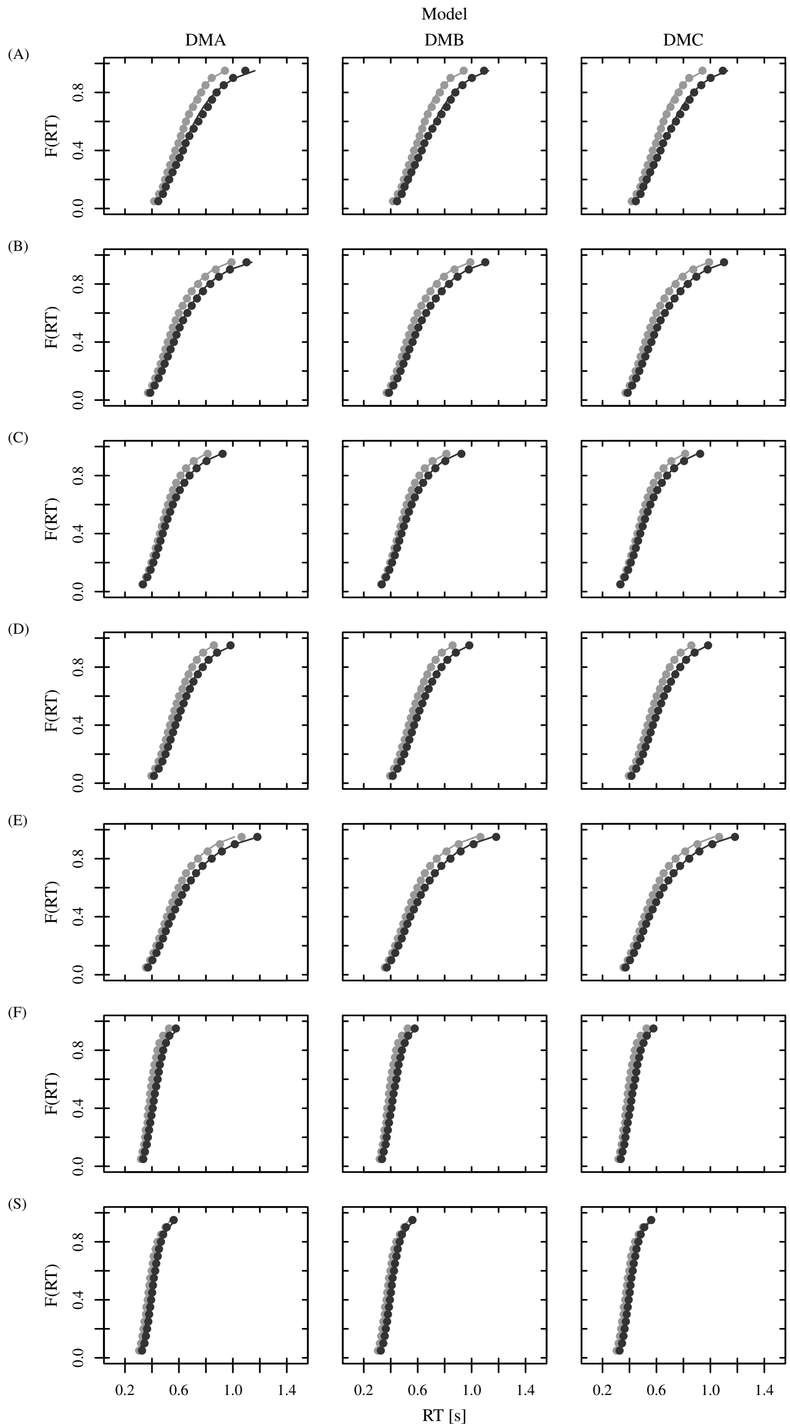
Electronic Supplement A: Qualitative Model Fits and Model Comparison Results for Each Data Set

In the main text, we did not consider the data sets separately when presenting the qualitative model fits and the model comparison results. Here, we provide figures and tables that show the results for each data set separately.

Figure A1 shows the average observed and predicted response time quantiles of correct responses separately for each data set. Qualitatively, DMA, DMB, and DMC could capture the observed quantiles of the BCE data well. Only minor misfits were apparent for DMA at the highest quantiles of some data sets.

Figure A1

Average Observed Versus Predicted Quantiles Across Models and Data Sets



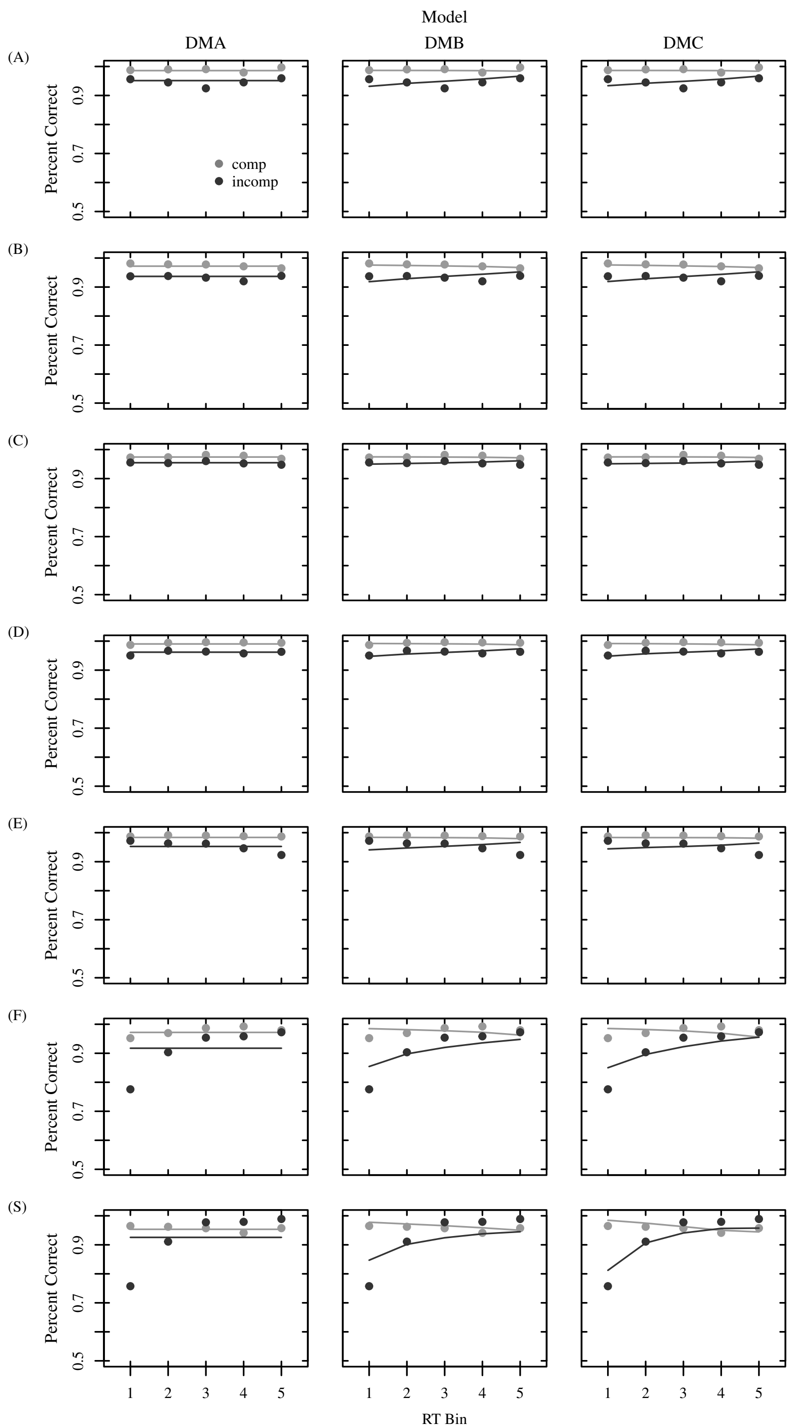
Note. Circles indicate the observed values. Lines indicate the predicted values. Both observed and predicted values were derived by averaging across participants. Each model (i.e., DMA, DMB, and DMC) is presented in a column. Each data set is presented in a row (see the letter on the left-outer margin). Light and dark gray circles/lines refer to compatible and incompatible conditions, respectively.

Figure A2 shows average observed and predicted conditional accuracy functions (CAFs), separately for each data set. Qualitatively, DMA, DMB, and DMC could capture the observed CAFs of the BCE data fairly well. Only minor misfits were apparent for the incompatible condition of data sets A, B, and E. With respect to the flanker and Simon data, larger misfits were apparent. As can be expected, DMA clearly failed to capture the tendency for fast errors.[10]. Also DMB and DMC could not account for the observed CAFs well. This is likely because fast errors were substantial in the flanker and Simon data set, and DMB and DMC can not fully account for fast errors as they were implemented here. In fact, when modeling data from flanker or Simon data sets, DMC requires additional variability in the starting point to perfectly account for observed CAFs (Ulrich et al., 2015). In the present study, however, no such trial-by-trial variability was incorporated, as we focused on BCE data sets, and not on data sets from conflict tasks.

[10] Models with a time-invariant drift cannot predict fast or slow errors, unless trial-by-trial variability in the drift rate or starting point is incorporated.

Figure A2

Average Observed Versus Predicted Conditional Accuracy Functions Across Models and Data Sets

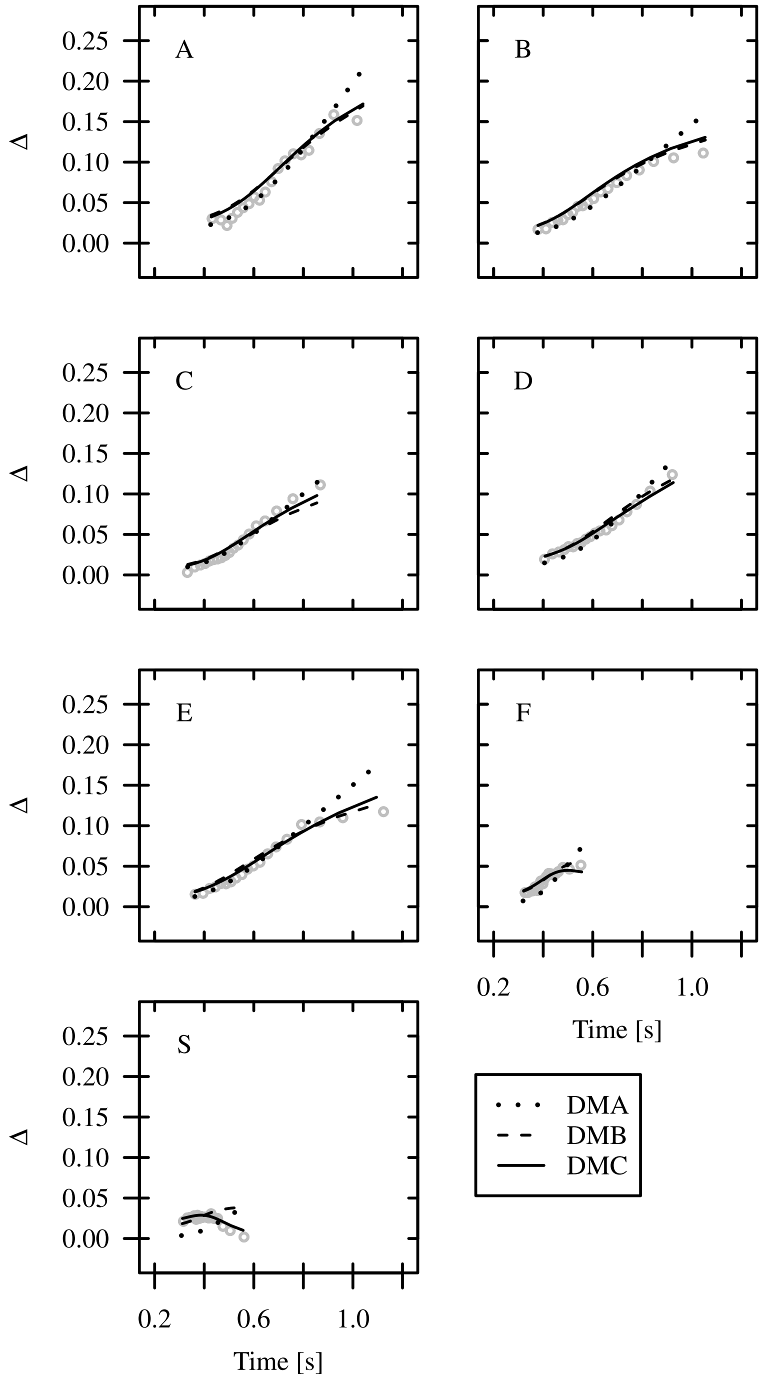


Note. The figure legend is the same as in Figure A1

Figure A3 shows the average observed and predicted delta functions separately for each data set. Qualitatively, DMA, DMB, and DMC could capture the observed delta functions of the BCE data well. Only minor misfits were apparent for slow responses with respect to DMA (especially for data sets A, B, and E). The same was true for the flanker data set. For the Simon data set, both DMA and DMB failed to capture the decreasing delta function.

Figure A3

Average Observed Versus Predicted Delta Functions for Each Model and Across Data Sets



Note. Each panel shows one data set (see the letter in the upper left corner of each panel). Circles indicate observed values. Lines indicate model predictions. Observed and predicted values were obtained by averaging across participants. The different model predictions by DMA, DMB, and DMC are shown by different line types (see the legend at the bottom right of the Figure).

Finally, Tables A1 and A2 summarize the results when comparing DMA, DMB, and DMC with respect to the AIC and BIC statistic, respectively. As is evident, DMA most-often turned out ’best’ across all BCE data sets. For the flanker and Simon data set, DMC most-often turned out ’best’.

Table A1

Summary of AIC Values for DMA, DMB, and DMC Across All Data Sets

		N		Σ		M	
Data set	DMA	DMB	DMC		DMA	DMB	DMC
BCE data sets							
A	8	1	3	12	-124	-123	-124
B	30	2	15	47	-132	-131	-132
C	38	2	3	43	-699	-696	-697
D	19	0	4	23	-345	-345	-346
E	17	1	6	24	-96	-92	-93
Conflict data sets							
F	2	2	12	16	-729	-740	-741
S	1	0	15	16	-695	-711	-717

Note. N = Number of participants for which the AIC statistic was smallest across DMA, DMB, and DMC (i.e., for which a certain model turned out ’best’), M = Mean, calculated across all participants for a certain model.

Table A2

Summary of BIC Values for DMA, DMB, and DMC Across All Data Sets

		N				*M*	
Data set	DMA	DMB	DMC	Σ	DMA	DMB	DMC
BCE data sets							
A	10	0	2	12	-106	-102	-103
B	39	1	7	47	-112	-108	-109
C	43	0	0	43	-676	-668	-669
D	19	0	4	23	-325	-321	-322
E	22	1	1	24	-76	-68	-69
Conflict data sets							
F	4	1	11	16	-710	-717	-718
S	2	0	14	16	-676	-688	-694

Note. N = Number of participants for which the BIC statistic was smallest across DMA, DMB, and DMC (i.e., for which a certain model turned out 'best'), M = Mean, calculated across all participants for a certain model.

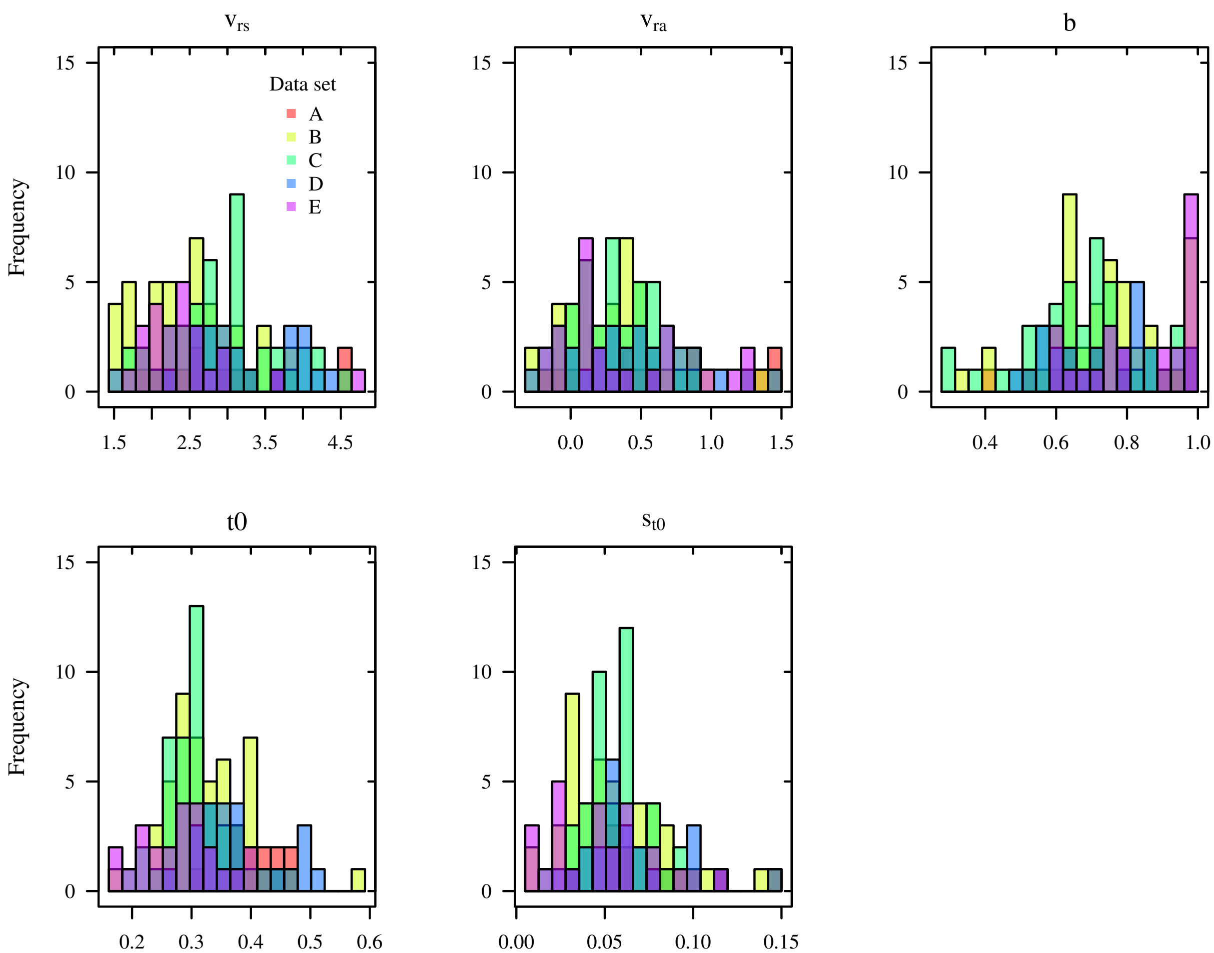
Electronic Supplement B: Parameter Distributions

In this Supplement, we present the distribution of parameters of DMA, DMB, and DMC in Figures B1-B3, respectively. Most parameters were (more or less) normally distributed. Yet, the boundary estimates *b* were often close to the upper parameter range. For example, 17 out of the 149 participants of the BCE data sets had a boundary estimate of 0.98 or higher.

In addition, we present in Figure B4 the parameter distribution of those 112 and 31 participants best described by DMA or DMC in Part 1, respectively.

Figure B1

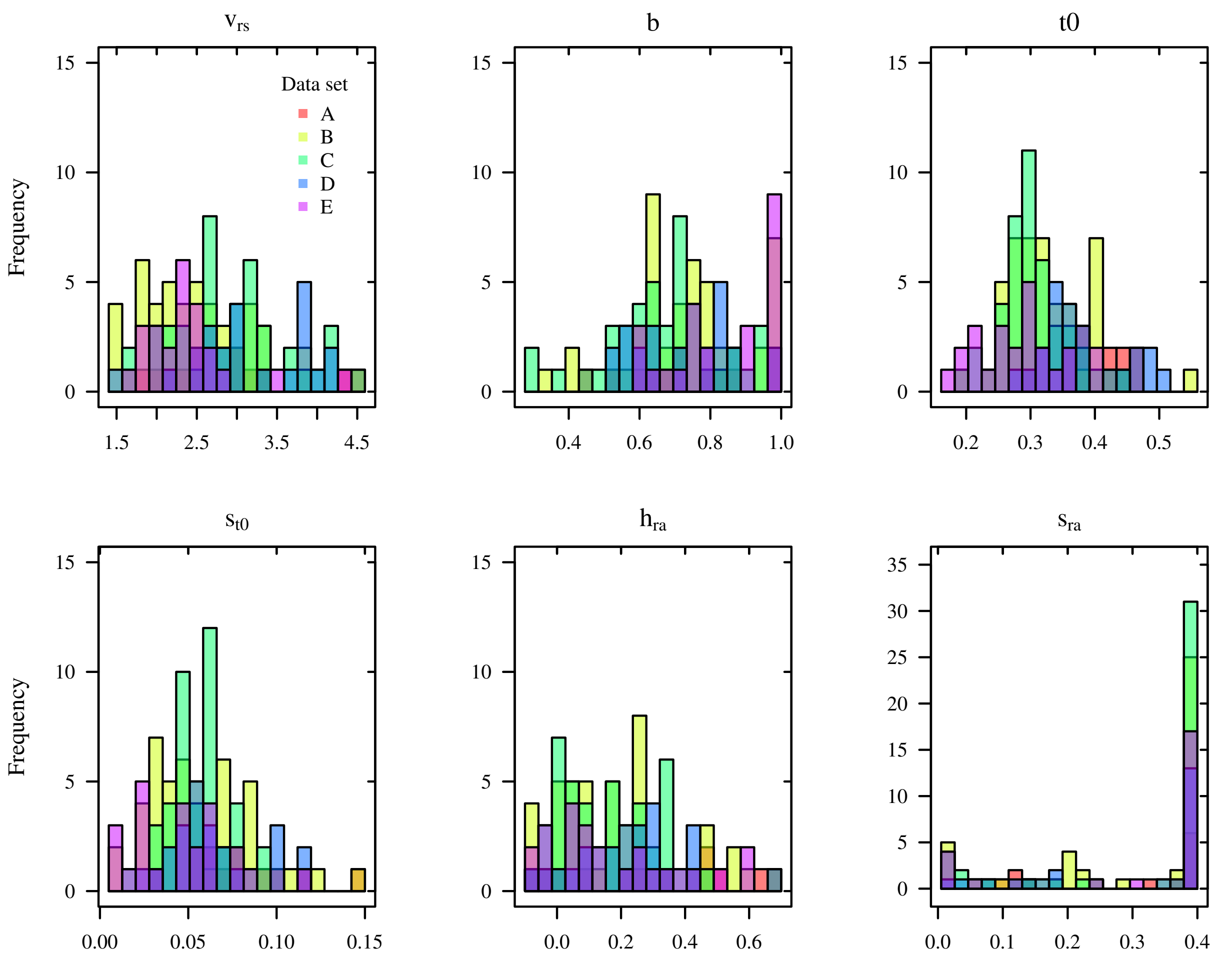
Parameter Distribution for DMA



Note. Each panel shows the histograms for one parameter (see the letter above each panel). Data sets are color coded, see the legend in the upper-left panel.

Figure B2

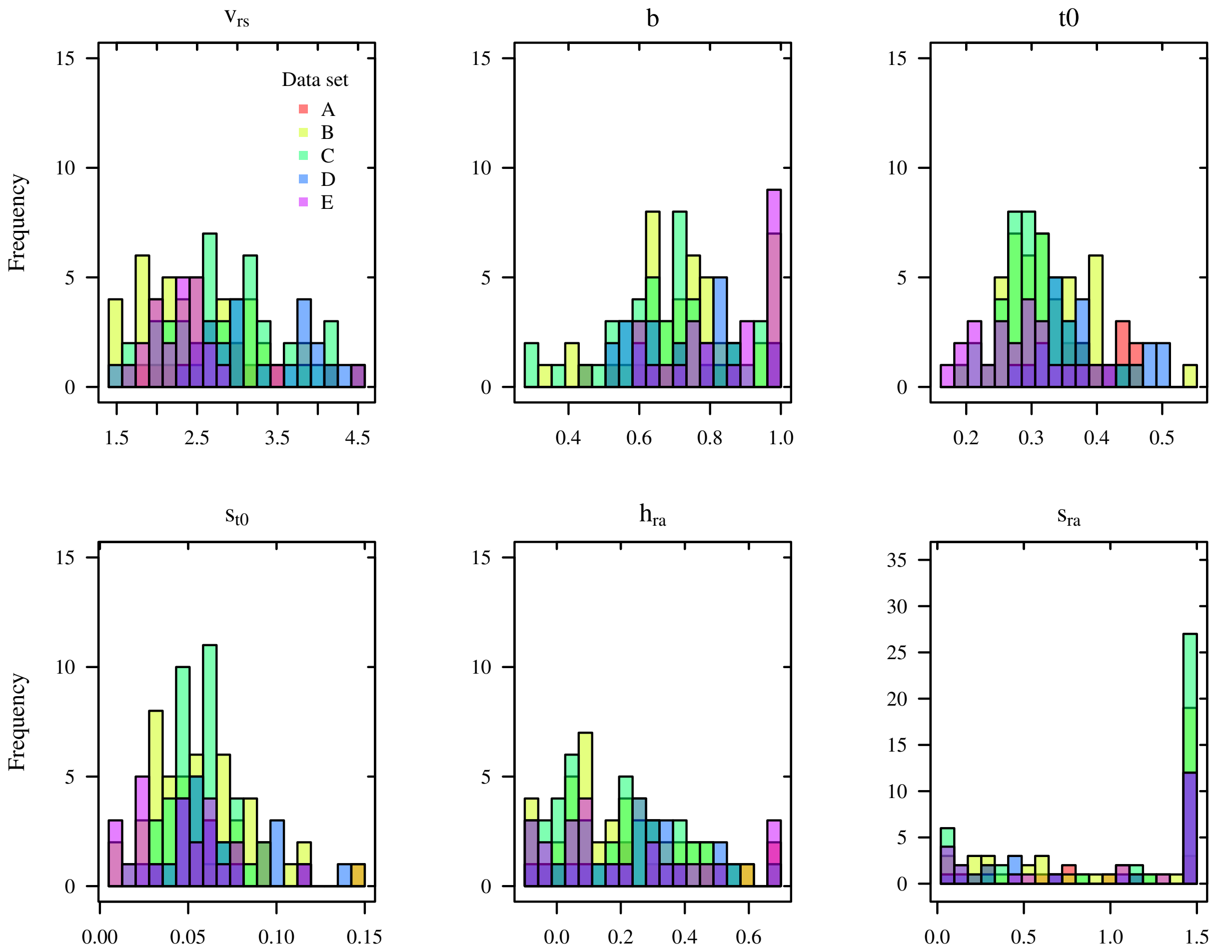
Parameter Distribution for DMB



Note. Legend is identical to B1

Figure B3

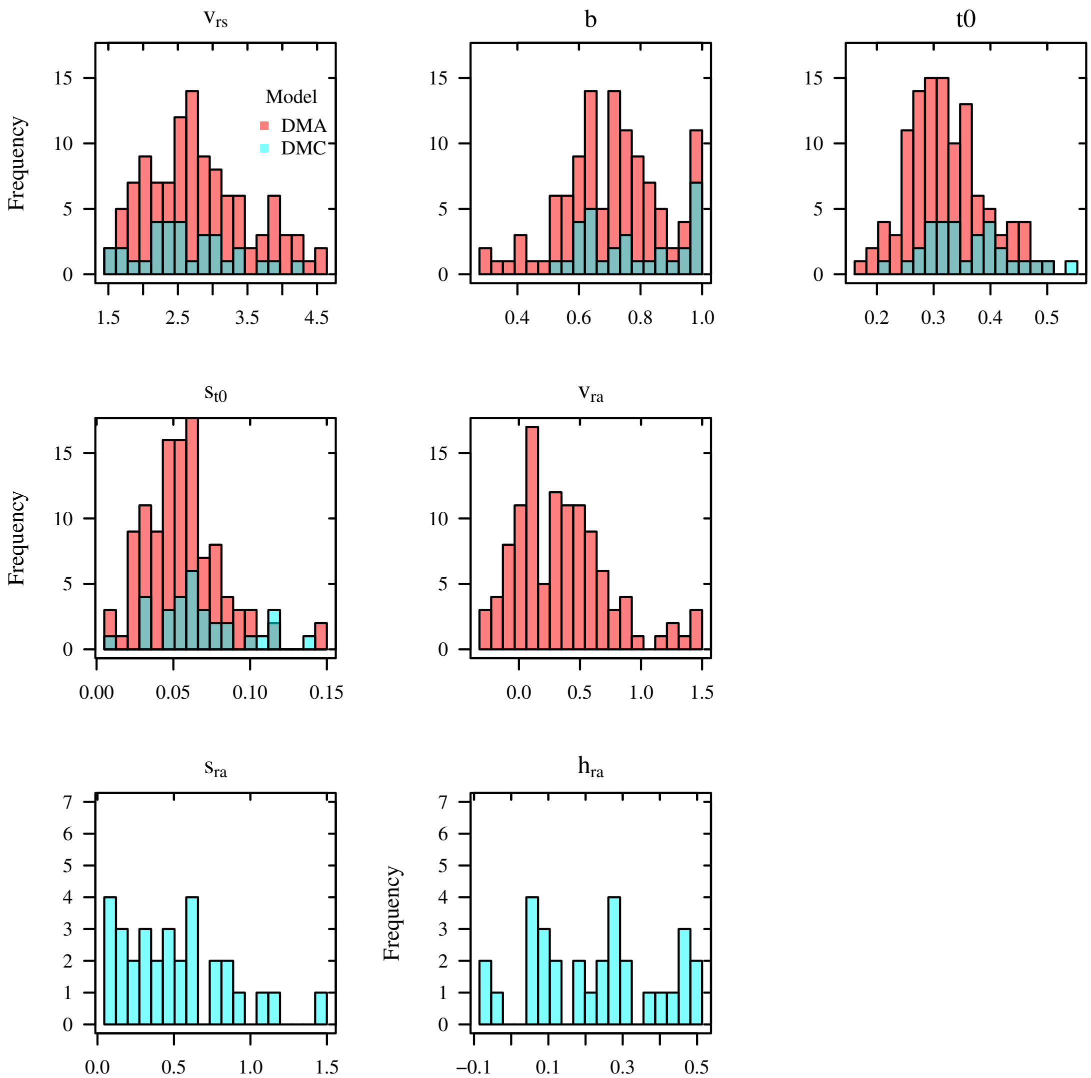
Parameter Distribution for DMC



Note. Legend is identical to B1

Figure B4

Parameter Distribution for Those Individuals Best Described by DMA and DMC



Note. Each panel shows a histogram of estimated parameters. Those individuals best described by DMA or DMC are coded in red and blue, respectively.

Electronic Supplement C: Tables for the Parameter Recovery

In this Electronic Supplement we report all correlations obtained along the parameter recovery study in Part 3 within Tables C1 to C3. All obtained average biases are presented in Tables C4 to C6.

Table C1
Correlations obtained for $\Delta t = \Delta x = 0.001$

	Parameters						
Model/Condition	ν_{rs}	b	$t0$	s_{t0}	ν_{ra}	h_{ra}	s_{ra}
DMC - s_{t0} fixed							
$N = 100$	.96	.77	.91			.65	.40
$N = 200$	.96	.89	.95			.80	.72
$N = 400$	.97	.91	.94			.86	.68
DMC - s_{t0} free							
$N = 100$	.96	.87	.96	.86		.81	.61
$N = 200$	.98	.93	.97	.93		.87	.57
$N = 400$	.98	.97	.99	.97		.91	.54
DMA - s_{t0} fixed							
$N = 100$	.94	.71	.91		.87		
$N = 200$	.97	.81	.93		.94		
$N = 400$	.98	.83	.93		.96		
DMA - s_{t0} free							
$N = 100$	.95	.79	.95	.87	.93		
$N = 200$	.97	.86	.96	.95	.96		
$N = 400$	.99	.95	.99	.97	.96		

Table C2

Correlations obtained for $\Delta t = \Delta x = 0.0025$

	Parameters						
Model/Condition	ν_{rs}	b	$t0$	s_{t0}	ν_{ra}	h_{ra}	s_{ra}
DMC - s_{t0} fixed							
$N = 100$	.94	.83	.93			.86	.52
$N = 200$	.96	.84	.91			.86	.55
$N = 400$	.97	.89	.92			.91	.67
DMC - s_{t0} free							
$N = 100$	.95	.83	.96	.86		.83	.49
$N = 200$	.98	.90	.97	.93		.83	.51
$N = 400$	.99	.98	.99	.97		.96	.53
DMA - s_{t0} fixed							
$N = 100$	.94	.81	.94		.90		
$N = 200$	.97	.90	.94		.93		
$N = 400$	.97	.88	.92		.95		
DMA - s_{t0} free							
$N = 100$	.94	.87	.95	.89	.87		
$N = 200$	.98	.91	.97	.94	.94		
$N = 400$	.99	.96	.99	.96	.97		

Table C3

Correlations obtained for $\Delta t = \Delta x = 0.005$

	Parameters						
Model/Condition	ν_{rs}	b	$t0$	s_{t0}	ν_{ra}	h_{ra}	s_{ra}
DMC - s_{t0} fixed							
$N = 100$	.94	.84	.95			.74	.35
$N = 200$	.96	.81	.91			.87	.44
$N = 400$	.96	.86	.95			.89	.77
DMC - s_{t0} free							
$N = 100$	.97	.81	.94	.78		.83	.59
$N = 200$	.97	.90	.97	.93		.85	.39
$N = 400$	.99	.97	.99	.96		.93	.72
DMA - s_{t0} fixed							
$N = 100$	.92	.73	.90		.88		
$N = 200$	.96	.80	.89		.91		
$N = 400$	.98	.84	.93		.96		
DMA - s_{t0} free							
$N = 100$	.96	.84	.95	.87	.88		
$N = 200$	.98	.91	.98	.93	.95		
$N = 400$	.99	.94	.98	.95	.98		

Table C4

Average biases obtained for $\Delta t = \Delta x = 0.001$

	Parameters						
Model/Condition	ν_{rs}	b	$t0$	s_{t0}	ν_{ra}	h_{ra}	s_{ra}
DMC - s_{t0} fixed							
$N = 100$	.01	.05	-.02			.08	.08
$N = 200$	0	.03	-.02			.06	.11
$N = 400$	.01	.01	-.01			.03	.09
DMC - s_{t0} free							
$N = 100$	.02	.02	-.01	-.06		.07	.15
$N = 200$	.01	0	.01	-.01		.05	.09
$N = 400$	.01	0	0	.01		.03	.07
DMA - s_{t0} fixed							
$N = 100$	.02	.03	-.01		0		
$N = 200$	.01	.05	-.02		0		
$N = 400$	0	.03	-.02		0		
DMA - s_{t0} free							
$N = 100$	.02	-.01	.01	-.01	.03		
$N = 200$	.02	.03	-.01	-.02	0		
$N = 400$	0	.01	0	-.01	0		

Note. Whenever biases are 0, this means that the absolute value of the average bias was smaller than .01.

Table C5

Average biases obtained for $\Delta t = \Delta x = 0.0025$

	Parameters						
Model/Condition	ν_{rs}	b	$t0$	s_{t0}	ν_{ra}	h_{ra}	s_{ra}
DMC - s_{t0} fixed							
$N = 100$	0	.06	-.02			.04	.05
$N = 200$	0	.02	-.01			.01	.05
$N = 400$	.01	.03	-.02			.03	.03
DMC - s_{t0} free							
$N = 100$	.04	.07	-.01	-.04		.07	.07
$N = 200$	.01	.02	0	-.01		.04	.09
$N = 400$	.01	.02	0	-.01		.01	.09
DMA - s_{t0} fixed							
$N = 100$	0	.04	-.02		-.01		
$N = 200$	0	.01	-.01		0		
$N = 400$	0	.02	-.02		.01		
DMA - s_{t0} free							
$N = 100$	.01	.01	.01	-.01	0		
$N = 200$	.02	.01	0	-.01	.01		
$N = 400$	.01	.01	0	-.01	0		

Note. Whenever biases are 0, this means that the absolute value of the average bias was smaller than .01.

Table C6

Average biases obtained for $\Delta t = \Delta x = 0.005$

	Parameters						
Model/Condition	ν_{rs}	b	$t0$	s_{t0}	ν_{ra}	h_{ra}	s_{ra}
DMC - s_{t0} fixed							
$N = 100$	.02	.04	-.01			.06	.11
$N = 200$	0	.03	-.02			.02	.05
$N = 400$	0	.01	-.01			.02	.05
DMC - s_{t0} free							
$N = 100$	.02	.03	0	-.06		.07	.11
$N = 200$	.01	.03	0	-.03		.04	.07
$N = 400$	0	0	0	-.01		.01	.08
DMA - s_{t0} fixed							
$N = 100$	0	.04	-.02		-.01		
$N = 200$	-.01	.02	-.02		0		
$N = 400$	-.01	.02	-.01		0		
DMA - s_{t0} free							
$N = 100$	.02	.02	0	-.02	.03		
$N = 200$	.01	.03	-.01	-.03	-.01		
$N = 400$	0	.01	-.01	-.03	0		

Note. Whenever biases are 0, this means that the absolute value of the average bias was smaller than .01.