Mixed-Model ANOVA

Goals

- What is Mixed-Model ANOVA?
- Carrying out Mixed ANOVA in SPSS
- Interpretation
  - Main Effects
  - Interactions

What is a Mixed-Model ANOVA?

- Mixed:
  - 1 or more factor uses the same participants
  - 1 or more factor uses different participants

What is a Three-Way Mixed-Model ANOVA?

- Three Factors
  - Three-way = Three factors
- Mixed:
  - 1 or more factor uses the same participants
  - 1 or more factor uses different participants

An Example: Speed Dating

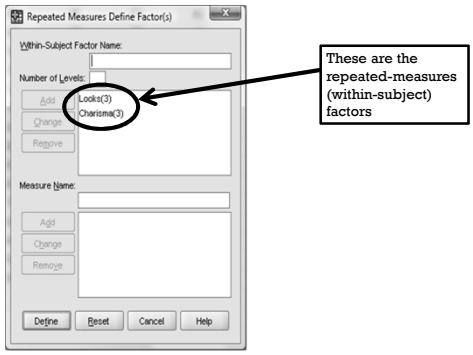
- 10 male participants and 10 female participants
  - 9 male confederates and 9 female confederates
    - 1 male confederate who is attractive and highly charismatic, 1 female confederate who is attractive and highly charismatic, and so on…
- Is personality or looks more important?
  - Factor 1 (Looks of date): Attractive, Average, Ugly
    - Within-subject factor with three levels
  - Factor 2 (Personality of date): High Charisma, Some Charisma, Dullard
    - Within-subject factor with three levels
  - Factor 3 (Sex of participant): Male or Female
    - Between-subjects factor with two levels
- Outcome Variable: Participant ratings of the date
  - 100% = The prospective date was perfect!
  - 0% = Not at all interested in the prospective date

	High Charisma			*Some Charisma*			*Dullard*		
Looks	*Att*	*Av*	*Ugly*	*Att*	*Av*	*Ug*	*Att*	*Av*	*Ug*
Male	86	84	67	88	69	50	97	48	47
	91	83	53	83	74	48	86	50	46
	89	88	48	99	70	48	90	45	48
	89	69	58	86	77	40	87	47	53
	80	81	57	88	71	50	82	50	45
	80	84	51	96	63	42	92	48	43
	89	85	61	87	79	44	86	50	45
	100	94	56	86	71	54	84	54	47
	90	74	54	92	71	58	78	38	45
	89	86	63	80	73	49	91	48	39
Female	89	91	93	88	65	54	55	48	52
	84	90	85	95	70	60	50	44	45
	99	100	89	80	79	53	51	48	44
	86	89	83	86	74	58	52	48	47
	89	87	80	83	74	43	58	50	48
	80	81	79	86	59	47	51	47	40
	82	92	85	81	66	47	50	45	47
	97	69	87	95	72	51	45	48	46
	95	92	90	98	64	53	54	53	45
	95	93	96	79	66	46	52	39	47

Effects

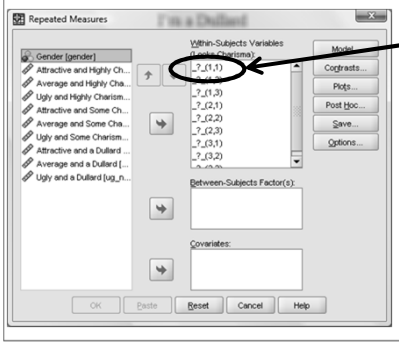
- Main effects
  - We will get an *F*-ratio for the main effect of each factor:
    - Looks (attractive vs. average vs. ugly)
    - Personality (high charisma vs. some charisma vs. dullard)
    - Sex (male vs. female)
- Two-Way Interactions
  - We will get *F*-ratios for all possible interactions between pairs of variables:
    - Looks × Personality
    - Looks × Sex
    - Personality × Sex
- Three-Way Interaction
  - We will get an *F*-ratio for the interaction between all three variables
    - Looks × Personality × Sex

Define the Repeated Measures Variables



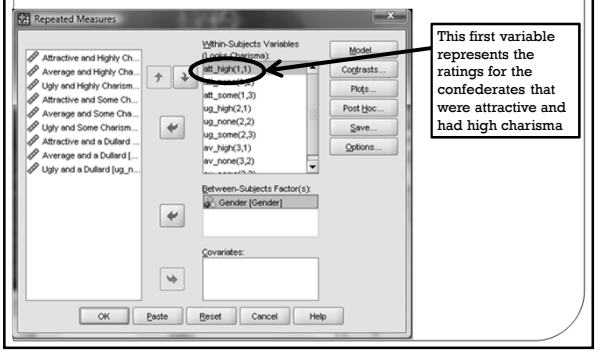
These are the repeated-measures (within-subject) factors

Define Levels of the Repeated Measures Variables



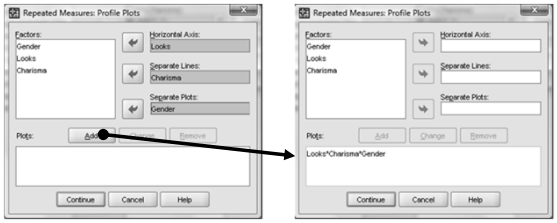
You select the variable that represents each combination of the levels from Factor 1 and Factor 2

Define Levels of the Repeated Measures Variables and Select the Between-Group Variable



This first variable represents the ratings for the confederates that were attractive and had high charisma

Define Interaction Graphs



Output: Sphericity

Mauchly's Test of Sphericity

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
LOOKS	.960	.590	2	.708	.962	1.000	.500
CHARISMA	.929	1.245	2	.536	.934	1.000	.500
LOOKS * CHARISMA	.613	8.025	2	.534	.799	1.000	.250

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

a. 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.

b. Design: Intercept+GENDER
Within Subjects Design: LOOKS+CHARISMA+LOOKS*CHARISMA

The sphericity assumption is met for the main effects of Looks and Charisma as well as their interaction

Repeated Measures Effects

Tests of Within-Subjects Effects

Measure: MEASURE_1
Sphericity Assumed

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
LOOKS	23233.600	2	11616.800	328.250	.000
LOOKS * GENDER	4420.133	2	2210.067	62.449	.000
Error(LOOKS)	1274.044	36	35.390		
CHARISMA	20779.633	2	10389.817	423.733	.000
CHARISMA * GENDER	3944.100	2	1972.050	80.427	.000
Error(CHARISMA)	882.711	36	24.520		
LOOKS * CHARISMA	4055.267	4	1013.817	36.633	.000
LOOKS * CHARISMA * GENDER	2669.667	4	667.417	24.116	.000
Error(LOOKS*CHARISMA)	1992.622	72	27.675		

There was a significant main effect for Looks

Repeated Measures Effects

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Error(LOOKS*CHARISMA)	1992.622	72	27.675		

There was a significant interaction for Looks x Sex

Repeated Measures Effects

Tests of Within-Subjects Effects

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There was a significant main effect for Charisma

Repeated Measures Effects

Tests of Within-Subjects Effects

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Source	Type III Sum of Squares	df	Mean Square	F	Sig.
LOOKS	23233.600	2	11616.800	328.250	.000
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There was a significant interaction for Charisma x Sex

Repeated Measures Effects

Tests of Within-Subjects Effects

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Sphericity Assumed

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There was a significant interaction for Looks x Charisma

Repeated Measures Effects

Tests of Within-Subjects Effects

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There was a significant three-way interaction for Looks x Charisma x Sex

Homogeneity of Variance

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Attractive and Highly Charismatic	1.131	1	18	.302
Attractive and a Dullard	1.949	1	18	.180
Attractive and Some Charisma	.599	1	18	.449
Ugly and Highly Charismatic	.005	1	18	.945
Ugly and a Dullard	.082	1	18	.778
Ugly and Some Charisma	.124	1	18	.729
Average and Highly Charismatic	.102	1	18	.753
Average and a Dullard	.004	1	18	.950
Average and Some Charisma	1.763	1	18	.201

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+GENDER
Within Subjects Design: LOOKS+CHARISMA+LOOKS*CHARISMA

These are the Levene's tests that compare the variances for male and female participants for each condition

Between-Group Effects

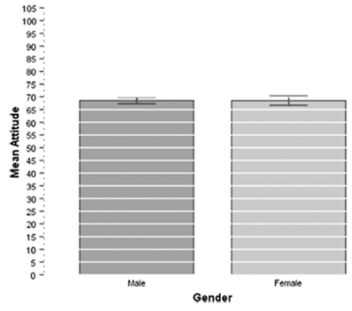
Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	94027.756	1	94027.756	20036.900	.000
Gender	.022	1	.022	.005	.946
Error	84.469	18	4.693		

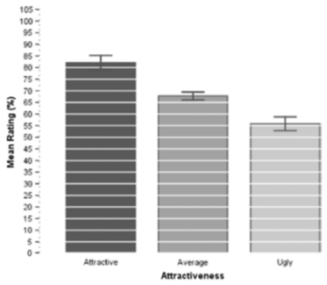
The main effect of sex was not significant

Main Effect of Sex



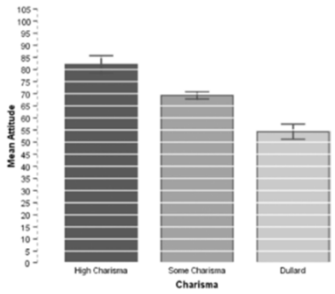
Male and female participants did not differ in their average ratings of the confederates

Main Effect of Looks



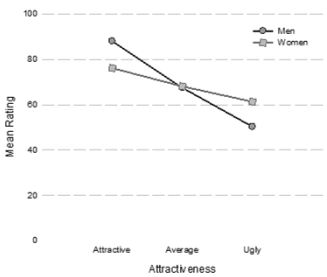
Attractive confederates appear to have received more positive ratings than average confederates who, in turn, received more positive ratings than ugly confederates…but this pattern should be confirmed with MCPs

Main Effect of Charisma



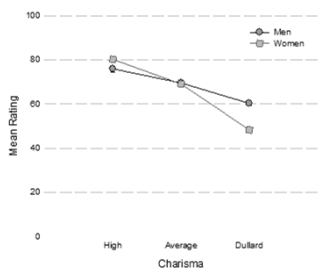
Highly charismatic confederates appear to have received more positive ratings than confederates with some charisma who, in turn, received more positive ratings than dullard confederates…but this pattern should be confirmed with MCPs

The Sex × Looks Interaction



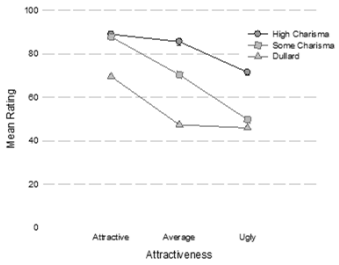
It appears that male participants were more influenced by the attractiveness of the female confederates…but this pattern should be confirmed with MCPs

Sex × Charisma Interaction



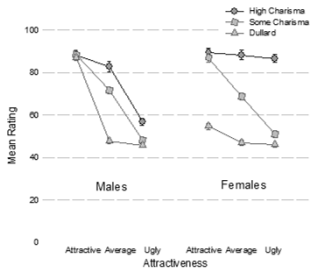
It appears that female participants were more influenced by the charisma of the male confederates…but this pattern should be confirmed with MCPs

The Looks × Charisma Interaction



It appears that the attractiveness of the confederates had the strongest impact on those with some charisma…but this pattern should be confirmed with MCPs

Sex × Looks × Charisma Interaction



The three-way interaction appears to be driven by the fact that male participants gave attractive female confederates high ratings regardless of their charisma and female participants gave male confederates with high charisma high ratings regardless of their attractiveness