



...of Structural Equation Modeling

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OVERVIEW

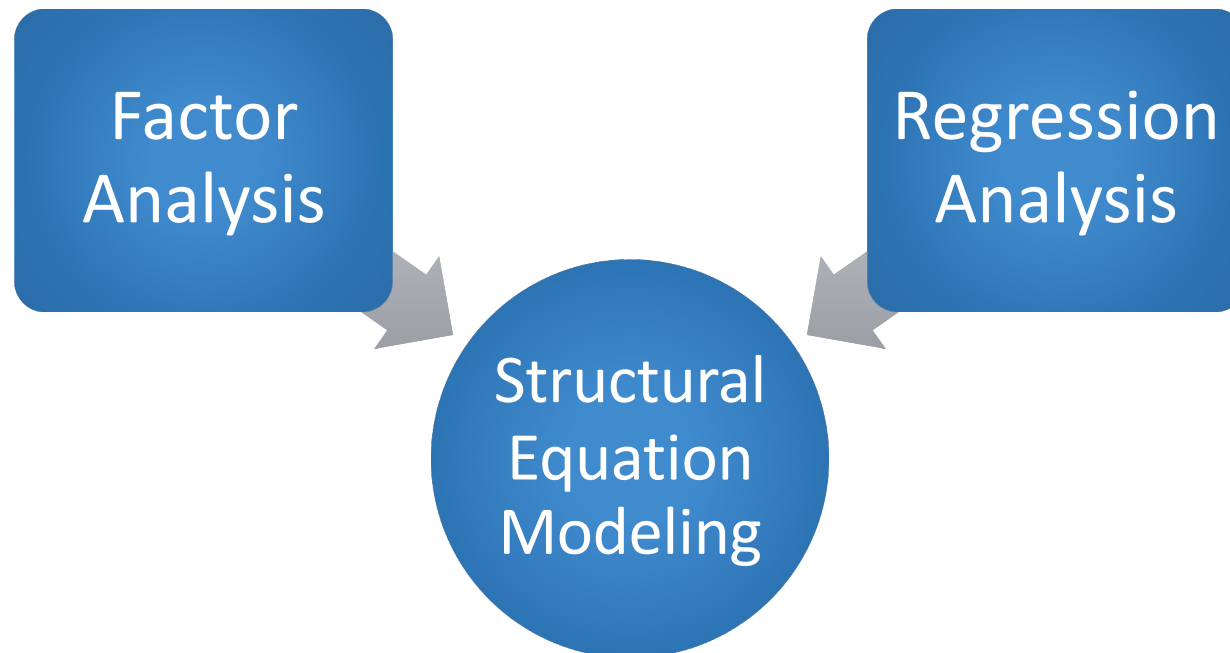
Introduction

- What is SEM?
- Connections with
 - Factor analysis (not PCA)
 - Regression analysis
- Path diagrams

Hands on Examples

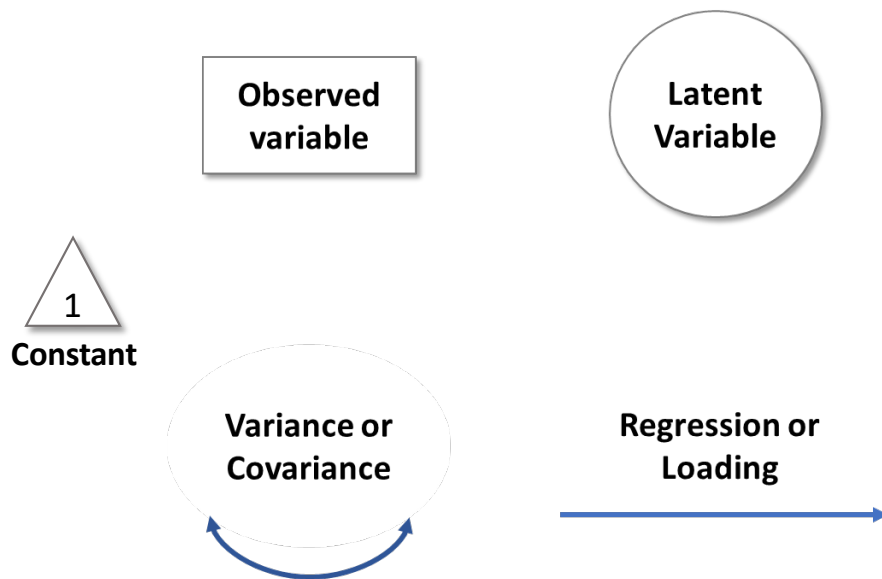
- Data for Demo: COVID-19
- Model specification and interpretation
- Answer specific questions
 - Confirmatory factor analysis
 - Multivariate Regression
- Wrap up: CFA & Regression

What is SEM?



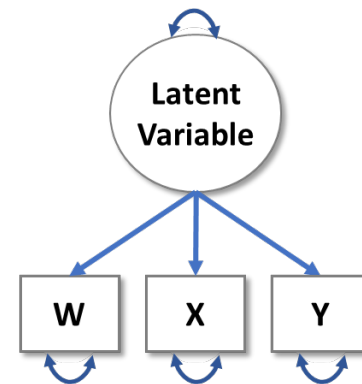
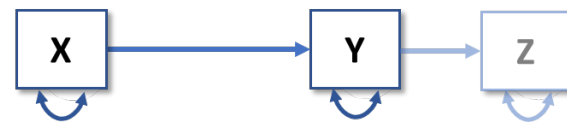
SEMs as Path Diagrams

SEM Path Diagram Elements

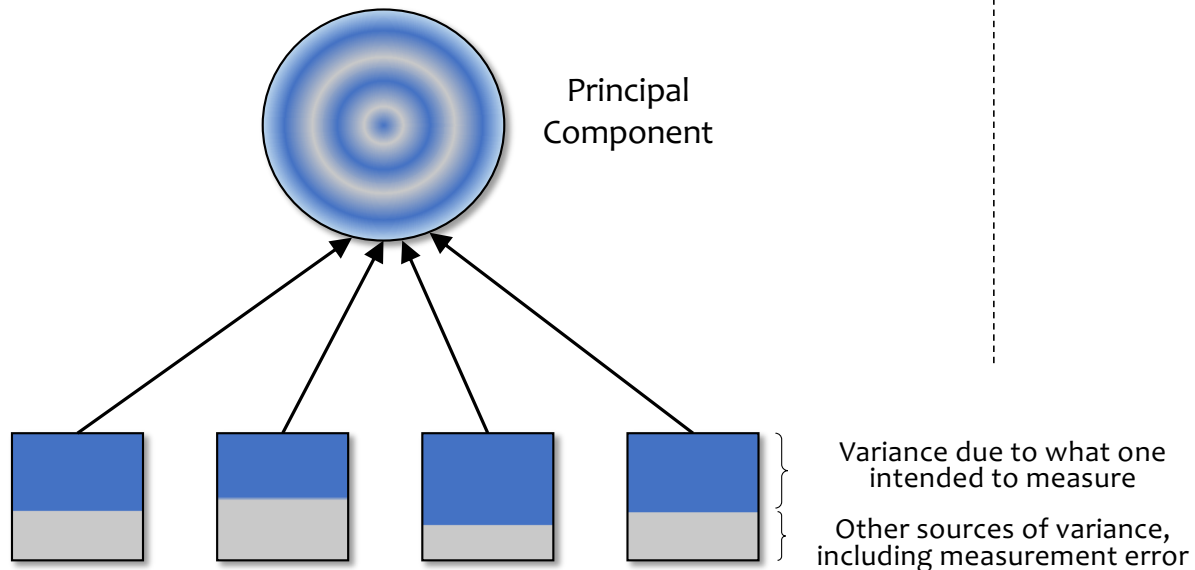


Fundamental SEM Examples

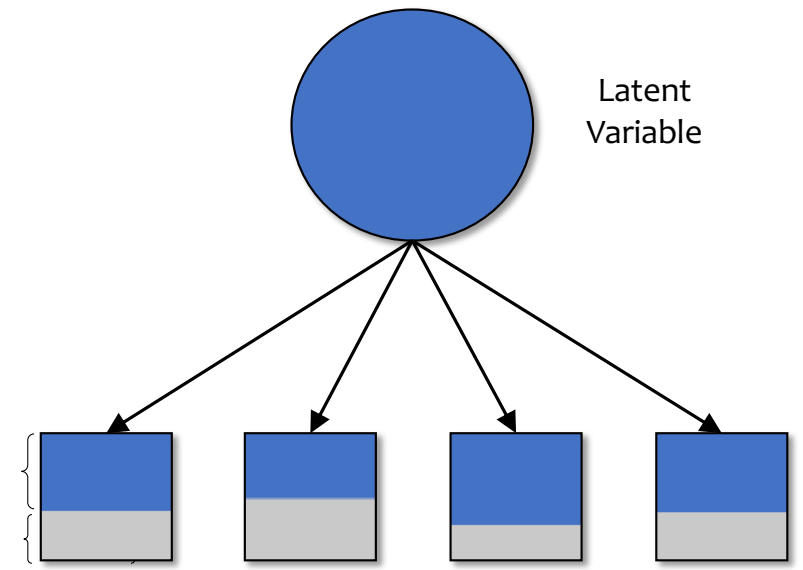
Y regressed on X



Principal Components Analysis

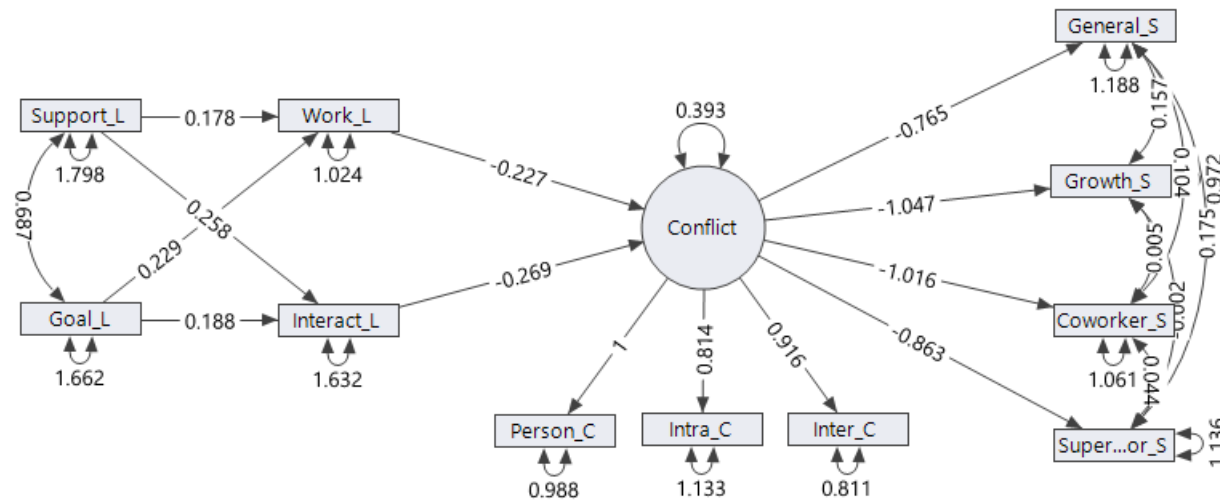


Factor Analysis



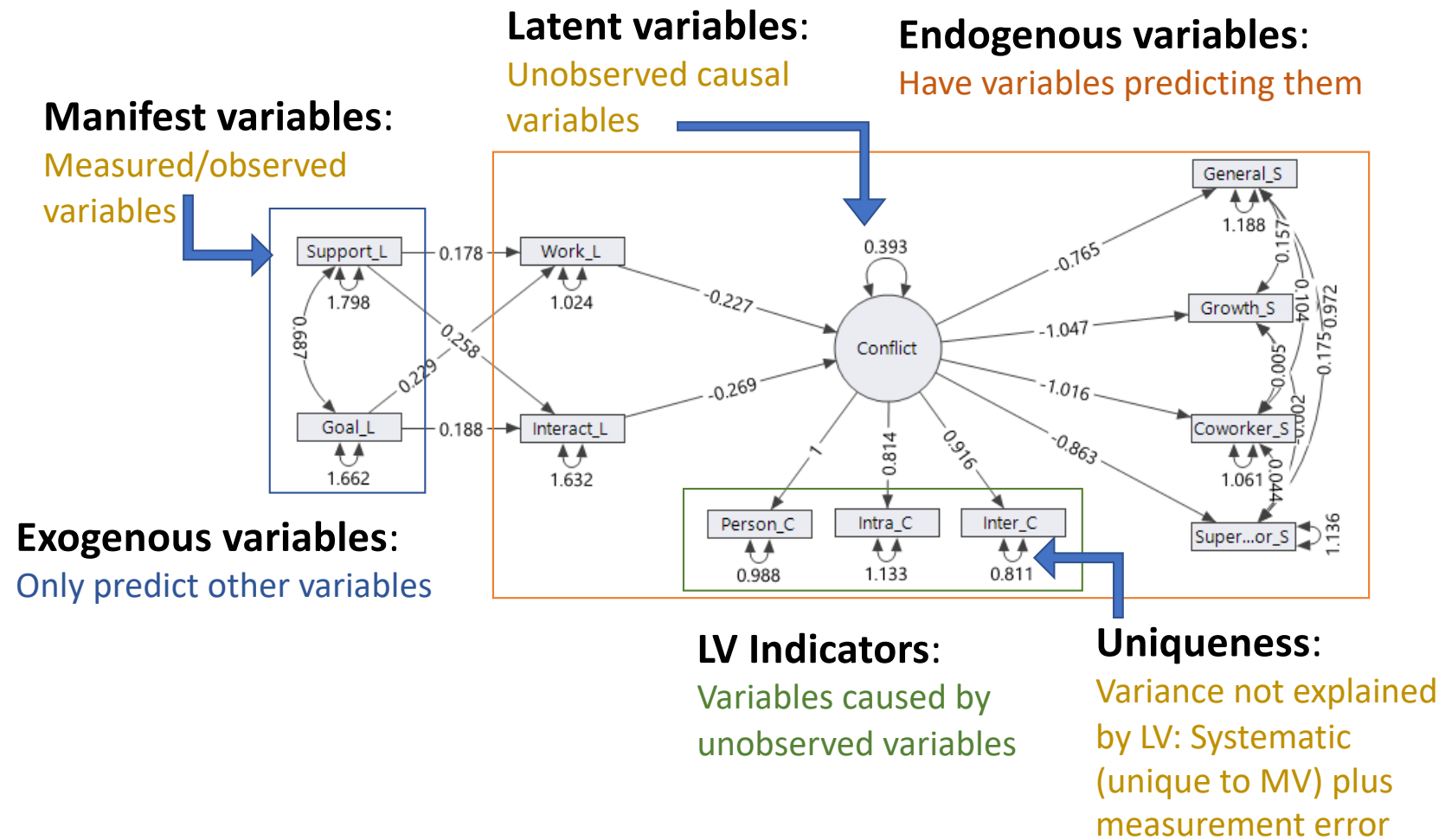
Measured Variables

Why Use SEM?



- Unobserved variables
- Account for measurement error
- Sequential relations between variables (observed/unobserved)
- Missing data

SEM Terminology



SEM Analysis

Shift in focus

Multivariate analysis of *covariance* structures (and means)

Data

Variances and covariances (and means)

Residuals

WRT variances and covariances (and means)

Degrees of freedom

WRT variances and covariances (and means)

OSF_COVID_Scale_Study2.jmp

236/0 Cols

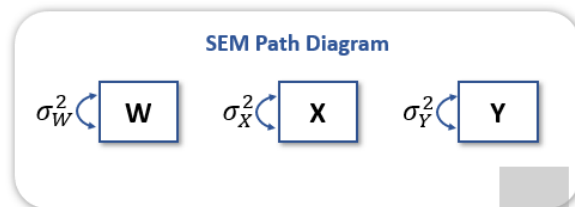
| | BDW_2 | BDW_3 | BDW_4 | BDW_5 | BDW_6 | BDW_7 | BDW_8 |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|
| SEM: 6-Factor CFA | 1 | 5 | 6 | 4 | 6 | 6 | 5 |
| SEM: Threats --> Well-Being | 2 | 6 | 6 | 3 | 6 | 5 | 6 |

Covariance Matrix

| | BDW_2 | BDW_3 | BDW_4 | BDW_5 | BDW_6 | BDW_7 | BDW_8 |
|-------|----------|----------|----------|----------|----------|----------|----------|
| BDW_2 | 2.86174 | -1.60938 | 1.51513 | 1.59817 | -1.24045 | 1.89967 | -1.48280 |
| BDW_3 | -1.60938 | 3.30554 | -1.54342 | -1.43866 | 1.62067 | -1.50560 | 2.24953 |
| BDW_4 | 1.51513 | -1.54342 | 2.74292 | 1.15966 | -1.49853 | 1.63612 | -1.43812 |
| BDW_5 | 1.59817 | -1.43866 | 1.15966 | 3.48178 | -1.01895 | 1.35102 | -1.52319 |
| BDW_6 | -1.24045 | 1.62067 | -1.49853 | -1.01895 | 2.84589 | -1.51472 | 1.63232 |
| BDW_7 | 1.89967 | -1.50560 | 1.63612 | 1.35102 | -1.51472 | 3.12378 | -1.37096 |
| BDW_8 | -1.48280 | 2.24953 | -1.43812 | -1.52319 | 1.63232 | -1.37096 | 3.06218 |

| | All rows | Selected | Excluded | Hidden | Labelled | | | |
|-----|----------|----------|----------|--------|----------|---|---|---|
| DOF | 16 | 5 | 3 | 5 | 6 | 5 | 6 | 2 |
| | 17 | 2 | 7 | 1 | 3 | 5 | 3 | 3 |
| | 18 | 3 | 6 | 2 | 1 | 5 | 3 | 5 |
| | 19 | 4 | 6 | 5 | 1 | 6 | 4 | 7 |
| | 20 | 2 | 6 | 1 | 5 | 7 | 1 | 6 |
| | 21 | 4 | 5 | 3 | 6 | 6 | 5 | 6 |

SEM Inner Workings



Depicts a model that implies a covariance structure

Model-implied covariance

| | W | X | Y |
|---|--------------|--------------|--------------|
| W | σ_W^2 | | |
| X | 0.00 | σ_X^2 | |
| Y | 0.00 | 0.00 | σ_Y^2 |

This model implies non-zero variances and zero covariances

Sample covariance

| | W | X | Y |
|---|------|------|------|
| W | 1.32 | | |
| X | 0.61 | 1.40 | |
| Y | 0.53 | 0.74 | 1.14 |

Model estimation tries to match the data as close as possible

Model Estimates

$\sigma_W^2 = 1.32$
 $\sigma_X^2 = 1.40$
 $\sigma_Y^2 = 1.14$

Difference (residuals)


| | W | X | Y |
|---|------|------|------|
| W | 0.00 | | |
| X | 0.61 | 0.00 | |
| Y | 0.53 | 0.74 | 0.00 |

Differences of what the model implied and what the data said are summarized to produce many indices of model fit

Data for Demo

Article Menu

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Measuring Realistic and Symbolic Threats of COVID-19 and Their Unique Impacts on Well-Being and Adherence to Public Health Behaviors

Frank J. Kachanoff , Yochanan E. Bigman, Kyra Kapsaskis, more...

First Published July 24, 2020 | Research Article



<https://doi.org/10.1177/1948550620931634>

Article information ▾



Abstract

COVID-19 threatens lives, livelihoods, and civic institutions. Although restrictive public health behaviors such as social distancing help manage its impact, these behaviors further sever our connections to people and institutions that affirm our identities. Two studies ($N = 1,195$) validated a brief 10-item COVID-19 Threat Scale that assesses (1) realistic threats to physical or financial safety and (2) symbolic threats to one's sociocultural identity. Studies reveal that both realistic and symbolic threats predict distress and lower well-being and demonstrate convergent validity with other measures of threat sensitivity. Importantly, the two kinds of threats diverge in their relationships to restrictive public health behaviors: Realistic threat predicted greater self-reported adherence, whereas symbolic threat predicted less self-reported adherence to social disconnection behaviors. Symbolic threat also predicted using creative ways to affirm identity even in isolation. Our findings highlight how social psychological theory can be leveraged to understand and predict people's behavior in pandemics.

How do Perceived Threats of COVID-19 Impact Well-Being and Public Health Behaviors

Integrated COVID-19 Threat Scale

The integrated COVID-19 threat scale has 10 items (random order). Five items assess perceived **realistic threats** of the COVID-19 pandemic. Five items assess perceived **symbolic threats** of the COVID-19 pandemic.

Preamble: On March 11th, 2020 the World Health Organization officially declared the COVID-19, a viral disease that has swept the globe, a pandemic. How much of a **threat**, if any, is the coronavirus outbreak for ...

| Not a threat | Minor threat | Moderate threat | Major threat |
|--------------|--------------|-----------------|--------------|
| 1 | 2 | 3 | 4 |

- Your personal health
- The health of the U.S. population as a whole
- Your personal financial safety
- The U.S. economy
- Day-to-day life in your local community

Realistic Threat

- What it means to be American
- American values and traditions
- The rights and freedoms of the U.S. population as a whole
- American democracy
- The maintenance of law and order in America

Symbolic Threat

Using SEM to Answer Specific Questions

- Exploratory factor analysis
- Confirmatory factor analysis
- Assessing measurement

1. How do we measure *perceptions* of COVID-19 threats?

- Two types of threat

2. Do perceptions of COVID-19 threats predict

- Well-being markers
- Public health behaviors

3. Are effects of each type of threat on outcomes equal?

- Equality constraints
- Model comparisons

- Simple regression
- Multiple regression
- Path analysis (multivariate multiple regression)

Demo

THANK YOU

Questions?