

# Model Building

# Overview

- Difference between a theory and a model
- Explore the different relationship types conveyed by a model
- Build and communicate a path diagram
- Review a published article

# What is a Theory

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A theory is a set of concepts whose proposed relationships offer explanation, understanding, or appreciation of a phenomenon of interest.  
— Hatch, 2013, p. 5

# What is a Model

**Models** are derived from theories to test a particular aspect of that theory. Models are useful because they allow us to communicate and test simplified pieces of our theory, thus providing a more local understanding of our phenomenon.

Fried (2020). Theories and models: What they are, what they are for, and what they are about. *Psychological Inquiry*,

# Testing Theories with Models and Data

Theories inform the development of models, which go on to inform what data to collect and what hypotheses or propositions we should **empirically test with real data and statistical models**.

The more empirical tests a theory survives, the more confidence we tend to have in that theory.

# Communicating Models with a Path Diagram

Path diagrams are used to visually communicate models and the relationships they posit among variables.

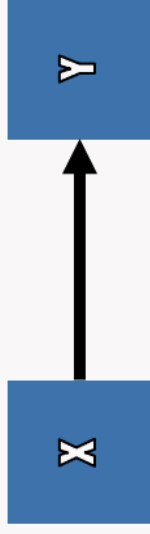
Path diagrams follow several graphical conventions:

1. Variables (or phenomena) are represented by a shape usually a square or circle.
2. Causal and predictive relationships among variables are represented with a unidirectional arrow.
3. Non-causal and non-predictive relationships (i.e. correlations) among variables are represented with curved, non-directional arrows.

# Types of Relationships Among Variables

Here are the three main relationships we will be working with in this course.

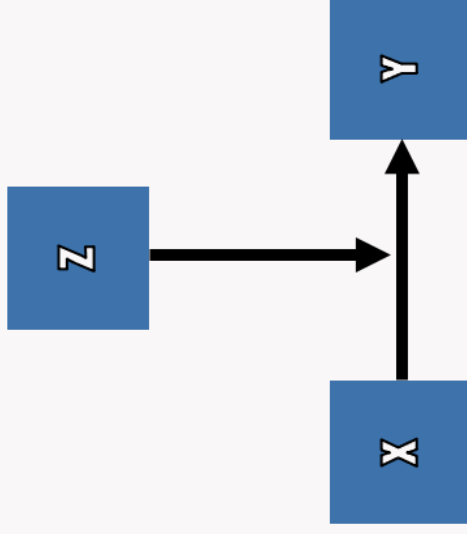
Direct Relationship



Mediated (Indirect) Relationship

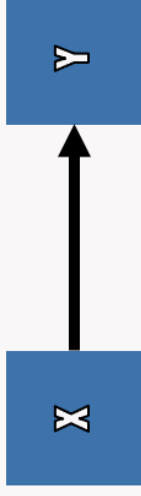


Moderated Relationship



# Direct Relationships

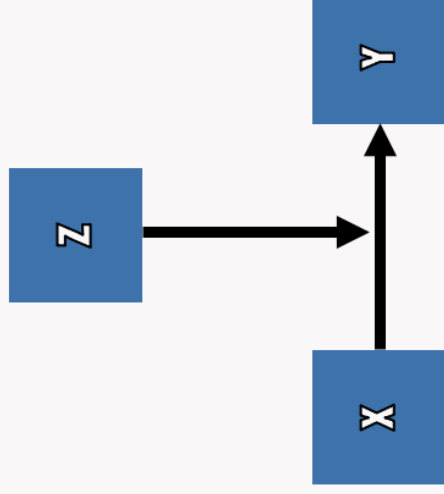
A **direct relationship**, causal or otherwise, is a relationship in which a predictor variable (or independent variable) has a direct impact on an outcome variable.





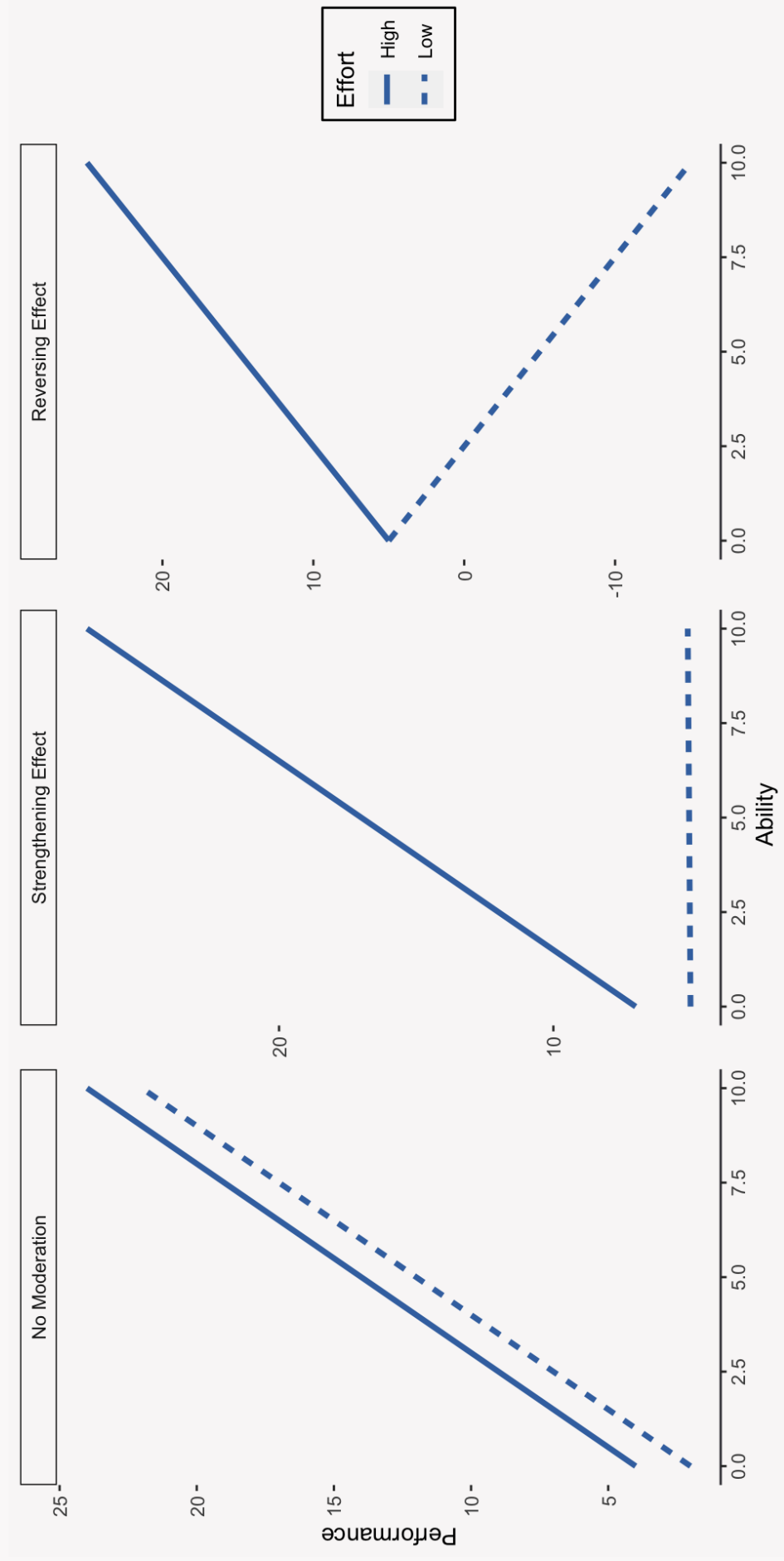
# Moderated Relationships: The “How Strong” Heuristic

A **moderated relationship**, causal or otherwise, involves three variables in which the relationship between two variables, a predictor and outcome variable, changes depending on the value of a third variable, the moderating variable or moderator.



# Thinking About Moderation with Plots

When you are hypothesizing a moderation—also referred to as an interaction—effect, it is helpful to draw a plot of your hypothesized effect.



# Mediated (Indirect) Relationships: The “Why” Heuristic

A **mediated (indirect) relationship** is one where a predictor variable influences an outcome variable **indirectly** through its influence on a mediating variable referred to as a **mediator**.



# Thinking About Indirect, Direct, and Total Effects

When we hypothesize a mediated relationship, we can talk about three different effects:

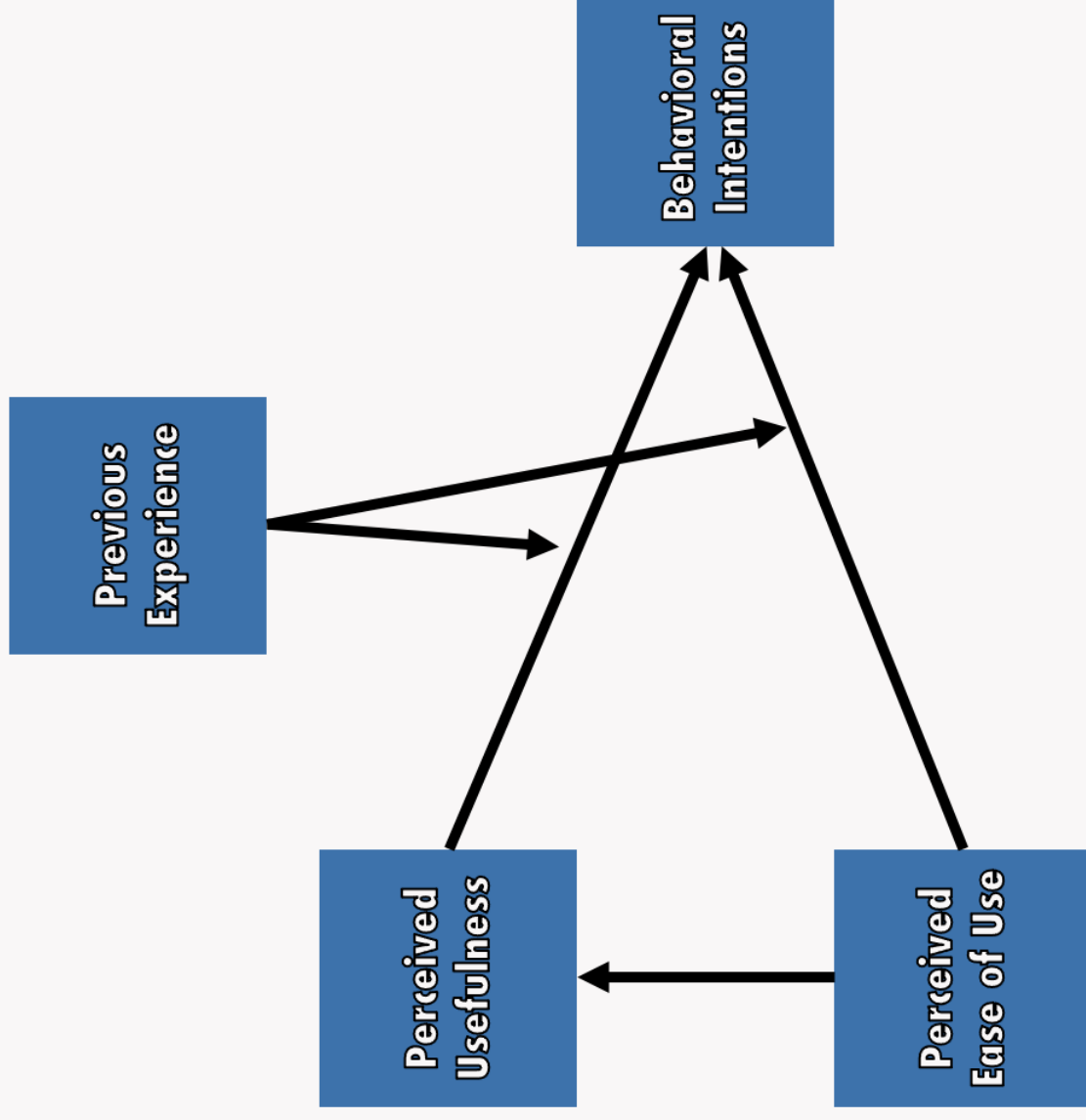
1. The indirect effect of X on Y
2. The direct effect of X on Y
3. The total effect of X on Y

# Why Use a Path Diagram?

A path diagram is useful as it is a simple way to graphically communicate our:

1. The phenomena (variables) we are interested in
2. Hypotheses or theoretical propositions about the relationships among variables
3. The regression equations needed to test the hypothesized model

# The Model Behind Your Homework as an Example



# Path Diagrams and Hypotheses

From the path diagram for our homework, we can infer several different hypotheses/propositions:

1. The effect of perceived ease of use is partially **mediated** through a tool's perceived usefulness.
2. The effect of perceived ease of use on one's intention to use the tool is **moderated** by one's previous experience with a similar tool.
3. The effect of perceived usefulness on one's intention to use the tool is **moderated** by one's previous experience with a similar tool.

# Path Diagrams and Regression Equations

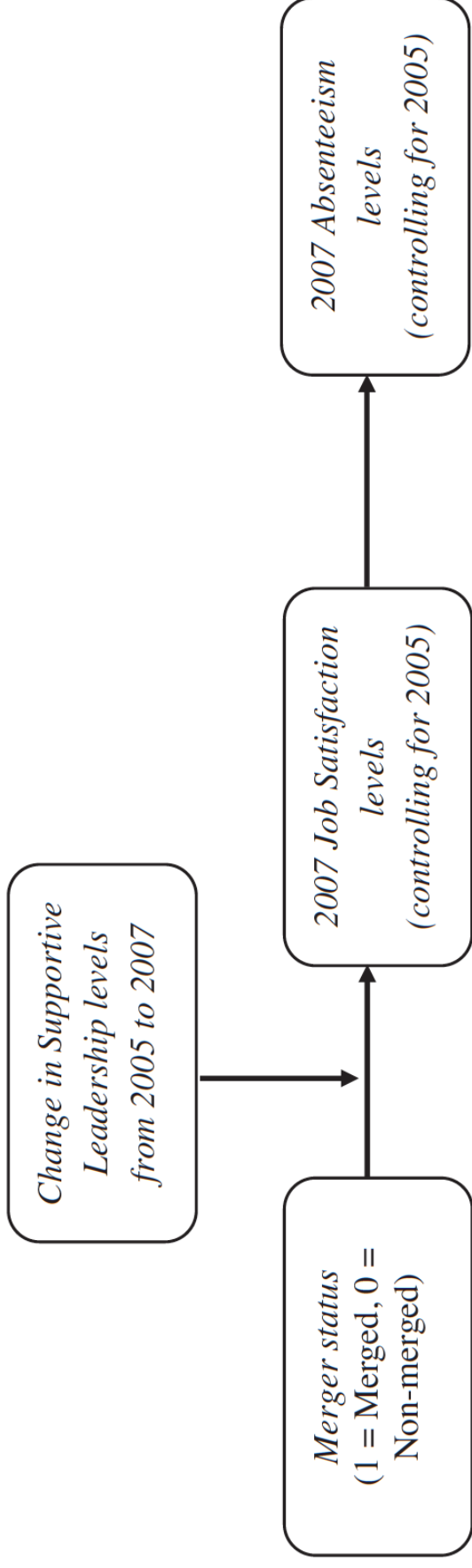
We can also infer the regression equations needed to test our hypotheses from the path diagram:

$$X_{\text{Useful.}} = \beta_0 + \beta_1 X_{\text{Ease Use}} + \epsilon$$

$$Y_{\text{Beh. Int.}} = \beta_0 + \beta_1 X_{\text{Ease Use}} + \beta_2 X_{\text{Useful.}} + \beta_3 Z_{\text{Mod.}} + \epsilon$$



# The Human Costs of Mergers: A Published Example



Giessner et al. (2023). The impact of supportive leadership on employee outcomes during organizational mergers: An

# Using Theories to Build Models

Giessner et al. (2023) use two broad theories to build their more narrow model:

- Organizational support theory
- Conservation of resources theory

# Mediation Hypotheses: H1 to H3

- *H1*: Merging organizations will experience greater decreases in job satisfaction relative to nonmerging organizations within the same context and time period. **[Total Effect]**
- *H2*: Merging organizations will experience greater increases in absenteeism relative to nonmerging organizations within the same context and time period. **[Direct Effect]**
- *H3*: The increases in absenteeism for merging organizations will be **(partially) mediated** by decreases in job satisfaction. **[Indirect Effect]**

## Moderation Hypothesis: H4

- *H4*: The decreases in job satisfaction for merged versus nonmerged organizations will be **moderated** by changes in supportive leadership at the midlevel management level, such that **this relationship will be weaker for organizations with increasing levels of supportive leadership**.

## Moderated Mediation Hypothesis: H5

- *H5:* The increases in absenteeism for merging organizations relative to nonmerging organizations as **mediated by the decreases in job satisfaction** will be **moderated by changes in supportive leadership** at the midlevel management level, such that **the indirect effect of mergers on absenteeism via job satisfaction will be weaker when there is an increase in supportive leadership.**

# Regression Models: Mediation Hypotheses

H1–H3 Testing Results

Dependent variable	H1	H2	H3
	Job satisfaction 2007	Absenteeism 2007	Absenteeism 2007
Intercept	1.28 (0.70, 1.86)***	3.53 (2.92, 4.14)***	7.63 (1.49, 13.76)***
PCT size <sup>a</sup>	0.02 (0.00, 0.04)*	0.00 (−0.01, 0.00)	0.00 (0.00, 0.00)
Job satisfaction 2005	0.62 (0.46, 0.78)***		1.03 (−0.81, 2.87)
Merger status <sup>b</sup>	−0.06 (−0.09, −0.03)***	0.08 (−0.36, 0.20)	−0.21 (−0.51, 0.09)
Absenteeism 2005		0.24 (0.10, 0.37)***	0.23** (0.09, 0.36)
Job satisfaction 2007			−2.22** (−3.79, 0.64)
Supportive leadership 2005			
Change in supportive leadership			
Merger Status × Change in Supportive Leadership	.308	.084	.133
R <sup>2</sup>			

Note. PCT = primary care trust; H = hypothesis. Figures in central section of table are unstandardized regression coefficients (with 95% confidence interval).

<sup>a</sup> Measured as number of employees in 2007 (i.e., postmerger). <sup>b</sup> 1 = merged; 0 = nonmerged.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

# Regression Models: Moderation Hypotheses

H4 Testing Results

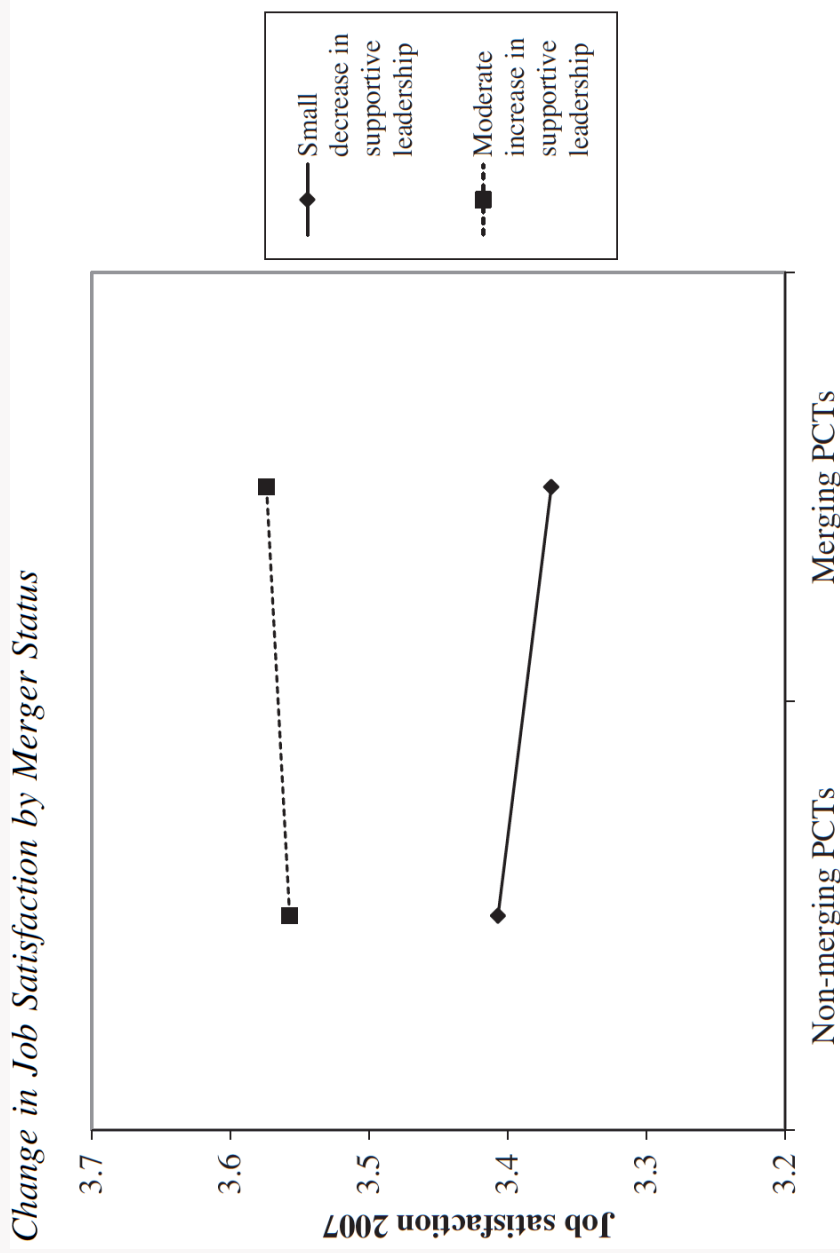
Dependent variable	H4		H5		H5	
	Job satisfaction 2007		Job satisfaction 2007		Absenteeism 2007	Absenteeism 2007
Intercept	0.33 (−0.01, 0.67)**		0.38 (0.02, 0.74)*		8.17 (2.11, 14.24)**	10.24 (4.61, 15.87)***
PCT size <sup>a</sup>	0.00 (0.00, 0.01)		0.00 (0.00, 0.00)		0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
Job satisfaction 2005	0.35 (0.17, 0.54)***		0.35 (0.16, 0.53)**		3.94 (0.97, 7.09)*	
Merger status <sup>b</sup>	−0.02 (−0.04, 0.00)*		−0.02 (−0.04, 0.00)*		−0.27 (−0.57, 0.03)	−0.20 (−0.50, 0.11)
Absenteeism 2005			−0.00 (−0.01, 0.00)		0.22 (0.08, 0.35)**	0.22 (0.08, 0.35)**
Job satisfaction 2007					−2.08 (−3.64, −0.52)**	
Supportive leadership 2005	0.52 (0.35, 0.69)***		0.51 (0.34, 0.68)***		−3.14 (−5.91, −0.37)*	−1.80 (−3.31, −0.29)*
Change in supportive leadership	0.63 (0.53, 0.72)***		0.63 (0.53, 0.72)***			−1.98 (−3.57, −0.39)*
Merger Status × Change in Supportive Leadership	0.23 (0.07, 0.38)*		0.23 (0.07, 0.38)*			0.527 (−2.09, 3.14)
R <sup>2</sup>	.787		.788		.163	.163

Note. PCT = primary care trust; H = hypothesis. Figures in central section of table are unstandardized regression coefficients (with 95% confidence interval).

<sup>a</sup> Measured as number of employees in 2007 (i.e., postmerger). <sup>b</sup> 1 = merged; 0 = nonmerged.

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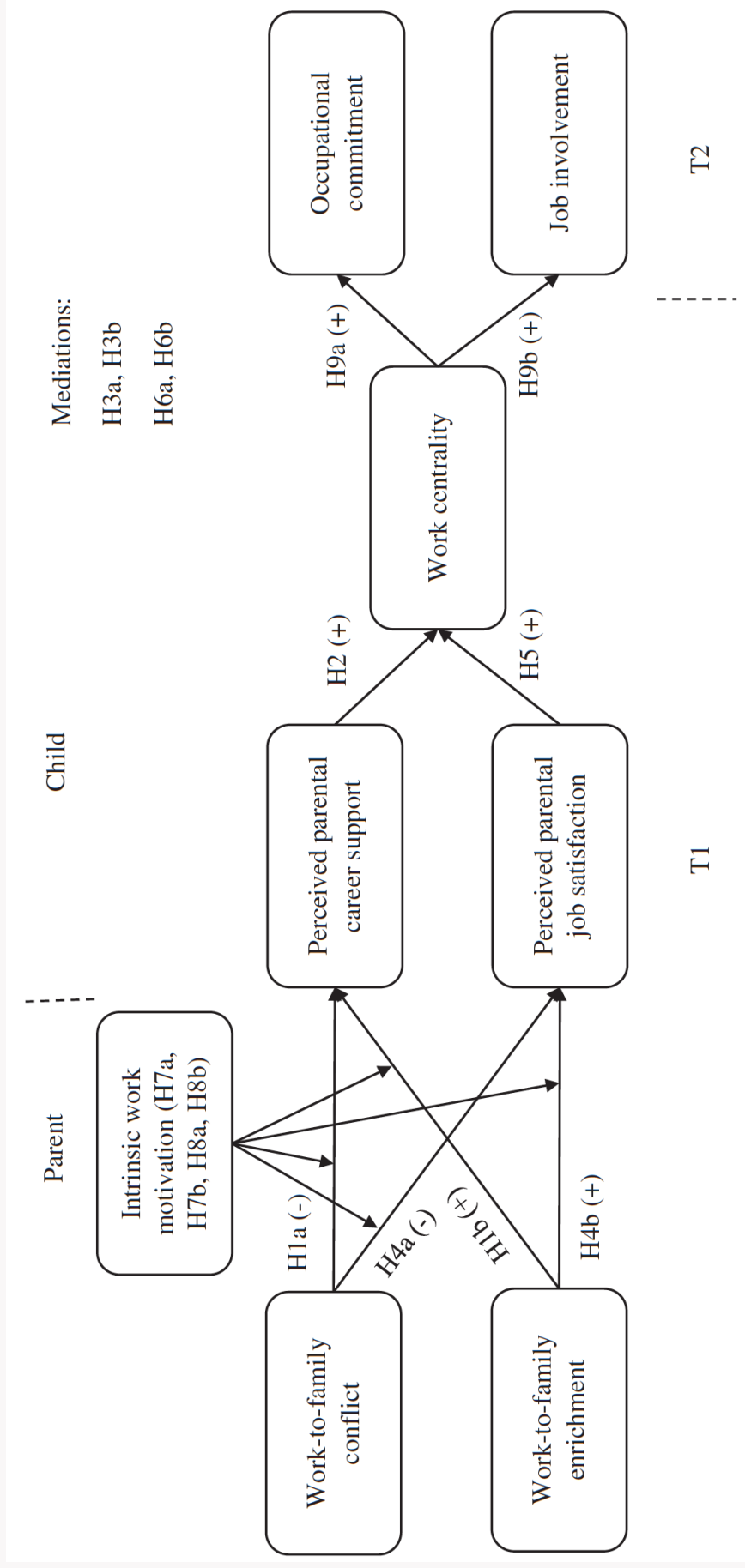
# Moderation Plot



Giessner et al. (2023). The impact of supportive leadership on employee outcomes during organizational mergers: An



# A More Complex Published Example



Steiner et al. (2023). Crossover effects of parent work-to-family experiences on child work centrality: A moderated

