Supplementary Material: Control of stimulus-set and response-set in task switching

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Supplementary Material A — Parameter Space Simulations

To demonstrate that the under-additive interaction between response-set and stimulus-set sequence predicted by ECTVA is a feature of the model architecture rather than the specific parameter values used in the simulations, in the current Section I conduct a series of simulations that explore the parameter space of the model. The under-additive interaction is exclusively due to the non-linear increase in reconfiguration time with increasing number of parameters to be reconfigured, as formalised in Equation 5, and as such should arise regardless of the actual parameter values.

To demonstrate this, I selectively varied one key parameter at a time across 12 values whilst retaining all other parameters at their default values (see Table 1) and plotted the model's response time predictions for each. Specifically, I varied the key control parameters ($\beta_{associated}$ and $\pi_{associated}$) as well as the key sensory evidence parameters ($\eta_{rs-associated}$ and $\eta_{ss-associated}$); I also varied the parameter reconfiguration time, which was the rate parameter of the exponential distribution (v). Note that I did not vary "unassociated" parameters. For example, I only varied $\beta_{associated}$, which represents the attentional bias to response-sets associated with the presented cue on the current trial (e.g., response-sets "odd" and "even" if the presented cue is "Odd/Even") ; I did not vary $\beta_{unassociated}$, which represents the attentional bias to response-sets unassociated with the presented cue (e.g., response-sets "low" and "high" if the presented cue is "Odd/Even"; see Table in the main Appendix for definitions of all parameters). What matters with the associated–unassociated pairings is the relative balance of weight assigned to each, and—by the very definition of the parameter—associated parameters must always be set to larger values of unassociated. So the parameter values varied in the current simulations varied the relative weight given to associated parameters in relation to unassociated parameters.

For each parameter that was the target of exploration in Table 1, I established 12 equally spaced parameter values within the range specified in the table. Then, for each

Table 1
ECTVA default parameter values from Logan and Gordon (2001) as well as the parameter value ranges explored in the parameter space simulations.

Parameter	Default	Range
$\eta_{\text{rs-associated}}$	10.00	3.00–10.00
$\eta_{\text{rs-unassociated}}$	1.00	—
$\beta_{\text{associated}}$	1.00	0.20–1.00
$\beta_{\text{unassociated}}$	0.10	—
$\eta_{\text{ss-associated}}$	10.00	3.00–10.00
$\eta_{\text{ss-unassociated}}$	1.00	—
$\pi_{\text{associated}}$	1.00	0.20–1.00
$\pi_{\text{unassociated}}$	0.10	—
v	1.00	0.50–3.00
α	0.30	—
K	3.00	—

parameter, I simulated 100 repetitions of the full experimental design (see Appendix A) using the target parameter value together with the default settings for the other parameters. I then plotted the mean simulated response time for response-set repetitions and switches and stimulus-set repetitions and switches.

The results of these simulations can be seen in Figure 1 ($\beta_{associated}$), Figure 2 ($\pi_{associated}$), Figure 3 ($\eta_{ss-associated}$), Figure 4 ($\eta_{rs-associated}$), and Figure 5 (v). Note in all Figures and for all parameter settings there is an under-additive interaction between response-set sequence and stimulus-set sequence.

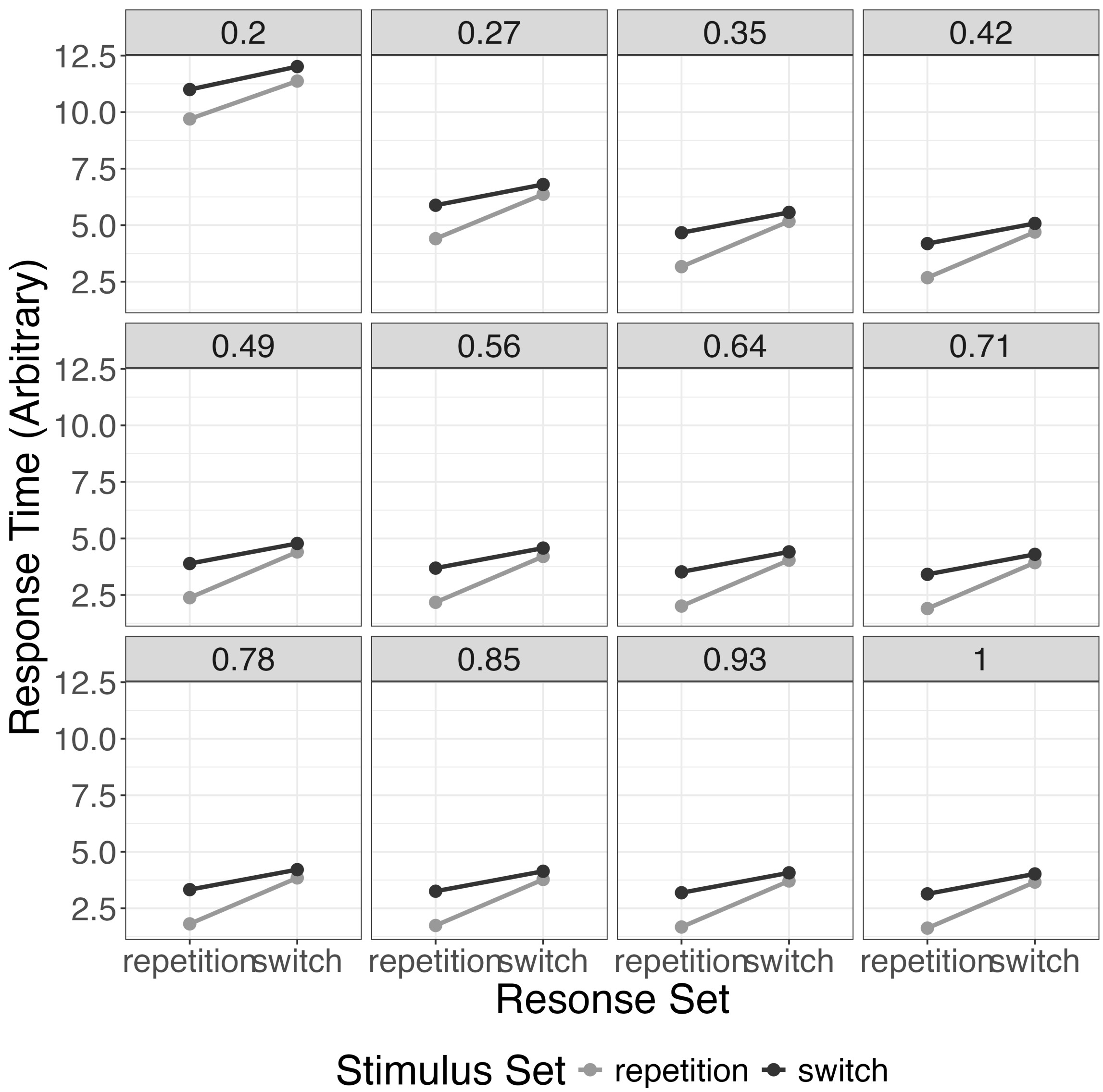

Figure 1. Predicted mean response time (in arbitrary units) for response-set and stimulus-set sequences (i.e., repetition vs. switch) from ECTVA simulations where the $\beta_{associated}$ parameter was varied between 0.2 and 1.0.

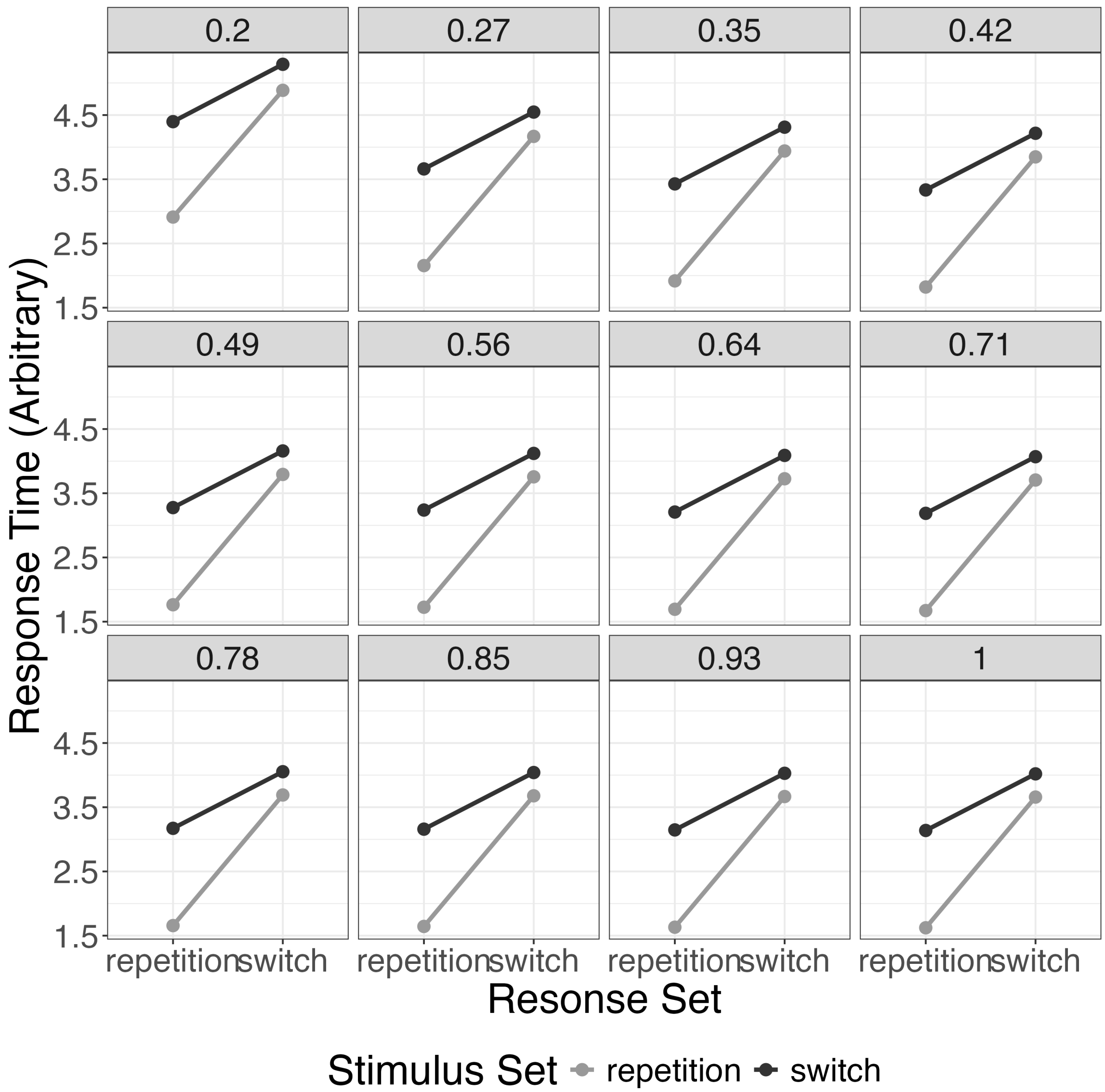

Figure 2. Predicted mean response time (in arbitrary units) for response-set and stimulus-set sequences (i.e., repetition vs. switch) from ECTVA simulations where the $\pi_{associated}$ parameter was varied between 0.2 and 1.0.

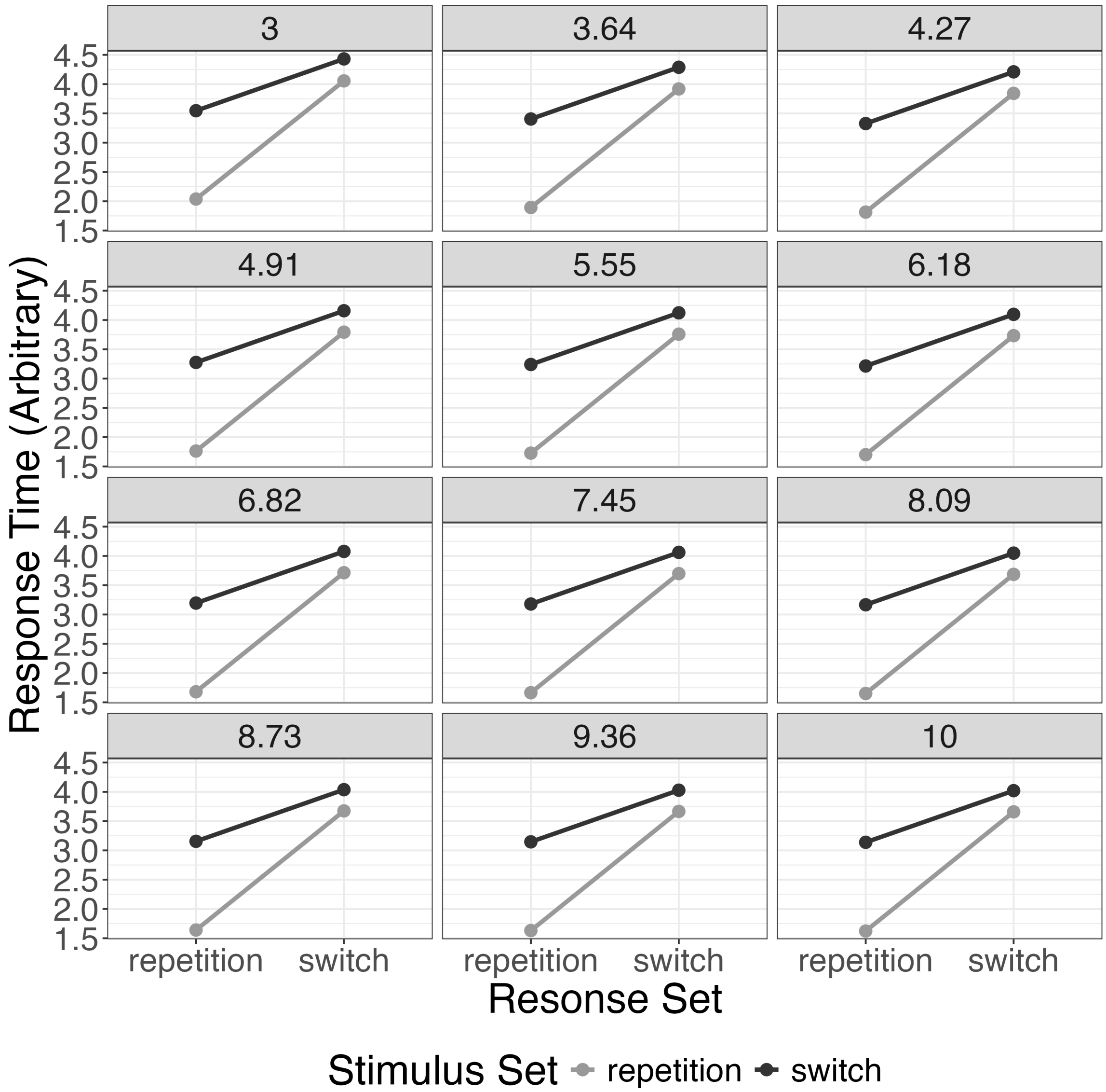

Figure 3. Predicted mean response time (in arbitrary units) for response-set and stimulus-set sequences (i.e., repetition vs. switch) from ECTVA simulations where the $\eta_{ss-associated}$ parameter was varied between 3.0 and 10.0.

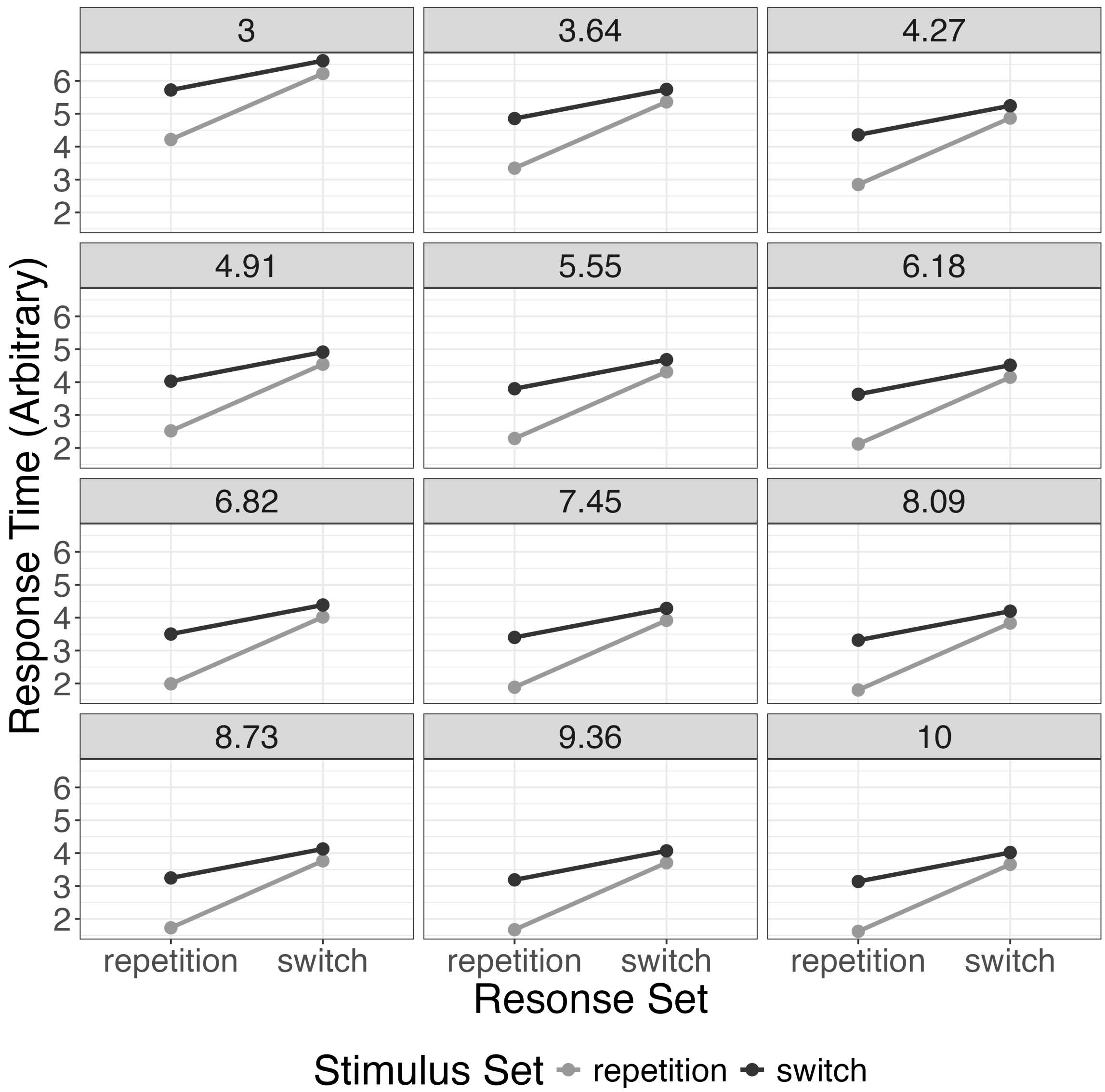

Figure 4. Predicted mean response time (in arbitrary units) for response-set and stimulus-set sequences (i.e., repetition vs. switch) from ECTVA simulations where the $\eta_{rs-associated}$ parameter was varied between 3.0 and 10.0.

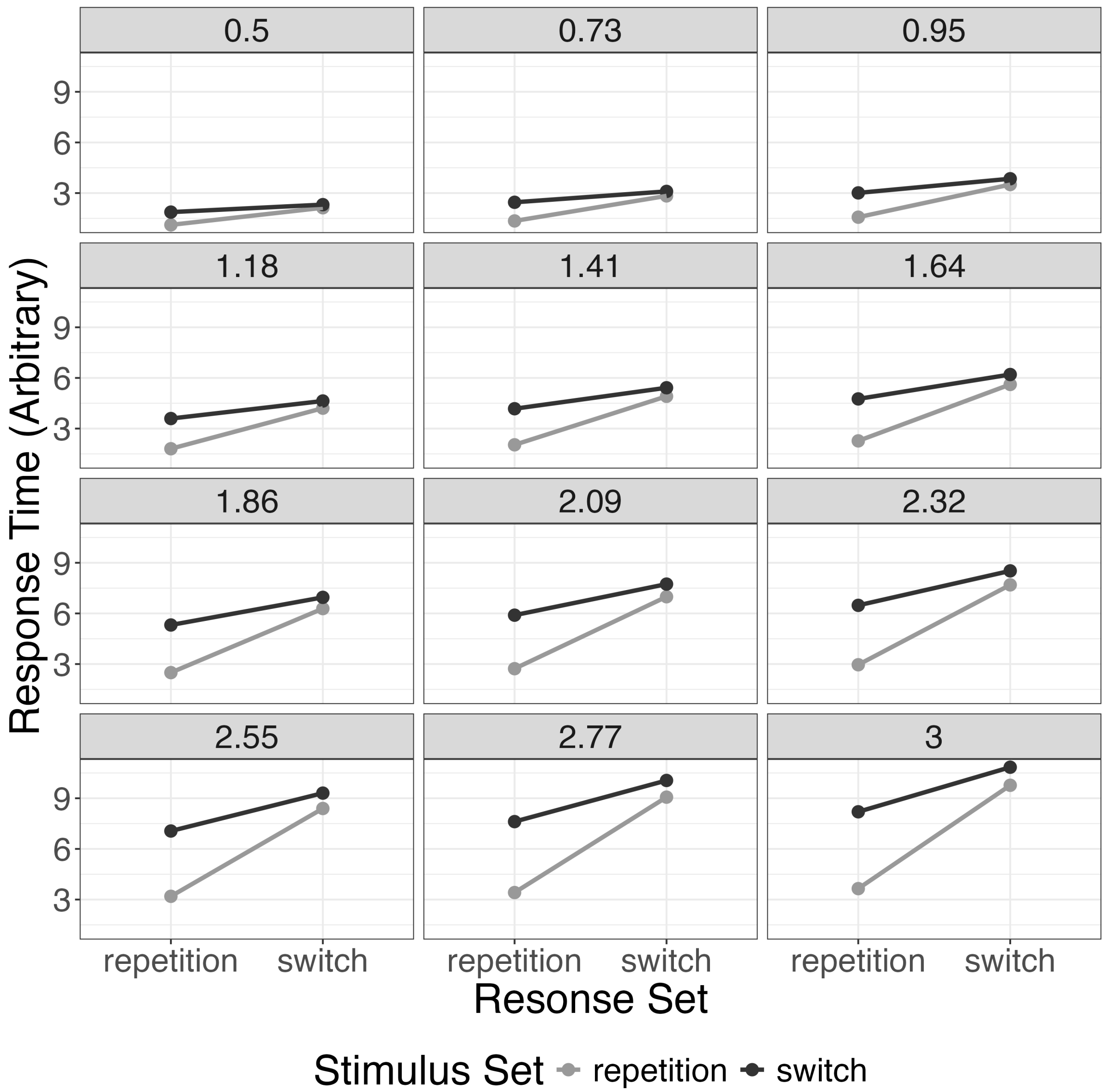

Figure 5. Predicted mean response time (in arbitrary units) for response-set and stimulus-set sequences (i.e., repetition vs. switch) from ECTVA simulations where the rate parameter v of reconfiguration time was varied between 0.5 and 3.0.

Supplementary Material B — Exploratory Analysis of Preparation Effects

To examine further the effects of preparation on switch cost, I examined the component switch costs across the entire response time distribution in Experiments 3b and 3c. To do so, I constructed delta plots which visualise component switch costs across various percentiles of the response-time distribution, from fastest responses to the slowest. To construct the delta plots, I collapsed the data across response-compatibility and for each participant I calculated their response times at various percentiles (0.1, 0.3, 0.5, 0.7, and 0.9) for each level of response-set and stimulus-set sequence and calculated the component switch costs at each percentile. This was done separately for the different levels of set-order. When constructing the delta plots for response-set switch costs, I calculated the switch cost as the difference between trials with a single-component switch of response-set (i.e., trials with a response-set switch but a repetition of stimulus-set) and trials with a repetition of both sets. For the stimulus-set delta plots, I calculated the switch cost as the difference between trials with a single-component switch of stimulus-set (i.e., trials with a stimulus-set switch but a repetition of response-set) and trials with a repetition of both sets. This was done separately for the levels of set-order (i.e., response-set cued first and stimulus-set cued first).

For response-set costs (see the first column of Figure 6A), response-set switch costs were smaller when the response-set was cued first for the first percentile, but at later percentiles the switch cost was larger when response-set was cued first. For stimulus-set switch costs (second column of Figure 6A), stimulus-set switch costs were smaller when the stimulus-set was cued first for the first percentiles, but at later percentiles the switch cost was larger when stimulus-set was cued first. For completeness, I also constructed delta plots for the switch costs when both components switched (final column of Figure 6A)) which showed switch costs were consistently smaller across percentiles when the stimulus-set was cued first.

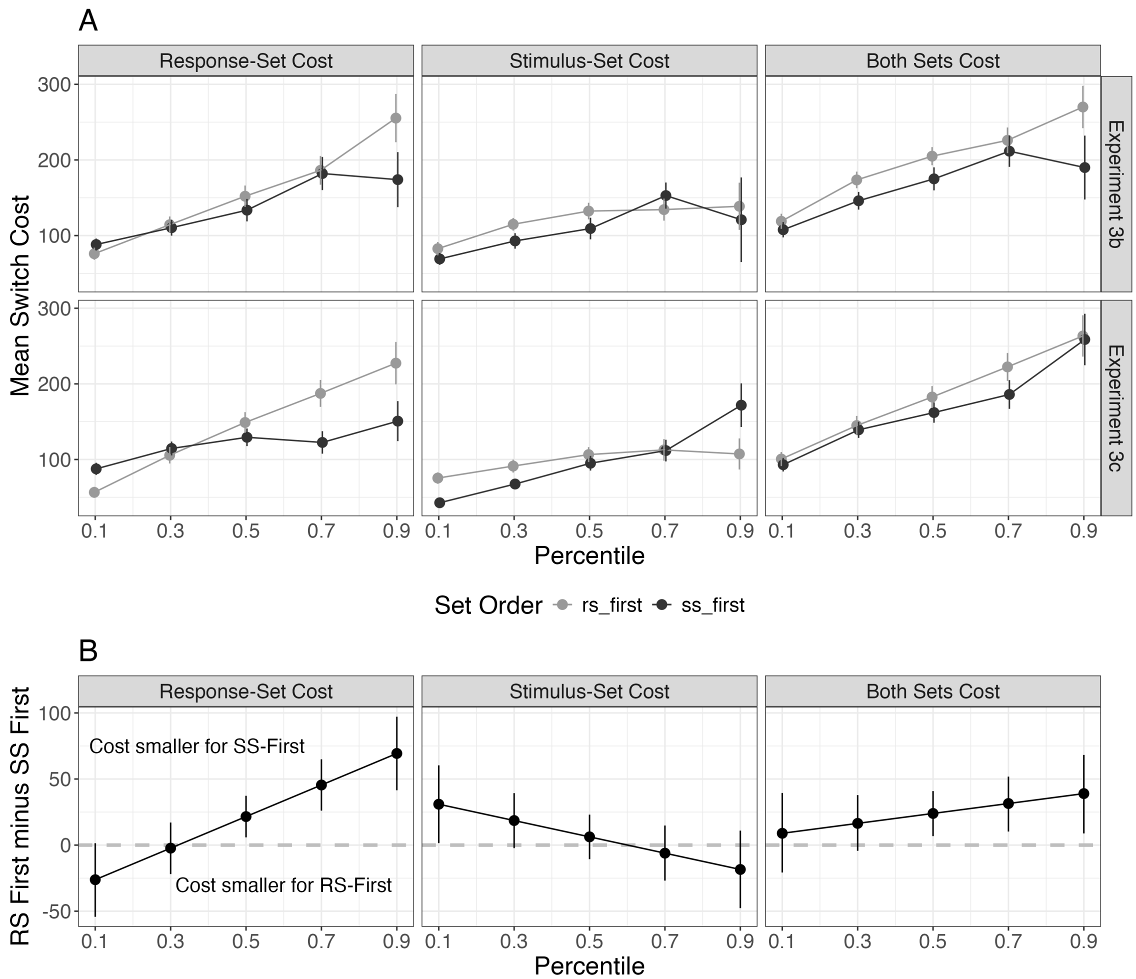

Figure 6. **A.** Delta plots showing mean response-set switch costs (first column), stimulus-set switch costs (second column) and switch costs when both components switch (final column) in Experiment 3b (upper row) and Experiment 3c (lower row). In each column, the separate lines show the set-order conditions when the response-set is cued first (“rs_first”), and when the stimulus-set is cued first (“ss_first”)). Error bars denote one standard error around the mean switch costs. **B.** Contrasts from the Bayesian linear models comparing the posterior estimates for the difference in switch cost between each level of set-order for response-set switch costs (first panel), stimulus-set switch costs (second panel), and switch costs when both components switch (third panel). Points show the mean posterior estimates for each contrast, and error bars denote 95% credible intervals. Points above the horizontal dashed line show switch costs that are smaller when the stimulus-set is cued first, and below the line show switch costs that are smaller when the response-set is cued first.

To examine these observations statistically, three separate Bayesian linear models were conducted (one for each type of switch cost) predicting the switch cost from set order and percentile. For these models, the data from Experiment 3b and 3c were combined.[1] For response-set costs, the model showed an effect of set-order (b = 38.12, 95% credible interval [CI] 21.18, 67.11), and effect of percentile (b = 213.84 [173.58, 253.53]), plus an interaction (b = -119.41 [-176.00, -62.02]). To examine this interaction, contrasts were taken from the model by comparing the posterior estimates for the difference in switch cost between each level of set-order (calculated by subtracting the cost for stimulus-set first from the cost for response-set first conditions). These contrasts can be seen in the first column of Figure 6B together with their 95% CIs. As can be seen, the contrasts showed that the switch cost was reliably smaller when the response-set was cued first at the shortest percentile, but this pattern was reversed at longer percentiles.

For stimulus-set costs the model showed an effect of set-order (b = -37.10, [-71.67, -2.94]), an effect of percentile (b = 54.19 [11.55, 96.67]), plus an interaction (b = 61.71 [2.23, 120.80]). The contrasts (see second column of Figure 6B) showed that the switch cost was reliably smaller when the stimulus-set was cued first at the shortest percentile, but this pattern was reversed at longer percentiles.

For the costs when both components switched the model showed no effect of set-order (b = -5.17, [-40.88, 29.61]), there was an effect of percentile (b = 189.12 [145.40, 231.66]), but no interaction (b = -37.56 [-97.64, 24.40]). The contrasts (see final column of Figure 6B) showed that the switch cost was smaller when the stimulus-set was cued first at all percentiles.

[1] I attempted to implement a Bayesian linear model with experiment as a random factor but experienced convergence issues that could not be resolved.

Experiment 3d

The exploratory distributional analysis has provided some support for ECTVA's predictions of reduced component-switch cost when that component is sufficiently prepared, but this conclusion relies on the assumption of the failure to engage hypothesis that responses in the shortest RT percentiles are those in which participants have engaged in advanced preparation (DeJong, 2000; see also Grange & Houghton, 2011). In an attempt to behaviourally encourage participants to engage in advanced preparation of task-set components, I conducted an additional experiment which modified Experiment 3c's design, but the cue presented first was only presented for 300 ms before disappearing. Reducing the cue presentation time should encourage advanced preparation (see Verbruggen, Liefooghe, Vandierendonck, & Demanet, 2007; but see Schneider, 2016).

Method.

Participants. 127 new participants were recruited from the same pool as the main experiments. I removed participants who failed to maintain a session-wise accuracy above 85%, which removed 29 participants. Note that this is a more liberal accuracy criterion than the main experiments which used 90%; however, this stricter criterion led to a removal of 46 participants, indicating that participants found this experiment more challenging (possibly due to the shorter cue-presentation times).

Materials & Procedure. The experiment was identical to Experiment 3c with the exception of the following. In the first stage of cue presentation, only information about either the response-set or the stimulus-set (dependent upon the current condition) was presented (as in Experiment 3b), but here it was only presented for 300 ms. After this time, the cue became a white placeholder (e.g., "low/high" changed to "–/—") which provided no information about either response-set or stimulus-set. This white placeholder was presented for a further 600 ms before the placeholder changed to cue the other component not previously cued (i.e., if the firs cue provided information about the response-set, the final cue only provided information about the stimulus-set). The trial stimuli appeared at the same time as this second cue. Importantly, as in Experiment 3c, the task-set component cued at the beginning of the trial was not present during stimulus onset.

Results. The mean response times and proportion error can be seen in Figure 7.

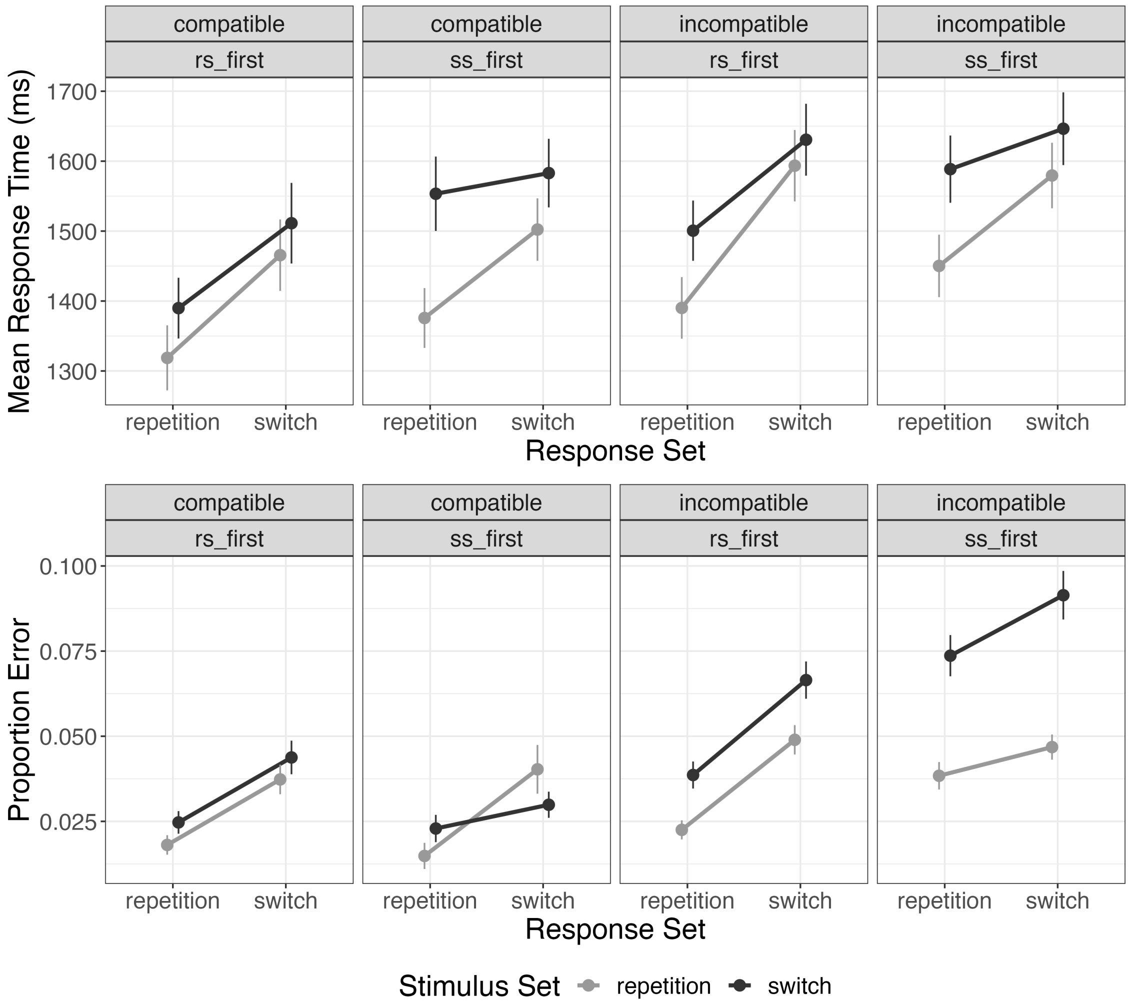

Figure 7. Behavioural data from Experiment 3d as a function of whether response-set was cued first ("rs_first") or stimulus-set was cued first ("ss_first"). Error bars show one standard error around the mean.

Response time analysis. The model comparisons can be seen in Table 2. This showed extreme evidence in favour of Order: RTs were shorter overall when the response-set cue was presented first (M = 1497 ms, SE = 17) than when the stimulus-set cue was presented first (M = 1550, SE = 16). As in previous experiments, there was extreme evidence in favour of both Response-Set Sequence and Stimulus-Set Sequence: Response-set repetitions (M = 1465 ms, SE = 16) were responded to faster than response-set switches (M = 1582, SE = 17), and stimulus-set repetitions (M = 1479, SE = 16) were responded to faster than stimulus-set switches (17). There was no evidence that stimulus-set sequence interacted with Set Order. However, the was strong evidence that response-set sequence interacted with Set Order: The response-set switch cost was 84 ms when the stimulus-set cue was presented first, but it was *larger* at 150 ms when the response-set cue was presented first.

There was extreme evidence for Response Compatibility: Response times were shorter for response-compatible trials (M = 1485, SE = 16) than for response-incompatible trials (M = 1562, SE = 16). However, there was moderate evidence that Response Compatibility was not involved in any interactions except for with Set Order (which was moderate): The compatibility effect was 104 ms when the response-set was cued first, and 48 ms when the stimulus-set was cued first.

There again was moderate evidence for an interaction between Response-Set Sequence and Stimulus-Set Sequence. There was moderate evidence that this interaction was not further modulated by Set Order or Compatibility, and there was moderate evidence against the four-way interaction.

Testing the predictions of task-set structure, the results (collapsing across compatibility and set-order) showed no evidence for a difference in response time between a single-component switch of response-set and a single-component switch of stimulus-set ($BF_{10} = 2.15$), extreme evidence for a difference between a single-component switch of response-set and a switch of both components ($BF_{10} = 5.93 \times 10^5$), and extreme evidence for a difference between a single-component switch of stimulus-set and a switch of both components ($BF_{10} = 4.74 \times 10^8$).

Table 2

Model comparison results for the behavioural data for Experiment 3d. The Bayes factors (BF) show comparison of the full factorial model (including all main effects and all interactions) against models with particular predictors omitted (i.e., $BF = \frac{omitted-model}{full-model}$). BF values below 1 indicate evidence in favour inclusion of that predictor.

Omission	BF (RT)	BF (Error)
Order (O) x Compatibility (C) x R-Set Seq. (RS) x S-Set Seq. (SS)	3.65	3.51
C x RS x SS	4.20	5.92
O x C x SS	3.13	0.03
O x C x RS	5.71	6.36
O x RS x SS	4.45	4.34
C x SS	6.00	1.43×10^{-4}
C x RS	5.94	11.95
C x O	0.26	0.02
RS x SS	0.24	7.00
O x SS	0.53	9.52
O x RS	0.09	4.22
C	3.78×10^{-10}	2.00×10^{-14}
SS	3.72×10^{-14}	4.65×10^{-9}
RS	1.78×10^{-23}	1.56×10^{-12}
O	8.98×10^{-5}	1.98×10^{-3}

Note. Seq. = sequence.

Error analysis. The results of the error analysis largely mirrored those for the response times, with the following exceptions. There was no evidence for an interaction between Response-Set Sequence and Set-Order, and no evidence for an interaction between Response-Set Sequence and Stimulus-Set Sequence. As in previous experiments, there was an interaction between Stimulus-Set Sequence and Response Compatibility which was further moderated by Set Order: When response-set was cued first, the stimulus-set switch cost for compatible trials was 1.26%, and was 1.96% for incompatible trials; when stimulus-set was cued first, there was a stimulus-set switch *benefit* for compatible trials of 0.24%, but there was a stimulus-set switch *cost* of 4.06% for incompatible trials.

Testing the predictions of task-set structure, the results (focussing on incompatible trials and collapsing across set order) showed no evidence for a difference in errors between a single-component switch of response-set and a single-component switch of stimulus-set ($BF_{10} = 1.86$), extreme evidence for a difference between a single-component switch of response-set and a switch of both components ($BF_{10} = 4.62 \times 10^5$), and strong evidence for a difference between a single-component switch of stimulus-set alone and a switch of both components ($BF_{10} = 30.25$).

Distributional analysis. As with the exploratory analysis of Experiments 3b and 3c, I constructed delta plots of the relevant component-switch costs. These can be seen in the upper row of Figure 8.

For response-set costs the model showed no effect of set-order (b = 16.98, [-37.53, 71.04]), there was an effect of percentile (b = 164.42 [97.88, 231.77]), and there was an interaction (b = -150.67 [-245.60, -54.56]). The contrasts (see second column of Figure 8A) showed that the switch cost equivalent between when response-set was cued first and when stimulus-set was cued first at the shortest percentile, but was reliably smaller when stimulus-set was cued first at longer percentiles. For stimulus-set costs the model showed a small effect of set-order (b = -45.62, [-98.69, 9.30]), no effect of percentile (b = -21.15 [-86.62, 45.61]), but there was an interaction (b = 221.04 [126.16, 313.21]). The contrasts (see second column of Figure 6B) showed that the switch cost equivalent between when stimulus-set was cued first and when response-set was cued first at the shortest two percentiles, but was reliably smaller when response-set was cued first at longer percentiles. For the costs when both components switched the model showed no effect of set-order (b = -10.57, [-68.80, 47.81]), there was an effect of percentile (b = 190.68 [118.34, 263.35]), but there was also no interaction (b = -6.63 [-108.16, 94.97]). The contrasts (see final column of Figure 6B) showed that the switch cost was equivalent at all percentiles.

Discussion. Despite providing more incentive to engage in advanced preparation of task-set components, this new experiment still failed to find a specific effect of component preparation on component-switch costs. In addition, the RT distributional analysis did not clearly replicate the finding from the exploratory analysis of Experiments 3b and 3c.

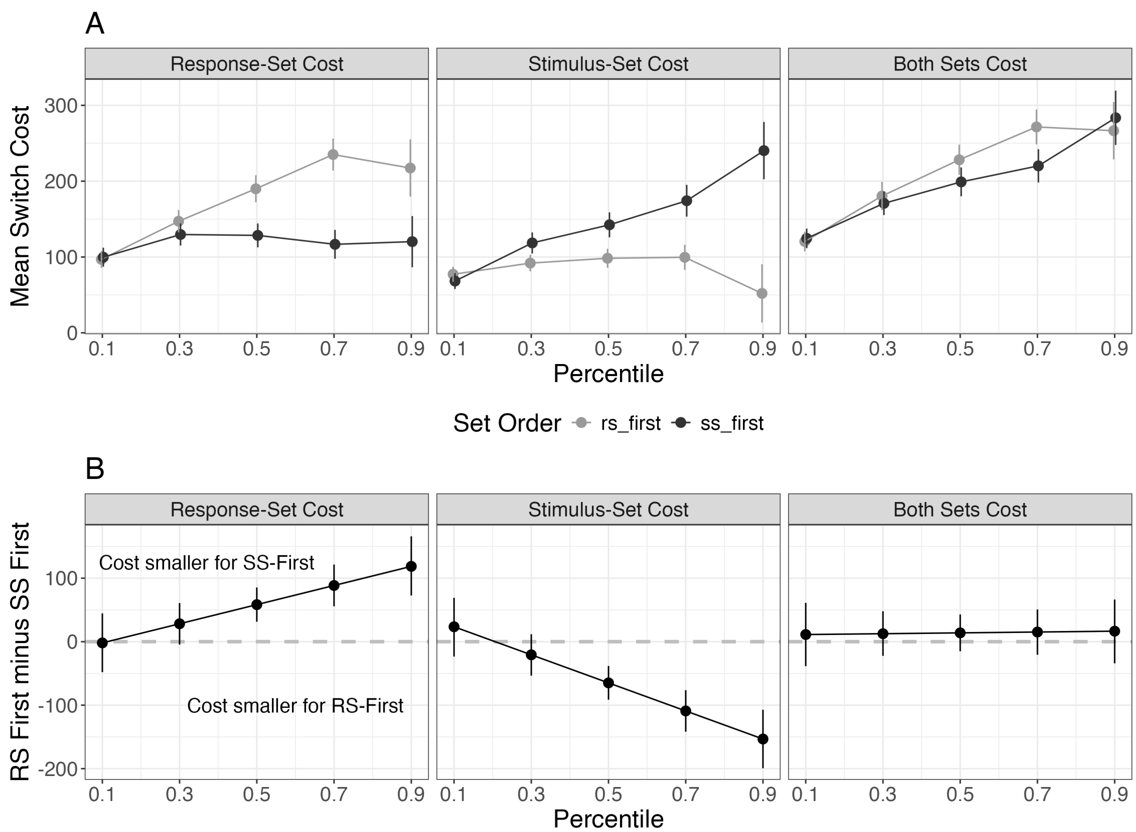

Figure 8. **A.** Delta plots showing mean response-set switch costs (first column), stimulus-set switch costs (second column) and switch costs when both components switch (final column) from Experiment 3d. In each column, the separate lines show the set-order conditions when the response-set is cued first ("rs_first"), when the stimulus-set is cued first ("ss_first")). Error bars denote one standard error around the mean switch costs. **B.** Contrasts from the Bayesian linear models comparing the posterior estimates for the difference in switch cost between each level of set-order for response-set switch costs (first panel), stimulus-set switch costs (second panel), and switch costs when both components switch (third panel). Points show the mean posterior estimates for each contrast, and error bars denote 95% credible intervals. Points above the horizontal dashed line show switch costs that are smaller when the stimulus-set is cued first, and below the line show switch costs that are smaller when the response-set is cued first.

Supplementary Material C — Bayesian Meta Analyses

In this appendix I describe the Bayesian meta analyses reported in the main paper which adopts the implementation suggested by Vuorre (2016). For each experiment (and each condition in each experiment, where relevant; e.g., "short CSI" and "long CSI" of Experiment 3a were analysed separately), three contrasts were calculated from the response time data, reflecting: (1) a single-component switch of response-set vs. a single-component switch of stimulus-set; (2) a single-component switch of response-set vs. a switch of both response-set and stimulus-set, and (3) a single-component switch of stimulus-set vs. a switch of both components. For each contrast and each experiment/condition, the mean and standard error of the contrast was calculated.

One Bayesian meta-analysis was then conducted per contrast. For each meta-analysis, the mean of the contrast of each experiment/condition is modelled as

$$y_i \sim \text{Normal}(\theta_i, \sigma_i), \tag{1}$$

where y_i is the mean estimate for experiment/condition i, which is modelled as a draw from a normal distribution centered on the true effect size of that experiment/condition, θ_i, and standard deviation σ_i. Here, σ_i is taken directly from the standard error of that experiment/study's contrast. The model also assumes that each study's true effect size, θ_i, is itself a draw from a population of studies centered on the true effect size in the population:

$$\theta_i \sim \text{Normal}(\mu, \tau), \tag{2}$$

where μ is the true effect size of the contrast in the population, and τ is the standard deviation of this effect size in the population.

Each model was fit using `brms` (Bürkner, 2017, 2018) together with regularising priors for μ and τ; parameter estimation proceeded by taking 5,000 samples from the posterior distribution from each of four chains (with 2,000 samples being taken as warm up per chain). Visual inspection of the chains showed good convergence, and all $\bar{R}$ values were very close to 1.

Supplementary Material D — Frequentist Analysis of Experiments

Experiment 1a

Mean Response Time Analysis. There was a significant main effect of *Response-Set Sequence*, $F(1, 42) = 63.91$, $p < .001$, $\eta^2_g = .081$, *Stimulus-Set Sequence*, $F(1, 42) = 168.78$, $p < .001$, $\eta^2_g = .093$, and *Response-Compatibility*, $F(1, 42) = 4.58$, $p = .038$, $\eta^2_g = .003$. There was a significant two-way interaction between *Response-Set Sequence* and *Stimulus-Set Sequence*, $F(1, 42) = 22.49$, $p < .001$, $\eta^2_g = .009$. *Response-Compatibility* did not interact with either *Response-Set Sequence*, $F(1, 42) = 0.19$, $p = .667$ $\eta^2_g < .001$, or *Stimulus-Set Sequence*, $F(1, 42) = 0.17$, $p = .685$, $\eta^2_g < .001$. The three-way interaction was also not significant, $F(1, 42) = 0.83$, $p = .368$, $\eta^2_g < .001$.

Error Analysis. There was a significant main effect of *Response-Set Sequence*, $F(1, 42) = 18.97$, $p < .001$, $\eta^2_g = .055$, *Stimulus-Set Sequence*, $F(1, 42) = 4.84$, $p = .033$, $\eta^2_g = .010$, and *Response-Compatibility*, $F(1, 42) = 5.86$, $p = .020$, $\eta^2_g = .020$. The two-way interaction between *Response-Set Sequence* and *Stimulus-Set Sequence* was not significant, $F(1, 42) = 0.49$, $p = .487$, $\eta^2_g <.001$. *Response-Compatibility* did not interact with either *Response-Set Sequence*, $F(1, 42) = 0.05$, $p = .825$, $\eta^2_g < .001$, or *Stimulus-Set Sequence*, $F(1, 42) = 3.49$, $p = .069$, $\eta^2_g = .007$. The three-way interaction was also not significant, $F(1, 42) = 0.00$, $p = .994$, $\eta^2_g < .001$.

Experiment 1b

Mean Response Time Analysis. There was a significant main effect of *Response-Set Sequence*, $F(1, 50) = 126.98$, $p < .001$, $\eta^2_g = .107$, *Stimulus-Set Sequence*, $F(1, 50) = 154.07$, $p < .001$, $\eta^2_g = .101$, and *Response-Compatibility*, $F(1, 50) = 15.63$, $p < .001$, $\eta^2_g = .008$. There was a significant two-way interaction between *Response-Set Sequence* and *Stimulus-Set Sequence*, $F(1, 50) = 52.25$, $p < .001$, $\eta^2_g = .013$. *Response-Compatibility* did not interact with either *Response-Set Sequence*, $F(1, 50) =$

0.02, p = .895, η_g^2 < .001, or *Stimulus-Set Sequence*, $F(1, 50) = 0.57$, p = .453, η_g^2 < .001. The three-way interaction was also not significant, $F(1, 50) = 0.42$, p = .520, η_g^2 < .001.

Error Analysis. There was a significant main effect of *Response-Set Sequence*, $F(1, 50) = 64.68$, p < .001, η_g^2 = .113, but no significant main effect of *Stimulus-Set Sequence*, $F(1, 50) = 1.27$, p = .265, η_g^2 = .001, or *Response-Compatibility*, $F(1, 50) = 2.20$, p = .144, η_g^2 = .005. The two-way interaction between *Response-Set Sequence* and *Stimulus-Set Sequence* was significant, $F(1, 50) = 10.11$, p = .003, η_g^2 =.010. *Response-Compatibility* interacted with *Response-Set Sequence*, $F(1, 50) = 4.82$, p = .033, η_g^2 =.009, but it did not interact with *Stimulus-Set Sequence*, $F(1, 50) = 0.64$, p = .428, η_g^2 = .001. The three-way interaction was also not significant, $F(1, 50) = 0.01$, p = .921, η_g^2 < .001.

Experiment 2

Mean Response Time Analysis. There was a significant main effect of *Response-Set Sequence*, $F(1, 54) = 14.37$, p < .001, η_g^2 = .004, *Stimulus-Set Sequence*, $F(1, 54) = 84.65$, p < .001, η_g^2 = .017, and *Response-Compatibility*, $F(1, 54) = 5.41$, p = .024, η_g^2 = .002. The two-way interaction between *Response-Set Sequence* and *Stimulus-Set Sequence* was close to significance, $F(1, 54) = 3.02$, p = .088, η_g^2 < .001. *Response-Compatibility* did not interact with either *Response-Set Sequence*, $F(1, 54) = 1.20$, p = .277, η_g^2 < .001, or *Stimulus-Set Sequence*, $F(1, 54) = 0.37$, p = .547, η_g^2 < .001. The three-way interaction was also not significant, $F(1, 54) = 0.04$, p = .839, η_g^2 < .001.

Error Analysis. There was a significant main effect of *Response-Set Sequence*, $F(1, 54) = 8.77$, p = .005, η_g^2 = .023, a significant main effect of *Stimulus-Set Sequence*, $F(1, 54) = 27.70$, p < .001, η_g^2 = .035, and a significant main effect of *Response-Compatibility*, $F(1, 54) = 57.59$, p < .001, η_g^2 = .090. The two-way interaction between *Response-Set Sequence* and *Stimulus-Set Sequence* was not significant, $F(1, 54) = 1.05$, p = .311, η_g^2 =.001. *Response-Compatibility* did not interact with *Response-Set Sequence*, $F(1, 54) = 0.04$, p = .849, η_g^2 < .001, but it did interact with *Stimulus-Set*

Table 3
Experiment 3a RTs.

Effect	$F(1,111)$	p	η_g^2
CSI	948.65	<.001	.252
R-Set Sequence (RS)	219.35	<.001	.064
S-Set Sequence (SS)	418.04	<.001	.071
Compatibility (C)	27.14	<.001	.005
CSI x RS	11.98	<.001	<.001
CSI x SS	10.10	.002	<.001
RS x SS	147.97	<.001	.012
CSI x C	0.58	.449	<.001
RS x C	0.97	.326	<.001
SS x C	0.30	.587	<.001
CSI x RS x SS	11.80	<.001	<.001
CSI x RS x C	0.16	.692	<.001
CSI x SS x C	0.49	.485	<.001
RS x SS x C	0.10	.753	<.001
CSI x RS x SS x C	0.07	.799	<.001

Sequence, $F(1,\ 54) = 26.75$, $p < .001$, η_g^2 =.041. The three-way interaction was not significant, $F(1,\ 54) = 0.37$, $p = .544$, $\eta_g^2 < .001$.

Experiment 3a

Mean Response Time Analysis. See Table 3.

Error Analysis. See Table 4.

Experiment 3b

Mean Response Time Analysis. See Table 5.

Error Analysis. See Table 6.

Experiment 3c

Mean Response Time Analysis. See Table 7.

Table 4
Experiment 3a acc.

Effect	$F(1,111)$	p	η_g^2
CSI	5.14	.025	.002
R-Set Sequence (RS)	69.09	<.001	.046
S-Set Sequence (SS)	37.67	<.001	.018
Compatibility (C)	51.63	<.001	.023
CSI x RS	1.13	.290	<.001
CSI x SS	0.00	.975	<.001
RS x SS	4.53	.035	.002
CSI x C	1.28	.261	<.001
RS x C	0.01	.907	<.001
SS x C	16.91	<.001	.007
CSI x RS x SS	0.03	.853	<.001
CSI x RS x C	2.55	.113	.001
CSI x SS x C	1.52	.220	<.001
RS x SS x C	0.59	.444	<.001
CSI x RS x SS x C	0.79	.375	<.001

Table 5
Experiment 3b RTs.

Effect	$F(1,102)$	p	η_g^2
Order (O)	0.94	.336	.001
R-Set Sequence (RS)	124.90	<.001	.013
S-Set Sequence (SS)	113.08	<.001	.006
Compatibility (C)	34.59	<.001	.004
O x RS	0.78	.378	<.001
O x SS	0.77	.381	<.001
RS x SS	44.05	<.001	.002
O x C	7.19	.009	<.001
RS x C	0.11	.736	<.001
SS x C	0.71	.400	<.001
O x RS x SS	0.46	.500	<.001
O x RS x C	4.37	.039	<.001
O x SS x C	0.40	.528	<.001
RS x SS x C	1.01	.318	<.001
O x RS x SS x C	0.27	.604	<.001

Table 6
Experiment 3b acc.

Effect	$F(1, 102)$	p	η_g^2
Order (O)	0.32	.575	<.001
R-Set Sequence (RS)	122.05	<.001	.060
S-Set Sequence (SS)	16.79	<.001	.006
Compatibility (C)	17.32	<.001	.014
O x RS	1.13	.290	<.001
O x SS	0.01	.943	<.001
RS x SS	5.68	.019	.002
O x C	0.52	.473	<.001
RS x C	4.83	.030	.002
SS x C	11.95	<.001	.005
O x RS x SS	1.16	.208	<.001
O x RS x C	0.01	.921	<.001
O x SS x C	1.42	.236	<.001
RS x SS x C	0.38	.537	<.001
O x RS x SS x C	2.27	.135	<.001

Table 7
Experiment 3c RTs.

Effect	$F(1, 100)$	p	η_g^2
Order (O)	14.78	<.001	.012
R-Set Sequence (RS)	188.55	<.001	.019
S-Set Sequence (SS)	182.59	<.001	.010
Compatibility (C)	48.85	<.001	.006
O x RS	4.27	.041	<.001
O x SS	0.98	.326	<.001
RS x SS	59.03	<.001	.002
O x C	42.67	<.001	.002
RS x C	4.93	.029	<.001
SS x C	0.02	.881	<.001
O x RS x SS	0.72	.398	<.001
O x RS x C	0.60	.440	<.001
O x SS x C	0.23	.629	<.001
RS x SS x C	0.50	.479	<.001
O x RS x SS x C	1.50	.223	<.001

Table 8
Experiment 3c acc.

Effect	$F(1, 100)$	p	η^2_g
Order (O)	2.36	.128	.002
R-Set Sequence (RS)	106.05	<.001	.067
S-Set Sequence (SS)	27.88	<.001	.012
Compatibility (C)	47.24	<.001	.025
O x RS	0.46	.501	<.001
O x SS	1.97	.164	<.001
RS x SS	0.67	.413	<.001
O x C	1.61	.208	<.001
RS x C	0.18	.669	<.001
SS x C	16.76	<.001	.008
O x RS x SS	2.31	.132	<.001
O x RS x C	1.70	.195	.001
O x SS x C	6.85	.010	.002
RS x SS x C	0.59	.446	<.001
O x RS x SS x C	0.44	.507	<.001

Error Analysis. See Table 8.

Experiment 4

Mean Response Time Analysis. See Table 9.

Error Analysis. See Table 10.

Table 9
Experiment 4 RTs.

Effect	$F(1, 101)$	p	η_g^2
RCI	85.97	<.001	.017
R-Set Sequence (RS)	319.39	<.001	.049
S-Set Sequence (SS)	373.84	<.001	.045
Compatibility (C)	21.95	<.001	.004
RCI x RS	11.61	<.001	<.001
RCI x SS	79.75	<.001	.005
RS x SS	101.29	<.001	.006
RCI x C	1.42	.236	<.001
RS x C	2.28	.134	<.001
SS x C	2.66	.106	<.001
RCI x RS x SS	0.22	.638	<.001
RCI x RS x C	0.02	.890	<.001
RCI x SS x C	0.05	.827	<.001
RS x SS x C	0.08	.781	<.001
RCI x RS x SS x C	0.02	.901	<.001

Table 10
Experiment 4 Acc.

Effect	$F(1, 101)$	p	η_g^2
RCI	2.49	.118	.001
R-Set Sequence (RS)	114.18	<.001	.070
S-Set Sequence (SS)	19.94	<.001	.009
Compatibility (C)	38.33	<.001	.016
RCI x RS	0.01	.920	<.001
RCI x SS	18.50	<.001	.007
RS x SS	1.88	.174	<.001
RCI x C	0.36	.550	<.001
RS x C	0.52	.473	<.001
SS x C	6.92	.010	.003
RCI x RS x SS	0.40	.528	<.001
RCI x RS x C	2.43	.122	.001
RCI x SS x C	5.12	.026	.002
RS x SS x C	2.86	.094	.001
RCI x RS x SS x C	0.00	.947	<.001

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