Conditional Effects and Moderation
Analysis Using SPSS and PROCESS

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Moderation and Mediation

- Mediation and moderation have taken increasingly prominent roles in the social and behavioral sciences in recent years
- In general, mediation and moderation seek to clarify the nature of a causal relationship between two variables
  - Both mediation and moderation are extensions of a direct cause-effect relationship
  - Independent variable (IV) = cause, and dependent variable (DV) = effect
- Both serve to describe the role of the "third variable" in a causal relationship between two other variables
 - Or, the processes involved when the cause elicits the effect

Moderation

- Moderation is used to describe "for whom" or "under what circumstances" an effect becomes stronger (or weaker)
  - The value of the Effect (DV) depends on knowing values of both the Cause (IV) and Moderator (Mo)
  - The Moderator should have temporal precedence and be uncorrelated with the Cause (IV)
  - The Moderator acts as a dimmer switch, gain control, or filter that allows more (or less) of the effect to come through under different conditions
  - Think of it as: *Moderation = Modify*

Moderation

- Moderation is a specific type of interaction, in which the moderator creates the "it depends" feature of a causal relationship
  - The causal relationship between the cause (IV) and effect (DV) is conceptually or empirically established beforehand
    - It is possible that the direct effect of the IV is equal to zero and moderation still exists
  - The Moderator serves to modify the strength of the causal relationship

Conceptual Moderation
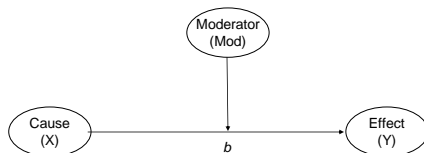
$$\hat{Y} = bX + bMo + b(X * Mo) + i$$

With *moderation* the relationship between the cause (X) and the effect (Y), is adjusted or conditional on the value of the moderator (Mod). This includes circumstances under which the cause no longer elicits the effect (i.e., the relationship is reduced to zero or near zero).
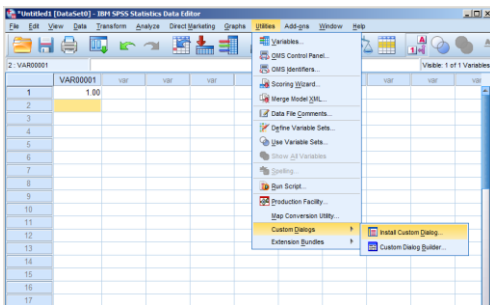
Analytical Moderation

- Moderation is most often demonstrated with a significant interaction in hierarchical regression
  - Moderation is present if the interaction between the IV and the Mo is associated with a significant ΔR^2
  - Because of (multi)colinearity, the significance of the interaction coefficient may be affected by inflated *SEs*
    - Centering will reduce but not eliminate (multi)colinearity

- Post-hoc tests of conditional effects (i.e., simple slopes) is preferred over visual-only interpretation
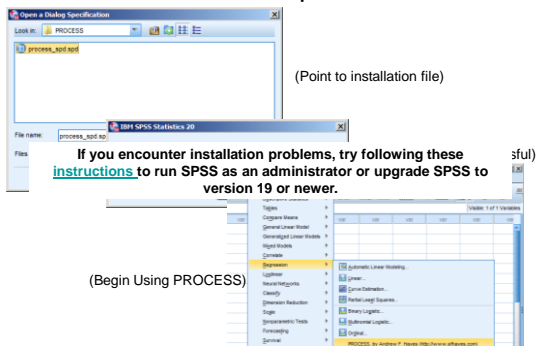 - See Holmbeck (2002) article for examples

Accessing and Installing
PROCESS for SPSS

- Navigate browser to http://afhayes.com/introduction-to-mediation-moderation-and-conditional-process-analysis.html and download the *.zip archive that contains PROCESS
- Extract the archive to a new folder on your hard drive
- Adding process to the list of regression procedures is accomplished by going to…
  - Utilities → Custom Dialogs → Install Custom Dialog

- See Hayes (2013) for additional details, features, and examples of PROCESS.

Adding a Custom Dialog

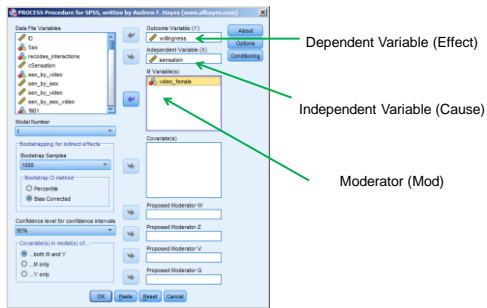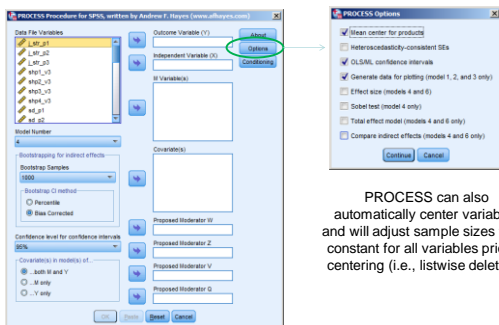## Select, Install, and Open PROCESS

(Point to installation file)

If you encounter installation problems, try following these ssful)
instructions to run SPSS as an administrator or upgrade SPSS to version 19 or newer.

(Begin Using PROCESS)

Simple Moderation in PROCESS
(Model 1)

Dependent Variable (Effect)

Independent Variable (Cause)

Moderator (Mod)

Options Dialog

PROCESS can also automatically center variables and will adjust sample sizes to be constant for all variables prior to centering (i.e., listwise deletion).
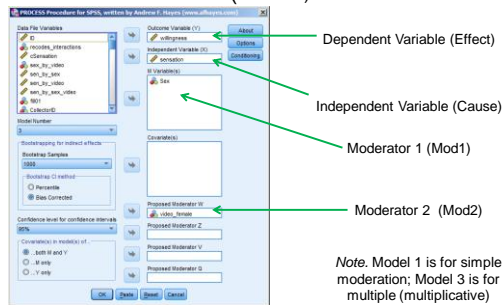
Interpreting the Output

- Example: Tests if exposure to a video starring a male or female actor affects the relationship between sensation seeking and willingness to engage in sexual activity with the actor
  - Dependent Variable: Sexual willingness, higher scores indicate more willingness
  - Independent variable(s): Actor Sex (Analysis 1), Participant Gender (Analysis 2), higher values indicate female/woman, respectively
  - Sensation seeking serves as the moderator, high scores indicate more sensation seeking activities
- See annotated moderation output

Multiple Multiplicative Moderators
in PROCESS
(Model 3)

Dependent Variable (Effect)

Independent Variable (Cause)

Moderator 1 (Mod1)

Moderator 2 (Mod2)

Note. Model 1 is for simple moderation; Model 3 is for multiple (multiplicative) moderators

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Moderation vs. Interactions:
A Caution

- Moderation implies the presence of a cause-and-effect relationship and also the circumstances under which the cause elicits the effect

- Moderators typically are stable, traits that are difficult to change (e.g., biological sex) and that occur long before the study begins

- The causal relationship between the cause and effect still needs to be established, otherwise the differential effect is better described as an interaction

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Advanced Models

- Moderation and mediation can easily be expanded, extended, or combined in a variety of ways
  - *Additive Moderation*: Multiple moderators independently impact the relationship between the IV and the DV, but there is no synergistic effect of the moderators acting in concert
  - *Mediated-Moderation:* The impact of the moderator on the focal relationship can be mediated, or partially mediated, through another variable
  - *Moderated-Mediation:* The indirect effect can emerge/disappear or vary under different circumstances
- Wu and Zumbo (2007) offer a relatively accessible treatment of these and other advanced conditional process models
- These and many, many, more advanced models can be easily accommodated in PROCESS!

Similar PROCESS Workshops

- This moderation workshop will be presented again:
  – Thursday (9/12) at 4:00pm in Malpass 180

- Related workshops discussing mediation analysis will be presented:
  – Wednesday (9/18) at 1:00pm in Malpass 180
  – Thursday (9/26) at 4:00pm in Malpass 180

- Andrew Hayes will hold PROCESS workshops in Chicago in early May, 2014
  – For Midwestern Psychological Association (probably May 1, 2014)
  – For Statistical Horizons on May 2nd and 3rd, 2014

Thank You!

Questions?
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