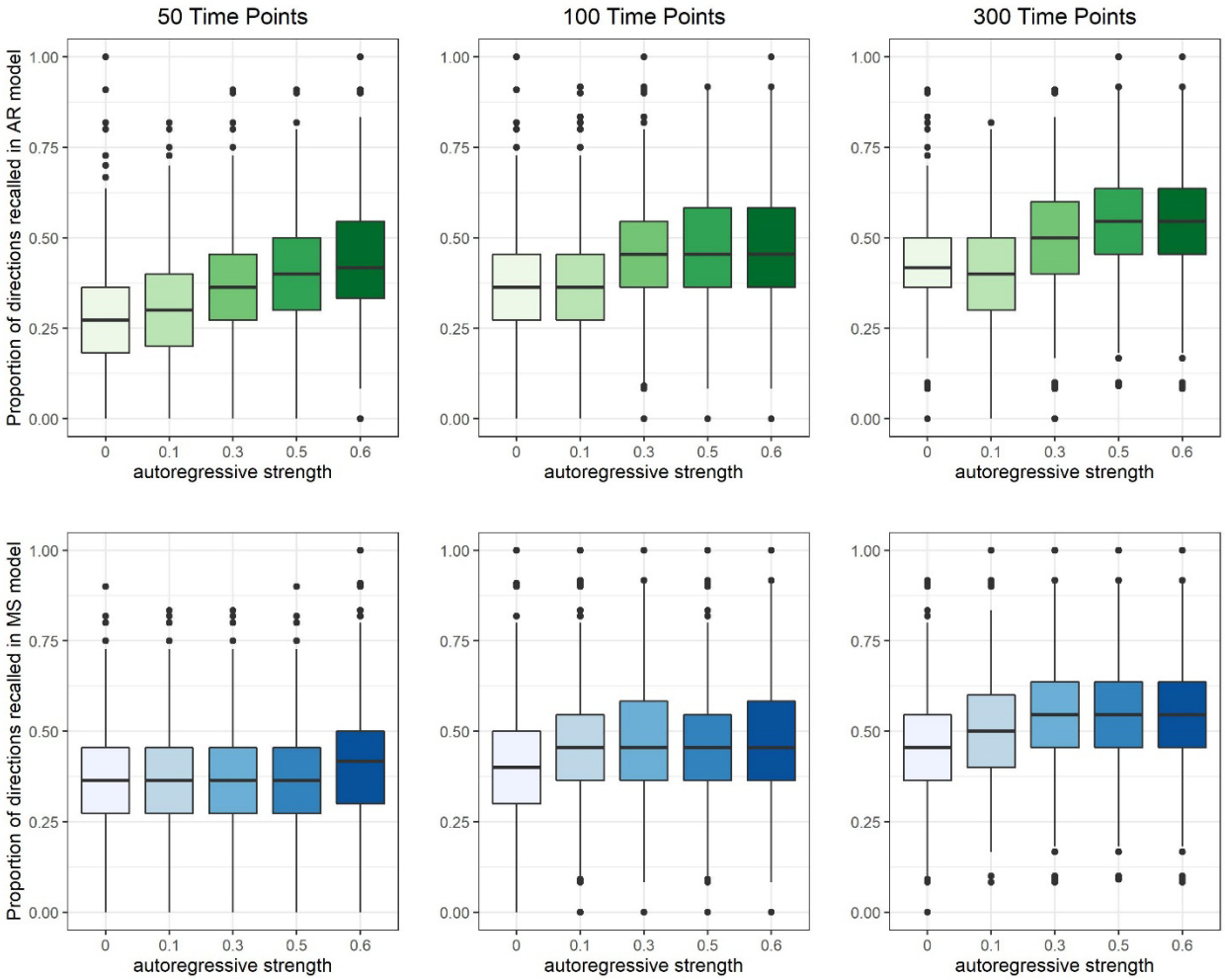
Findings on how the average number of individual-level solutions (across all group-level solutions) in each replication ($\mu Isol/rep$) differs by simulation condition are detailed in the main body of the manuscript. In order to better characterize the extent to which these effects occur at the level group versus individual solutions, here we detail how the average number of group-level solutions per replication ($\mu Gsol/rep$) and the average number of subjects' individual-level solutions per group-level solution per replication ($\mu Isol/Gsol$) change across simulation conditions (Supplemental Figure 1). The reported effect in which the CG condition (green) displayed the greatest overall number of individual-level solutions ($\mu Isol/rep$) was largely driven by greater numbers of group-level solutions ($\mu Gsol/rep$). The BA condition (red) generally displayed overall numbers of individual-level solutions in between the other two conditions, although a pattern emerged in which BA had systematically fewer solutions at the group level ($\mu Gsol/rep$) than CG, but often a comparable number of solutions at the individual level ($\mu Isol/Gsol$). The relative predominance of multiple solutions at the group level for CG versus at the individual level for BA may reflect a pattern in which the strong contemporaneous relations in CG are more likely to be estimated, and therefore to generate multiple solutions, in the earlier group level search than are the moderate-sized contemporaneous relations in BA. The general finding that multiple solutions tended to be infrequent when strong autoregressive relations were present was also most apparent at the group level.

Supplemental Figures

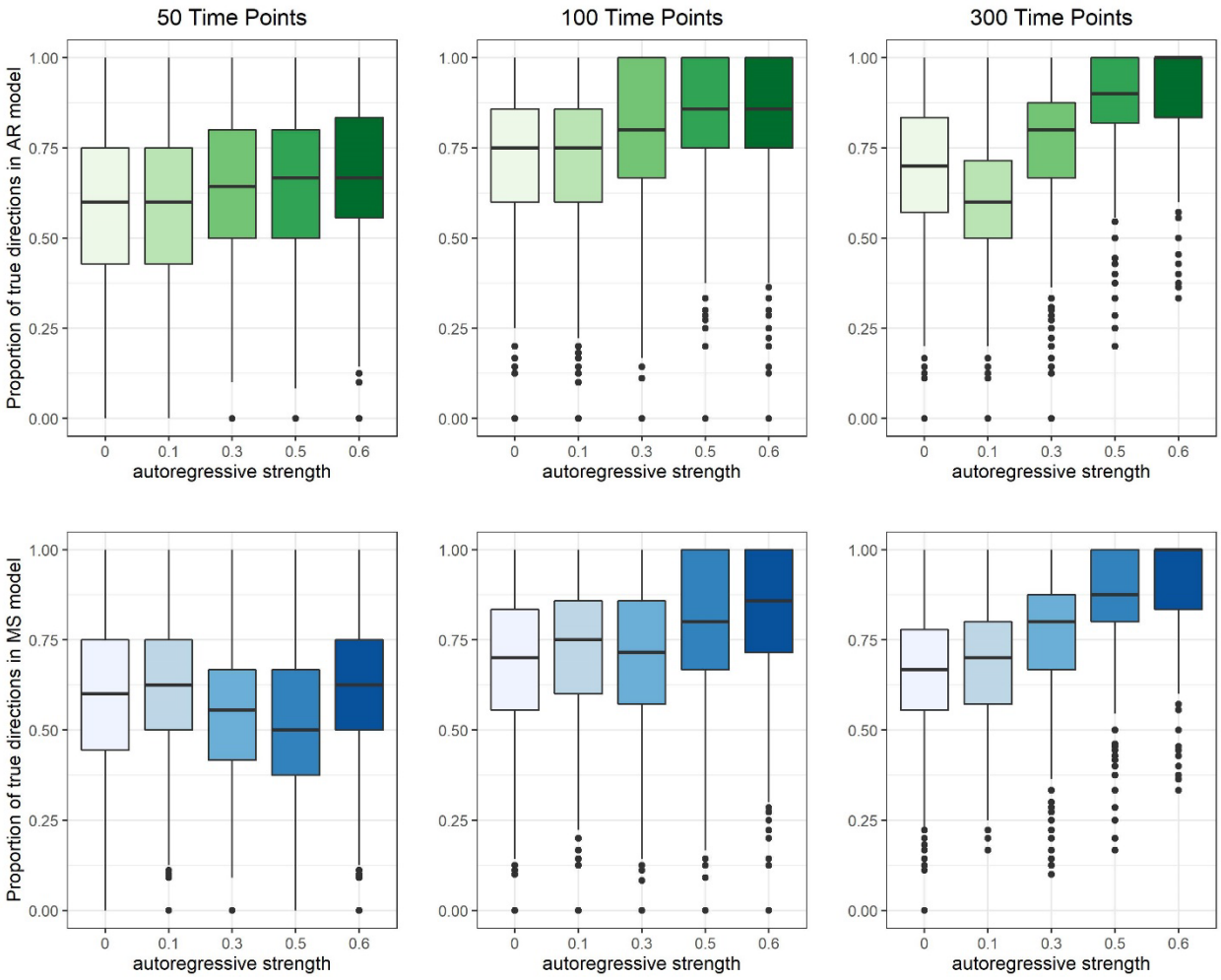
Supplemental Figure 1. Average number of group-level solutions per replication (μ$Gsol/rep$), average number of individual-level solutions per subject and group-level solution in each replication (μ$Isol/Gsol$), and average number of individual-level solutions per subject across all group-level solutions in each replication (μ$Isol/rep$) for the balanced (red), lagged-greater (blue) and contemporaneous-greater (green) conditions. The black dashed line in each plot highlights the value of 1, where each statistic would fall if multiple solutions were not found.



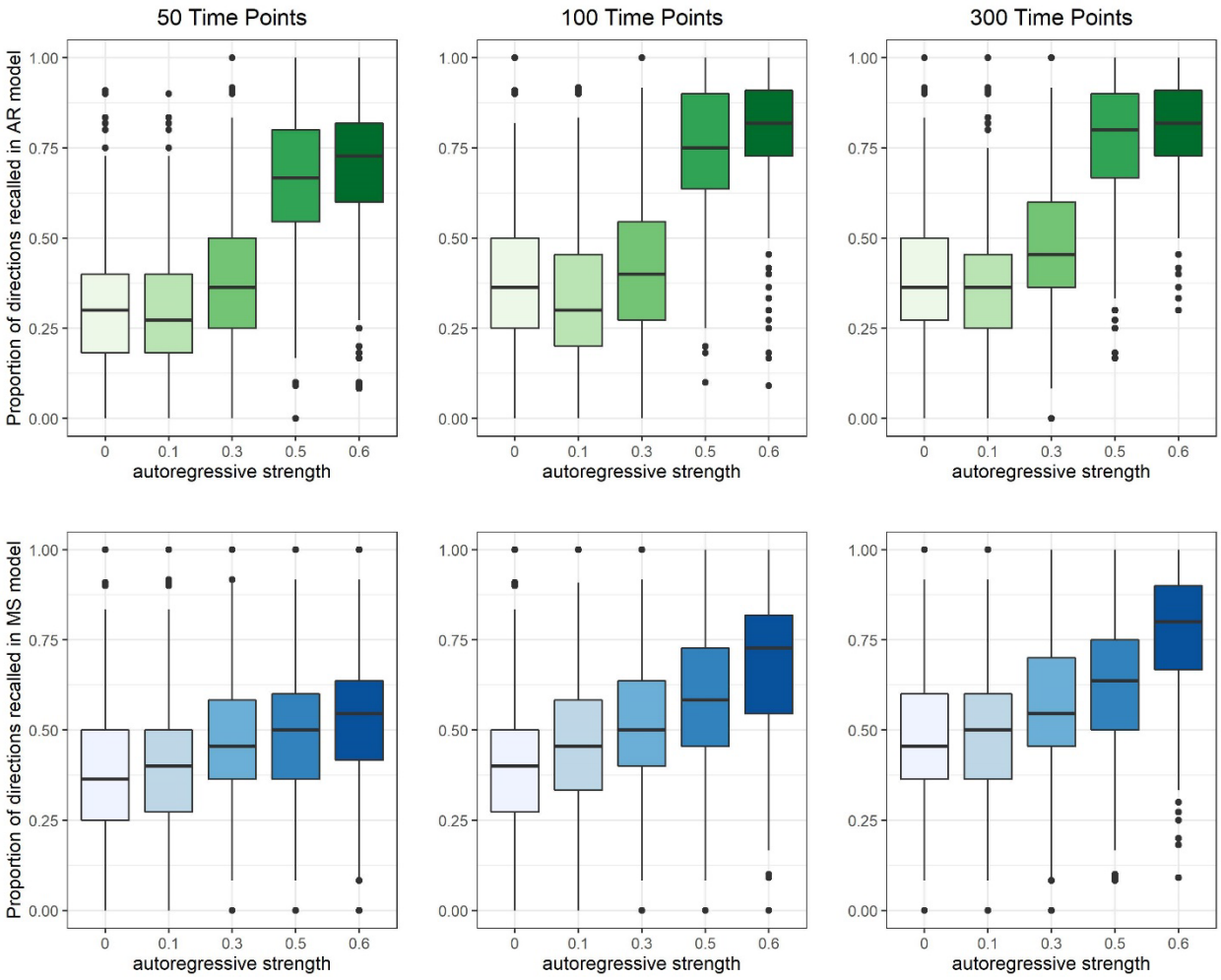
Supplemental Figure 2. Box plots of contemporaneous relation direction recall for individual-level models in the lagged greater (LG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies.



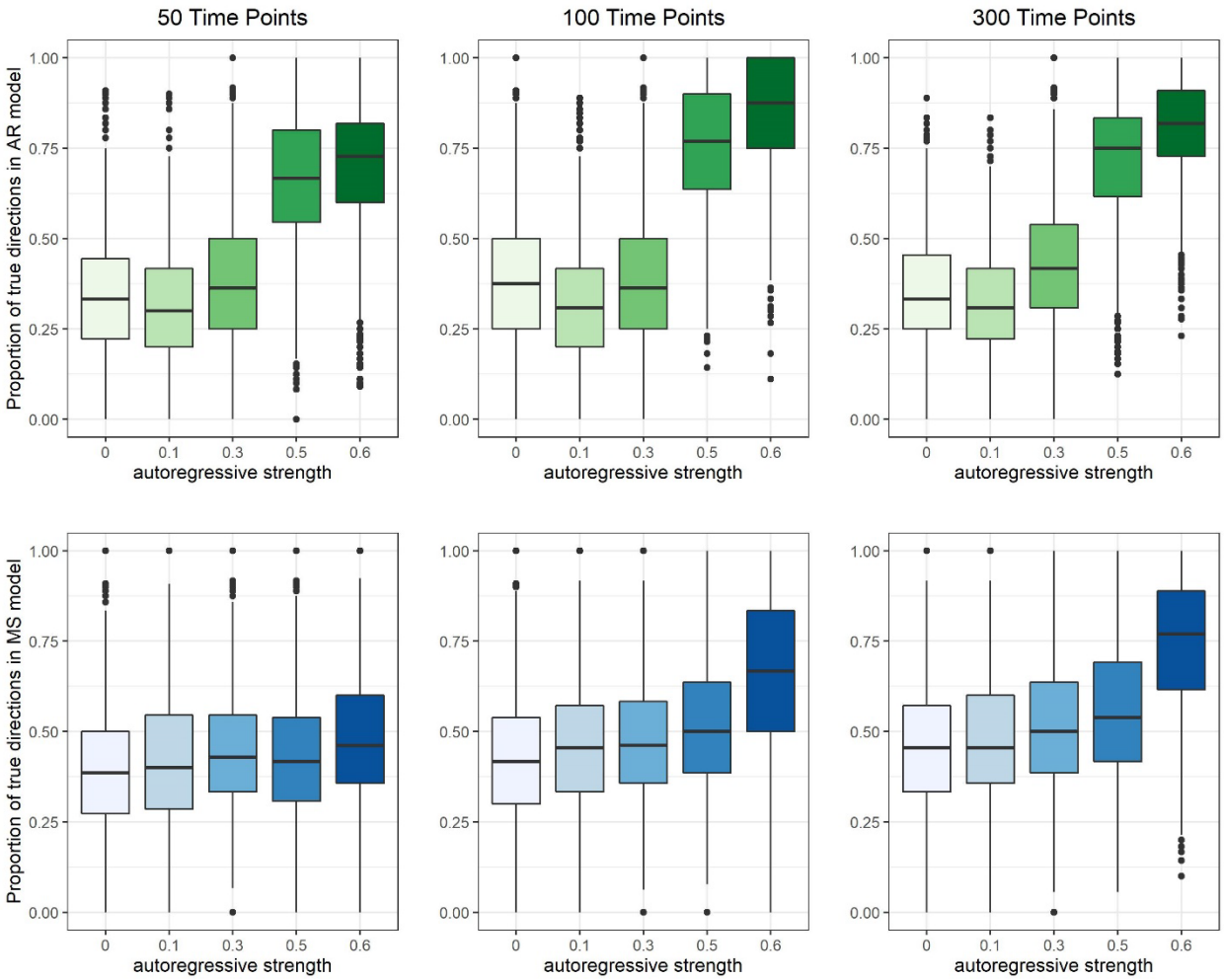
Supplemental Figure 3. Box plots of contemporaneous relation direction precision for individual-level models in the lagged greater (LG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies.



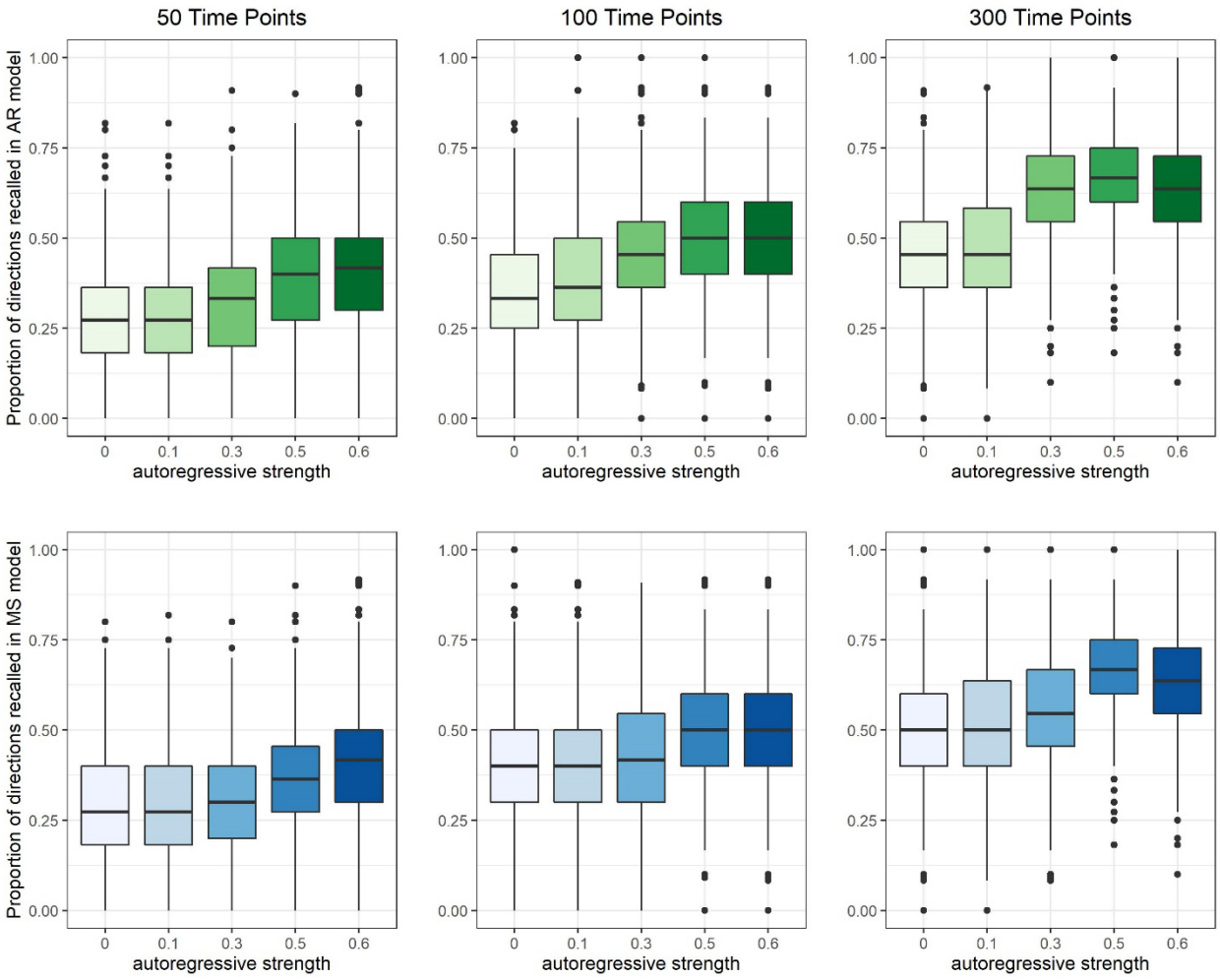
Supplemental Figure 4. Box plots of contemporaneous relation direction recall for individual-level models in the contemporaneous greater (CG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies.



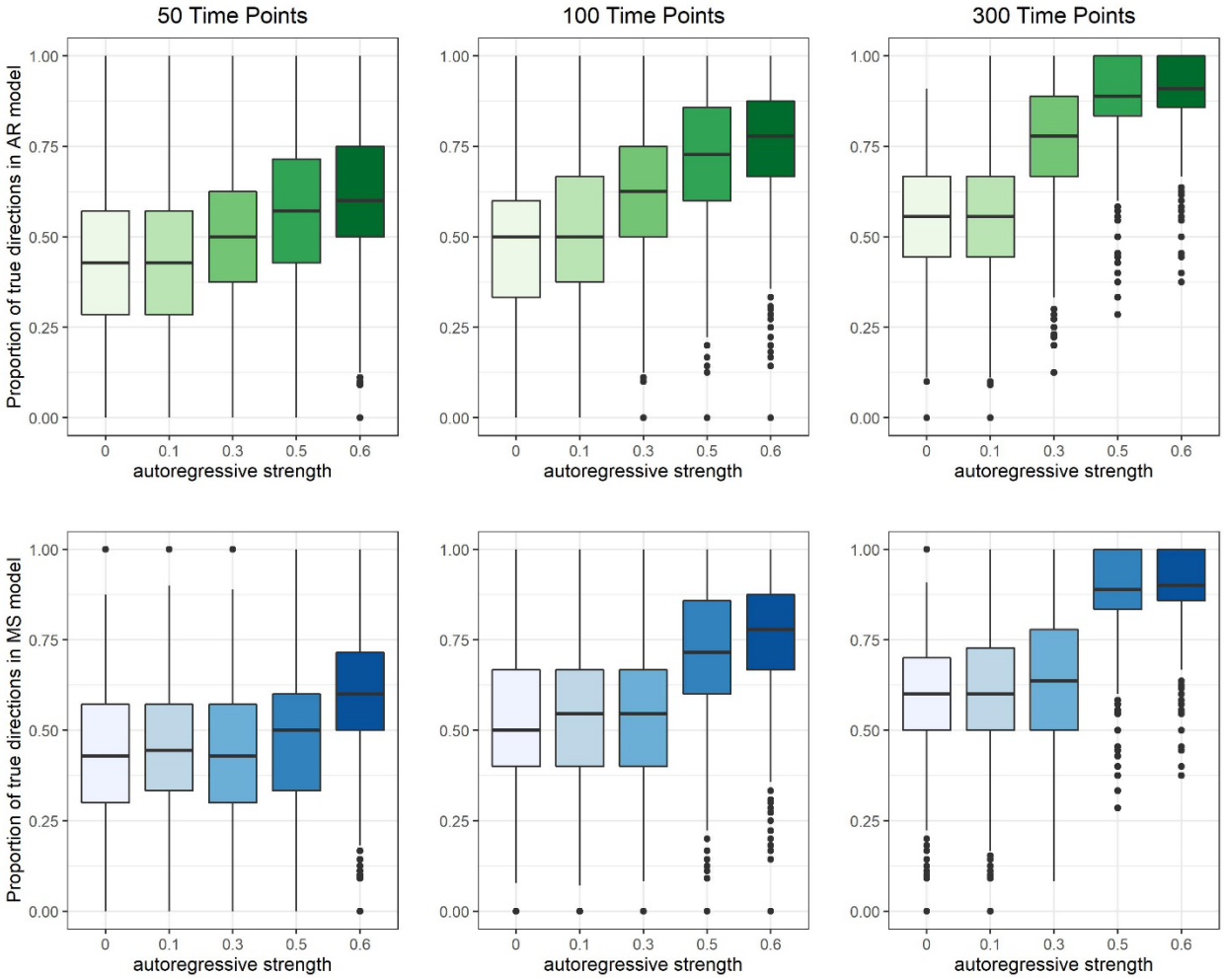
Supplemental Figure 5. Box plots of contemporaneous relation direction precision for individual-level models in the contemporaneous greater (CG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies.



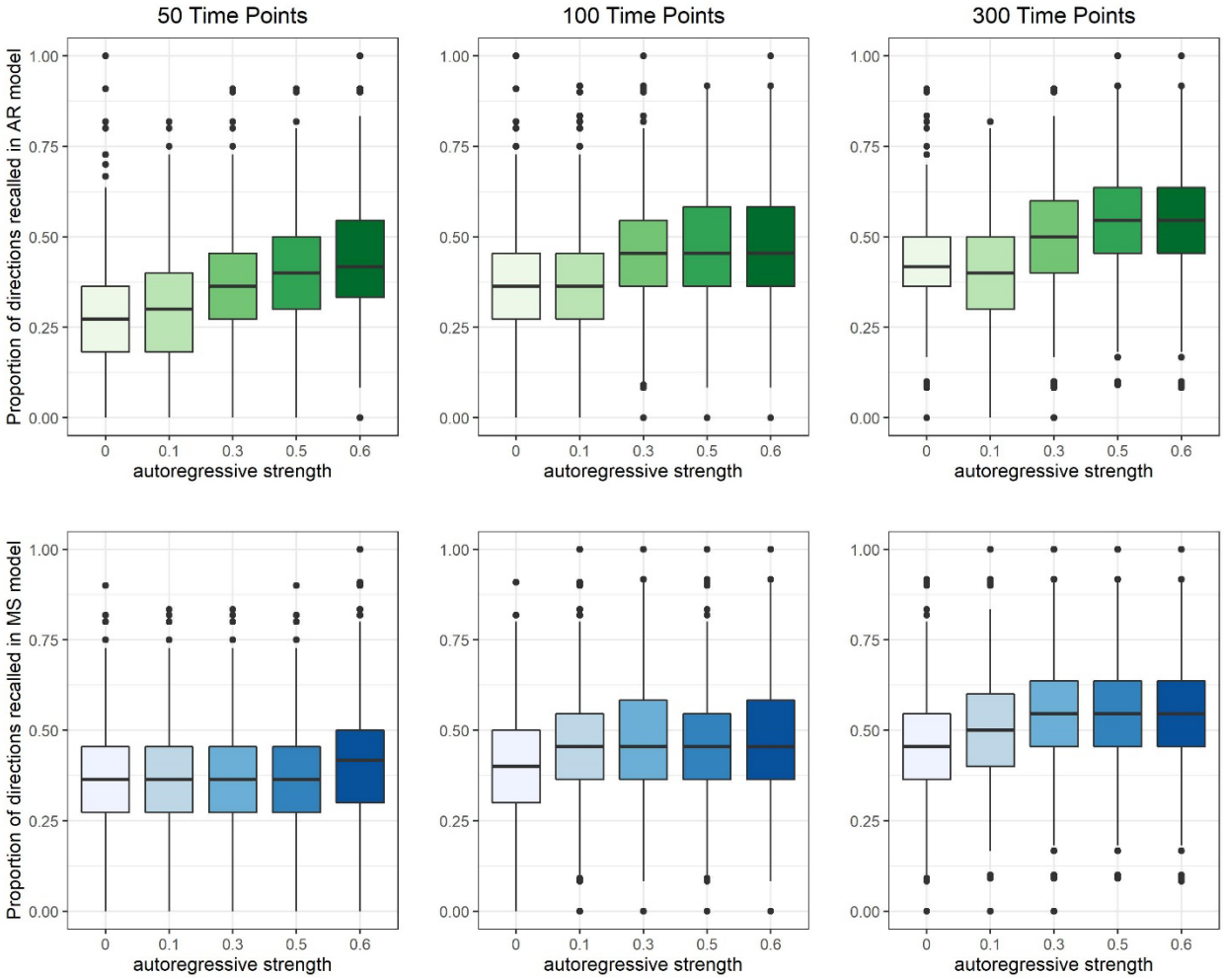
Supplemental Figure 6. Box plots of contemporaneous relation direction recall for individual-level models in the balanced (BA) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



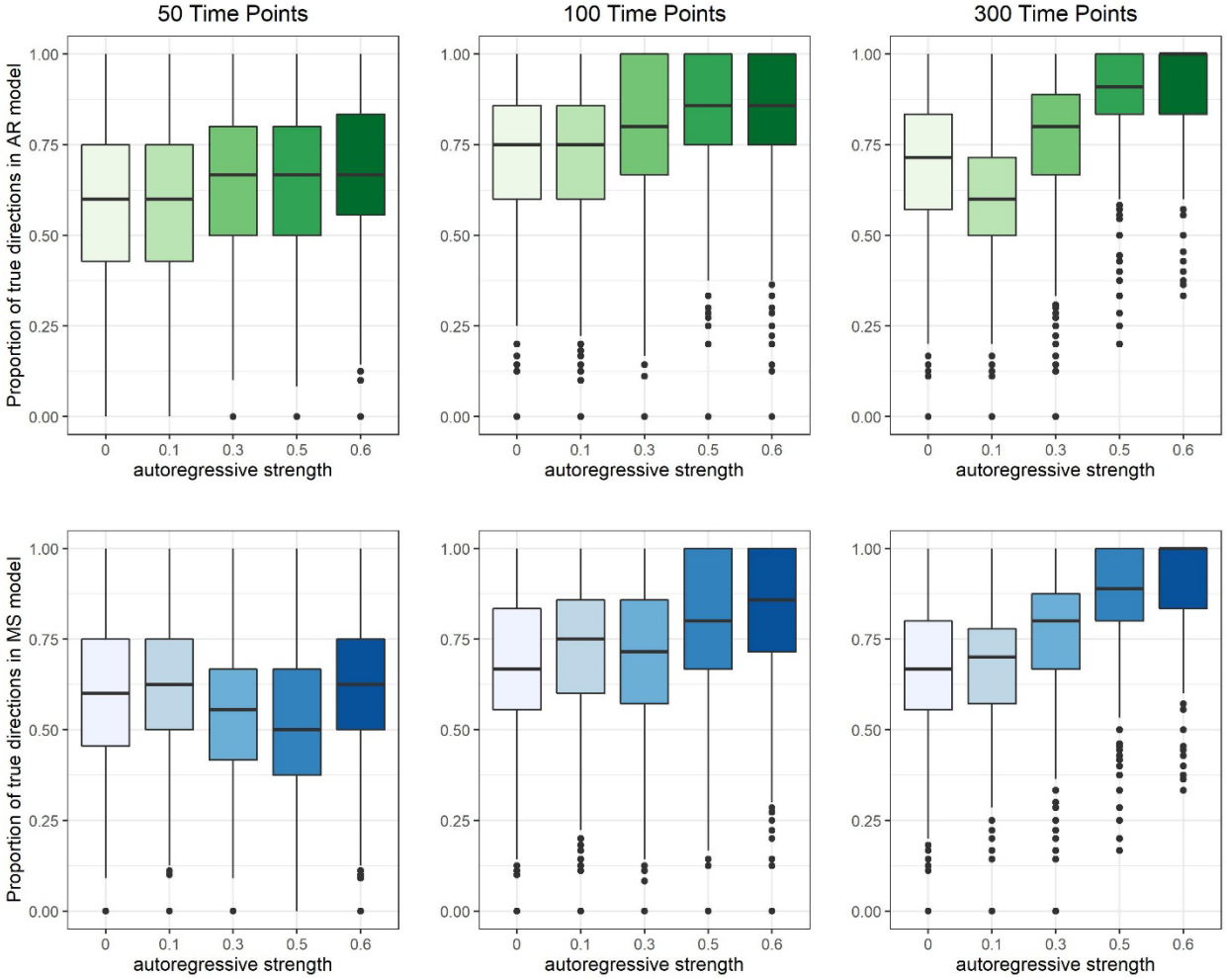
Supplemental Figure 7. Box plots of contemporaneous relation direction precision for individual-level models in the balanced (BA) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



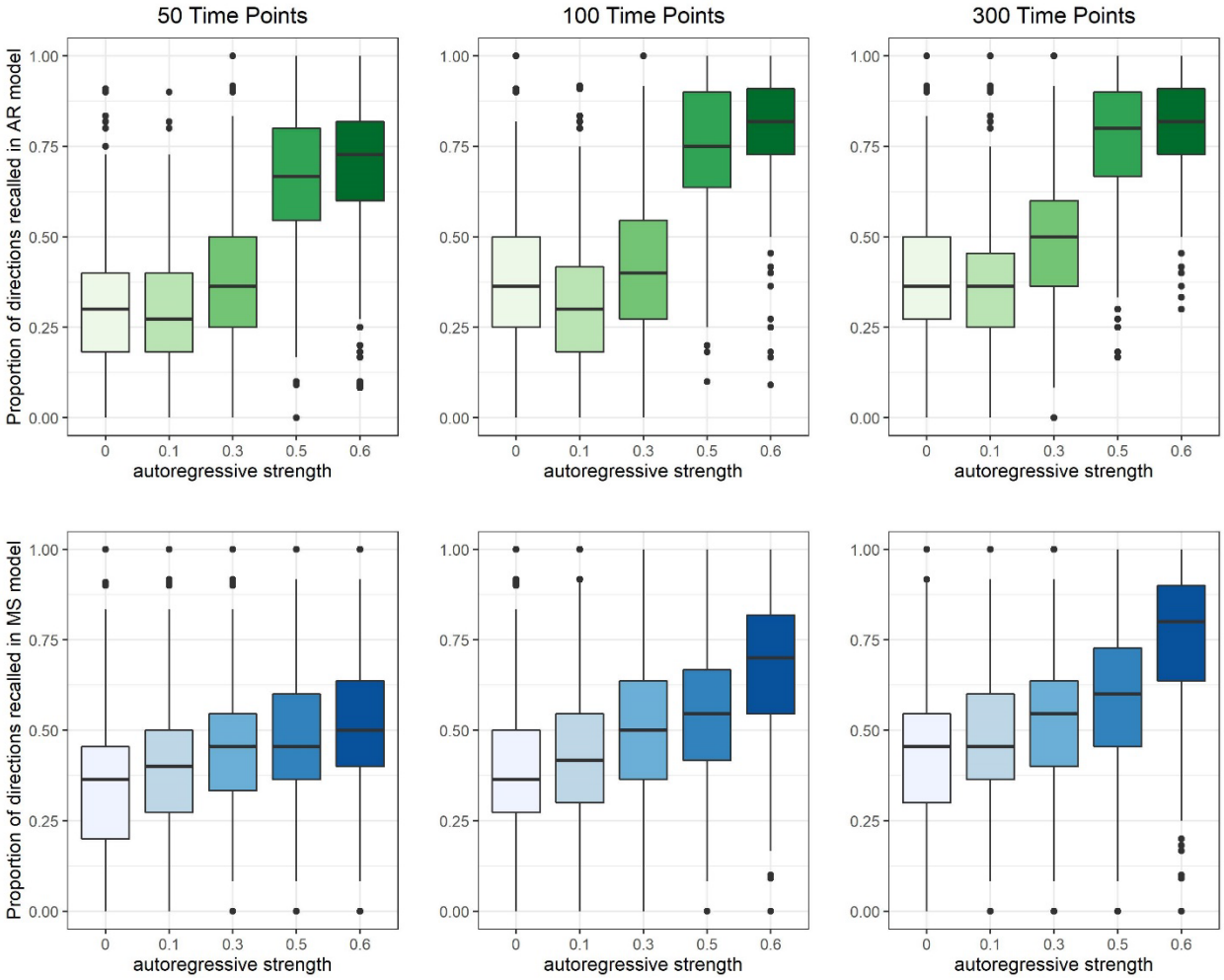
Supplemental Figure 8. Box plots of contemporaneous relation direction recall for individual-level models in the lagged greater (LG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



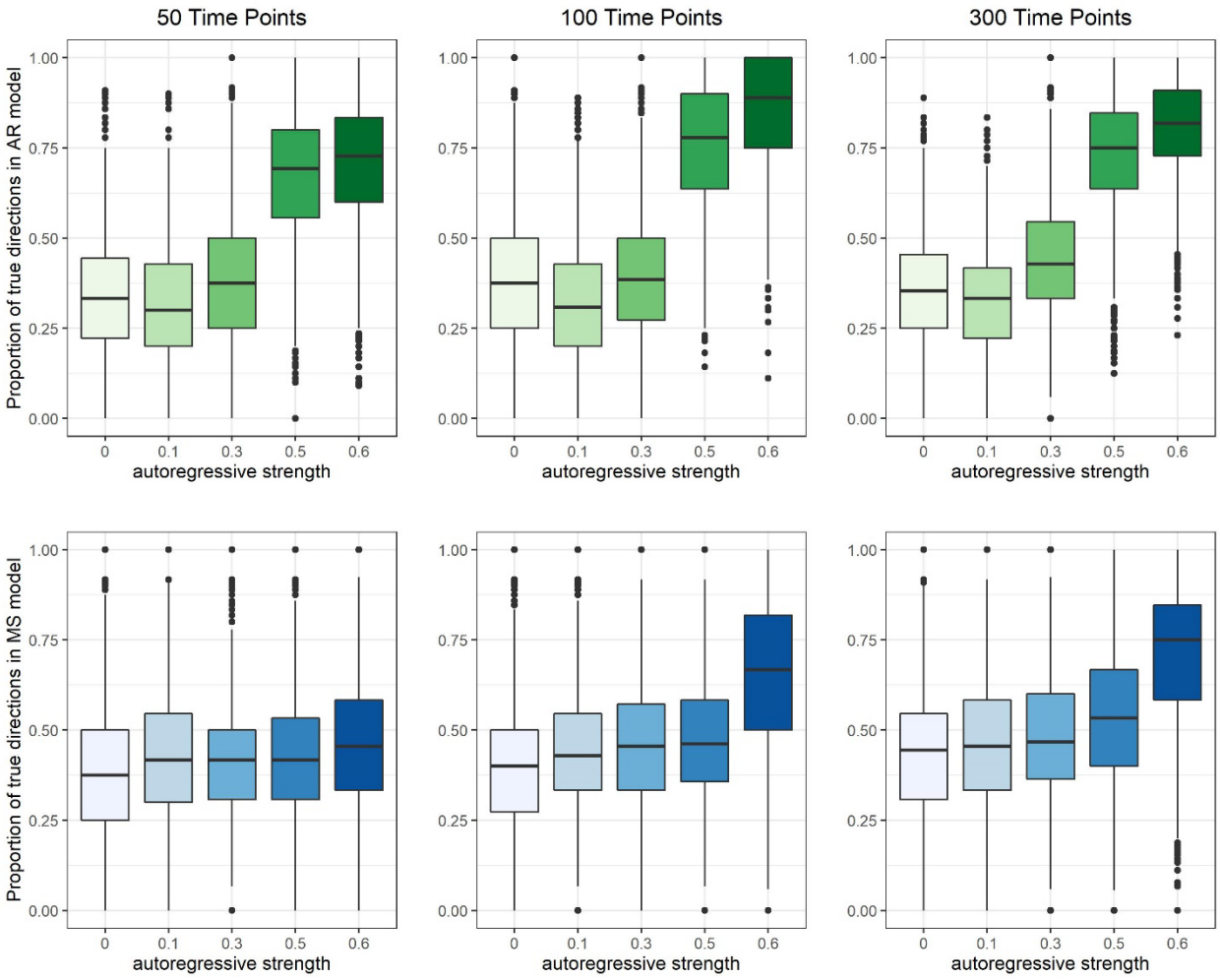
Supplemental Figure 9. Box plots of contemporaneous relation direction precision for individual-level models in the lagged greater (LG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



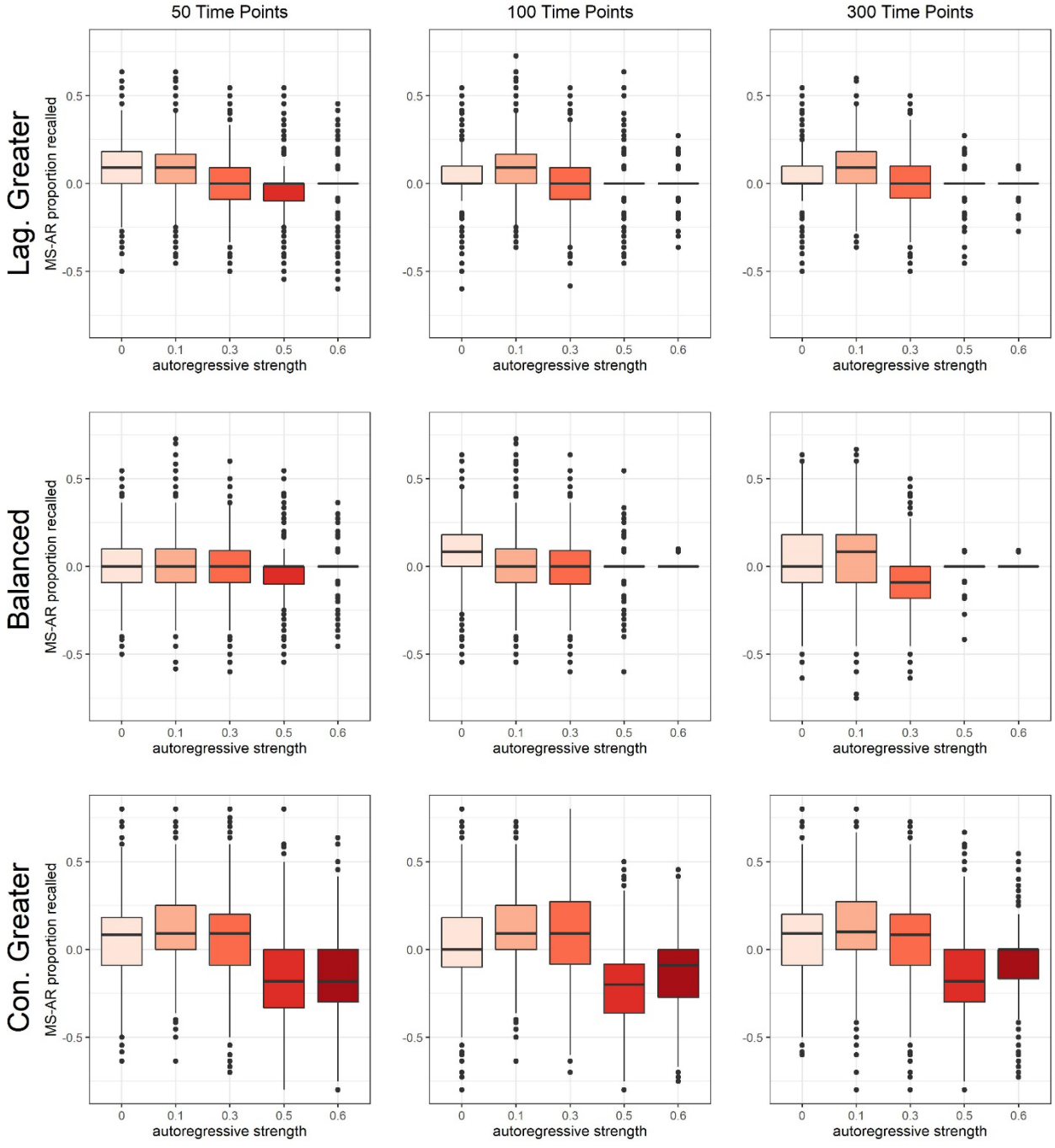
Supplemental Figure 10. Box plots of contemporaneous relation direction recall for individual-level models in the contemporaneous greater (CG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



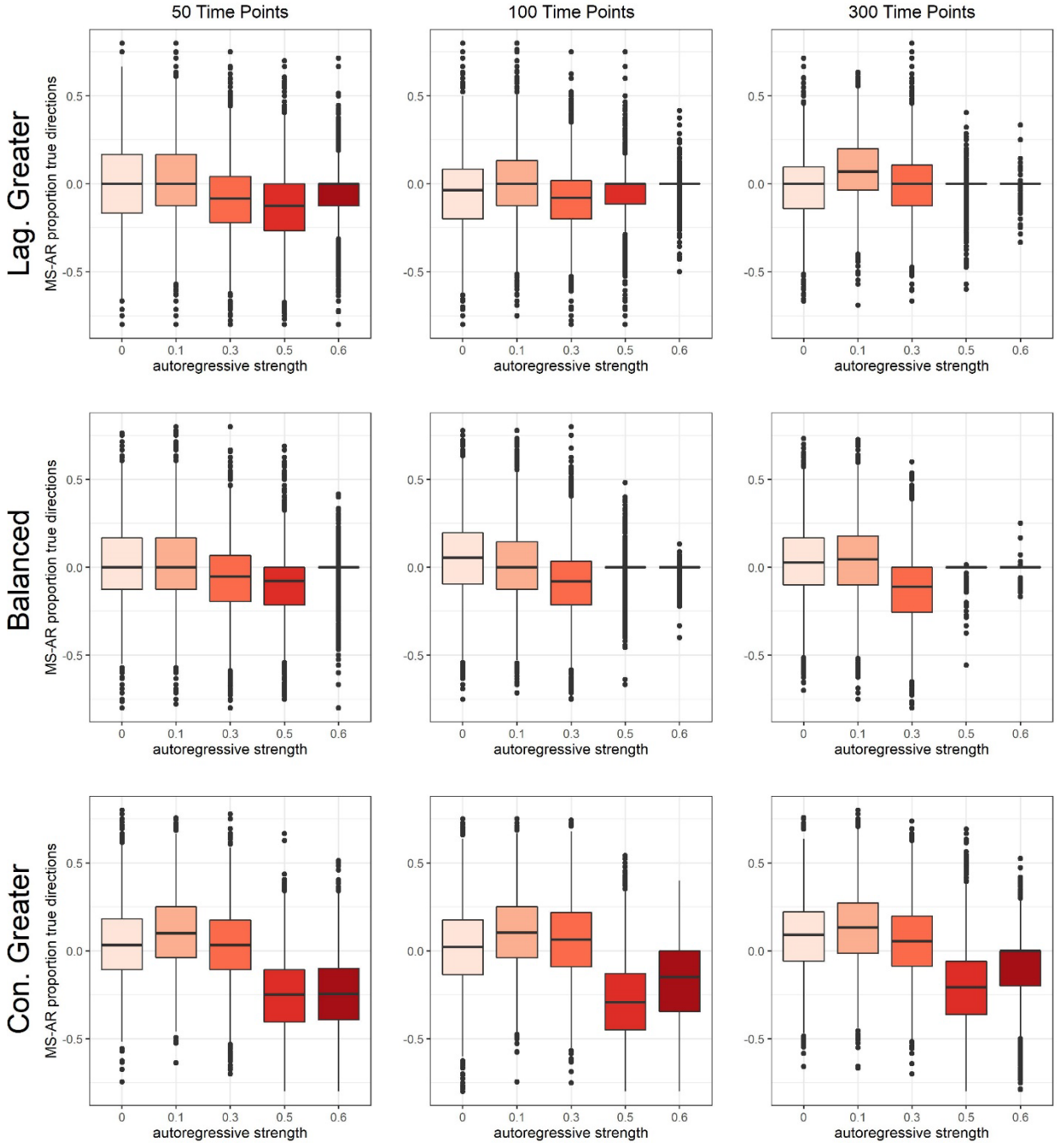
Supplemental Figure 11. Box plots of contemporaneous relation direction precision for individual-level models in the contemporaneous greater (CG) simulation condition for GIMME-AR (top/green) and GIMME-MS (bottom/blue) search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



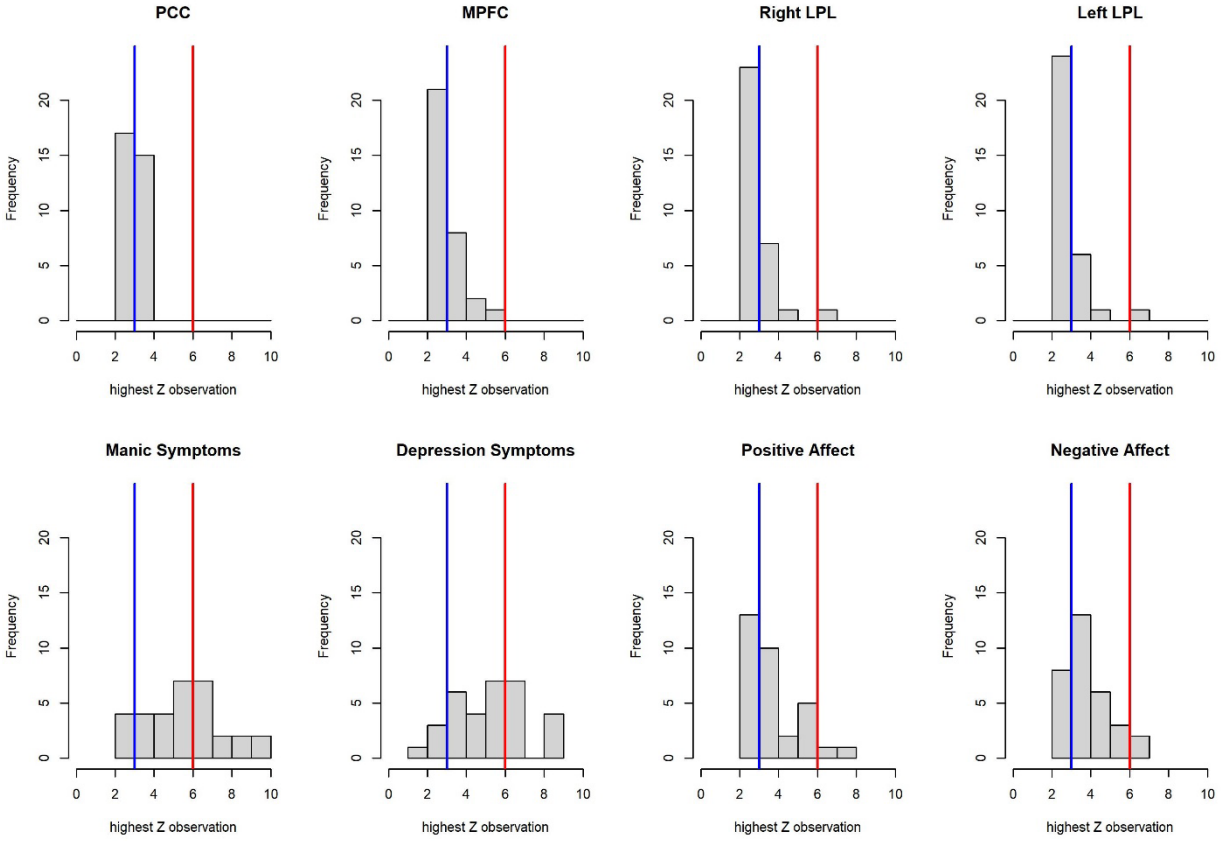
Supplemental Figure 12. Box plots of contemporaneous direction recall differences between the two search strategies (GIMME-MS minus GIMME-AR) for individual-level models in all simulation conditions when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



Supplemental Figure 13. Box plots of contemporaneous direction precision differences between the two search strategies (GIMME-MS minus GIMME-AR) for individual-level models in all simulation conditions when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered.



Supplemental Figure 14. Histograms of individuals' highest *Z*-score values observed for each variable in the fMRI (top row) and daily diary (bottom row) example data. Vertical blue and red lines highlight common cutoffs for outlier values: >3 standard deviations or >6 standard deviations, respectively, from the mean.



Supplemental Tables

Supplemental Table 1. Direction recall and direction precision for lagged relations across all simulation conditions and across the GIMME-AR and GIMME-MS search strategies, as well as the difference between strategies (GIMME-MS values minus GIMME-AR values). BA = balanced contemporaneous and lagged paths condition; LG = lagged-greater condition; CG = contemporaneous-greater condition; Auto. = autoregressive

			GIMME-AR			GIMME-MS			MS - AR Difference		
Recovery Statistic	Time Points	Auto. Strength	BA	LG	CG	BA	LG	CG	BA	LG	CG
Direction Recall	*50*	*0.00*	0.41	0.81	0.21	0.44	0.81	0.26	0.03	0.00	0.05
		0.10	0.43	0.83	0.23	0.45	0.84	0.29	0.02	0.01	0.06
		0.30	0.45	0.86	0.29	0.46	0.87	0.34	0.01	0.00	0.05
		0.50	0.48	0.83	0.39	0.48	0.82	0.39	0.00	0.00	0.00
		0.60	0.47	0.82	0.42	0.48	0.82	0.41	0.00	0.00	-0.01
	100	*0.00*	0.56	0.87	0.26	0.59	0.87	0.30	0.03	0.00	0.04
		0.10	0.57	0.89	0.28	0.60	0.90	0.34	0.03	0.01	0.06
		0.30	0.59	0.93	0.36	0.61	0.93	0.41	0.02	0.00	0.05
		0.50	0.59	0.91	0.47	0.59	0.91	0.46	0.00	0.00	-0.01
		0.60	0.56	0.89	0.49	0.56	0.89	0.48	0.00	0.00	-0.01
	300	*0.00*	0.75	0.88	0.35	0.73	0.89	0.37	-0.02	0.01	0.02
		0.10	0.78	0.89	0.40	0.76	0.92	0.40	-0.02	0.02	0.00
		0.30	0.79	0.93	0.49	0.74	0.94	0.48	-0.04	0.01	-0.01
		0.50	0.73	0.92	0.58	0.73	0.92	0.52	0.00	0.00	-0.06
		0.60	0.66	0.91	0.59	0.66	0.91	0.57	0.00	0.00	-0.03
Direction Precision	*50*	*0.00*	0.69	0.89	0.59	0.70	0.87	0.57	0.00	-0.02	-0.02
		0.10	0.68	0.89	0.57	0.67	0.87	0.57	0.00	-0.02	0.00
		0.30	0.67	0.86	0.55	0.62	0.78	0.49	-0.06	-0.08	-0.06
		0.50	0.68	0.84	0.66	0.61	0.73	0.45	-0.08	-0.11	-0.21
		0.60	0.69	0.83	0.69	0.68	0.78	0.47	-0.01	-0.05	-0.22
	100	*0.00*	0.85	0.97	0.73	0.84	0.95	0.66	-0.01	-0.02	-0.06
		0.10	0.84	0.97	0.69	0.82	0.94	0.67	-0.02	-0.02	-0.02
		0.30	0.85	0.96	0.66	0.77	0.89	0.58	-0.08	-0.07	-0.08
		0.50	0.86	0.95	0.81	0.86	0.91	0.55	-0.01	-0.04	-0.26
		0.60	0.88	0.94	0.85	0.87	0.93	0.65	0.00	-0.01	-0.20
	300	*0.00*	0.98	0.98	0.79	0.95	0.97	0.76	-0.03	-0.01	-0.03
		0.10	0.97	0.97	0.81	0.95	0.97	0.75	-0.03	0.00	-0.05
		0.30	0.98	0.96	0.72	0.93	0.95	0.68	-0.05	-0.01	-0.04
		0.50	0.99	0.97	0.80	0.99	0.96	0.63	0.00	-0.01	-0.17
		0.60	0.99	0.96	0.85	0.99	0.96	0.76	0.00	0.00	-0.08

Supplemental Table 2. Direction recall and direction precision for contemporaneous relations across all simulation conditions and across the GIMME-AR and GIMME-MS search strategies, as well as the difference between strategies (GIMME-MS values minus GIMME-AR values), when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered. BA = balanced contemporaneous and lagged paths condition; LG = lagged-greater condition; CG = contemporaneous-greater condition; Auto. = autoregressive

			GIMME-AR			GIMME-MS			MS - AR Difference		
Recovery Statistic	Time Points	Auto. Strength	BA	LG	CG	BA	LG	CG	BA	LG	CG
Direction Recall	*50*	*0.00*	0.27	0.29	0.30	0.29	0.36	0.35	0.03	0.07	0.05
		0.10	0.27	0.31	0.29	0.30	0.38	0.40	0.03	0.07	0.12
		0.30	0.33	0.37	0.37	0.31	0.36	0.44	-0.02	0.00	0.07
		0.50	0.40	0.41	0.66	0.35	0.37	0.47	-0.05	-0.04	-0.18
		0.60	0.42	0.43	0.70	0.42	0.42	0.52	0.00	-0.02	-0.18
	100	*0.00*	0.34	0.37	0.37	0.40	0.41	0.39	0.06	0.05	0.02
		0.10	0.37	0.38	0.32	0.41	0.46	0.43	0.03	0.08	0.11
		0.30	0.45	0.45	0.40	0.42	0.47	0.50	-0.03	0.02	0.09
		0.50	0.51	0.48	0.75	0.51	0.46	0.54	0.00	-0.01	-0.21
		0.60	0.51	0.48	0.81	0.51	0.48	0.67	0.00	0.00	-0.14
	300	*0.00*	0.45	0.43	0.38	0.49	0.47	0.44	0.04	0.04	0.07
		0.10	0.47	0.40	0.35	0.52	0.50	0.48	0.05	0.09	0.12
		0.30	0.63	0.51	0.48	0.56	0.54	0.53	-0.07	0.04	0.05
		0.50	0.67	0.56	0.77	0.67	0.55	0.60	0.00	-0.01	-0.17
		0.60	0.64	0.56	0.82	0.64	0.56	0.75	0.00	0.00	-0.07
Direction Precision	*50*	*0.00*	0.42	0.58	0.34	0.44	0.59	0.38	0.02	0.01	0.04
		0.10	0.42	0.59	0.32	0.44	0.62	0.42	0.02	0.03	0.10
		0.30	0.49	0.62	0.38	0.43	0.54	0.41	-0.06	-0.09	0.03
		0.50	0.57	0.64	0.67	0.47	0.51	0.41	-0.10	-0.14	-0.26
		0.60	0.60	0.67	0.71	0.58	0.60	0.46	-0.02	-0.07	-0.25
	100	*0.00*	0.47	0.72	0.38	0.52	0.67	0.41	0.05	-0.06	0.03
		0.10	0.52	0.71	0.33	0.53	0.72	0.43	0.01	0.01	0.11
		0.30	0.62	0.78	0.39	0.53	0.70	0.45	-0.09	-0.09	0.05
		0.50	0.71	0.83	0.76	0.70	0.77	0.46	-0.01	-0.06	-0.29
		0.60	0.76	0.83	0.84	0.75	0.81	0.63	-0.01	-0.02	-0.20
	300	*0.00*	0.56	0.69	0.36	0.58	0.66	0.43	0.03	-0.03	0.08
		0.10	0.56	0.60	0.33	0.60	0.68	0.46	0.04	0.08	0.13
		0.30	0.75	0.77	0.43	0.63	0.77	0.48	-0.12	0.00	0.05
		0.50	0.89	0.88	0.73	0.89	0.87	0.52	0.00	-0.02	-0.21
		0.60	0.91	0.90	0.81	0.91	0.90	0.70	0.00	0.00	-0.11

Supplemental Table 3. Direction recall and direction precision for lagged relations across all simulation conditions and across the GIMME-AR and GIMME-MS search strategies, as well as the difference between strategies (GIMME-MS values minus GIMME-AR values), when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered. BA = balanced contemporaneous and lagged paths condition; LG = lagged-greater condition; CG = contemporaneous-greater condition; Auto. = autoregressive

			GIMME-AR			GIMME-MS			MS - AR Difference		
Recovery Statistic	Time Points	Auto. Strength	BA	LG	CG	BA	LG	CG	BA	LG	CG
Direction Recall	*50*	*0.00*	0.42	0.81	0.21	0.45	0.82	0.27	0.02	0.01	0.05
		0.10	0.44	0.84	0.24	0.45	0.85	0.29	0.01	0.01	0.05
		0.30	0.46	0.87	0.30	0.47	0.87	0.34	0.01	0.00	0.04
		0.50	0.48	0.83	0.40	0.49	0.83	0.39	0.00	0.00	-0.01
		0.60	0.48	0.82	0.42	0.48	0.82	0.41	0.00	0.00	-0.01
	100	*0.00*	0.57	0.87	0.26	0.61	0.88	0.30	0.04	0.00	0.04
		0.10	0.59	0.89	0.28	0.61	0.90	0.34	0.02	0.01	0.06
		0.30	0.61	0.93	0.38	0.62	0.93	0.41	0.01	0.00	0.03
		0.50	0.60	0.92	0.48	0.60	0.91	0.46	0.00	0.00	-0.02
		0.60	0.56	0.89	0.49	0.56	0.89	0.48	0.00	0.00	-0.02
	300	*0.00*	0.75	0.89	0.35	0.75	0.90	0.37	0.00	0.01	0.02
		0.10	0.79	0.90	0.42	0.78	0.92	0.41	-0.01	0.02	0.00
		0.30	0.79	0.93	0.50	0.76	0.94	0.48	-0.04	0.01	-0.02
		0.50	0.73	0.93	0.59	0.73	0.92	0.52	0.00	0.00	-0.07
		0.60	0.66	0.92	0.60	0.66	0.92	0.57	0.00	0.00	-0.03
Direction Precision	*50*	*0.00*	0.70	0.90	0.60	0.70	0.88	0.58	0.00	-0.02	-0.01
		0.10	0.69	0.89	0.59	0.67	0.87	0.58	-0.01	-0.02	0.00
		0.30	0.68	0.86	0.56	0.62	0.78	0.49	-0.06	-0.08	-0.08
		0.50	0.69	0.84	0.67	0.61	0.73	0.45	-0.08	-0.11	-0.22
		0.60	0.69	0.83	0.70	0.68	0.78	0.47	-0.01	-0.05	-0.23
	100	*0.00*	0.86	0.97	0.74	0.86	0.95	0.68	-0.01	-0.02	-0.06
		0.10	0.85	0.97	0.72	0.83	0.95	0.69	-0.02	-0.02	-0.03
		0.30	0.85	0.96	0.67	0.78	0.90	0.59	-0.08	-0.06	-0.09
		0.50	0.87	0.95	0.81	0.86	0.92	0.54	-0.01	-0.04	-0.28
		0.60	0.88	0.94	0.85	0.88	0.93	0.66	0.00	-0.01	-0.19
	300	*0.00*	0.98	0.99	0.81	0.96	0.97	0.77	-0.02	-0.01	-0.04
		0.10	0.98	0.98	0.82	0.95	0.97	0.77	-0.02	0.00	-0.05
		0.30	0.99	0.96	0.74	0.93	0.95	0.68	-0.05	-0.01	-0.06
		0.50	0.99	0.97	0.81	0.99	0.96	0.63	0.00	-0.01	-0.18
		0.60	0.99	0.96	0.85	0.99	0.96	0.74	0.00	0.00	-0.11

Supplemental Table 4. Effects of the relative strength of contemporaneous and lagged relations on direction recall and direction precision for GIMME-AR ("AR") and GIMME-MS "("MS") search strategies when only plausible models (i.e., those with standardized error covariance matrix values between 0 and 1) are considered. Values in the table represent difference scores obtained by subtracting recovery statistics in the contemporaneous greater (CG) condition from those in the lagged greater (LG) condition. Therefore, positive values indicate better recall or precision in the LG condition, whereas negative values indicate better recall or precision in the CG condition.

Time Points	Auto. Strength	Recall		Precision	
		AR	MS	AR	MS
50	*0.00*	-0.02	0.00	0.24	0.21
	0.10	0.02	-0.02	0.27	0.20
	0.30	0.00	-0.07	0.24	0.12
	0.50	-0.25	-0.10	-0.03	0.09
	0.60	-0.27	-0.10	-0.04	0.14
100	*0.00*	0.00	0.02	0.34	0.26
	0.10	0.06	0.03	0.39	0.29
	0.30	0.05	-0.03	0.39	0.25
	0.50	-0.27	-0.08	0.07	0.30
	0.60	-0.33	-0.20	-0.01	0.18
300	*0.00*	0.05	0.03	0.33	0.23
	0.10	0.05	0.02	0.27	0.22
	0.30	0.03	0.02	0.34	0.29
	0.50	-0.21	-0.05	0.16	0.35
	0.60	-0.26	-0.19	0.09	0.20