Results

Mixed Model - Overall 3x3

Model Info

Info	
Estimate	Linear mixed model fit by REML
Call	efrc_err ~ 1 + feedback + model + feedback:model+(1 | ppid)
AIC	-4255.904
BIC	-4119.011
LogLikel.	2099.294
R-squared Marginal	0.724
R-squared Conditional	0.804
Converged	yes
Optimizer	bobyqa

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
feedback	37.88	2	1357	< .001
model	2488.32	2	1354	< .001
feedback ✻ model	3.11	4	1354	0.015

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

Names	Effect	Estimate	SE	95% Confidence Interval		df	t	p
				Lower	Upper			
(Intercept)	(Intercept)	0.17481	0.00676	0.1616	0.18807	22.8	25.841	< .001
feedback1	hand - cursor	0.02269	0.00327	0.0163	0.02910	1355.1	6.939	< .001
feedback2	none - cursor	0.02656	0.00338	0.0199	0.03318	1357.7	7.866	< .001
model1	bbox - cog	0.01749	0.00333	0.0110	0.02401	1353.8	5.255	< .001
model2	random - cog	0.21148	0.00333	0.2050	0.21800	1353.8	63.552	< .001
feedback1 ✻ model1	hand - cursor ✻ bbox - cog	-0.00229	0.00797	-0.0179	0.01334	1353.8	-0.287	0.774
feedback2 ✻ model1	none - cursor ✻ bbox - cog	-0.00900	0.00816	-0.0250	0.00700	1353.8	-1.103	0.270
feedback1 ✻ model2	hand - cursor ✻ random - cog	-0.01344	0.00797	-0.0291	0.00218	1353.8	-1.686	0.092
feedback2 ✻ model2	none - cursor ✻ random - cog	-0.02802	0.00816	-0.0440	-0.01203	1353.8	-3.434	< .001

Random Components

Groups	Name	SD	Variance	ICC
ppid	(Intercept)	0.0324	0.00105	0.293
Residual		0.0505	0.00255	

Anmerkung. Number of Obs: 1386 , groups: ppid 24

Post Hoc Tests

Post Hoc Comparisons - feedback

Comparison			Difference	SE	t	df	p_{holm}
feedback		feedback					
cursor	-	hand	-0.02269	0.00327	-6.94	1355	< .001
cursor	-	none	-0.02656	0.00338	-7.87	1358	< .001
hand	-	none	-0.00387	0.00345	-1.12	1358	0.262

Post Hoc Comparisons - model

Comparison			Difference	SE	t	df	p_{holm}
model		model					
bbox	-	random	-0.1940	0.00333	-58.30	1354	< .001
cog	-	bbox	-0.0175	0.00333	-5.26	1354	< .001
cog	-	random	-0.2115	0.00333	-63.55	1354	< .001

Post Hoc Comparisons - feedback ✻ model

Comparison									
feedback	model		feedback	model	Difference	SE	t	df	p_{holm}
cursor	bbox	-	cursor	random	-0.20405	0.00552	-36.955	1354	< .001
cursor	bbox	-	hand	bbox	-0.02564	0.00565	-4.542	1354	< .001
cursor	bbox	-	hand	random	-0.21854	0.00565	-38.707	1354	< .001
cursor	bbox	-	none	bbox	-0.02990	0.00580	-5.158	1355	< .001
cursor	bbox	-	none	random	-0.21493	0.00580	-37.077	1355	< .001
cursor	cog	-	cursor	bbox	-0.02125	0.00552	-3.848	1354	0.001
cursor	cog	-	cursor	random	-0.22530	0.00552	-40.803	1354	< .001
cursor	cog	-	hand	bbox	-0.04689	0.00565	-8.306	1354	< .001
cursor	cog	-	hand	cog	-0.02793	0.00565	-4.947	1354	< .001
cursor	cog	-	hand	random	-0.23979	0.00565	-42.471	1354	< .001
cursor	cog	-	none	bbox	-0.05115	0.00580	-8.824	1355	< .001
cursor	cog	-	none	cog	-0.03890	0.00580	-6.710	1355	< .001
cursor	cog	-	none	random	-0.23618	0.00580	-40.743	1355	< .001
cursor	random	-	hand	random	-0.01449	0.00565	-2.567	1354	0.083
cursor	random	-	none	random	-0.01088	0.00580	-1.877	1355	0.365
hand	bbox	-	cursor	random	-0.17840	0.00565	-31.599	1354	< .001
hand	bbox	-	hand	random	-0.19289	0.00575	-33.548	1354	< .001
hand	bbox	-	none	bbox	-0.00426	0.00591	-0.720	1355	0.944
hand	bbox	-	none	random	-0.18928	0.00591	-32.018	1355	< .001
hand	cog	-	cursor	bbox	0.00668	0.00565	1.184	1354	0.710
hand	cog	-	cursor	random	-0.19736	0.00565	-34.957	1354	< .001
hand	cog	-	hand	bbox	-0.01896	0.00575	-3.298	1354	0.010
hand	cog	-	hand	random	-0.21185	0.00575	-36.845	1354	< .001
hand	cog	-	none	bbox	-0.02322	0.00591	-3.927	1355	0.001
hand	cog	-	none	cog	-0.01097	0.00591	-1.855	1355	0.365
hand	cog	-	none	random	-0.20824	0.00591	-35.226	1355	< .001
hand	random	-	none	random	0.00361	0.00591	0.611	1355	0.944
none	bbox	-	cursor	random	-0.17415	0.00580	-30.043	1355	< .001
none	bbox	-	hand	random	-0.18864	0.00591	-31.909	1355	< .001
none	bbox	-	none	random	-0.18503	0.00601	-30.791	1354	< .001
none	cog	-	cursor	bbox	0.01765	0.00580	3.045	1355	0.021
none	cog	-	cursor	random	-0.18640	0.00580	-32.156	1355	< .001
none	cog	-	hand	bbox	-0.00800	0.00591	-1.353	1355	0.706
none	cog	-	hand	random	-0.20089	0.00591	-33.982	1355	< .001
none	cog	-	none	bbox	-0.01225	0.00601	-2.039	1354	0.292
none	cog	-	none	random	-0.19728	0.00601	-32.830	1354	< .001

Estimated Marginal Means

feedback

				95% Confidence Interval	
feedback	**Mean**	**SE**	**df**	**Lower**	**Upper**
cursor	0.158	0.00700	26.1	0.144	0.173
hand	0.181	0.00703	26.7	0.167	0.196
none	0.185	0.00708	27.4	0.170	0.199

Anmerkung. Estimated means are estimated averaging across interacting variables

model

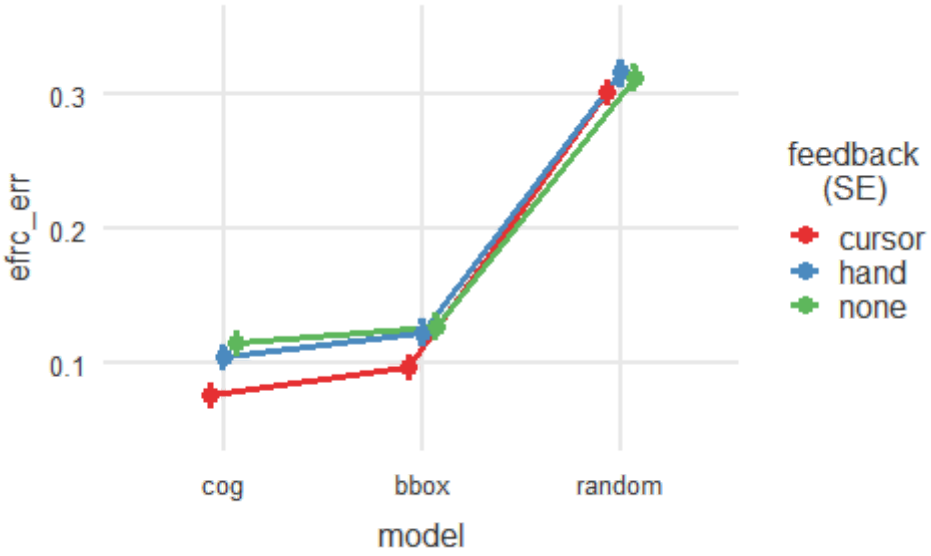
				95% Confidence Interval	
model	**Mean**	**SE**	**df**	**Lower**	**Upper**
cog	0.0985	0.00703	26.6	0.0840	0.113
bbox	0.1160	0.00703	26.6	0.1015	0.130
random	0.3100	0.00703	26.6	0.2955	0.324

Anmerkung. Estimated means are estimated averaging across interacting variables

feedback:model

					95% Confidence Interval	
feedback	**model**	**Mean**	**SE**	**df**	**Lower**	**Upper**
cursor	cog	0.0762	0.00769	38.0	0.0606	0.0918
hand	cog	0.1041	0.00778	39.8	0.0884	0.1199
none	cog	0.1151	0.00789	42.0	0.0992	0.1310
cursor	bbox	0.0975	0.00769	38.0	0.0819	0.1130
hand	bbox	0.1231	0.00778	39.8	0.1074	0.1388
none	bbox	0.1274	0.00789	42.0	0.1114	0.1433
cursor	random	0.3015	0.00769	38.0	0.2859	0.3171
hand	random	0.3160	0.00778	39.8	0.3003	0.3317
none	random	0.3124	0.00789	42.0	0.2965	0.3283

Effects Plots



Mixed Model - Sphere

Model Info

	Info
Estimate	Linear mixed model fit by REML
Call	efrc_err_cursor ~ 1 + model+(1 + model | ppid)
AIC	-1862.362
BIC	-1793.178
LogLikel.	927.672
R-squared Marginal	0.815
R-squared Conditional	0.906
Converged	yes
Optimizer	bobyqa

Anmerkung. (Almost) singular fit. Maybe random coefficients variances are too small or correlations among them too large.
Anmerkung. boundary (singular) fit: see help('isSingular')

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
model	568	2	44.8	< .001

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	0.1583	0.00657	0.1454	0.1711	23.0	24.08	< .001
model1	bbox - cog	0.0212	0.00401	0.0134	0.0291	90.5	5.30	< .001
model2	random - cog	0.2253	0.00727	0.2110	0.2395	24.7	30.99	< .001

Random Components

Groups	**Name**	**SD**	**Variance**	**ICC**
ppid	(Intercept)	0.03130	9.80e-4	0.452
	model1	0.00661	4.37e-5	
	model2	0.03044	9.27e-4	
Residual		0.03447	0.00119	

Anmerkung. Number of Obs: 501 , groups: ppid 24

Random Parameters correlations

Groups	**Param.1**	**Param.2**	**Corr.**
ppid	(Intercept)	model1	-1.000
	(Intercept)	model2	-1.000
	model1	model2	1.000

Post Hoc Tests

Post Hoc Comparisons - model

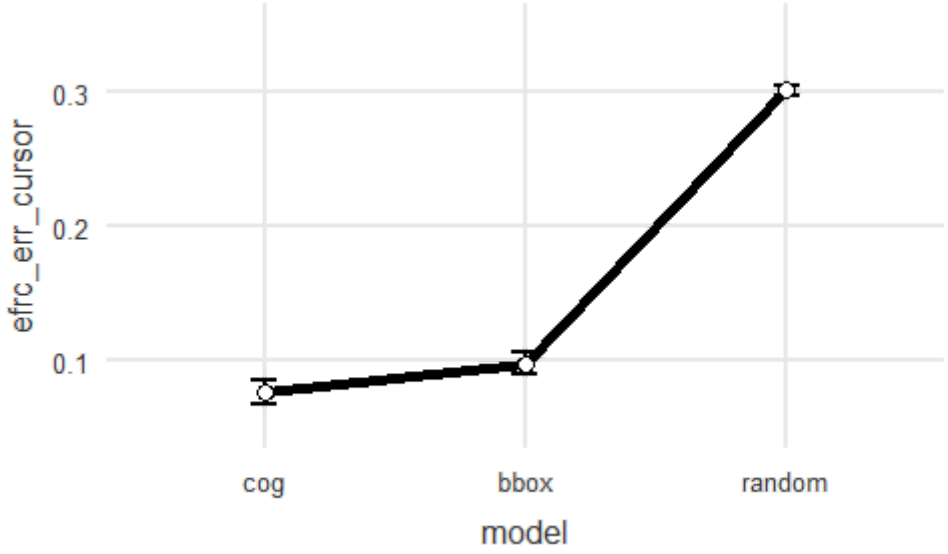
Comparison							
model		**model**	**Difference**	**SE**	**t**	**df**	**p_{holm}**
bbox	-	random	-0.2040	0.00616	-33.14	23.0	< .001
cog	-	bbox	-0.0212	0.00401	-5.30	23.0	< .001
cog	-	random	-0.2253	0.00727	-30.99	23.0	< .001

Estimated Marginal Means

model

				95% Confidence Interval	
model	**Mean**	**SE**	**df**	**Lower**	**Upper**
cog	0.0761	0.00930	23.1	0.0568	0.0953
bbox	0.0973	0.00802	23.2	0.0807	0.1139
random	0.3014	0.00379	30.0	0.2936	0.3091

Effects Plots



Mixed Model - Hand Model

Model Info

Info	
Estimate	Linear mixed model fit by REML
Call	efrc_err_hand ~ 1 + model+(1 | ppid)
AIC	-1471.334
BIC	-1425.368
LogLikel.	728.023
R-squared Marginal	0.703
R-squared Conditional	0.842
Converged	yes
Optimizer	bobyqa

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
model	1028	2	435	< .001

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	0.1813	0.00897	0.16375	0.1989	22.2	20.21	< .001
model1	bbox - cog	0.0190	0.00517	0.00883	0.0291	435.2	3.67	< .001
model2	random - cog	0.2119	0.00517	0.20172	0.2220	435.2	40.98	< .001

Random Components

Groups	Name	SD	Variance	ICC
ppid	(Intercept)	0.0426	0.00182	0.469
Residual		0.0454	0.00206	

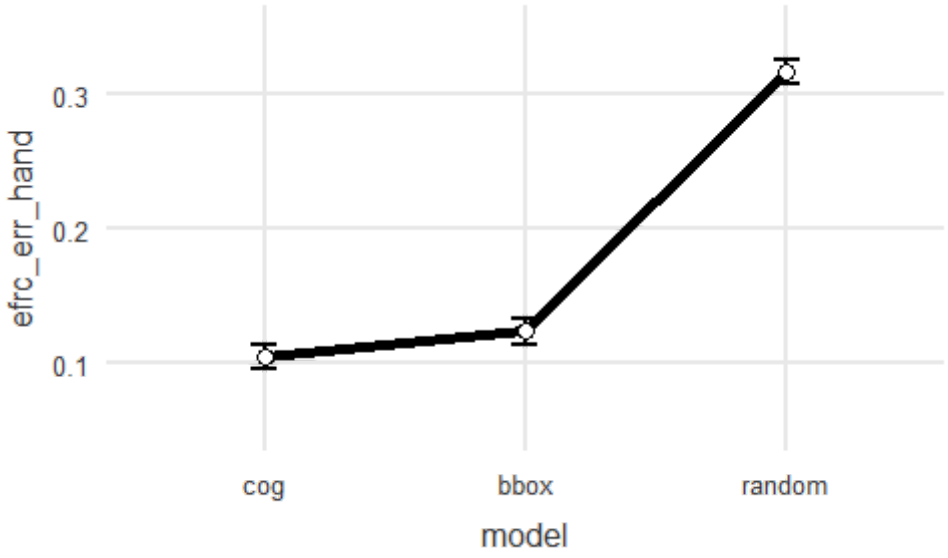
Anmerkung. Number of Obs: 462 , groups: ppid 24

Estimated Marginal Means

model

				95% Confidence Interval	
model	**Mean**	**SE**	**df**	**Lower**	**Upper**
cog	0.104	0.00946	27.4	0.0850	0.124
bbox	0.123	0.00946	27.4	0.1040	0.143
random	0.316	0.00946	27.4	0.2969	0.336

Effects Plots



Mixed Model - No Feedback

Model Info

	Info
Estimate	Linear mixed model fit by REML
Call	efrc_err_none ~ 1 + model+(1 + model | ppid)
AIC	-1367.181
BIC	-1302.207
LogLikel.	681.340
R-squared Marginal	0.558
R-squared Conditional	0.868
Converged	yes
Optimizer	bobyqa

Anmerkung. (Almost) singular fit. Maybe random coefficients variances are too small or correlations among them too large.
Anmerkung. boundary (singular) fit: see help('isSingular')

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
model	221	2	35.9	< .001

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	0.1953	0.01333	0.16915	0.2214	21.6	14.65	< .001
model1	bbox - cog	0.0113	0.00523	0.00108	0.0216	103.9	2.17	0.033
model2	random - cog	0.1911	0.00976	0.17198	0.2102	19.8	19.58	< .001

Random Components

Groups	**Name**	**SD**	**Variance**	**ICC**
ppid	(Intercept)	0.06295	0.00396	0.686
	model1	0.00600	3.60e-5	
	model2	0.03988	0.00159	
Residual		0.04259	0.00181	

Anmerkung. Number of Obs: 423 , groups: ppid 23

Random Parameters correlations

Groups	**Param.1**	**Param.2**	**Corr.**
ppid	(Intercept)	model1	-1.000
	(Intercept)	model2	-1.000
	model1	model2	1.000

Post Hoc Tests

Post Hoc Comparisons - model

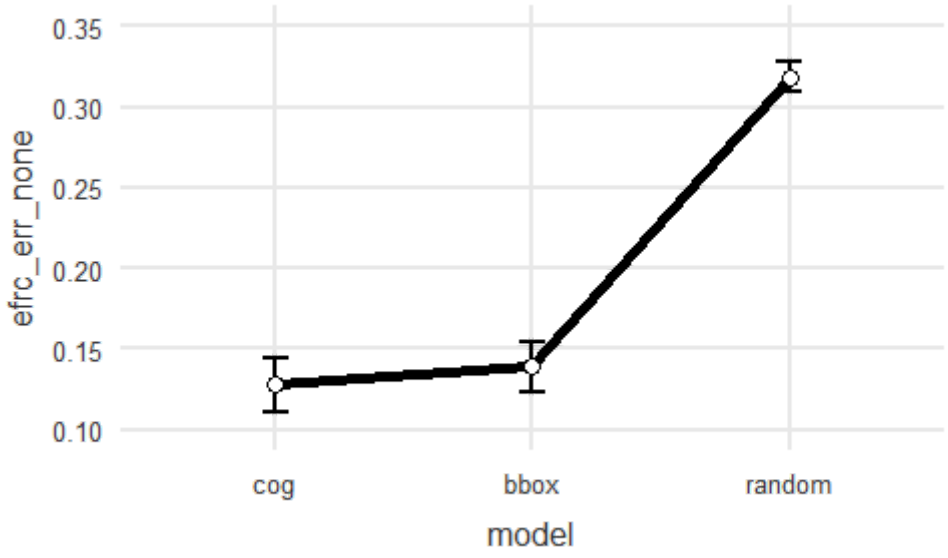
Comparison							
model		**model**	**Difference**	**SE**	**t**	**df**	**p_{holm}**
bbox	-	random	-0.1798	0.00874	-20.58	21.7	< .001
cog	-	bbox	-0.0113	0.00526	-2.15	20.4	0.044
cog	-	random	-0.1911	0.00978	-19.54	21.8	< .001

Estimated Marginal Means

model

				95% Confidence Interval	
model	**Mean**	**SE**	**df**	**Lower**	**Upper**
cog	0.128	0.01675	21.2	0.0930	0.163
bbox	0.139	0.01553	21.1	0.1068	0.171
random	0.319	0.00879	20.0	0.3006	0.337

Effects Plots



Mixed Model - CoM

Model Info

Info	
Estimate	Linear mixed model fit by REML
Call	efrc_err_cog ~ 1 + feedback+(1 | ppid)
AIC	-1309.6360
BIC	-1264.3987
LogLikel.	647.5382
R-squared Marginal	0.0568
R-squared Conditional	0.3936
Converged	yes
Optimizer	bobyqa

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
feedback	21.2	2	438	< .001

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	0.0989	0.00870	0.0819	0.1159	22.6	11.37	< .001
feedback1	hand - cursor	0.0290	0.00613	0.0170	0.0410	436.5	4.73	< .001
feedback2	none - cursor	0.0389	0.00632	0.0265	0.0513	438.3	6.16	< .001

Random Components

Groups	Name	SD	Variance	ICC
ppid	(Intercept)	0.0407	0.00166	0.357
Residual		0.0546	0.00298	

Anmerkung. Number of Obs: 462 , groups: ppid 24

Estimated Marginal Means

feedback

				95% Confidence Interval	
feedback	**Mean**	**SE**	**df**	**Lower**	**Upper**
cursor	0.0762	0.00932	29.8	0.0572	0.0953
hand	0.1053	0.00942	31.1	0.0860	0.1245
none	0.1152	0.00955	32.7	0.0958	0.1346

Effects Plots

Mixed Model - BBox

Model Info

Info	
Estimate	Linear mixed model fit by REML
Call	efrc_err_bbox ~ 1 + feedback+(1 | ppid)
AIC	-1213.5402
BIC	-1168.5957
LogLikel.	599.6367
R-squared Marginal	0.0340
R-squared Conditional	0.2893
Converged	yes
Optimizer	bobyqa

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
feedback	10.9	2	438	< .001

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	0.1160	0.00803	0.1002	0.1317	22.4	14.45	< .001
feedback1	hand - cursor	0.0259	0.00687	0.0124	0.0393	436.7	3.76	< .001
feedback2	none - cursor	0.0296	0.00708	0.0157	0.0435	439.2	4.18	< .001

Random Components

Groups	**Name**	**SD**	**Variance**	**ICC**
ppid	(Intercept)	0.0367	0.00135	0.264
Residual		0.0612	0.00375	

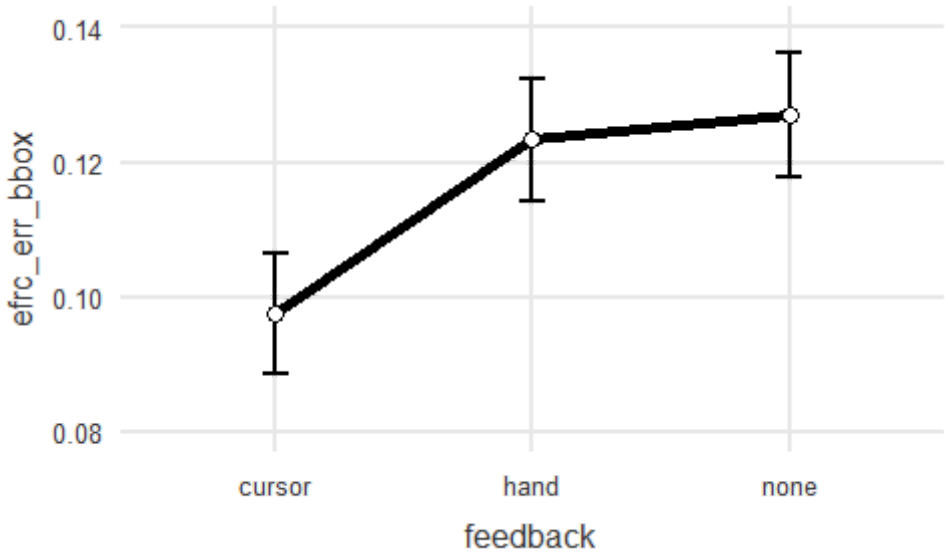
Anmerkung. Number of Obs: 462 , groups: ppid 24

Estimated Marginal Means

feedback

				95% Confidence Interval	
feedback	**Mean**	**SE**	**df**	**Lower**	**Upper**
cursor	0.0975	0.00886	33.3	0.0794	0.115
hand	0.1233	0.00899	35.1	0.1051	0.142
none	0.1271	0.00916	37.6	0.1085	0.146

Effects Plots



Mixed Model - Random

Model Info

Info	
Estimate	Linear mixed model fit by REML
Call	efrc_err_random ~ 1 + feedback+(1 | ppid)
AIC	-1948.4273
BIC	-1898.7380
LogLikel.	964.7079
R-squared Marginal	0.0303
R-squared Conditional	0.2936
Converged	yes
Optimizer	bobyqa

[3]

Model Results

Fixed Effect Omnibus tests

	F	Num df	Den df	p
feedback	9.77	2	438	< .001

Anmerkung. Satterthwaite method for degrees of freedom

Fixed Effects Parameter Estimates

				95% Confidence Interval				
Names	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	(Intercept)	0.3093	0.00368	0.30213	0.3166	22.4	84.09	< .001
feedback1	hand - cursor	0.0122	0.00310	0.00617	0.0183	436.6	3.95	< .001
feedback2	none - cursor	0.0115	0.00320	0.00519	0.0177	439.0	3.58	< .001

Random Components

Groups	Name	SD	Variance	ICC
ppid	(Intercept)	0.0169	2.84e-4	0.272
Residual		0.0276	7.62e-4	

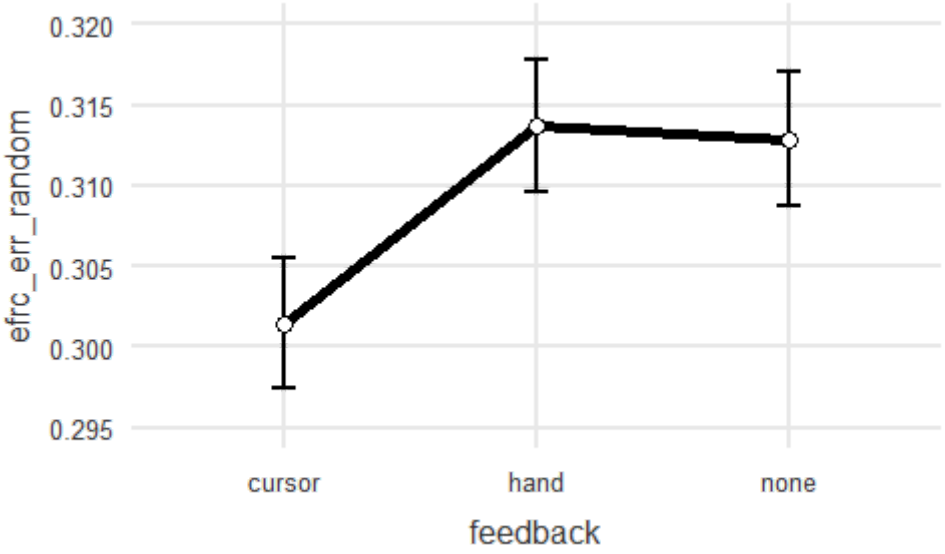
Anmerkung. Number of Obs: 462 , groups: ppid 24

Estimated Marginal Means

feedback

				95% Confidence Interval	
feedback	**Mean**	**SE**	**df**	**Lower**	**Upper**
cursor	0.301	0.00405	32.8	0.293	0.310
hand	0.314	0.00411	34.6	0.305	0.322
none	0.313	0.00418	37.0	0.304	0.321

Effects Plots



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[2] R Core Team (2022). *R: A Language and environment for statistical computing*. (Version 4.1) [Computer software]. Retrieved from https://cran.r-project.org. (R packages retrieved from CRAN snapshot 2023-04-07).

[3] Gallucci, M. (2019). *GAMLj: General analyses for linear models*. [jamovi module]. Retrieved from https://gamlj.github.io/.