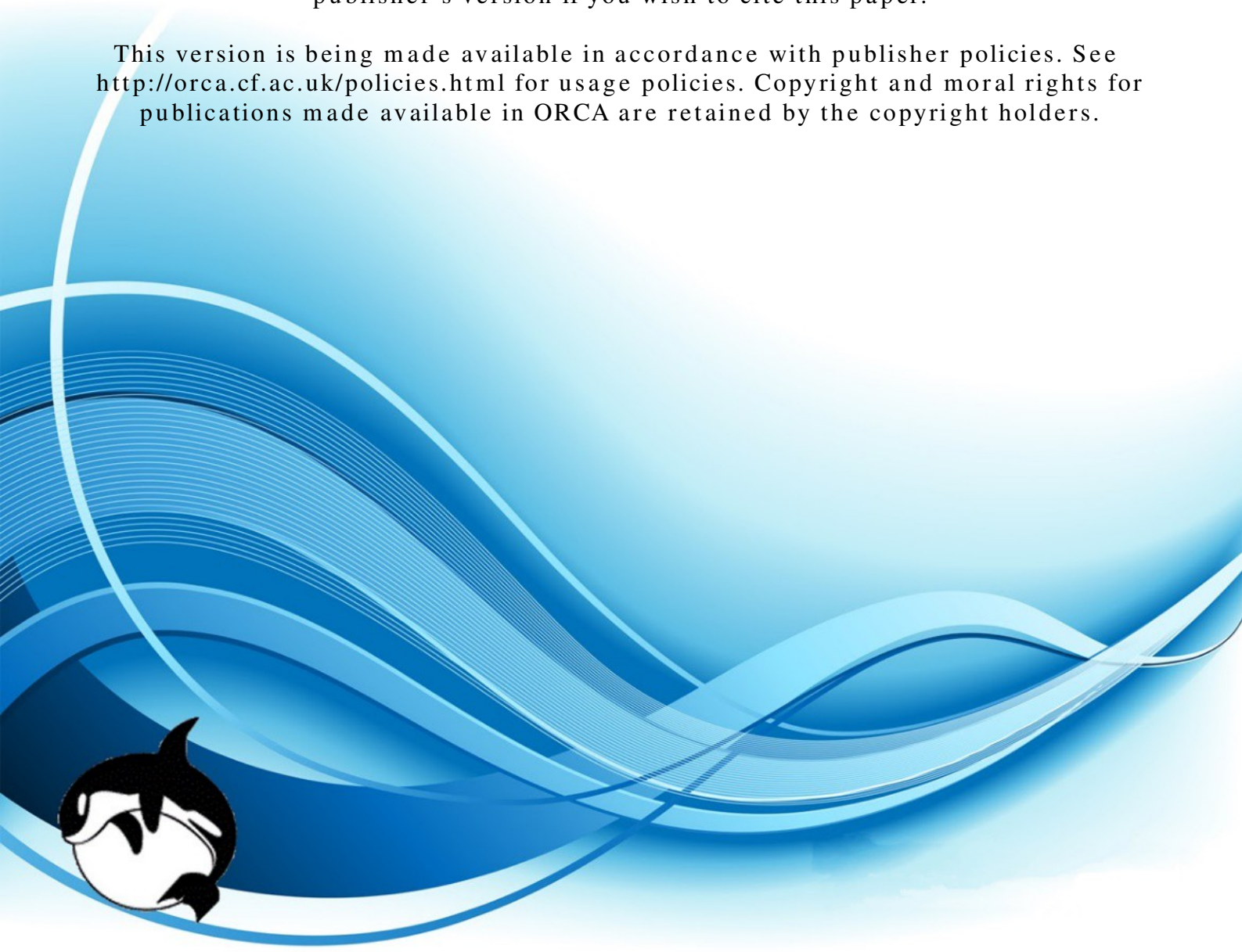

SUPPLEMENT: Appendix A: Insignificant experiment (6)

One more experiment was conducted, yielding an insignificant target effect of pair distance overall, but still showing a tendency in one condition (i.e., means in the expected direction of greater liking for pairs of wide than narrow pair distances when oriented towards the maximum). The SDE was replicated. Following the arguments of Rosenthal (1979), and, more recently, Lakens and Etz (2017), we argue that mixed levels of significance in a series of studies which form a line of research often are more likely to occur than a series of exclusively significant studies, and can provide evidence for the target hypothesis if statistical power is sufficient and Type I error rates are adequately controlled (see Overview section above). We describe this experiment in short terms.

Six sets of six ideographs, from six languages unfamiliar to our student population, were chosen as stimuli. We expected the SDE to replicate and further predicted more positive evaluative judgments for elements from wider pairs, as compared to elements from narrower pairs. The same methodology was used as in Experiment 1 except using two more fictitious languages (6 instead of 4), and using a shorter chain of six ideographs per language (instead of eight). No participant was excluded. For accuracies and response latencies see Table 6.

Table 6 **Experiment 6**, Accuracies and Response latencies by Pair distance.

	Pair 3/4		Pair 2/5		Pair 1/6	
Accuracy	.736	(.357)	.856	(.268)	.895	(.235)
Latency	1409	(571)	1354	(535)	1223	(499)

Note. Accuracies are given in proportion of correct responses. Response latencies are given in milliseconds. Standard deviations are presented in brackets.

Using the same type of statistical modelling as in Experiment 1, and with significant SDE's for accuracy and latency, liking was compared between elements as part of trained stimulus pairs of type 1/6 (pair distance = 5, M_{16} = 3.53, SD = 1.53) and 4/5 (pair distance = 1, M_{45} = 3.41, SD = 1.44), $F(1, 40) = 2.00$; $p = .16$, $dz = .10$. As the interaction between pair distance and orientation was significant, $F(1,1664) = 4.91$; $p = .03$, Bonferroni-Holm corrected simple effects were calculated revealing that the outer-inner difference was significant when stimuli were oriented towards the maximum (M_{outer} = 3.69, M_{inner} = 3.43; $t(94.5) = -2.45$; $p < .03$), whereas the difference was not significant for stimuli oriented towards the minimum (M_{outer} = 3.37, M_{inner} = 3.38; $t(94.5) = .177$; $p = .86$). The blending hypothesis was confirmed for outer pairs as stimuli closer to the maximum were preferred to those closer to the minimum ($p < .001$), but not for inner pairs ($p = .57$).

In a separately calculated model, predicting preferences for the stimuli involved in inner and outer pairs by the response times to these same stimuli, and participants as random factor, we found that response times for a stimulus significantly predicted the preference for it, $F(1,50.73) = 5.61$; $p = .02$, $\beta = -.14$. That is, the shorter the response time, the more a stimulus was liked.

SUPPLEMENT: Appendix B: Artificial words from Bailey & Hahn (2001)

Four blocks:

1) Binth, Clemp, Dresp, Flesk, Misp, Nulp, Shrept, Shrust
2) Blesk, Clenth, Dolf, Finth, Resp, Slon, Smiss, Zint
3) Breltch, Crupt, Druss, Frondge, Gesht, Sesk, Swess, Wust
4) Brunth, Crusp, Drup, Freltch, Kwesk, Smist, Swuft, Thrindge

SUPPLEMENT: Appendix C: Modelling of effects

In order to determine which random effect structure to assume, we used generalized linear mixed models with random effects for *participants* for accuracy data, and linear mixed models with random effects for *participants* for latency and preference data. Non-minimal models were compared with the corresponding minimal model for each experiment (see below). If there was a significant difference in fit, the particular type of random slope as specified in the non-minimal model under comparison was then retained for the final model, afinal, resp., tfinal, resp., pfinal. In a second step, these final models were assembled and run in order to evaluate the respective fixed effect structure from those models (see Jaeger, 2008). This strategy thus considers random intercepts and random slopes for the main effects of the experimental design. The analyses employed the statistical programming language R (R Core Team, 2013), using the package lme4 (Bates, Maechler, Bolker, & Walker, 2015) and afex (Singmann, Bolker, Westfall, & Aust, 2018).

Experiment 1

Model comparisons were performed in a two-steps procedure: In the first step, we fitted three or four models for each data type (a1, a2, a3 for accuracy data, tm1, tm2, tm3 for latency data, and p1, p2, p3, p4 for preference data). Models of type a and tm had the same fixed effect structure, that is, pair distance and ideograph style, as well as their interaction. Models of type p had, additionally, orientation (towards minimum or maximum of the dimension) as a fixed effect. All models had a random intercept for participants. Models a3, tm3 and p4 had only this intercept, so these models are minimal. Models a1 / tm1 / p1 also had a random slope for pair distance as function of participant. Models a2 and tm2 had a random slope for ideograph style instead, whereas model p2 had a random slope for orientation. Finally, model p3 had a random slope for ideograph style. These models were then compared using the Chi square difference statistic $\Delta\chi^2$.

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Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
a3	17	1987.8	2085.8	-976.88	1953.8			
a1	26	1960.8	2110.8	-954.37	1908.8	45.014	9	9.17e-07 ***
a2	26	1889.2	2039.3	-918.62	1837.2	116.51	9	< 2.2e-16 ***

afinal = random slopes for pair distance and ideograph style, as a function of participants, are kept.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm3	18	29311	29410	-14637	29275			
tm1	27	29263	29411	-14604	29209	65.624	9	1.091e-10 ***
tm2	27	29284	29432	-14615	29230	44.641	9	1.075e-06 ***

tfinal = random slopes for pair distance and ideograph style, as a function of participants, are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
p4	18	4486.1	4577.5	-2225.1	4450.1			
p1	20	4487.0	4588.5	-2223.5	4447.0	3.16	2	0.206
p2	27	4480.2	4581.8	-2220.1	4440.2	9.9093	2	0.007051 **
p3	20	4444.9	4581.9	-2195.4	4390.9	59.276	9	1.848e-09***

pfinal = random slopes for ideograph style and orientation, as a function of participants, are kept.

Experiment 2

Model comparisons were performed in a two-steps procedure: In the first step, we fitted three models for accuracy and latency data (a1, a2, a3 for accuracy, tm1, tm2, tm3 for latency), and five models for preference data (p1, p2, p3, p4, p5). Models pertaining to accuracy and latency had pair distance and nonword list, as well as their interaction, as fixed factors. Models pertaining to preference had these, and additionally, orientation (towards minimum or maximum of the dimension) and comparator as fixed factors, along with all possible interactions. All models had a random intercept for participants. Models a3, tm3 and p5 had only this intercept, so these models are minimal. Models a1 / tm1 / p1 also had a random slope for pair distance as function of participant, whereas a2 / tm2 / p2 had a random slope for nonword list. Model p3 had a random slope for orientation, and model p4 had a random slope for comparator. These models were then compared using the Chi square difference statistic $\Delta\chi^2$.

Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
a3	17	2946.7	3046.9	-1456.3	2912.7			
a1	26	2909.1	3062.4	-1428.6	2857.1	55.582	9	9.434e-09 ***
a2	26	2859.3	3012.6	-1403.7	2807.3	105.39	9	< 2.2e-16 ***

afinal = random slopes for pair distance and nonword list, as a function of participants, are kept.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm3	18	29240	29339	-14602	29204			

tm1	27	29221	29370	-14584	29167	36.447	9	3.303e-05	***
tm2	27	29171	29319	-14558	29117	87.192	9	5.948e-15	***

tfinal = random slopes for pair distance and nonword list, as a function of participants, are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*	
p5	43	4662.2	4886.0	-2288.1	4576.2	53.605	9	2.244e-08	***
p1	36	4670.6	4858.0	-2299.3	4598.6	31.181	2	1.694e-07	***
p2	43	4662.2	4886.0	-2288.1	4576.2	53.605	9	2.244e-08	***
p3	36	4671.8	4859.1	-2299.9	4599.8	30.004	2	3.053e-07	***
p4	36	4684.1	4871.4	-2306.1	4612.1	17.717	2	0.0001422	***

pfinal = random slopes for pair distance, nonword list, orientation and comparator, as a function of participants, are kept.

Experiment 3

Model comparisons were performed in a two-steps procedure: In the first step, we fitted three or four models for each data type (a1, a2, a3 for accuracy data, tm1, tm2, tm3 for latency data, and p1, p2, p3, p4 for preference data). Models of type a and tm had the same fixed effect structure, that is, pair distance, ideograph style and number of learning cycles, as well as their interactions. Models of type p had, additionally, orientation (towards minimum or maximum of the dimension) as a fixed effect. All models had a random intercept for participants. Models a3, tm3 and p4 had only this intercept, so these models are minimal. Models a1 / tm1 / p1 also had a random slope for pair distance as function of participant. Models a2 and tm2 had a random slope for ideograph style instead, whereas model p2 had a random slope for orientation. Finally, model p3 had a random slope for ideograph style. These models were then compared using the Chi square difference statistic $\Delta\chi^2$.

Experiment 3a

Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*	
a3	37	1962.1	2198.8	-944.06	1888.1				
a1	42	1929.7	2198.3	-922.82	1845.7	42.465	5	4.742e-08	***

a2	46	1941.1	2235.3	-924.55	1849.1	39.014	9	1.145e-05

afinal = random slopes for pair distance and ideograph style as a function of participants are kept.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm3	38	12605	12845	-6264.5	12529			
tm1	43	12541	12813	-6227.4	12455	74.137	5	1.408e-14***
tm2	47	12560	12858	-6233.1	12466	62.751	9	3.942e-10***

tfinal = random slopes for pair distance and ideograph style as a function of participants are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
p4	50	5687.3	5952.2	-2793.7	5587.3			
p1	52	5682.0	5957.4	-2789.0	5578.0	9.3361	2	0.009391**
p2	52	5673.3	5948.7	-2784.6	5569.3	18.056	2	0.00012***
p3	59	5751.5	6064.0	-2816.7	633.5	0	9	1

pfinal = random slopes for pair distance and orientation, as a function of participants, are kept.

Experiment 3b

Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
a3	37	1187.0	1421.5	-556.49	1113.0			
a1	42	1191.7	1457.9	-553.87	1107.7	5.2413	5	0.3871
a2	46	1201.4	1492.9	-554.70	1109.4	3.5791	9	0.9369

afinal = no random slopes as a function of participants are kept.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm3	38	12521	12761	-6222.5	12445			
tm1	43	12460	12731	-6186.8	12374	71.451	5	5.111e-14***
tm2	47	12477	12773	-6191.4	12383	62.185	9	5.075e-10***

tfinal = random slopes for pair distance and ideograph style as a function of participants are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
p4	50	5402.3	5664.3	-2651.2	5302.3			
p1	52	5402.2	5674.6	-2649.1	5298.2	4.1457	2	0.1258
p2	52	5406.0	5678.4	-2651.0	5302.0	0.3673	2	0.8322
p3	59	5405.1	5714.1	-2643.5	5287.1	15.286	9	0.08338

pfinal = no random slopes as a function of participants are kept.

Experiment 4

In this experiment, type of comparator ("older", or "more frequently used", see Methods section in Experiment 1) did make a difference for accuracies and latencies, but not for preference. Therefore, the reported models for preference do not have comparator as a fixed factor, whereas the remaining models do.

For accuracy and latency models, four models each were fitted (a1, a2, a3, a4 for accuracy, tm1, tm2, tm3, tm4 for latency). These had pair distance, type of ideograph, and comparator, as well as their interactions, as fixed factors. The five models pertaining to preference (p1, p2, p3, p4, p5) had pair distance, type of ideograph, comparator and orientation (towards minimum or maximum of the dimension) as fixed factors, along with all possible interactions. All models had a random intercept for participants. Models a4, tm4 and p5 had only this intercept, so these models are minimal. Models a1 / tm1 / p1 also had a random slope for pair distance as function of participant, whereas a2 / tm2 / p2 had a random slope for type of ideograph. Models a3 /tm3 / p3 had a random slope for comparator, and p4 had a random slope for orientation. These models were then compared using the Chi square difference statistic $\Delta\chi^2$.

Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
a4	33	10947	11194	-5440.7	10881			
a1	42	10525	10839	-5220.6	10441	440.12	9	< 2.2e-16 ***

a2	42	10556	10869	-5235.8	10472	409.76	9	< 2.2e-16 ***
a3	35	10937	11199	-5433.6	10867	14.219	2	0.0008172 ***

afinal = random slopes for pair distance, type of ideograph, and comparator, as a function of participants, are kept.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm4	10	157867	157939	-78923	157847			
tm1	12	157807	157894	-78892	157783	63.37	2	1.735e-14 ***
tm2	12	157703	157789	-78839	157679	167.98	2	< 2.2e-16 ***
tm3	12	157862	157948	-78919	157838	8.6139	2	0.01347 *

tfinal = random slopes for pair distance, type of ideograph, and comparator, as a function of participants, are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
p5	34	25781	26011	-12856	25713			
p1	36	25759	26003	-12844	25687	25.517	2	2.878e-06 ***
p2	43	25626	25917	-12770	25540	172.83	9	< 2.2e-16 ***
p3	36	25727	25971	-12828	25655	57.146	2	3.899e-13 ***
p4	36	25736	25980	-12832	25664	48.858	2	2.458e-11 ***

pfinal = random slopes for pair distance, type of ideograph and orientation, as a function of participants, are kept.

Experiment 5

Model structure and comparisons were the same as in Experiment 2.

Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
a3	33	2375.9	2563.5	-1154.9	2309.9			

a1	42	2353.9	2592.7	-1135.0	2269.9	39.931	9	7.822e-06 ***
a2	42	2376.8	2615.6	-1146.4	2292.8	17.057	9	0.04784 *

afinal = random slopes were kept for pair distance and nonword list, as a function of participants.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm3	34	2828.9	3009.1	-1380.5	2760.9			
tm1	43	2776.9	3004.8	-1345.5	2690.9	69.972	9	1.542e-11 **
tm2	43	2809.6	3037.4	-1361.8	2723.6	37.335	9	2.293e-05 ***

tfinal = random slopes for pair distance and nonword list, as a function of participants, are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
p2	10	1896.1	1939.1	-938.05	1876.1			
p0	12	1899.0	1950.6	-937.49	1875.0	1.114	2	0.5729
p1	12	1887.8	1939.3	-931.87	1863.8	12.35	2	0.002081 **

pfinal = random slopes for orientation as a function of participants, are kept.

Experiment 6

Model comparisons were performed in the same way as in Experiment 1.

Accuracies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
a3	33	1999.6	2190	-966.80	1933.6			
a1	42	1972.7	2215	-944.35	1888.7	44.912	9	9.581e-07
a2	42	1902.2	2144.6	-909.12	1818.2	115.36	9	2.2e-16

afinal = random slopes for pair distance and ideograph style as a function of participants are kept.

Latencies

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
tm3	34	29326	29513	-14629	29258			
tm1	43	29280	29516	-14597	29194	64.101	9	2.157e-10***
tm2	43	29298	29534	-14606	29212	46.182	9	5.572e-07***

tfinal = random slopes for pair distance and ideograph style as a function of participants are kept.

Preferences

Model	*df*	*AIC*	*BIC*	*loglik*	*deviance*	$\Delta\chi^2$	Δdf	*p*
p4	26	7170.7	7315.9	-3559.3	7118.7			
p1	28	7170.8	7327.2	-3557.4	7114.8	3.8215	2	0.148
p2	28	7167.9	7324.3	-3556.0	7111.9	6.7188	2	0.03476 *
p3	46	7145.3	7402.2	-3526.7	7053.3	65.324	20	1.036e-06 ***

pfinal = random slopes for ideograph style and orientation, as a function of participants, are kept.

SUPPLEMENT: Appendix D: Model estimates for effects

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Experiment 1

Accuracies, fixed effects:

```
Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)   2.63295    0.24644  10.684  < 2e-16 ***
dist1        -1.54619    0.21328  -7.250 4.18e-13 ***
dist2         0.06476    0.20907   0.310  0.75674
dist3         0.27689    0.24126   1.148  0.25110
block1       -0.42041    0.22262  -1.888  0.05896 .
block2       -0.12663    0.27819  -0.455  0.64898
block3        0.71211    0.36054   1.975  0.04825 *
dist1:block1  0.43260    0.19378   2.232  0.02559 *
dist2:block1 -0.48045    0.20196  -2.379  0.01736 *
dist3:block1 -0.08144    0.22315  -0.365  0.71514
dist1:block2  0.52009    0.19740   2.635  0.00842 **
dist2:block2  0.39904    0.21683   1.840  0.06572 .
dist3:block2 -0.69873    0.21960  -3.182  0.00146 **
dist1:block3 -0.94003    0.23802  -3.949 7.84e-05 ***
dist2:block3  0.34092    0.24957   1.366  0.17193
dist3:block3  0.57871    0.27421   2.110  0.03482 *
---
```

Accuracies, random effects:

```
 Groups Name        Variance Std.Dev. Corr
 Part.  (Intercept) 1.4824   1.2175
        dist1       0.9402   0.9696   -0.51
        dist2       0.4969   0.7049    0.58 -0.67
        dist3       0.8783   0.9372   -0.06 -0.26 -0.44
        block1      0.7390   0.8597   -0.36  0.45 -0.55 -0.13
        block2      1.4017   1.1839    0.20  0.13  0.07 -0.56  0.50
        block3      2.4419   1.5627    0.17 -0.03 -0.02  0.25 -0.72 -0.50
```

Latencies, fixed effects:

```
             Estimate Std. Error       df t value Pr(>|t|)
(Intercept)  1526.901    101.301   36.151  15.073  < 2e-16 ***
dist1         127.252     35.661  195.908   3.568 0.000452 ***
dist2          97.813     50.798   37.385   1.926 0.061794 .
dist3         -46.931     35.234   57.513  -1.332 0.188122
block1        119.273     48.154   35.456   2.477 0.018163 *
block2        -30.006     45.905   35.810  -0.654 0.517512
block3        -51.325     44.149   39.533  -1.163 0.251982
dist1:block1    8.519     59.471 1654.926   0.143 0.886112
dist2:block1  -48.223     55.526 1666.344  -0.868 0.385262
dist3:block1   78.582     53.783 1676.294   1.461 0.144181
dist1:block2   42.059     59.098 1594.652   0.712 0.476769
dist2:block2  -19.157     55.264 1679.683  -0.347 0.728894
dist3:block2  -84.788     54.042 1684.890  -1.569 0.116855
dist1:block3   47.136     60.553 1628.298   0.778 0.436426
dist2:block3  -93.145     53.616 1698.662  -1.737 0.082521 .
dist3:block3   92.243     52.291 1672.674   1.764 0.077909 .
---
```

Latencies, random effects:

```
 Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 367153   605.93
          dist1         2945    54.27    0.63
          dist2        58037   240.91    0.61  0.41
          dist3        10665   103.27    0.30 -0.06 -0.52
          block1       47968   219.02    0.66 -0.10  0.16  0.63
          block2       40003   200.01    0.14  0.82 -0.04 -0.05 -0.53
          block3       35350   188.02   -0.61 -0.43  0.21 -0.79 -0.63 -0.2
2
 Residual             576967   759.58
```

Preferences, fixed effects:

```
                   Estimate Std. Error         df t value Pr(>|t|)
(Intercept)         3.46791    0.12110   36.00065  28.636   <2e-16 ***
block1              0.16047    0.13460   36.05218   1.192   0.2410
block2              0.08615    0.10075   36.08062   0.855   0.3981
block3             -0.04223    0.10817   37.61538  -0.390   0.6984
dist1              -0.10135    0.04154 1024.00003  -2.440   0.0149 *
direct1            -0.07095    0.06243   36.69587  -1.136   0.2631
block1:dist1       -0.13514    0.07195 1024.00003  -1.878   0.0606 .
block2:dist1        0.02703    0.07195 1024.00003   0.376   0.7073
block3:dist1       -0.03378    0.07195 1024.00003  -0.470   0.6388
block1:direct1      0.03716    0.07195 1024.00003   0.517   0.6056
block2:direct1      0.10473    0.07195 1024.00003   1.456   0.1458
block3:direct1     -0.05743    0.07195 1024.00003  -0.798   0.4249
dist1:direct1       0.07939    0.04154 1024.00003   1.911   0.0563 .
block1:dist1:direct1 -0.11318  0.07195 1024.00003  -1.573   0.1160
block2:dist1:direct1  0.13682  0.07195 1024.00003   1.902   0.0575 .
block3:dist1:direct1  0.02872  0.07195 1024.00003   0.399   0.6899
```

Preferences, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 0.47881  0.6920
          block1      0.47876  0.6919   -0.39
```

```
          block2      0.18402  0.4290    0.14 -0.59
          block3      0.24140  0.4913    0.59 -0.87  0.44
          direct1     0.08034  0.2834    0.07  0.05  0.37  0.30
 Residual              2.04311  1.4294
```

Experiment 2

Accuracies, fixed effects:

```
             Estimate   Std. Error z value  Pr(>|z|)
(Intercept)  1.41994    0.18587   7.639 2.18e-14 ***
dist1       -1.11965    0.15919  -7.034 2.01e-12 ***
dist2       -0.09876    0.13295  -0.743   0.4576
dist3        0.31192    0.14790   2.109   0.0349 *
list1        0.07208    0.18415   0.391   0.6955
list2       -0.06987    0.20693  -0.338   0.7356
list3        0.19113    0.15664   1.220   0.2224
dist1:list1  0.28611    0.14639   1.954   0.0507 .
dist2:list1 -0.27098    0.14984  -1.808   0.0705 .
dist3:list1 -0.22075    0.15741  -1.402   0.1608
dist1:list2 -0.33527    0.14992  -2.236   0.0253 *
dist2:list2  0.03662    0.15182   0.241   0.8094
dist3:list2  0.31638    0.16017   1.975   0.0482 *
dist1:list3  0.02398    0.14559   0.165   0.8692
dist2:list3 -0.13247    0.15171  -0.873   0.3825
dist3:list3  0.16373    0.16196   1.011   0.3120
```

Accuracies, random effects:

```
Groups Name        Variance Std.Dev. Corr
 Part.  (Intercept) 1.2378   1.1126
        dist1       0.7075   0.8411   -0.75
        dist2       0.3296   0.5741   -0.22  0.05
        dist3       0.4014   0.6336    0.64 -0.80 -0.34
        list1       0.9539   0.9767   -0.21  0.26 -0.34 -0.20
        list2       1.2971   1.1389    0.38 -0.39  0.00  0.47 -0.89
        list3       0.5507   0.7421   -0.14  0.13  0.01  0.13 -0.10 -0.10
```

Latencies, fixed effects:

```
              Estimate Std. Error       df t value Pr(>|t|)
(Intercept) 1655.123    104.704   40.972  15.808   <2e-16 ***
dist1         35.797     49.607   44.596   0.722   0.4743
dist2         90.014     38.355   42.852   2.347   0.0236 *
dist3        -26.597     44.625   43.866  -0.596   0.5542
list1         30.359     52.573   38.581   0.577   0.5670
list2         -5.873     57.003   40.888  -0.103   0.9184
list3         70.585     46.777   42.762   1.509   0.1387
dist1:list1    3.386     59.953 1479.539   0.056   0.9550
dist2:list1    8.415     55.874 1603.311   0.151   0.8803
dist3:list1   38.097     53.874 1597.097   0.707   0.4796
dist1:list2    2.419     65.899 1433.024   0.037   0.9707
dist2:list2   52.668     57.003 1557.384   0.924   0.3556
dist3:list2  -28.607     55.194 1606.034  -0.518   0.6043
dist1:list3  -21.803     59.557 1254.731  -0.366   0.7144
```

```
dist2:list3   11.712     53.614 1593.953   0.218   0.8271
dist3:list3  -50.882     52.804 1606.282  -0.964   0.3354
```

Latencies, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 445196   667.2
          dist1        48848   221.0    -0.23
          dist2        18918   137.5    -0.07 -0.61
          dist3        42206   205.4     0.19 -0.59  0.45
          list1        72124   268.6     0.27 -0.23  0.39  0.15
          list2        86919   294.8    -0.46  0.19 -0.26  0.23 -0.53
          list3        50014   223.6     0.65 -0.59  0.01  0.35 -0.21 -0.3
2
 Residual             569831   754.9
```

Preferences, fixed effects:

```
                          Estimate Std. Error         df t value Pr(>|t|)
(Intercept)             3.548e+00  9.476e-02  4.132e+01  37.442  < 2e-16 **
*
list1                   2.107e-01  6.512e-02  6.912e+02   3.236 0.001272 **
list2                   2.732e-02  6.567e-02  7.041e+02   0.416 0.677544
list3                  -2.135e-01  6.692e-02  6.385e+02  -3.191 0.001490 **
comp1                   9.125e-04  5.359e-02  4.146e+01   0.017 0.986496
dist1                  -1.699e-01  6.058e-02  4.158e+01  -2.804 0.007636 **
direct1                -6.555e-02  6.042e-02  4.135e+01  -1.085 0.284193
list1:comp1             5.522e-02  6.999e-02  1.173e+03   0.789 0.430332
list2:comp1            -8.531e-02  7.042e-02  1.171e+03  -1.211 0.225978
list3:comp1             7.596e-02  7.146e-02  1.096e+03   1.063 0.288016
list1:dist1            -1.455e-01  5.863e-02  1.155e+03  -2.482 0.013222 *
list2:dist1             7.205e-02  5.904e-02  1.160e+03   1.220 0.222564
list3:dist1             7.023e-02  6.087e-02  1.167e+03   1.154 0.248838
comp1:dist1             7.830e-02  3.404e-02  1.149e+03   2.300 0.021621 *
list1:direct1          -4.052e-02  5.863e-02  1.155e+03  -0.691 0.489634
list2:direct1           5.633e-02  5.905e-02  1.159e+03   0.954 0.340281
list3:direct1           1.971e-03  6.089e-02  1.167e+03   0.032 0.974183
comp1:direct1          -4.791e-03  3.404e-02  1.149e+03  -0.141 0.888099
dist1:direct1           2.668e-02  3.403e-02  1.148e+03   0.784 0.433160
list1:comp1:dist1      -3.748e-02  6.634e-02  8.591e+02  -0.565 0.572262
list2:comp1:dist1      -2.522e-01  6.657e-02  8.686e+02  -3.789 0.000162 **
*
list3:comp1:dist1       1.674e-01  6.821e-02  8.856e+02   2.454 0.014300 *
list1:comp1:direct1    -2.696e-03  6.661e-02  8.815e+02  -0.040 0.967722
list2:comp1:direct1    -1.030e-01  6.684e-02  8.908e+02  -1.542 0.123496
list3:comp1:direct1     1.623e-01  6.847e-02  9.074e+02   2.370 0.018006 *
list1:dist1:direct1     7.170e-03  5.847e-02  1.148e+03   0.123 0.902435
list2:dist1:direct1    -3.639e-02  5.879e-02  1.148e+03  -0.619 0.536064
list3:dist1:direct1     3.805e-02  6.042e-02  1.148e+03   0.630 0.528971
comp1:dist1:direct1     2.325e-02  3.403e-02  1.148e+03   0.683 0.494670
list1:comp1:dist1:
direct1                 1.981e-01  5.847e-02  1.148e+03   3.388 0.000728 **
*
list2:comp1:dist1:
direct1                -1.285e-01  5.879e-02  1.148e+03  -2.186 0.028989 *
list3:comp1:dist1:
direct1                 -1.416e-01  6.042e-02  1.148e+03  -2.343 0.019300 *
```

Preferences, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 0.32760  0.5724
          dist1       0.10490  0.3239   -0.06
          comp1       0.07149  0.2674   -0.32  0.49
          direct1     0.10404  0.3226   -0.03  0.24  0.27
 Residual             1.48842  1.2200
```

Experiment 3 a

Accuracies, fixed effects:

```
                          Estimate Std. Error z value Pr(>|z|)
(Intercept)                4.293944   0.232165  18.495  < 2e-16 ***
step1                     -1.054184   0.217272  -4.852 1.22e-06 ***
step2                      0.183479   0.242895   0.755 0.450019
block1                    -0.049737   0.311540  -0.160 0.873157
block2                    -0.099881   0.286441  -0.349 0.727317
block3                    -0.036297   0.296876  -0.122 0.902689
repetition1               -0.207722   0.202782  -1.024 0.305666
repetition2                0.477172   0.216423   2.205 0.027467 *
step1:block1              -0.120893   0.271796  -0.445 0.656470
step2:block1               0.708900   0.296873   2.388 0.016946 *
step1:block2              -0.038608   0.252778  -0.153 0.878606
step2:block2               0.181330   0.284875   0.637 0.524435
step1:block3               0.459219   0.274426   1.673 0.094253 .
step2:block3              -1.069223   0.289957  -3.688 0.000226 ***
step1:repetition1         -0.048743   0.241243  -0.202 0.839878
step2:repetition1          0.187482   0.259863   0.721 0.470622
step1:repetition2          0.003215   0.257473   0.012 0.990039
step2:repetition2         -0.136498   0.265301  -0.515 0.606901
block1:repetition1         0.246787   0.324754   0.760 0.447302
block2:repetition1         0.090177   0.290361   0.311 0.756128
block3:repetition1        -0.110958   0.311637  -0.356 0.721803
block1:repetition2        -0.181326   0.337272  -0.538 0.590835
block2:repetition2         0.123538   0.317773   0.389 0.697452
block3:repetition2         0.280613   0.344473   0.815 0.415293
step1:block1:repetition1 -0.262922   0.286749  -0.917 0.359191
step2:block1:repetition1 -0.408547   0.339272  -1.204 0.228517
step1:block2:repetition1  0.416527   0.271286   1.535 0.124690
step2:block2:repetition1 -0.339780   0.318207  -1.068 0.285613
step1:block3:repetition1  0.299748   0.296862   1.010 0.312627
step2:block3:repetition1 -0.904686   0.308758  -2.930 0.003389 **
step1:block1:repetition2 -0.425040   0.313526  -1.356 0.175202
step2:block1:repetition2  0.497231   0.361240   1.376 0.168680
step1:block2:repetition2 -0.355756   0.308177  -1.154 0.248340
step2:block2:repetition2  0.452458   0.368805   1.227 0.219889
step1:block3:repetition2  0.301906   0.353919   0.853 0.393639
step2:block3:repetition2 -0.165652   0.351057  -0.472 0.637022
```

Accuracies, random effects:

```
Groups Name        Variance Std.Dev. Corr
 Part.  (Intercept) 0.7215   0.8494
        step1       1.4571   1.2071   -0.50
        step2       1.1119   1.0545    0.29 -0.39
        block1      1.9988   1.4138    0.02  0.04  0.68
        block2      1.4896   1.2205    0.05 -0.09 -0.11 -0.41
        block3      1.7822   1.3350   -0.05  0.12 -0.44 -0.32 -0.46
```

Latencies, fixed effects:

	Estimate	Std. Error	df	t value	Pr(>|t|)	
(Intercept)	1.768e+00	4.533e-02	9.477e+01	39.003	< 2e-16	***
step1	3.288e-01	3.461e-02	9.525e+01	9.498	1.91e-15	***
step2	-2.598e-02	2.394e-02	2.736e+02	-1.086	0.278636	
block1	1.636e-01	4.342e-02	9.320e+01	3.768	0.000288	***
block2	-8.638e-02	3.473e-02	9.708e+01	-2.487	0.014586	*
block3	-1.784e-02	3.696e-02	9.784e+01	-0.483	0.630370	
repetition1	4.699e-02	6.421e-02	9.486e+01	0.732	0.466111	
repetition2	4.327e-02	6.473e-02	9.471e+01	0.669	0.505422	
step1:block1	1.010e-01	4.042e-02	3.777e+03	2.499	0.012512	*
step2:block1	-3.636e-02	3.939e-02	3.720e+03	-0.923	0.356077	
step1:block2	6.838e-02	3.969e-02	3.787e+03	1.723	0.085046	.
step2:block2	-1.717e-02	3.886e-02	3.733e+03	-0.442	0.658645	
step1:block3	-5.988e-02	3.935e-02	3.785e+03	-1.522	0.128204	
step2:block3	3.223e-02	3.905e-02	3.737e+03	0.825	0.409298	
step1:repetition1	-5.113e-02	4.914e-02	9.635e+01	-1.040	0.300721	
step2:repetition1	2.381e-03	3.407e-02	2.771e+02	0.070	0.944320	
step1:repetition2	4.345e-02	4.935e-02	9.441e+01	0.880	0.380912	
step2:repetition2	6.676e-04	3.407e-02	2.714e+02	0.020	0.984379	
block1:repetition1	3.648e-02	6.164e-02	9.413e+01	0.592	0.555419	
block2:repetition1	-6.665e-02	4.924e-02	9.743e+01	-1.354	0.178948	
block3:repetition1	6.339e-02	5.245e-02	9.918e+01	1.208	0.229740	
block1:repetition2	-8.127e-02	6.202e-02	9.276e+01	-1.310	0.193299	
block2:repetition2	3.013e-02	4.935e-02	9.684e+01	0.611	0.542911	
block3:repetition2	-4.442e-03	5.266e-02	9.616e+01	-0.084	0.932953	
step1:block1:repetition1	1.254e-01	5.758e-02	3.793e+03	2.178	0.029458	*
step2:block1:repetition1	-4.890e-02	5.589e-02	3.726e+03	-0.875	0.381707	
step1:block2:repetition1	-8.599e-02	5.623e-02	3.789e+03	-1.529	0.126239	
step2:block2:repetition1	8.101e-02	5.517e-02	3.737e+03	1.469	0.142048	
step1:block3:repetition1	-1.748e-02	5.597e-02	3.801e+03	-0.312	0.754834	
step2:block3:repetition1	2.442e-02	5.596e-02	3.761e+03	0.436	0.662512	
step1:block1:repetition2	2.033e-02	5.773e-02	3.771e+03	0.352	0.724744	
step2:block1:repetition2	-1.297e-01	5.613e-02	3.710e+03	-2.310	0.020947	*
step1:block2:repetition2	1.418e-02	5.619e-02	3.789e+03	0.252	0.800702	
step2:block2:repetition2	7.371e-03	5.493e-02	3.724e+03	0.134	0.893258	
step1:block3:repetition2	-4.660e-02	5.574e-02	3.762e+03	-0.836	0.403227	
step2:block3:repetition2	3.420e-02	5.543e-02	3.715e+03	0.617	0.537213	

Latencies, random effects:

Groups	Name	Variance	Std.Dev.	Corr				
Part.	(Intercept)	0.175381	0.41878					
	step1	0.065564	0.25605	0.73				
	step2	0.005807	0.07621	-0.37	-0.54			
	block1	0.099725	0.31579	0.24	0.59	-0.92		
	block2	0.039238	0.19809	0.14	0.40	0.14	-0.10	
	block3	0.056339	0.23736	-0.28	-0.32	0.69	-0.52	-0.38
Residual		1.055531	1.02739					

Preferences, fixed effects:

```
                          Estimate Std. Error         df t value Pr(>|t|)
(Intercept)              4.433e+00  8.027e-02  9.688e+01  55.227  < 2e-16**
*
step1                   -1.506e-01  4.300e-02  9.739e+01  -3.502 0.000699**
*
dominance1               1.119e-01  4.930e-02  9.819e+01   2.270 0.025392*
block1                  -5.124e-02  6.957e-02  1.170e+03  -0.736 0.461605
block2                   1.630e-01  6.884e-02  1.173e+03   2.368 0.018040*
block3                  -4.668e-02  6.827e-02  1.169e+03  -0.684 0.494257
repetition1             -4.051e-02  1.136e-01  9.674e+01  -0.356 0.722266
repetition2             -8.346e-02  1.148e-01  9.717e+01  -0.727 0.468894
step1:dominance1        -1.989e-02  3.968e-02  1.152e+03  -0.501 0.616271
step1:block1             2.170e-02  6.905e-02  1.184e+03   0.314 0.753309
step1:block2            -1.039e-01  6.827e-02  1.183e+03  -1.522 0.128171
step1:block3            -9.045e-02  6.784e-02  1.175e+03  -1.333 0.182709
dominance1:block1        7.096e-02  6.919e-02  1.181e+03   1.026 0.305331
dominance1:block2       -9.109e-03  6.842e-02  1.182e+03  -0.133 0.894107
dominance1:block3       -4.432e-02  6.795e-02  1.175e+03  -0.652 0.514341
step1:repetition1        6.615e-02  6.090e-02  9.776e+01   1.086 0.280090
step1:repetition2       -4.566e-02  6.156e-02  9.784e+01  -0.742 0.460005
dominance1:repetition1   7.272e-02  6.980e-02  9.842e+01   1.042 0.300029
dominance1:repetition2  -1.793e-02  7.055e-02  9.859e+01  -0.254 0.799940
block1:repetition1       1.572e-01  9.874e-02  1.173e+03   1.592 0.111748
block2:repetition1      -2.454e-01  9.745e-02  1.170e+03  -2.518 0.011929*
block3:repetition1       1.799e-01  9.652e-02  1.167e+03   1.863 0.062662.
block1:repetition2       3.208e-02  9.951e-02  1.170e+03   0.322 0.747250
block2:repetition2       8.458e-02  9.812e-02  1.178e+03   0.862 0.388863
block3:repetition2      -8.533e-02  9.789e-02  1.166e+03  -0.872 0.383530
step1:dominance1:block1-3.971e-03  6.900e-02  1.152e+03  -0.058 0.954115
step1:dominance1:block2-2.866e-02  6.823e-02  1.152e+03  -0.420 0.674480
step1:dominance1:block3 5.577e-02  6.781e-02  1.152e+03   0.822 0.411014
step1:dominance1:repetition1
                        -8.729e-02  5.620e-02  1.152e+03  -1.553 0.120662
step1:dominance1:repetition2
                         2.602e-03  5.682e-02  1.152e+03   0.046 0.963483
step1:block1:repetition1
                        -1.001e-01  9.786e-02  1.190e+03  -1.023 0.306742
step1:block2:repetition1
                        -1.715e-01  9.676e-02  1.179e+03  -1.773 0.076556.
step1:block3:repetition1
                         7.254e-02  9.595e-02  1.175e+03   0.756 0.449833
step1:block1:repetition2
                         1.106e-01  9.877e-02  1.183e+03   1.119 0.263235
step1:block2:repetition2
                         6.984e-02  9.714e-02  1.188e+03   0.719 0.472320
step1:block3:repetition2
                        -5.950e-02  9.735e-02  1.173e+03  -0.611 0.541194
dominance1:block1:repetition1
                         7.223e-02  9.811e-02  1.186e+03   0.736 0.461745
dominance1:block2:repetition1
                        -6.068e-03  9.694e-02  1.178e+03  -0.063 0.950100
dominance1:block3:repetition1
                        -1.155e-01  9.610e-02  1.174e+03  -1.202 0.229701
dominance1:block1:repetition2
                        -9.808e-03  9.897e-02  1.180e+03  -0.099 0.921073
dominance1:block2:repetition2
                         2.158e-02  9.739e-02  1.187e+03   0.222 0.824693
dominance1:block3:repetition2
                         4.453e-02  9.749e-02  1.172e+03   0.457 0.647934
step1:dominance1:block1:repetition1
                        -4.718e-02  9.779e-02  1.152e+03  -0.482 0.629559
step1:dominance1:block2:repetition1
                        -2.544e-02  9.671e-02  1.152e+03  -0.263 0.792517
step1:dominance1:block3:repetition1
                         1.061e-01  9.591e-02  1.152e+03   1.106 0.268823
```

```
step1:dominance1:block1:repetition2
                        2.988e-02  9.871e-02  1.152e+03   0.303 0.762151
step1:dominance1:block2:repetition2
                        4.595e-02  9.707e-02  1.152e+03   0.473 0.636007
step1:dominance1:block3:repetition2
                       -8.848e-02  9.731e-02  1.152e+03  -0.909 0.363404
```

Preferences, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 0.47917  0.6922
          step1       0.02693  0.1641   -0.86
          dominance1  0.08337  0.2887    0.56 -0.73
 Residual             2.31606  1.5219
```

Experiment 3 b

Accuracies, fixed effects:

```
                          Estimate Std. Error z value Pr(>|z|)
(Intercept)                3.76413    0.14250  26.415  < 2e-16 ***
step1                     -0.64180    0.13143  -4.883 1.04e-06 ***
step2                      0.35060    0.16181   2.167   0.0303 *
block1                    -0.10630    0.18215  -0.584   0.5595
block2                    -0.02321    0.17658  -0.131   0.8954
block3                     0.08832    0.19424   0.455   0.6493
repetition1               -0.23691    0.17294  -1.370   0.1707
repetition2                0.04720    0.18075   0.261   0.7940
step1:block1               0.12229    0.22311   0.548   0.5836
step2:block1              -0.21049    0.26391  -0.798   0.4251
step1:block2               0.04412    0.21575   0.205   0.8380
step2:block2               0.18675    0.27165   0.687   0.4918
step1:block3              -0.14895    0.23370  -0.637   0.5239
step2:block3              -0.02470    0.28910  -0.085   0.9319
step1:repetition1          0.21318    0.17978   1.186   0.2357
step2:repetition1         -0.24143    0.21264  -1.135   0.2562
step1:repetition2         -0.35072    0.18378  -1.908   0.0563 .
step2:repetition2          0.25008    0.23722   1.054   0.2918
block1:repetition1        -0.20244    0.23707  -0.854   0.3931
block2:repetition1         0.23527    0.24343   0.966   0.3338
block3:repetition1        -0.10573    0.25215  -0.419   0.6750
block1:repetition2        -0.09793    0.25345  -0.386   0.6992
block2:repetition2         0.10635    0.25730   0.413   0.6794
block3:repetition2         0.16030    0.29967   0.535   0.5927
step1:block1:repetition1   0.44996    0.30411   1.480   0.1390
step2:block1:repetition1  -0.18595    0.33422  -0.556   0.5780
step1:block2:repetition1  -0.01007    0.30256  -0.033   0.9734
step2:block2:repetition1   0.25895    0.37340   0.693   0.4880
step1:block3:repetition1   0.09061    0.30943   0.293   0.7697
step2:block3:repetition1   0.15900    0.37140   0.428   0.6686
step1:block1:repetition2   0.03660    0.30386   0.120   0.9041
step2:block1:repetition2   0.23535    0.38288   0.615   0.5388
step1:block2:repetition2   0.18486    0.30857   0.599   0.5491
step2:block2:repetition2  -0.40567    0.39315  -1.032   0.3022
```

```
step1:block3:repetition2 -0.60487    0.34017  -1.778   0.0754 .
step2:block3:repetition2  0.29719    0.45735   0.650   0.5158
```

Accuracies, random effects:

```
Groups Name        Variance Std.Dev.
 Part.  (Intercept) 0.3754   0.6127
```

Latencies, fixed effects:

```
                         Estimate Std. Error         df t value Pr(>|t|)
(Intercept)             1.761e+00  5.068e-02  9.510e+01  34.745  < 2e-16 **
*
step1                    2.933e-01  3.338e-02  9.926e+01   8.786 4.74e-14 **
*
step2                    3.880e-02  3.340e-02  1.008e+02   1.162  0.24813
block1                   8.290e-02  4.321e-02  8.221e+01   1.918  0.05854 .
block2                  -9.139e-02  3.356e-02  1.453e+02  -2.723  0.00726 **
block3                   5.735e-02  4.067e-02  8.825e+01   1.410  0.16198
repetition1              7.656e-02  7.195e-02  9.625e+01   1.064  0.28994
repetition2             -8.284e-03  7.112e-02  9.504e+01  -0.116  0.90752
step1:block1             2.929e-02  4.130e-02  3.728e+03   0.709  0.47828
step2:block1            -1.451e-02  4.105e-02  3.723e+03  -0.353  0.72375
step1:block2            -4.899e-02  4.056e-02  3.729e+03  -1.208  0.22713
step2:block2             3.688e-02  4.018e-02  3.721e+03   0.918  0.35871
step1:block3             5.096e-02  4.116e-02  3.724e+03   1.238  0.21570
step2:block3            -4.205e-02  4.073e-02  3.718e+03  -1.033  0.30190
step1:repetition1        4.756e-02  4.759e-02  1.013e+02   0.999  0.32002
step2:repetition1       -2.917e-03  4.766e-02  1.032e+02  -0.061  0.95131
step1:repetition2       -2.110e-02  4.687e-02  9.944e+01  -0.450  0.65357
step2:repetition2       -1.508e-02  4.681e-02  1.005e+02  -0.322  0.74797
block1:repetition1      -1.835e-02  6.229e-02  8.296e+01  -0.295  0.76906
block2:repetition1       9.522e-03  4.792e-02  1.474e+02   0.199  0.84275
block3:repetition1      -8.949e-03  5.823e-02  8.901e+01  -0.154  0.87820
block1:repetition2       4.775e-02  6.049e-02  8.182e+01   0.789  0.43214
block2:repetition2       4.752e-03  4.722e-02  1.460e+02   0.101  0.91998
block3:repetition2      -4.795e-03  5.721e-02  8.850e+01  -0.084  0.93339
step1:block1:repetition1
                         1.301e-02  5.940e-02  3.727e+03   0.219  0.82668
step2:block1:repetition1
                         3.202e-02  5.928e-02  3.723e+03   0.540  0.58909
step1:block2:repetition1
                         7.248e-03  5.753e-02  3.720e+03   0.126  0.89976
step2:block2:repetition1
                        -3.509e-02  5.709e-02  3.716e+03  -0.615  0.53886
step1:block3:repetition1
                        -1.139e-01  5.888e-02  3.727e+03  -1.934  0.05323 .
step2:block3:repetition1
                         1.300e-01  5.838e-02  3.721e+03   2.228  0.02597 *
step1:block1:repetition2
                        -1.027e-01  5.795e-02  3.725e+03  -1.772  0.07642 .
step2:block1:repetition2
                         4.196e-02  5.739e-02  3.719e+03   0.731  0.46479
step1:block2:repetition2
                         3.273e-02  5.711e-02  3.726e+03   0.573  0.56655
step2:block2:repetition2
                         1.281e-02  5.653e-02  3.718e+03   0.227  0.82080
step1:block3:repetition2
                         9.991e-02  5.812e-02  3.727e+03   1.719  0.08570 .
step2:block3:repetition2
                        -3.805e-02  5.718e-02  3.719e+03  -0.666  0.50573
```

Latencies, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 ps       (Intercept) 0.22011  0.4692
          step1       0.05252  0.2292    0.23
          step2       0.05384  0.2320    0.48 -0.73
          block1      0.08602  0.2933    0.30  0.12  0.02
          block2      0.02522  0.1588   -0.66  0.18 -0.65 -0.59
          block3      0.07018  0.2649    0.18 -0.36  0.42 -0.63  0.33
 Residual             1.11616  1.0565
```

Preferences, fixed effects:

```
                       Estimate   Std. Error  df       t value     Pr(>|t|
)
(Intercept)            4.346e+00  8.901e-02  9.355e+01  48.821  < 2e-16 **
*
step1                 -1.455e-01  4.218e-02  1.247e+03  -3.450 0.000579 **
*
dominance1             2.452e-01  4.218e-02  1.247e+03   5.814 7.72e-09 **
*
block1                 1.053e-01  7.408e-02  1.278e+03   1.422 0.155414
block2                 4.895e-02  7.295e-02  1.288e+03   0.671 0.502335
block3                -1.618e-01  7.352e-02  1.270e+03  -2.201 0.027920 *
repetition1            3.738e-02  1.265e-01  9.490e+01   0.296 0.768155
repetition2            1.298e-01  1.248e-01  9.335e+01   1.040 0.301008
step1:dominance1       6.975e-03  4.218e-02  1.247e+03   0.165 0.868684
step1:block1          -6.683e-02  7.302e-02  1.247e+03  -0.915 0.360236
step1:block2           8.835e-02  7.163e-02  1.247e+03   1.233 0.217649
step1:block3           1.456e-02  7.271e-02  1.247e+03   0.200 0.841249
dominance1:block1     -4.091e-02  7.302e-02  1.247e+03  -0.560 0.575364
dominance1:block2      1.261e-01  7.163e-02  1.247e+03   1.760 0.078592 .
dominance1:block3     -7.063e-02  7.271e-02  1.247e+03  -0.971 0.331508
step1:repetition1      4.573e-02  6.035e-02  1.247e+03   0.758 0.448692
step1:repetition2     -8.380e-03  5.910e-02  1.247e+03  -0.142 0.887263
dominance1:repetition1 5.057e-02  6.035e-02  1.247e+03   0.838 0.402162
dominance1:repetition2-4.414e-03  5.910e-02  1.247e+03  -0.075 0.940469
block1:repetition1     5.802e-02  1.067e-01  1.283e+03   0.544 0.586765
block2:repetition1    -4.804e-02  1.038e-01  1.298e+03  -0.463 0.643589
block3:repetition1    -6.457e-02  1.053e-01  1.273e+03  -0.613 0.539741
block1:repetition2    -1.299e-01  1.036e-01  1.274e+03  -1.254 0.210019
block2:repetition2     9.413e-02  1.028e-01  1.290e+03   0.916 0.359946
block3:repetition2     9.979e-02  1.033e-01  1.272e+03   0.966 0.334390
step1:dominance1:block1
                      -1.267e-01  7.302e-02  1.247e+03  -1.736 0.082877 .
step1:dominance1:block2
                       7.183e-03  7.163e-02  1.247e+03   0.100 0.920137
step1:dominance1:block3
                      -3.158e-02  7.271e-02  1.247e+03  -0.434 0.664124
step1:dominance1:repetition1
                       1.438e-02  6.035e-02  1.247e+03   0.238 0.811670
step1:dominance1:repetition2
                       3.704e-03  5.910e-02  1.247e+03   0.063 0.950037
step1:block1:repetition1
                      -3.709e-02  1.049e-01  1.247e+03  -0.354 0.723667
step1:block2:repetition1
                      -6.114e-02  1.015e-01  1.247e+03  -0.602 0.547131
step1:block3:repetition1
                      -5.764e-02  1.040e-01  1.247e+03  -0.554 0.579589
step1:block1:repetition2
```

```
                      -6.261e-02  1.023e-01  1.247e+03  -0.612 0.540749
step1:block2:repetition2
                       3.329e-02  1.008e-01  1.247e+03   0.330 0.741243
step1:block3:repetition2
                       8.933e-02  1.021e-01  1.247e+03   0.875 0.381787
dominance1:block1:repetition1
                      -1.253e-01  1.049e-01  1.247e+03  -1.194 0.232571
dominance1:block2:repetition1
                       1.346e-01  1.015e-01  1.247e+03   1.325 0.185335
dominance1:block3:repetition1
                       1.320e-01  1.040e-01  1.247e+03   1.269 0.204771
dominance1:block1:repetition2
                       5.009e-02  1.023e-01  1.247e+03   0.490 0.624539
dominance1:block2:repetition2
                      -9.272e-02  1.008e-01  1.247e+03  -0.920 0.357814
dominance1:block3:repetition2
                      -1.535e-01  1.021e-01  1.247e+03  -1.504 0.132940
step1:dominance1:block1:repetition1
                       1.278e-02  1.049e-01  1.247e+03   0.122 0.903046
step1:dominance1:block2:repetition1
                      -1.334e-01  1.015e-01  1.247e+03  -1.314 0.189197
step1:dominance1:block3:repetition1
                       1.531e-01  1.040e-01  1.247e+03   1.472 0.141351
step1:dominance1:block1:repetition2
                       1.160e-01  1.023e-01  1.247e+03   1.134 0.256962
step1:dominance1:block2:repetition2
                       6.278e-02  1.008e-01  1.247e+03   0.623 0.533471
step1:dominance1:block3:repetition2
                      -1.291e-01  1.021e-01  1.247e+03  -1.264 0.206320
```

Preferences, random effects:

```
Groups   Name        Variance Std.Dev.
 ps       (Intercept) 0.5947   0.7711
 Residual             2.4664   1.5705
```

Experiment 4

Accuracies, fixed effects:

```
                     Estimate Std. Error z value Pr(>|z|)
(Intercept)          2.738357   0.126679  21.616  < 2e-16 ***
dist1               -1.676532   0.117178 -14.308  < 2e-16 ***
dist2               -0.575291   0.104866  -5.486 4.11e-08 ***
dist3                0.688374   0.130369   5.280 1.29e-07 ***
block1              -0.120501   0.105867  -1.138 0.255024
block2               0.174799   0.119452   1.463 0.143375
block3              -0.148505   0.108950  -1.363 0.172863
Compare1             0.196517   0.041218   4.768 1.86e-06 ***
dist1:block1        -0.052340   0.086257  -0.607 0.543987
dist2:block1         0.104023   0.091302   1.139 0.254563
dist3:block1        -0.059105   0.102959  -0.574 0.565924
dist1:block2         0.219526   0.090350   2.430 0.015110 *
dist2:block2        -0.152376   0.093637  -1.627 0.103672
dist3:block2         0.033039   0.107743   0.307 0.759111
dist1:block3         0.008815   0.084956   0.104 0.917360
dist2:block3         0.332591   0.092140   3.610 0.000307 ***
dist3:block3        -0.033598   0.101350  -0.332 0.740263
dist1:Compare1      -0.014371   0.047949  -0.300 0.764397
dist2:Compare1      -0.026147   0.050682  -0.516 0.605924
dist3:Compare1       0.001264   0.057844   0.022 0.982564
block1:Compare1      0.094837   0.054673   1.735 0.082806 .
```

```
block2:Compare1       -0.016744   0.056661  -0.296 0.767604
block3:Compare1       -0.007113   0.054015  -0.132 0.895228
dist1:block1:Compare1 -0.168497   0.076914  -2.191 0.028472 *
dist2:block1:Compare1  0.079146   0.084008   0.942 0.346130
dist3:block1:Compare1  0.203442   0.095025   2.141 0.032279 *
dist1:block2:Compare1  0.062463   0.079591   0.785 0.432572
dist2:block2:Compare1 -0.029946   0.084904  -0.353 0.724308
dist3:block2:Compare1 -0.082454   0.097988  -0.841 0.400082
dist1:block3:Compare1  0.045831   0.075069   0.611 0.541522
dist2:block3:Compare1  0.032531   0.084117   0.387 0.698956
dist3:block3:Compare1 -0.134246   0.093100  -1.442 0.149314
```

Accuracies, random effects:

```
Groups Name     Variance Std.Dev. Corr
Pt. (Intercept) 2.08512  1.4440
    dist1       1.58626  1.2595   -0.68
dist2       0.87429  0.9350   -0.40  0.07
    dist3       0.86547  0.9303    0.60 -0.58 -0.48
    block1      1.07921  1.0388   -0.02  0.18 -0.18 -0.10
    block2      1.42849  1.1952   -0.06  0.15  0.06 -0.07 -0.36
    block3      1.22305  1.1059   -0.09 -0.16  0.20  0.18 -0.35 -0.42
    Compare1    0.05911  0.2431   -0.35  0.37  0.04 -0.23  0.04 -0.30  0.2
2
```

Latencies, fixed effects:

```
                  Estimate Std. Error        df t value Pr(>|t|)
(Intercept)         1623.2319    34.3905  200.8205  47.200  < 2e-16 ***
dist1                155.1745    17.1855  184.4779   9.029 2.28e-16 ***
dist2                 49.7165    13.7309  283.0102   3.621 0.000348 ***
dist3                -48.3644    13.6357  202.0599  -3.547 0.000485 ***
block1               147.6690    24.6739  203.2047   5.985 9.66e-09 ***
block2               -59.9040    22.5666  194.8752  -2.655 0.008598 **
block3               -33.1447    22.6775  200.1547  -1.462 0.145426
Compare1              41.3594     7.5705  285.0324   5.463 1.02e-07 ***
dist1:block1         -54.1733    24.5066 7826.5775  -2.211 0.027095 *
dist2:block1          22.2221    21.9141 8695.2696   1.014 0.310585
dist3:block1          31.9609    21.1019 8829.6987   1.515 0.129909
dist1:block2          12.8960    23.0882 8197.2518   0.559 0.576482
dist2:block2          -1.5667    21.4467 8712.5131  -0.073 0.941766
dist3:block2         -34.6069    20.6377 8802.6013  -1.677 0.093602 .
dist1:block3           9.7803    23.7505 8105.2846   0.412 0.680501
dist2:block3         -17.3616    21.4687 8679.7807  -0.809 0.418714
dist3:block3          32.6975    20.9948 8813.1499   1.557 0.119410
dist1:Compare1        26.6225    13.4749 8774.8542   1.976 0.048220 *
dist2:Compare1       -17.2145    12.4066 8689.5938  -1.388 0.165318
dist3:Compare1       -11.1901    12.0196 8735.8057  -0.931 0.351883
block1:Compare1       -1.2902    12.6005 8773.1877  -0.102 0.918447
block2:Compare1        6.0386    12.2342 8777.9951   0.494 0.621614
block3:Compare1        0.8958    12.3604 8752.7495   0.072 0.942225
dist1:block1:Compare1 25.9076    23.9166 8716.8247   1.083 0.278729
dist2:block1:Compare1 14.1993    21.7434 8622.8533   0.653 0.513749
dist3:block1:Compare1 -44.9762   21.0010 8712.3093  -2.142 0.032251 *
dist1:block2:Compare1 -18.3138   22.8068 8649.9671  -0.803 0.421998
dist2:block2:Compare1 -15.1899   21.3421 8661.0752  -0.712 0.476648
dist3:block2:Compare1  10.1411   20.6244 8705.4171   0.492 0.622940
dist1:block3:Compare1  -3.9886   23.2618 8702.4837  -0.171 0.863860
```

```
dist2:block3:Compare1   -5.9614    21.2677 8648.7817  -0.280 0.779252
dist3:block3:Compare1    3.9877    20.9031 8713.0925   0.191 0.848711
```

Latencies, random effects:

```
Groups  Name        Variance Std.Dev. Corr
Pt. (Intercept) 229149   478.69
    dist1        21412   146.33    0.42
    dist2         6473    80.46    0.30  0.48
    dist3         8143    90.24   -0.37 -0.38 -0.52
    block1       89567   299.28    0.18  0.08 -0.40  0.19
    block2       71791   267.94   -0.01 -0.14  0.56 -0.48 -0.36
block3       72021   268.37   -0.20  0.04 -0.01  0.13 -0.61 -0.14
    Compare1      1230    35.07    0.57 -0.02  0.28 -0.16  0.05 -0.24 -0.1
6
    Residual    476470   690.27
```

Preferences, fixed effects:

```
                      Estimate Std. Error         df t value Pr(>|t|)
(Intercept)           4.204e+00  5.307e-02  2.067e+02  79.222  < 2e-16 **
*
block1               -9.384e-02  5.312e-02  1.883e+02  -1.766   0.0789 .
block2               -7.371e-02  5.134e-02  1.876e+02  -1.436   0.1528
block3                1.200e-01  5.133e-02  1.717e+02   2.338   0.0205 *
comp1                 4.365e-02  2.959e-02  4.369e+02   1.475   0.1409
distance1             6.641e-02  2.691e-02  2.085e+02   2.468   0.0144 *
direct1               1.717e-01  2.901e-02  2.086e+02   5.918 1.32e-08 **
*
block1:comp1         -5.449e-02  5.833e-02  3.169e+02  -0.934   0.3509
block2:comp1         -2.879e-02  5.630e-02  3.241e+02  -0.511   0.6094
block3:comp1          4.486e-02  5.801e-02  3.145e+02   0.773   0.4399
block1:distance1     -8.386e-02  3.412e-02  5.306e+03  -2.458   0.0140 *
block2:distance1      2.922e-02  3.461e-02  5.316e+03   0.844   0.3985
block3:distance1     -5.739e-03  3.518e-02  5.352e+03  -0.163   0.8704
comp1:distance1       1.522e-02  1.987e-02  5.260e+03   0.766   0.4436
block1:direct1       -8.193e-02  3.413e-02  5.303e+03  -2.400   0.0164 *
block2:direct1        2.611e-02  3.462e-02  5.311e+03   0.754   0.4508
block3:direct1        1.865e-02  3.520e-02  5.346e+03   0.530   0.5962
comp1:direct1        -1.431e-02  1.987e-02  5.259e+03  -0.720   0.4714
distance1:direct1    -1.290e-01  1.986e-02  5.257e+03  -6.493 9.20e-11 **
*
block1:comp1:distance1 1.996e-02  3.693e-02  2.799e+03   0.540   0.5889
block2:comp1:distance1-6.607e-02  3.748e-02  2.826e+03  -1.763   0.0780 .
block3:comp1:distance1-1.823e-02  3.799e-02  2.899e+03  -0.480   0.6313
block1:comp1:direct1  6.210e-02  3.751e-02  3.199e+03   1.656   0.0979 .
block2:comp1:direct1  2.491e-02  3.802e-02  3.181e+03   0.655   0.5124
block3:comp1:direct1 -6.545e-02  3.850e-02  3.239e+03  -1.700   0.0892 .
block1:distance1:direct1
                      3.313e-02  3.406e-02  5.257e+03   0.973   0.3307
block2:distance1:direct1
                     -2.192e-02  3.454e-02  5.257e+03  -0.635   0.5256
block3:distance1:direct1
                      2.443e-03  3.505e-02  5.257e+03   0.070   0.9444
comp1:distance1:direct11.627e-02  1.986e-02  5.257e+03   0.819   0.4127
block1:comp1:distance1:direct1
                     -2.516e-02  3.406e-02  5.257e+03  -0.739   0.4601
block2:comp1:distance1:direct1
                      5.499e-04  3.454e-02  5.257e+03   0.016   0.9873
block3:comp1:distance1:direct1
                      2.575e-02  3.505e-02  5.257e+03   0.735   0.4626
```

Preferences, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 0.48628  0.69734
          block1      0.32097  0.56654   0.01
          block2      0.27688  0.52619  -0.09 -0.43
          block3      0.25227  0.50227   0.03 -0.28 -0.37
          comp1       0.00643  0.08019  -0.34 -0.39  0.43  0.18
          distance1   0.06635  0.25758  -0.08  0.18 -0.22 -0.22  0.49
         direct1     0.09001  0.30001  -0.10  0.08  0.22  0.05  0.51  0.05
 Residual             2.46474  1.56995
```

Experiment 5

Accuracies, fixed effects:

```
Estimate Std. Error z value Pr(>|z|)
(Intercept)            -1.43315    0.21033  -6.814 9.51e-12 ***
sequence1               0.09906    0.20622   0.480  0.63096
block1                 -0.11903    0.17426  -0.683  0.49459
block2                 -0.14985    0.17340  -0.864  0.38749
block3                 -0.04971    0.18085  -0.275  0.78343
dist1                   0.58823    0.14843   3.963 7.40e-05 ***
dist2                   0.11770    0.14625   0.805  0.42093
dist3                  -0.03995    0.13746  -0.291  0.77134
sequence1:block1       -0.06606    0.16614  -0.398  0.69089
sequence1:block2        0.03957    0.16166   0.245  0.80662
sequence1:block3       -0.01296    0.17272  -0.075  0.94018
sequence1:dist1        -0.09478    0.14296  -0.663  0.50735
sequence1:dist2         0.22024    0.13467   1.635  0.10196
sequence1:dist3        -0.20581    0.12489  -1.648  0.09938 .
block1:dist1           -0.01875    0.16057  -0.117  0.90707
block2:dist1            0.23369    0.16271   1.436  0.15095
block3:dist1           -0.20817    0.16485  -1.263  0.20666
block1:dist2           -0.06583    0.16732  -0.393  0.69399
block2:dist2           -0.46049    0.17428  -2.642  0.00824 **
block3:dist2            0.32324    0.16807   1.923  0.05445 .
block1:dist3           -0.10378    0.17154  -0.605  0.54519
block2:dist3            0.39386    0.16621   2.370  0.01780 *
block3:dist3            0.01053    0.16921   0.062  0.95039
sequence1:block1:dist1 -0.20521    0.15711  -1.306  0.19150
sequence1:block2:dist1 -0.09865    0.15961  -0.618  0.53652
sequence1:block3:dist1  0.52306    0.16119   3.245  0.00117 **
sequence1:block1:dist2  0.20116    0.16463   1.222  0.22177
sequence1:block2:dist2  0.46238    0.17288   2.675  0.00748 **
sequence1:block3:dist2 -0.70057    0.16512  -4.243 2.21e-05 ***
sequence1:block1:dist3 -0.01892    0.16867  -0.112  0.91068
sequence1:block2:dist3 -0.27270    0.16451  -1.658  0.09738 .
sequence1:block3:dist3 -0.01453    0.16565  -0.088  0.93012
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Accuracies, random effects:

```
Groups      Name        Variance Std.Dev. Corr
 participant (Intercept) 1.2929   1.1370
             block1      0.5815   0.7625   -0.41
             block2      0.4755   0.6896    0.60 -0.46
```

```
            block3      0.6245   0.7902   -0.25 -0.51 -0.42
            dist1       0.3793   0.6159   -0.59 -0.06 -0.31  0.46
            dist2       0.2547   0.5047    0.43 -0.29  0.96 -0.46 -0.23
            dist3       0.1956   0.4423   -0.27  0.72 -0.85  0.06  0.01 -
0.79
Number of obs: 2176, groups:  participant, 34
```

Latencies, fixed effects:

```
                             Estimate Std. Error  df t value Pr(>|t|)
(Intercept)              1.236e+00  8.303e-02  3.203e+01  14.886 6.05e-16 *
**
sequence1               -1.985e-01  8.303e-02  3.203e+01  -2.391 0.022873 *
block1                  -3.683e-02  4.046e-02  3.306e+01  -0.910 0.369166
block2                  -1.007e-01  3.557e-02  3.809e+01  -2.832 0.007356 *
*
block3                   1.714e-01  4.232e-02  3.172e+01   4.050 0.000308 *
**
dist1                    8.515e-02  3.730e-02  3.288e+01   2.283 0.029031 *
dist2                    6.622e-02  3.008e-02  5.661e+01   2.201 0.031810 *
dist3                   -6.638e-02  3.127e-02  3.504e+01  -2.123 0.040934 *
sequence1:block1        -3.145e-02  4.046e-02  3.306e+01  -0.777 0.442432
sequence1:block2        -1.220e-02  3.557e-02  3.809e+01  -0.343 0.733444
sequence1:block3        -5.162e-02  4.232e-02  3.172e+01  -1.220 0.231583
sequence1:dist1          7.959e-02  3.730e-02  3.288e+01   2.134 0.040416 *
sequence1:dist2         -7.501e-02  3.008e-02  5.661e+01  -2.493 0.015601 *
sequence1:dist3         -2.336e-02  3.127e-02  3.504e+01  -0.747 0.460114
block1:dist1            -2.542e-02  4.807e-02  1.331e+03  -0.529 0.597002
block2:dist1            -3.546e-02  4.617e-02  1.340e+03  -0.768 0.442558
block3:dist1             1.663e-02  4.568e-02  1.270e+03   0.364 0.715922
block1:dist2            -2.828e-02  4.507e-02  1.312e+03  -0.627 0.530466
block2:dist2            -9.487e-02  4.490e-02  1.320e+03  -2.113 0.034773 *
block3:dist2             6.840e-02  4.521e-02  1.321e+03   1.513 0.130521
block1:dist3             7.153e-03  4.275e-02  1.324e+03   0.167 0.867130
block2:dist3             8.567e-02  4.364e-02  1.335e+03   1.963 0.049818 *
block3:dist3             1.615e-02  4.315e-02  1.325e+03   0.374 0.708181
sequence1:block1:dist1 -6.197e-03  4.807e-02  1.331e+03  -0.129 0.897438
sequence1:block2:dist1  1.799e-03  4.617e-02  1.340e+03   0.039 0.968925
sequence1:block3:dist1  5.597e-02  4.568e-02  1.270e+03   1.225 0.220752
sequence1:block1:dist2  8.724e-02  4.507e-02  1.312e+03   1.936 0.053105 .
sequence1:block2:dist2  7.130e-02  4.490e-02  1.320e+03   1.588 0.112500
sequence1:block3:dist2 -8.834e-02  4.521e-02  1.321e+03  -1.954 0.050906 .
sequence1:block1:dist3 -1.406e-02  4.275e-02  1.324e+03  -0.329 0.742287
sequence1:block2:dist3 -3.490e-02  4.364e-02  1.335e+03  -0.800 0.423911
sequence1:block3:dist3 -1.473e-02  4.315e-02  1.325e+03  -0.341 0.732842
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Latencies, random effects:

```
 Groups      Name        Variance Std.Dev. Corr
 participant (Intercept) 0.226699 0.47613
             block1      0.032744 0.18095   0.53
             block2      0.020816 0.14428  -0.11  0.30
             block3      0.038559 0.19636  -0.62 -0.77  0.26
             dist1       0.021910 0.14802   0.74  0.43 -0.63 -0.73
             dist2       0.007316 0.08554  -0.02  0.08  0.80  0.53 -0.46
             dist3       0.011915 0.10915   0.52  0.36  0.36 -0.45  0.01 -
0.05
 Residual                0.307287 0.55433
Number of obs: 1479, groups:  participant, 34
```

Preferences, fixed effects:

```
                        Estimate Std. Error       df t value Pr(>|t|)
```

```
(Intercept)               3.96875    0.17712  31.99999  22.407  < 2e-16 **
*
sequence1                -0.06801    0.17712  31.99999  -0.384  0.70352
ring1                    -0.11949    0.05245 472.00000  -2.278  0.02317 *
direct1                   0.17096    0.07829  32.00000   2.184  0.03643 *
sequence1:ring1          -0.02390    0.05245 472.00000  -0.456  0.64889
sequence1:direct1         0.11213    0.07829  32.00000   1.432  0.16176
ring1:direct1            -0.16728    0.05245 472.00000  -3.189  0.00152 **
sequence1:ring1:direct1  -0.03493    0.05245 472.00000  -0.666  0.50581
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Preferences, random effects:

```
 Groups      Name        Variance Std.Dev. Corr
 participant (Intercept) 0.9731   0.9865
             direct1     0.1149   0.3389   0.27
 Residual                1.4966   1.2234
Number of obs: 544, groups:  participant, 34
```

Experiment 6

Accuracies, fixed effects:

```
                 Estimate Std. Error z value Pr(>|z|)
(Intercept)       2.99156    0.30937   9.670  < 2e-16 ***
distance1        -1.20215    0.22586  -5.323 1.02e-07 ***
distance2         0.08249    0.17300   0.477 0.633479
style1            0.31220    0.29425   1.061 0.288694
style2            0.71060    0.36372   1.954 0.050736 .
style3           -0.20029    0.26121  -0.767 0.443203
style4           -0.20822    0.26347  -0.790 0.429357
style5            0.19881    0.29647   0.671 0.502474
distance1:style1 -0.33691    0.20015  -1.683 0.092324 .
distance2:style1  0.46250    0.22148   2.088 0.036778 *
distance1:style2 -0.55078    0.22905  -2.405 0.016187 *
distance2:style2  0.87994    0.25794   3.411 0.000646 ***
distance1:style3 -0.14627    0.19475  -0.751 0.452626
distance2:style3 -0.31365    0.19624  -1.598 0.109980
distance1:style4  0.34705    0.19268   1.801 0.071680 .
distance2:style4 -0.32652    0.19549  -1.670 0.094863 .
distance1:style5  0.62844    0.20292   3.097 0.001955 **
distance2:style5 -0.62379    0.19797  -3.151 0.001628 **
---
```

Accuracies, random effects:

```
Groups Name        Variance Std.Dev. Corr
Part.(Intercept)3.1283   1.7687
    distance1   1.3472   1.1607   -0.41
    distance2   0.3581   0.5984   -0.18 -0.47
    style1      1.1869   1.0894    0.09 -0.67  0.24
    style2      2.1844   1.4780    0.30  0.24 -0.23 -0.21
    style3      1.0906   1.0443   -0.05  0.00  0.18 -0.17 -0.24
    style4      1.1040   1.0507   -0.24  0.49 -0.51 -0.25 -0.11 -0.47
    style5      1.3481   1.1611    0.18 -0.29  0.22 -0.46  0.09 0.13 -0.37
```

Latencies, fixed effects:

	Estimate	Std. Error	t value
(Intercept)	1304.82	57.78	22.583
distance1	78.70	22.98	3.424
distance2	24.95	15.28	1.634
style1	-28.70	41.90	-0.685
style2	-51.27	36.89	-1.390
style3	124.55	39.98	3.116
style4	-51.19	30.39	-1.684
style5	2.12	45.93	0.046
distance1:style1	46.72	31.62	1.478
distance2:style1	-15.57	29.87	-0.521
distance1:style2	-21.61	32.48	-0.665
distance2:style2	-40.13	29.94	-1.340
distance1:style3	-16.87	33.82	-0.499
distance2:style3	62.86	31.91	1.970
distance1:style4	-10.82	31.67	-0.342
distance2:style4	37.50	29.93	1.253
distance1:style5	-46.14	31.14	-1.482
distance2:style5	13.69	30.71	0.446

Latencies, random effects:

Groups	Name	Variance	Std.Dev.	Corr					
Part.	(Intercept)	132676	364.25						
	distance1	12736	112.86	0.24					
distance2		1794	42.35	0.17	-0.12				
style1		52967	230.15	0.10	-0.52	0.59			
style2		35207	187.64	-0.16	-0.13	-0.80	-0.16		
style3		44198	210.23	0.30	0.22	0.24	-0.09	-0.54	
style4		18699	136.74	-0.39	-0.16	-0.46	-0.23	0.18	-0.43
style5		66464	257.81	0.45	0.36	0.14	-0.31	-0.26	-0.11	0.01
Residual			206724	454.67					

Preferences, fixed effects:

	Estimate	Std. Error	t value
(Intercept)	3.471545	0.137056	25.329
style1	-0.008130	0.094285	-0.086
style2	-0.291667	0.087335	-3.340
style3	0.110772	0.104710	1.058
style4	0.202236	0.101447	1.994
style5	-0.114837	0.097273	-1.181
dist1	-0.092480	0.030736	-3.009
direct1	-0.058943	0.041716	-1.413
style1:dist1	-0.005081	0.068728	-0.074
style2:dist1	0.065041	0.068728	0.946
style3:dist1	0.022358	0.068728	0.325
style4:dist1	-0.130081	0.068728	-1.893
style5:dist1	0.022358	0.068728	0.325
style1:direct1	-0.008130	0.068728	-0.118
style2:direct1	0.147358	0.068728	2.144
style3:direct1	-0.035569	0.068728	-0.518
style4:direct1	-0.035569	0.068728	-0.518
style5:direct1	0.001016	0.068728	0.015
dist1:direct1	0.068089	0.030736	2.215
style1:dist1:direct1	-0.122967	0.068728	-1.789
style2:dist1:direct1	-0.150407	0.068728	-2.188
style3:dist1:direct1	0.038618	0.068728	0.562
style4:dist1:direct1	0.002033	0.068728	0.030
style5:dist1:direct1	0.166667	0.068728	2.425

Preferences, random effects:

```
Groups   Name        Variance Std.Dev. Corr
 Part.    (Intercept) 0.73143  0.8552
          direct1     0.03262  0.1806   -0.21
          style1      0.17081  0.4133    0.30  0.05
          style2      0.11906  0.3450   -0.04 -0.01 -0.32
          style3      0.25586  0.5058   -0.03  0.75  0.14  0.24
          style4      0.22828  0.4778   -0.18 -0.23 -0.44 -0.55 -0.60
          style5      0.19427  0.4408    0.22 -0.31 -0.61  0.21 -0.18  0.0
1
          Residual    1.85921  1.3635
```

SUPPLEMENT: Appendix E: General approach to data analysis and results concerning the SDE effect as found in all experiments.

Overview of data analysis

For accuracy, latency, and preference data, we estimated linear mixed models (or generalized linear mixed models with logistic link function) with *participants* as random factors, to determine the best-fitting random structure. The final model with appropriate

random effects was used to evaluate fixed effects (Jaeger, 2008; Judd, Westfall, & Kenny, 2012, see Appendix C). Appendix D contains estimates for fixed and random effects. Effect sizes are reported as Cohen's *dz*. Independent variables used orthogonal sum-to-zero contrasts (deviation or effects coding) where the last factor level of each variable is mapped onto all contrast variables with -1 and all other factor levels are mapped onto exactly one contrast variable with +1. Because by default, lmer-models do not use this coding, we explicitly set the contrasts for these types of models via afex::set_sum_contrasts().

Latencies (correct responses) are trimmed according to the Tukey criterion (outlier trials being values larger (smaller) than the upper (lower) quartile plus (minus) 1.5 times the interquartile range in an individual's distribution of latencies (see Clark-Carter, 2004, Chapter 9). If nothing else reported, type of comparator had no effect, therefore models without this factor are described.

Experiment 1:

1. Accuracy

The overall error level was 16.5%, across participants. The final model contained fixed effects for pair distance (pair 4/5, pair 3/6, pair 2/7, and pair 1/8), ideograph style (Chinese, Georgian, Konkani, Tigrinya), and their interaction. Pair distance was significant, $\chi^2(3) = 46.03$; $p < .001$, with more correct responses at wider pair distances ($M_{45} = .67$; $M_{36} = .82$; $M_{27} = .86$; $M_{18} = .93$, SDE-effect replicated), see Table 1. Responses to pair type 1/8 were more correct than to type 3/6 ($z = -3.24$; $p = .003$) and to type 4/5 ($z = -7.20$; $p < .001$), responses to pair type 2/7 were more correct than to type 4/5 ($z = -5.18$; $p < .001$), and responses to pair type 3/6 were more correct than to type 4/5 ($z = -4.65$; $p < .001$).

The interaction was also significant, $\chi^2(9) = 35.23$; $p < .001$. Bonferroni-Holm corrected contrasts showed the pair distance effect significant for each of the four ideograph styles alone ($p < .01$), but less pronounced in the Georgian style than in other styles.

2. Response latencies

The final model had the same fixed effect structure as above (see Appendix C). Only pair distance was significant, $F(3,33.15) = 6.19$; $p = .002$, showing quicker responding in trials of wider than narrower pairs, (SDE-effect, $M_{45} = 1715$ *ms*; $M_{36} = 1620$ *ms*; $M_{27} = 1512$ *ms*; $M_{18} = 1371$ *ms*), see Table 1. Responses to pair type 1/8 were faster than to type 3/6 ($t(35.9) = 3.02$; $p = .02$), and to type 4/5 ($t(35.2) = 4.34$; $p < .001$). Responses to pair type 2/7 were faster than to type 4/5 ($t(34.5) = 2.97$; $p = .02$).

Experiment 2:

1. Accuracy

The overall error level was 28.9%. The final model contained fixed effects for pair distance (pairs 4/5, 3/6, 2/7, 1/8), list (4 non-word-lists), and the interaction. A significant pair distance effect, $\chi^2(3) = 41.59$; $p < .001$, indicated more correct responses with wider pair distances (SDE, $M_{45} = .55$; $M_{36} = .72$; $M_{27} = .75$; $M_{18} = .82$), Table 2. Responses to pair type 1/8 were more correct than to types 4/5 ($z = -7.36$; $p < .001$), 3/6 ($z = -3.91$; $p < .001$), and 2/7 ($z = -2.57$; $p = .02$); responses to pair type 2/7 were more correct than type 4/5 ($z = -5.30$; $p < .001$), responses to pair type 3/6 were more correct than responses to type 4/5 ($z = -4.88$; $p < .001$). The significant interaction, $\chi^2(9) = 17.11$; $p < .05$, showed a significant SDE in each word list separately (Bonferroni-Holm corrected contrasts, $p < .001$ level), although less pronounced with lists 1 and 3.

2. SDE-Effect: Response latencies

The final model had the same fixed effect structure as above (see Appendix C). Only pair distance was significant, $F(3,45.65) = 3.20$; $p = .03$, showing quicker responding with wider than narrower pairs (SDE, M_{45} = 1735 *ms*; M_{36} = 1800 *ms*; M_{27} = 1649 *ms*; M_{18} = 1591 *ms*), see Table 2. Responses to pair type 1/8 were faster than to type 3/6 ($t(40.3) = 2.77$; $p < .05$), no other post hoc comparison was significant. This, together with the accuracy results, shows that participants presumably generated spatial representation amongst the eight stimuli, thereby determining the difficulty levels between wide and narrow pairs along the comparator dimension.

Experiment 3:

The Tukey criterion was applied for data trimming on a blockwise basis, such that across participants, blocks with extremly high average error rates would be excluded (average percentage correct per block smaller than the lower quartile minus 1.5 times the interquartile range in the sample's distribution of block averages, see Clark-Carter, 2004, Chapter 9).

1. SDE-Effect: Accuracy

Experiment 3a (spatial learning cues). Out of 408 blocks, 39 blocks were excluded, leaving 369 blocks left for analysis. The overall error level after exclusion was 6.39%. The final model used for analysis contained fixed effects for pair distance (pair 3/4, pair 2/5, and pair 1/6), ideograph style (Chinese, Georgian, Konkani, and Tigrinya), number of learning cycles (3, 5, and 8), and the three-way interaction of these factors. There was a significant fixed factor effect for pair distance, $\chi^2(2) = 23.98$; $p < .001$, indicating that responses were more correct with wider pair distances (M_{34} = .89; M_{25} = .94; M_{16} = .96), thus replicating the SDE, see Table 3. In particular, responses to pair type 1/6 were more correct than responses to pair type 3/4 ($z = -4.22$; $p < .001$) and responses to pair type 2/5 were more correct than

responses to pair type 3/4 (z = -3.48; p < .001), but responses to pair type 1/6 were not significantly more correct than responses to pair type 2/5 (z = -1.39; p = .34).

The interaction between pair distance and ideograph style was also significant, $\chi^2(6) = 18.81$; p = .004, indicating that the pair distance effect was more pronounced in the Chinese ideograph block as compared to the other three styles. We also found a significant triple-interaction between pair distance, ideograph style, and number of learning cycles, $\chi^2(12) = 40.06$; p < .001, which was not interpreted.

Experiment 3b (temporal learning cues). Out of 404 blocks, 56 blocks were excluded, leaving 348 blocks left for analysis. The overall error level after exclusion was 3.16%. The final model used for analysis was of the same structure as the previous one for Experiment 8a. There was a significant fixed factor effect for pair distance, $\chi^2(2) = 23.94$; p < .001, indicating that responses were more correct with wider pair distances (M_{34} = .95; M_{25} = . 98; M_{16} = .98), thus replicating the SDE, see Table 3. In particular, responses to pair type 1/6 were more correct than responses to pair type 3/4 (z = -3.79; p <.001) and responses to pair type 2/5 were more correct than responses to pair type 3/4 (z = -4.02; p < .001), but responses to pair type 1/6 were not significantly more correct than responses to pair type 2/5 (z = .20; p = .97). No further significant effects were observed.

2. SDE-Effect: Response latencies

Experiment 3a (spatial learning cues). The final model used for analysis had the same fixed effect structure as the one reported for accuracy (for its random effect structure see Appendix C). In this model, pair distance had a significant effect, $F(2,92.78) = 50.96$; p < .001, replicating the SDE by showing quicker responding in trials of wider than narrower pair distance, (M_{34} = 2160 *ms*; M_{25} = 1748 *ms*; M_{16} = 1469 *ms*), see Table 3. In particular, responses to pair type 1/6 were faster than responses to pair type 3/4 (*t-ratio* = 10.14 (*df* = 95.5); p <.001), responses to pair type 1/6 were faster than responses to pair type 2/5 (*t-ratio*

= 6.19 (*df* = 93.0); $p < .001$), and responses to pair type 2/5 were faster than responses to pair type 3/4 (*t-ratio* = 7.05 (*df* = 94.2); $p < .001$).

Ideograph style also had a significant main effect, $F(3,88.48) = 5.58$; $p < .001$, indicating that responses to Chinese ideographs were slowest as compared to the other three ideograph styles, *p*s < .04, with no other post hoc differences being significant. There was also a significant interaction of pair distance and ideograph style, $F(6,3709.17) = 2.50$; $p = .02$, with the SDE appearing more pronounced in Chinese and Georgian scripts as compared to Konkani and Tigrinya, *p*s < .05. No further effects were significant.

Experiment 3b (temporal learning cues). A similar model as above was fitted and statistically evaluated (for its random effect structure see Appendix C). In this model, pair distance had a significant effect, $F(2,92.19) = 72.58$; $p < .001$, replicating the SDE by showing quicker responding in trials of wider than narrower pair distance, (M_{34} = 2077 *ms*; M_{25} = 1808 *ms*; M_{16} = 1437 *ms*), see Table 3. In particular, responses to pair type 1/6 were faster than responses to pair type 3/4 (*t-ratio* = 11.75 (*df* = 92.9); $p < .001$), responses to pair type 1/6 were faster than responses to pair type 2/5 (*t-ratio* = 6.96 (*df* = 93.3); $p < .001$), and responses to pair type 2/5 were faster than responses to pair type 3/4 (*t-ratio* = 4.23 (*df* = 93.5); $p < .001$). Ideograph style also had a significant main effect, $F(3,83.58) = 3.99$; $p < .01$, indicating that responses to Chinese ideographs were slower than those to Georgian, $p = .04$, as well as responses to Konkani ideographs being slower than those to Georgian, $p = .04$. No further effects were significant.

Experiment 4:

SDE-Effect: Accuracy

The overall error level was 18%. The final model contained fixed effects for pair distance (pair 3/4, pair 2/5, and pair 1/6), ideograph style (Chinese, Georgian, Konkani, and

Tigrinya), type of comparator, and their interaction. A significant effect for pair distance, $\chi^2(3) = 199.67$; $p < .001$, indicated more correct responses with wider pair distances (SDE, $M_{45} = .67$; $M_{36} = .80$; $M_{27} = .87$; $M_{18} = .92$), see Table 4. Responses to pair type 1/8 were more correct than to type 4/5 ($z = -12.66$; $p < .001$), responses to pair type 1/8 were more correct than responses to pair type 3/6 ($z = -8.80$; $p < .001$), responses to type 1/8 were more correct than to type 2/7 ($z = -3.55$; $p < .001$), responses to type 2/7 were more correct than to type 4/5 ($z = -11.66$; $p < .001$), responses to type 2/7 were more correct than to type 3/6 ($z = -6.59$; $p < .001$), and responses to type 3/6 were more correct than to type 4/5 ($z = -8.04$; $p < .001$).

The interaction showed, $\chi^2(9) = 30.57$; $p = .0004$, that the SDE was less pronounced for Georgian letters than for other types (ps < .01). Type of comparator was significant, $\chi^2(1) = 21.29$; $p < .001$, with accuracies higher for comparator "*old*" ($M = .84$) than for "*more frequently used*" ($M = .79$, $z = 4.76$; $p < .001$).

SDE-Effect: Response latencies

The final model had the same fixed effect structure as above (Appendix C). Pair distance had a significant effect, $F(3,229.18) = 37.72$; $p < .001$, showing quicker responding in trials of wider than narrower pair distance, (SDE, $M_{45} = 1790$ *ms*; $M_{36} = 1694$ *ms*; $M_{27} = 1601$ *ms*; $M_{18} = 1491$ *ms*), see Table 4. In particular, responses to pair type 1/8 were faster than to type 4/5 ($z = 10.28$; $p < .001$), to type 3/6 ($z = 8.13$; $p < .001$), and to type 2/7 ($z = 4.64$; $p < .001$). Responses to pair type 2/7 were faster than to type 4/5 ($z = 7.95$; $p < .001$) and to type 3/6 ($z = 4.37$; $p < .001$), and responses to pair type 3/6 were faster than responses to type 4/5 ($z = 4.44$; $p < .001$).

Type of ideograph, $F(3,218.32) = 13.29$; $p < .001$, showed that, as post-hoc tests revealed (ps < .001), participants needed on average longer to respond to Chinese ideographs ($M = 1819$ *ms*) as compared to Georgian ($M = 1595$ *ms*), Konkani ($M = 1626$ *ms*) or Tigrinya

ideographs (M = 1501 *ms*). Lastly, type of comparator was significant, $F(1,226.18) = 29.75$; $p < .001$ with slower responding to "*older than*" items (M = 1673 *ms*) than to "*more frequently used*" items (M = 1592 *ms;* $z = 5.46$; $p < .001$).

Experiment 5:

SDE-Effect: Accuracy

The overall error level was 27%. The final model contained fixed effects for pair distance (pairs 4/5, 3/6, 2/7, 1/8), list (4 non-word-lists), and the interaction. A significant pair distance effect, $\chi^2(3) = 18.11$; $p < .001$, indicated more correct responses with wider pair distances (SDE, M_{45} = .65; M_{36} = .69; M_{27} = .75; M_{18} = .81), see Table 5. Responses to pair type 1/8 were more correct than to types 4/5 ($z = 4.32$; $p < .001$), 3/6 ($z = 3.00$; $p < .01$), and 2/7 ($z = 2.44$; $p = .04$); responses to pair type 2/7 were more correct than type 4/5 ($z = 2.96$; $p < .01$).

SDE-Effect: Response latencies

The final model had the same fixed effect structure as above (see Appendix C). Pair distance was significant, $F(3,38.23) = 5.63$; $p = .003$, showing a tendency to quicker responding with wider than narrower pairs (SDE, M_{45} = 1305 *ms*; M_{36} = 1329 *ms*; M_{27} = 1157 *ms*; M_{18} = 1187 *ms*), see Table 5. Responses to pair type 1/8 were faster than to types 4/5 ($z = 4.32$; $p < .001$), 3/6 ($z = 3.00$; $p < .01$) and 2/7 ($z = 2.44$; $p < .04$), as well as faster to type 2/7 than type 4/5 ($z = 2.96$; $p < .01$). This, together with the accuracy results, shows that participants presumably generated spatial representation amongst the eight stimuli, thereby determining the difficulty levels between wide and narrow pairs along the comparator dimension.

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