

## Class 9 - Techniques II - Moderation

# Agenda

- The logic of moderation: what, why, when, how (30 minutes)
- Application paper discussion (30 minutes)
- *Break*
- Replication presentation (15 minutes)
- Skills corner - Class walkthrough in R (25 minutes)
- General discussion (15 minutes)

## Preamble

While I really dove into the weeds last class, I will be keeping it higher level for remainder of the “techniques” classes

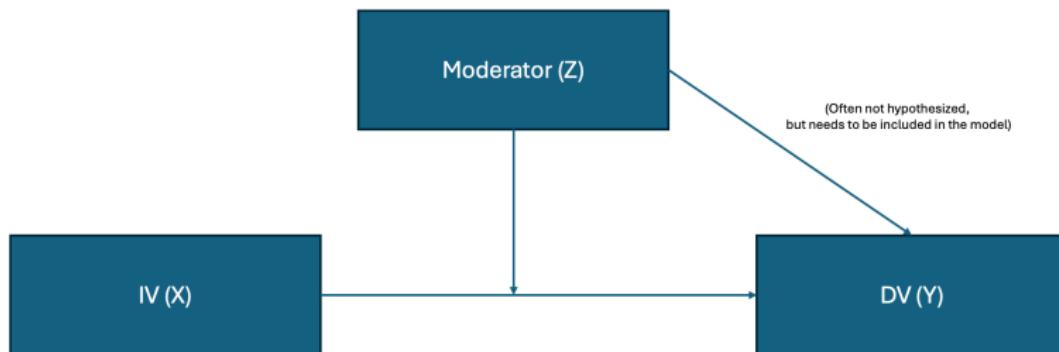
## The logic of moderation

# What is moderation?

*In general terms, a moderator is any variable that affects the association between two or more other variables; moderation is the effect the moderator has on this association.*  
*Dawson (2014)*

# What is moderation?

Nomological network view:



Regression model view:

$$Y = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 XZ + \epsilon$$

# Why moderation?

- Solves a theoretical problem
  - Management research, like many other disciplines, is replete with theories suggesting that the relationship between two variables is dependent on a third variable (Dawson 2014)
- New tools are available for modeling
  - Recent developments have proven to be more flexible and appropriate for multilevel data arrangements. Most notably, random coefficients modeling (RCM) has seemingly become the analysis of choice (Hitt et al. 2007)
  - And while moderation in linear regression is straightforward, it is not so simple for non-linear models like logit or probit where marginal effects are non-constant

# When is moderation appropriate?

- Complementarities and substitution effects:

$$y = \beta_1 PB + \beta_2 Jelly + \beta_3 PB * Jelly$$

- Contextual differences:  $y = \beta_1 x + \beta_2 D_{country} + \beta_3 x D_{country}$

- Structural breaks:  $y = \beta_1 t + \beta_2 \delta + \beta_3 \delta t$

- Difference-in-differences:  $y = \beta_1 \Delta + \beta_2 \delta + \beta_3 \Delta \delta$

- Curvilinear effects:  $y = \beta_1 x + \beta_2 x^2 = y = (\beta_1 + \beta_2 x)x$

- Heterogeneous effects:  $y_{ij} = \beta_0 + \beta_{1j}x + \epsilon_{ij}; \beta_{1j} = \gamma_{10} + \nu_j$

## Performing a moderation analysis

# How do you perform a (basic) moderation analysis?

- 1 **Clearly** make your prediction as a hypothesis.
- 2 (Optional). Center and scale variables
- 3 Run regression with “main effects” only (including the moderator!)
- 4 Include interaction effects
- 5 Perform statistical inference (t-tests,  $\Delta R^2$ , F-tests)
- 6 Plot interaction and assess marginal effects
- 7 Run supplemental tests (e.g., tests of curvature (Haans, Pieters, and He 2016), simple slopes (Dawson 2014), regions of significance)

## Deep dive: Clearly make your prediction as a hypothesis

It is critical when making an argument for moderation that you specify what you mean. Is it:

- A pre-existing (positive / negative) main effect will become (stronger / weaker) in the presence of the moderator?
- An (existing/null) effect will become (absent/present) in the presence of the moderator?
- The moderator has such an influence that it will flip the sign of the effect, depending on its level?
- Which is the main effect and what is the moderator?
- Will the moderator have an independent influence (i.e., a mean shift)?

## Illustrating an moderation: Interaction plots

Here is an example of an amplifying interaction, the moderator has an independent effect (shifts the curve up) and increases the slope of the main effect

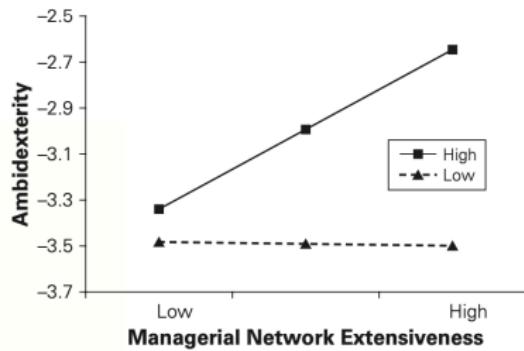


Figure 1: An amplifying interaction

## Illustrating an moderation: Interaction plots

Here is an example of an “cross-over” interaction, the moderator has no independent effect (curves are centered at a common point) but the slope changes

The “extreme case” of a crossover interaction is when the X variable has no main effect across the whole population, but has a positive or negative effect depending on the level of the moderator

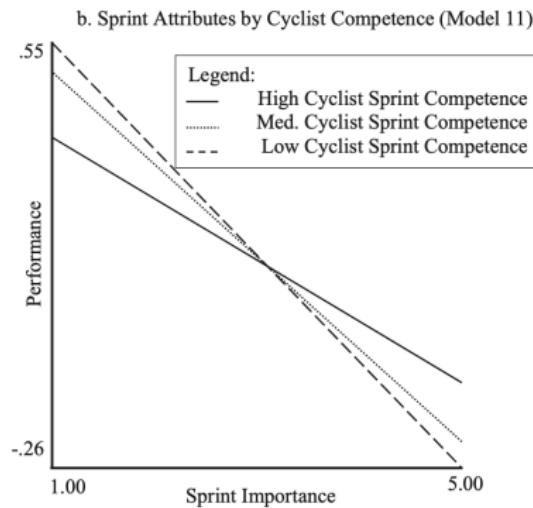


Figure 2: A crossover interaction

## Things can get crazy! Three-way interactions

Yes, you can test them (although statistical power becomes an issue).

But to be justified, you need to **explain** all of the various ways three variables can interact.

Let's keep it simple and say each variable is binary (0/1). That is already  $2^3$  possible combinations to consider and have a story for.

## Statistical v. substantive meaning

- Statistical meaning - the coefficient is significant
- Substantive meaning - how is the pattern of results differs with or without the interaction included in the model

## “Generalizing” moderation: HLM / RCM

I have given you two readings (Hitt et al. (2007) and Wolfson and Mathieu (2018)) to help you dip your toes into the waters of hierarchical linear modeling (HLM) / a.k.a. random coefficients modeling (RCM)

This can be viewed as a “generalization” of moderation, where slope coefficients (betas) and intercepts can not only be dependent on a third variable but may have their own *random distribution*

This technique allows you to naturally model nested settings (Hitt et al. 2007), but gets complicated quickly

## Alternative analyses

- Subsample analyses
- Qualitative comparative analysis (QCA)
- Orthogonal polynomial regression
- Contingency tables (cross-tabs)

The logic of moderation  
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Performing a moderation analysis  
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Applications  
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Preparation for next class  
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# Applications

# Application readings

Let's level-set people's familiarity with these pieces.

- Heavey, C., Simsek, Z., & Fox, B. C. 2015. Managerial Social Networks and Ambidexterity of SMEs: The Moderating Role of a Proactive Commitment to Innovation. *Human Resource Management*, 54(S1).
- Wolfson, M. A., & Mathieu, J. E. 2018. Sprinting to the finish: Toward a theory of Human Capital Resource Complementarity. *J Appl Psychol*, 103(11), 1165-1180.

# Heavey et al (2015)

- What was this paper about?
- What were the findings?
- What was the method?
- What makes sense? What was confusing?



MANAGERIAL SOCIAL NETWORKS  
AND AMBIDEXTERITY OF SMEs:  
THE MODERATING ROLE  
OF A PROACTIVE COMMITMENT  
TO INNOVATION

Ciaran Heavey, Zeki Simsek, and Brian Curtis Fox

Organizational research suggests that ambidexterity is attainable if top managers cultivate collective behavioral routines that enable them to synthesize large amounts of information and decision alternatives, and manage conflict and ambiguity. However, the type of information and knowledge sources that enable top managers to meet the knowledge demands of ambidexterity remains poorly understood. Toward that end, we argue that the extensiveness of top managers' social networks inside and outside the firm, on an integrative basis, can offer the dual knowledge benefits conducive to ambidexterity. Because ambidexterity entails the firm's departure from existing products, technologies, and practices, we further argue that the contribution of extensive networks to ambidexterity is conditional upon a collective violation of top managers to pursue extensive network opportunities into innovative pursuits. From a study of CEOs and top management teams in SMEs operating in technology-based industries, we find support for both a network extensiveness effect and the moderating role of a proactive commitment to innovation in shaping this effect. © 2015 Wiley Periodicals, Inc.

**Keywords:** ambidexterity, managerial social networks, managerial proactiveness

**O**rganizational scholars have long sought to describe and explain how firms deliberately cultivate strategic orientations for exploitation and exploration, otherwise known as an ambidextrous orientation (Birkinshaw & Gupta, 2013; Kostopoulos & Botsoglou, 2011; Turner, Swart, & Maylor, 2013; C. L. Wang & Ratig, 2014). While the major focus of scholarly attention has been on charting

the structural, contextual, and temporal foundations of ambidexterity, it is also recognized that top managers play a critical role, particularly in assessing and integrating the knowledge requirements for exploitation and exploration. Indeed, because firms exhibit inertial and path-dependent tendencies in their knowledge processes toward the pursuit of either exploitation or exploration (e.g., Rosenbloom, 2000; Tripsas & Gavett, 2000),

Correspondence to: Ciaran Heavey, University College Dublin, Lochlann Quinn School of Business, Belfield, Dublin 4, Ireland, Phone: +353-1-7164742, E-mail: Ciaran.Heavey@ucd.ie

Journal of Management, December 2015, Vol. 54, No. S1, pp. S201–S221  
© 2015 Wiley Periodicals, Inc.

Published online in Wiley Online Library (wileyonlinelibrary.com).

DOI: 10.1002/jom.21703

Correction added on June 5, 2016, after first online publication: In Figure 1, the key listed the solid line as corresponding to low

# Wolfson and Mathieu (2018)

- What was this paper about?
- What were the findings?
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doi:10.1037/aps0000521

## Sprinting to the Finish: Toward a Theory of Human Capital Resource Complementarity

Mikhail A. Wolfson and John E. Mathieu  
University of Connecticut

In traditional work contexts, factors such as individuals' general competencies are used to predict indices of their performance such as yearly performance appraisals. Whereas traditional approaches to predicting individuals' performance focus on differences between individuals, a considerable proportion of variability in performance is attributable to within-person sources. However, we submit that within-person variability in performance may also be attributable to the way individuals work in different situational contexts. Moreover, individual performance may be influenced by team complementarity factors. Accordingly, we advance a Human Capital Resource Complementarity (HCR) theory to explain the alignment of human capital resources with dynamic situational features, and to illustrate the influence of team collecting competencies on the performance of individuals. We have empirically test HCR theory using data from a cycling race, the Tour de France. We collected data from 100 stages of the continental Tour de France. Our results suggest that individuals' specific competencies interact with situational characteristics to predict their performance variability over time, beyond that accounted for by their general competencies. Moreover, these effects are accounted to the extent that teammates' competencies align with the specific challenges in a given situation. Implications for future theory building, research, and practice are discussed.

**Keywords:** competencies, interactionism, multifield, performance, situational attributes

"The finish was around 9:00 p.m. in the city of lights and the stars came out to shine the four at the top of the general classification had a flag to wave to the crowd to determine the winner of the 21st stage and it was Marcé Kintel who [finished] the Tour as started it—with a victory."  
(Le Tour, 2013)

That was the scene at the finish line at the 100th Tour de France (TDF). Marcel Kintel had started and finished the tour with individual stage victories, yet it was Christopher Froome who won the overall race. So, we know the "winner" of the race, but what about the most prestigious cycling event in the world, but do we understand the underlying dynamics that combine to produce this result? Performance is cycling, or in many conventional workplace settings, is often based on successful completion of a variety of dynamic tasks over prolonged periods of time. As such, performance on one type of task does not necessarily explain overall performance.

Mikhail A. Wolfson and John E. Mathieu, Management Department, University of Connecticut.

We thank Greg Wolfson for his assistance in acquiring the data, and Greg Reilly and Devi Dalal for their feedback on a draft of this work. An earlier version of this article was presented at the 2016 Academy of Management Conference, Anaheim, CA.

Correspondence concerning this article should be addressed to Mikhail A. Wolfson, Management Department, Kogod School of Business, American University, Washington, DC 20016. E-mail: [Mikhail.Wolfson@american.edu](mailto:Mikhail.Wolfson@american.edu)

The traditional approach to predicting employees' performance focuses on differences between individuals, although a considerable proportion of variability in performance is attributable to within-person sources (Dalal, Lane, Weiss, Welsh, & Holtz, 2014; Day, Sir, & Chen, 2004). In fact, in a recent review of the literature, Dalal, Bhove, and Fiset (2014, p. 2) found that the vast majority of investigations sought to identify "good versus bad performers [emphasis added]" as opposed to good versus bad performances [emphasis added]. This focus on differences or similarities emanated by [emphasis added] from the original work of Lirtzman and Gersbach (1992) highlighted the value of adopting a within-person approach to explore dynamics in performance as influenced by age, tenure and seniority. Building on this work, Dalal et al. (2014, p. 2) submitted that "theorizing at the within-person level will frequently provide a more scientific understanding of the process underlying performance." And that within-person thinking is important for economists because "the notion of similarity across levels as it is in the case of differences," (p. 4, emphasis in original).

As we will elaborate upon below, it may also be the case that within-person performance variability may be attributable to the fact that individuals work in different contexts that are more, or less, suitable for their particular competencies. In other words, within-person variability may actually stem from person by situational interactions. Specifically, the extent to which these interactions may be particularly salient, so too are the contexts and contributions of surrounding team members.

Accordingly, we have five goals for this article. First, we draw

upon work by Playforth, Nyberg, Reilly, and Malarich (2014) as well as Soda and Furlotti's (2017) theory of resource complemen-

# Break



**COFFEE BREAK**

# Replication Presentation

- Replication: Heavey, C., Simsek, Z., & Fox, B. C. 2015.  
Managerial Social Networks and Ambidexterity of SMEs: The  
Moderating Role of a Proactive Commitment to Innovation.  
Human Resource Management, 54(S1).

The logic of moderation  
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Performing a moderation analysis  
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Applications  
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Preparation for next class  
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# Class walkthrough in R

The logic of moderation  
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Performing a moderation analysis  
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Applications  
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Preparation for next class  
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## Preparation for next class

## Next class

### Techniques III: Mediation

- 1 Mathieu, J. E., & Taylor, S. R. 2006. Clarifying conditions and decision points for mediational type inferences in Organizational Behavior. *Journal of Organizational Behavior*, 27(8), 1031-1056.
- 2 Williams, L. J., Vandenberg, R. J., & Edwards, J. R. 2009. 12 Structural Equation Modeling in Management Research: A Guide for Improved Analysis. *Academy of Management Annals*, 3(1), 543-604.

## Next class

### Techniques III: Mediation

Applications:

- 3 Ling, Y., Simsek, Z., Lubatkin, M. H., & Veiga, J. F. 2008. Transformational Leadership's Role in Promoting Corporate Entrepreneurship: Examining the CEO-TMT Interface. *Academy of Management Journal*, 51(3), 557-576.
- 4 Replication: Fox, B. C., Simsek, Z., & Heavey, C. 2022. Top Management Team Experiential Variety, Competitive Repertoires, and Firm Performance: Examining the Law of Requisite Variety in the 3D Printing Industry (1986–2017). *Academy of Management Journal*, 65(2), 545-576.

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- Dawson, Jeremy F. 2014. "Moderation in Management Research: What, Why, When, and How." *Journal of Business and Psychology* 29 (1): 1–19.
- Haans, Richard F. J., Constant Pieters, and Zi-Lin He. 2016. "Thinking about  $\wedge$ : Theorizing and Testing  $\wedge$ - and Inverted  $\wedge$ -shaped Relationships in Strategy Research." *Strategic Management Journal* 37 (7): 1177–95.
- Hitt, Michael A., Paul W. Beamish, Susan E. Jackson, and John E. Mathieu. 2007. "Building Theoretical and Empirical Bridges Across Levels: Multilevel Research in Management." *Academy of Management Journal* 50 (6): 1385–99.
- Wolfson, MA, and JE Mathieu. 2018. "Sprinting to the Finish: