General Linear Model

Within-Subjects Factors

Measure: Time

modality	complexity	Dependent Variable
Multi-hand zoom (MH)	Easy	MH_easy
	Medium	MH_medium
	Hard	MH_hard
Single-hand zoom (SH)	Easy	SH_easy
	Medium	SH_medium
	Hard	SH_hard

Descriptive Statistics

	Mean	Std. Deviation	N
MH_easy	42.0718	11.62263	30
MH_medium	76.5706	18.94788	30
MH_hard	95.5537	19.19854	30
SH_easy	39.6880	8.66147	30
SH_medium	65.4519	16.24421	30
SH_hard	88.3702	24.99454	30

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
modality	Pillai's Trace	.259	10.136[b]	1.000	29.000	.003
	Wilks' Lambda	.741	10.136[b]	1.000	29.000	.003
	Hotelling's Trace	.350	10.136[b]	1.000	29.000	.003
	Roy's Largest Root	.350	10.136[b]	1.000	29.000	.003
complexity	Pillai's Trace	.949	260.862[b]	2.000	28.000	<.001
	Wilks' Lambda	.051	260.862[b]	2.000	28.000	<.001
	Hotelling's Trace	18.633	260.862[b]	2.000	28.000	<.001
	Roy's Largest Root	18.633	260.862[b]	2.000	28.000	<.001
modality * complexity	Pillai's Trace	.205	3.621[b]	2.000	28.000	.040
	Wilks' Lambda	.795	3.621[b]	2.000	28.000	.040
	Hotelling's Trace	.259	3.621[b]	2.000	28.000	.040
	Roy's Largest Root	.259	3.621[b]	2.000	28.000	.040

Multivariate Tests[a]

Effect		Partial Eta Squared
modality	Pillai's Trace	.259
	Wilks' Lambda	.259
	Hotelling's Trace	.259
	Roy's Largest Root	.259
complexity	Pillai's Trace	.949
	Wilks' Lambda	.949
	Hotelling's Trace	.949
	Roy's Largest Root	.949
modality * complexity	Pillai's Trace	.205
	Wilks' Lambda	.205
	Hotelling's Trace	.205
	Roy's Largest Root	.205

a. Design: Intercept
Within Subjects Design: modality + complexity + modality * complexity

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: Time

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser
modality	1.000	.000	0	.	1.000
complexity	.857	4.319	2	.115	.875
modality * complexity	.779	7.010	2	.030	.819

Mauchly's Test of Sphericity[a]

Measure: Time

	Epsilon[b]	
Within Subjects Effect	Huynh-Feldt	Lower-bound
modality	1.000	1.000
complexity	.927	.500
modality * complexity	.861	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: modality + complexity + modality * complexity

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: Time

Source		Type III Sum of Squares	df	Mean Square	F
modality	Sphericity Assumed	2139.553	1	2139.553	10.136
	Greenhouse-Geisser	2139.553	1.000	2139.553	10.136
	Huynh-Feldt	2139.553	1.000	2139.553	10.136
	Lower-bound	2139.553	1.000	2139.553	10.136
Error(modality)	Sphericity Assumed	6121.686	29	211.093	
	Greenhouse-Geisser	6121.686	29.000	211.093	
	Huynh-Feldt	6121.686	29.000	211.093	
	Lower-bound	6121.686	29.000	211.093	
complexity	Sphericity Assumed	79124.194	2	39562.097	336.713
	Greenhouse-Geisser	79124.194	1.750	45217.162	336.713
	Huynh-Feldt	79124.194	1.853	42699.206	336.713
	Lower-bound	79124.194	1.000	79124.194	336.713
Error(complexity)	Sphericity Assumed	6814.720	58	117.495	
	Greenhouse-Geisser	6814.720	50.746	134.290	
	Huynh-Feldt	6814.720	53.739	126.812	
	Lower-bound	6814.720	29.000	234.990	
modality * complexity	Sphericity Assumed	574.105	2	287.052	2.007
	Greenhouse-Geisser	574.105	1.637	350.627	2.007
	Huynh-Feldt	574.105	1.722	333.376	2.007
	Lower-bound	574.105	1.000	574.105	2.007
Error(modality*complexity)	Sphericity Assumed	8294.237	58	143.004	
	Greenhouse-Geisser	8294.237	47.484	174.676	
	Huynh-Feldt	8294.237	49.941	166.082	
	Lower-bound	8294.237	29.000	286.008	

Tests of Within-Subjects Effects

Measure: Time

Source		Sig.	Partial Eta Squared
modality	Sphericity Assumed	.003	.259
	Greenhouse-Geisser	.003	.259
	Huynh-Feldt	.003	.259
	Lower-bound	.003	.259
Error(modality)	Sphericity Assumed		
	Greenhouse-Geisser		
	Huynh-Feldt		
	Lower-bound		
complexity	Sphericity Assumed	<.001	.921
	Greenhouse-Geisser	<.001	.921
	Huynh-Feldt	<.001	.921
	Lower-bound	<.001	.921
Error(complexity)	Sphericity Assumed		
	Greenhouse-Geisser		
	Huynh-Feldt		
	Lower-bound		
modality * complexity	Sphericity Assumed	.144	.065
	Greenhouse-Geisser	.153	.065
	Huynh-Feldt	.151	.065
	Lower-bound	.167	.065
Error(modality*complexity)	Sphericity Assumed		
	Greenhouse-Geisser		
	Huynh-Feldt		
	Lower-bound		

Tests of Within-Subjects Contrasts

Measure: Time

Source	modality	complexity	Type III Sum of Squares	df	Mean Square	F
modality	Linear		2139.553	1	2139.553	10.136
Error(modality)	Linear		6121.686	29	211.093	
complexity		Linear	78281.326	1	78281.326	493.741
		Quadratic	842.868	1	842.868	11.026
Error(complexity)		Linear	4597.877	29	158.547	
		Quadratic	2216.843	29	76.443	
modality * complexity	Linear	Linear	172.776	1	172.776	.935
		Quadratic	401.329	1	401.329	3.968
Error(modality*complexity)	Linear	Linear	5361.365	29	184.875	
		Quadratic	2932.872	29	101.134	

Tests of Within-Subjects Contrasts

Measure: Time

Source	modality	complexity	Sig.	Partial Eta Squared
modality	Linear		.003	.259
Error(modality)	Linear			
complexity		Linear	<.001	.945
		Quadratic	.002	.275
Error(complexity)		Linear		
		Quadratic		
modality * complexity	Linear	Linear	.342	.031
		Quadratic	.056	.120
Error(modality*complexity)	Linear	Linear		
		Quadratic		

Tests of Between-Subjects Effects

Measure: Time

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	831121.456	1	831121.456	759.554	<.001	.963
Error	31732.466	29	1094.223			

Estimated Marginal Means

1. modality

Estimates

Measure: Time

modality	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Multi-hand zoom	71.399	2.604	66.074	76.724
Single-hand zoom	64.503	2.779	58.819	70.188

Pairwise Comparisons

Measure: Time

(I) modality	(J) modality	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for [b]...
					Lower Bound
Multi-hand zoom	Single-hand zoom	6.895*	2.166	.003	2.466
Single-hand zoom	Multi-hand zoom	-6.895*	2.166	.003	-11.325

Pairwise Comparisons

Measure: Time

(I) modality	(J) modality	95% Confidence Interval for [b]...
		Upper Bound
Multi-hand zoom	Single-hand zoom	11.325
Single-hand zoom	Multi-hand zoom	-2.466

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.259	10.136[a]	1.000	29.000	.003	.259
Wilks' lambda	.741	10.136[a]	1.000	29.000	.003	.259
Hotelling's trace	.350	10.136[a]	1.000	29.000	.003	.259
Roy's largest root	.350	10.136[a]	1.000	29.000	.003	.259

Each F tests the multivariate effect of modality. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

2. complexity

Estimates

Measure: Time

complexity	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Easy	40.880	1.600	37.608	44.151
Medium	71.011	2.764	65.358	76.664
Hard	91.962	3.458	84.890	99.034

Pairwise Comparisons

Measure: Time

(I) complexity	(J) complexity	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Easy	Medium	-30.131*	1.656	<.001	-34.339	-25.924
	Hard	-51.082*	2.299	<.001	-56.923	-45.241
Medium	Easy	30.131*	1.656	<.001	25.924	34.339
	Hard	-20.951*	1.929	<.001	-25.853	-16.048
Hard	Easy	51.082*	2.299	<.001	45.241	56.923
	Medium	20.951*	1.929	<.001	16.048	25.853

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.949	260.862[a]	2.000	28.000	<.001	.949
Wilks' lambda	.051	260.862[a]	2.000	28.000	<.001	.949
Hotelling's trace	18.633	260.862[a]	2.000	28.000	<.001	.949
Roy's largest root	18.633	260.862[a]	2.000	28.000	<.001	.949

Each F tests the multivariate effect of complexity. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

3. modality * complexity

Estimates

Measure: Time

modality	complexity	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Multi-hand zoom	Easy	42.072	2.122	37.732	46.412
	Medium	76.571	3.459	69.495	83.646
	Hard	95.554	3.505	88.385	102.723
Single-hand zoom	Easy	39.688	1.581	36.454	42.922
	Medium	65.452	2.966	59.386	71.518
	Hard	88.370	4.563	79.037	97.703

Pairwise Comparisons

Measure: Time

complexity	(I) modality	(J) modality	Mean Difference (I-J)	Std. Error	Sig.[b]
Easy	Multi-hand zoom	Single-hand zoom	2.384	1.942	.230
	Single-hand zoom	Multi-hand zoom	-2.384	1.942	.230
Medium	Multi-hand zoom	Single-hand zoom	11.119*	3.312	.002
	Single-hand zoom	Multi-hand zoom	-11.119*	3.312	.002
Hard	Multi-hand zoom	Single-hand zoom	7.183	4.289	.105
	Single-hand zoom	Multi-hand zoom	-7.183	4.289	.105

Pairwise Comparisons

Measure: Time

complexity	(I) modality	(J) modality	95% Confidence Interval for Difference[b]	
			Lower Bound	Upper Bound
Easy	Multi-hand zoom	Single-hand zoom	-1.589	6.356
	Single-hand zoom	Multi-hand zoom	-6.356	1.589
Medium	Multi-hand zoom	Single-hand zoom	4.345	17.892
	Single-hand zoom	Multi-hand zoom	-17.892	-4.345
Hard	Multi-hand zoom	Single-hand zoom	-1.589	15.956
	Single-hand zoom	Multi-hand zoom	-15.956	1.589

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

complexity		Value	F	Hypothesis df	Error df	Sig.
Easy	Pillai's trace	.049	1.506[a]	1.000	29.000	.230
	Wilks' lambda	.951	1.506[a]	1.000	29.000	.230
	Hotelling's trace	.052	1.506[a]	1.000	29.000	.230
	Roy's largest root	.052	1.506[a]	1.000	29.000	.230
Medium	Pillai's trace	.280	11.270[a]	1.000	29.000	.002
	Wilks' lambda	.720	11.270[a]	1.000	29.000	.002
	Hotelling's trace	.389	11.270[a]	1.000	29.000	.002
	Roy's largest root	.389	11.270[a]	1.000	29.000	.002
Hard	Pillai's trace	.088	2.805[a]	1.000	29.000	.105
	Wilks' lambda	.912	2.805[a]	1.000	29.000	.105
	Hotelling's trace	.097	2.805[a]	1.000	29.000	.105
	Roy's largest root	.097	2.805[a]	1.000	29.000	.105

Multivariate Tests

complexity		Partial Eta Squared
Easy	Pillai's trace	.049
	Wilks' lambda	.049
	Hotelling's trace	.049
	Roy's largest root	.049
Medium	Pillai's trace	.280
	Wilks' lambda	.280
	Hotelling's trace	.280
	Roy's largest root	.280
Hard	Pillai's trace	.088
	Wilks' lambda	.088
	Hotelling's trace	.088
	Roy's largest root	.088

Each F tests the multivariate simple effects of modality within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

4. complexity * modality

Estimates

Measure: Time

modality	complexity	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Multi-hand zoom	Easy	42.072	2.122	37.732	46.412
	Medium	76.571	3.459	69.495	83.646
	Hard	95.554	3.505	88.385	102.723
Single-hand zoom	Easy	39.688	1.581	36.454	42.922
	Medium	65.452	2.966	59.386	71.518
	Hard	88.370	4.563	79.037	97.703

Pairwise Comparisons

Measure: Time

modality	(I) complexity	(J) complexity	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for [b]...
						Lower Bound
Multi-hand zoom	Easy	Medium	-34.499*	2.407	<.001	-40.615
		Hard	-53.482*	2.958	<.001	-60.997
	Medium	Easy	34.499*	2.407	<.001	28.383
		Hard	-18.983*	3.274	<.001	-27.302
	Hard	Easy	53.482*	2.958	<.001	45.966
		Medium	18.983*	3.274	<.001	10.664
Single-hand zoom	Easy	Medium	-25.764*	2.188	<.001	-31.323
		Hard	-48.682*	3.761	<.001	-58.239
	Medium	Easy	25.764*	2.188	<.001	20.204
		Hard	-22.918*	2.811	<.001	-30.062
	Hard	Easy	48.682*	3.761	<.001	39.126
		Medium	22.918*	2.811	<.001	15.775

Pairwise Comparisons

Measure: Time

modality	(I) complexity	(J) complexity	95% Confidence Interval for [b]... Upper Bound
Multi-hand zoom	Easy	Medium	-28.383
		Hard	-45.966
	Medium	Easy	40.615
		Hard	-10.664
	Hard	Easy	60.997
		Medium	27.302
Single-hand zoom	Easy	Medium	-20.204
		Hard	-39.126
	Medium	Easy	31.323
		Hard	-15.775
	Hard	Easy	58.239
		Medium	30.062

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

modality		Value	F	Hypothesis df	Error df	Sig.
Multi-hand zoom	Pillai's trace	.936	204.586[a]	2.000	28.000	<.001
	Wilks' lambda	.064	204.586[a]	2.000	28.000	<.001
	Hotelling's trace	14.613	204.586[a]	2.000	28.000	<.001
	Roy's largest root	14.613	204.586[a]	2.000	28.000	<.001
Single-hand zoom	Pillai's trace	.864	89.307[a]	2.000	28.000	<.001
	Wilks' lambda	.136	89.307[a]	2.000	28.000	<.001
	Hotelling's trace	6.379	89.307[a]	2.000	28.000	<.001
	Roy's largest root	6.379	89.307[a]	2.000	28.000	<.001

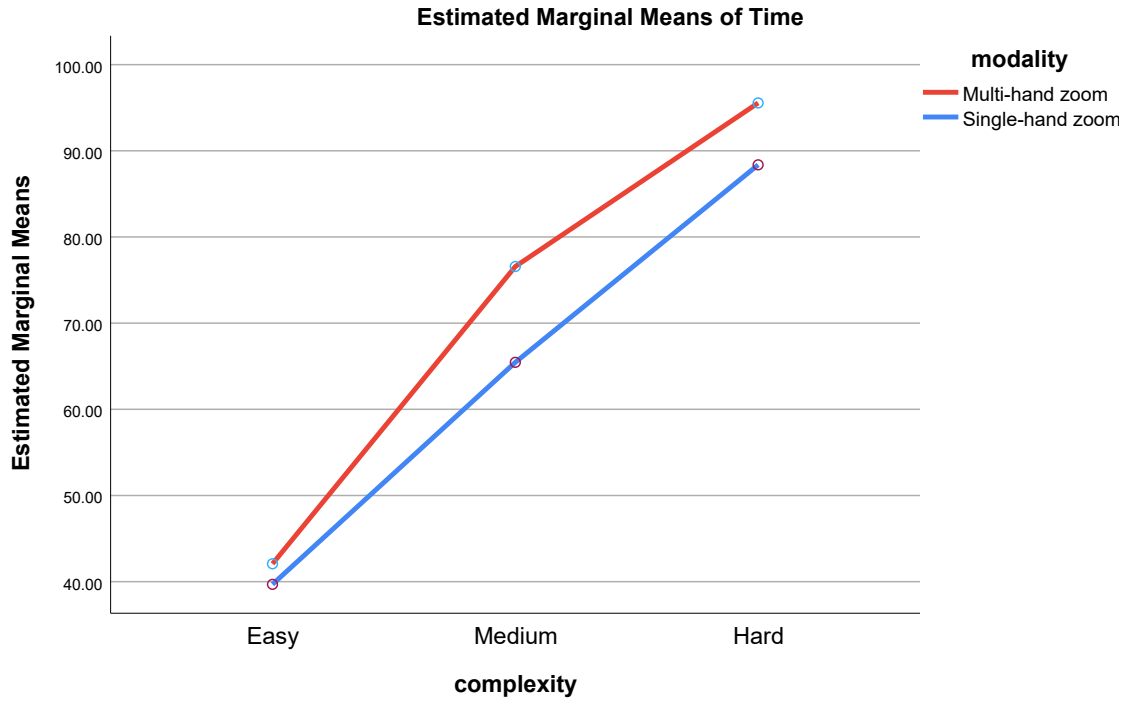
Multivariate Tests

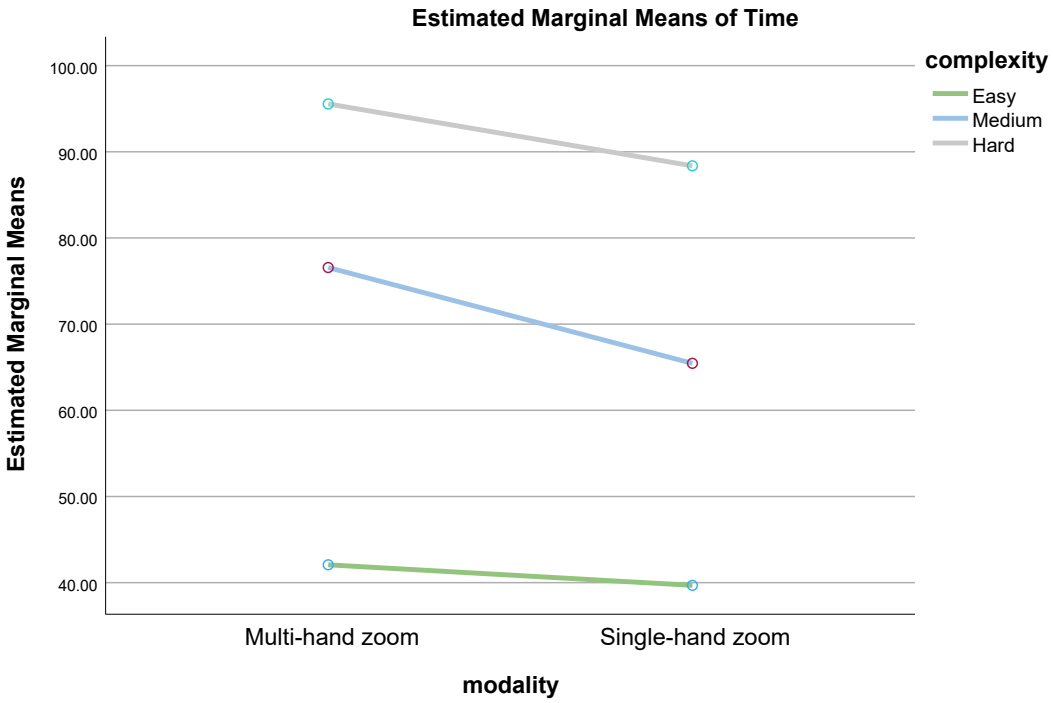
modality		Partial Eta Squared
Multi-hand zoom	Pillai's trace	.936
	Wilks' lambda	.936
	Hotelling's trace	.936
	Roy's largest root	.936
Single-hand zoom	Pillai's trace	.864
	Wilks' lambda	.864
	Hotelling's trace	.864
	Roy's largest root	.864

Each F tests the multivariate simple effects of complexity within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Profile Plots




Estimated Marginal Means of Time
Estimated Marginal Means
100.00
90.00
80.00
70.00
60.00
50.00
40.00
Multi-hand zoom
Single-hand zoom
modality
complexity
Easy
Medium
Hard