Advanced Stats I

Interactions!

Goals

- Categorical + continuous variables
  - Gender effects
- Interactions
  - In MR
  - In ANOVA

Categorical + continuous

- It is easy to use multiple categorical/ continuous variables in MR.
- The basic interpretation of these variables stays the same.
- There are some issues with coding categorical variables, however.

0, 1

- Do not directly use polytomous variables in your MR
  - E.g., where were you born?
    - 0 = Toronto
    - 1 = Minneapolis
    - 2 = Oakland

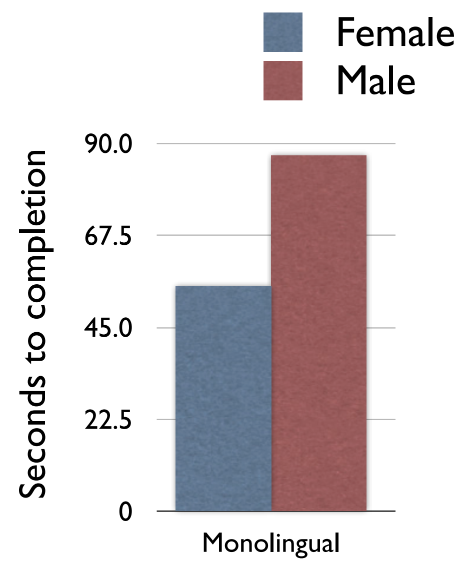
0, 1

- Translate into 0's and 1's
  - Toronto? 0, 1
  - Minneapolis? 0, 1
  - Oakland? 0, 1
- Because 1 will only be turned on for one city, these three variables are **orthogonal**

	Tor.	Minn.	Oak.
Subj 1	1	0	0
Subj 2	0	0	1
Subj 3	0	1	0

Gender effects

- Girls and boys
- Let's code in terms of 1's and 0's
- 0 = female
- 1 = male

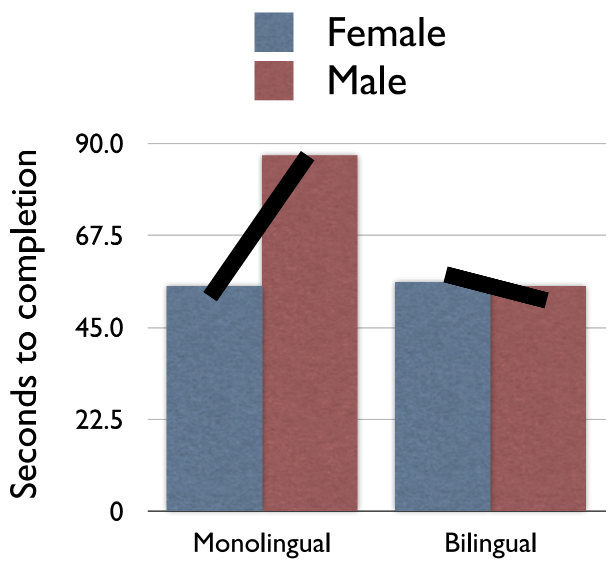


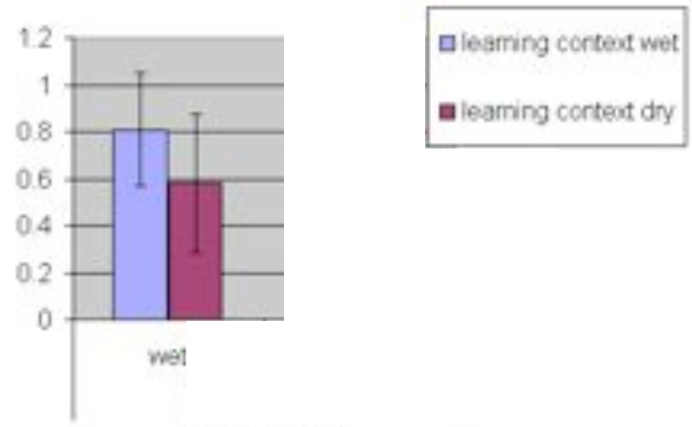
Interactions

- Your differences in the outcome variable (using one independent variable) are **modulated** in terms of another independent variable
- In other words, "it depends."
- E.g., women better than men on memory game, except when...

Interactions

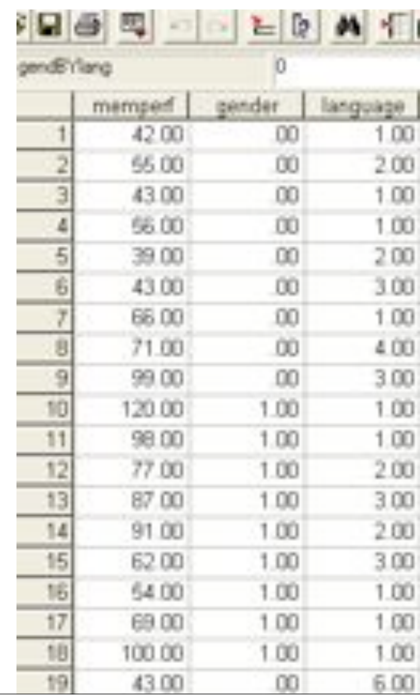
- Separate your cases in terms of one independent variable (e.g., language)
- Plot the outcome variable in terms of the other independent variable (e.g., gender)
- Interaction means: Slopes will be different!





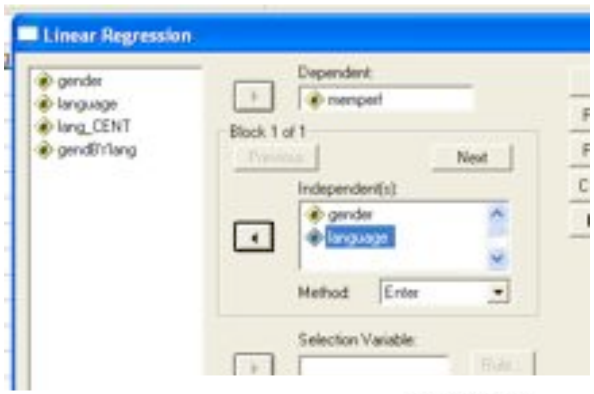
Interactions

- Outcome variable: Memory task performance: Seconds needed
    - Lower = faster
- Independent variables:
    - Female vs. male (0,1)
    - Monolingual vs. bilingual (1-10)



gendBYlang 0

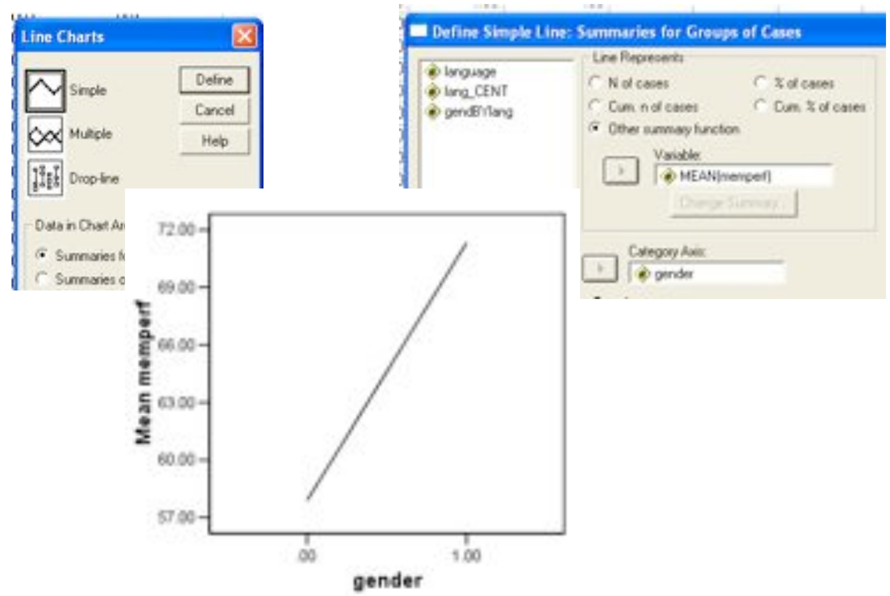
	memperf	gender	language
1	42.00	.00	1.00
2	55.00	.00	2.00
3	43.00	.00	1.00
4	56.00	.00	1.00
5	39.00	.00	2.00
6	43.00	.00	3.00
7	66.00	.00	1.00
8	71.00	.00	4.00
9	99.00	.00	3.00
10	120.00	1.00	1.00
11	98.00	1.00	1.00
12	77.00	1.00	2.00
13	87.00	1.00	3.00
14	91.00	1.00	2.00
15	62.00	1.00	3.00
16	54.00	1.00	1.00
17	69.00	1.00	1.00
18	100.00	1.00	1.00
19	43.00	.00	6.00

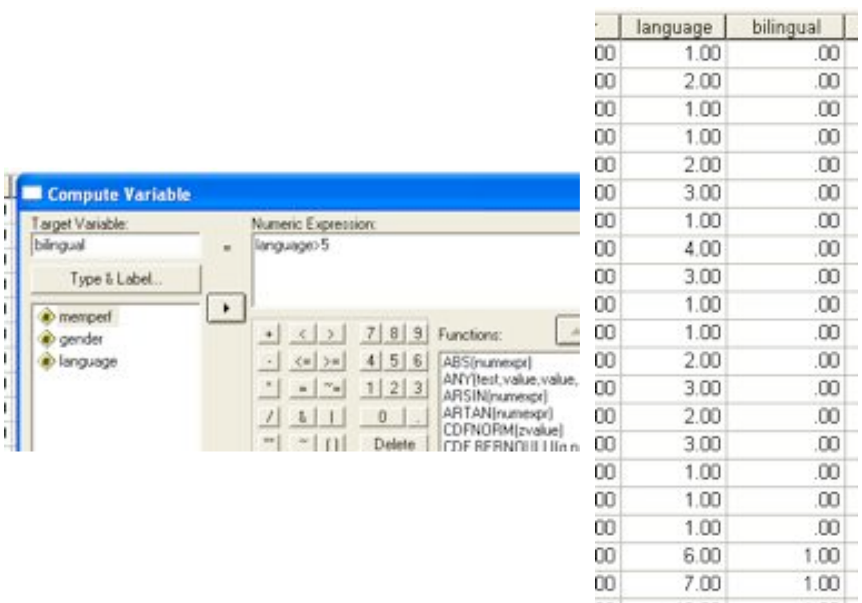


Coefficients[a]

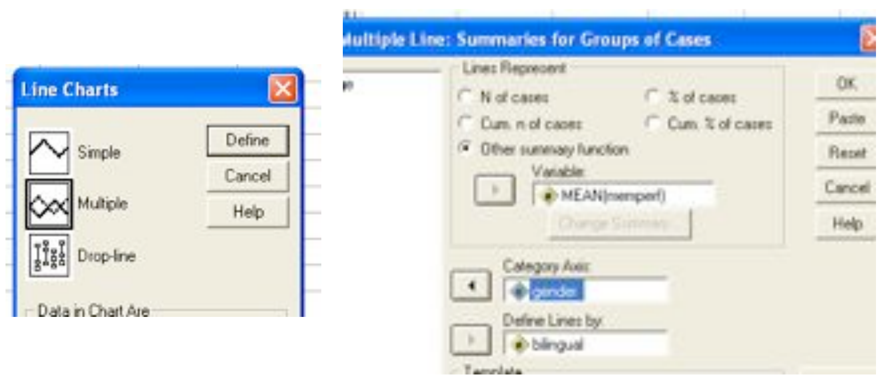
Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	66.216	6.761		9.793	.000
	gender	13.261	6.547	.320	2.025	.051
	language	-1.647	.975	-.267	-1.690	.101

a. Dependent Variable: memperf

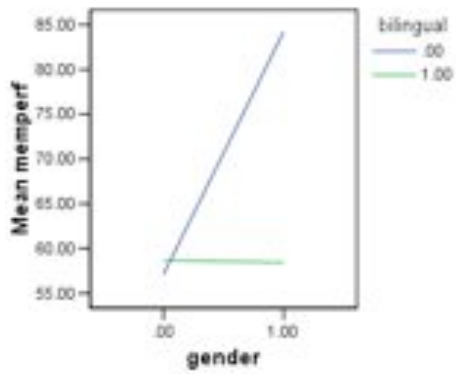




language	bilingual
1.00	.00
2.00	.00
1.00	.00
1.00	.00
2.00	.00
3.00	.00
1.00	.00
4.00	.00
3.00	.00
1.00	.00
1.00	.00
2.00	.00
3.00	.00
2.00	.00
3.00	.00
1.00	.00
1.00	.00
1.00	.00
6.00	1.00
7.00	1.00



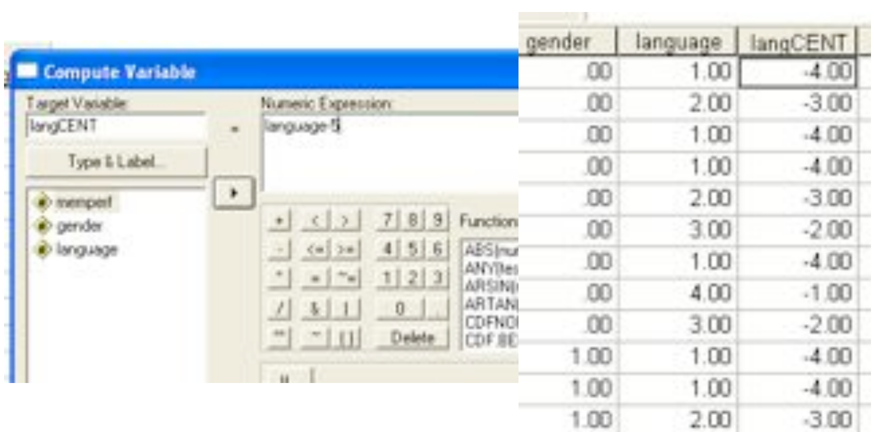
Interaction?



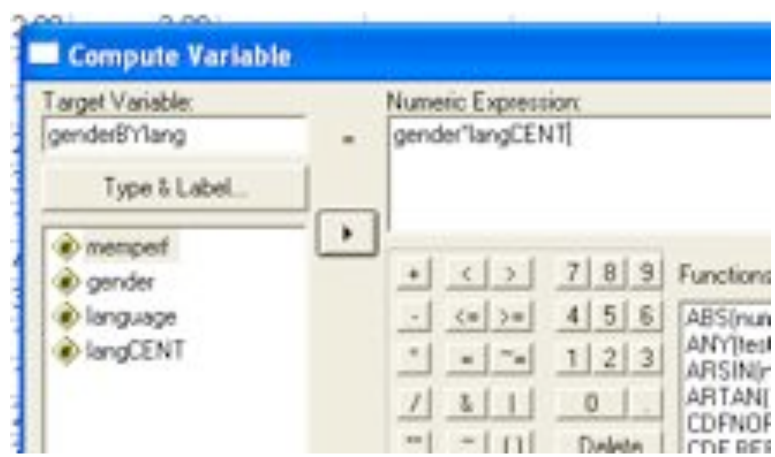
Testing for an interaction

- In MR, we test for an interaction by using a cross-product variable defined by our two independent variables
  - Basically: Gender x Language
- But: Any continuous variable should be centered first (see Keith, p. 133)

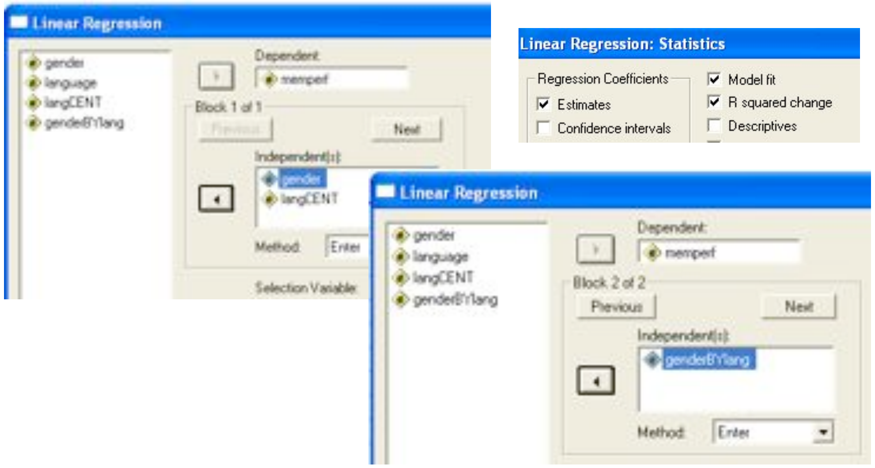
Center first...



Then "cross product"...



MR!



Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.420a	.176	.127	19.63961	.176	3.536	2	33	.041
2	.563b	.317	.253	18.16278	.141	6.585	1	32	.015

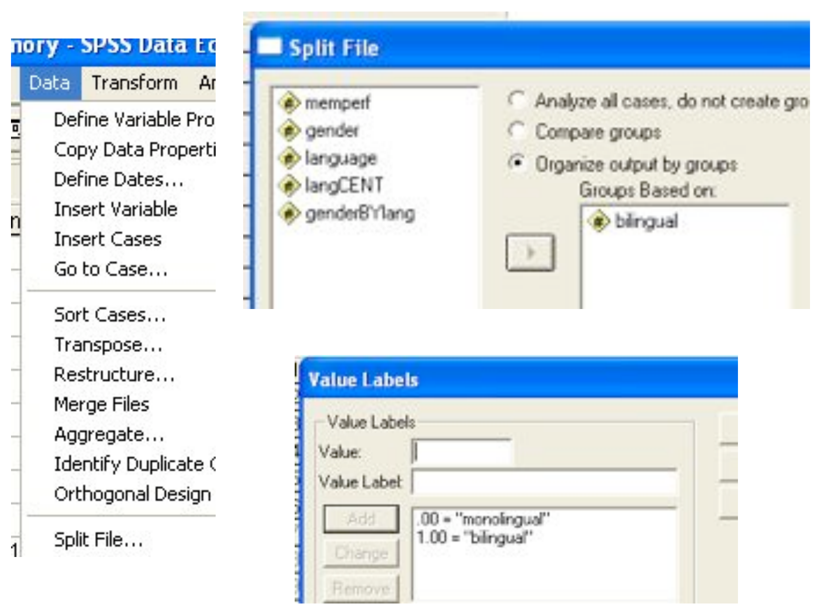
(R Square Change, F Change, df1, df2 and Sig. F Change are printed under "Change Statistics".)

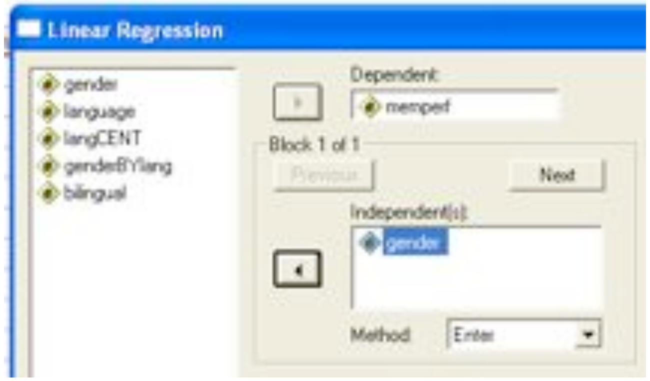
a. Predictors: (Constant), langCENT, gender

b. Predictors: (Constant), langCENT, gender, genderBYlang

Interaction

- Okay, what does it mean?
- It means: There is a significant modulation (or, "moderation") of the effects on the outcome variable through the interaction between our two independent variables
- Okay, okay...what do we do with it?
  - Let's run the two regressions separately!





bilingual = monolingual

Variables Entered/Removed[b,c]

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	57.111	6.693		8.533	.000
	gender	27.111	9.465	.582	2.864	.011

a. Dependent Variable: memperf

b. bilingual = monolingual

bilingual = bilingual

Variables Entered/Removed[b,c]

Variables Variables

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	58.667	5.514		10.640	.000
	gender	-.222	7.798	-.007	-.028	.978

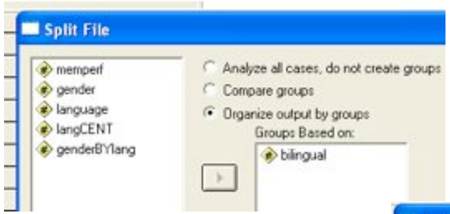
a. Dependent Variable: memperf

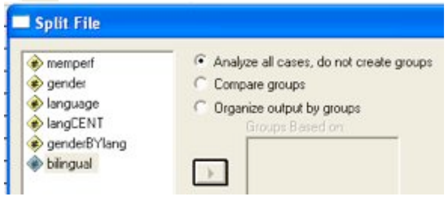
b. bilingual = bilingual

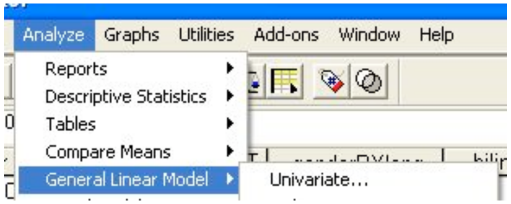
ANOVA?

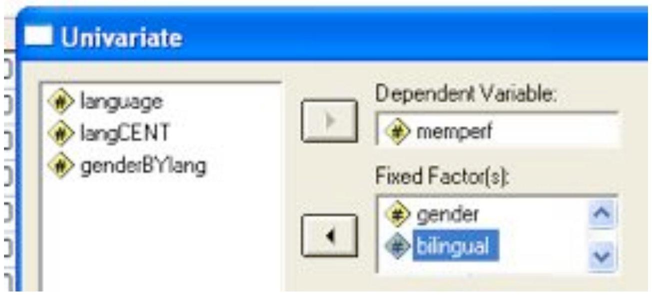
- This analysis can be done using ANOVA very easily.
- Just enter your two independent (categorical) variables and ANOVA automatically tests the interaction.

Make sure we're not split...









Tests of Between-Subjects Effects

Dependent Variable: memperf

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4627.889[a]	3	1542.630	4.559	.009
Intercept	150285.444	1	150285.444	444.111	.000
gender	1626.778	1	1626.778	4.807	.036
bilingual	1320.111	1	1320.111	3.901	.057
gender * bilingual	1681.000	1	1681.000	4.968	.033
Error	10828.667	32	338.396		
Total	165742.000	36			
Corrected Total	15456.556	35			

a. R Squared = .299 (Adjusted R Squared = .234)

Exercise 14