climber

belay

wikiHow to Belay

Belay device (ATC)

Rope

Belay Device

Me!

How does it work?

- Rope Spikes?
- Friction?
- Magnets?
- Divine Intervention?

Process Theories and Evidence

What are process theories?

Process theories are stories related to

how, *when, and why*

causes become effects.
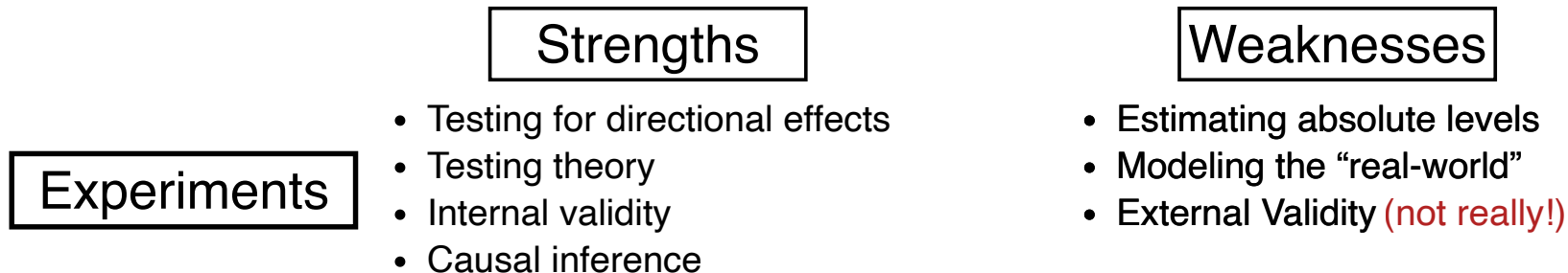
What is process evidence?

Process evidence helps to refute, support, qualify or further our understanding of process theories.

Process evidence can come in many forms.

Should we care about process? If so, when? | Yes, when it matters.

Process, Experiments, and Validity

How are these three related?

Strengths	Weaknesses

Experiments

- Testing for directional effects
- Testing theory
- Internal validity
- Causal inference

- Estimating absolute levels
- Modeling the "real-world"
- External Validity (not really!)

But wait! Process theories are theories…

...And theory is what generalizes from an experiment.

Convincing process evidence helps us generalize from our experiment to the "real world".
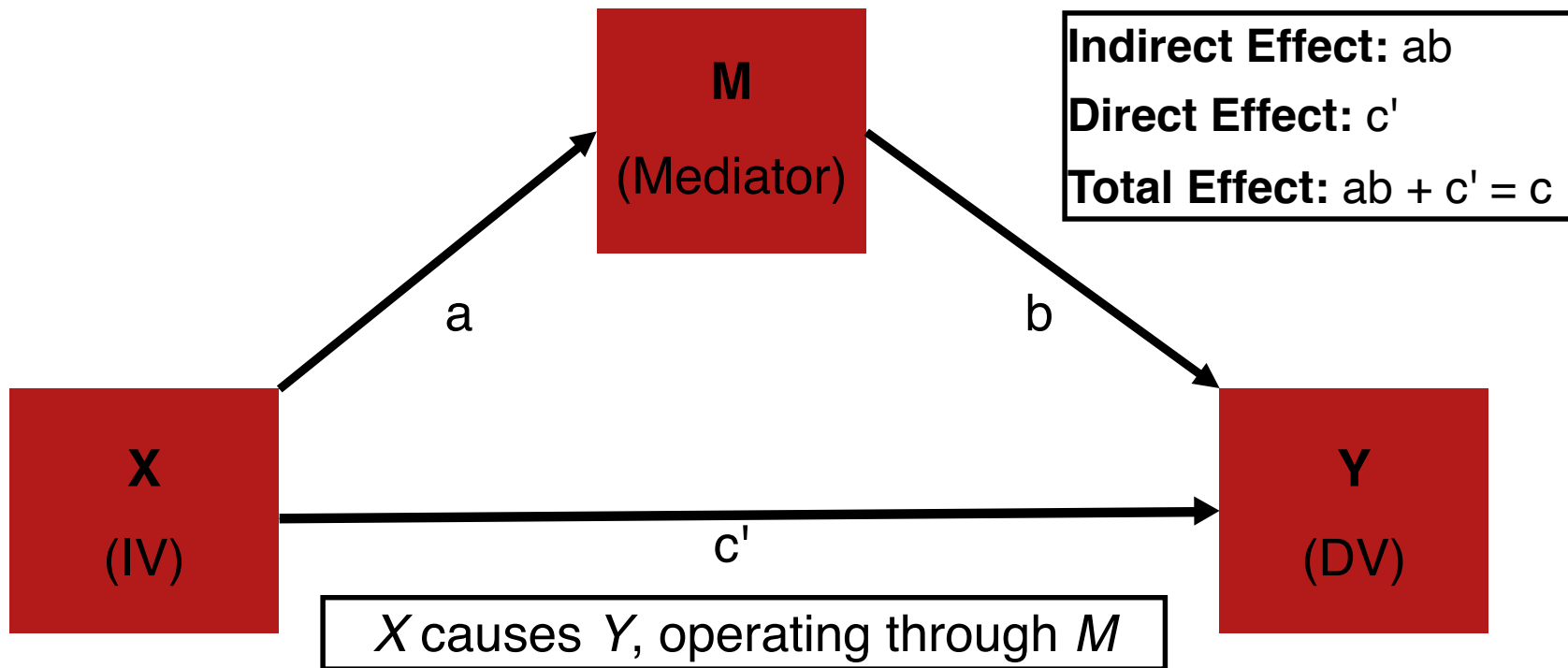
Disclaimer!

Experiments are not the only methodological approach that provides process evidence.

So why am I focusing on experiments…

- Well-designed experiments can provide strong causal evidence, that other approaches cannot.
- Experiments are suitable for testing nuanced theory and leveraging strict control to rule out alternative explanations.
- I am an experimental researcher, so I know more about experiments than other methods. (And I like them. :))

Mediation

Mediation helps us understand *how or why* causes become effects.

M
(Mediator)

a

b

Indirect Effect: ab
Direct Effect: c'
Total Effect: ab + c' = c

X
(IV)

c'

X causes *Y*, operating through *M*

Y
(DV)

Mediation

Mediation can help us understand *how or why* causes become effects.
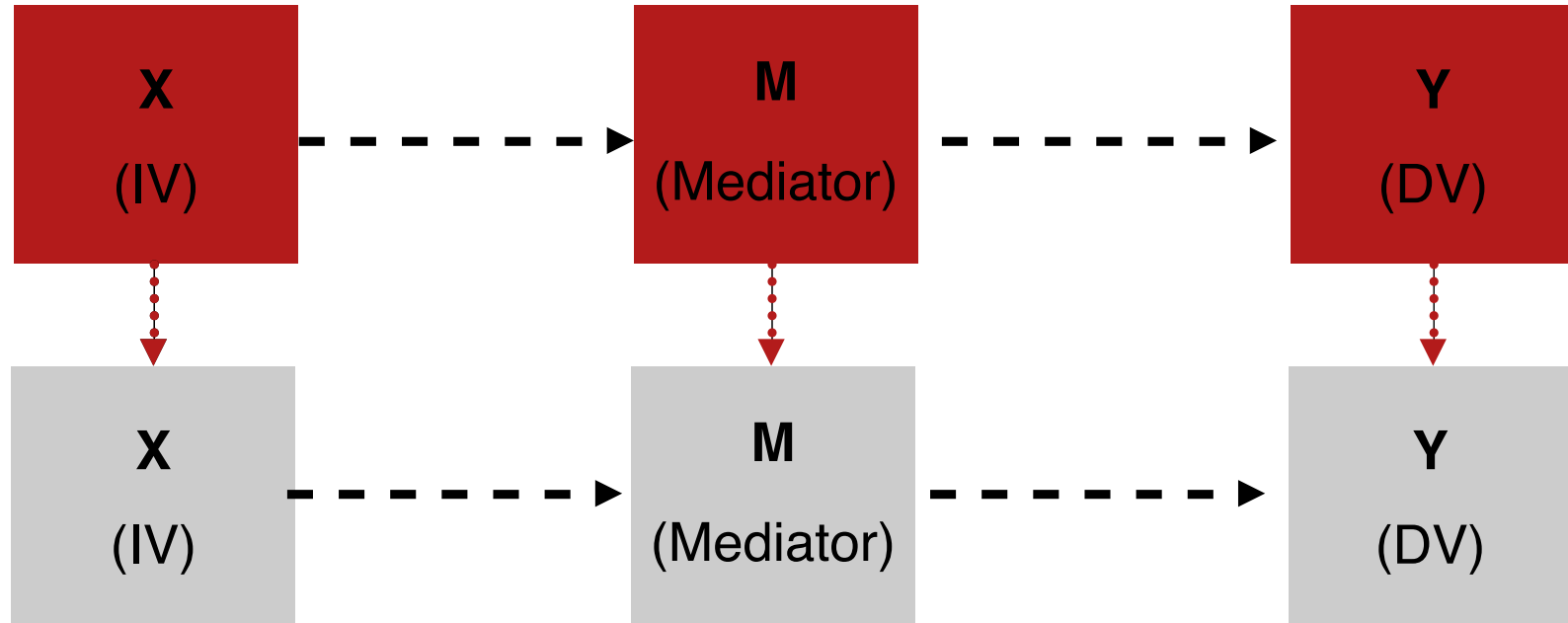
Strengths

- Can provide convincing *correlational* process evidence.
- Generally allows for efficient designs.
- Usually easy to implement.
- Can be implemented without altering experimental flow.
- Analysis is (usually) straightforward with modern stats software.

Weaknesses

- Can only provide *correlational*, not causal evidence.
- Often relies on PEQs or participant self-insight, which can introduce validity threats.
- Relies on measured variables, so subject to measurement error concerns.
- No benefit of random assignment to the mediator.
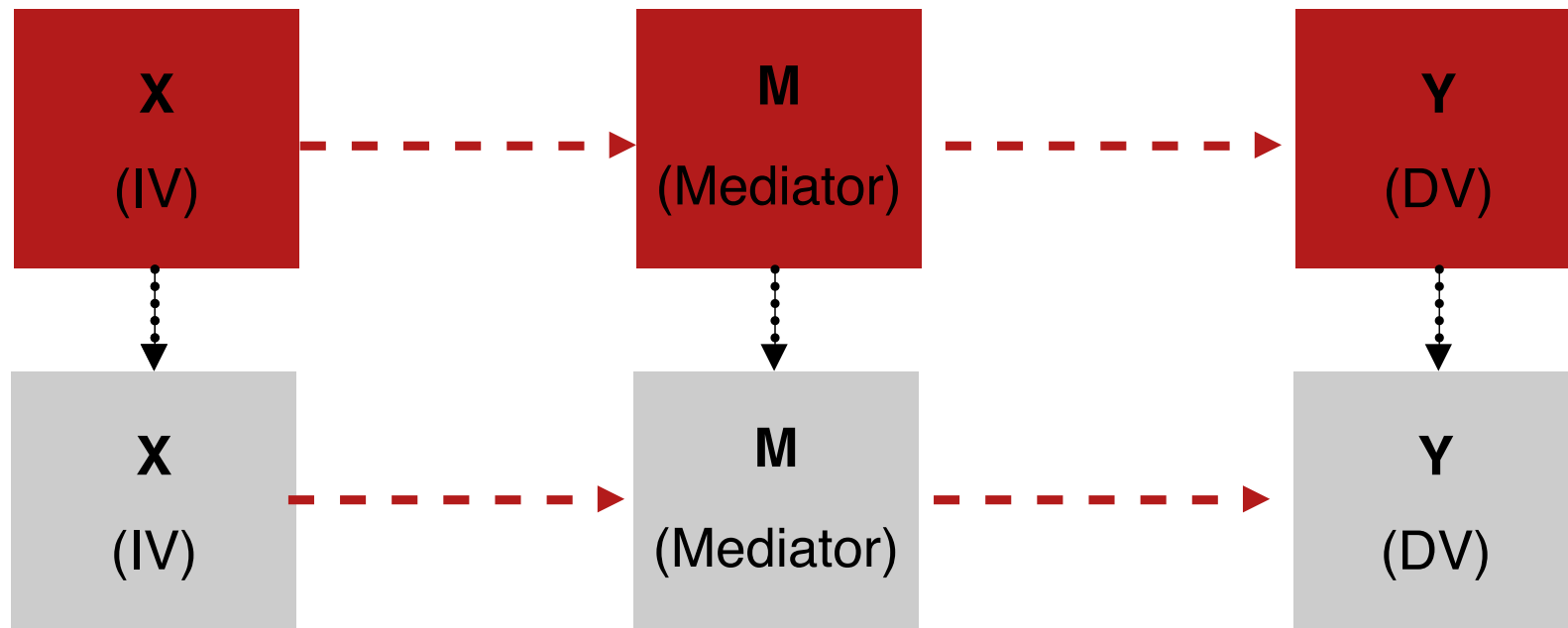- Coefficients are often biased.

Mediation: What could go wrong?

Construct Operationalization Threats

Mediation: What could go wrong?

Mediation: Best Practices

- Unobtrusive Measures
  - Technology
  - Coded Responses

- Obtrusive Measures
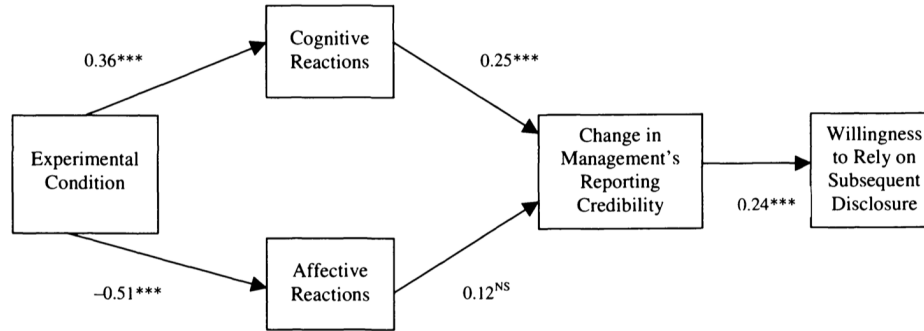 - Scale and Question Design

- Participant Self-insight

- Carryover from M to Y
- Carryover from Y to M
- Carryover from M to other Ms.

- One "thing", all "things", or somewhere in-between?
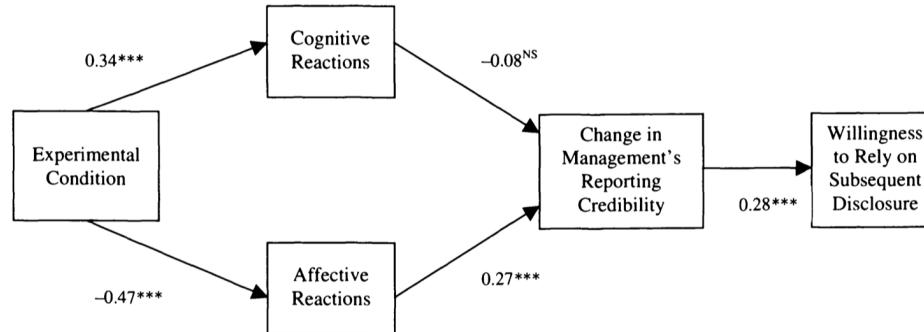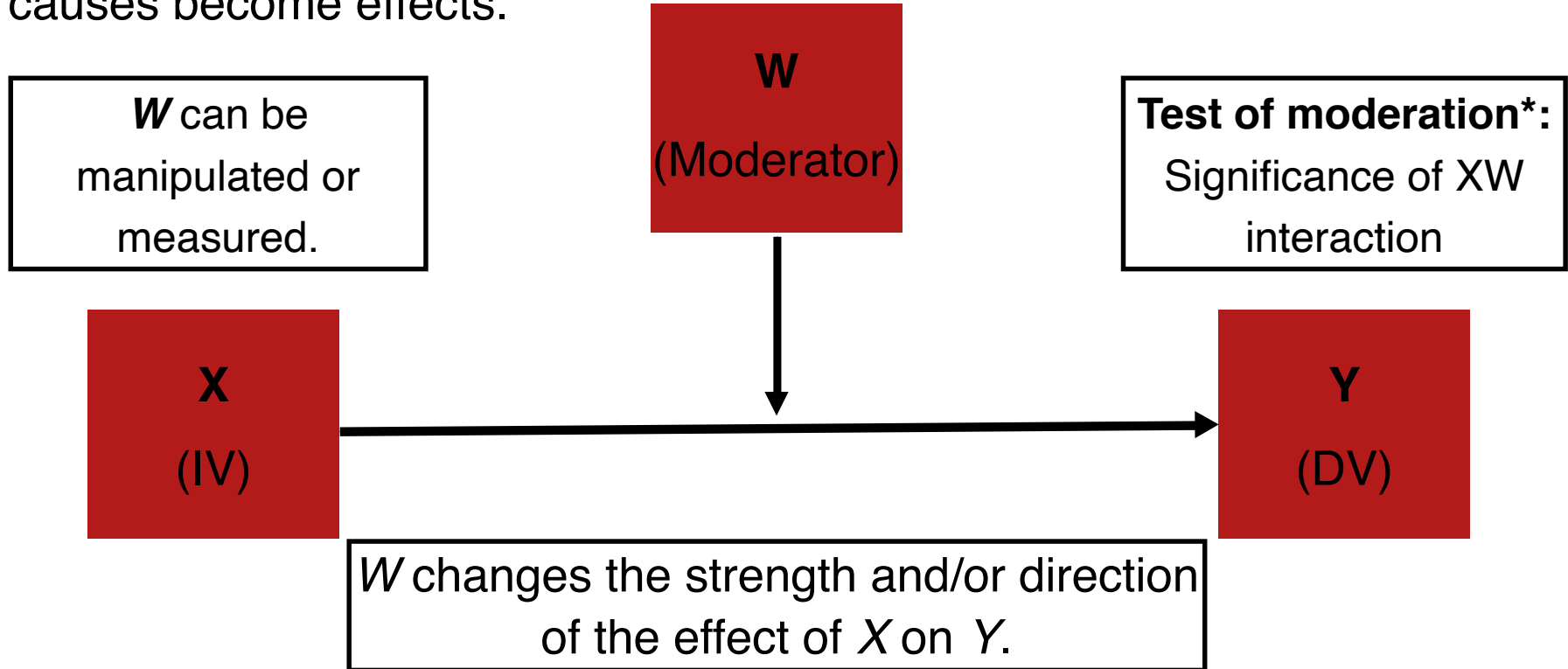
Credibility and forthcomingness

Figure 3 - Mercer (2005 TAR)

Moderation

Moderation helps us understand *when (or under what circumstances)* causes become effects.

Moderation

Moderation can help us understand *when (or under what circumstances)* causes become effects.
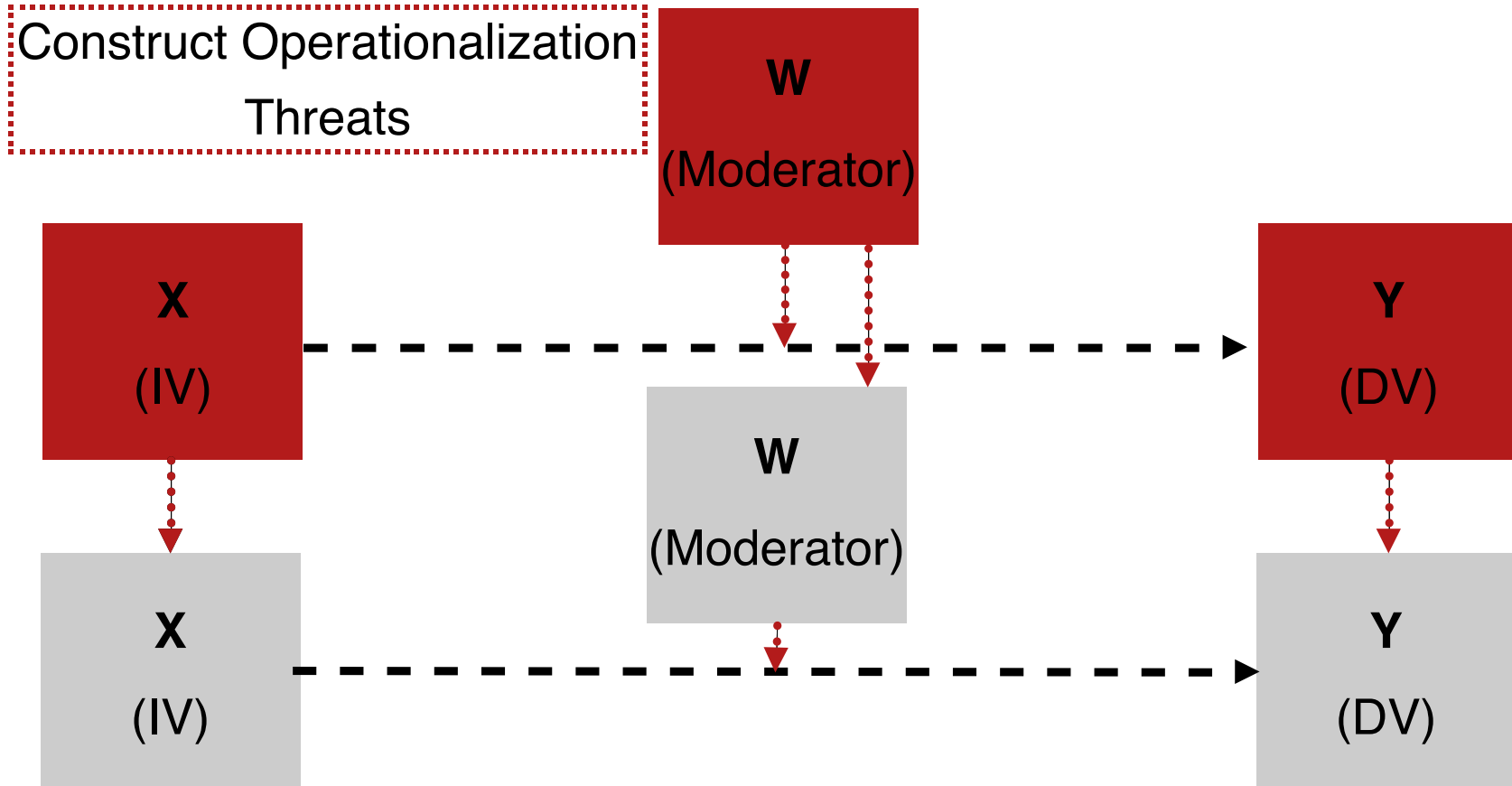
Strengths

- Can provide convincing *causal* process evidence (only when the moderator is manipulated).
- Manipulated moderators can leverage random assignment and control of temporal order to rule out plausible alternative theories.
- Does not (usually) rely on fancier stats than an ANOVA or regression.
- Manipulated moderators largely alleviate measurement error concerns.
- Often provide confirmatory and disconfirmatory evidence at the same time.

Weaknesses

- Many of the weaknesses of mediation also apply to measured moderator designs.
- Manipulated moderator designs often entail high participant resource demands (less efficient).
- Some moderators are not able to be (ethically) manipulated.
- Moderators are often more difficult to design (more abstracted from process).

Moderation: What could go wrong?

Construct Operationalization Threats

W (Moderator)

X (IV)

Y (DV)

W (Moderator)

X (IV)

Y (DV)

Moderation: What could go wrong?

Variable Sequence

Measured moderators only!

W
(Moderator)

X
(IV)

Y
(DV)

W
(Moderator)

X
(IV)

Y
(DV)
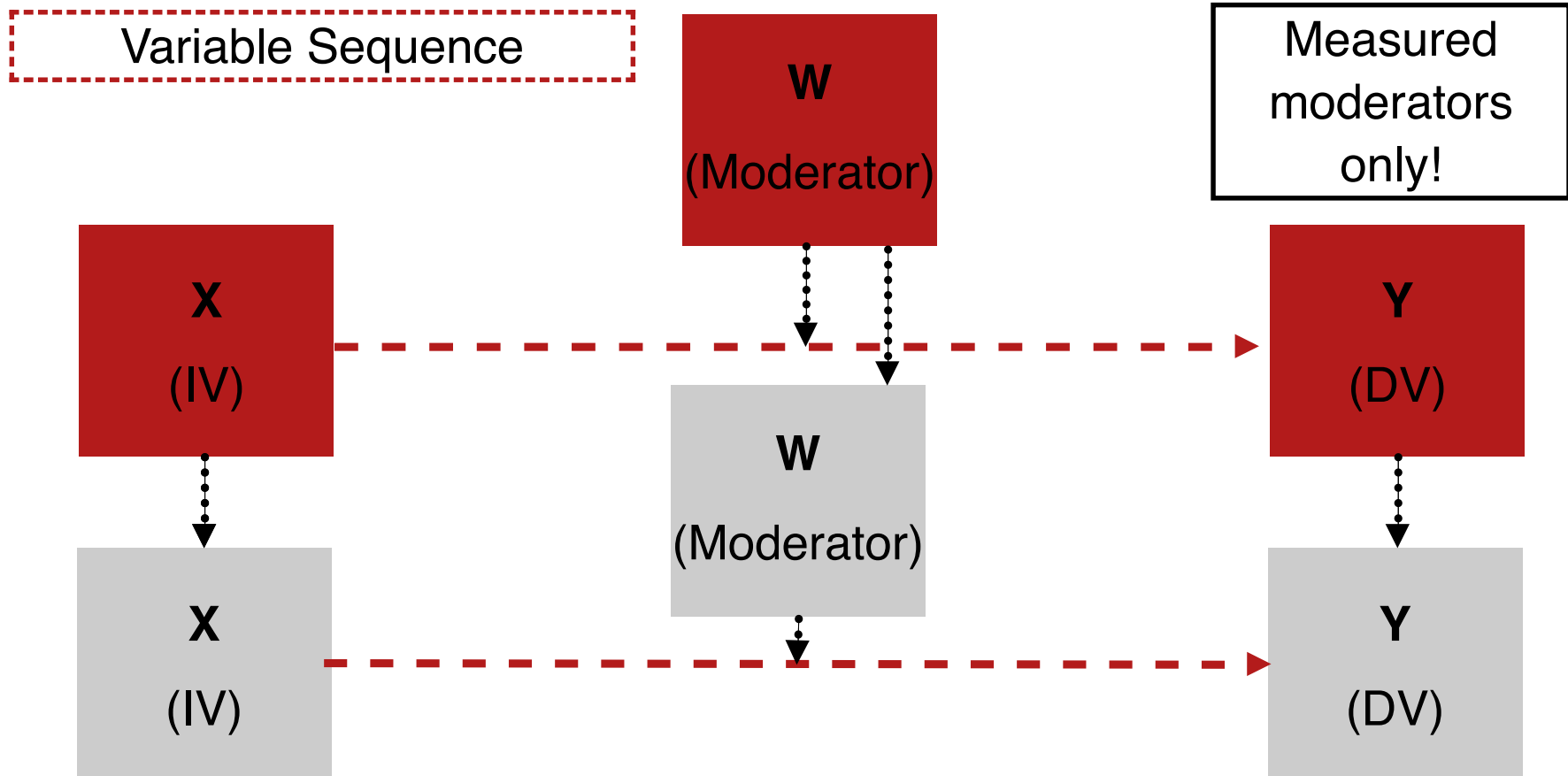
Moderation: Best Practices

Manipulated Moderators

- Manipulated moderators have fewer validity threats, but need well-specified theory.
- Manipulated moderators should only manipulate the construct of interest.

Measured Moderators

- Subject to variable sequence threats (like mediation).
- Measured moderators should not be affected by other manipulations or measures.

All Moderation Designs

- Moderator cleanly maps to construct.
- Interaction alone doesn't always mean process evidence.
- Consider costs of recruitment.

I-FoMO and Investment Amount

The Effect of Push Notification, Information Release, and I-FoMO on Investment Amount
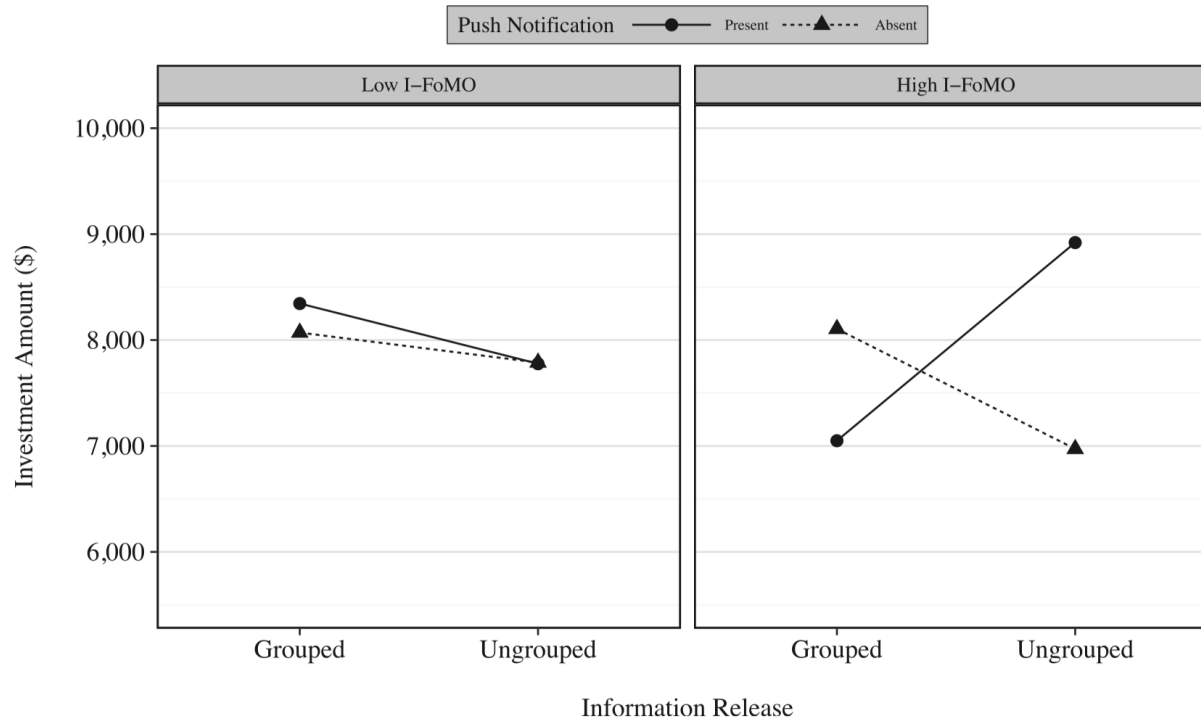
Figure 1 - Clor-Proell, Guggenmos, and Rennekamp (2020 TAR)

Multiple Sources

Increasing the quality, quantity, and/or diversity of process evidence can allow for stronger claims about process.

Multiple methods can help "rule out" that an effect is a methodological artifact.

Multiple experiments allow for strategic design.

- Breaking into smaller pieces (home in on process).
- Test the causal chain.
- Don't need to run cells that aren't useful.

Triangulation across studies can lead to richer inference over the lifetime of a research literature.

Takeaways

Not every study needs to be able to tell us *how* or *why* something happens. Sometimes documenting an important effect is enough.

But when we want to speak to process, approach providing process evidence with rigor commensurate with how much the contribution hinges on understanding process.

Process testing (and design, more generally) is a game of tradeoffs. Be mindful and make these choices intentionally.

Choose the right tool for the job. Whether mediation vs. moderation, measurement vs. manipulation, or choosing between one or multiple studies - match the theory, to the hypothesis, to the method, to the analysis.

More Resources and References

For more resources related to statistics and research design:

https://rdg222.github.io/Resources/

Primary Reference:

Asay, H. S., R. Guggenmos, K. Kadous, L. Koonce, and R. Libby. 2021."Theory Testing and Process Evidence in Accounting Experiments." *The Accounting Review*, forthcoming

Thank you!

QUESTIONS?