

PSY792F SEM

Week 4 — Moderation

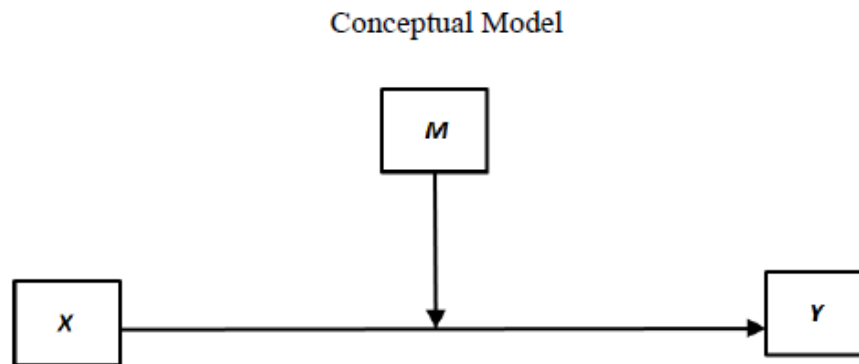
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Exam 1

- Posted on dropbox
 - Scheduled for 2/13
 - You can use your own computer
 - Don't cheat.
 - Closed book and closed notes
-
- This is an opportunity to consolidate information and memorize key points.
 - You will get output in addition to the questions

What is Moderation?

- Variable that affects the direction and/or strength of the relationship between a predictor and a criterion variable
- Categorical (e.g., males vs. females)
- Continuous (e.g., level of depression)

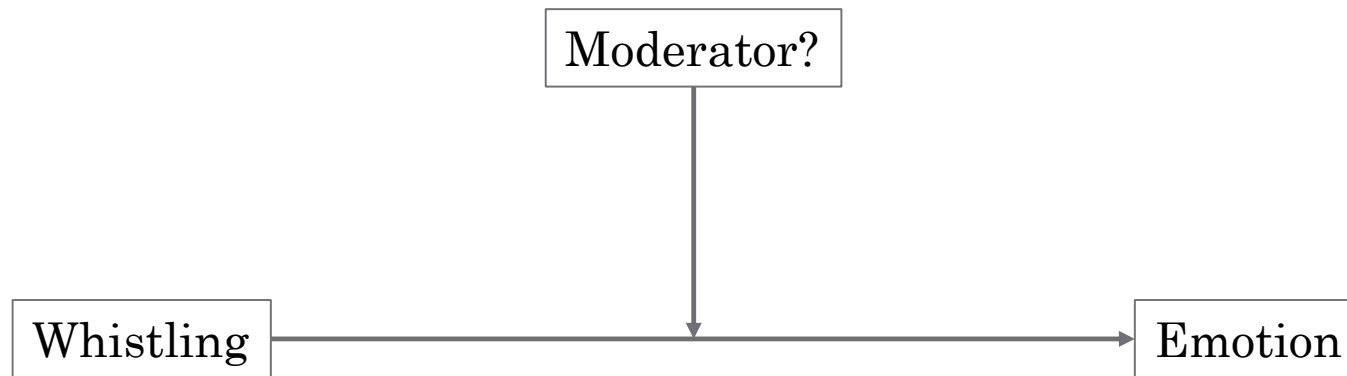


Some terms

- Mediated Moderation
- Moderated Mediation
- Conditional Indirect effect

Moderation *Meditation*

- <https://www.youtube.com/watch?v=AZOxsy8mS0M>
- Taj Mahal “Ain’t Gwine To Whistle Dixie (Any Mo’)”
- Listen to the song, what is the moderator?



- The primary relationship is negative – whistling is reminiscent of oppression.
- The song provides a different emotional expression. What is the moderator?

Testing Moderation

- Regression equation:

$$Y = a_0 + a_1X + a_2W + a_3XW + e$$

- $XW = X * W$
- You should decide which is the moderator based on your research question a priori
 - Does W moderate the X-Y relationship?
 - Does X moderate the W-Y relationship?
- This decision has implications on how you probe the interaction (i.e., understand what's going on if a_3 is significant)

Centering

- Aiken & West, 1991
 - Subtract the mean value from continuous variables
 - Called mean centering
- Does not change the regression coefficients or standard errors of the interaction term, but main effects change

Centering

- Centering helps with interpretation
- The a_3 term is zero when either or both of the centered variables are at their means of zero
- Thus, a_1 can be interpreted as the effect of X on Y at the mean of W because X appears in only the a_1X term
- Centering reduces multicollinearity, but does not avoid multicollinearity

Moderated Mediation

- *How* and *when* a given effect occurs
- Strength of an indirect effect depends on the level of some variable, or in other words, when mediated relations are contingent on the level of a moderator
- Example. Hopefulness mediates relationship between health and negative mood, moderated by gender

Mediated Moderation

- Involves first showing an interaction effect of X and W on Y, then introducing a mediator of that effect.
- Example:

Gender X alcohol consumed predicts BAC, and this moderation is mediated by alcohol metabolism

AlcoholXGender \rightarrow Alc metabolism. \rightarrow BAC

“Conditional Indirect Effects”

- More general term
- “The effect of interest is an indirect (mediation) effect that is potentially conditioned on the value of one or more moderators” (p. 215; Preacher et al., 2007).

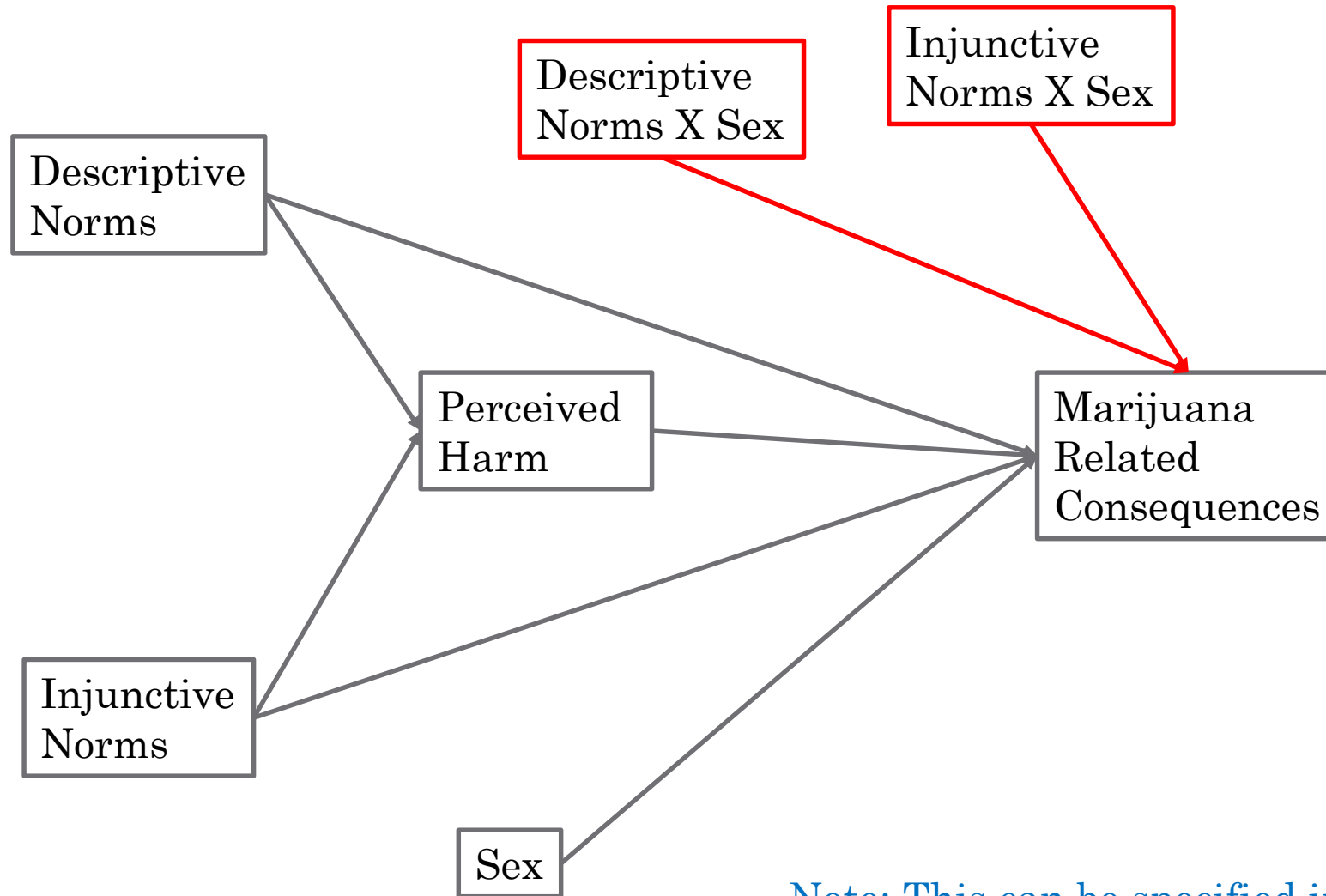
Real Data Example (moderated mediation)

- National sample of High School students' perceptions about marijuana use and personal experience of marijuana related consequences
- Descriptive Norms (continuous) – belief about how much marijuana peers are using
- Injunctive Norms (continuous) – belief about how accepting peers find marijuana use
- Perceived Harm (continuous) – belief about how harmful marijuana use is
- Marijuana Related Consequences (continuous) – Total number of personally experienced negative consequences due to marijuana use
- Sex (binary) M = 0, F = 1

Hypotheses

- H1: Students' beliefs about others use and acceptability of use predict the number of marijuana related consequences they personally experience.
- H2: The effect of normative beliefs impacts consequences via perceived harm. (Mediation)
- H3: The pattern of findings is different between males and females. (Moderation)
 - *Technically moderated mediation*

Moderation Model Type I – *adding interaction terms*



Note: This can be specified in multiple ways

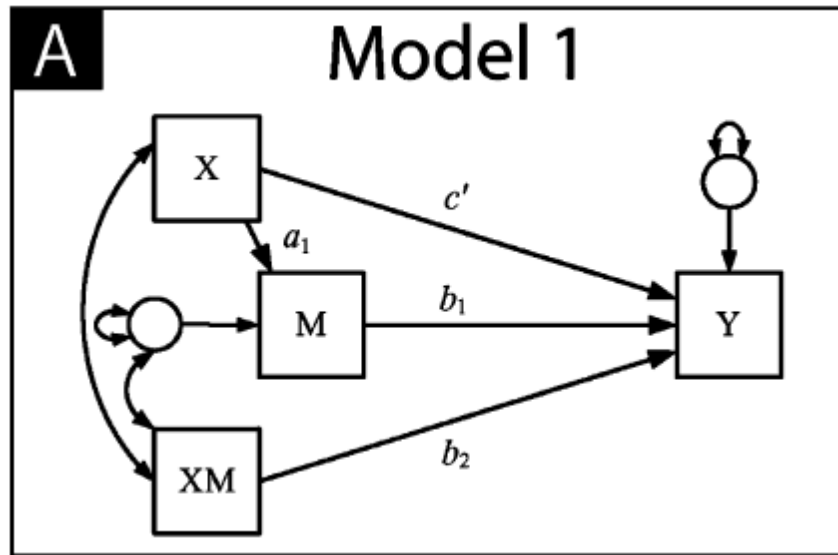
How to write the code

- Just like a typical path analysis
- Use define statements to make mediation terms.
- Can also use define statements for centering (if you want to center your variables)
- In the example above the c paths are moderated
- Input file “moderation interaction p29.inp”

Alternative Models

- Model 1: Independent variable is also the moderator
- Model 2: When the “a” path is moderated
- Model 3: When the ”b” path is moderated
- Model 4: When “a” path and “b” path are each moderated by separate moderators
- Model 5: When “a” path and ”b” path are each moderated by a single moderator
- *I am going to use the examples from Preacher, Rucker, & Hayes (2007) because they are more straight forward

Model 1: Independent variable is also the moderator



ANALYSIS:

BOOTSTRAP = 5000;

MODEL:

y on m (b1)

x

xm (b2);

m on x (a1);

xm with m;

MODEL CONSTRAINT:

new (ind xmodval);

xmodval = -1;

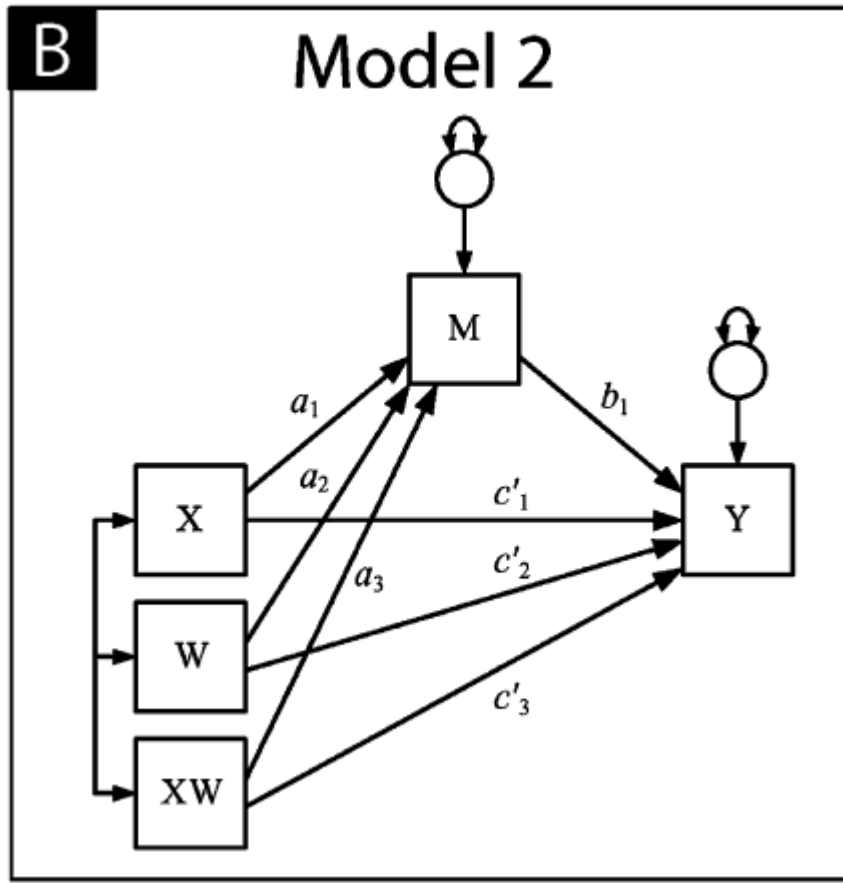
ind = a1*(b1+b2*xmodval);

OUTPUT:

cinterval (bootstrap);

Notice the ; in the code to see where each statement ends

Model 2: When “a” path is moderated



ANALYSIS:

BOOTSTRAP = 5000;

MODEL:

y on m (b1)

x

w

xw;

m on x (a1)

w

xw (a3);

MODEL CONSTRAINT:

new (ind wmodval);

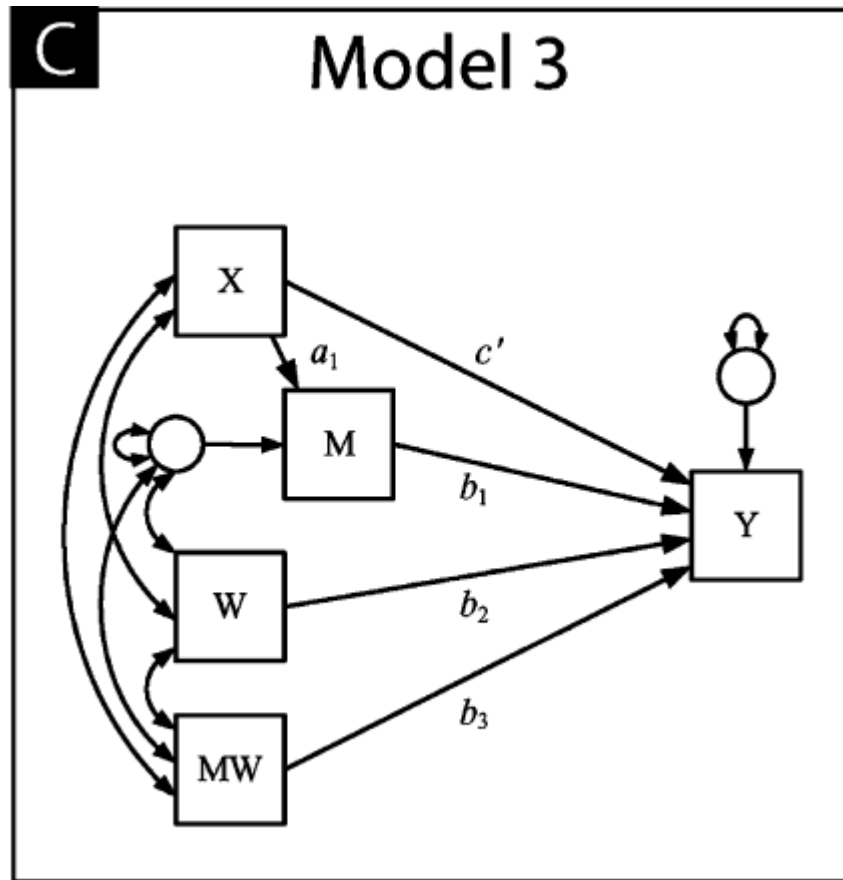
wmodval = -1;

ind=(a1+a3*wmodval)*b1;

OUTPUT:

cinterval (bcbootstrap);

Model 3: When “b” path is moderated



ANALYSIS:

BOOTSTRAP = 5000;

MODEL:

y on m (b_1)

x

w

mw (b_3);

m on x (a_1);

w with m;

mw with m;

MODEL CONSTRAINT:

new (ind wmodval);

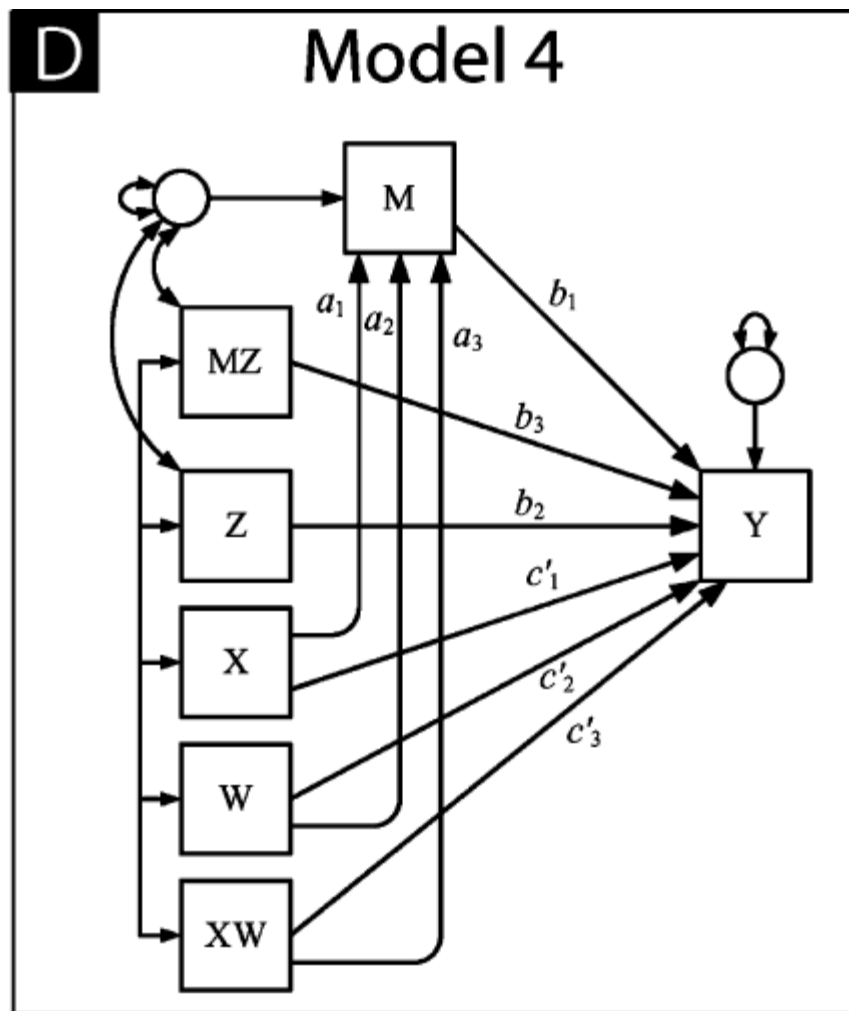
wmodval = -1;

ind = $a_1 * (b_1 + b_3 * wmodval)$;

OUTPUT:

cinterval (bootstrap);

Model 4: When “a” path and “b” path are each moderated by separate moderators



ANALYSIS:

BOOTSTRAP = 5000;

MODEL:

y on m (b1)

x

w

z

mz (b3)

xw;

m on x (a1)

w

xw (a3);

z with m;

mz with m;

MODEL CONSTRAINT:

new (ind wmodval zmodval);

wmodval = 1;

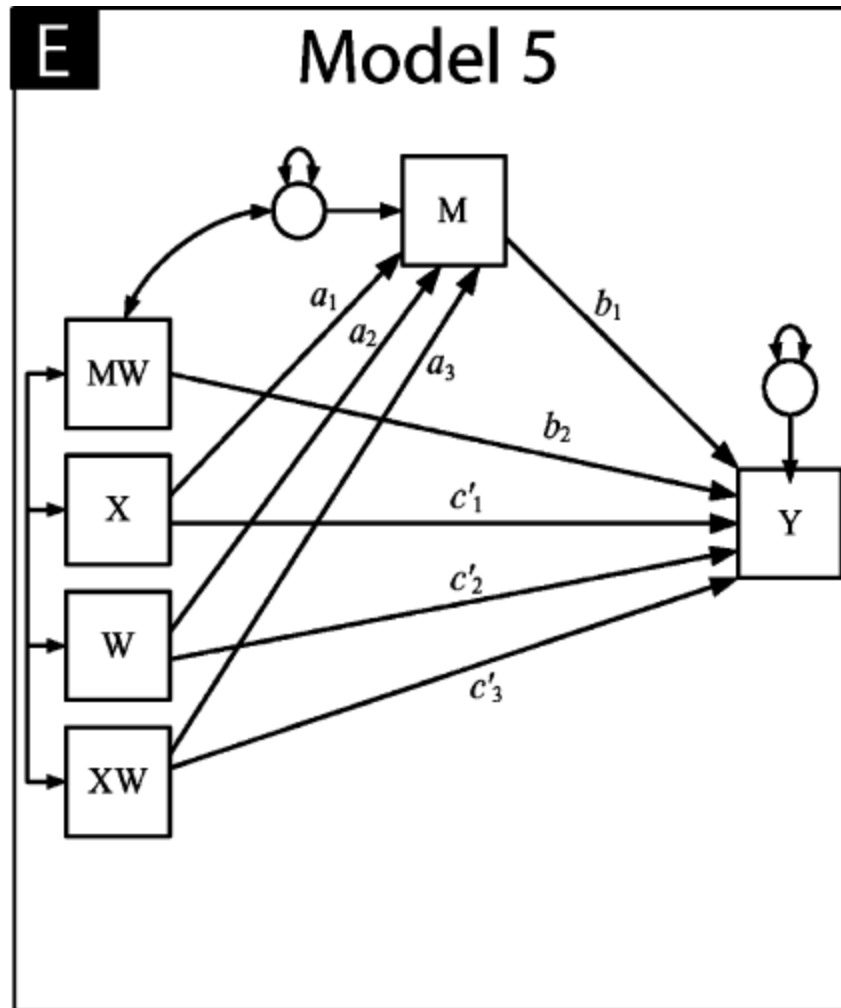
zmodval = 2;

ind=(a1+a3*wmodval)*(b1+b3*zmodval);

OUTPUT:

cinterval (bootstrap);

Model 5: When “a” path and “b” path are each moderated by a single moderator



ANALYSIS:

BOOTSTRAP = 5000;

MODEL:

MODEL:
y on m (b1)

x

w

mw (b2)

xw;

m on x (a1)

w

xw (a3);

mw with m;

MODEL CONSTRAINT:

new (ind wmodval);

wmodval = -1;

ind=(a1+a3*wmodval)*(b1+b2*wmodval
);

OUTPUT:

cinterval (bootstrap);

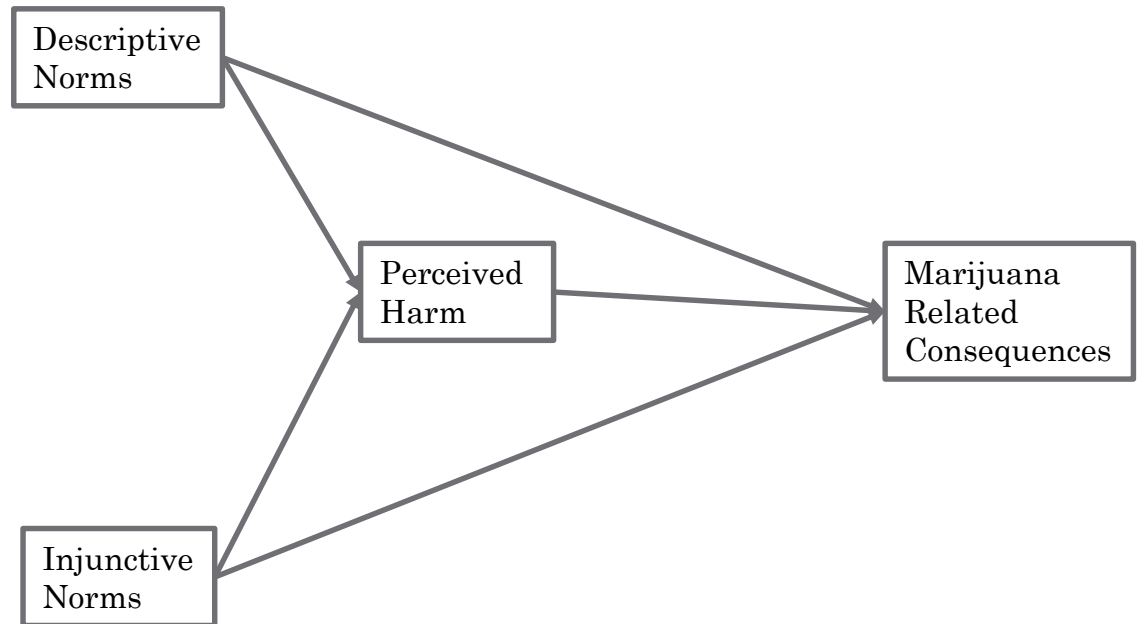
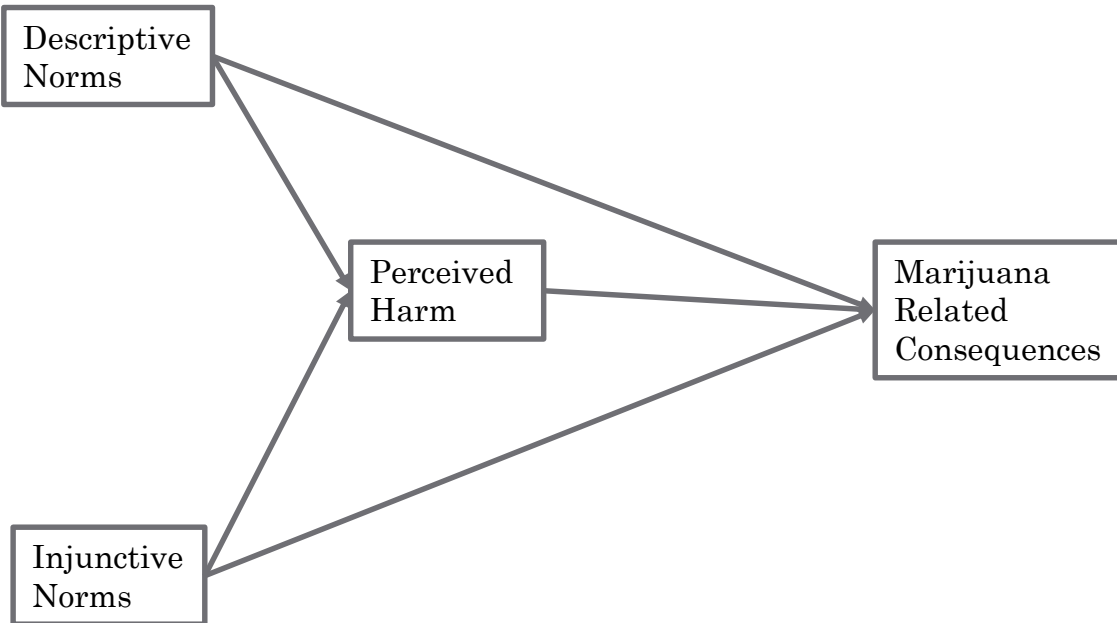
How to write up the results

- In the analysis plan need to describe any coding decisions you made (e.g., centering), and exactly how the moderation was specified
- Still report fit indices
- Start with the direct effect (main effects) and indirect effect (mediation tests)
- Then describe the interactions (moderation effects)
- If interaction terms are significant, you need to describe the simple slopes and explain how the relationship between X and Y varies as a function of W
- If interaction terms are not significant you can focus the write up on the direct effects
- Make sure to discuss effect size (Standardized Betas are a good way to go)
- Note: if you compare models need to describe the model building procedure, report comparative fit indices, and provide a rationale for your final model, but only report on the final model.

Moderation Model Type II – *multi-group analysis*

MALES

FEMALES



How to write the code

- See “Moderation MG ex_nouse.inp”
- Here we have the flexibility to constrain any paths we want to be the same across groups or to vary across groups and compare model fit among these *nested models*
- Running this model with various constraints is considered comparing nested models because they are all variations of the same model.
- Two models with different variables (even with the same structure) are non-nested
 - The reason is that the comparative fit indices (e.g., BIC) have values that are dependent on the scales of the variables in the model

Comparative Model Fit

Fit Index	All constrained	All free	Only b constrained
χ^2 , df, p	6.8, 5, .23	2.6, 1, .10	.48, 1, .48
BIC	65809	65839	65836
CFI	.997	.998	1.00
TLI	.995	.978	1.01
RMSEA, CI, p	.013, [.00, .03], 1.00	.026, [.00, .07], .79	.00, [.00, .048], .96
SRMR	.012	.007	.003

How to write up the results

- Same as above, but...
- Need to describe differences, effect sizes can be helpful or just the absolute magnitude of the differences in effects across groups
- If you ran various models with different constraints be sure to describe the process in the analysis plan, give a rationale for the selection of the final model, and report only on the final model
- In the discussion, talk about implications of similarities or differences

Interpreting the Interaction: Simple Slopes Analysis

- Use one of the variables in the interaction as a grouping variable
 - Categorical variable is best
 - If continuous, then create new grouping variable (at 1 SD below, within 1 SD of the mean, and 1 SD above the mean; or other meaningful groups)
- Examine regression coefficients by group
- In either approach you can get the regression equation for different levels of the moderator and graph the lines

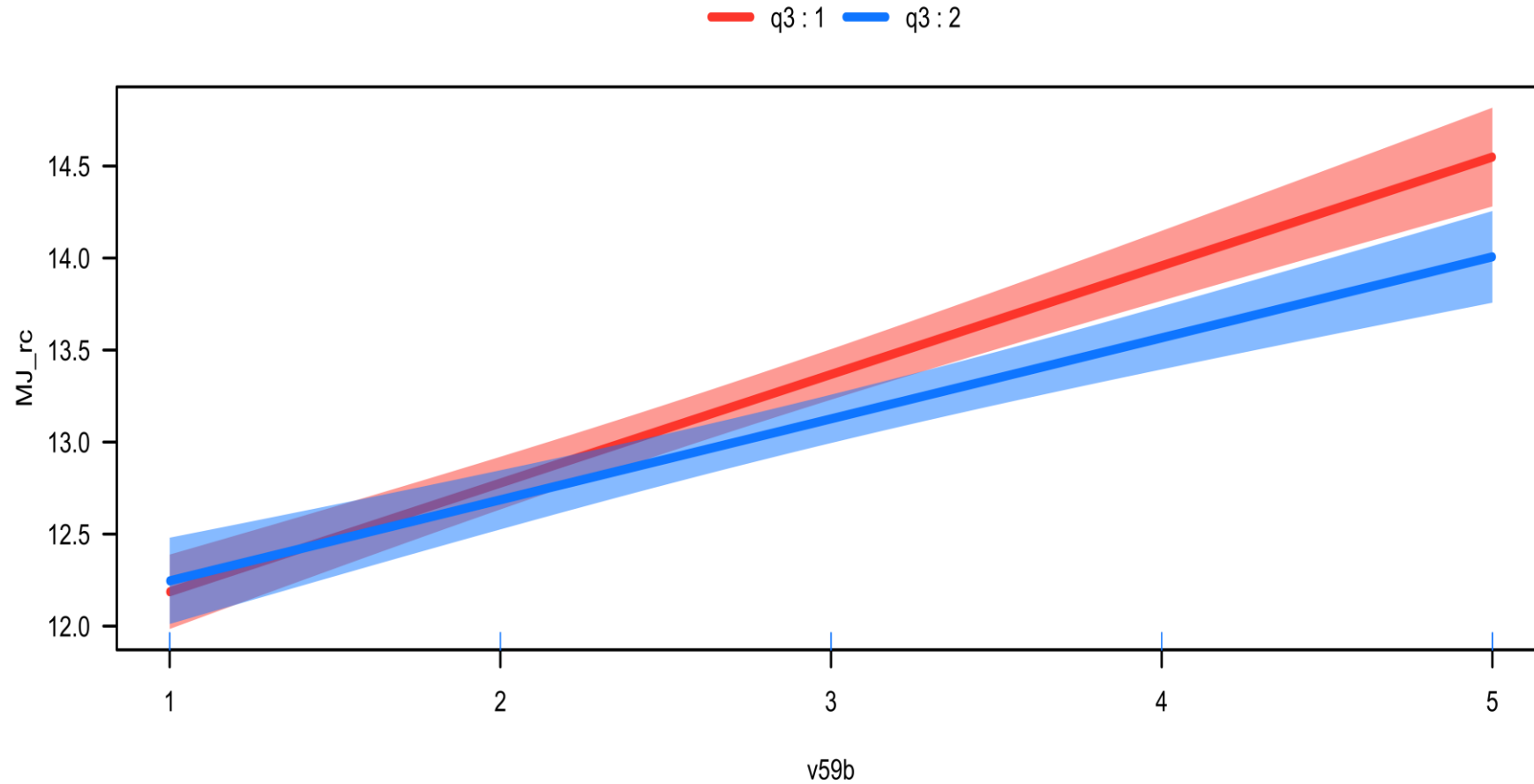
Tables and Figures

- Tables
 - Need a table for fit indices, unless you have a single model then report them in text
 - Need a table for regression coefficients, SEs, CIs, ps
- Figures
 - Path diagram
 - Any moderated paths, a simple slopes diagram can be helpful
 - The quantpsy.org utility is helpful
 - Need to use tech3 to get the numbers for it
 - The R package visreg is another good option
 - Mplus has a loop function
 - On a PC you can use the diagramer to see figures
 - On a Mac you have to use R to access the plots

Interpreting Interactions

- Graphing can help elucidate the pattern of effects
 - R visreg package
- Simple slopes – regression of Y on X at specific values of W
<http://quantpsy.org/interact/interactions.htm>
- Mplus LOOP function – will visualize moderations
 - PC's can use diagramer
 - Mac's need to use R

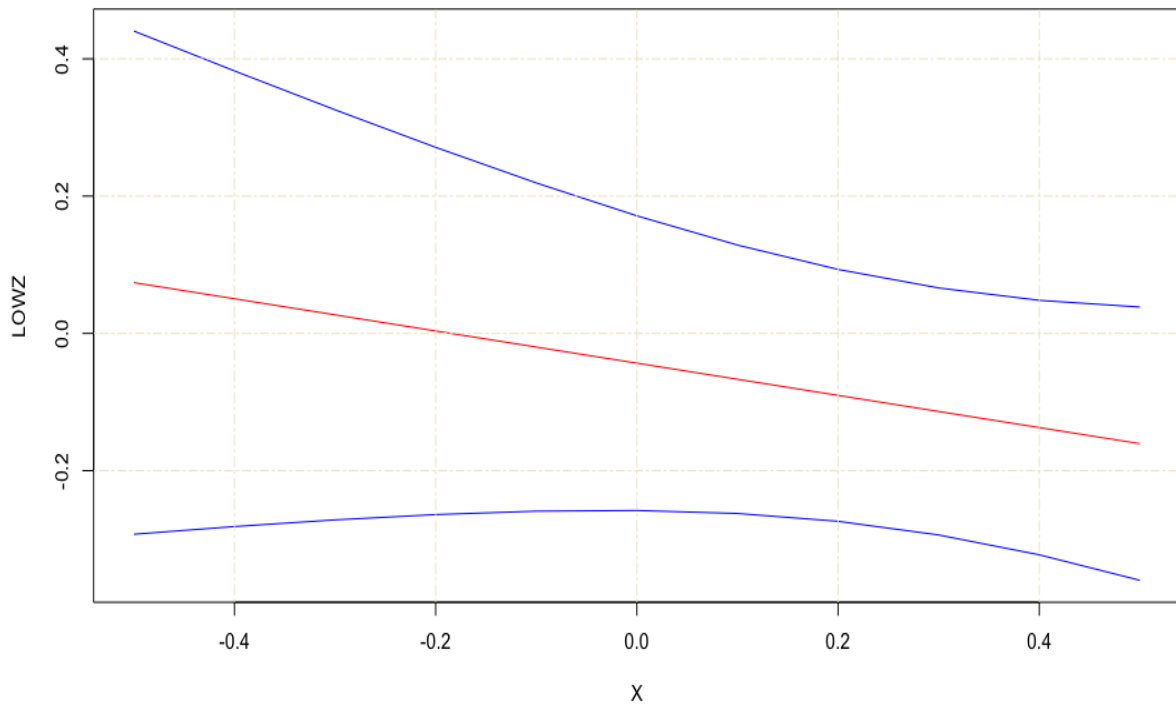
Figure from visreg



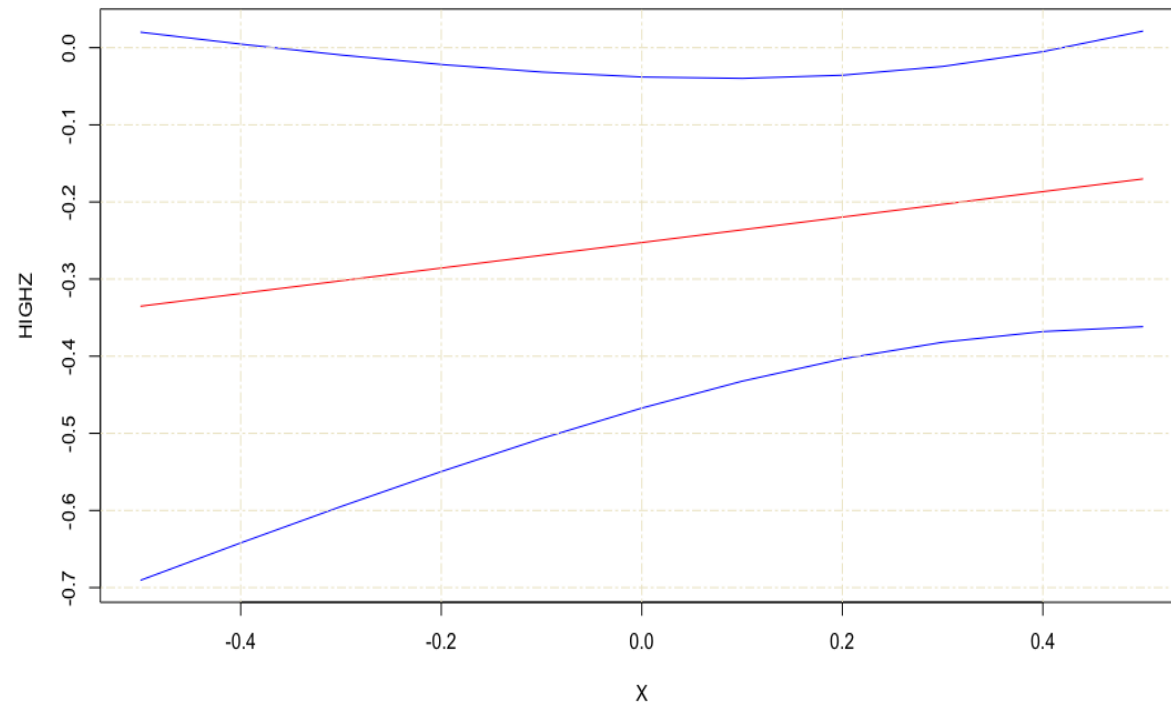
$q3$ = sex, M = 1, F = 2; $v59b$ = Descriptive Norms; MJ_rc = marijuana related consequences

Figures from Mplus' Loop function

Loop plot for LOWZ



Loop plot for HIGHZ



Interaction between Latent and Observed Variables

Mplus

ANALYSIS:

TYPE = RANDOM;

MODEL:

inter | observed XWITH latent;