Simple Effects Analysis - Python Report

Dependent variable: G3
Factor A: sex
Factor B: studytime

Interpretation:

analysis	dependent_variable	factor_a	factor_b	interaction_p_value	significant_simple_effects_count	main_interpretation	simple_effects_summary	reporting_note
Simple Effects Analysis	G3	sex	studytime	0.08323	3	The sex × studytime interaction is not statistically significant, so simple effects are exploratory/contextual.	Simple effect of Factor A within Factor B = 4; Simple effect of Factor B within Factor A = F; Simple effect of Factor B within Factor A = M	Report the factorial ANOVA first, then decompose the interaction with simple effects and cell means

Factorial ANOVA:

effect	df_effect	df_error	ss_effect	ss_error	ms_effect	ms_error	F	p_value	partial_eta_squared	decision_alpha_0_05
Main effect: Factor A	1.0	641.0	31.067749	6202.305509	31.067749	9.675984	3.210810	7.362479e-02	0.004984	Not significant
Main effect: Factor B	3.0	641.0	383.462806	6202.305509	127.820935	9.675984	13.210123	2.233030e-08	0.058226	Significant
Interaction: Factor A × Factor B	3.0	641.0	64.815481	6202.305509	21.605160	9.675984	2.232865	8.322970e-02	0.010342	Not significant

Simple effects:

effect	simple_factor	moderator_factor	moderator_level	tested_levels	n_in_simple_effect	df_effect	df_error	ss_effect	ss_error	ms_effect	ms_error	F	p_value	partial_eta_squared	decision_alpha_0_05
Simple effect of Factor A within Factor B = 1	Factor_A	Factor_B	1	F, M	212	1	210	18.435602	2167.427606	18.435602	10.321084	1.786208	0.182835	0.008434	Not significant
Simple effect of Factor A within Factor B = 2	Factor_A	Factor_B	2	F, M	305	1	303	6.242168	3191.187341	6.242168	10.531971	0.592687	0.441982	0.001952	Not significant
Simple effect of Factor A within Factor B = 3	Factor_A	Factor_B	3	F, M	97	1	95	3.772127	597.238182	3.772127	6.286718	0.600015	0.440496	0.006276	Not significant
Simple effect of Factor A within Factor B = 4	Factor_A	Factor_B	4	F, M	35	1	33	67.433333	246.452381	67.433333	7.468254	9.029330	0.005043	0.214834	Significant
Simple effect of Factor B within Factor A = F	Factor_B	Factor_A	F	1, 2, 3, 4	383	3	379	236.204334	3492.229086	78.734778	9.214325	8.544823	0.000017	0.063352	Significant
Simple effect of Factor B within Factor A = M	Factor_B	Factor_A	M	1, 2, 3, 4	266	3	262	212.073953	2710.076423	70.691318	10.343803	6.834171	0.000189	0.072575	Significant

Cell summary:

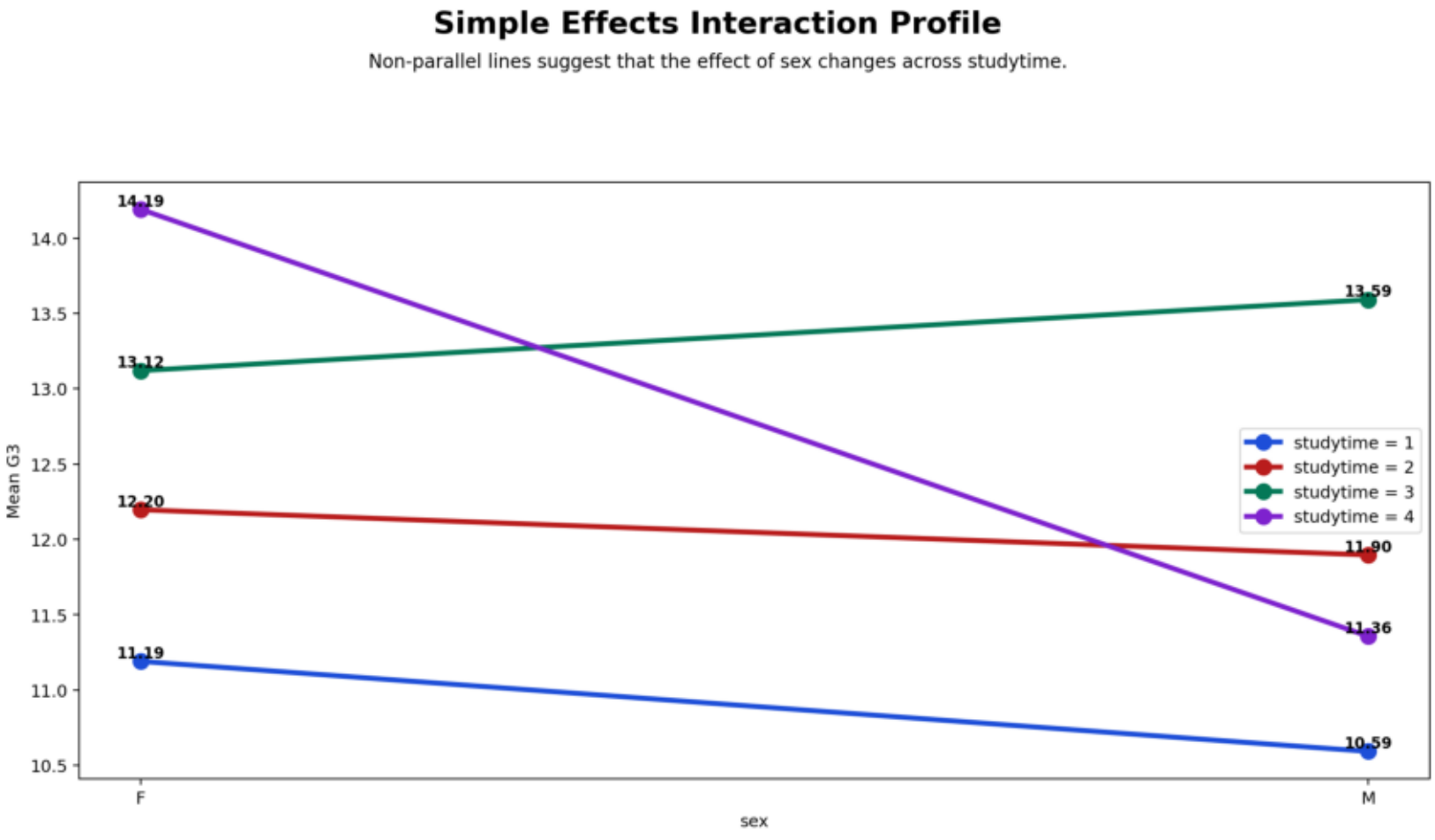
factor_a_level	factor_b_level	n	mean	standard_deviation	standard_error	ci95_low	ci95_high	minimum	maximum
F	1	89	11.191011	2.969069	0.314721	10.574159	11.807864	0.0	17.0
M	1	123	10.593496	3.377450	0.304534	9.996608	11.190383	0.0	18.0
F	2	198	12.196970	3.223737	0.229101	11.747932	12.646008	0.0	18.0
M	2	107	11.897196	3.284999	0.317573	11.274753	12.519639	0.0	19.0
F	3	75	13.120000	2.609546	0.301324	12.529404	13.710596	8.0	18.0
M	3	22	13.590909	2.108014	0.449430	12.710026	14.471792	9.0	17.0
F	4	21	14.190476	2.874353	0.627235	12.961095	15.419857	10.0	19.0
M	4	14	11.357143	2.499450	0.668006	10.047851	12.666435	6.0	17.0

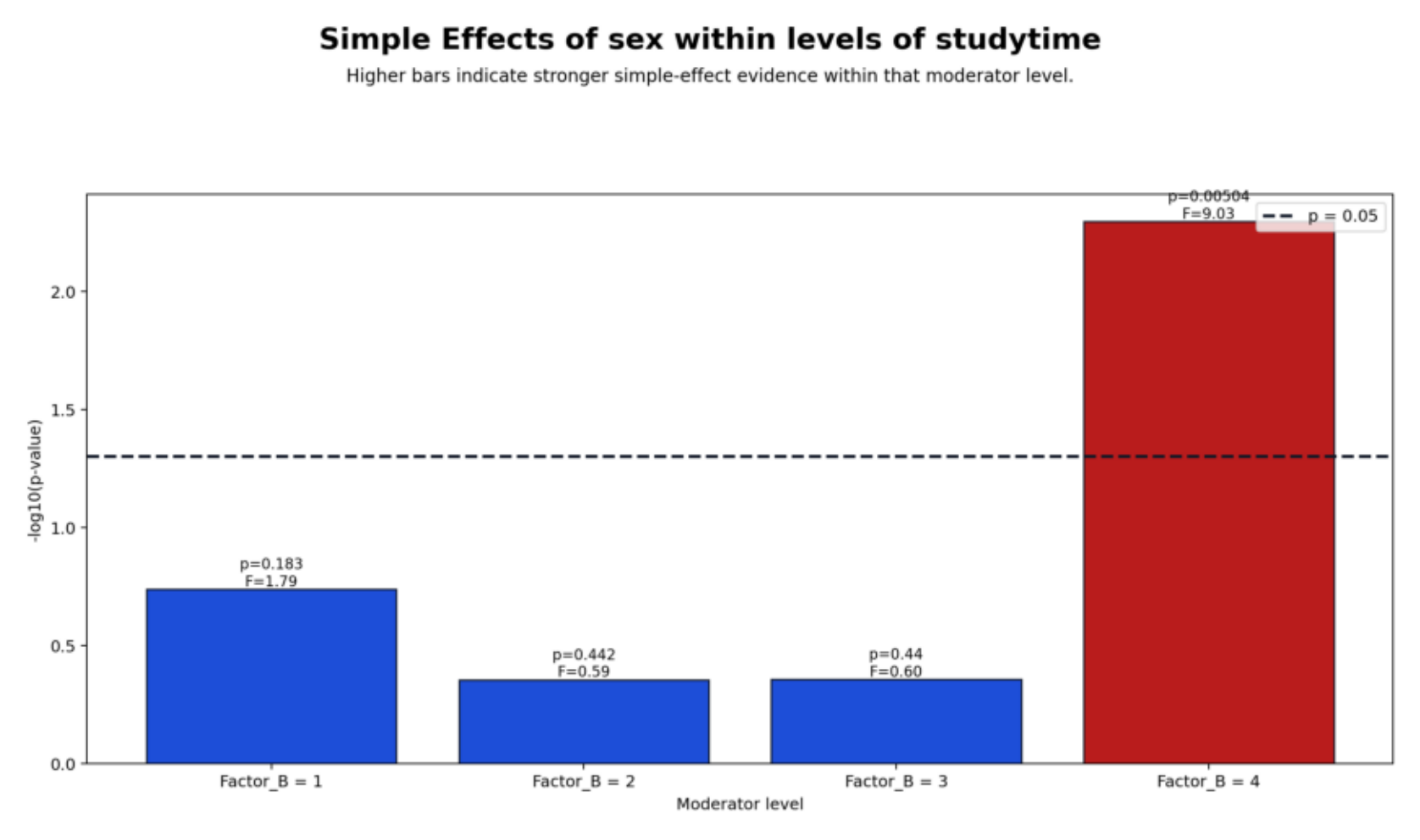
Marginal means:

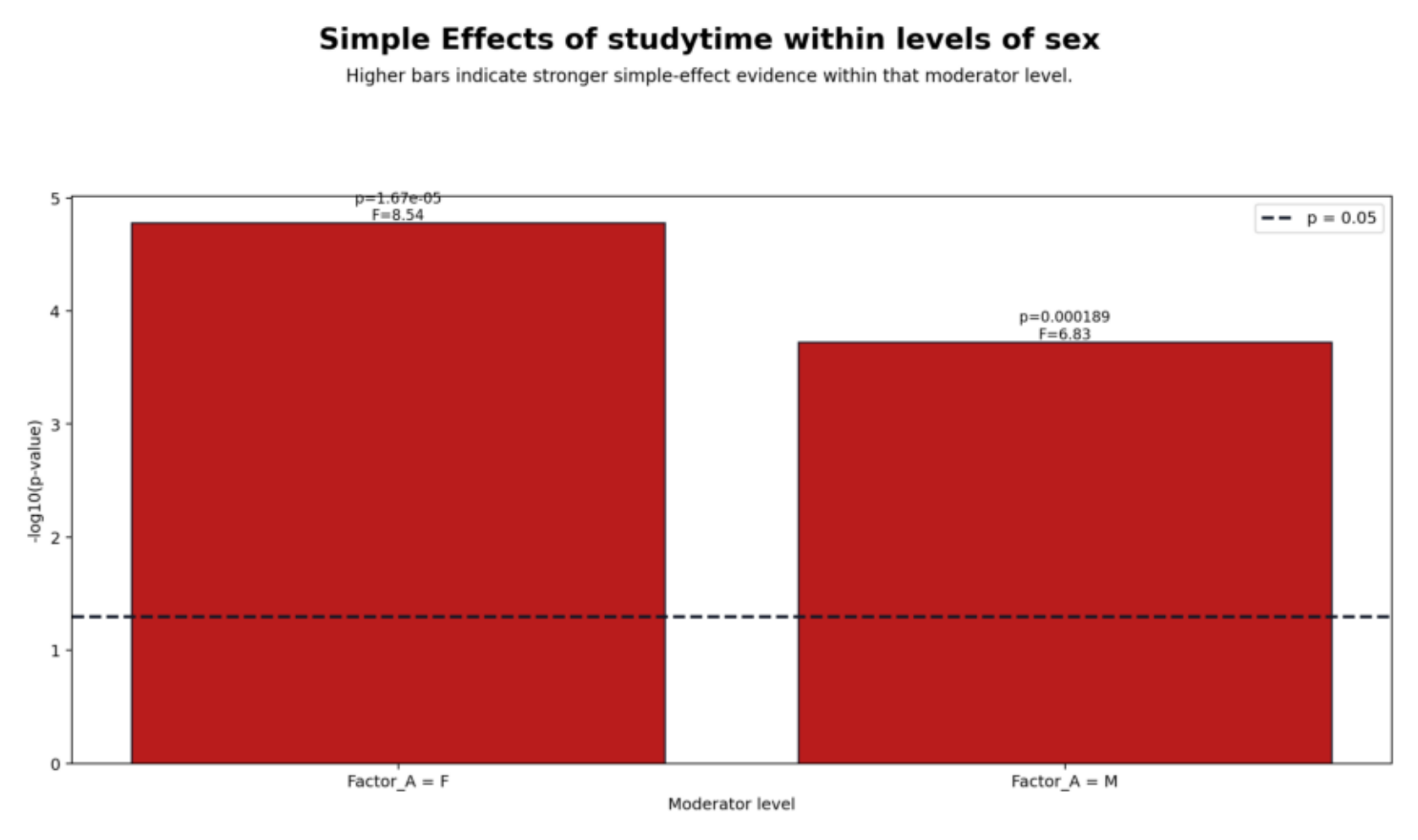
factor	level	n	mean	standard_deviation	standard_error	ci95_low	ci95_high
Factor_A	F	383	12.253264	3.124147	0.159636	11.940376	12.566151
Factor_A	M	266	11.406015	3.320690	0.203605	11.006950	11.805080
Factor_B	1	212	10.844340	3.218624	0.221056	10.411070	11.277609
Factor_B	2	305	12.091803	3.243125	0.185701	11.727830	12.455777
Factor_B	3	97	13.226804	2.502104	0.254050	12.728866	13.724742
Factor_B	4	35	13.057143	3.038410	0.513585	12.050516	14.063769

Pairwise follow-ups inside simple effects:

simple_factor	moderator_factor	moderator_level	level_1	level_2	n_1	n_2	mean_1	mean_2	mean_difference_1_minus_2	standard_error	df_error	t_statistic	p_value_lsd_unadjusted	critical_mean_difference_alpha_0_05	decision_alpha_0_05	method_note
Factor_A	Factor_B	1	F	M	89	123	11.191011	10.593496	0.597515	0.447078	210	1.336491	0.182835	0.881335	Not significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_A	Factor_B	2	F	M	198	107	12.196970	11.897196	0.299773	0.389386	303	0.769862	0.441982	0.766243	Not significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_A	Factor_B	3	F	M	75	22	13.120000	13.590909	-0.470909	0.607933	95	-0.774607	0.440496	1.206900	Not significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_A	Factor_B	4	F	M	21	14	14.190476	11.357143	2.833333	0.942909	33	3.004884	0.005043	1.918363	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	F	1	2	89	198	11.191011	12.196970	-1.005958	0.387387	379	-2.596779	0.009776	0.761697	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	F	1	3	89	75	11.191011	13.120000	-1.928989	0.475804	379	-4.054167	0.000061	0.935546	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	F	1	4	89	21	11.191011	14.190476	-2.999465	0.736416	379	-4.073056	0.000057	1.447974	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	F	2	3	198	75	12.196970	13.120000	-0.923030	0.411576	379	-2.242674	0.025495	0.809258	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	F	2	4	198	21	12.196970	14.190476	-1.993506	0.696645	379	-2.861581	0.004449	1.369773	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	F	3	4	75	21	13.120000	14.190476	-1.070476	0.749423	379	-1.428400	0.154000	1.473548	Not significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	M	1	2	123	107	10.593496	11.897196	-1.303700	0.425167	262	-3.066325	0.002394	0.837179	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	M	1	3	123	22	10.593496	13.590909	-2.997413	0.744492	262	-4.026117	0.000074	1.465950	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	M	1	4	123	14	10.593496	11.357143	-0.763647	0.907160	262	-0.841800	0.400668	1.786252	Not significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	M	2	3	107	22	11.897196	13.590909	-1.693713	0.752890	262	-2.249614	0.025304	1.482486	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	M	2	4	107	14	11.897196	11.357143	0.540053	0.914065	262	0.590826	0.555146	1.799848	Not significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.
Factor_B	Factor_A	M	3	4	22	14	13.590909	11.357143	2.233766	1.099553	262	2.031523	0.043211	2.165085	Significant	LSD-style pairwise follow-up inside each simple effect. Use after inspecting the factorial interaction.

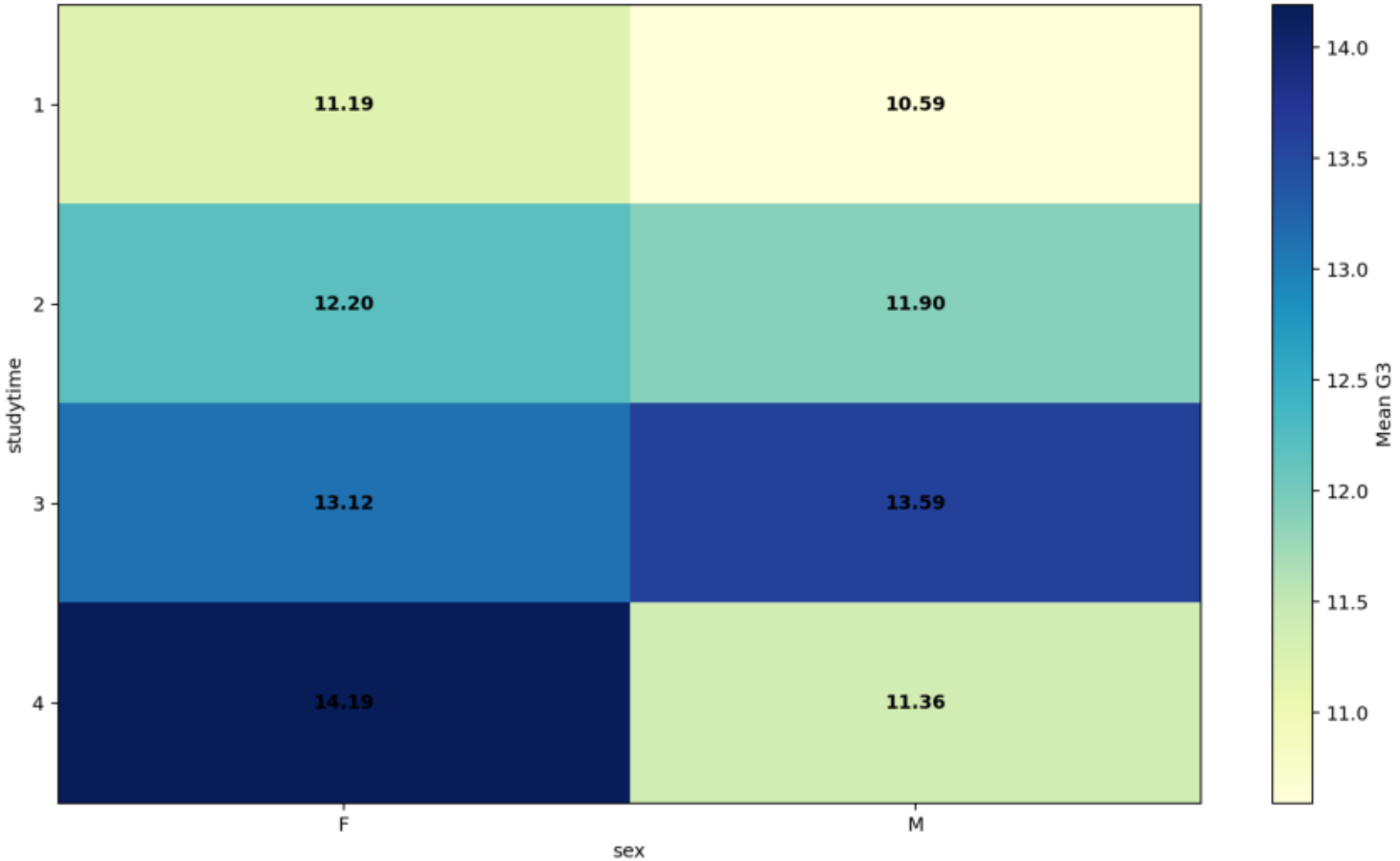

Simple Effects Interaction Profile
Non-parallel lines suggest that the effect of sex changes across studytime.
Mean G3
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
14.19
13.12
12.20
11.19
13.59
11.90
11.36
10.59
F
M
sex
studytime = 1
studytime = 2
studytime = 3
studytime = 4


Simple Effects of sex within levels of studytime
Higher bars indicate stronger simple-effect evidence within that moderator level.
-log10(p-value)
Moderator level
p = 0.05
p=0.183
F=1.79
p=0.442
F=0.59
p=0.44
F=0.60
p=0.00504
F=9.03
Factor_B = 1
Factor_B = 2
Factor_B = 3
Factor_B = 4
0.0
0.5
1.0
1.5
2.0


Simple Effects of studytime within levels of sex
Higher bars indicate stronger simple-effect evidence within that moderator level.
p=1.67e-05
F=8.54
p=0.000189
F=6.83
p = 0.05
-log10(p-value)
0
1
2
3
4
5
Factor_A = F
Factor_A = M
Moderator level

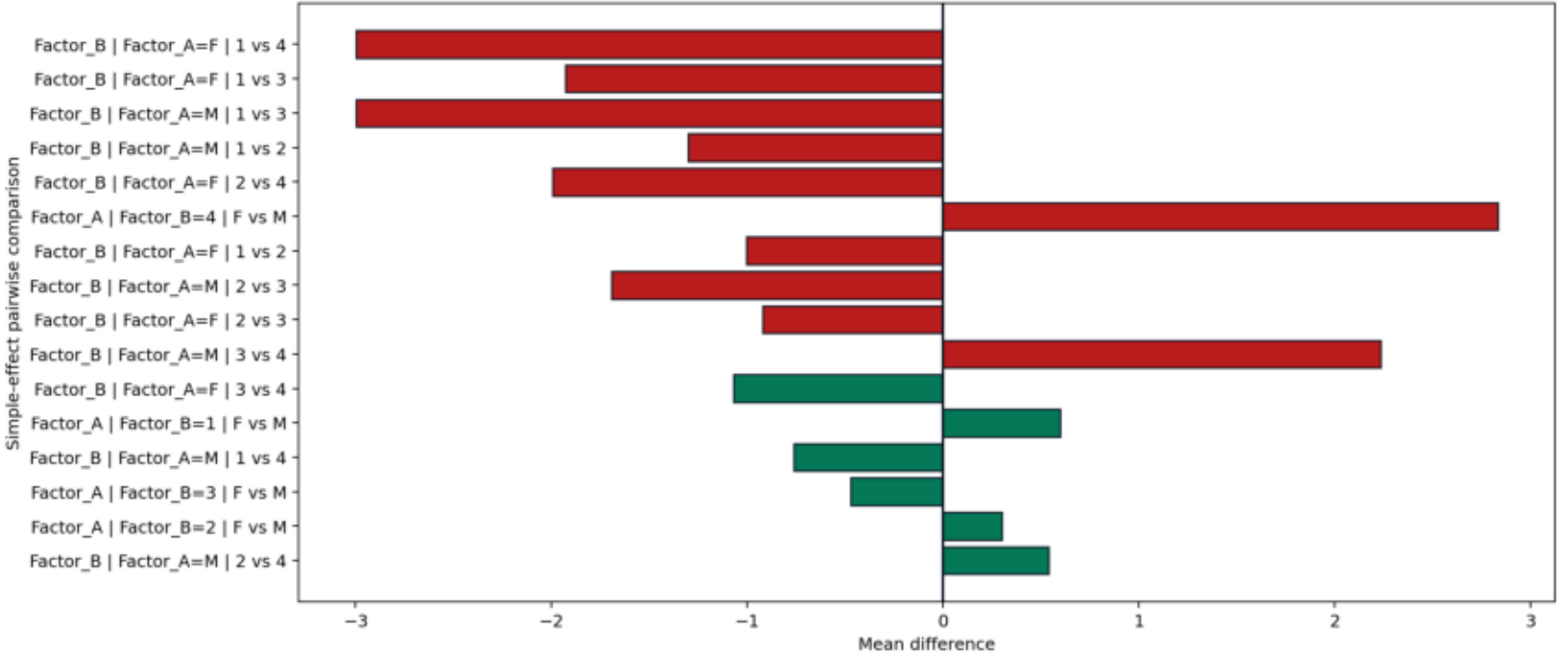
Simple Effects Cell Mean Heatmap

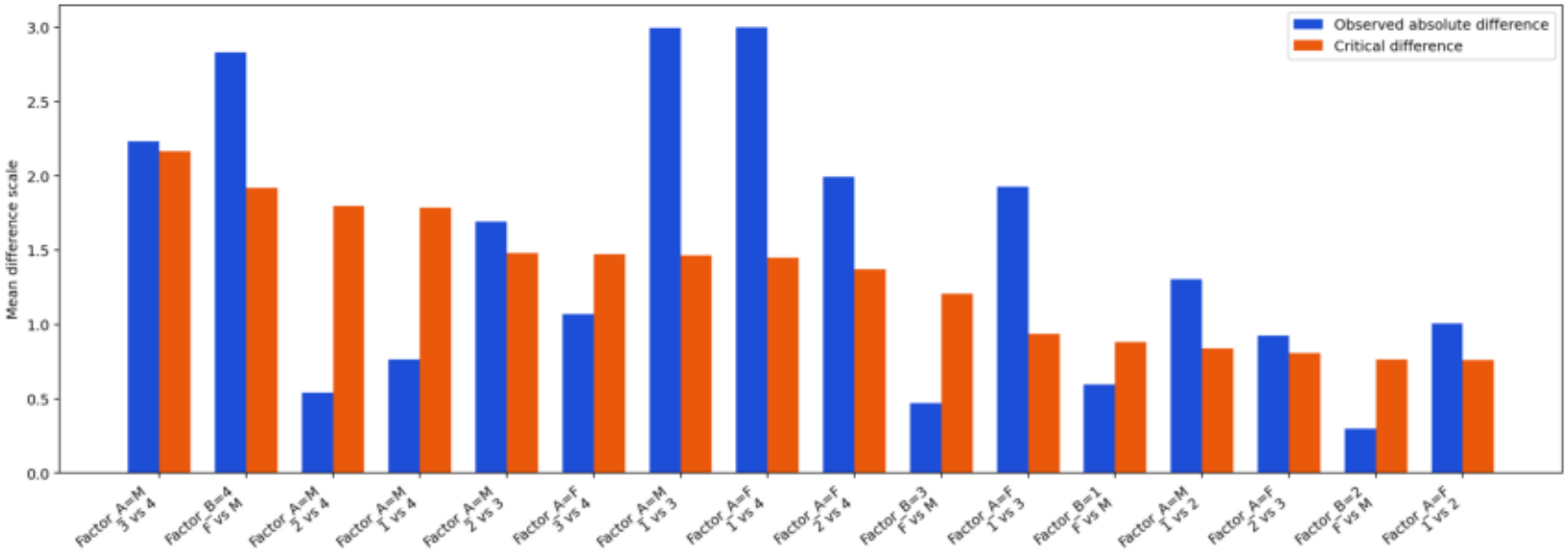
Each cell is a condition mean used to explain the interaction.



Simple-Effect Pairwise Comparison Map

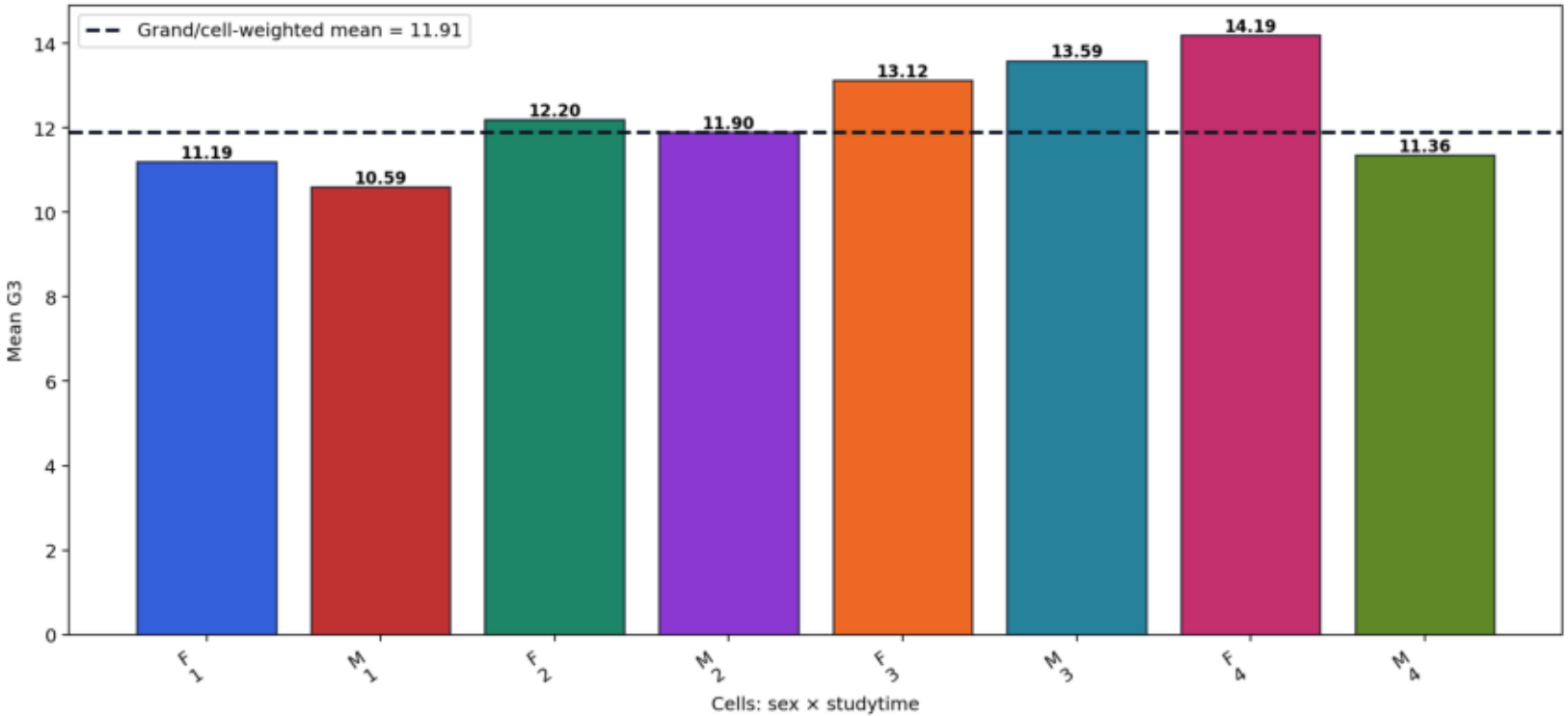
Red bars are significant LSD-style follow-ups within a simple effect.




Simple Effects Critical Difference Thresholds
A follow-up is significant when the observed absolute difference exceeds the threshold.
Observed absolute difference
Critical difference
Mean difference scale
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Factor_A=M 3 vs 4
Factor_B=4 F vs M
Factor_A=M 2 vs 4
Factor_A=M 1 vs 4
Factor_A=M 2 vs 3
Factor_A=F 3 vs 4
Factor_A=M 1 vs 3
Factor_A=F 1 vs 4
Factor_A=F 2 vs 4
Factor_B=3 F vs M
Factor_A=F 1 vs 3
Factor_B=1 F vs M
Factor_A=M 1 vs 2
Factor_A=F 2 vs 3
Factor_B=2 F vs M
Factor_A=F 1 vs 2

Cell Means Behind the Simple Effects

Simple effects explain how these cell means differ inside each moderator level.



Simple Effects Distribution Context

Cell-level distributions help explain whether means are stable or influenced by spread/outliers.